

Department of Homeland Security

Science and Technology

Budget Overview



Fiscal Year 2018

Congressional Justification

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Science and Technology

Appropriation Organization Structure

Organization Name	Level	Fund Type (* Includes Defense Funding)
Science and Technology	Component	
Operations and Support	Appropriation	
Mission Support	PPA	Discretionary - Appropriation
Laboratory Facilities	PPA	Discretionary - Appropriation
Acquisition and Operations Analysis	PPA	Discretionary - Appropriation
Procurement, Construction, and Improvements	Appropriation	
Laboratory Facilities	PPA	Discretionary - Appropriation
Research and Development	Appropriation	
Research, Development and Innovation	PPA	Discretionary - Appropriation
University Programs	PPA	Discretionary - Appropriation

Science and Technology Strategic Context

Component Overview

The Science & Technology (S&T) is comprised of the following mission-oriented programs that support achievement of the DHS strategic missions, goals, and objectives.

Acquisition and Operations Analysis: The Acquisition and Operations Analysis programs provide expert assistance to entities across the homeland security enterprise to ensure that the transition, acquisition, and deployment of technologies and information improve the efficiency and effectiveness of operational capabilities across the homeland security enterprise. This program assists in testing and evaluation, standards development, requirements analysis, systems engineering, and supporting technology transition.

Laboratory Facilities: The Laboratory Facilities program oversees a coordinated network of five DHS laboratories and as many as 13 Department of Energy laboratories that are vital to the homeland security mission. This network enables scientists and engineers to apply their expertise and develop solutions that address homeland security related threats and vulnerabilities.

Research, Development, and Innovation: Research, Development, and Innovation is a portfolio of customer-focused and output-oriented research, development, testing and evaluation programs. The program consists of specific portfolios to include: Border Security, Chemical/Biological/ Explosives Defense, Cyber Security/Information Analysis, Counter Terrorist, and First Responder/Disaster Resilience. These portfolios support the needs of the operational components of the Department and the first responder community to address capability gaps.

University Programs: University Programs streamlines access to the expertise of the nation's colleges and universities to address pressing homeland security needs. The program brings together scientists, mathematicians, and engineers from many academic disciplines and institutions. These researchers are investigating research questions important to DHS and developing new technologies and approaches to solve complex and challenging homeland security problems. The program focuses on building homeland security expertise in the academic community, creating strategic partnerships among universities and public agencies, and developing a new scientific workforce of homeland security experts.

Mission Support: The Mission Support program provides enterprise leadership, management, and business administrative services that sustain the day-to-day back office operations. Key capabilities include managing the agency's performance, finances, workforce, physical and personnel security, acquisition of goods and services, information technology, property and assets, communications, legal affairs, and administration.

Component Contributions to Achieving Departmental Missions

The table below shows the alignment of the S&T programs to the DHS Missions and Mature and Strengthen Homeland Security.

Programs	DHS Missions					*Mature and Strengthen Homeland Security
	*Prevent Terrorism and Enhance Security	*Secure and Manage Our Borders	*Enforce and Administer Our Immigration Laws	*Safeguard and Secure Cyberspace	*Strengthen National Preparedness and Resilience	
Acquisition and Operations Analysis					19%	81%
Laboratory Facilities						100%
Research, Development, and Innovation	41%	16%		17%	21%	5%
University Programs						100%
Mission Support						100%

**Totals account for rounding*

Mission 1: Prevent Terrorism and Enhance Security

Resources Requested

S&T resources supporting *Prevent Terrorism and Enhance Security* are provided in the table below.

\$ in thousands

Program Name	FY 2016 Revised Enacted		FY 2017 Annualized CR		FY 2018 President's Budget	
	\$	FTE	\$	FTE	\$	FTE
Research, Development, and Innovation	187,819	-	176,495	-	141,692	-
Total	187,819	-	176,495	-	141,692	-

Performance Measures

S&T contributes to this mission, but does not have performance measures in this area.

Mission 2: Secure and Manage Our Borders

Resources Requested

S&T resources supporting *Secure and Manage Our Borders* are provided in the table below.

\$ in thousands

Program Name	FY 2016 Revised Enacted		FY 2017 Annualized CR		FY 2018 President's Budget	
	\$	FTE	\$	FTE	\$	FTE
Research, Development, and Innovation	41,478	-	66,028	-	54,201	-
Total	41,478	-	66,028	-	54,201	-

Performance Measures

S&T contributes to this mission, but does not have performance measures in this area.

Mission 4: Safeguard and Secure Cyberspace*Resources Requested*

S&T resources supporting *Safeguard and Secure Cyberspace* are provided in the table below.

\$ in thousands

Program Name	FY 2016 Revised Enacted		FY 2017 Annualized CR		FY 2018 President's Budget	
	\$	FTE	\$	FTE	\$	FTE
Research, Development, and Innovation	85,065	-	86,483	-	58,248	-
Total	85,065	-	86,483	-	58,248	-

Performance Measures

For *Safeguard and Secure Cyberspace*, strategic performance measures are presented. Strategic Measures represent measures that gauge achievement for this mission area, and are considered to be our Government Performance and Results Act Modernization Act (GPRAMA) performance measures.

Strategic Measures

Measure: Percent of planned cybersecurity products and services transitioned to government, commercial and open sources						
Description: This measure reflects the percent of identified and completed planned transitions of cybersecurity products and/or services (e.g. technologies, tools, capabilities, standards, knowledge products) within Science & Technology Directorate's Cyber Security Division projects to government, commercial or open sources. The percent reported is reviewed using the number of planned transition milestones stated in the Cyber Security Division's budget execution plan for the fiscal year, and the explanation that is provided in each quarterly performance data call. The Program identifies, funds, and coordinates cyber security research and development resulting in deployable security solutions. These solutions include user identity and data privacy technologies, end system security, research infrastructure, law enforcement forensic capabilities, secure protocols, software assurance, and cybersecurity education.						
Fiscal Year:	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Target:	60%	65%	80%	73%	80%	80%
Result:	89%	93%	60%	73%	N/A	N/A

Mission 5: Strengthen National Preparedness and Resilience***Resources Requested***

S&T resources supporting *Strengthen National Preparedness and Resilience* are provided in the table below.

\$ in thousands

Program Name	FY 2016 Revised Enacted		FY 2017 Annualized CR		FY 2018 President's Budget	
	\$	FTE	\$	FTE	\$	FTE
Acquisition and Operations Analysis	8,043	-	8,043	-	8,043	-
Research, Development, and Innovation	102,488	-	82,396	-	70,841	-
Mission Support	-	-	-	-	-	-
Total	110,531	-	90,439	-	78,884	-

Performance Measures

For Strengthen National Preparedness and Resilience, Management Measures are displayed to provide a more thorough context of expected performance results.

Management Measures

Measure: Number of SAFETY Act "transition" (new, highly innovative) technologies awarded.						
Description: In order to stay up to date with the continually changing nature of terrorism, the Office of SAFETY (Support Anti-Terrorism by Fostering Effective Technologies) Act Implementation (OSAI) will seek out those evolving technologies that can serve a homeland security mission and provide coverage to enable their transition into the commercial market, at a rate of 20 percent a year. A "transition" technology is defined as any technology that is awarded Developmental Testing and Evaluation (DTE) Designation, and those that can be considered new and innovative (i.e. a new technological application in the homeland security arena). OSAI is actively seeking out these technologies in an effort to address the ever-changing nature of terrorism. The SAFETY Act program is the only federal program that attempts to help industry transition these developmental technologies into the commercial marketplace.						
Fiscal Year:	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Target:	21	21	21	21	18	18
Result:	11	22	17	18	N/A	N/A

Mature and Strengthen Homeland Security

Resources Requested

S&T resources supporting *Mature and Strengthen Homeland Security* are provided in the table below.

\$ in thousands

Program Name	FY 2016 Revised Enacted		FY 2017 Annualized CR		FY 2018 President's Budget	
	\$	FTE	\$	FTE	\$	FTE
Acquisition and Operations Analysis	39,060	-	37,809	-	34,509	-
Laboratory Facilities	133,731	136	133,943	136	92,243	121
Research, Development, and Innovation	18,000	-	21,549	-	18,000	-
University Programs	39,724	-	39,724	-	29,724	-
Mission Support	121,245	344	119,220	344	119,823	334
Total	351,760	480	352,245	480	294,299	455

Performance Measures

For *Mature and Strengthen Homeland Security*, two types of performance measures are presented. Strategic Measures represent S&T measures that gauge achievement for this mission area, and are considered to be our GPRAMA performance measures. Additional Management Measures are displayed, as appropriate, to provide a more thorough context of expected performance results.

Strategic Measures

Measure: Percent of Apex technologies or knowledge products transitioned to customers for planned improvements in the Homeland Security Enterprise						
Description: This measure gauges the transition of high priority, and high value research and development projects known as Apex projects. Apex technologies and knowledge products are quickly delivered to improve homeland security operations. Apex products consist of cross-cutting, multi-disciplinary efforts which employ 3 to 5 year innovation cycles from project inception through operational testing.						
Fiscal Year:	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Target:	N/A	N/A	80%	80%	80%	80%
Result:	N/A	N/A	82%	100%	N/A	N/A

Management Measures

Measure: Percent of Capabilities Development Support Group program milestones that are met, as established in the fiscal year's budget execution plan

Description: This measure reflects the Capability Development Support (CDS) program milestones that are met, or completed, as established in the fiscal year budget execution plan. These milestones reflect the programmatic and technical events, accomplishments, or intermediate goals in the life of CDS projects and programs. These milestones indicate satisfactory progress toward achieving long-term program performance goals and Department-wide goals and objectives. In particular, this measure captures the contribution of CDS in supporting decisions resulting in improved acquisition and research and development outcomes across DHS. When CDS completes tests and evaluations, technical assessments, standards and operations analyses, and process analyses, the results of these analyses inform decisions for DHS Components, Acquisitions Review Board, Joint Requirements Council (JRC), R&D programs, standards community, and S&T that improve acquisition and R&D outcomes.

Fiscal Year:	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Target:	75%	75%	75%	75%	75%	75%
Result:	100%	87%	100%	95%	N/A	N/A

Measure: Percent of fiscal year milestones met for the Administration and Support Division governed by applicable laws, regulations and management directives

Description: This measure reflects the Administration and Support Division milestones identified in the Future Years Homeland Security Program (FYHSP), Program Data Module (PDM) and are governed by applicable laws, regulations and management directives. These milestones reflect the business and administrative requirements of DHS S&T including facilities, property, administration, audits and assessments, physical and information security, information technology, human capital, occupational health and safety, environment and energy, and readiness and operations coordination. Milestones are defined as significant events, accomplishments, or intermediate goals in the activities of the administrative support functions used to indicated satisfactory progress toward achieving long-term performance goals and Department-wide goals and objectives. They help identify specific and established criteria for measuring incremental progress associated with long-term activities and program outcomes.

Fiscal Year:	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Target:	75%	75%	75%	75%	75%	75%
Result:	100%	100%	100%	100%	N/A	N/A

Measure: Percent of Homeland Security Advanced Research Projects Agency (HSARPA) program milestones that are met, as established in the fiscal year's budget execution plan

Description: This measure reflects the Homeland Security Advanced Research Projects Agency (HSARPA) program milestones that meet their fiscal year budget execution and five-year plan goals. HSARPA manages a portfolio of highly innovative programs that are transforming the future mission space for Homeland Security. Complimentary to the S&T Directorate's other programs and projects, HSARPA projects push scientific limits to address customer-identified gaps in areas where current technologies and R&D are inadequate or non-existent. HSARPA program managers lead teams of national experts in the development of new homeland security technologies, demonstrations and applications that offer significant breakthroughs for DHS operations. These milestones reflect the programmatic and technical events, accomplishments, or intermediate goals in the life of HSARPA projects and programs.

Fiscal Year:	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Target:	75%	75%	75%	75%	75%	75%
Result:	62%	77%	62%	79%	N/A	N/A

Measure: Percent of Research and Development Partnerships (RDP) program milestones that are met, as established in the fiscal year's budget execution plan

Description: This measure reflects the Research and Development Partnerships (RDP) Group program milestones that meet their fiscal year budget execution and five-year plan goals. RDP conducts extensive outreach efforts with members of the HSE based on the strategic and programmatic needs of the Department and S&T. The R&D Partnerships Group assists in both "transmitting and receiving information" to stakeholders across the HSE. The R&D Partnerships Group enables opportunities for evaluating, expediting and monitoring the execution of programs with an increased speed-of-execution compared to "in-house only" activities. Our Group maintains extensive contacts and key references to conduct outreach, and provide research and funding opportunities to the public and private sectors both domestically and internationally.

Fiscal Year:	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Target:	75%	75%	75%	75%	75%	75%
Result:	95%	77%	80%	88%	N/A	N/A

Measure: Percent of the Homeland Security Enterprise and First Responders Group program milestones that are met, as established in the fiscal year's budget execution plan						
Description: This measure reflects the Homeland Security Enterprise and First Responders Group (FRG) program milestones that meet their fiscal year budget execution and five-year plan goals. FRG identifies, validates, and facilitates the fulfillment of First Responder capability gaps through the use of existing and emerging technologies, knowledge products, and the acceleration of standards. FRG manages working groups, teams, and other stakeholder outreach efforts in order to better understand the needs and requirements of local, tribal, state, and Federal First Responders, including those on the front line of border protection and transportation security.						
Fiscal Year:	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Target:	75%	75%	75%	75%	75%	75%
Result:	77%	78%	85%	75%	N/A	N/A

Measure: Percent of university programs milestones that are met, as established in the fiscal year's budget execution plan						
Description: This measure reflects the percent of University Programs milestones that meet their fiscal year budget execution and five-year plan goals. University Programs works closely with its stakeholders to identify requirements, set goals for milestones and deliverables, discuss the status of projects, and plan for the allocation of resources.						
Fiscal Year:	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Target:	75%	75%	75%	75%	75%	75%
Result:	100%	86%	82%	92%	N/A	N/A

Science and Technology Budget Comparison and Adjustments

Comparison of Budget Authority and Request

Dollars in Thousands

Organization	FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Operations and Support	480	480	\$302,079	480	480	\$299,015	431	455	\$254,618	(49)	(25)	(\$44,397)
Research and Development	-	-	\$474,574	-	-	\$472,675	-	-	\$372,706	-	-	(\$99,969)
Total	480	480	\$776,653	480	480	\$771,690	431	455	\$627,324	(49)	(25)	(\$144,366)
Subtotal Discretionary - Appropriation	480	480	\$776,653	480	480	\$771,690	431	455	\$627,324	(49)	(25)	(\$144,366)

S&T requests 431 positions, 455 FTE, and \$627.324M of total discretionary funding in FY 2018, a decrease of \$144.366M from the FY 2017 annualized Continuing Resolution (CR).

S&T has prioritized Administration and Secretarial priorities within available resources based on the Department's Integrated Product Team (IPT) process, which prioritized capability gaps from around the Department that require research and development, and the internal S&T Portfolio and Analysis Review. The proposed strategic reductions will ensure that S&T is rightsized for the future and allow S&T to focus on the highest priority needs of the Homeland Security Enterprise (HSE), such as border security and immigration technology. The total decreases by appropriation include:

- A decrease of \$44.397M in Operations and Support. This includes reductions across the three PPAs in O&S and the closure of the three laboratory facilities listed below.
 - National Biodefense Analysis and Countermeasures Center in Fort Detrick, Frederick, Maryland.
 - Chemical Security Analysis Center in Aberdeen Proving Ground, Aberdeen Maryland.
 - National Urban Security Technology Laboratory in Manhattan, New York City, New York and Oakbrook Terrace, IL (near Chicago).
- A decrease of \$99.969M in Research and Development. This includes reductions or eliminations of projects in the Research, Development and Innovation (RD&I) PPA as well as reducing the number of Centers of Excellence from ten to seven. To better align S&T's resources to Administration and Secretarial priorities, S&T will not request funding for the following projects:
 - Chemical research and development.
 - Cargo security research and development.

- Radiological and nuclear resiliency research and development.
 - Cyber education, outreach, experimental test beds, and research data repositories.
 - Eliminates most program funding for the DHS Standards program. S&T will maintain one FTE to ensure that DHS complies with Standards requirements.
- No funds are requested for Procurement, Construction, and Improvements in FY 2018.

Science and Technology Comparison of Obligations

Dollars in Thousands

Budget Authority	FY 2016	FY 2017	FY 2018
Enacted	\$786,938		
Transfers & Reprogrammings	-		
Delta in Enacted Fee Estimate to Fee Actuals	-		
Enacted Rescissions to Prior Year	(\$10,285)		
Revised Enacted/Request	\$776,653	\$771,690	\$627,324
Carryover and/or Recoveries (Actual/Estimates/Projections)	\$189,071	\$225,221	\$125,906
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	\$965,724	\$996,911	\$753,230
Collections – Reimbursable Resources	\$47,988	\$24,500	\$24,500
Total Budget Resources	\$1,013,712	\$1,021,411	\$777,730
Obligations (Actual/Projections/Estimates)	\$768,682	\$745,373	\$590,795
Personnel: Positions and FTE			
Enacted/Request Positions	480	480	431
Enacted/Request FTE	480	480	455
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	482	480	431
FTE (Actual/Estimates/Projections)	473	480	455

The FY 2018 estimated obligation is \$590.795M out of an estimated \$753.230M of total budgetary resources. Total budget obligations for FY 2017 and FY 2018 are based on FY 2016 execution.

Science and Technology Personal Compensation and Benefits

Pay Summary *Dollars in Thousands*

Organization	FY 2016 Revised Enacted				FY 2017 Annualized CR				FY 2018 President's Budget				FY 2017 to FY 2018 Total Changes			
	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate
Operations and Support	480	480	\$83,526	\$173.54	480	480	\$85,070	\$177.07	431	455	\$82,729	\$180.61	(49)	(25)	(\$2,341)	\$3.54
Total	480	480	\$83,526	\$173.54	480	480	\$85,070	\$177.07	431	455	\$82,729	\$180.61	(49)	(25)	(\$2,341)	\$3.54
Discretionary - Appropriation	480	480	\$83,526	\$173.54	480	480	\$85,070	\$177.07	431	455	\$82,729	\$180.61	(49)	(25)	(\$2,341)	\$3.54

* The FTE Rate calculation does not include Object Class 11.8-Special Personal Services Payments or 13.0-Benefits for Former Personnel.

S&T's personnel compensation and benefits are accounted for in the Operations and Support Appropriation, Mission Support and Laboratory Facilities PPAs. The Mission Support PPA includes a salaries and benefits decrease of \$0.4 million and Laboratory Facilities salaries and benefits decrease by \$1.9 million. The total reduction in overall salaries and benefits is \$2.3 million. The change in rate is driven by both a reduction in staffing and the FY 2018 pay increase and annualization. The FY 2018 request includes a reduction of 49 FTP (25 FTE) due to the closure of three laboratory facilities and R&D reductions. S&T expects to begin FY 2018 fully staffed, while utilizing various human capital tools to implement the staff reduction, thus resulting in a higher rate change than if staff was reduced on the first day of fiscal year.

Science and Technology
Pay by Object Class
Dollars in Thousands

Pay Object Classes	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
11.1 Full-time Permanent	\$57,847	\$59,324	\$55,361	(\$3,963)
11.3 Other than Full-Time Permanent	\$5,271	\$5,274	\$5,256	(\$18)
11.5 Other Personnel Compensation	\$1,105	\$975	\$1,125	\$150
12.1 Civilian Personnel Benefits	\$19,078	\$19,422	\$20,437	\$1,015
13.0 Benefits for Former Personnel	\$225	\$75	\$550	\$475
Total - Personnel Compensation and Benefits	\$83,526	\$85,070	\$82,729	(\$2,341)
Positions and FTE				
Positions - Civilian	480	480	431	(49)
FTE - Civilian	480	480	455	(25)

Science and Technology Non Pay Budget Exhibits

Non Pay Summary

Dollars in Thousands

Organization	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
Operations and Support	\$218,553	\$213,945	\$171,889	(\$42,056)
Research and Development	\$474,574	\$472,675	\$372,706	(\$99,969)
Total	\$693,127	\$686,620	\$544,595	(\$142,025)
Discretionary - Appropriation	\$693,127	\$686,620	\$544,595	(\$142,025)

The FY 2018 non-pay summary is \$142.025 less than FY 2017 annualized Continuing Resolution (CR). This request includes decreases to Operations and Support and Research and Development programs associated with three laboratory closures and reduced R&D activities.

Science and Technology Non Pay by Object Class

Dollars in Thousands

Non-Pay Object Classes	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
21.0 Travel and Transportation of Persons	\$3,387	\$3,349	\$2,782	(\$567)
22.0 Transportation of Things	\$45	\$46	\$34	(\$12)
23.1 Rental Payments to GSA	\$1,711	\$1,827	\$2,100	\$273
23.2 Rental Payments to Others	\$112	\$112	\$89	(\$23)
23.3 Communications, Utilities, and Misc. Charges	\$81	\$87	\$60	(\$27)
25.1 Advisory and Assistance Services	\$159,973	\$158,837	\$118,736	(\$40,101)
25.2 Other Services from Non-Federal Sources	\$4,195	\$4,183	\$3,372	(\$811)
25.3 Other Goods and Services from Federal Sources	\$316,081	\$307,624	\$249,858	(\$57,766)
25.4 Operation and Maintenance of Facilities	\$5,758	\$6,101	\$4,291	(\$1,810)
25.5 Research and Development Contracts	\$147,831	\$147,849	\$118,025	(\$29,824)
25.6 Medical Care	\$3	\$3	\$3	-
25.7 Operation and Maintenance of Equipment	\$4,739	\$5,577	\$5,346	(\$231)
26.0 Supplies and Materials	\$4,097	\$4,447	\$3,299	(\$1,148)
31.0 Equipment	\$7,677	\$9,127	\$8,394	(\$733)
32.0 Land and Structures	\$612	\$653	\$450	(\$203)
41.0 Grants, Subsidies, and Contributions	\$36,825	\$36,798	\$27,756	(\$9,042)
Total - Non Pay Object Classes	\$693,127	\$686,620	\$544,595	(\$142,025)

Reductions in object classes is directly proportional with the decreases proposed in this FY 2018 President's budget request.

Science and Technology
Supplemental Budget Justification Exhibits

Working Capital Fund

Dollars in Thousands

Appropriation and PPA	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget
Operations and Support	\$36,396	\$26,755	\$27,793
Mission Support	\$36,396	\$26,755	\$27,793
Total Working Capital Fund	\$36,396	\$26,755	\$27,793

The DHS Working Capital Fund (WCF) provides shared services that the Components rely on to execute their missions, such as contracting officers and the DHS-wide IT infrastructure. Funds provided within the Mission Support PPA are used to acquire DHS WCF services, which include: IT services, human resources, and financial systems. The WCF also provides consolidated subscriptions, government-wide mandated services, and DHS crosscutting activities.

Science and Technology

Status of Congressionally Requested Studies, Reports and Evaluations

Fiscal Year	Due Date	Reference/Citation	Requirement	Status
FY 2016	1/17/2016	Senate Report 114-68, p. 131	NBAF Construction Plan Update S&T shall submit to the Committee a detailed update of NBAF construction progress and a schedule not later than 30 days after the date of enactment of this act.	Submitted
FY 2016	2/9/2016	Senate Report 114-68, p. 128	Research and Development Results for FY 2015 In conjunction with the President's fiscal year 2017 budget request, S&T is to report on results of its R&D for the prior fiscal year to include all technologies, technology improvements, or capabilities delivered to frontline users.	Submitted
FY 2016	2/1/2016	Public Law 114-113 Joint Explanatory Statement, p. 15	Component Obligation Plans – Q1 Obligation plans from each DHS component shall be provided to the Committees within 45 days of the date of enactment of this Act, with updates provided not later than 30 days after the end of each quarter.	Submitted
FY 2016	5/2/2016	Public Law 114-113 Joint Explanatory Statement, p. 15	Component Obligation Plans – Q2 Obligation plans from each DHS component shall be provided to the Committees within 45 days of the date of enactment of this Act, with updates provided not later than 30 days after the end of each quarter.	Submitted
FY 2016	7/30/2016	Public Law 114-113 Joint Explanatory Statement, p. 15	Component Obligation Plans – Q3 Obligation plans from each DHS component shall be provided to the Committees within 45 days of the date of enactment of this Act, with updates provided not later than 30 days after the end of each quarter.	Submitted
FY 2016	10/30/2016	Public Law 114-113 Joint Explanatory Statement, p. 15	Component Obligation Plans – Q4 Obligation plans from each DHS component shall be provided to the Committees within 45 days of the date of enactment of this Act, with updates provided not later than 30 days after the end of each quarter.	Submitted

Science and Technology
Authorized/Unauthorized Appropriations

Dollars in Thousands

Budget Activity	Last year of Authorization	Authorized Level	Appropriation in Last Year of Authorization	FY 2018 President's Budget
	Fiscal Year	Amount	Amount	Amount
Operations and Support	N/A	N/A	N/A	\$254,618
Mission Support	N/A	N/A	N/A	\$119,823
Laboratory Facilities	N/A	N/A	N/A	\$92,243
Acquisition and Operations Analysis	N/A	N/A	N/A	\$42,552
Research and Development	N/A	N/A	N/A	\$372,706
Research Development and Innovation	N/A	N/A	N/A	\$342,982
University Programs	N/A	N/A	N/A	\$29,724
Total Direct Authorization/Appropriation				\$627,324

Science and Technology Proposed Legislative Language

Operations and Support

For necessary expenses *of the Science and Technology Directorate* for operations and support, [science and technology research and development, acquisition, and laboratory operations] as authorized by title III of the Homeland Security Act of 2002 (6 U.S.C. 181 et seq.), and the purchase or lease of not to exceed 5 vehicles, \$[278,733,000]254,618,000, of which \$[89,043,000]134,795,000 [is for management and administration; and of which \$189,690,000] shall remain available until September 30, [2019]2020: *Provided*, That not to exceed \$7,650 shall be for official reception and representation expenses.

Language Provision	Explanation
<i>of the Science and Technology Directorate of the Science and Technology Directorate</i> for operations and support, [science and technology research and development, acquisition, and laboratory operations]	Updated language for consistency.
\$[278,733,000]254,618,000	Dollar change only.
\$[89,043,000]134,795,000	Dollar change only.
[is for management and administration; and of which \$189,690,000]	Removed unnecessary language for consistency.
[2019]2020	Updated period of availability.

Research and Development

For necessary expenses *of the Science and Technology Directorate* for [science and technology] research and development, [including advanced research projects] as authorized by title III of the Homeland Security Act of 2002 (6 U.S.C. 181 et seq.), \$[469,869,000]372,706,000, to remain available until September 30, [2019]2020.

Language Provision	Explanation
<i>of the Science and Technology Directorate</i> for [science and technology]	Updated language for consistency.
[including advanced research projects]	Removed unnecessary language for consistency.
\$[469,869,000]372,706,000	Dollar change only.
[2019]2020	Updated period of availability.

Science and Technology Reimbursable Resources

Dollars in Thousands

Collections	FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Change		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Agriculture - Department of Agriculture Source	-	-	\$693	-	-	\$700	-	-	\$700	-	-	-
Operations and Support	-	-	\$693	-	-	\$700	-	-	\$700	-	-	-
Laboratory Facilities	-	-	\$693	-	-	\$700	-	-	\$700	-	-	-
Department of Agriculture - Agricultural Marketing Service Source	-	-	\$970	-	-	\$1,000	-	-	\$1,000	-	-	-
Operations and Support	-	-	\$970	-	-	\$1,000	-	-	\$1,000	-	-	-
Laboratory Facilities	-	-	\$970	-	-	\$1,000	-	-	\$1,000	-	-	-
Department of Defense - Department of Defense Source	-	-	\$3,798	-	-	\$4,250	-	-	\$4,250	-	-	-
Operations and Support	-	-	-	-	-	\$250	-	-	\$250	-	-	-
Mission Support	-	-	-	-	-	\$250	-	-	\$250	-	-	-
Research and Development	-	-	\$3,798	-	-	\$4,000	-	-	\$4,000	-	-	-
Research, Development and Innovation	-	-	\$3,338	-	-	\$3,500	-	-	\$3,500	-	-	-
University Programs	-	-	\$460	-	-	\$500	-	-	\$500	-	-	-
Department of Energy - Department of Energy Source	-	-	\$429	-	-	\$500	-	-	\$500	-	-	-
Research and Development	-	-	\$429	-	-	\$500	-	-	\$500	-	-	-
Research, Development and Innovation	-	-	\$429	-	-	\$500	-	-	\$500	-	-	-
Department of Homeland Security - Federal Emergency Management Agency Source	-	-	\$4,079	-	-	\$1,300	-	-	\$1,300	-	-	-
Operations and Support	-	-	\$167	-	-	\$400	-	-	\$400	-	-	-
Mission Support	-	-	\$2	-	-	\$250	-	-	\$250	-	-	-
Laboratory Facilities	-	-	\$165	-	-	\$150	-	-	\$150	-	-	-
Research and Development	-	-	\$3,912	-	-	\$900	-	-	\$900	-	-	-
Research, Development and Innovation	-	-	\$3,912	-	-	\$900	-	-	\$900	-	-	-
Department of Homeland Security - Transportation Security Administration Source	-	-	\$6,111	-	-	\$1,950	-	-	\$1,950	-	-	-
Operations and Support	-	-	\$796	-	-	\$750	-	-	\$750	-	-	-
Laboratory Facilities	-	-	\$506	-	-	\$500	-	-	\$500	-	-	-
Acquisition and Operations Analysis	-	-	\$290	-	-	\$250	-	-	\$250	-	-	-
Research and Development	-	-	\$5,315	-	-	\$1,200	-	-	\$1,200	-	-	-
Research, Development and Innovation	-	-	\$5,315	-	-	\$1,200	-	-	\$1,200	-	-	-
Department of Homeland Security - US Immigration and Customs Enforcement Source	-	-	\$1,848	-	-	\$100	-	-	\$100	-	-	-
Research and Development	-	-	\$1,848	-	-	\$100	-	-	\$100	-	-	-
Research, Development and Innovation	-	-	\$1,848	-	-	\$100	-	-	\$100	-	-	-
Department of Homeland Security - Citizenship and Immigration Services Source	-	-	\$265	-	-	\$150	-	-	\$150	-	-	-
Research and Development	-	-	\$265	-	-	\$150	-	-	\$150	-	-	-
Research, Development and Innovation	-	-	\$265	-	-	\$150	-	-	\$150	-	-	-
Independent Agency - Intelligence Community Management Account Source	-	-	\$3,295	-	-	\$3,500	-	-	\$3,500	-	-	-
Research and Development	-	-	\$3,295	-	-	\$3,500	-	-	\$3,500	-	-	-
Research, Development and Innovation	-	-	\$3,295	-	-	\$3,500	-	-	\$3,500	-	-	-

Department of Homeland Security

Science and Technology

Collections		FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Change		
		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Justice - Federal Bureau of Investigation	Source	-	-	\$3,500	-	-	\$3,500	-	-	\$3,500	-	-	-
Research and Development	Location	-	-	\$3,500	-	-	\$3,500	-	-	\$3,500	-	-	-
Research, Development and Innovation	Location	-	-	\$3,500	-	-	\$3,500	-	-	\$3,500	-	-	-
Department of Defense - Research, Development, Test, and Evaluation	Source	-	-	\$6	-	-	-	-	-	-	-	-	-
Research and Development	Location	-	-	\$6	-	-	-	-	-	-	-	-	-
Research, Development and Innovation	Location	-	-	\$6	-	-	-	-	-	-	-	-	-
Department of Justice - Drug Enforcement Administration	Source	-	-	\$100	-	-	-	-	-	-	-	-	-
Research and Development	Location	-	-	\$100	-	-	-	-	-	-	-	-	-
Research, Development and Innovation	Location	-	-	\$100	-	-	-	-	-	-	-	-	-
Department of Homeland Security - United States Coast Guard	Source	-	-	\$1,588	-	-	\$1,500	-	-	\$1,500	-	-	-
Research and Development	Location	-	-	\$1,588	-	-	\$1,500	-	-	\$1,500	-	-	-
Research, Development and Innovation	Location	-	-	\$1,588	-	-	\$1,500	-	-	\$1,500	-	-	-
Department of Homeland Security - National Protection and Programs Directorate	Source	-	-	\$3,791	-	-	\$900	-	-	\$900	-	-	-
Research and Development	Location	-	-	\$3,791	-	-	\$900	-	-	\$900	-	-	-
Research, Development and Innovation	Location	-	-	\$3,791	-	-	\$900	-	-	\$900	-	-	-
Department of Homeland Security - US Customs and Border Protection	Source	-	-	\$10,147	-	-	\$2,600	-	-	\$2,600	-	-	-
Operations and Support	Location	-	-	\$441	-	-	\$600	-	-	\$600	-	-	-
Mission Support	Location	-	-	\$342	-	-	\$500	-	-	\$500	-	-	-
Acquisition and Operations Analysis	Location	-	-	\$99	-	-	\$100	-	-	\$100	-	-	-
Research and Development	Location	-	-	\$9,706	-	-	\$2,000	-	-	\$2,000	-	-	-
Research, Development and Innovation	Location	-	-	\$9,706	-	-	\$2,000	-	-	\$2,000	-	-	-
Department of Homeland Security - Office of the Under Secretary for Management	Source	-	-	\$4,482	-	-	\$1,000	-	-	\$1,000	-	-	-
Research and Development	Location	-	-	\$4,482	-	-	\$1,000	-	-	\$1,000	-	-	-
Research, Development and Innovation	Location	-	-	\$4,482	-	-	\$1,000	-	-	\$1,000	-	-	-
Department of State - Department of State	Source	-	-	\$150	-	-	\$150	-	-	\$150	-	-	-
Operations and Support	Location	-	-	\$150	-	-	\$150	-	-	\$150	-	-	-
Laboratory Facilities	Location	-	-	\$150	-	-	\$150	-	-	\$150	-	-	-
Department of Transportation - Department of Transportation	Source	-	-	\$540	-	-	-	-	-	-	-	-	-
Research and Development	Location	-	-	\$540	-	-	-	-	-	-	-	-	-
Research, Development and Innovation	Location	-	-	\$540	-	-	-	-	-	-	-	-	-
Department of Homeland Security - Office of Health Affairs	Source	-	-	\$204	-	-	\$650	-	-	\$650	-	-	-
Operations and Support	Location	-	-	\$154	-	-	\$150	-	-	\$150	-	-	-
Acquisition and Operations Analysis	Location	-	-	\$154	-	-	\$150	-	-	\$150	-	-	-
Research and Development	Location	-	-	\$50	-	-	\$500	-	-	\$500	-	-	-
Research, Development and Innovation	Location	-	-	\$50	-	-	\$500	-	-	\$500	-	-	-
Department of Homeland Security - Domestic Nuclear Detection Office	Source	-	-	\$535	-	-	\$350	-	-	\$350	-	-	-
Operations and Support	Location	-	-	\$10	-	-	-	-	-	-	-	-	-
Laboratory Facilities	Location	-	-	\$10	-	-	-	-	-	-	-	-	-
Research and Development	Location	-	-	\$525	-	-	\$350	-	-	\$350	-	-	-
Research, Development and Innovation	Location	-	-	\$525	-	-	\$350	-	-	\$350	-	-	-
Intelligence Advanced Research Projects Activity	Source	-	-	\$807	-	-	-	-	-	-	-	-	-
Research and Development	Location	-	-	\$807	-	-	-	-	-	-	-	-	-
Research, Development and Innovation	Location	-	-	\$807	-	-	-	-	-	-	-	-	-

Collections		FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Change		
		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Canada	Source	-	-	\$300	-	-	\$400	-	-	\$400	-	-	-
Research and Development	Location	-	-	\$300	-	-	\$400	-	-	\$400	-	-	-
Research, Development and Innovation	Location	-	-	\$300	-	-	\$400	-	-	\$400	-	-	-
Israel	Source	-	-	\$350	-	-	-	-	-	-	-	-	-
Research and Development	Location	-	-	\$350	-	-	-	-	-	-	-	-	-
Research, Development and Innovation	Location	-	-	\$350	-	-	-	-	-	-	-	-	-
Total Collections		-	-	\$47,988	-	-	\$24,500	-	-	\$24,500	-	-	-

Department of Homeland Security

Science and Technology

Operations and Support



Fiscal Year 2018
Congressional Justification

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Operations and Support

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

Dollars in Thousands

Organization	FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Mission Support	344	344	\$121,245	344	344	\$119,220	324	334	\$119,823	(20)	(10)	\$603
Laboratory Facilities	136	136	\$133,731	136	136	\$133,943	107	121	\$92,243	(29)	(15)	(\$41,700)
Acquisition and Operations Analysis	-	-	\$47,103	-	-	\$45,852	-	-	\$42,552	-	-	(\$3,300)
Total	480	480	\$302,079	480	480	\$299,015	431	455	\$254,618	(49)	(25)	(\$44,397)
Subtotal Discretionary - Appropriation	480	480	\$302,079	480	480	\$299,015	431	455	\$254,618	(49)	(25)	(\$44,397)

Overview

Mission Statement for Science and Technology – Operations and Support:

The mission of Operations and Support (O&S) is to fund the effective and efficient management of the Science and Technology (S&T) Directorate activities to deliver advanced technology solutions to DHS Components and first responders. This includes costs necessary for regular operations, salaries, facilities, mission support, headquarters, management and DHS Working Capital Fund (WCF) costs.

Budget Activities:

S&T has three program, project, and activities (PPAs) in the O&S appropriation. The three PPAs include Mission Support (MS), Laboratory Facilities, and Acquisition and Operations Analysis (AOA).

Mission Support

The MS PPA funds all of the corporate-level functions in S&T that allow the technical divisions to manage the Research, Development, Test, and Evaluation (RDT&E) programs. The MS PPA funds business operations, salaries and benefits and S&T's share of the WCF. The business operations functions pay for rent, office supplies, utilities, and other operational functions associated with the S&T's headquarters offices. This account pays for the training and travel associated with senior management of S&T and contractor staff who support the execution of headquarters functions including financial management, facility planning, maintenance, and other administrative functions. MS also funds the headquarters shared services agreements, and financial and programmatic databases. S&T plans to eliminate 20 FTP and 10 FTEs in Mission Support in FY 2018.

Laboratory Facilities

The Office of National Laboratories (ONL) manages the Laboratory Facilities Programs. ONL provides the Nation with a coordinated, enduring core of productive science, technology and engineering laboratories, organizations and institutions, which provide the knowledge and technology required to secure our homeland. The Laboratory Facilities PPA is being reduced by \$41.700M for FY 2018. S&T plans to close three laboratory facilities and reduce staff by 33 positions, and plans to hire four positions for National Bio and Agro-Defense Facility (NBAF) operations. The total laboratory facilities staffing request is 121 FTE and 107 FTP for FY 2018; a reduction of 29 positions, and 15 FTE from the FY 2017 annualized Continuing Resolution (CR).

Acquisition and Operations Analysis

AOA provides expert assistance to entities across the Homeland Security Enterprise (HSE) to ensure that the transition, acquisition, and deployment of technologies, information, and procedures improve the efficiency and effectiveness of the operational capabilities across the HSE mission. S&T plans to reduce AOA by \$3.300M, including eliminating the Standards program, and the staff (three FTP) associated with this program retaining 1 FTE to remain as an S&T representative in the Standards community. The three FTP are paid out of the MS PPA and are included in the 20 FTP reduction.

Operations and Support
Budget Authority and Obligations
Dollars in Thousands

Budget Authority	FY 2016	FY 2017	FY 2018
Enacted	\$312,364		
Transfers & Reprogrammings	-		
Delta in Enacted Fee Estimate to Fee Actuals	-		
Enacted Rescissions to Prior Year	(\$10,285)		
Revised Enacted/Request	\$302,079	\$299,015	\$254,618
Carryover and/or Recoveries (Actual/Estimates/Projections)	\$60,353	\$75,707	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	\$362,432	\$374,722	\$254,618
Collections – Reimbursable Resources	\$3,381	\$4,000	\$4,000
Total Budget Resources	\$365,813	\$378,722	\$258,618
Obligations (Actual/Projections/Estimates)	\$299,608	\$290,086	\$215,537
Personnel: Positons and FTE			
Enacted/Request Positions	480	480	431
Enacted/Request FTE	480	480	455
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	482	480	431
FTE (Actual/Estimates/Projections)	473	480	455

Operations and Support Collections – Reimbursable Resources

Dollars in Thousands

Collections		FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget		
		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Agriculture - Department of Agriculture	Source	-	-	\$693	-	-	\$700	-	-	\$700
Department of Agriculture - Agricultural Marketing Service	Source	-	-	\$970	-	-	\$1,000	-	-	\$1,000
Department of Defense - Department of Defense	Source	-	-	-	-	-	\$250	-	-	\$250
Department of Homeland Security - Federal Emergency Management Agency	Source	-	-	\$167	-	-	\$400	-	-	\$400
Department of Homeland Security - Transportation Security Administration	Source	-	-	\$796	-	-	\$750	-	-	\$750
Department of Homeland Security - US Customs and Border Protection	Source	-	-	\$441	-	-	\$600	-	-	\$600
Department of State - Department of State	Source	-	-	\$150	-	-	\$150	-	-	\$150
Department of Homeland Security - Office of Health Affairs	Source	-	-	\$154	-	-	\$150	-	-	\$150
Department of Homeland Security - Domestic Nuclear Detection Office	Source	-	-	\$10	-	-	-	-	-	-
Total Collections		-	-	\$3,381	-	-	\$4,000	-	-	\$4,000

The FY 2018 estimated obligation is \$215.537M out of an estimated \$254.618M of total budgetary resources. Total budget obligations for FY 2017 and FY 2018 are based on FY 2016 execution data.

Operations and Support
Summary of Budget Changes
Dollars in Thousands

Budget Formulation Activity	Positions	FTE	Amount
FY 2016 Enacted	480	480	\$312,364
FY16 Rescissions of prior year appropriations	-	-	(\$10,285)
Total Rescissions	-	-	(\$10,285)
FY 2016 Revised Enacted	480	480	\$302,079
FY 2017 Annualized CR	480	480	\$299,015
FY 2018 Base Budget	480	480	\$299,015
Transfer to A&O from S&T/MS due to A&O WCF Activity Costs Removal	-	-	(\$14)
Transfer to OSEM/OGC from S&T/MS due to OGC WCF Activity Costs Removal	-	-	(\$3)
Transfer to USM/CHCO from S&T/MS due to CHCO WCF Activity Costs Removal	-	-	(\$55)
Transfer to USM/CIO from S&T/MS due to CIO WCF Activity Costs Removal	-	-	(\$1,308)
Transfer to USM/CPO from S&T/MS due to CPO WCF Activity Costs Removal	-	-	(\$151)
Transfer to USM/CRSO from S&T/MS due to CRSO WCF Activity Costs Removal	-	-	(\$248)
Transfer to USM/CSO from S&T/MS due to CSO WCF Activity Costs Removal	-	-	(\$18)
Total Transfers	-	-	(\$1,797)
FY17 Pay Raise	-	-	\$1,158
FY17: FY16 Annualized Pay	-	-	\$386
FY18 Pay Raise	-	-	\$910
FY18: FY17 Annualized Pay	-	-	\$303
Rent	-	-	\$4,095
Total, Pricing Increases	-	-	\$6,852
Hiring Freeze Savings	-	-	(\$2,600)
Total, Pricing Decreases	-	-	(\$2,600)
Total Adjustments-to-Base	-	-	\$2,455
FY 2018 Current Services	480	480	\$301,470
Acquisition and Operations Analysis	-	-	(\$3,300)
Laboratory Facilities Closures and Personnel Reductions	(29)	(15)	(\$41,700)
R&D and AOA Personnel Reductions	(20)	(10)	(\$1,852)

Budget Formulation Activity	Positions	FTE	Amount
Total, Program Decreases	(49)	(25)	(\$46,852)
FY 2018 Request	431	455	\$254,618
FY 2017 TO FY 2018 Change	(49)	(25)	(\$44,397)

Budget Request Summary:

The S&T Directorate requests 455 FTE, 431 positions and \$254.618M for O&S in FY 2018.

The adjustments-to-base total an increase of \$0.603M and include:

- Transfer out of Mission Support Working Capital Fund to DHS HQ (\$1.797M).
- Increase for FY 2018 federal pay raise and FY 2017 annualization, of pay \$1.213M.
- Increase for FY 2017 federal pay raise and FY2016 annualization, of pay \$1.544M.
- Increase rent \$4.095M.
- Decrease for hiring freeze savings (\$2.600M).

The program changes total a decrease of 49 FTE and \$46.852 million and include:

- A program decrease of \$3.300M in AOA.
- A program decrease of \$41.700M and 29 positions (15 FTE) for Laboratory Facilities.
- A program decrease for 20 positions (10 FTE) in MS (reductions to staff correspond to decreased funding in AOA and R&D programs and projects).

Operations and Support
Justification of Pricing Changes
Dollars in Thousands

Pricing Changes	FY 2018 President's Budget		
	Positions	FTE	Amount
Pricing Change 1 - FY17 Pay Raise	-	-	\$1,158
Mission Support	-	-	\$724
Laboratory Facilities	-	-	\$434
Pricing Change 2 - FY17: FY16 Annualized Pay	-	-	\$386
Mission Support	-	-	\$241
Laboratory Facilities	-	-	\$145
Pricing Change 3 - FY18 Pay Raise	-	-	\$910
Mission Support	-	-	\$666
Laboratory Facilities	-	-	\$244
Pricing Change 4 - FY18: FY17 Annualized Pay	-	-	\$303
Mission Support	-	-	\$222
Laboratory Facilities	-	-	\$81
Pricing Change 5 - Hiring Freeze Savings	-	-	(\$2,600)
Mission Support	-	-	(\$1,696)
Laboratory Facilities	-	-	(\$904)
Pricing Change 6 - Rent	-	-	\$4,095
Mission Support	-	-	\$4,095
Total Pricing Changes	-	-	\$4,252

2018 Pay Increase and Annualization of 2017 Pay: Increase of \$1.213M to account for the 2.1 percent pay increase in FY 2017 and the 1.9 percent pay increase in FY 2018.

Hiring Freeze Savings: Decrease of \$2.6M in salaries and benefits due to hiring freeze savings.

Rent: Increase of \$4.095M increase due to the delayed move to St. Elizabeth's campus.

Operations and Support Justification of Program Changes

Dollars in Thousands

Program Changes	FY 2018 President's Budget		
	Positions	FTE	Amount
Program Change 1 - Acquisition and Operations Analysis	-	-	(\$3,300)
Acquisition and Operations Analysis	-	-	(\$3,300)
Program Change 2 - Laboratory Facilities Closures and Personnel Reductions	(29)	(15)	(\$41,700)
Laboratory Facilities	(29)	(15)	(\$41,700)
Program Change 3 - R&D and AOA Personnel Reductions	(20)	(10)	(\$1,852)
Mission Support	(20)	(10)	(\$1,852)
Total Program Changes	(49)	(25)	(\$46,852)

Program Change

Acquisition and Operations Analysis

Description

The funding decrease in AOA is part of S&T's strategic reorganization to support border security and immigration priorities. The AOA reduction will eliminate funding for the Standards program and reduce funding for Technology Transition areas. The Standards program provides standard test methods, test kits and guidance to for DHS Components including TSA's Quality Assurance/Quality Control for standards for bulk, trace and stand-off explosive detection technologies, including non-aviation standards for other applications (i.e., facility security) and trace drug detection standards. In addition, the Standards program develops test methods for response robots capabilities that support aerial systems, submersibles, urban search and rescue, and bomb squads.

Justification

This decrement includes the elimination of the Standards Program by \$3M and four FTE. S&T would retain one position fulfilling DHS coordination and oversight responsibilities and participating in standards committees. Standards development and enforcement relies on voluntary compliance and multi-agency and industry cooperation and will not impact current daily operations.

S&T plans to decrease funding to program transition by \$.300M. Program transition establishes and implements technology development focusing on near-term S&T work on transitioning projects and capabilities needed by DHS Components, and their external customers.

Performance

This elimination of standards and reduction in program transition will have a minimal effect on work currently being performed. S&T will continue to work closely with the DHS components to ensure programs and systems reduce or mitigate the challenges in the safest, most efficient and most cost-effective manner.

Program Change

Laboratory Facilities

Description

The decrease in Laboratory Facilities will result in the closing of three labs, National Biodefense Analysis and Countermeasures Center (NBACC), Chemical Security Analysis Center (CSAC) and National Urban Security Technology Laboratory (NUSTL). S&T will eliminate 33 positions from the closing of the three laboratory facilities and increase the National Bio and Agro-Defense Facility (NBAF) by 4 positions, resulting in a net FTP decrease of 29 positions.

Justification

NBACC – S&T proposes to close the NBACC laboratory including the National Bioforensic Analysis Center (NBFAC) and the National Biological Threat Characterization Center (NBTCC) centers associated with \$37.6 million and two FTP. NBACC aids in defending the nation against biological threats. Its work supports intelligence assessments, preparedness planning, emerging threat characterization and bioforensic analyses. The closing of NBACC laboratory also includes the National Bioforensic Analysis Center (NBFAC) and the National Biological Threat Characterization Center. The closing of the NBACC may impact DHS's ability to characterize select agents in research and during a Bio event; however, S&T assesses that capabilities at NBACC can be replicated at other facilities. The closing of NBFAC will have no impact on DHS components since its sole user is the Federal Bureau of Investigations (FBI).

S&T made the strategic decision to make corresponding reductions to the R&D Appropriation for Bioforensics R&D projects of \$7.7M, including two centers located in NBACC National Bioforensic Analysis Center (NBFAC). NBFAC conducts technical analyses in support of federal law enforcement investigations, and the National Biological Threat Characterization Center conducts experiments and studies to better understand biological vulnerabilities and hazards. Together, these centers offer a national resource for understanding the risks posed by the malicious use of biological agents and the operational capability to support the investigation, prosecution and prevention of biocrimes and bioterrorism.

CSAC –S&T proposes to close the CSAC laboratory associated with \$0.7 million and six FTP. CSAC identifies and assesses chemical threats and vulnerabilities in the United States and develops the best responses to potential chemical hazards. CSAC supports the homeland security community by providing a knowledge repository of chemical threat information, design and execution of laboratory and field tests, and a science-based threat and risk analysis capability, among other services. Elimination of CSAC may reduce DHS's ability to have direct scientific and research advice during a chemical incident; however, S&T assesses that capabilities at CSAC can be replicated at other facilities. Since S&T is closing CSAC, the strategic decision was made to reduce the corresponding projects in the R&D Appropriation. CSAC executes the Chemical Terrorism Risk Assessment (CTRA) to help the federal government manage its resources and priorities to the appropriate level of risk. Agencies use the CTRA Desktop Tool to maintain awareness of chemical threats and analyze mitigation and response strategies to protect the public. S&T proposes to eliminate its Chemical Program at \$11 million, which would eliminate any R&D funding associated with CSAC.

NUSTL – S&T proposes to close the NUSTL laboratory associated with \$3.4 million and 25 FTP. NUSTL serves as a federal resource supporting the successful development, evaluation and transition of homeland security technologies into field use for law enforcement, fire, and other emergency response agencies. First Responder operational test and evaluation (T&E) is not solely reliant on a dedicated facility in New York City, as these (T&E) activities can be carried out in field locations across the country. This program is run by the NUSTL staff, and elimination of this program reduces the need for S&T to operate and maintain NUSTL. S&T made the strategic decision to make corresponding reductions to the R&D Appropriation to eliminate the Radiological and Nuclear Resiliency Program in the amount of \$5 million.

NBAF – S&T proposes an increase of four FTP in support of NBAF. NBAF will be a state-of-the-art, biocontainment laboratory for the study of diseases that threaten both America's animal agricultural industry and public health. NBAF will strengthen our nation's ability to conduct research, develop vaccines, diagnose emerging diseases, and train veterinarians. NBAF will initiate on-boarding of several positions in FY 2018 including the laboratory director, science director, and operations director.

Performance

With the closure of these three laboratory facilities, S&T will continue to provide the Nation with a coordinated, enduring core of productive science, technology, and engineering laboratories, organizations, and institutions, which will provide the knowledge and technology required to secure our homeland. S&T will remain able to establish direct relationships between its researchers and customers across DHS. This extensive network facilitates the delivery of enduring capabilities vital to DHS and the national homeland security mission, and houses some of the most advanced scientific expertise and capabilities in the world. As a result, the Homeland Security Enterprise is able to leverage, transfer, and apply a wealth of expertise to inform policy, improve operations, and advance research in support of homeland security.

Program Change

Mission Support

Description

Program decrease of 20 positions, 10 FTE and a decrease of \$1.9 million in Mission Support.

Justification

All salaries and benefits for the S&T directorate, with the exception of Laboratory Facilities, reside in the Mission Support PPA. Out of the 20 positions being decreased, 17 positions are associated with the program decreases in the R&D Appropriation, Research Development and Innovation PPA, and the remaining 3 positions will be reduced from the O&S Appropriation, AOA PPA. S&T is estimating a \$1.852M cost savings from FY 2017 to FY 2018 with a reduction of 10 FTE.

Performance

S&T's mission is to deliver effective and innovative insight, methods and solutions for the critical needs of the HSE. The FTE reductions are directly associated with programs that are being eliminated or reduced and thereby will not affect S&T's performance. S&T's R&D work will continue to provide and support cutting-edge research to produce revolutionary changes in technologies, new capabilities and threat and risk assessments for the HSE.

Operations and Support Personnel Compensation and Benefits

Pay Summary *Dollars in Thousands*

Organization	FY 2016 Revised Enacted				FY 2017 Annualized CR				FY 2018 President's Budget				FY 2017 to FY 2018 Total Changes			
	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate
Mission Support	344	344	\$61,305	\$177.7	344	344	\$62,270	\$180.8	324	334	\$61,866	\$184.33	(20)	(10)	(\$404)	\$3.53
Laboratory Facilities	136	136	\$22,221	\$163.02	136	136	\$22,800	\$167.65	107	121	\$20,863	\$170.36	(29)	(15)	(\$1,937)	\$2.71
Total	480	480	\$83,526	\$173.54	480	480	\$85,070	\$177.07	431	455	\$82,729	\$180.61	(49)	(25)	(\$2,341)	\$3.54
Discretionary - Appropriation	480	480	\$83,526	\$173.54	480	480	\$85,070	\$177.07	431	455	\$82,729	\$180.61	(49)	(25)	(\$2,341)	\$3.54

* The FTE Rate calculation does not include Object Class 11.8-Special Personal Services Payments or 13.0-Benefits for Former Personnel.

S&T will pursue a reduction in personnel of an estimated 49 FTP, 25 FTE through attrition, Voluntary Early Retirement Authority (VERA) and Voluntary Separation Incentive Payment (VSIP) authorities, or other reassignment possibilities within the Department. In addition, the Office of Chief Human Capital Officer may reassign individuals across the Department to support National Security priorities.

Mission Support: The increase of \$0.888M is a result of a 1.9 percent pay increase for FY 2018. S&T is estimating a decrease of approximately \$1M in cost savings in program management and administration cost savings as a result of the 10 FTE decrease. This amount assumes that funding will still be in place to cover FTEs until reassignment, retirement option and/or off boarding dates are determined for the positions that will be eliminated.

Laboratory Facilities: Estimated salaries and benefits will result in no change from FY 2017 to FY 2018. Maintaining the current salaries and benefits level will cover both the FY 2018 pay increase as well as continue to cover salaries and benefits until all designated employees complete their off boarding. FY 2018 is expected to begin fully staffed and will utilize various HR-related actions to complete staffing reductions.

Operations and Support
Pay by Object Class
Dollars in Thousands

Pay Object Classes	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
11.1 Full-time Permanent	\$57,847	\$59,324	\$55,361	(\$3,963)
11.3 Other than Full-Time Permanent	\$5,271	\$5,274	\$5,256	(\$18)
11.5 Other Personnel Compensation	\$1,105	\$975	\$1,125	\$150
12.1 Civilian Personnel Benefits	\$19,078	\$19,422	\$20,437	\$1,015
13.0 Benefits for Former Personnel	\$225	\$75	\$550	\$475
Total - Personnel Compensation and Benefits	\$83,526	\$85,070	\$82,729	(\$2,341)
Positions and FTE				
Positions - Civilian	480	480	431	(49)
FTE - Civilian	480	480	455	(25)

The decrease of \$2.341M is a result of decreased funding due to 49 FTP (25 FTE) reduction. The decrease of 49 positions is associated with the elimination of 29 positions in Laboratory Facilities PPA and 20 positions in Mission Support PPA

Operations and Support Permanent Positions by Grade – Appropriation

Grades and Salary Range	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
Total, SES	16	17	17	-
GS-15	156	155	147	-8
GS-14	105	111	96	-15
GS-13	73	74	60	-14
GS-12	45	43	39	-4
GS-11	21	16	15	-1
GS-9	12	14	12	-2
GS-7	2	2	2	-
GS-6	1	1	-	-1
GS-5	4	4	3	-1
Other Graded Positions	45	43	40	-3
Total Permanent Positions	480	480	431	-49
Position Locations				
Headquarters	336	336	323	-13
U.S. Field	143	143	107	-36
Foreign Field	1	1	1	-
Averages				
Average Personnel Costs, ES Positions	181,818	182,572	184,260	1,688
Average Personnel Costs, GS Positions	121,532	124,169	124,713	544
Average Grade, GS Positions	14	14	14	-

The Mission Support PPA will result in a 20 FTP reduction. This includes a Program Management reduction of 17 FTP from the Research Development and Innovation PPA and 3 FTP reduction from the Acquisition and Operations Analysis PPA.

The Laboratory Facilities PPA will result in a 33 FTP reduction from CSAC, NBACC and NUSTL Laboratories. NBAF increases by 4 FTP for an overall decrease of 29 FTP.

Operations and Support Non Pay Budget Exhibits

Non Pay Summary *Dollars in Thousands*

Organization	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
Mission Support	\$59,940	\$56,950	\$57,957	\$1,007
Laboratory Facilities	\$111,510	\$111,143	\$71,380	(\$39,763)
Acquisition and Operations Analysis	\$47,103	\$45,852	\$42,552	(\$3,300)
Total	\$218,553	\$213,945	\$171,889	(\$42,056)
Discretionary - Appropriation	\$218,553	\$213,945	\$171,889	(\$42,056)

S&T is experiencing an overall decrease of \$42.056M to the O&S appropriation. These non-pay reductions are directly proportional to the program related cuts in both AOA and Laboratory Facilities PPAs.

Operations and Support Non Pay by Object Class

Dollars in Thousands

Non-Pay Object Classes	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
21.0 Travel and Transportation of Persons	\$1,739	\$1,708	\$1,487	(\$221)
22.0 Transportation of Things	\$18	\$20	\$13	(\$7)
23.1 Rental Payments to GSA	\$1,711	\$1,827	\$2,100	\$273
23.3 Communications, Utilities, and Misc. Charges	\$78	\$84	\$58	(\$26)
25.1 Advisory and Assistance Services	\$92,591	\$91,738	\$65,694	(\$26,044)
25.2 Other Services from Non-Federal Sources	\$1,354	\$1,354	\$1,131	(\$223)
25.3 Other Goods and Services from Federal Sources	\$93,924	\$86,430	\$74,698	(\$11,732)
25.4 Operation and Maintenance of Facilities	\$5,758	\$6,101	\$4,291	(\$1,810)
25.5 Research and Development Contracts	\$6,523	\$7,149	\$6,653	(\$496)
25.6 Medical Care	\$3	\$3	\$3	-
25.7 Operation and Maintenance of Equipment	\$4,569	\$5,408	\$5,212	(\$196)
26.0 Supplies and Materials	\$3,201	\$3,555	\$2,592	(\$963)
31.0 Equipment	\$5,919	\$7,377	\$7,008	(\$369)
32.0 Land and Structures	\$612	\$653	\$450	(\$203)
41.0 Grants, Subsidies, and Contributions	\$553	\$538	\$499	(\$39)
Total - Non Pay Object Classes	\$218,553	\$213,945	\$171,889	(\$42,056)

The reduction in O&S funds will result in reductions in all object class codes. These non-pay reductions are directly proportional to the program related decreases in both Acquisition and Operations Analysis and Laboratory Facilities.

Mission Support-PPA

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

Organization	FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Mission Support	344	344	\$121,245	344	344	\$119,220	324	334	\$119,823	(20)	(10)	\$603
Total	344	344	\$121,245	344	344	\$119,220	324	334	\$119,823	(20)	(10)	\$603
Subtotal Discretionary - Appropriation	344	344	\$121,245	344	344	\$119,220	324	334	\$119,823	(20)	(10)	\$603

PPA DESCRIPTION: Mission Support

S&T requests 324 positions and \$119.823M for MS in FY 2018.

Program Description:

The 324 positions provide executive direction to S&T for policy analysis, planning, financial management, and guidance formulation. These FTE also conduct program management, execution, oversight, and analysis, as well as operations and maintenance support for all S&T research and development programs in the Research and Development Innovation, University Programs and Acquisition and Operations Analysis PPAs.

The Mission Support PPA funds all of the corporate-level functions in S&T that allow the technical divisions to manage the RDT&E programs. Those functions include the Finance and Budget Division, including the DHS WCF; Administration and Support Division (ASD); and Corporate Communications Division. This budget request also supports the salaries and benefits, overhead and administration for S&T's four groups, each of which has an important role in implementing RDT&E activities: First Responders Group (FRG), Homeland Security Advanced Research Projects Agency (HSARPA), Capabilities Development Support (CDS), and Research and Development Partnerships (RDP).

Finance and Budget Division

The Finance and Budget Division (FBD) provides S&T with high-quality, efficient, and cost-effective financial management services through six branches. The Budget and Performance Branch develops long-term plans for resource allocation, execution plans, Congressional Justifications, and management of financial resources within S&T. It also develops and implements internal and external performance metrics for S&T programs, as well as risk assessment methodologies to help inform programming decisions.

The Acquisition Branch develops the S&T Directorate's acquisition strategy and managing S&T's procurements. The Financial Services Branch manages the conferences, travel and purchase card programs. The Financial Operations Branch is dedicated to sound fiscal stewardship of S&T's appropriations and reimbursable funding; timely and accurate budget execution, financial management, and financial reporting. The Internal Controls Branch monitors programs and activities to provide assurance about the adequacy of internal controls within S&T. The Interagency Branch streamlines work with other agencies and supports the management and oversight of those agreements.

Administration and Support Division

The Administration and Support Division manages the facilities, personnel, and information technology (IT), and provides critical infrastructure support to S&T and is composed of seven components: Facilities, Human Capital Office, Office of the Chief Information Officer, Office of the Chief Administrative Officer, Office of Administration and Audits, Central Security Office, and Readiness and Operational Coordination. In compliance with Presidential Directives, Federal regulations, and Departmental guidance, the Administration and Support Division provides support and continuous process improvement through problem identification and solution, sound policy and procedure development, and high-quality service.

Corporate Communications Division

The Corporate Communications Division communicates the objectives and status of homeland security technology programs, disseminates information regarding opportunities for private-sector entities (corporate and academic), and ensures that the media understands and accurately represents DHS technologies and programs. The Corporate Communications Division holds conferences and manages S&T's presence at other information-sharing events to improve contact among technology developers, vendors, and acquisition personnel. It also promotes the participation of colleges, universities, private research institutes, and companies (and consortia thereof) in the research process by disseminating information regarding research conducted or sponsored by the Department, and provides public-communication support to S&T-sponsored FFRDCs.

Working Capital Fund

The DHS WCF provides shared services that the components rely on to execute their missions, such as contracting officers and the DHS-wide IT infrastructure. Funds provided within the Mission Support PPA are used to acquire DHS WCF services, which includes: IT services, human resources, procurement operations, and financial systems. The WCF also provides consolidated subscriptions, government-wide mandated services, and DHS crosscutting activities.

Mission Support
Budget Authority and Obligations
Dollars in Thousands

Budget Authority	FY 2016	FY 2017	FY 2018
Enacted	\$131,530		
Transfers & Reprogrammings	-		
Delta in Enacted Fee Estimate to Fee Actuals	-		
Enacted Rescissions to Prior Year	(\$10,285)		
Revised Enacted/Request	\$121,245	\$119,220	\$119,823
Carryover and/or Recoveries (Actual/Estimates/Projections)	-	-	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	\$121,245	\$119,220	\$119,823
Collections – Reimbursable Resources	\$344	\$1,000	\$1,000
Total Budget Resources	\$121,589	\$120,220	\$120,823
Obligations (Actual/Projections/Estimates)	\$131,271	\$118,984	\$119,586
Personnel: Positons and FTE			
Enacted/Request Positions	344	344	324
Enacted/Request FTE	344	344	334
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	353	344	324
FTE (Actual/Estimates/Projections)	344	344	334

Mission Support Collections – Reimbursable Resources

Dollars in Thousands

Collections	FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Defense - Department of Defense Source	-	-	-	-	-	\$250	-	-	\$250
Department of Homeland Security - Federal Emergency Management Agency Source	-	-	\$2	-	-	\$250	-	-	\$250
Department of Homeland Security - US Customs and Border Protection Source	-	-	\$342	-	-	\$500	-	-	\$500
Total Collections	-	-	\$344	-	-	\$1,000	-	-	\$1,000

The FY 2018 estimated obligation is \$119.586M out of an estimated \$120.823M of total budgetary resources. MS is an annual appropriation and S&T aims to obligate 99 percent of its funding in FY 2018 as it has executed in previous years. Total Budget Obligations for FY 2017 and FY 2018 are based on FY 2016 execution totals.

Mission Support
Summary of Budget Changes
Dollars in Thousands

Budget Formulation Activity	Positions	FTE	Amount
FY 2016 Enacted	344	344	\$131,530
FY16 Rescissions of prior year appropriations	-	-	(\$10,285)
Total Rescissions	-	-	(\$10,285)
FY 2016 Revised Enacted	344	344	\$121,245
FY 2017 Annualized CR	344	344	\$119,220
FY 2018 Base Budget	344	344	\$119,220
Transfer to A&O from S&T/MS due to A&O WCF Activity Costs Removal	-	-	(\$14)
Transfer to OSEM/OGC from S&T/MS due to OGC WCF Activity Costs Removal	-	-	(\$3)
Transfer to USM/CHCO from S&T/MS due to CHCO WCF Activity Costs Removal	-	-	(\$55)
Transfer to USM/CIO from S&T/MS due to CIO WCF Activity Costs Removal	-	-	(\$1,308)
Transfer to USM/CPO from S&T/MS due to CPO WCF Activity Costs Removal	-	-	(\$151)
Transfer to USM/CRSO from S&T/MS due to CRSO WCF Activity Costs Removal	-	-	(\$248)
Transfer to USM/CSO from S&T/MS due to CSO WCF Activity Costs Removal	-	-	(\$18)
Total Transfers	-	-	(\$1,797)
FY17 Pay Raise	-	-	\$724
FY17: FY16 Annualized Pay	-	-	\$241
FY18 Pay Raise	-	-	\$666
FY18: FY17 Annualized Pay	-	-	\$222
Rent	-	-	\$4,095
Total, Pricing Increases	-	-	\$5,948
Hiring Freeze Savings	-	-	(\$1,696)
Total, Pricing Decreases	-	-	(\$1,696)
Total Adjustments-to-Base	-	-	\$2,455
FY 2018 Current Services	344	344	\$121,675
R&D and AOA Personnel Reductions	(20)	(10)	(\$1,852)
Total, Program Decreases	(20)	(10)	(\$1,852)
FY 2018 Request	324	334	\$119,823

Budget Formulation Activity	Positions	FTE	Amount
FY 2017 TO FY 2018 Change	(20)	(10)	\$603

PPA Description

Mission Support: MS funds all of the corporate-level functions in S&T that allow the technical divisions to manage RDT&E programs. The MS PPA funds business operations, salaries and benefits and the S&T's share of the WCF. MS also funds the headquarters shared services agreements, and financial and programmatic databases.

Adjustments to Base Justification

The adjustments-to-base total an increase of \$0.603M and includes:

- Transfer out of Working Capital Fund services to DHS HQ offices \$1.797M.
- Increase for Federal pay raise and annualization of pay for both FY 2018 and FY 2017 of \$1.853M.
- Increase rent \$4.095M.
- Decrease for hiring freeze savings \$1.696M.

Mission Support Personnel Compensation and Benefits

Pay Summary

Dollars in Thousands

Organization	FY 2016 Revised Enacted				FY 2017 Annualized CR				FY 2018 President's Budget				FY 2017 to FY 2018 Total Changes			
	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate
Mission Support	344	344	\$61,305	\$177.7	344	344	\$62,270	\$180.8	324	334	\$61,866	\$184.33	(20)	(10)	(\$404)	\$3.53
Total	344	344	\$61,305	\$177.7	344	344	\$62,270	\$180.8	324	334	\$61,866	\$184.33	(20)	(10)	(\$404)	\$3.53
Discretionary - Appropriation	344	344	\$61,305	\$177.7	344	344	\$62,270	\$180.8	324	334	\$61,866	\$184.33	(20)	(10)	(\$404)	\$3.53

* The FTE Rate calculation does not include Object Class 11.8-Special Personal Services Payments or 13.0-Benefits for Former Personnel.

NARRATIVE EXPLANATION OF CHANGES

S&T will pursue a reduction in personnel of an estimated 20 FTP, 10 FTE associated directly with the R&D work, through attrition, Voluntary Early Retirement Authority (VERA) and Voluntary Separation Incentive Payment (VSIP) authorities, or other reassignment possibilities within the Department. In addition, the Office of Chief Human Capital Officer may reassign individuals across the Department to support National Security priorities.

FTE Change FY 2017-2018: Decrease in 20 positions and 10 FTE.

PCB Change FY 2017-2018: Decrease of \$0.404M includes the FY 2018 pay increase for 344 FTE and is then reduced by an approximate cost savings for 10 FTE.

Average Cost Change FY 2017-2018: The average rate change takes into account the 1.9 percent increase at the FY 2017 FTE levels of 344 FTE and costs savings associated with a reduction of 10 FTE. The average rate change will increase by \$.003 million.

Mission Support
Pay by Object Class
Dollars in Thousands

Pay Object Classes	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
11.1 Full-time Permanent	\$42,152	\$42,920	\$41,544	(\$1,376)
11.3 Other than Full-Time Permanent	\$4,543	\$4,614	\$4,696	\$82
11.5 Other Personnel Compensation	\$621	\$630	\$780	\$150
12.1 Civilian Personnel Benefits	\$13,814	\$14,031	\$14,546	\$515
13.0 Benefits for Former Personnel	\$175	\$75	\$300	\$225
Total - Personnel Compensation and Benefits	\$61,305	\$62,270	\$61,866	(\$404)
Positions and FTE				
Positions - Civilian	344	344	324	(20)
FTE - Civilian	344	344	334	(10)

Pay Cost Drivers
Dollars in Thousands

Leading Cost-Drivers	FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Total Changes		
	FTE	Amount	Rate	FTE	Amount	Rate	FTE	Amount	Rate	FTE	Amount	Rate
Personnel S&B	344	\$61,305	\$178	344	\$62,270	\$181	324	\$61,866	\$184	(20)	(\$404)	\$3
Total – Pay Cost Drivers	344	\$61,305	\$178	344	\$62,270	\$181	324	\$61,866	\$184	(20)	(\$404)	\$3

S&T cost drivers for personnel salaries & benefits are due to human capital restructuring, reshaping, downsizing tools. It will take several months to implement reshaping tools. In addition, S&T may incur relocation costs in staff reassignments. All costs are directly proportional to the proposed staffing decreases.

Mission Support Non Pay Budget Exhibits

Non Pay Summary

Dollars in Thousands

Organization	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
Mission Support	\$59,940	\$56,950	\$57,957	\$1,007
Total	\$59,940	\$56,950	\$57,957	\$1,007
Discretionary - Appropriation	\$59,940	\$56,950	\$57,957	\$1,007

The non-pay request for FY 2018 is \$57.957M. The associated costs are primarily made up of operations and maintenance costs for facilities and equipment, contracts, funds sent to other federal agencies, supplies, training and travel.

Non Pay by Object Class

Dollars in Thousands

Non-Pay Object Classes	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
21.0 Travel and Transportation of Persons	\$572	\$518	\$528	\$10
25.1 Advisory and Assistance Services	\$11,435	\$14,844	\$14,234	(\$610)
25.2 Other Services from Non-Federal Sources	\$305	\$276	\$282	\$6
25.3 Other Goods and Services from Federal Sources	\$39,359	\$29,933	\$31,406	\$1,473
25.4 Operation and Maintenance of Facilities	\$298	\$270	\$275	\$5
25.5 Research and Development Contracts	\$1,034	\$1,753	\$1,788	\$35
25.6 Medical Care	\$3	\$3	\$3	-
25.7 Operation and Maintenance of Equipment	\$2,152	\$3,024	\$3,085	\$61
26.0 Supplies and Materials	\$282	\$437	\$445	\$8
31.0 Equipment	\$4,500	\$5,892	\$5,911	\$19
Total - Non Pay Object Classes	\$59,940	\$56,950	\$57,957	\$1,007

Increase in the non-pay object class is associated with an increase in costs for rent in the FY 2018 request. Due to the delay in S&T's move to St. Elizabeth's in FY 2018, there is an additional funding requirement for WCF for rent in FY 2018.

Non Pay Cost Drivers

Dollars in Thousands

Leading Non Pay Cost-Drivers	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
Working Capital Fund (WCF)	\$36,396	\$26,755	\$27,793	\$1,038
Advisory and Assistance Services	\$11,435	\$14,844	\$14,234	(\$610)
Equipment	\$4,500	\$5,892	\$5,911	\$19
Operations and Maintenance of Equipment	\$2,152	\$3,024	\$3,085	\$61
Research and Development Contracts	\$1,034	\$1,753	\$1,788	\$35
Other Costs	\$4,423	\$4,682	\$5,146	\$464
Total – Non Pay Cost Drivers	\$59,940	\$56,950	\$57,957	\$1,007

NARRATIVE EXPLANATION OF CHANGES

The primary costs driver associated with the Mission Support PPA is the WCF contributions, followed by CIO related costs in the form of contract, Interagency, equipment and operation and maintenance costs.

Laboratory Facilities-PPA

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

Organization	FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Laboratory Facilities	136	136	\$133,731	136	136	\$133,943	107	121	\$92,243	(29)	(15)	(\$41,700)
Total	136	136	\$133,731	136	136	\$133,943	107	121	\$92,243	(29)	(15)	(\$41,700)
Subtotal Discretionary - Appropriation	136	136	\$133,731	136	136	\$133,943	107	121	\$92,243	(29)	(15)	(\$41,700)

PPA DESCRIPTION: Laboratory Facilities

S&T requests 121 FTE, 107 positions and \$92.243M for Laboratory Facilities in FY 2018. The 107 position request includes the four new positions for NBAF operations. The new positions at NBAF will help to ensure that NBAF construction and operations remain on track for 2023.

Laboratory Facilities PPA: ONL manages the Laboratory Facilities Programs. ONL provides the Nation with a coordinated, enduring core of productive science, technology, and engineering laboratories, organizations, and institutions, which provide the knowledge and technology required to secure our homeland.

Laboratory Operations: FY 2017: \$133.942M. FY 2018 Request: \$92.243M. This program manages the operations, core capabilities, maintenance, and personnel requirements of the S&T Laboratories and infrastructure. This program also oversees the continued operations of facilities to meet mission requirements while maintaining safe, secure, compliant, and efficient operations. S&T also maintains a partnership with 13 Department of Energy national laboratories that are vital to the national homeland security mission

In FY 2017, initiation of closure plans for Plum Island Animal Disease Center (PIADC) will begin to prepare for the transition to the NBAF in 2023. Further in FY 2018, S&T will close three laboratory facilities, National Urban Security Technology Laboratory (NUSTL), Chemical Security Analysis Center (CSAC) and National Biodefense Analysis and Countermeasures Center (NBACC) Operations.

National Bio and Agro-Defense Facility Operations

NBAF will be a state-of-the-art, biocontainment laboratory for the study of diseases that threaten both America's animal agricultural

industry and public health. The facility will strengthen our nation's ability to conduct research, develop vaccines, diagnose emerging diseases, and train veterinarians.

NBAF operations funding incorporates S&T requirements for the operational stand-up of NBAF, including on-site project and lab management staffing, the Operational Planning and Technology Integration Contract (OPTIC) supporting stand-up activities, and the Management, Operations, & Research Support (MORS) contract award that will support the long term operations of NBAF. NBAF Operations includes a diverse range of one-time stand-up costs necessary to establish the operations of this unique state-of-the-art laboratory as well as support ongoing long-term management and operations activities as they phase in and continue to be performed through the achievement of full operating capacity by 2023.

One time stand-up costs include relocation of Federal employees from PIADC, scientific and IT equipment and systems not associated with construction, and establishment of programs and operating models that will set the baseline for the new laboratory's performance. Activities that will be awarded under the OPTIC include: development of IT system architecture to ensure appropriate technology integration and cybersecurity, and the Biorepository Transfer Plan for the safe and efficient relocation of the inventory of existing catalog of R&D biological material samples, including the foot and mouth disease vaccine and vaccine bank currently at PIADC.

The NBAF Federal management team and the MORS contract will begin in FY 2018 and achieve Select Agent Registration and full operating capacity by 2023. The timing of federal staff placement, acquisition of contract vehicles, and procurement of equipment is closely linked to construction milestones and funding availability. NBAF also is funded with USDA resources and S&T coordinates stand-up activities and associated funding requests with USDA to ensure proper funding alignment.

NBAF will initiate on-boarding of federal staff in FY 2018 to include the laboratory director, science director, and operations director. Leased space will be required to house both federal and contractor staff as the facility is being constructed. Leased space will also be used to construct a mock-up of the NBAF laboratory spaces prior to final fit-out.

2017 Key Milestone Event

- Award OPTIC to support the Government in the development of planning documents for NBAF operational planning, including the MORS acquisition.
- Complete development of the CONOPS, which will serve as the guiding document for how the laboratory will be operated.
- Complete concrete pours for the laboratories' high containment walls.

2018 Key Milestone Event

- Complete hire of key federal operational staff to lead operational planning, including oversight of contract execution.

- Award MORS contract to begin executing activities to support achieving select agent registration in FY 2023.
- Begin erecting stainless steel frame and enclosing the main laboratory facility.

Plum Island Animal Disease Center Operations

Since 1954, Plum Island Animal Disease Center (PIADC) has served as the nation's premier defense against accidental or intentional introduction of transboundary animal diseases (a.k.a. foreign animal diseases) including foot-and-mouth disease (FMD). PIADC is the only laboratory in the nation that can work on live FMD virus (FMDV). PIADC provides a host of high-impact, indispensable preparedness and response capabilities, including vaccine R&D, diagnostics, training, and bioforensics among others.

PIADC has an interagency mission to protect U.S. agriculture from the threat of high-consequence foreign animal diseases. DHS is responsible for the operational management of PIADC. In addition, the DHS PIADC Targeted Advanced Development team –in partnership with USDA Agricultural Research Service and industry performs advanced development of vaccines of other biological countermeasures needed for and effective response to high threat foreign animal diseases such as FMD. The biologic countermeasure development at PIADC also supports S&T's agro-terrorism countermeasures program. Research at the facility occurs in biosafety level (BSL)-2, BSL-3, and BSL-4 Agricultural laboratory spaces. DHS is responsible for the management, operations, and maintenance of the facility. The laboratory is a self-sustaining operation, with its own power plant, fuel storage, fire protection, waste disposal, and security systems. S&T provides the only ferry transport to and from the island, and is responsible for operating and maintaining the ferries, docks, and harbor. S&T delivers the day-to-day operational support, including the operations work force. Major operations costs include bio safety, security, operations and maintenance contract, Information Technology upgrades to support regulatory requirements, equipment replacement to endure safe facility operations, energy renewal projects and studies, utilities, and fuel.

2017 Key Milestone Event

- Complete construction of the liquid waste decontamination plant and move forward with an update to the security systems and IT system as required to support critical laboratory operations to the transition of the NBAF.
- Complete Conceptual Site Model will serve as a basis for determining Decontamination and Decommissioning projects.
- Conduct bio risk assessment of the current laboratory infrastructure and ensure repairs as necessary to ensure continued safe and secure operation of critical laboratory infrastructure until transition of the laboratory to the NBAF.
- Conduct test and evaluation of new FMDV master seed, which supports the development of biologic countermeasures for high threat foreign animal diseases.

2018 Key Milestone Event

- Develop validated decontamination procedures for biologic agents to support safe laboratory operations and the safe removal of equipment and other items from the laboratory, which support laboratory closure and transition to the NBAF.
- Support transition of the newly developed FMDV to manufacturing and safe storage of master seeds for availability in the potential outbreak of FMD.
- Complete the selection of a new contractor for the PIADC and move forward with the consolidation of almost 10 contracts for improved operational efficiency.
- Commence full operations of the liquid waste decontamination plant and complete remaining upgrade projects.

Transportation Security Laboratory (TSL) Operations

The Transportation Security Laboratory (TSL) is a federal laboratory aligned under S&T and which is responsible for researching, developing, testing and evaluating technologies to detect and mitigate the threat of explosives and other weapons that may be used against our nation's transportation systems and infrastructure. Since TSL's creation in 1992, the constantly evolving threats to our nation's transportation systems have spurred the need for rapid development of detection and mitigation technologies, which require testing by TSL prior to deployment. Major operational costs include rent, operation support contracts, building maintenance, utilities, energy renewal projects/studies, security, and information technology. TSL is located at the Federal Aviation Administration's William J. Hughes Technical Center in Atlantic City, NJ.

2017 Key Milestone Event

- Complete successful internal audits promoting management practices and development of standard operating procedures for ISO Certification and implementation of technical procedures by core labs.
- Demonstrate full operational capability of TSL's new laboratory building by conducting certification testing in each of the buildings two hardened test cells.
- Develop, test, and document the standard operating procedures for safely creating, analyzing, and testing marginally stable improvised explosives in quantities up to 100 grams.
- Implement a rigorous inventory management system for non-hazardous test materials and objects used to verify the performance of explosive detection devices, and implement a quality management program to obtain from system vendors and system users feedback regarding the quality and timeliness of TSL products.

2018 Key Milestone Event

- Establish a TSL-wide Risk Management Program that supports a more accurate assessment of the return on investment associated with TSL T&E activities.

- Develop and implement protocols for the validation of threat articles used to test, evaluate, and certify explosive detection devices.
- Publish an Automation Master Plan that will identify cost-effective facilities, equipment, and operating procedures to help reduce risk and increase quality of synthesized improvised explosive materials.
- Manage and operate TSL to complete IT upgrades and ensure all safety and security compliance is met.

Chemical Security Analysis Center Operations

This facility develops and informs risk assessments related to national chemical defense. CSAC is co-located at the Department of Defense (DoD) Edgewood Chemical Biological Center (ECBC) at the Aberdeen Proving Grounds in Maryland. CSAC supports a variety of customers within DHS, the Federal Government, and the HSE, to include S&T's Chemical and Biological Division, DHS Components such as the National Protection and Programs Directorate (NPPD), the Office of Health Affairs (OHA), the United States Secret Service (USSS), the Transportation Security Administration and (TSA), and other Federal agencies. The CSAC provides science- and technology-based quality assurance information capabilities for acquiring, storing, indexing, evaluating and making strategically available cheminformatic data, technical reports and other threat and risk knowledge products across the chemical threat spectrum to support the unified effort to secure the Nation. Operational costs for this facility include rent, security, utilities, energy renewal projects/studies, and information technology. To better align with Administration and Secretarial priorities, S&T proposes to close CSAC in FY 2018. However, S&T believes the work conducted at this facility could be assumed by others in the field.

2017 Key Milestone Event

- Ensure that there are no Risk Assessment Code (RAC) 1-3 codes identified in the FY 2017 Q4 compliance report.
- Within 90 days of receiving the final annual Facility Assessment report, execute the mitigation and countermeasure actions identified in the report.
- Submit 100 percent inventory report to S&T Administrative Support Division (ASD) confirming accountability of all assigned government property.

National Urban Security Technology Laboratory Operations

NUSTL is a federal laboratory which provides testing and evaluation services and products to the national first responder community. The Laboratory's mission is to test, evaluate and analyze homeland security capabilities while serving as a technical authority to first responder, state and local entities protecting our cities. NUSTL services and products help first responders prepare, protect and respond to homeland security threats. NUSTL uniquely provides independent technology evaluations and assessments for first responders, thereby enabling informed acquisition and deployment decisions, and helping to ensure that responders have the best technology available to use in homeland security missions. NUSTL is a preferred and trusted partner with first responder agencies across all levels of government. NUSTL works with end users in the lab and field to promote successful deployment of both commercial and emerging technologies. NUSTL's activities emphasize testing and evaluation alongside responders in operational

scenarios, assisting with fielding of technologies, sponsoring R&D, supporting the development of Concept of Operations documents and providing post-deployment advisory support. NUSTL is the only lab entirely focused on first responders and enabling their mission effectiveness. NUSTL is a Government-owned, Government-operated laboratory located in the borough of Manhattan, New York, NY. Major operational costs include rent, the infrastructure required to test First Responder equipment, information technology, energy renewal projects/studies, and security. To better align with Administration and Secretarial priorities, S&T proposes to close NUSTL in FY 2018. However, S&T believes the work conducted at this facility could be assumed by others in the field.

2017 Key Milestone Event

- Complete training and annual audits to ensure compliance with the Safety, Health, Environmental Management Systems (SHEMS) and Environmental Safety and Health (ESH) regulatory requirements. Compliance to these operating standards ensures the safety, health and compliance of the facility and personnel to continue support of the mission critical areas of NUSTL.
- Conduct Quality Assurance and Quality Control training, audits, and reviews for the DHS mission essential administrative and technical functions of the Laboratory through NUSTL, such as Quality Management System in accordance with ISO9001:2015, the international standard that specifies requirements for a quality management system, Records Management, and Inventory Management. These mission sustainable cornerstone practices enable the Laboratory to maintain the daily operations and promote efficiencies and best practices allowing them to provide improved deliverables to both internal and external stakeholders.
- Complete risk infrastructure assessment and analysis of alternatives (AoA) to meet mission requirements to provide cost savings and practices for safe, secure, and efficient space utilization in conjunction with DHS Management Directorate Real Property Standards.

National Biodefense Analysis and Countermeasures Center (NBACC) Operations

NBACC provides the capability to characterize current and future biological threats, assess their impacts, and inform the development of countermeasures and vaccines in response to events and identified threats. The NBACC mission is to provide the Nation with the scientific basis for characterization of biological threats and bioforensic analysis to support attribution of their planned and actual use. NBACC is part of the National Interagency Biodefense Campus that includes the Department of Health and Human Services (HHS), DoD, and Department of Agriculture (USDA). NBACC closely collaborates with the FBI and other law enforcement and national security agencies.

S&T operates NBACC as a Federally Funded Research and Development Center (FFRDC). The FFRDC plans, manages, and executes the NBACC research programs, and operates the facility. NBACC has achieved all of the required certifications and registrations for its biosafety level (BSL) 2, 3, and 4 laboratories. Major operational costs include safety, security, addressing and maintaining regulatory compliance, information technology and IT upgrades, facility equipment upgrades and refresh, utility and

garrison support costs, and energy renewal projects/studies. To better align with Administration and Secretarial priorities, S&T proposes to close NBACC in FY 2018.

2017 Key Milestone Event

- Completion of a site visit of the animal care program by Association for the Assessment and Accreditation of Laboratory Animal Care (AAALAC) International.
- Receive renewal of accreditation (valid three years) from AAALAC International.
- Receive National Bioforensic Analysis Center (NBFAC) ISO 17025 Renewal Assessment and Accreditation, November 2016 (valid two years from January 2017). This accreditation provides the framework for a Quality Management System for a testing or calibration laboratory.
- Submit second project year (PY-02) annual planning documentation to Contracting Officer.
- Complete annual testing of facility systems supporting BSL-3 operations, and document the findings in a report.
- Complete at least three Risk Assessments in compliance with ISO 31000 standard.
- Submit a 100% inventory report to S&T's Administrative Support Division (ASD) confirming accountability of all assigned government property.
- Report upon completion and results of annual testing of facility systems supporting BSL-4 operations.
- Demonstrate successful community outreach with at least one hosted visit at NBACC, at least one regional community activity, or at least one interaction that supports the quarterly benchmarking or peer review of an NBACC operational process.
- Implement the insider threat program approved by NBACC leadership.

Laboratory Facilities-PPA
Budget Authority and Obligations
Dollars in Thousands

Budget Authority	FY 2016	FY 2017	FY 2018
Enacted	\$133,731		
Transfers & Reprogrammings	-		
Delta in Enacted Fee Estimate to Fee Actuals	-		
Enacted Rescissions to Prior Year	-		
Revised Enacted/Request	\$133,731	\$133,943	\$92,243
Carryover and/or Recoveries (Actual/Estimates/Projections)	\$46,245	\$57,171	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	\$179,976	\$191,114	\$92,243
Collections – Reimbursable Resources	\$2,494	\$2,500	\$2,500
Total Budget Resources	\$182,470	\$193,614	\$94,743
Obligations (Actual/Projections/Estimates)	\$125,928	\$125,827	\$66,385
Personnel: Positons and FTE			
Enacted/Request Positions	136	136	107
Enacted/Request FTE	136	136	121
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	129	136	107
FTE (Actual/Estimates/Projections)	129	136	121

Laboratory Facilities-PPA Collections – Reimbursable Resources

Dollars in Thousands

Collections		FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget		
		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Agriculture - Department of Agriculture	Source	-	-	\$693	-	-	\$700	-	-	\$700
Department of Agriculture - Agricultural Marketing Service	Source	-	-	\$970	-	-	\$1,000	-	-	\$1,000
Department of Homeland Security - Federal Emergency Management Agency	Source	-	-	\$165	-	-	\$150	-	-	\$150
Department of Homeland Security - Transportation Security Administration	Source	-	-	\$506	-	-	\$500	-	-	\$500
Department of State - Department of State	Source	-	-	\$150	-	-	\$150	-	-	\$150
Department of Homeland Security - Domestic Nuclear Detection Office	Source	-	-	\$10	-	-	-	-	-	-
Total Collections		-	-	\$2,494	-	-	\$2,500	-	-	\$2,500

The FY 2018 estimated obligation is \$66.385M out of an estimated \$94.743M of total budgetary resources. Total budget obligations for FY 2017 and FY 2018 are based on FY 2016 execution totals.

Laboratory Facilities
Summary of Budget Changes
Dollars in Thousands

Budget Formulation Activity	Positions	FTE	Amount
FY 2016 Enacted	136	136	\$133,731
FY 2016 Revised Enacted	136	136	\$133,731
FY 2017 Annualized CR	136	136	\$133,943
FY 2018 Base Budget	136	136	\$133,943
FY17 Pay Raise	-	-	\$434
FY17: FY16 Annualized Pay	-	-	\$145
FY18 Pay Raise	-	-	\$244
FY18: FY17 Annualized Pay	-	-	\$81
Total, Pricing Increases	-	-	\$904
Hiring Freeze Savings	-	-	(\$904)
Total, Pricing Decreases	-	-	(\$904)
FY 2018 Current Services	136	136	\$133,943
Laboratory Facilities Closures and Personnel Reductions	(29)	(15)	(\$41,700)
Total, Program Decreases	(29)	(15)	(\$41,700)
FY 2018 Request	107	121	\$92,243
FY 2017 TO FY 2018 Change	(29)	(15)	(\$41,700)

PPA Description

Laboratory Facilities: ONL manages the Laboratory Facilities Programs. ONL provides the Nation with a coordinated, enduring core of productive science, technology, and engineering laboratories, organizations, and institutions, which will provide the knowledge and technology required to secure our homeland.

Adjustments to Base Justification

The adjustments-to-base total a net increase of \$0 and includes:

- Increase for Federal pay raise and annualization of pay \$0.904M.
- Decrease for hiring freeze savings \$0.904M.

Laboratory Facilities Personnel Compensation and Benefits

Pay Summary

Dollars in Thousands

Organization	FY 2016 Revised Enacted				FY 2017 Annualized CR				FY 2018 President's Budget				FY 2017 to FY 2018 Total Changes			
	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate
Laboratory Facilities	136	136	\$22,221	\$163.02	136	136	\$22,800	\$167.65	107	121	\$20,863	\$170.36	(29)	(15)	(\$1,937)	\$2.71
Total	136	136	\$22,221	\$163.02	136	136	\$22,800	\$167.65	107	121	\$20,863	\$170.36	(29)	(15)	(\$1,937)	\$2.71
Discretionary - Appropriation	136	136	\$22,221	\$163.02	136	136	\$22,800	\$167.65	107	121	\$20,863	\$170.36	(29)	(15)	(\$1,937)	\$2.71

* The FTE Rate calculation does not include Object Class 11.8-Special Personal Services Payments or 13.0-Benefits for Former Personnel.

NARRATIVE EXPLANATION OF CHANGES

The estimated salaries and benefits in Laboratory facilities will decrease by \$1.937M from FY 2017 to FY 2018. S&T will pursue a reduction in personnel of an estimated 29 FTP, 15 FTE during FY 2018 through attrition, Voluntary Early Retirement Authority (VERA) and Voluntary Separation Incentive Payment (VSIP) authorities, or other reassignment possibilities within S&T, or across the Department to support National Security priorities.

FTE Change FY 2017-2018: Decrease of 29 positions and 15 FTE.

PCB Change FY 2017-2018: Decrease of \$1.937 million includes the FY 2018 pay increase for 136 FTE, and the cost savings associated with the reduction of 15 FTE.

Average Cost Change FY 2017-2018: The average rate change takes into account the 1.9 percent pay increase at the FY 2017 FTE levels of 136 FTE and costs savings associated with a reduction of 15 FTE. The average rate change will increase by \$0.003 million.

Laboratory Facilities Pay by Object Class

Dollars in Thousands

Pay Object Classes	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
11.1 Full-time Permanent	\$15,695	\$16,404	\$13,817	(\$2,587)
11.3 Other than Full-Time Permanent	\$728	\$660	\$560	(\$100)
11.5 Other Personnel Compensation	\$484	\$345	\$345	-
12.1 Civilian Personnel Benefits	\$5,264	\$5,391	\$5,891	\$500
13.0 Benefits for Former Personnel	\$50	-	\$250	\$250
Total - Personnel Compensation and Benefits	\$22,221	\$22,800	\$20,863	(\$1,937)
Positions and FTE				
Positions - Civilian	136	136	107	(29)
FTE - Civilian	136	136	121	(15)

Due to the decrease in positions there will be a decrease of \$1.937M in Laboratory Facilities pay in FY 2018.

Pay Cost Drivers

Dollars in Thousands

Leading Cost-Drivers	FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Total Changes		
	FTE	Amount	Rate	FTE	Amount	Rate	FTE	Amount	Rate	FTE	Amount	Rate
Personnel S&B	136	\$22,221	\$163	136	\$22,800	\$168	121	\$ 20,863	\$170	(15)	(\$1,937)	\$3
Total – Pay Cost Drivers	136	\$22,221	\$163	136	\$22,800	\$168	121	\$20,863	\$170	15	(\$1,937)	\$3

The primary pay cost drivers for Laboratory Facilities are directly associated with personnel compensation costs. Laboratory Facilities is requesting a decrease of 29 FTP/15 FTE in FY 2018 with expected cost savings of \$1.937M. Potential cost savings could possibly be offset by relocation fees, retirement incentives and other off boarding activities for employees.

Laboratory Facilities Non Pay Budget Exhibits

Non Pay Summary

Dollars in Thousands

Organization	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
Laboratory Facilities	\$111,510	\$111,143	\$71,380	(\$39,763)
Total	\$111,510	\$111,143	\$71,380	(\$39,763)
Discretionary - Appropriation	\$111,510	\$111,143	\$71,380	(\$39,763)

The non-pay request for FY 2018 is \$71.380. The decrement of \$39.763M is associated with activities being reduced in laboratory operations due to the closure of three facilities.

Non Pay by Object Class

Dollars in Thousands

Non-Pay Object Classes	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
21.0 Travel and Transportation of Persons	\$566	\$605	\$416	(\$189)
22.0 Transportation of Things	\$18	\$20	\$13	(\$7)
23.1 Rental Payments to GSA	\$1,711	\$1,827	\$2,100	\$273
23.3 Communications, Utilities, and Misc. Charges	\$78	\$84	\$58	(\$26)
25.1 Advisory and Assistance Services	\$61,805	\$58,057	\$33,979	(\$24,078)
25.2 Other Services from Non-Federal Sources	\$591	\$632	\$435	(\$197)
25.3 Other Goods and Services from Federal Sources	\$35,751	\$38,182	\$26,295	(\$11,887)
25.4 Operation and Maintenance of Facilities	\$5,460	\$5,831	\$4,016	(\$1,815)
25.5 Research and Development Contracts	\$561	\$599	\$413	(\$186)
25.7 Operation and Maintenance of Equipment	\$336	\$358	\$247	(\$111)
26.0 Supplies and Materials	\$2,919	\$3,118	\$2,147	(\$971)
31.0 Equipment	\$1,102	\$1,177	\$811	(\$366)
32.0 Land and Structures	\$612	\$653	\$450	(\$203)
Total - Non Pay Object Classes	\$111,510	\$111,143	\$71,380	(\$39,763)

Reduction in object class is directly proportional with the decrease in the FY 2018 request.

Laboratory Facilities Non Pay Cost Drivers

Dollars in Thousands

Leading Non Pay Cost-Drivers	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
Advisory and Assistance Services	\$61,805	\$58,057	\$33,979	(\$24,078)
Other Goods and Services from Federal Sources	\$35,751	\$38,182	\$26,295	(\$11,887)
Operations and Maintenance of Facilities	\$5,460	\$5,831	\$4,016	(\$1,815)
Supplies and Materials	\$2,919	\$3,118	\$2,147	(\$971)
Rental Payments to GSA	\$1,711	\$1,827	\$2,100	\$273
Other Costs	\$3,864	\$4,128	\$2,843	(\$1,285)
Total – Non Pay Cost Drivers	\$111,510	\$111,143	\$71,380	(\$39,763)

NARRATIVE EXPLANATION OF CHANGES

The non-pay request for FY 2018 is \$71.380M. The associated costs are primarily made up of operations and maintenance costs for the lab facilities, contracts, agreements with federal sources, supplies, and rental costs.

Acquisitions and Operations Analysis-PPA
Budget Comparison and Adjustments
Comparison of Budget Authority and Request

Organization	FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Acquisition and Operations Analysis	-	-	\$47,103	-	-	\$45,852	-	-	\$42,552	-	-	(\$3,300)
Total	-	-	\$47,103	-	-	\$45,852	-	-	\$42,552	-	-	(\$3,300)
Subtotal Discretionary - Appropriation	-	-	\$47,103	-	-	\$45,852	-	-	\$42,552	-	-	(\$3,300)

PPA DESCRIPTION: Acquisition and Operations Analysis

The S&T Directorate requests \$42.552M for Acquisition and Operations Analysis in FY 2018.

Acquisition and Operations Analysis (AOA) PPA – The AOA PPA provides expert assistance, including systems engineering, to entities across the HSE to ensure that the transition, acquisition, and deployment of technologies, information, and procedures improve the efficiency and effectiveness of the operational capabilities across the HSE mission. This includes providing technological assessment of major acquisition programs in DHS to help ensure that technologies, concept of operations (CONOPS), and procedures meet operational requirements, technology analysis and technology review of analysis of alternatives at the beginning and throughout an acquisition programs life; standards to support the homeland security mission; and administration of the Support Anti-Terrorism by Fostering Effective Technologies (SAFETY) Act program.

The six thrust areas of AOA are Operations and Requirements Analysis; SAFETY Act; Standards; Systems Engineering; Test and Evaluation and Technology Transition Support. The CDS Group manages four of the five thrusts, and one thrust is being proposed for elimination in FY 2018.

Capability Development Support

This program provides S&T and DHS with leadership and oversight of the following four Thrust Areas: Operations and Requirements Analysis, Standards, Systems engineering, and Test and Evaluation. Working with the Under Secretary for Management, CDS leverages S&T's critical mass of scientific and engineering expertise to ensure that DHS develops and/or procures technologies that work as expected, and are delivered, or transitioned on time and on budget.

Operations and Requirements Analysis Thrust - FY 2017: \$7.873M. FY 2018 Request: \$7.873M.

Under the Office of Operations and Requirements Analysis, reviews homeland security operations to identify ways to prioritize cross-Department capability gaps, and duplications as well as identify cost effective solutions for Component operations and process inefficiencies. This office improves operations efficiencies, reduces duplicative programs, and unifies DHS's efforts through joint capability developments where appropriate. In addition, this thrust area supports S&T's role in providing support for Department capabilities and requirements analysis.

FY 2017 Key Milestone Events

- Perform capabilities analysis for the Domain and Situational Awareness and Securing and Law Enforcement Joint Requirements Council (JRC) Portfolios.
- Complete a threat classification prediction analysis for CBP Air Marine Operations Center (AMOC). The analysis developed and delivered an analysis tool to the AMOC operators that enable them to predict in real-time the threat-probability of aircraft approaching the southern border of the United States. This results in earlier identification of suspicious aircraft and faster response time for law enforcement to engage high-threat aircraft crossing the U.S. border.
- Complete a radar coverage analysis for CBP Air Marine Operations to assess the pending mission impact on AMOC surveillance capability following U.S. government sale of portions of the frequency spectrum that would decrease the number of available surveillance radars. The radar coverage analysis analyzed AMOC's probability of detecting aircraft (accounting for the projected reduction in available radars) at ranges between 60 and 100 nautical miles from the U.S. southern border. The analysis results enabled AMOC to provide CBP and DHS leadership a data-driven, analytically defensible description of the mission impact ensuing from the gaps in radar coverage that would result following the frequency sell-off.
- Completed a statistical analysis for the DHS Executive Secretariat to characterize Department responsiveness to time-critical Congressional correspondence. The results enabled the Secretariat to provide a data-driven understanding of overall responsiveness as well as pinpoint which parts of the response process required improvement. In addition, ORA developed and delivered an analysis tool that automated the calculation of DHS executive correspondence response statistics for Congress – the Secretariat can now generate statistical response reports in minutes versus hours.
- Value Focused Modeling analysis for CBP AMOC that accomplished a bottoms-up examination of AMOC operations. The analysis identified how each AMOC mission function and task contributed to mission execution, and hence the value of each function and task. This resulted in a baseline "Value Model" for AMOC operations. This Value Model" now informs AMOC leadership on where staff resources or capability enhancements should be invested to have the greatest impact on mission

FY 2018 Key Milestone Events

- Perform capabilities analysis for at least two JRC Portfolios to be determined closer to FY 2018 based on the presidential priorities.
- Deliver three gap analyses final reports to DHS IPTs, Components, or Joint Task Forces supporting their requests.

Federally Funded Research & Development Center, Program Management Office: Homeland Security Operations and Analysis Center & Homeland Security System Engineering Development Institute

The Federally Funded Research and Development Center Program Management Office (FFRDC PMO), on the behalf of the Under Secretary for Science & Technology, provides centralized oversight and support of two of the Department's FFRDCs. They are the Homeland Security Systems Engineering and Development Institute (HSSEDI) and the Homeland Security Operational Analysis Center (HSOAC). These FFRDCs are working in the public interest to ensure the highest levels of excellence by bringing together the expertise and point-of-view of government, industry, and academia.

HSOAC supports the DHS Components by providing specialized expertise in a spectrum of mission-critical capacities, to include program analyses and evaluation, targeted tradeoff studies of mission-level goals and strategies; analyzing operations and operational requirements; assessing DHS organizations and their governance; and evaluating performance metrics to effectively meet the future challenges facing the Nation. HSOAC works to solve complex Homeland Security Enterprise problems based on their core technical capabilities, their long-term relationship with the Department, their special access to data, and their inherent objectivity and independence.

HSSEDI provides specialized independent and objective technical and systems engineering expertise to department components, program managers and operating elements in addressing national homeland security system development and integration issues. HSSEDI works to enhance the Department capabilities through the recommendation of new technologies; development of prototypes and proof-of-concept demonstrations; review of systems design optimization and trade-space considerations; development of integrating architectures and frameworks; application of enterprise systems engineering principles for improved interoperability and information sharing; establishment of technical standards, measures and best practices; and, development of realistic test environments and scenarios.

2017 Key Milestone Event

- The FFRDC PMO issued an IDIQ Core Management Task Order(s) in support of the IDIQ activities (i.e. Annual Report, Annual Core Research Report) and other PMO execution requirements for each FFRDC.
- The FFRDC PMO issued the necessary contracts to support and build out the HSSEDI SCIF

2018 Key Milestone Event

- The FFRDC PMO will issue an IDIQ Core Management Task Order(s) in support of the IDIQ activities (i.e. Annual Report, Annual Core Research Report) and other PMO execution requirements for each FFRDC.
- The FFRDC PMO will issue the necessary contracts to maintain the HSSEDI SCIF.

Joint Requirements Support

This effort leads capabilities and requirements analysis for the DHS JRC. A key element of the Unity of Effort initiative, the JRC is a Component-led body that aims to identify and prioritize cross-Department capability gaps and inform investment decision making. The analysis that this effort performs for the JRC allows DHS leadership to address the gaps and duplications at an enterprise level rather than at the individual Component level, potentially enabling DHS to realize significant cost savings. This effort is responsible for performing capabilities analysis for each of the DHS portfolio areas brought before the JRC in order to identify, coordinate, and assess departmental capabilities, as well as recommend courses of action to address gaps in key areas including chemical, biological, radiological, and nuclear (CBRN) surveillance and detection, aviation, and cybersecurity. It draws upon S&T's previous development of a repeatable, structured analytic process that was successfully validated in the Integrated Investment Life Cycle Management pilot analyses. Key outputs of this effort for each portfolio area include operational visualizations, functional analyses, operational analysis reports, capabilities-based assessments, mission analyses, and prioritized shortfalls.

Operations Analysis

This effort comprehensively defines operational problems, characterizes current operations and processes, describes the future state for operations and processes, and identifies alternative solutions to enable the future operational state. It provides rapid analytic support that enables tough operational challenges to be systematically addressed. This effort leverages S&T's subject matter expertise in operations analysis, modeling and simulation, and Lean Six Sigma process improvement to support Headquarters and Component mission analyses. By engaging early in the life cycle, Operations Analysis helps optimize analysis of alternatives through analytic insight into operational context, gaps, and requirements. Additionally, this effort is used to deliver short-turn, non-materiel operational solutions that directly impact critical DHS missions. Key outputs of this project include process maps, value streams, efficiency opportunities, and cost benefits analyses.

Standards Thrust - FY 2017 Annualized Continuing Resolution: \$3million. FY 2018 Request: \$0.

This program implements the Department's statutory responsibilities for the utilization and participation in the development of consensus standards with end users - private sector. These responsibilities are enabled through memberships in, and coordination with, national and international standards development organizations. Additionally, this program ensures that standards activities across all of the DHS components are harmonized and compatible with the mission, authority, and priorities of the Department.

The Standards program provides standard test methods, test kits, and guidance to DHS Components including TSA's Quality Assurance/Quality Control for standards for bulk, trace, and stand-off explosive detection technologies; non-aviation standards for other applications (i.e., facility security). In addition, the Standards program develops test methods for response robots capabilities that support aerial systems, submersibles, urban search and rescue, and bomb squads.

The Standards program provides standard test methods, test kits and guidance to for DHS Components. With the elimination of Standards, homeland security enterprise and industrial base equities would not be represented in over 1000 new standards each year to deliver interoperable and counter-terrorism technologies to the Department, other Federal agencies, first responder community and private sector. S&T would retain one position to continue fulfilling DHS coordination and oversight responsibilities and participating in standards committees.

FY 2017 Key Milestone Events

- Provide standard test methods, test kits and guidance to at least one first responder organization for ground robot/unmanned system evaluation and exercise.
- Provide guidance and reference test material to at least one DHS Component (i.e. TSA) for Quality Assurance/Quality Control for standards for bulk, trace and stand-off explosive detection technologies, including non-aviation standards for other applications (i.e., facility security) and trace drug detection standards.
- Complete final annual standards report to National Institute of Standards Technology (NIST) per OMB A-119 for the National Technology Transfer and Advancement Act (NTTAA) for the previous Fiscal Year.
- Complete balloting documentary standards to support biothreat detection capabilities.

FY 2018 Key Milestone Events

- Compile and submit annual standards report to NIST per OMB A-119 for the NTTAA for the previous FY.

Systems Engineering Thrust - FY 2017: \$4.364M. FY 2018 Request: \$4.364M.

Under this program, the Office of Systems Engineering conducts Technical Assessments of S&T's R&D programs and assists DHS Acquisitions and R&D programs in implementing systems engineering policies and processes. Systems Engineering is critical to the success of all DHS programs because it lays the framework for managing the technical design and development activities of acquisition and R&D programs, as well as facilitates sound decision-making relative to system performance, risk, cost, and schedule. Current efforts include conducting Technical Assessments, which inform senior acquisition leaders of major technical risks prior to

making acquisition decisions; operating the DHS Systems Engineering Center of Excellence through which systems engineering experts work directly with DHS acquisition programs to implement systems engineering policy and process; leading the development and revision of the DHS Systems Engineering Life Cycle (SELC) policy, guidebook and supplemental guidance; developing a systems engineering-based framework within S&T to guide the selection and management of S&T R&D investments; and developing a DHS Systems Engineering Level I, II, and III certification program.

FY 2017 Key Milestone Events

- Deliver at least four Letters of Technical Assessment, highlighting technical risks, analyzing technical challenges and assessing mitigation strategies to support upcoming Acquisition Review Boards (ARBs) and the Acquisition Decision Authority (ADA).
- Provide DHS with System Engineering recommendations for inclusion in at least three Acquisition Decision Memoranda for DHS.

FY 2018 Key Milestone Events

- Deliver at least four Letters of Technical Assessment that identify major technical risks and recommendations to reduce those risks to the DHS Acquisition Decision Authority to support acquisition decisions.
- Complete at least four systems engineering engagements with programs to assist them in planning and/or conducting systems engineering activities.

Test and Evaluation Thrust - FY 2017: \$7.220M. FY 2018: \$7.220M.

The Office of Test and Evaluation (T&E) provides support and assistance to the Department and all the Components in the following areas:

- Acts as the principal advisor on T&E to the Office of the Secretary and the Component heads.
- Develops policy and procedures for the planning, execution, and assessment of T&E.
- Monitors and reviews T&E and providing guidance for those level 1 & 2 programs on the Major Acquisition List (MAOL).
- Assist in the development of the DHS T&E professional. This includes develop and or update T&E curriculum, providing instructor support, and hosting T&E learning seminars and workshops.

Office of T&E works closely with all Level 1 & 2 programs on the MAOL in the area of T&E design; preparation, review and approval of the Test & Evaluation Master Plan (TEMP); review and approval of the Operational Test Agent; preparation, review and approval of the Operational Test Plan; and, participation in Program Working Integrated Product Teams.

Prior to Acquisition Decision Event 2C where a particular program begins production and delivery, the Office of T&E will develop a Letter of Assessment (LOA) for those Level 1 & 2 programs on the MAOL depicting the systems operational effectiveness, operational suitability, cybersecurity, and interoperability. The Office of T&E works to ensure that DHS integrates test and evaluation processes into the acquisition lifecycle framework (ALF), and SELC.

FY 2017 Key Milestone Events

- Deliver at least four Letters of Assessment to support upcoming ARBs and the ADA.
- Provide DHS with Test and Evaluation recommendations for inclusion in at least three Acquisition Decision Memoranda.

FY 2018 Key Milestone Events

- Deliver at least four Letters of Assessment to support upcoming ARBs and the ADA.
- Provide DHS with T&E recommendations for inclusion in at least three Acquisition Decision Memoranda for DHS.

Technology Transition Support Thrust – FY 2017: \$15.352M. FY 2018: \$15.052M.

This thrust facilitates the transition of S&T's product solutions to customers. These activities involve integrating technology development efforts across S&T to develop the most cost-effective and timely solutions, and processes to meet customer requirements, including first responders.

Interagency Programs

This program addresses high-priority homeland security needs through facilitation and collaboration with cooperative science, technology, and RDT&E endeavors with other Federal agencies, academia, and private sector. It establishes trusted partnerships with government agencies to leverage their investments and other resources, acting as a force-multiplier for S&T programs and initiatives. It provides a key conduit for government agencies to capitalize on S&T innovation and leverages the capabilities and investments of external organizations to reduce duplication and identify unmet needs pursuant to §302 (13) of the *Homeland Security Act of 2002*. Outreach is conducted with Federal, State, local, territorial, and tribal (FSLTT) government partners to strengthen collaborative efforts, and to collect input on their technology gaps.

2017 Key Milestone Event

- Meet with the Homeland Security Science and Technology Advisory Committee four times a year, three in person meetings (quarterly) and one webinar. As a result IAO produced a report on the Internet of Things and defined threats and recommendations to mitigate IAO also produced a report on Best Practices for Social Media in Exercises to be distributed to

the First Responder Community. IAO has also produced 5 white papers on Cybersecurity, Artificial Intelligence, Autonomous Vehicles, Adaptive Manufacturing and Chemical, Biological, Radiological and Nuclear Detection. These 5 white papers will be included as appendices to the 2018 Quadrennial Homeland Security Review. The white papers included threat assessments, technological maturity and recommendations to support DHS's mission success in using or countering these technology areas.

- Update the Science Advisory Guide for Emergencies to ensure currency of membership and relevancy of incidents.
- Host three meetings of the Capabilities Development Working Group that focus on topics of mutual interest and collaboration opportunities between the DHS and DoD within the realm of science and technology, research and development, advanced concepts, testing, experimentation, and acquisition. Specific goals include reducing redundancy and facilitating technology transitions by: Exploring topics of mutual interest and decide on appropriate implementation paths; Supporting/informing policy, planning, decision-making activities; and developing an interagency technology scouting standard operating procedure to strengthen collaborative efforts to fill technology gaps.
- Develop an interagency technology scouting standard operating procedure to strengthen collaborative efforts to fill technology gaps.

2018 Key Milestone Event

- The Homeland Security Science and Technology Advisory Committee will meet four times a year, three in person meetings (quarterly) and one webinar. Deliverables are developed at the request of the Under Secretary for Science and Technology. Appropriate tasking includes topics that have direct policy implications, require extensive stakeholder coordination, understanding research and development trends, horizon scanning and scouting recommendation and in providing independent advice and recommendations that can be coordinated across the foremost experts in the R&D technology fields.
- Update the Science Advisory Guide for Emergencies (SAGE) to ensure currency of membership and relevancy of incidents. IAO will validate 95% accuracy of SME information and validate the SAGE programs capability annually.
- Hold three meetings of the Capabilities Development Working Group to share DHS's high priority technology gaps with the DOD joint staff leadership. The outcome will be to jointly develop solutions to close identified gaps while reducing redundancy and costs.
- Implement interagency technology scouting standard operating procedure to strengthen collaborative efforts to fill technology gaps.

International Cooperative Programs Office (ICPO)

As security challenges continue to emerge and evolve, S&T is developing relationships with international allies to enhance our innovative R&D knowledge, funding, and other unique capabilities and resources. ICPO develops understandings and agreements, and facilitates the planning and implementation of international cooperative activity to address the strategic priorities for the HSE.

The United States and its allies in the global war on terrorism will mutually benefit from the sharing of technological expertise to combat domestic and international terrorism and other high consequence events.

2017 Key Milestone Event

- Facilitate nine bilateral meetings for the Under Secretary and Deputy Under Secretary for S&T that develops partnerships with foreign governments and international organizations to enhance scientific and technical knowledge for the Homeland Security Enterprise (HSE).

2018 Key Milestone Event

- Facilitate nine bilateral meetings for the Under Secretary and Deputy Under Secretary for S&T that develops partnerships with foreign governments and international organizations to enhance scientific and technical knowledge for the Homeland Security Enterprise (HSE).

Knowledge Management and Technology Scouting

This program enhances the S&T's ability to gather and manage accumulated knowledge and essential information for the benefit of the HSE to identify and evaluate existing or developing technologies, services, and emerging trends.

The Knowledge Management program develops and maintains an environment where S&T employees share and access relevant knowledge and lessons learned, and foster collaborative development efforts. Proper management of knowledge and information helps to protect the privacy of all individuals, ensures compliance with Freedom of Information Act (FOIA) requirements, and cost-effectively shares important information with a wide and diverse homeland security enterprise audience. Knowledge Management works with S&T staff to assess privacy risks, recommend privacy protections, and mitigate improper disclosures and breaches of personal information, encourage cost effective use of electronic knowledge sharing, while also facilitating efforts to promote an open and transparent government.

Technology scouting program supports S&T strategic and tactical R&D investment decision-making by providing Program Managers with a better understanding of the state of technology, including new and emerging technology, market analysis, and private sector innovation landscape. Technology scouting shapes the way S&T discovers, monitors, and assesses new and emerging technologies critical to homeland security enterprise missions. Technology scouting provides the foundation for S&T program decisions and helps shape program priorities. Technology scouting program goals are to improve alternative options, increase speed of project execution, and reduce costs for projects.

SAFETY Act Thrust – FY 2017: \$8.043M. FY 2018 Request: \$8.043M.

This program provides liability protections for claims resulting from an act of terrorism, and provides legal liability protection for providers of qualified anti-terrorism technologies. The program incentivizes the private sector to commit additional resources to significantly improve anti-terrorism preparedness and resilience. This program also creates pathways for S&T to work with industry and small businesses in a synchronized, strategic fashion to improve the pace and quality of solution development for the critical needs of the homeland security enterprise. In addition, the SAFETY Act Program actively supports DHS programs and initiatives (e.g., the National Infrastructure Protection Plan, TSA's Certified Cargo Screening Program, CBP's Customs-Trade Partnership Against Terrorism and other Federal anti-terrorism programs by developing a streamlined procedure for providing SAFETY Act coverage known as Block Designations.

2017 Key Milestone Event

- Complete draft process document to be used by program evaluators as procedures for determining the SAFETY Act liability insurance requirement.
- Identify critical infrastructure/key resilience (CI/KR) sectors that have under-represented SAFETY Act applicants.
- Develop outreach plan to SAFETY Act applicants who provide capabilities protecting under-represented critical infrastructure/key resilience (CI/KR) sectors.
- Hold at least two outreach events for SAFETY Act applicants who provide capabilities protecting under-represented critical infrastructure/key resilience sectors.

2018 Key Milestone Event

- Complete final version of process document to be used by program evaluators as procedures for determining the SAFETY Act liability insurance requirement.
- Develop plan to expand outreach to potential cybersecurity technology applicants.
- Develop process and procedures to conduct readiness assessments for potential SAFETY Act venue applicants prior to their full application submissions.

Office of the Chief Scientist

The Office of the Chief Scientist (OCS) serves as a senior advisor and analytic capability to the Under Secretary for Science and Technology. The office provides analysis of the overall S&T portfolio as well as assessments of individual technologies and investments. OCS will conduct a Portfolio Analysis and Review (PAR) to provide insight into the effectiveness of S&T's technology investment portfolio and oversee the reviews of programmatic health and capability development for each of S&T's individual programs and projects. These reviews will also provide a picture of how well S&T's programs are filling capability gaps identified and validated by the Integrated Product Team process and the First Responder Requirements Group. The office will also provide

analysis of emerging technologies which will often enable increased security while also posing new threats. Drones are a prime example of an emerging technology that can both increase DHS's ability to monitor vast stretches of unattended border as well as carry out a multitude of nefarious acts like delivering drugs over the border. These reviews and analytic activities will guide the Under Secretary and S&T's senior leadership in prioritizing and aligning S&T's investments to address the highest priorities of the Administration and Department and the most challenging missions faced by the operational elements of DHS.

Program Transition

This project establishes and implements a technology development program to focus near-term S&T work on transitioning projects and capabilities needed by DHS operational Components, and their external customers.

Office of Public-Private Partnerships (P3)

P3 services and capabilities allow S&T to identify innovative technologies and companies, partner with innovators to develop technology solutions, and facilitate the transition of those solutions to homeland security end-users. These services and capabilities include technology scouting, market analysis, innovation experimentation, prize competitions, the EMERGE Accelerator Program, Long Range Broad Agency Announcement, managing execution of the Small Business Innovation Research (SBIR) program, and technology transfer and commercialization support services. P3 coordinates component-wide implementation of the S&T Innovation Strategy, which integrates S&T efforts to identify and leverage technology innovation for use by the homeland security enterprise. P3 facilitates S&T partnerships with innovative companies of all sizes, with a special focus on entrepreneurs, startups, and other non-traditional partners that have technologies and techniques that contribute to homeland security solutions. Collectively, P3 services and capabilities help to identify, develop, and deliver more effective and impactful solutions for the homeland security enterprise, through expanded partnerships with private sector innovators. P3 organizes its capabilities and services within the following three portfolios:

- **Innovation Discovery:** P3 provides capabilities for industry engagement and outreach, technology scouting, market analysis, horizon scanning, and innovation experimentation. These services ensure that S&T is actively engaging innovators and can identify and leverage current or emerging technologies, as well as examine commercial markets to inform R&D investment decisions relevant to a specific homeland security need or problem set.
- **Partnering and Investment Mechanisms:** P3 provides access to partnership and investment mechanisms that allow S&T to connect with a range of innovative performers, based on the varying needs and characteristics of a specific R&D program or project. These include prize competitions, the *EMERGE* Accelerator Program, Long-Range Broad Agency Announcement, and the Small Business Innovation Research program.
- **Technology Transfer and Commercialization:** P3's technology transfer services promote the transfer and exchange of knowledge, facilities or capabilities developed under Federal R&D funding with industry, State and local governments, academia and other Federal agencies through the execution of technology transfer agreements. P3 also provides

commercialization support through market analyses, commercialization strategies, business plans, and partnership development.

2017 Key Milestone Event

- Conduct operational experimentation events to connect industry and operators.
- Execute a series of accelerators and prize competitions to address high-priority DHS R&D needs.
- Provide technology scouting and market analysis to inform initiation of new R&D programs.

2018 Key Milestone Event

- Provide technology scouting and market analysis to leverage emerging technology and an understanding of a market to inform the path forward for priority S&T R&D projects.
- Provide commercialization support services to priority S&T projects.

Acquisitions and Operations Analysis Budget Authority and Obligations

Dollars in Thousands

Budget Authority	FY 2016	FY 2017	FY 2018
Enacted	\$47,103		
Transfers & Reprogrammings	-		
Delta in Enacted Fee Estimate to Fee Actuals	-		
Enacted Rescissions to Prior Year	-		
Revised Enacted/Request	\$47,103	\$45,852	\$42,552
Carryover and/or Recoveries (Actual/Estimates/Projections)	\$14,108	\$18,536	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	\$61,211	\$64,388	\$42,552
Collections – Reimbursable Resources	\$543	\$500	\$500
Total Budget Resources	\$61,754	\$64,888	\$43,052
Obligations (Actual/Projections/Estimates)	\$42,409	\$45,275	\$29,566
Personnel: Positons and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

Acquisitions and Operations Analysis Collections – Reimbursable Resources

Dollars in Thousands

Collections		FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget		
		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Homeland Security - Transportation Security Administration	Source	-	-	\$290	-	-	\$250	-	-	\$250
Department of Homeland Security - US Customs and Border Protection	Source	-	-	\$99	-	-	\$100	-	-	\$100
Department of Homeland Security - Office of Health Affairs	Source	-	-	\$154	-	-	\$150	-	-	\$150
Total Collections		-	-	\$543	-	-	\$500	-	-	\$500

The FY 2018 estimated obligation is \$29.566M out of an estimated \$43.052M of total budgetary resources. Budget Obligation estimates for FY 2017 and FY 2018 are based on FY 2016 obligation totals.

Acquisitions and Operations Analysis Summary of Budget Changes

Dollars in Thousands

Budget Formulation Activity	Positions	FTE	Amount
FY 2016 Enacted	-	-	\$47,103
FY 2016 Revised Enacted	-	-	\$47,103
FY 2017 Annualized CR	-	-	\$45,852
FY 2018 Base Budget	-	-	\$45,852
FY 2018 Current Services	-	-	\$45,852
Acquisition and Operations Analysis	-	-	(\$3,300)
Total, Program Decreases	-	-	(\$3,300)
FY 2018 Request	-	-	\$42,552
FY 2017 TO FY 2018 Change	-	-	(\$3,300)

PPA Description

Acquisitions and Operations Analysis: AOA provides expert assistance to entities across the HSE to ensure that the transition, acquisition, and deployment of technologies, information, and procedures improve the efficiency and effectiveness of the operational capabilities across the HSE mission.

Adjustments to Base Justification

There are no ATBs for the AOA PPA.

Acquisitions and Operations Analysis Non Pay Budget Exhibits

Non Pay Summary

Dollars in Thousands

Organization	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
Acquisition and Operations Analysis	\$47,103	\$45,852	\$42,552	(\$3,300)
Total	\$47,103	\$45,852	\$42,552	(\$3,300)
Discretionary - Appropriation	\$47,103	\$45,852	\$42,552	(\$3,300)

The non-pay request for FY 2018 is \$42.552M. The associated cost change from FY 2017 is primarily made up of Contracts and IAAs eliminated, due to the elimination of the Standards program.

Acquisitions and Operations Analysis Non Pay by Object Class

Dollars in Thousands

Non-Pay Object Classes	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
21.0 Travel and Transportation of Persons	\$601	\$585	\$543	(\$42)
25.1 Advisory and Assistance Services	\$19,351	\$18,837	\$17,481	(\$1,356)
25.2 Other Services from Non-Federal Sources	\$458	\$446	\$414	(\$32)
25.3 Other Goods and Services from Federal Sources	\$18,814	\$18,315	\$16,997	(\$1,318)
25.5 Research and Development Contracts	\$4,928	\$4,797	\$4,452	(\$345)
25.7 Operation and Maintenance of Equipment	\$2,081	\$2,026	\$1,880	(\$146)
31.0 Equipment	\$317	\$308	\$286	(\$22)
41.0 Grants, Subsidies, and Contributions	\$553	\$538	\$499	(\$39)
Total - Non Pay Object Classes	\$47,103	\$45,852	\$42,552	(\$3,300)

Acquisitions and Operations Analysis

Non Pay Cost Drivers

Dollars in Thousands

Leading Non Pay Cost-Drivers	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
Advisory and Assistance Services	\$19,351	\$18,837	\$17,481	(\$1,356)
Other Goods and Services from Federal Sources	\$18,814	\$18,315	\$16,997	(\$1,318)
Research and Development Contracts	\$4,928	\$4,797	\$4,452	(\$345)
Operations and Maintenance of Equipment	\$2,081	\$2,026	\$1,880	(\$146)
Travel	\$601	\$585	\$543	(\$42)
Other Costs	\$1,328	\$1,292	\$1,199	(\$93)
Total – Non Pay Cost Drivers	\$47,103	\$45,852	\$42,552	\$3,300

NARRATIVE EXPLANATION OF CHANGES

The non-pay request for FY 2018 is \$42.552M. The associated costs are primarily made up of Contracts/IAs, operations and maintenance and travel related costs.

Department of Homeland Security

Science and Technology

Research and Development



**Fiscal Year 2018
Congressional Justification**

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Research and Development

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

Dollars in Thousands

Organization	FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Research, Development and Innovation	-	-	\$434,850	-	-	\$432,951	-	-	\$342,982	-	-	(\$89,969)
University Programs	-	-	\$39,724	-	-	\$39,724	-	-	\$29,724	-	-	(\$10,000)
Total	-	-	\$474,574	-	-	\$472,675	-	-	\$372,706	-	-	(\$99,969)
Subtotal Discretionary - Appropriation	-	-	\$474,574	-	-	\$472,675	-	-	\$372,706	-	-	(\$99,969)

Overview

Mission Statement for Science and Technology Directorate – Research and Development:

The mission of the Science and Technology Directorate (S&T) is to *strengthen America's security and resiliency by providing knowledge products and innovative technology solutions for the Homeland Security Enterprise (HSE)*. Congress created the S&T Directorate under the Homeland Security Act of 2002, among other things, to “[conduct] basic and applied research, development, demonstration, testing, and evaluation activities relevant to any or all elements of the Department.”

The extraordinary breadth and diversity of Department of Homeland Security's (DHS) missions requires S&T to address a wide range of programs including DHS Components' near-term needs for new operational capabilities and improved operational effectiveness, efficiency, and safety. S&T also has responsibilities related to understanding and creating solutions to biological and chemical threats, and to conducting the research and development (R&D) required to meet homeland cybersecurity needs. While S&T's work is often identified with technology development, equally important are the Directorate's contributions to homeland security in the form of analyses or “knowledge products.” These include analyses of alternative technology options; assessments of complex issues such as the relative risk of different chemical, biological, radiological and nuclear threats; operational testing and evaluation of technologies proposed for acquisition; and the detailed technical characterization of potential biological threat organisms to support both human and agricultural biodefense. In addition, the Directorate's capacity to engage R&D activities worldwide is greatly augmented by S&T's university-based Centers of Excellence (COEs) and 13 bilateral international agreements.

In order to meet the broad scope of its mission, S&T has built a highly trained and technically-proficient staff that is DHS's core source of science, engineering, and analytical subject matter experts. Using its staff and budget for maximal impact, S&T has focused its energies on efforts that have a direct and demonstrable link to improving the efficiency, effectiveness, and safety of DHS's

operational missions and enhancing the safety, interoperability, and communications capabilities of the first responder community. S&T's contributions to the Department and the HSE fall into four general categories:

- *New capabilities and knowledge products* – S&T creates new technological capabilities that address DHS operational needs that are necessary to address evolving homeland security threats.
- *Process enhancements and efficiencies* – S&T conducts systems-based analysis to provide streamlined, resource-saving process improvements to existing operations.
- *Acquisition support* – The Department achieves more effective and efficient operations and avoids costly acquisition failures and delays by leveraging S&T's technical expertise to improve project management, operational analysis, and acquisition management.
- *Understanding of homeland security risks and opportunities* – S&T's relationships across DHS and the HSE contribute to strategic understanding of existing and emerging threats as well as opportunities for collaboration across departmental, interagency, and state/local boundaries.

Budget Activities:

The Directorate has two program, project, and activities (PPA) in the R&D appropriation. The two PPAs are Research, Development and Innovation (RD&I) and University Programs (UP).

Research, Development, and Innovation

RD&I provides state-of-the-art technology and/or solutions to meet the needs of DHS Components and the first responder community. It includes customer-focused and output-oriented RDT&E programs that balance risk, cost, impact, and time to delivery. RD&I includes: Apex; Border Security; Chemical, Biological, and Explosive (CBE) Defense; Counter Terrorist; Cyber Security/Information Analysis; and First Responder/Disaster Resilience.

University Programs

University Programs supports critical homeland security-related research and education at U.S. colleges and universities to address high-priority DHS-related issues and to enhance homeland security capabilities over the long term. University Programs includes COEs and Minority Serving Institutions.

Research and Development
Budget Authority and Obligations
Dollars in Thousands

Budget Authority	FY 2016	FY 2017	FY 2018
Enacted	\$474,574		
Transfers & Reprogrammings	-		
Delta in Enacted Fee Estimate to Fee Actuals	-		
Enacted Rescissions to Prior Year	-		
Revised Enacted/Request	\$474,574	\$472,675	\$372,706
Carryover and/or Recoveries (Actual/Estimates/Projections)	\$134,657	\$149,514	\$125,906
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	\$609,231	\$622,189	\$498,612
Collections – Reimbursable Resources	\$44,607	\$20,500	\$20,500
Total Budget Resources	\$653,838	\$642,689	\$519,112
Obligations (Actual/Projections/Estimates)	\$469,074	\$455,287	\$375,258
Personnel: Positons and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

The FY 2018 estimated obligation is \$375.257M out of an estimated \$519.112M of total budgetary resources.

Research and Development Summary of Budget Changes

Dollars in Thousands

Budget Formulation Activity	Positions	FTE	Amount
FY 2016 Enacted	-	-	\$474,574
FY 2016 Revised Enacted	-	-	\$474,574
FY 2017 Annualized CR	-	-	\$472,675
FY 2018 Base Budget	-	-	\$472,675
FY 2018 Current Services	-	-	\$472,675
Research, Development and Innovation	-	-	(\$89,969)
S&T - University Programs Centers of Excellence R&D	-	-	(\$10,000)
Total, Program Decreases	-	-	(\$99,969)
FY 2018 Request	-	-	\$372,706
FY 2017 TO FY 2018 Change	-	-	(\$99,969)

Budget Request Summary:

The S&T Directorate requests \$372.706M for R&D for FY 2018. This is a net decrease of \$99.969M to basic, applied, and experimental R&D.

The program changes total a decrease of \$99.969M and include:

- A program decrease of \$89.969M in RD&I.
- A program decrease of \$10.000M in UP.

Research and Development Justification of Program Changes

Dollars in Thousands

Program Changes	FY 2018 President's Budget		
	Positions	FTE	Amount
Program Change 1 - Research, Development and Innovation	-	-	(\$89,969)
Research, Development and Innovation	-	-	(\$89,969)
Program Change 2 - S&T - University Programs Centers of Excellence R&D	-	-	(\$10,000)
University Programs	-	-	(\$10,000)
Total Program Changes	-	-	(\$99,969)

Program Change

Research, Development and Innovation

Description

The funding decrease in Research, Development and Innovation will be applied across the six thrusts: Apex, Cargo Security, Chemical, Biological and Explosive Defense Research and Development, Counter Terrorist, Cyber Security/Information Analysis, and First Responders/Disaster Resilience. In order to maximize available research and development funding, S&T leadership has prioritized projects to support Administration and Secretarial immigration and border security priorities.

Justification

- **Apex** – a decrement of \$25.628M eliminates the Real-Time Bio-threat Awareness project and adjusts funding levels of Apex programs and Engines to focus on Administration and Secretarial priorities, including immigration and border security. The request maintains funding for the cross cutting Apex Engines and most Apex projects including Next Generation First Responder and Flood Awareness. The total funding for Apex programs is \$53.3M.
- **Border Security** – a decrement of \$8.348M eliminates funding under the Cargo and Point of Entry (POE) Security program: Air Cargo Screening, Cargo and Conveyance Security, Cargo Forensics, Land Sea Cargo Screening and other project reductions; to focus on Administration and Secretarial priorities, including immigration and border security. The request increases funding for administration priorities such as Land Border Security and Maritime Border Security. The total funding for Border Security programs is \$48.4M.
- **Chemical, Biological and Explosive Defense Research and Development** – a decrement of \$5.748M eliminates funding for Agriculture Screening and Surveillance, Chemical Detection and other project reductions to focus on Administration and

Secretarial priorities, including immigration and border security. The request increases funding for Bioagent detection while making strategic prioritizations in Explosive Detection. The total funding for Chemical, Biological and Explosive Defense Research and Development is \$52.6M.

- **Counter Terrorist** – a decrement of \$18.455M eliminates research funding for the Chemical Security Analysis Center, Multifunction Detectors and other project reductions to focus on Administration and Secretarial priorities, including immigration and border security. The request increases funding for Explosive Threat assessment by \$7.1M. The total funding for Counter Terrorist is \$81.1M.
- **Cyber Security/Information Analysis** – a decrement of \$20.234M eliminates Cyber Security Research Infrastructure and Cyber Transition and Outreach investment to focus on Administration and Secretarial priorities, including immigration and border security. The request makes strategic adjustments to Information Analytics and Network & System Security and Investigations. The total funding for Cyber Security/Information Analysis is \$48.2M.
- **First Responder/Disaster Resilience** – a decrement of \$11.555M eliminates R&D projects: Bio-Forensics R&D; Bio-Forensics Operations (NBFAC); Chemical Forensics; Explosives, Radiological and Nuclear Attack Resiliency (Rad/Nuc); Interoperability and Compatibility Standards; and other adjustments to focus on Administration and Secretarial priorities, including immigration and border security. The request increases investment in Natural Disaster Resiliency projects. The total funding for First Responder/Disaster Resilience is \$61.2M.

Performance

These strategic reductions will allow S&T to focus on the highest priority needs of the Homeland Security Enterprise (HSE). The request prioritizes Administration and Secretarial priorities within available resources based on the Department's Integrated Product Team (IPT) process, which prioritized capability gaps from around the Department that require research and development, and the internal S&T Portfolio and Analysis Review. With this proposal, S&T has sought to minimize the impact to DHS Component customers. S&T will continue to leverage R&D from other government agencies and the private sector to realize the highest return on investment in current and new technologies for the Homeland Security Enterprise.

Program Change

University Programs, COEs

Description

The \$10.000M reduction in funding for the COEs will result in the elimination of three centers of excellence. The total funding for University Programs is \$29.7M.

Justification

S&T plans to eliminate a current COE and two planned COEs as outlined below:

- **Maritime Security:** This current COE, led by Stevens Institute of Technology, enhances Maritime Domain Awareness (MDA) and develops strategies to support Marine Transportation System (MTS) resilience and educational programs for current and aspiring homeland security practitioners. This COE conducts research to support DHS and other federal agencies' arctic security missions.
- **Cross Border Threat Screening and Supply Chain Defense:** This proposed COE would have conducted R&D to support the identification of biological threats and/or hazards at ports of entry, land borders, and other critical nodes within the supply chain.
- **Counterterrorism:** This proposed COE would have examined adversarial behavior within the homeland and beyond our borders to better understand and anticipate evolving threats and the effectiveness of counterterrorism efforts.

Performance

The Office of University Programs (OUP) taps the expertise of the nation's colleges and universities to tackle tough homeland security challenges. Component access to the centers will remain available through basic ordering agreements maintained by S&T. OUP will continue to harnesses the intellectual power of America's universities for homeland security research, development and education to deliver tools, technologies, knowledge products, training and expertise to the Homeland Security Enterprise through the remaining COEs.

Research and Development Non Pay Budget Exhibits

Non Pay Summary *Dollars in Thousands*

Organization	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
Research, Development and Innovation	\$434,850	\$432,951	\$342,982	(\$89,969)
University Programs	\$39,724	\$39,724	\$29,724	(\$10,000)
Total	\$474,574	\$472,675	\$372,706	(\$99,969)
Discretionary - Appropriation	\$474,574	\$472,675	\$372,706	(\$99,969)

S&T's basic, applied, and experimental research and development funding is reduced by an overall decrease of \$99.969M to the R&D appropriation. This reduction allows S&T to focus on Administration and Departmental priorities such as immigration and border security priorities. These non-pay reductions are associated with the program related cuts in both RD&I and UP.

Research and Development Non Pay by Object Class

Dollars in Thousands

Non-Pay Object Classes	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
21.0 Travel and Transportation of Persons	\$1,648	\$1,641	\$1,295	(\$346)
22.0 Transportation of Things	\$27	\$26	\$21	(\$5)
23.2 Rental Payments to Others	\$112	\$112	\$89	(\$23)
23.3 Communications, Utilities, and Misc. Charges	\$3	\$3	\$2	(\$1)
25.1 Advisory and Assistance Services	\$67,382	\$67,099	\$53,042	(\$14,057)
25.2 Other Services from Non-Federal Sources	\$2,841	\$2,829	\$2,241	(\$588)
25.3 Other Goods and Services from Federal Sources	\$222,157	\$221,194	\$175,160	(\$46,034)
25.5 Research and Development Contracts	\$141,308	\$140,700	\$111,372	(\$29,328)
25.7 Operation and Maintenance of Equipment	\$170	\$169	\$134	(\$35)
26.0 Supplies and Materials	\$896	\$892	\$707	(\$185)
31.0 Equipment	\$1,758	\$1,750	\$1,386	(\$364)
41.0 Grants, Subsidies, and Contributions	\$36,272	\$36,260	\$27,257	(\$9,003)
Total - Non Pay Object Classes	\$474,574	\$472,675	\$372,706	(\$99,969)

The reduction in R&D funds will result in reductions in all object class codes. These non-pay reductions are directly proportional to the program related cuts in both RD&I and UP.

*Research, Development, and Innovation – PPA***Budget Comparison and Adjustments****Comparison of Budget Authority and Request***Dollars in Thousands*

Organization	FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Research, Development and Innovation	-	-	\$434,850	-	-	\$432,951	-	-	\$342,982	-	-	(\$89,969)
Total	-	-	\$434,850	-	-	\$432,951	-	-	\$342,982	-	-	(\$89,969)
Subtotal Discretionary - Appropriation	-	-	\$434,850	-	-	\$432,951	-	-	\$342,982	-	-	(\$89,969)

PPA DESCRIPTION:**Research, Development and Innovation**

The S&T Directorate requests \$342.982M for RD&I in FY 2018.

Research, Development, and Innovation

RD&I provides state-of-the-art technology and/or solutions to meet the needs of DHS operational Components and the first responder community. It includes customer-focused and output-oriented Research, Development, Test and Evaluation (RDT&E) programs that balance risk, cost, impact, and time to delivery. RD&I includes: Apex; Border Security; Chemical, Biological, and Explosive (CBE) Defense; Counter Terrorist; Cyber Security/Information Analysis and First Responder/Disaster Resilience.

Research, Development, and Innovation – PPA Budget Authority and Obligations

Dollars in Thousands

Budget Authority	FY 2016	FY 2017	FY 2018
Enacted	\$434,850		
Transfers & Reprogrammings	-		
Delta in Enacted Fee Estimate to Fee Actuals	-		
Enacted Rescissions to Prior Year	-		
Revised Enacted/Request	\$434,850	\$432,951	\$342,982
Carryover and/or Recoveries (Actual/Estimates/Projections)	\$131,138	\$142,424	\$125,906
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	\$565,988	\$575,375	\$468,888
Collections – Reimbursable Resources	\$44,147	\$20,000	\$20,000
Total Budget Resources	\$610,135	\$595,375	\$488,888
Obligations (Actual/Projections/Estimates)	\$432,542	\$415,737	\$349,993
Personnel: Positons and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

The FY 2018 estimated obligation is \$349.993M out of an estimated \$488.888M of total budgetary resources. .

Research, Development, and Innovation – PPA Summary of Budget Changes

Dollars in Thousands

Budget Formulation Activity	Positions	FTE	Amount
FY 2016 Enacted	-	-	\$434,850
FY 2016 Revised Enacted	-	-	\$434,850
FY 2017 Annualized CR	-	-	\$432,951
FY 2018 Base Budget	-	-	\$432,951
FY 2018 Current Services	-	-	\$432,951
Research, Development and Innovation	-	-	(\$89,969)
Total, Program Decreases	-	-	(\$89,969)
FY 2018 Request	-	-	\$342,982
FY 2017 TO FY 2018 Change	-	-	(\$89,969)

PPA Description

The funding decrease in RD&I will be applied across the six thrusts: Apex, Border Security, Chemical, Biological and Explosive Defense Research and Development, Counter Terrorist, Cyber Security/Information Analysis, and First Responders/Disaster Resilience. In order to maximize available research and development funding, S&T has prioritized R&D for DHS Components including border security, counterterrorism, explosives, cyber, and first responder/disaster resilience and minimizes reductions to biological defense investments.

Justification

S&T based its priorities on the Department's Integrated Product Team process, S&T's internal Portfolio Analysis and Review, and the Administration's immigration and border security priorities.

- **Apex** – Apex projects are crosscutting, multi-disciplinary projects agreed to by the requesting DHS Component and the Under Secretary for Science and Technology. Total funding for Apex projects is \$53.3M. The decrement of \$25.6 million eliminates the Real-Time Bio-threat Awareness project and adjusts funding levels of Apex programs.
- **Border Security** – DHS secures the borders, territorial waters, ports, terminals, waterways, and air, land, and sea transportation systems of the United States. S&T invests in border security research and development for technologies and solutions to prevent the illicit movement and illegal entry or exit of people, weapons, dangerous goods, and contraband, and

manage the risk posed by people and goods in transit. Total funding for Border Security is \$484M, a decrement of \$8.348M eliminates funding for Air Cargo Screening, Cargo and Conveyance Security, Cargo Forensics, Land Sea Cargo Screening and other R&D project reductions.

- **Chemical, Biological and Explosive Defense Research and Development (CBE Defense)** – S&T invests in R&D to support prevention and protective strategies and coordinated surveillance and detection to address CBE threats. R&D work includes: prevention of terrorism; reduction of vulnerability of critical infrastructure from terrorist attacks and other hazards; and prevention of the illicit movement and illegal entry or exit of people, weapons, dangerous goods, and contraband by providing technology, methods, and procedures to detect CBE threats. Total funding for CBE Defense is \$52.6M, a decrement of \$5.748M, which eliminates funding for Agriculture Screening, and Surveillance, Chemical Detection and other R&D project reductions.
- **Counter Terrorist** – The S&T invests in the R&D technologies, methods, and procedures to counter terrorists. Efforts include R&D to identify individuals or groups that intend to conduct terrorist attacks or to illicitly move weapons, dangerous goods, and contraband. It also includes providing threat assessments of the high-consequence attack methods such as CBE that terrorists may use to attack the Nation. Total funding for Counter Terrorist is \$81.1M, a decrement of \$18.455M, which eliminates research funding for the Chemical Security Analysis Center, Multifunction Detectors and other R&D project reductions.
- **Cyber Security/Information Analysis** – Conducts and supports RDT&E and transition for advanced cybersecurity and information assurance technologies to secure the Nation's current and future cyber and critical infrastructures. These solutions include user identity and data privacy technologies, end system security, law enforcement forensic capabilities, secure protocols, and software assurance. Total funding for Cyber Security/Information Analysis is \$46.2M, a decrement of \$20.234M, which eliminates Cyber Security Research Infrastructure and Cyber Transition and Outreach investments.
- **First Responder/Disaster Resilience** – Work includes reduction of vulnerability of critical infrastructure, key leadership, and events to terrorist attacks and other hazards; working with State, local, tribal, and territorial governments to secure their information systems; working with local and regional partners to identify hazards, assess vulnerabilities, and develop strategies to manage risks associated with all hazards; increasing the state of preparedness of State, local, regional, tribal, and territorial partners, as well as nongovernmental organizations, the private sector, and the general public; advancing and improving disaster emergency and interoperable communications capabilities; and, improving the capabilities of DHS to lead in emergency management. Total funding for First Responder/Disaster Resilience is \$61.3M, a decrement of \$11.555M, which eliminates Bio-Forensics R&D, Bio-Forensics Operations (NBFAC), Chemical Forensics, Explosives and Radiological/Nuclear Resiliency (Rad/Nuc), Interoperability and Compatibility Standards and other R&D project reductions

Adjustments to Base Justification

There are no adjustments to base in FY 2018.

Research, Development, and Innovation – PPA Non Pay Budget Exhibits

Non Pay Summary

Dollars in Thousands

Organization	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
Research, Development and Innovation	\$434,850	\$432,951	\$342,982	(\$89,969)
Total	\$434,850	\$432,951	\$342,982	(\$89,969)
Discretionary - Appropriation	\$434,850	\$432,951	\$342,982	(\$89,969)

The non-pay request for FY 2018 is \$342.982M. The associated costs are primarily made up of contracts, funds sent to other federal agencies, supplies, training and travel. There is a decrease in management and support services that is proportional to the decrement in R&D activities. In addition, there is a proportional decrease in travel funding for federal employees supporting the R&D programs.

Research, Development, and Innovation – PPA

Non Pay by Object Class

Dollars in Thousands

Non-Pay Object Classes	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
21.0 Travel and Transportation of Persons	\$1,538	\$1,531	\$1,213	(\$318)
22.0 Transportation of Things	\$27	\$26	\$21	(\$5)
23.2 Rental Payments to Others	\$112	\$112	\$89	(\$23)
23.3 Communications, Utilities, and Misc. Charges	\$3	\$3	\$2	(\$1)
25.1 Advisory and Assistance Services	\$64,795	\$64,512	\$51,106	(\$13,406)
25.2 Other Services from Non-Federal Sources	\$2,839	\$2,827	\$2,240	(\$587)
25.3 Other Goods and Services from Federal Sources	\$220,595	\$219,632	\$173,991	(\$45,641)
25.5 Research and Development Contracts	\$139,258	\$138,650	\$109,838	(\$28,812)
25.7 Operation and Maintenance of Equipment	\$170	\$169	\$134	(\$35)
26.0 Supplies and Materials	\$896	\$892	\$707	(\$185)
31.0 Equipment	\$1,758	\$1,750	\$1,386	(\$364)
41.0 Grants, Subsidies, and Contributions	\$2,859	\$2,847	\$2,255	(\$592)
Total - Non Pay Object Classes	\$434,850	\$432,951	\$342,982	(\$89,969)

Reduction in all object class codes are proportional with the decreases to research and development projects in the FY 2018 request.

Research, Development, and Innovation – PPA Non Pay Cost Drivers

Dollars in Thousands

Leading Non Pay Cost-Drivers	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
Advisory and Assistance Services	\$64,795	\$64,512	\$51,106	\$(13,406)
Research and Development Contracts	\$139,258	\$138,650	\$109,838	\$(28,812)
Other Goods and Services from Federal Sources	\$220,595	\$219,632	\$173,991	\$(45,641)
Travel	\$1,538	\$1,531	\$1,213	\$(318)
Other Costs	\$8,664	\$8,626	\$6,834	\$(1,792)
Total Non Pay Cost Drivers	\$434,850	\$432,951	\$342,982	\$(89,969)

NARRATIVE EXPLANATION OF CHANGES

Advisory and Assistance Services: The decreases are proportional to the R&D projects reductions. Advisory and Assistance Services are contractual costs associated with administering R&D work.

Research and Development Contracts: The decreases are proportional to the R&D projects reductions and associated with the elimination of the Real Time Bio-Threat Awareness, Cargo Security, Chemical Detection, Cyber Infrastructure, Cyber Outreach, Bio-Forensics, and Explosive Rad/Nuc Resiliency projects. Research and Development Contracts are the direct cost of conducting research and development.

Other Goods and Services from Federal Sources: The decreases are proportional to the R&D projects reductions. Other Goods and Services from Federal Sources represents funding that is placed with other government agencies under the authority of the Economy Act.

Travel: The decreases in travel funding for federal employees supporting the R&D programs are proportional to the R&D projects reductions.

Other Costs: The decreases to the remainder of the costs are proportional to the R&D project reductions.

Research, Development, and Innovation – PPA Research and Development

Technology Readiness Level Exhibit

PPA DESCRIPTION:

Research Development & Innovation PPA – Provides state-of-the-art technologies and solutions to meet the needs of the operational Components of the Department and the first responder community. Includes customer-focused and output-oriented RDT&E programs that balance risk, cost, impact, and time to delivery. The six thrust areas of RD&I include: Apex; Border Security; CBE Defense; Counter Terrorist; Cyber Security/Information Analysis; and First Responder/Disaster Resilience.

Apex	\$53.346M
Border Security	\$48.401M
CBE Defense	\$52.641M
Counter Terrorist	\$81.051M
Cyber Security/Information Analytics	\$46.248M
First Responder/Disaster Resilience	\$61.294M
FY 2018 Request	\$342.981M

1. **Apex** – FY 2017 Annualized Continuing Resolution: \$78.973M. FY 2018 Request: \$53.346M. Consists of crosscutting, multi-disciplinary projects agreed to by the requesting DHS Component Head and the Under Secretary for Science and Technology.

A. **Apex Programs** – FY 2017 Annualized Continuing Resolution: \$60.974M. FY 2018 Request: \$35.346M.

Apex Screening at Speed

- **Problem:** Continuously evolving threats at checkpoints necessitates an Apex Screening at Speed (SaS) program that provides technological innovation, while allowing for changing operational needs. The technology solutions for airports must improve the passenger experience and enhance threat detection capabilities at low cost. As an example, current checkpoint throughput (135-150 passengers per hour per lane), negatively impacts commerce and causes sizable costs to the Government due to the number of lanes that must be staffed each day in order to securely screen the roughly 720 million passengers that board aircraft nationwide each year. Although the primary use will be for aviation screening, other screening venues also will be considered during development.

- Solution:** The multi-year Apex SaS program researches and develops the new technology, techniques, and processes to the Transportation Security Administration's (TSA) highest security standards, so that aviation checkpoints can screen up to 300 passengers and their carry-on belongings per lane per hour. New systems will reduce the need for removal of clothing or liquids and electronics from carry-on bags, and adapt dynamically to information provided by risk-based screening, while detecting more challenging emerging threats. Raising throughput and lowering costs will also enable highly secure screening to benefit other HSE customers including U.S. Customs and Border Protection (CBP) and the United States Secret Service (USSS). Apex SaS will seek novel technologies and techniques complementary to other explosives detection efforts, most notably, Primary Screening for Passengers, Primary Screening for Carry-On Baggage, and Secondary Screening Technology Development.
- Impact:** Apex SaS plans to invest in several capabilities: a future curb-to-gate screening architecture, advanced screening technologies, identity verification, risk-based methodologies, training and human performance, and surveillance and video analytics. These capabilities represent major steps toward relative to current checkpoints. One of the novel technologies is X-ray diffraction, which is an essential technology to explore for various TSA applications, including the checkpoint. Using today's technology, screening equipment cannot tell the difference between an ordinary bottle of water and a bottle of acetone. X-ray diffraction, by separating objects by their crystal structure, can differentiate between the two. Improved detection probabilities and reduced false alarms will translate into fewer secondary inspections, thereby lowering per-passenger costs for TSA, and reducing inconvenience for airline passengers. An integrated systems-of-systems approach focusing on open architectures will reduce security risks, reduce lifecycle costs, and facilitate rapid, cost-effective system upgrades as threats evolve.

Overall Project Funding

	FY2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	6,400	4,000	12,600	8,000
Obligations	-	5,894	2,820	236	-

FY 2016 Key Milestone Events

- Complete Broad Agency Announcement, Source Selection, and contract award for next-generation technologies necessary for achieving program throughput goals, detection, and Risk-Based Screening.
- Issue awards for component technologies with joint funding from the Primary Screening for Passengers, Primary Screening for carry-on baggage, and Secondary Screening Technology Development programs.
- Complete assessment of alternative screening processes.

FY 2017 Planned Key Milestone Events

- Hold Preliminary Design Review for Advanced Imaging Technology (AIT; "person scanner") prototype(s) that would scan walking (~1 m/s) passengers.
- Kick off a prize competition that challenges developers to find anomalies on people using higher-resolution data for an S&T funded prototype millimeter-wave Advanced Imaging Technology system.
- Deliver a prototype system to TSA that uses X-ray diffraction to screen personal and carry-on-sized items.
- Accept draft performance report for a prototype Widely Tunable Infrared Source quantum cascade laser system that illuminates and energizes substances for optical trace detection.
- Deliver system-specific final reports for all Qualification Readiness Assistance and Qualification Readiness Testing activities conducted on systems provided by OEMs such as: Active Millimeter Wave; X-ray Backscatter; Handheld Resolution Tools; Enhanced Metal Detectors; Advanced Technology X-Ray systems; Computed Tomography X-ray systems; alternative checkpoint technologies; Bottled Liquid Scanners and their alternatives.
- Deliver Final Report for a dual-energy computed tomography (CT), carry-on-sized bag scanner. Data will have been collected at the Transportation Security Laboratory using stream-of-commerce items and/or real threats.
- Hold a workshop with security stakeholders that will develop requirements for aviation security technologies.

FY 2018 Planned Key Milestone Events

- Analysis and primary design of a video passenger identity correlation system in an airport environment.
- Optimized phase contrast imaging prototype design for carry-on screening, including raw data of explosive and benign materials scanned using phase contrast methodologies.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Developed algorithms and prototype designs for automated systems that associate passengers with their accessible belongings.	FY 2016 Q4	FY 2018 Q3
Qualification Readiness Testing activities.	FY 2016 Q1	FY 2018 Q4
Developed algorithms that establish video passenger identity correlation in an airport environment.	FY 2016 Q4	FY 2018 Q3

FY 2017		
Report on phase contrast imaging system.	FY 2017 Q1	FY 2018 Q3
Assess phase contrast research prototype for applicability to TSA missions.	FY 2017 Q1	FY 2017 Q4
Refine design and performance of a Widely Tunable Infrared Source quantum cascade laser system.	FY 2017 Q1	FY 2017 Q2
Research components and configuration, and design an AIT, "person scanner") prototype.	FY 2017 Q1	FY 2017 Q4
FY 2018		
Delivery of phase contrast X-ray data on explosive and benign materials	FY 2018 Q2	FY 2018 Q4
Analysis and primary design of a video passenger identity correlation system in an airport environment	FY 2018 Q2	FY 2018 Q4

Type of Research

Developmental

Technical Readiness Level

DHS defines Technical Readiness levels by the following chart:

Basic Research		Applied Research		Technology Development	Technology Demonstration	System Development
Technology Readiness Level-1	Technology Readiness Level-2	Technology Readiness Level-3	Technology Readiness Level-4	Technology Readiness Level-5	Technology Readiness Level-6	Technology Readiness Level-7
Basic Principles Observed/ Reported	Technology Concept/application formulated	Critical function or Characteristic proof of concept	Validation in lab Environment	Validation in Relevant Environment	System Prototypes in relevant environment	System Prototypes in operational environment

The program plans to begin at TRL2 in FY 2016 and end at TRL7 in FY 2021.

Transition Plans

- S&T will work closely with TSA to create a checkpoint architecture evolution plan.
- Systems developed by funded awardees will initially transition to TSA's Office of Acquisition Program Management, after the completion of Developmental Test and Evaluation (DT&E) at the Transportation Security Laboratory (TSL). Other Government customers may leverage this DT&E towards additional applications.
- Screening device development spirals will be coordinated with TSA's recapitalization plans ensuring smooth and timely technology insertion.
- S&T will engage industry through outreach events (Industry Days), Broad Agency Announcements, and the Small Business Innovation Research (SBIR) program.

Apex Border Situational Awareness (BSA)

- **Problem:** CBP and partner law enforcement agencies (Federal, State, local, tribal, and international) need improved situational awareness to more effectively and efficiently deploy its resources to the areas of highest risk.
- **Solution:** To improve border situational awareness by establishing an enterprise capability to (1) access more data sources, (2) make available decision support tools to translate the available data into actionable information and intelligence, and (3) share that actionable information and intelligence with partner law enforcement agencies.
- **Impact:** The Apex BSA program will enable the HSE to achieve increased border situational awareness leading to increased border incursion detection, interdictions, and deterrence. Specifically, the increased situational awareness will result in:
 - Improved measurement of illegal border activity and aggregated analysis of trends, statistics and intelligence to understand current state.
 - Improved assessment of risks by identifying current threats along with emerging patterns and trends.
 - Improved alignment of resources to risk for current and future operations on both a tactical and strategic level.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	2,913	8,794	9,279	5,800
Obligations	-	2,600	6,334	2,150	-

FY 2016 Key Milestone Events (Prior Year)

- Evaluated selected commercial off the shelf (COTS) solutions.
- Conducted integration and developmental testing of selected COTS and GOTS solutions.
- Began coordination and planning of field test and evaluation activities.

FY 2017 Key Milestone Events (Year of Execution)

- Conduct pilot of Spiral 1 of the Border Situational Awareness project focused on establishing enterprise information sharing for CBP.
- Perform Spiral 2 requirements analysis and develop requirements focused on tactical response for CBP.

FY 2018 Key Milestone Events (Budget Year)

- Conclude pilot of Spiral 1; development of the Border Situational Awareness project focused on establishing enterprise information sharing for CBP.
- Initiate pilot of Spiral 2; focused on improving tactical response for CBP.
- Initiate Spiral 3; focused on improving strategic planning for CBP.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Conduct pilot of Spiral 1 of the Border Situational Awareness project focused on establishing enterprise information sharing for CBP	FY 2017 Q1	FY2017 Q2
Transition Spiral 1 enterprise information sharing capability into existing CBP system baseline	FY 2017 Q3	FY2018 Q1
Perform Spiral 2 requirements analysis and develop requirements focused on tactical response for CBP	FY 2017 Q1	FY2017 Q2
Perform integration and developmental testing of selected Spiral 2 solutions	FY 2017 Q3	FY 2018 Q2
FY 2018		
Conduct pilot of Spiral 2 of the Border Situational Awareness project	FY 2018 Q3	FY 2019 Q1

focused on improving tactical response for CBP		
Perform Requirements Analysis of Sprial 3 focusing on improving strategic planning	FY 2018 Q3	FY 2019 Q1

Type of Research

Developmental

Technical Readiness Level

The program began TRL 5 in FY 2017 or higher (multiple technologies being pursued) and end at TRL 7.

Transition Plans

Transition capabilities to CBP:

- Pilot integrated enterprise proof-of-concept capability at select border locations.
- Establish operational utility and prove cost/benefit of capability.
- Enhance capability based on user-defined operational needs and field analysis.
- Demonstrate initial operating capability and transition to CBP.
- Assist CBP in implementing full operating capability.

Apex Next Generation Cyber Infrastructure

- Problem: Hacking of the cyber fabric underlying our Nation's critical infrastructure (CI) is a threat to U.S. national security. Known penetration of financial sector networks by sophisticated adversaries combined with existing fragilities exist in the core of the financial sector present a clear and growing risk to our economic and national security.
- Solution: S&T is partnering with the Financial Services Sector (FSS) to develop and deliver advanced sensing technologies, situation understanding, response, and recovery and network protections to institutional, sector, and cross sector levels.
- Impact: With S&T's assistance, the FSS will reduce security vulnerabilities, improve information sharing, and increase response and recovery times.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	13,090	10,039	10,000	4,000
Obligations	-	4,638	1,240	207	-

FY 2016 Key Milestone Events (Prior Year)

- Complete Sector Requirements Analysis
- Determine Technology Forage
- Determine Go/No-Go Decision for Testing and Evaluation of Forage Result
- Conduct Testing and Evaluation of Forage Result

FY 2017 Key Milestone Events (Year of Execution)

- Complete Financial Sector Requirements Analysis.
- Complete Tech Forage list and make Go/No go decision for test & evaluation of technologies in two project areas.
- Conduct Testing and Evaluation of Forage Result.
- Transition prototype technologies, all analyses, models and knowledge products, to Financial Services Sector Institutions.
Transition efforts will correspond to, and coincide with the two project / technology topic areas identified in the Tech Foraging phase each year.

FY 2018 Key Milestone Events (Budget Year)

- Revalidate Financial Sector Requirements and conduct test & evaluation of technologies in two additional project areas to address cyber gaps in sector
- Transition proven prototype technologies, all analyses, models and knowledge products, to Financial Services Sector Institutions

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Identify and engage FSS (Government and non-Government) stakeholders	FY 2016 Q1	FY 2016 Q1
Analyze FSS needs using National Institute of Standards and Technology (NIST) Cybersecurity Framework to develop a crosscutting assessment of asset classes to operational functions	FY 2016 Q2	FY 2016 Q2
Conduct Annual Financial Sector Exercise	FY 2016 Q2	FY 2016 Q4
FY 2017		
Partner with the Silicon Valley Innovation Program to issue the Financial Services Cyber Security Active Defense (FSCSAD) solicitation to attract cutting-edge solutions from technology innovators	FY 2017 Q1	FY 2017 Q1
Conduct proof of concept, pilots and operational testing in the areas of Intrusion Deception, Moving Target Defense, and Isolation and Containment for the FSS.	FY 2017 Q2	FY 2017 Q4
Establish Other Transaction Authority agreement to rapidly test and transition technology solutions to the FSS	FY 2017 Q2	FY 2017 Q3
Conduct testing & evaluation of technologies that address Network Detection and Network Identification	FY 2017 Q3	FY 2017 Q4
FY 2018		
Transition analyses, models, technology prototypes, and knowledge products related to prior year testing & evaluation activities to FSS	FY 2018 Q1	FY 2018 Q2
Conduct testing & evaluation of technologies that address Application Identify and Data Protection for the FSS	FY 2018 Q1	FY 2018 Q4
Conduct market survey to determine evolving high priority threat areas for the FSS to inform additional technical areas to address.	FY 2018 Q2	FY 2018 Q2
Partner with the Silicon Valley Innovation Program (SVIP) to solicit the start up community to address high priority threat areas identified in market survey.	FY 2018 Q2	FY 2018 Q4

Type of Research

Developmental

Technical Readiness Level

The program will have varying TRL entry and exit points depending on the solution pursued for a specific Tech Foraging area. For less matured areas, the program plans to begin at TRL 3 and end at TRL 6. For more matured areas, the program plans to begin at TRL 6 and end at TRL 7

Transition Plans

All analyses, models, technology prototypes, and knowledge products will be transitioned to FSS institutions, commercialized or made available through open source during the course of the Apex project. Products may include, but are not limited to:

- Sensor capabilities to verify the presence or absence of attacker modifications to network infrastructure.
- Real Time Intrusion prevention capability using non signature based technologies.
- Behavior modeling tools to detect potential violations of system security policy by an authorized user, identify anomalous behavior within a network in real time using probabilistic modeling and traffic analysis, and detect patterns of impending pending data exfiltration.
- Sensor correlation tools and tools to drastically reduce the amount of data that requires analysis.
- Tools to measure logical and physical internet topologies and measure the effectiveness of routing in order to determine problem.

Apex Real-Time BioThreat Awareness

- **Problem:** The timely detection, coordination and information sharing of a potential biological hazard in a public space is a critical challenge within Federal, State, local, and tribal governments, including the Public Health and First Responder communities.
- **Solution:** This Apex develops and integrates biosurveillance technology advancements in data fusion concepts, sensor detection capabilities, and data visualization to demonstrate the art-of-the-capable with coordination between the Federal agencies, State and Local Public Health First Responder communities. It explores a variety of methods and systems to rapidly collect and exploit information useful for identifying outbreaks or unusual events using current and future computing architectures. S&T works with the Office of Health Affairs (OHA) BioWatch Program and OHA National Biosurveillance Integration Center (NBIC) in partnership with Department of Defense (DoD) when directing requirements development utilizing the Homeland Integrated Biosurveillance and Response Information Demonstration (HIBRID) project to update potential operational architectures. Additional coordination and collaboration with other Federal agencies is being forged in

various specialized areas. All tasks and projects within the bio-threat Apex are coordinated and aligned with both the Biowatch and NBIC programs. An Integrated Product Team (IPT) has been working for approximately one year to ensure project/program alignments.

- **Impact:** Optimized collection and integration of relevant environmental, animal, and public health data will promote prompt awareness of a bio-attack or disease outbreak, resulting in reduced casualties, and faster implementation of early mitigation steps.

Overall Project Funding

	2014	2015	2016	2017	2018
Project Funding	-	-	7,000	6,000	0
Obligations	-	-	1,695	4,784	-

FY 2016 Key Milestone Events (Prior Year)

- Identify and validate Federal, State, local, and tribal requirements via IPT and workshop activities.
- Demonstrate rapid data feed integration from four disparate environmental monitoring and emergency call sources, analysis, and reporting using the National Biosurveillance Integration System (NBIS). Integrate additional data sources and demonstrate information sharing platforms within local jurisdictions.

FY 2017 Key Milestone Events (Year of Execution)

- Issue a Biosurveillance Prize for innovation in cross-jurisdictional information sharing.
- Perform baseline biosurveillance workshops and table-tops in local jurisdictions to capture current situational awareness capabilities of state and local governments.
- Demonstrate tools for capture and analysis of biosurveillance related data sources at the State and local level.

FY 2018 Key Milestone Events (Budget Year)

This project will be terminated in FY 2018 to focus on higher priority R&D projects that align with Administration and DHS priorities.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Reports on an independent Capabilities Based Assessment for the NBIC	FY 2017 Q1	FY 2017 Q3
Conduct component interviews to develop detailed requirements and concept of operations for biodetection and biosurveillance	FY 2017 Q1	FY 2018 Q1
Apply systems engineering processes to develop national environmental biodetection architecture for DHS	FY 2017 Q2	FY 2018 Q3
Develop acquisition strategies to fulfill component and national biodetection and biosurveillance gaps and needs	FY 2017 Q2	FY 2018 Q3
Market survey and systems analysis of near-term biological detection technologies, to include next generation sequencing and mass spectrometry	FY 2016 Q4	FY 2017 Q4
Feasibility study of the utility of the Suite for Automated Global Electronic bioSurveillance (SAGES) during an emergency or disaster for DHS components and State and Local jurisdictions and recommendations for enhanced health surveillance	FY 2017 Q2	FY 2018 Q1
Demonstrate anomalous event alerting algorithms for use in disease outbreak investigation	FY 2017 Q1	FY 2018 Q1

Type of Research

Applied

Technical Readiness Level

The program plans to begin at TRL 6 and end at TRL 7.

Transition Plans

This project will be eliminated in FY 2018 to allow S&T to focus on Administration and DHS priorities. Useful knowledge products will be available to the Biosurveillance program and New York City biosurveillance/biodetection test-bed project.

Apex Next Generation First Responder Program

- Problem: First responders rely primarily on disparate voice radio communications, limited network connectivity for data and video, and personal protective equipment (PPE) with insufficient threat protection—each of which offers little or no access to available or advanced sensor technologies.
- Solution: The Next Generation First Responder (NGFR) program is developing a scalable and modular system that includes an enhanced duty uniform, personal protective equipment, wearable computing and sensing technology, and robust voice and data communication networks. NGFR will harness the best existing and emerging technologies and integrate them in a well-defined and standards-based open architecture.
- Impact: NGFR's cutting-edge technologies accelerate decision-making and improve response to better safeguard lives and property before, during, and after incidents.

Sub Project

- Communications Hub: Routes incoming and outgoing information to the chosen destination using the best available communication medium.
- Physiological Monitoring: Provides real-time feedback on the first responder and provides necessary insight to on-scene commanders and incident managers enabling them to make the best decisions possible in time critical situations.
- Assistant for Understanding Data through Reasoning, Extraction and synthesis (AUDREY): Performs as a human-like reasoning program for automated big data analytics.
- First Responder Electronic Jamming Exercise: Works towards identifying and combatting electronic jamming threats facing the first responder community.
- Project 25 Compliance Assessment Program (P25 CAP): Ensures that P25 communications equipment declared by the supplier is P25 compliant, and tested against the standards with publicly published results.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	6,628	4,542	4,546	4,546
Obligations	-	6,421	2,734	100	

FY 2016 Key Milestone Events (Prior Year)

- Conduct a First Responder Operational Exercise, evaluating the impact of global navigation satellite system (GNSS) challenged and electronic threat environments on first responder communications systems.
- Develop working draft of the NGFR Interface Control Document to raise industry awareness of the standards, data formats and interfaces NGFR devices are using.

FY 2017 Key Milestone Events (Year of Execution)

- Demonstrate NGFR technology, incorporating additional technologies and functionality of including the Wearable Communications Hub, advanced environmental and physiological monitoring, and enhanced data analytics.
- Conduct the 2017 First Responder Electronic Jamming Exercise to evaluate how technologies and tactics reduce the impact of electronic threats to first responder communications systems.

FY 2018 Key Milestone Events (Budget Year)

- Demonstrate NGFR Integration Spiral 3, incorporating additional technologies and functionality from the Spiral 2 and PlugFest events, including environmental and physiological monitoring augmented intelligence-enabled data synthesis, and personal protective equipment.
- Transition, commercialize, or make available through open source platforms at least three technologies (e.g., Analyses, models, technology prototypes and/or knowledge prototypes).

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Demonstrate the integration and interoperability of NGFR technology (e.g. Internet of Things Communications Hub and PPE) in Spiral 1.	FY 2016 Q3	FY 2016 Q3
Develop prototypes of the Wearable Communications Hub and plan integration into NGFR system architecture.	FY 2016 Q3	FY 2016 Q4
Conduct a proof of concept demo of the AUDREY system within the simulated test environment.	FY 2016 Q4	FY 2016 Q4
Demonstrate the Physiological Monitoring integrated capability in a live field test.	FY 2016 Q4	FY 2016 Q4
FY 2017		
Conduct DHS Component Communications Experiment in Boston, MA.	FY 2017 Q1	FY 2017 Q1
Complete technology foraging for 3D indoor mapping and visualization.	FY 2017 Q2	FY 2017 Q3
Update the communication hub software to transmit voice data over the network.	FY 2017 Q2	FY 2017 Q4
Demonstrate NGFR technology integration Spiral 2, incorporating additional technologies and functionality (communications hub, physiological monitoring, enhanced duty uniform, etc.) with first responders.	FY 2017 Q3	FY 2017 Q3
Conduct a PlugFest with industry vendors relevant to at least one portion of the NGFR system architecture (e.g., wearables).	FY 2017 Q4	FY 2017 Q4
FY 2018		
Demonstrate NGFR technology integration Spiral 3, incorporating additional technologies and functionality of including the Wearable Communications Hub, advanced environmental and physiological monitoring, and enhanced data analytics.	FY 2018 Q2	FY 2018 Q2
Publish recommendations to better prepare public safety agencies to	FY 2018 Q3	FY 2018 Q3

Research & Development Description	Plan Start Date	Planned Completion
counter electronic threats, using the analysis from the 2017 First Responder Electronic Jamming Exercise.		
Demonstrate NGFR technology integration Spiral 3, incorporating additional technologies and functionality of including the Wearable Communications Hub, advanced environmental and physiological monitoring, and enhanced data analytics.	FY 2018 Q4	FY 2018 Q4
Transition, commercialize, or make available through open source platforms at least three analyses, models, technology prototypes and knowledge products.	FY 2018 Q2	FY 2018 Q4

Type of Research

Developmental

Technical Readiness Level

The program begins at TRL2 and ends at TRL 6.

Transition Plans

- FRG has initiated a portfolio approach to integration of capabilities for the NGFR Apex program. All proposed initiatives must be assessed against an architectural system framework to determine functional and operational requirements that are then integrated into the NGFR Apex spiral demonstrations. All initiatives must demonstrate an interoperable approach, allowing a services-based approach using open standards that allows industry to propose enhanced products to integrate with the NGFR capabilities.
- All analyses, models, technology prototypes, and knowledge products will be transitioned to industry, commercialized, or made available through open source platforms during the course of the NGFR Apex program.
- NGFR technologies will be considered for inclusion on the DHS FEMA Approved Equipment List (AEL) for DHS Grant funding available to State and local governments.
- NGFR's commitment to a modular design, interoperability, open source standards, and continual engagement with industry will facilitate transition. Technologies developed under the NGFR Apex program are required to interface or integrate using open standards, which will allow responder organizations to incrementally acquire new NGFR capabilities while extending the life of legacy systems.
- In addition, NGFR technologies can "plug-and-play" with commercial technologies that are not typically considered part of the

first responder market (i.e., health sensors for athletes), increasing dual use for secondary markets and allowing first responder organizations to custom-build the suite of NGFR-compatible technologies that mission requirements and resource constraints.

- The NGFR Apex program will collaborate with industry and identify key partners to test interoperability of commercially available sensors and communications equipment with the NGFR system in concert with NGFR Apex spiral demonstrations.

Apex Flood

- Problem: Flooding of all kind are a leading cause of fatalities and economic losses in the United States from natural disasters. Communities need new and emerging technologies that are designed to increase communities' resilience to flood disasters and provide flood predictive analytic tools to FEMA, state and local governments in effort to reduce future flood fatalities and economic damages.
- Solution: This Apex program will culminate in development of the National Flood Decision Support Toolbox (NFDST), which will enable the translation of science into actions that reduce flood risk exposure and enhance community resiliency. The Toolbox will consist of modules that will support flood response, recovery, and resiliency decision making. When fully developed, the Toolbox will be transitioned to Federal Emergency Management Agency (FEMA) to assist Federal, State, local, tribal, territorial and other stakeholder group in making planning, disaster response and recovery, and investment decisions related to floods.
- Impact: With support from S&T, FEMA will be able to: 1) leverage existing data sources to create multi-dimensional representations of community functions using an integrated system-of-systems approach; 2) enhance whole community collaboration around disaster risk reduction; 3) identify indicators of community resilience and opportunities to introduce advanced technology solutions; 4) empower communities with decision support capabilities to enable both pre-event scenario-based risk planning and adaptive recovery in the post-event environment; and 5) enable faster decision-making.

Sub Projects

- Reduce Fatalities: Develop and test an integrated flood warning system incorporating inexpensive, deployable flood sensors; information integration and modeling software; and an automated smartphone-based, geo-targeted alert system.
- Reduce Uninsured Losses: Assess technologies and practicality of developing a national inventory of structures database for flood-prone areas, especially identified FEMA Special Flood Hazard Areas; including type of structure, elevation and other relevant data.
- Improve Investment Decisions: Support more cost-effective investment decisions improving both residential property, business continuity and public/private infrastructure resilience by improving the decision-making tools available, including integrated

analytics such as Kentucky's Community Hazard Assessment and Mitigation Planning System (CHAMPS) tool, and the use of low cost historical satellite imagery to identify flood prone areas outside of those mapped to date by FEMA.

- Enhance Community Resilience: Promote faster and more complete recovery from flood disasters by identifying quantitative indicators of resilience that have practical use in guiding and mitigating investment decisions and by developing SOPs, planning methodologies and quantitative methods to integrate resilience analysis into local and state flood planning, response and mitigation activities.
- Improve Flood Data Quality and Access: Provide decision-makers with access to the data they need, when they need it, through developing a roadmap of the best available flood decision data for all data categories, developing new types of flood sensors that are cheap enough to be widely distributed and easily moved, developing technologies to create, maintain and share elevation and structure footprint data, and developing new technical methods for filling decision data gaps.
- Improve Predictive Models and Analytical Services: Provide decision-makers with access to better models for all phases of flood management. Review all available flood models and forecasting tools with multiple uses and users in mind; create flood alert models, tuned to local terrain, that can provide longer lead-times and more accurate geo-targeting; provide better coverage of inland and flash flooding, accounting for increased impervious surfaces and the availability of fine-grained elevation data from new technology and expand the coverage of models to better forecast the aftermath of floods.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	2,295	5,000	5,000	5,000
Obligations	-	2,114	4,167	0	-

FY 2016 Key Milestone Events (Prior Year)

- Demonstrate the technical capability to issue geo-target flood alerts.
- Initiate development of a Tsunami Module for the FEMA Hazards United States (HAZUS) program.

FY 2017 Key Milestone Events (Year of Execution)

- Complete Tsunami Module for FEMA HAZUS program.
- Develop technology and plan to scale geo-targeted flood alerts nationally.

FY 2018 Key Milestone Events (Budget Year)

- Determination on the feasibility of near real-time monitoring of dam/levee integrity by transmitting geo-targeted alerts from deployed dam/levee integrity/breach sensors. Includes creating and testing prototypes of the necessary low-cost, deployable,

networked dam/levee sensors.

- Deploy the first phase of a structure-level data utility service that provides insurers, flood plain managers and consumers with Digital Elevation Models (DEM) of structures whose geospatial footprints have been digitized through aerial imagery.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Complete development and initial testing of flood sensor prototypes.	FY 2016 Q3	FY 2016 Q3
Demonstrate the technical capability to issue geo-targeted flood alerts.	FY 2016 Q1	FY 2016 Q3
Initiate development of the Tsunami Module for Hazus.	FY 2016 Q1	FY 2016 Q1
Complete initial pilots to test the accuracy of identification of flood-prone areas through analysis of historical LANDSAT imagery.	FY 2016 Q4	FY 2016 Q4
FY 2017		
Put SUMMIT into production at FEMA as the first generation release of the NFDST.	FY 2017 Q3	FY 2017 Q3
Complete development of technologies required for the National Structures Inventory.	FY 2017 Q4	FY 2017 Q4
Complete the Tsunami Module for the FEMA HAZUS program.	FY 2017 Q4	FY 2017 Q4
Develop technology and plan to scale geo-targeted flood alerts nationally.	FY 2017 Q4	FY 2017 Q4
FY 2018		
Make a determination on the feasibility of near real-time monitoring of dam/levee integrity.	FY 2018 Q4	FY 2018 Q4
Deploy the first phase of a structure-level data utility service that provides insurers, flood plain managers and consumers with DEM.	FY 2017 Q3	FY 2018 Q4

Type of Research

Applied

Technical Readiness Level

This program begins at TRL2 and ends at TRL6.

Transition Plans

- Development of charter and IPT to maintain close coordination with FEMA and to ensure the program's development aligns with operational requirements.
- Development of transition agreement to transfer decision support tool to FEMA for deployment to Federal, State, local users and other stakeholders, including non-governmental agencies.

Apex Cyber.gov

- Problem: Government networks and those that run our critical infrastructure are under regular reconnaissance and attack. Government networks have recently demonstrated significant weaknesses that have been exploited, resulting in loss of personally identifiable information, intellectual property, and sensitive security information.
- Solution: S&T is designing a robust, innovative and holistic .Gov cyber security architecture that mitigates modern threats by leveraging best practices and implementable solutions with minimal impact to workforce efficiency. S&T will also develop a robust data correlation and data analytics capability in partnership with the National Protection and Programs Directorate (NPPD) and other Federal Agencies.
- Impact: This effort will significantly improve the cyber security posture of the entire .Gov network and increase the ability of government networks to be aware of when they are being probed and attacked, to model behaviors to anticipate insider threats, and to leverage analytics to correlate incidents, events and network traffic.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	10,000	10,000	8,000
Obligations	-	-	8,789	0	-

FY 2016 Key Milestone Events (Prior Year)

- Initiate program plan approval.
- Start evaluation of the utility of classified signatures.
- Initiate measurement infrastructure analysis.

- Initiate architecture analysis leveraging existing data types and protocols.
- Active red teaming of all capability development.

FY 2017 Key Milestone Events (Year of Execution)

- Evaluate the utility of classified signatures.
- Draft of the cyber security architecture including presentation and detailed schemas
- Draft of the Baseline requirements per components of the cyber architecture.

FY 2018 Key Milestone Events (Budget Year)

- Conduct demonstration of measurement infrastructure with at least one department or agency.
- Testbeds and pilot with at least one department or agency.
- Analysis and inclusion of new technologies to enhance the cyber security architecture based upon pilots.
- Red teaming results and implementation tests.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Executed Contract Awards	FY 2016 Q1	FY 2016 Q3
Draft Program Plan	FY 2016 Q2	FY 2016 Q3
FY 2017		
Implementation and integration of Software Defined Perimeter in testbed	FY 2017 Q2	FY 2017 Q3
Initial Architecture Report	FY 2017 Q1	FY 2017 Q3
FY 2018		
Development of in-house components as needed for the architecture	FY 2017 Q4	FY 2018 Q1
Initial pilot of available capabilities for the architecture	FY 2018 Q1	FY 2018 Q2

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

Once complete, technology developed under this effort will be deployed to all interested government agencies. The program includes significant ongoing outreach and discussion with government agencies to ensure transition.

Apex Engines: FY 2017 Annualized Continuing Resolution: \$18.000M. FY 2018 Request: \$18.000M. The Apex Technology Engines have been designed to provide a concentration of expertise, people, and knowledge capabilities that support multiple Apex programs and components. The Engines work with Apex programs to anticipate program needs and deliver quality support and services for the Apex programs. The Engines efficiently source and deliver solutions. The Engines' collective experience and

awareness of emerging technology trends has resulted in a robust knowledge base and network that continually serves the dynamic needs of S&T, mission critical operators, and the DHS enterprise.

Identity and Access Management Engine (IDAM-E)

- **Problem:** Apex projects have identified requirements associated with identity and access management capabilities, including controlled access of secure data and system user identification tools for approved users who have an operational “need to know.” Currently, DHS does not have a set of baseline IDAM capabilities for program managers to incorporate into their R&D projects.
- **Solution:** S&T’s IDAM Engine has the ability and expertise to apply identity and access management solutions to the various Apex projects focus areas. The Engine will employ existing capabilities, including an Identity Management Test bed, and develop new technologies for program managers to leverage while executing their Apex projects.
- **Impact:** The IDAM Engine creates efficiencies for Apex programs that DHS operators and agents utilize by offering and implementing solutions addressing logical and physical access decisions across multiple domains. This work provides the operators and agents who use DHS systems with a digital identity, credentials, authentication, and authorization to allow the right people the right data at the right time and in a secure manner.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	-	2,000	2,100	2,100	1,313
Obligations	-	1,579	1,927	0	-

FY 2018 Planned Key Milestone Events (Budget Year)

- Deliver a tool, technology or knowledge product that increases the security of the current CBP preclearance operations while improving the passenger experience.
- Deliver a tool, technology or knowledge product that improves the anti-spoofing capabilities of wearables and in-ground and above ground sensor platforms that support the mission requirements of emergency responders as well as border situational awareness and defense.

FY 2018 Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Enhancing Passenger PreClearance Project	FY 2017 Q3	FY 2019 Q3
Identity, Anti-Spoofing and Information Integrity of Wearables and Sensor Platforms Project	FY 2017 Q3	FY 2019 Q3

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- This project consists of a mixture of open source releases of technology and knowledge products, commercial capability development as well as direct transitions to Apex Programs and DHS Components.

Data Analytics Engine (DA-E)

- **Problem:** Leveraging data sources to compute threats, impacts, risks, decision support, and situational awareness continues to become increasingly challenging due to the exponential growth of data, particularly data associated with the Internet-of-Things. Further, data analytics technologies, including computational, methodological and systems components, rapidly evolve on six month innovation cycles making it difficult to track solution options.
- **Solution:** Keeping pace with growing data sets and rapidly evolving solutions requires an agile core technical service that can quickly diagnose privacy, security, computation and analytics for the missions of S&T, the Department, and the extended Homeland Security Enterprise. The DA-E assists in problem definition and solutions development for Department programs using relevant data sets, analytic methodology, technologies and systems in collaboration with subject matter experts from government, industry and academia. Further, DA-E works across disciplines to illuminate next generation problem sets and technologies (including social media and live streaming) to inform program planning, avoid technical obsolescence and prevent mission surprise.
- **Impact:** DA-E helps analysts, operators, and agents across DHS increase mission effectiveness by better leveraging data for decision-making. DA-E provides S&T and Department programs with coordinated information, subject matter expertise, mission

studies, analysis of alternatives, experiments, prototypes, business methodologies and transition planning to improve program efficiency, share best practices, and improve security and privacy protection across DHS analytics system investments.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	-	4,461	4,250	5,300	5,211
Obligations	-	4,157	3,911	3,656	

FY 2018 Planned Key Milestone Events (Budget Year)

- Deliver reports on image, video, and speech analytic experiments to improve open source and social media analytics for DHS missions.
- Deliver a framework for approaching Real Time Analytics for Multi-Latency Multi-Party Metro Scale Networks (RAMMMNets) problem sets to improve the focus and impact of research efforts on homeland security mission priorities.
- Deliver an analysis of advanced analytic applications such as graph processing capabilities to Immigrations and Customs Enforcement (ICE) that demonstrate significant mission impact for national security investigations and that is also relevant to other DHS mission areas including nuclear threat detection and critical infrastructure protection.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Deliver report on image, video, and speech analytic experiments to improve open source and social media analytics for DHS missions.	FY 2018 Q1	FY 2018 Q2
Deliver a framework for approaching RAMMMNets problem sets for research.	FY 2018 Q1	FY 2018 Q2
Deliver an analysis of advanced analytic applications such as graph processing capabilities to ICE that demonstrate significant mission impact for national security investigations and that is also relevant to other DHS mission areas including nuclear threat detection and critical infrastructure protection.	FY 2018 Q3	FY2018 Q4

Type of Research

DA-E projects include elements of Basic, Applied, and Developmental research.

Technical Readiness Level

DA-E projects range from Technology Readiness Level 2 to 7.

Transition Plans

DA-E technology development efforts transition once they have been proven in the Component's operational environment. Social Media tools, the current major investment area, undergo an operational test pilot with end users. The pilots are supported by the respective DHS Component leadership who hosts S&T staff onsite to conduct the testing. The DHS Social Media Task Force, consisting of DHS-wide organizations, including the Office of the Chief Financial Officer, Office of Privacy, and Office of Civil Rights and Civil Liberties, oversees the pilots and addresses oversight issues before pilots begin to facilitate future transition.

Model & Simulation Engine (MS-E)

- **Problem:** Currently there is no centralized Modeling and Simulation (M&S) repository or single M&S coordination manager in DHS S&T. M&S is an analytical capability that is used across multiple S&T projects and programs, which have similar elements and requirements, and they are often discarded after the completion of the project -- there is an opportunity to coordinate M&S across these programs and to leverage capabilities and best practices from interagency partners such as the Department of Defense (DoD) Defense Modeling and Simulation Coordination Office (DMSCO).
- **Solution:** MS-E will provide a centralized repository and single-manager M&S Coordination function for mission-based models as well as modeling and simulation tools that will be available for use to S&T program managers. This will allow M&S analytical capabilities and best practices to be coordinated across programs.
- **Impact:** The M&S Engine will increase the efficiency of DHS component operators, eliminate duplication and save resources and money. The MS-E will enhance DHS S&T's collaboration with DoD and other agency partners in the M&S domain, and leverage best practices to ensure a coordinated M&S approach for S&T's Apex programs and other component programs. This coordinated approach assists mission critical Apex programs by providing M&S capabilities across the government to ensure the safety of our agents and citizens.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	-	820	1,696	1,500	1,876
Obligations	-	1,005	833	190	-

FY 2018 Planned Key Milestone Events (Budget Year)

- Coordinate scenario development utilizing immersive simulation technologies through subject matter expertise, knowledge products, and best practices.
- Develop a DHS S&T Modeling and Simulation Coordination Strategy in collaboration with the DoD DMSCO; extending DMSCO's existing M&S Catalog and Enterprise Metacard Builder Resource (EMBR) to include DHS S&T M&S capabilities contributing to information sharing and delivering knowledge products.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Initiate the coordination of Next Generation First Responder (NGFR) scenario development utilizing immersive simulation technologies supporting NGFR training development through subject matter expertise, knowledge products, and best practices.	FY 2017 Q1	FY 2017 Q2
Develop a DHS S&T Modeling and Simulation Coordination Strategy in collaboration with the DoD DMSCO; extending DMSCO's existing M&S Catalog and Enterprise Metacard Builder Resource (EMBR) to include DHS S&T M&S capabilities contributing to information sharing and delivering knowledge products.	FY 2017 Q1	FY 2017 Q3
Establish an initial Counter Unmanned Aerial System (CUAS) Modeling and Simulation environment for DHS S&T and Component activities; contributes directly to DHS S&T Program Executive Office Unmanned Aerial Systems (PEO UAS) support to DHS Components and wider CUAS Community through delivering M&S subject matter expertise and tailored solutions.	FY 2017 Q1	FY 2017 Q4
FY 2018		
Establish Counter Small Unmanned Aerial Systems Advisory and Review Toolkit (C-SMART) 2.0 capabilities for the Program Executive Office for Unmanned Aerial Systems (PEO UAS). C-SMART 2.0 provides significant enhancements to 1.0 features, such as incorporating radio frequency (RF) propagation modeling to increase fidelity of UAS and C-UAS simulations.	FY 2017 Q4	FY 2018Q4
Expand NGFR immersive simulation technologies to include incident command (IC) training for fire, police, and unified command activities. This capability will allow joint tactics, techniques, and procedure (TTP) development, and enhancement of IC training delivered to HSE stakeholders.	FY 2017 Q2	FY 2018Q3

Research & Development Description	Plan Start Date	Planned Completion
Finalize co-development of DHS M&S Catalog in coordination with DMSCO using EMBR tools, and populate catalog with comprehensive list of DHS S&T M&S capabilities.	FY 2017 Q3	FY 2018Q3

Type of Research

Developmental and Applied

Technical Readiness Level

TRL 5 & 6

Transition Plans

FY 2017 –

- Initiate the coordination NGFR scenario development utilizing immersive simulation technologies supporting NGFR training development through subject matter expertise, knowledge products, and best practices. Transition Customer include: NGFR Apex, FLETC engaged in discussions, Orange County (FL) Fire and Rescue and Cambridge (MA) Fire Department.
- Develop a DHS S&T Modeling and Simulation Coordination Strategy in collaboration with the DoD Defense Modeling and Simulation Coordination Office (DMSCO); extending DMSCO's existing M&S Catalog and Enterprise Metacard Builder Resource (EMBR) to include DHS S&T M&S capabilities contributing to information sharing and delivering knowledge products. Transition Customers include: DHS S&T's Chemical and Biological Defense Division.
- Establish an initial Counter Unmanned Aerial System (CUAS) Modeling and Simulation environment for DHS S&T and Component activities; contributes directly to DHS S&T Program Executive Office Unmanned Aerial Systems (PEO UAS) support to DHS Components and wider CUAS Community through delivering M&S subject matter expertise and tailored solutions. Transition Customers include: PEO UAS and USSS

FY 2018 –

- Establish Counter Small Unmanned Aerial Systems Advisory and Review Toolkit (C-SMART) 2.0 capabilities for the Program Executive Office for Unmanned Aerial Systems (PEO UAS). C-SMART 2.0 provides significant enhancements to 1.0 features, such as incorporating radio frequency (RF) propagation modeling to increase fidelity of UAS and C-UAS simulations. Transition Customers include: PEO UAS, USSS, and CBP
- Expand NGFR immersive simulation technologies to include incident command (IC) training for fire, police, and unified command activities. This capability will allow joint tactics, techniques, and procedure (TTP) development, and enhancement

of IC training delivered to HSE stakeholders. Transition Customers include: NGFR Apex, FLETC, Orange County (FL) Fire and Rescue and Cambridge (MA) Fire Department.

- Finalize co-development of DHS M&S Catalog in coordination with DMSCO using EMBR tools, and populate catalog with comprehensive list of DHS S&T M&S capabilities. Transition Customers include: DHS S&T CBD, Apex Programs, and other M&S stakeholders

Behavioral, Economic, and Social Science Engine (BESS-E)

- **Problem:** Current Apex Projects have project components related to human subject research, public perceptions of new technologies, metrics development, organizational adoption of new technologies, and program evaluation and impact studies. However, there is not currently a centralized location for program managers to receive help on these social science issues.
- **Solution:** S&T developed a BESS-E which has the ability and expertise to apply social science techniques to the myriad programs that the Apex Projects focus on. The Engine has created a backbench capability for program managers to reach out to subject matter expertise in the social sciences. Additionally, the Engine assists Apex Project managers with specific tasks and deliverables of importance to the program which require social science techniques.
- **Impact:** BESS-E analyzes the social and behavioral implications of new technologies, programs, and policies to support their research, implementation, and diffusion across Apex programs, Federal, State, Local and Tribal agencies. Centralizing this capability in an Engine allows the BESS-E to impact multiple Apex programs and provide centralized support to DHS components, Federal, State, Local and Tribal agencies.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	-	1,101	1,479	1,500	1,500
Obligations	-	989	582	0	-

FY 2018 Planned Key Milestone Events (Budget Year)

- Provide a knowledge product to FEMA with recommendations that can be used to decrease uninsured flood losses.
- Improve the transition of screening technologies to TSA by improving end-user perception and satisfaction.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Metrics Development	FY 2016 Q1	FY 2016 Q3
Requirements Gathering	FY 2016 Q1	FY 2016 Q4
FY 2017		
Evaluate Plugfest at Maritime Security Conference	FY 2017 Q1	FY 2017 Q2
Conduct interviews and focus groups with CBP agents to understand their intelligence needs	FY 2017 Q1	FY 2017 Q3
Develop a survey for homeowners in Virginia to better understand why they do or do not purchase flood insurance	FY 2017 Q2	FY 2017 Q3
FY 2018		
Conduct passenger intercept surveys at innovation task force lanes in airports	FY 2018 Q1	FY 2018 Q3
Develop a research plan to assess the effectiveness of emergency communications in making a listener take the recommended action	FY 2018 Q1	FY 2018 Q1

Type of Research

Applied.

Technical Readiness Level

N/A – BESS-E relies upon primarily SME and knowledge product support.

Transition Plans

BESS-E serves as a research support function to the Apex Programs at DHS S&T. Our research is used to aid in the transition plans of those Apex Programs.

Communications & Networking (CN-E)

- Problem:** During an emergency, public safety personnel frequently are unable to communicate with one another. Factors such as the non-interoperable radio equipment, insufficient radio bandwidth allocation, and outdated equipment all contribute to this problem. The Apex Communications and Network Engine (Apex CN-E) seeks to promote R&D in wireless communications solutions to deliver an interoperable and efficient communication ecosystem to vastly improve the first responder's communications capabilities.

- **Solution:** The CN-E Apex Engine is focusing its efforts to provide subject matter expertise, knowledge product and best practices in the following key areas: 1) promote standards-based communications solutions and leverage commercial available technologies to improve communication interoperability; 2) invest in systems that are designed to improve access to communication technologies in austere and degraded environments, such as noisy surroundings, as well as indoor and remote areas having limited or no wireless signals, 3) use of connected sensors (e.g., video, physiological and environmental) and wearable technologies to enable data analytics to further improve situational awareness during a mission.
- **Impact:** Apex CN-E will benefit DHS Apex Programs as they achieve greater level of communications interoperability between federal, state, local and tribal agencies. This will dramatically impact the Apex Programs' ability to communicate mission-critical information as they carry out their daily tasks of saving lives and protecting properties.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	-	3,150	2,274	2,300	2,752
Obligations	-	2,900	2,600	0	-

FY 2018 Planned Key Milestone Events (Budget Year)

- Provision a portable band-14 LTE network system, allowing first responders to access the dedicated public safety spectrum, to participate in a public safety field exercise or an actual Component operational event and document the outcome as well as the technology's impact to the way information sharing is carried out by the end users.
- Document the technology demonstration outcome from the Phase 1 of the Speech Analytic project at a proof-of-concept event.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Milestone 1: The Next Generation First Responder Spiral 1 technology integration and demonstration event	FY 2015 Q4	FY 2016 Q2
Milestone 2: Technology demonstration for the Mobile Ad-hoc Network (MANET) communications system for the New York State Police and document the outcome.	FY 2016 Q2	FY 2016 Q4
FY 2017		
Milestone 3: Document the technology demonstration outcome from Next Generation First Responder Apex Program Spiral 2	FY 2017 Q1	FY 2017 Q4
Milestone 4: Technology demonstration for the Mobile Ad-hoc Network (MANET) communications system for the New York Police Department (NYPD) and document the outcome.	FY 2017 Q1	FY 2017 Q3
FY 2018		
Milestone 5: Provision a standalone band-14 LTE system to participate in a public safety field exercise or an actual Component operational event and document the outcome	FY 2018 Q2	FY 2018 Q2
Milestone 6: Document the technology demonstration outcome from the Phase 1 of the Speech Analytic project at a proof-of-concept event.	FY 2018 Q1	FY 2018 Q3

Type of Research

Basic, Applied and Developmental

Technical Readiness Level

Technology Readiness Level 3 to 6

Transition Plans

- Personal Area Network. Transition Plan: Communications Hub – FY 2018 Q2 to NGFR Apex.
- Incidental Area Network. Transition Plan: Deployable B14 LTE – FY 2017/18 to NGFR Apex. MANET – FY 2017 Q3 to BSA Apex.
- Broadband Communications Networks and Advanced Applications and Services. Transition Plan: Datacasting Network – FY 2016 plus several follow-on upgrades deployed with the City of Houston during FY 2017.
- Public Safety User Interface. Transition Plan: Speech Analytic Phase 1 – FY 2018 Q3 to NGFR Apex. Speech Analytic Phase 2 – FY 2019 Q3 to NGFR Apex.

Situational Awareness & Decision Support (SANDS-E)

- **Problem:** The loss of valuable data and situational understanding due to the incompatibility of communications hardware and software, and the complexities these incompatibilities impose on our communications architecture is a major problem for DHS and its components. Mission essential information and data that must be processed, integrated, recorded, and shared is growing at an exponential rate, while the proliferation of communication devices and protocols that transmit, encode and display this information and data is growing at a similar rate, all leading to debilitating incompatibility and interoperability.
- **Solution:** The SANDS Engine provides Apex projects with the most efficient and effective assured, secure access to databases (or knowledge bases), shared situational awareness, and integrated networking solutions ensuring interoperable communication across all network platforms and mediums (voice, video and data).
- **Impact:** The SANDS Engine ensures that Apex projects and DHS components can exchange critical information and data across all mediums and on any platform, and that the most critical and relevant information will be rapidly accessible to the right decision makers to achieve improved situational awareness in operational environments and meet Apex defined requirements.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	-	3,468	2,751	2,300	1,939
Obligations	-	3,054	1,823	913	-

FY 2018 Planned Key Milestone Events (Budget Year)

- Develop prototype Flood Decision Support Tool.
- Assess IoT sensors, standards, and physical prototypes for interoperable situational awareness.
- Assess and test First Responder technology for protected and connected situational awareness tools (e.g. Wi-Fi finder, indoor mapping, and cyber security for IoT sensors).

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Architecture assessments, design documents and recommendations for Flood Apex, Border Situational Awareness Apex, and Real-Time BioThreat Apex	FY 2016 Q1	FY 2016 Q2/Q3
Interagency Working Group for Public Safety and Communications Identity and Credential Access Management (PSC-ICAM) use case definition, prioritize goals and associated task definition and preliminary assessments.	FY 2016 Q1	FY 2016 Q4
Request For Information (RFI) Prototype	FY 2016 Q2	FY 2017 Q1
FY 2017		
Develop draft Public Safety & Communications ICAM Procurement Guidance for First Responder community (e.g. SAFECOM and FirstNet) in support of the NGFR Apex.	FY 2017 Q2	FY 2017 Q4
Deploy Request For Information (RFI) Tool to operational environment within DHS Data Center for CBP field agents	FY 2017 Q3	FY 2017 Q4
Develop Smart City Interoperable Reference Architecture (SCIRA) with commercial industry partners and standards development organization leadership.	FY 2017 Q3	FY 2017 Q4
Assess Internet of Things (IoT) Intelligent Building Infrastructure sensors and building codes for 3-D imaging, imagery and motion detection.	FY 2017 Q3	FY 2018 Q1
Assess Unmanned Aerial Systems (UAS) as a delivery platform for IoT sensors for mass transit tunnel search & reconnaissance.	FY 2017 Q3	FY 2018 Q1
FY 2018		
Build out, test and recommend Trust Framework capability solution(s) for Public Safety & Communications stakeholders (SAFECOM and FirstNet) in support of NGFR Apex	FY 2018 Q1	FY 2018 Q4
Expand RFI Tool functionality for mobile, secure and disconnected communications for CBP field agents.	FY 2018 Q1	FY 2018 Q4
Test and evaluate Smart City Interoperable Reference Architecture (SCIRA) with selected stakeholder community for practical implementation and cyber security protocols	FY 2018 Q1	FY 2018 Q3
Prototype IoT Intelligent Building Infrastructure sensors with stakeholder community	FY 2018 Q1	FY 2018 Q4
Prototype UAS platform and sensor payload for mass transit tunnel search and reconnaissance.	FY 2018 Q1	FY 2018 Q4

Type of Research

Applied and Developmental.

Technical Readiness Level

Readiness Level 2 to 7.

Transition Plans

FY 2018-

- Build out, test and recommend Trust Framework capability solution(s) for Public Safety & Communications stakeholders (SAFECON and FirstNet) in support of NGFR Apex. Transition: SAFECON / FirstNet.
- Expand RFI Tool functionality for mobile, secure and disconnected communications for CBP field agents. Transition: CBP & OCIO.
- Test and evaluate Smart City Interoperable Reference Architecture (SCIRA) with selected stakeholder community for practical implementation and cyber security protocols. Transition: Open Geospatial Consortium (industry).
- Prototype IoT Intelligent Building Infrastructure sensors with stakeholder community. Transition: SBIR, GSA and Industry
- Prototype UAS platform and sensor payload for mass transit tunnel search and reconnaissance. Transition: SBIR, Boston Fire and Industry.

Partnership Mechanisms and Technology Transition (formerly “TITAN”)

- **Problem:** To support the broad mission of DHS and keep pace with rapid changes in technology, S&T requires access to a wide range of innovative companies to include non-traditional Government partners. To encourage these innovative companies to engage with the Government requires creative approaches to communicate and invest with these non-traditional partners on specific problem sets.
- **Solution:** S&T provides a suite of capabilities to engage non-traditional partners (e.g., startups, incubators, accelerators) in the development of technology solutions for homeland security. The EMERGE Accelerator Program, Prize Program, and connectivity to In-Q-Tel are specifically designed to engage and partner with non-traditional performers to develop innovative technologies and approaches for homeland security needs. S&T continues to work with other Departments and Agencies to identify successful approaches to engage the full range of performers.
- **Impact:** These programs broaden S&T’s reach to innovators by working with a variety of startups, accelerators, incubators, and other non-traditional partners to find commercial technology that is adaptable for use by the homeland security enterprise. Influencing commercial technology supports S&T’s goal to ensure transition of technology to end-users to close homeland security gaps. These capabilities allow DHS S&T to leverage investments by other Government Agencies and the private sector. In addition, access to these partner networks supports S&T technology scouting efforts by increasing awareness of emerging technologies to inform S&T investments.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	-	1,000	3,000	3,000	3,000
Obligations	-	963	1,326	233	

Budget Year Key Milestone Event (FY 2018)

- Execute a targeted industry engagement campaign to convey to non-traditional partners S&T's key priorities and available mechanisms for partnering with S&T.
- Integrate information on developing technologies within non-traditional partner networks into S&T's technology scouting process.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Conduct Prize Competition: NBAF Think and Do Challenge	FY 2016	FY 2016
Conduct Prize Competition: USCG Environmentally Friendly Replacement of Buoy Moring Systems	FY 2016	FY 2016
FY 2017		
Conduct Prize Competition:TSA Person Screening Algorithm	FY 2017	FY 2018
Conduct Prize Competition: Biothreat Early Warning Challenge	FY 2017	FY 2018
Conduct Prize Competition: Pocket Escape Mask Design Challenge	FY 2017	FY 2018
Conduct <i>EMERGE</i> Wearables Accelerator	FY 2017	FY 2017
FY 2018		
Conduct Prize Competition: Entry and Exit Point People Screening	FY 2018	FY 2018

Type of Research

Applied

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

Transition Plans vary based on the specific problem statement and final results of the competition, accelerator, call, and/or work program.

Biometrics Technology Engine (BT-E)

- **Problem:** Biometric technologies are playing an increasingly significant role in securing the Homeland against dynamic threats, yet S&T lacks a coordinated approach to developing and pushing biometric solutions and innovations to DHS operational components.
- **Solution:** The Biometrics Technology Engine (BT-E) will provide a sustainable, common platform for driving biometrics standards, best practices, and innovation across S&T, DHS, and the Homeland Security Enterprise (HSE). The BT-E will coordinate and expand upon S&T's biometric competencies to provide world-class biometric expertise, methods, tools, technology, best practices, industry and international coordination, and operational insight to address the dynamic biometric needs of DHS and the HSE.
- **Impact:** The BT-E will accelerate effective integration of biometrics technologies into Apex programs and Component operations, and work in a cross-cutting fashion to mitigate potential inefficiencies, further driving down costs and increasing operational impact.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	-	-	-	-	408
Obligations	-	-	-	-	

FY 2018 Planned Key Milestone Events (Budget Year)

- Engage JRC, DHS Components, and HSE partners to identify common unmet operational needs.
- Formalize Biometric Technology Evaluations to inform or streamline DHS technology acquisitions.
- Demonstrate and evaluate cloud-based biometric matching and fusion capabilities, in collaboration with DA-E and IDAM-E.

- Co-lead multi-agency biometrics challenge prize for bleeding edge Nail-to-nail fingerprint collection technologies.
- Develop portfolio of S&T biometric offerings that positively impact Apex programs and Component operations.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Develop foundational documents (e.g., charter, factsheets, etc)	FY 2017 Q3	FY 2018 Q1
Compile and analyze S&T portfolio of biometric programs to include: working groups, capabilities, use cases, and customers	FY 2017 Q3	FY 2018 Q2
FY 2018		
Develop strategic messaging and engage DHS, interagency, industry, and international stakeholders	FY 2018 Q1	FY 2018 Q4
Build, maintain, and grow an accessible biometric “body of knowledge” for the HSE	FY 2018 Q1	FY 2018 Q4
Develop and promulgate BT-E capability offerings to DHS, interagency, industry, and international stakeholders	FY 2018 Q1	FY 2018 Q2
Contribute to the enhancement of biometric technologies, standards, and best practices in coordination with relevant entities (e.g. NIST), and drive adoption of biometric standards across the HSE	FY 2018 Q1	FY 2018 Q4
Execute test and evaluation activities at the Maryland Test Facility in collaboration with HSE stakeholders to assess innovative technologies	FY 2018 Q1	FY 2018 Q4

Type of Research

Developmental

Technical Readiness Level

TRL 6

Transition Plans

FY 2018 - Deliver Final Technology and Process Assessment report for Biometrics Technology Refresh and Deliver an initial biometrics “body of knowledge”. Transition: Apex program to DHS and HSE.

3. Border Security – FY 2017 Annualized Continuing Resolution: \$56.749M. FY 2018 Request: \$48.401M. DHS secures the borders, territorial waters, ports, terminals, waterways, and air, land, and sea transportation systems of the United States. S&T invests

in border security research and development for technologies and solutions to prevent the illicit movement and illegal entry or exit of people, weapons, dangerous goods, and contraband, and manage the risk posed by people and goods in transit.

A. *Cargo and Port of Entry (POE) Security* – FY 2017 Annualized Continuing Resolution: \$21.726M. FY 2018 Request: \$4.544M.

This program develops technologies to ensure the integrity of cargo shipments (including sea, air, and land conveyances) and enhances the end-to-end security of the supply chain, from the manufacturer of goods to final delivery, while ensuring economic throughput for the U.S. economy. This work will reduce the risk of terrorists and transnational criminal organizations from manipulating cargo as it conveys across various transit modes in the international supply chain.

Air Cargo Screening

- **Problem:** Air Cargo is a critical component of the Aviation Security Triad consisting of Air Cargo, Checked Baggage, and Checkpoint Baggage. Almost fifty percent of the contents in a passenger aircraft are Cargo and almost all US commercial carrier passenger flights carry Air Cargo. Screening of Air Cargo is mandated by Public Law 110-52 which dictates 100% screening of air cargo on passenger aircraft and that it must be screened commensurate to the same level as checked baggage. Additionally, DHS Strategic Priority #1 is to prevent terrorism and enhance security per 2014 QHSR. Screening checked and checkpoint baggage without equivalent screening of air cargo is like screening only half the passenger baggage and expecting to be safe. In response to the Congressional mandate, TSA instituted the Certified Screening Facility program to screen all air cargo using TSA approved screening equipment. Since private screening companies are low margin facilities, screening equipment has to be affordable. Evolving threats pose a continual threat to passenger safety through the Air Cargo conduit. Current screening techniques are labor intensive and IATA projected increase in Air Cargo volume would make it impossible to handle future Air Cargo throughput requirements in a secure manner in the next two to five years.
- **Solution:** The Air Cargo program aims to (a) augment existing screening systems to support increased security in the short term, (b) develop low cost CT-like systems, for 3D imaging of skids, and automated threat detection in the midterm, and (c) develop technologies to screen dense cargo using high penetration screening systems in the long term. The program seeks to achieve these goals in order to meet TSA capability gaps identified by close collaboration between TSA, S&T, OEMs and Screening Companies. The program plan builds capability in a graduated manner through incremental funding of programs based on approved funding. Thus elimination of funding will result in incomplete projects that dead end in a manner that prior funding would also be a waste of money.
- **Impact:** Air passenger safety remains uncompromised with the development of effective and affordable air cargo screening systems. Procurement of these systems by the Certified Cargo Screening Facilities enhances TSA's ability to maintain air cargo screening effectiveness and promptly address evolving air cargo threats.

Overall Project Funding

	2014	2015	2016	2017	2018
Project Funding	2,000	5,000	5,200	7,476	0
Obligations	1,800	4,448	4,708	0	-

FY 2016 Key Milestone Events (Prior Year)

- Deliver second findings of “ground truth” Improvised Explosive Device (IED) Cargo Build Studies – Report on second threats.

FY 2017 Key Milestone Events (Year of Execution)

- Deliver Residue Studies report provided by Massachusetts Institute of Technology's Lincoln Laboratory to TSA's Air Cargo Program to assist in development of new Explosives Trace Detection (ETD) detection thresholds. Deliver firm findings on “ground truth” IED Cargo Build Studies – Report on final six threats.
- Conduct a preliminary design review on study to evaluate explosives trace detection vapor trace effectiveness, which will be a review of the test design and methodology to be used including test articles.
- Conduct critical design review on study to evaluate explosives trace detection vapor trace effectiveness, which will be a review of the specific test design implementation and test procedure to be used to collect the study data for analysis.
- Conduct a preliminary design review for Opacity and Complexity Analysis Screening Tool (OCAST).
- Complete review and analysis of test results of enhanced Explosives Trace Detection.
- Complete review of Long Range Broad Agency Announcement (LRBAA) proposal submissions received in response to topic area 3.0 of LRBAA14-02.

FY 2018 Key Milestone Events (Budget Year)

- N/A

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Trace Residue Characterization studies	FY 2016 Q1	FY 2017 Q2
FY 2017		
Develop low cost CT-like 3D imaging PDR	FY 2017 Q2	FY 2018 Q2
Develop Automated Operator Assist Tools, OCAST PDR	FY 2017 Q2	FY 2017 Q4
Vapor Detection of Explosives in Air Cargo	FY 2017 Q2	FY 2018 Q2
Air Cargo Trace Residue Characterization Studies	FY 2017 Q3	FY 2020 Q1

Type of Research

Developmental

Technical Readiness Level

Low cost CT-like 3D imaging. This program plans to begin at TRL 3 and end at TRL 6.

Develop high penetration cargo skid size screening capability PDR. This program plans to begin at TRL3 and end at TRL 6.

Transition Plans

When the CT and the high penetration air cargo skid scanners reach TRL level 6 (successful DT&E at TSL) the products would be available to TSA for certification testing. On successful certification the TSA will place these products on the Air Cargo Screening Technology List (ACSTL). This will then allow the Certified Cargo Screening Facilities to procure and use these products.

Cargo and Conveyance Security

- **Problem:** The lack of actionable information used in the targeting of cargo for inspection diverts resources from higher risk shipments, while reducing the efficient flow of low risk/legitimate cargo. Inefficient targeting and lack of confidence in the security of containerized cargo in the global supply chain costs U.S. importers billions in lost revenue per year. Moreover, the

volume of inbound cargo to U.S. POEs is projected to increase from year to year while CBP manpower will not be increased proportionately. As such, new or improved technology and technical studies can be a force multiplier or enabler to help address these problems.

- **Solution:** This project develops technologies for collecting additional cargo security data, while also investing in the analysis methods for transforming new and existing cargo security data into actionable information. This improved targeting leads to a higher probability of detecting illegal or hazardous materials in cargo while expediting the delivery of legitimate cargo.
- **Impact:** Improved targeting and improvements in container security through the use of technology will reduce the number of containers requiring scanning and/or manual inspection saving CBP annually in labor and facility costs, while increasing the throughput of legitimate cargo. The use of technology could yield millions of dollars in additional tax revenue and would allow the automation of manual processes at the POEs, freeing up thousands of hours/year of CBP labor.

Overall Project Funding

	2014	2015	2016	2017	2018
Project Funding	3,450	-	-	1000	0
Obligations	1,971	921	242	2,163	

FY 2016 Key Milestone Events (Prior Year)

- Government RECONS: Transitioned comprehensive study results to CBP (T&E Analysis, Cost/Benefit Analysis, Acquisition Recommendation, Vendors List).
- Conducting end-to-end analysis that will influence electronic chain-of-custody processes, procedures, and technology implementations.
- Follow-on study of Border Wait Time Pilot Candidate Technologies is currently underway; evaluating potential application of an enterprise-wide solution.
- Working with FPS to integrate vehicle security device hardware & software into the new Scanning Facility operations enterprise.

FY 2017 Key Milestone Events (Year of Execution)

- Develop draft requirements and Concept of Operations for CITRUS data analytic tool.
- Refine operational test and evaluation plan for cargo trend analysis and anomaly detection system.

- Deliver a formal report assessing the utility of the Federal Highway Administration Radio Frequency Identification (RFID) commercial wait time solution as a tool to assist the accurate collection and dissemination of wait times at distinct crossings on the U.S. - Mexico border.

FY 2018 Key Milestone Events (Budget Year)

- N/A

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Refine operational test and evaluation of cargo trend analysis and anomaly detection into CBP's automated targeting system	FY 2017 Q2	FY 2017 Q3
Develop draft requirements and Concept of Operations for data analytic tool for CITRIS User Interface	FY 2017 Q3	FY 2017 Q4
Develop and test software for Cargo Trend Analysis	FY 2017 Q4	FY 2018 Q2

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- Deliver to FPS an automated capability to permit logging of deliveries within the National Capital Region (NCR), communication with container security devices, and tracking of container movement.
- Deliver to CBP an ATS-integrated cargo trend analysis and anomaly detection capability

Cargo Forensics

- **Problem:** CBP has limited capability to collect and analyze evidence from cargo and cargo containers to enforce trade law. CBP is heavily dependent on commercial laboratories to process pollen samples for enforcement of trade compliance. Not

only is this expensive, it induces a large time delay that results in lost opportunities to enforce trade law and collect customs revenue. Pollen sample analysis demands have more than doubled in the last 10 years. Similarly, CBP's limited capability to collect and analyze DNA samples from cargo and packages limits their ability to support prosecution of illegal activity.

- **Solution:** This project provides CBP with the capability to detect and prosecute illegal activity through the forensic analysis of material collected from suspicious packages and cargo.
- **Impact:** Improved tools and methods to validate cargo and enforce trade compliance will increase the availability of forensic evidence enabling enhanced trade compliance enforcement. Improved enforcement of trade law will increase the collection of millions of dollars of currently uncollected tariffs and duties.

Overall Project Funding

	2014	2015	2016	2017	2018
Project Funding	8,406	8,300	6,784	1,000	0
Obligations	4,877	6,873	5,586	258	-

Prior Year Key Events

- Additional pollen collections and processing for database.
- Transition of pollen forensic capability.
- Lab testing with field package samples using PCR Collection directive and DNA/Package Metadata.

Current Year Key Events

- Transition of PCR Collection directive and DNA package metadata database.

Budget Year Key Events

None

Project Schedule Including Milestones

- Operational Evaluation of PCR Collection Capability (FY 2016).
- Operational Evaluation of Pollen Forensic Capability (FY 2016).

- Publish and transition to customers at least four Chemical Forensics Standard Methods for the collection or analysis of Chemical Threat Agents of interest (FY 2016).
- Publish at least two Chemical Forensic articles in relevant scientific journals (FY 2016).
- Transition to CBP an in-laboratory Pollen Forensic Identification and Geo-location capability (FY 2017).

Type of Research

Applied

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- Transition to CBP (1) an in-house capability for pollen sample collection, preparation, analysis, and storage, (2) a robust regional pollen database, and (3) compiled reference material on the geographic distribution of pollen.
- Transition to CBP methods of the DNA analysis process; DNA purification, DNA extraction, PCR analysis versus other methods, and geo-location or criminal database comparison analysis.

Land/Sea Cargo Scanning

- **Problem:** Several CBP non-intrusive cargo scanning systems are reaching the end of their service life and are exhibiting reduced performance and rising maintenance costs. Other scanning systems are using technology that needs to be refreshed to maintain parity with the smuggling threat. In addition, CBP lacks the capability to non-intrusively detect contraband hidden in the walls of refrigerated cargo containers and in structural voids of conveyances and vehicles, requiring them to use time intensive manual inspection techniques. CBP/ICE has limited ability to detect/interdict counterfeit merchandise entering the U.S. and ICE seized \$66 million in bulk cash being illegally smuggled out of the U.S. in FY 2016.
- **Solution:** This project develops software and hardware upgrades for the legacy cargo scanning units, infusing state-of-the-art technology which will enhance their detection performance and extend their service life, and prototypes non-intrusive scanning capabilities for refrigerated cargo containers and structural voids. This project also provides CBP with the capability to detect the transport of contraband, counterfeit merchandise, or invasive species in inbound and outbound cargo at the Ports of Entry (POEs).
- **Impact:** The S&T Directorate's efforts will enhance CBP's effectiveness in detecting contraband at Ports of Entry while increasing the throughput of legitimate cargo. The project will increase the availability of evidence enabling enhanced trade

compliance enforcement, allowing for the collection of millions of dollars of currently uncollected tariffs and duties. Upgrades to CBP cargo scanning systems will improve performance, while significantly reducing operational and maintenance costs. The project anticipates the seizure of a larger portion of the estimated \$65 billion in bulk cash being illegally smuggled out of the U.S. each year.

Overall Project Funding

	2014	2015	2016	2017	2018
Project Funding	2,600	3,600	487	6,400	0
Obligations	2,390	3,323	0	414	

FY 2016 Key Milestone Events (Prior Year)

- Initiate transition of Mid-Level Scanning System Upgrade.
- Initiate transition of pre-production Mobile Backscatter Scanning System.
- Initiate transition of Currency Detection System.

FY 2017 Key Milestone Events (Year of Execution)

- Develop common non-intrusive inspection (NII) capability from Mid-Level Scanner and Mobile Backscatter Scanner to improve performance of future NII systems.
- Conduct Operational Pilot of Common Viewer Workstation under real conditions.

FY 2018 Key Milestone Events (Budget Year)

- N/A

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Develop common NII capability from Mid-Level Scanner and Mobile Backscatter Scanner to improve performance of future NII systems	FY 2016 Q3	FY 2017 Q2
FY 2017		
Conduct Operational Pilot of Common Viewer Workstation under real conditions	FY 2017 Q4	FY 2018 Q1
Perform Test and Evaluation of prototype Void & Deck Anomaly Detector	FY 2017 Q3	FY 2018 Q3
Perform Test and Evaluation of prototype Mobile Backscatter Scanning System	FY 2017 Q4	FY 2018 Q4

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- Transition to CBP (and potentially TSA) a Common Viewer Workstation for non-intrusive inspection systems.
- Transition operational prototype Through the Wall/Floor Detection System for field evaluation at selected POEs. S&T will assist CBP with acquisition or commercialization.
- Transition to CBP one or more pre-production Mid-Level Energy Scanning System units and the associated technical data package from which to develop an acquisition package and procure additional systems.
- Transition a field installation kit to modernize the CBP Mobile Backscatter Scanning Systems, extend the life of the units, and create a baseline for modernization and upgrade of other CBP Backscatter units. Specifically the project will deliver to CBP

one or more pre-production units and the associated technical data package from which to develop an acquisition package and procure additional systems. S&T will assist CBP with acquisition or commercialization.

People Screening

- **Problem:** Increases in international travel have strained CBP resources, resulting in increased wait times and delays for passengers to clear Federal Inspection Service areas. CBP needs to introduce process and technology improvements to traveler inspection operations in order to strengthen traveler vetting and facilitate lawful and legitimate travel.
- **Solution:** Analyze current entry operations, and implement technologies and process enhancements to existing airport operations, to increase CBP's capability to expedite and strengthen screening of travelers entering the United States. Develop recommended approaches and implement improvements in processes and/or technologies for cost-effective and integrated biometric, biographic, or other capabilities to support transformation of the inspection process and facilitate increased travel and tourism. This will include focus on traveler queuing optimization, next-generation Federal Inspection Service inspections, development of inspection metrics and analytics, integrated customs and agriculture baggage inspection, and evaluations of officer-systems performance.
- **Impact:** With S&T's assistance, CBP will increase its ability to confirm the identity of persons entering the United States, quantify the increase in efficacy of inspections, fulfill its obligation to keep our nations' borders safe and secure as required by the National Security Strategy, and ensure that processes are efficient and keep pace with the projected growth in international trade and travel.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	5,850	3,544
Obligations	-	-	-	414	

FY 2016 Key Milestone Events (Prior Year)

N/A

FY 2017 Key Milestone Events (Year of Execution)

- Deliver Final Technology and Process Assessment Report Counting & Measuring.
- Develop CONOPs to enhance traveler identification validation and CBP operations by integrating biometrics validation or Pre-Clearance Technology into CBP capabilities.

- Deliver Business Case Report for Global Entry Evolution to support CBP acquisition planning.
- Conduct a pilot in an operationally-relevant environment to determine the effectiveness of new/improved traveler queuing schemes on the time required for a traveler to complete entry processing into the United States.
- Perform test, evaluation, and analysis of new commercially available biometric technologies to assess performance, and determine business case for potential integration into DHS operations.

FY 2018 Key Milestone Events (Budget Year)

- Deliver Business Case Analysis Report for counting and measuring to support CBP acquisition planning.
- Deliver Operational Readiness Assessment Report for Global Entry Evolution.
- Conduct non-contact fingerprint operational readiness assessment demonstration for biometrics technology refresh.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Conduct technology readiness evaluations of fingerprint, face, and iris biometric recognition capabilities	FY 2017 Q1	FY 2017 Q4
Perform Field Trial of Bluetooth/IR System in operational Federal Inspection Services (FIS) environment for passenger Counting & Measuring	FY 2017 Q2	FY 2017 Q3
Conduct operational readiness assessments of non-contact fingerprint, speaker, face, and iris biometric recognition capabilities	FY 2017 Q4	FY 2018 Q3
Develop Global Entry Operational Readiness Assessment Report	FY 2017 Q2	FY 2018 Q1
FY 2018		
Pilot Global Entry Technology and CONOPS at selected Federal Inspection Service (FIS) area	FY 2018 Q1	FY 2018 Q2
Develop Business Case Analysis Report for Counting and Measuring to support CBP acquisition planning	FY 2018 Q2	FY 2018 Q4

Type of Research

Developmental

Technical Readiness Level

The program begins at TRL3 and ends at TRL7.

Transition Plans

- All analyses, models, technology prototypes, and knowledge products will be transitioned to CBP. Select work products may also be shared with airlines, airports, and other travel industry stakeholders to facilitate adoption and integration into aviation operations. Products include all operational assessment reports and business case documentation for follow-on CBP acquisition and/or sustainment to include Business Case Analysis and foundational acquisition documentation.

POE Forensics and Investigations

- **Problem:** CBP and ICE have limited capability to collect and analyze forensics evidence from cargo and cargo containers to enforce trade law. DHS is heavily dependent on commercial laboratories to process forensics information for enforcement of trade compliance. Not only is this expensive, it induces a large time delay that results in lost opportunities to enforce trade law and collect customs revenue. For example, Pollen sample analysis demands have more than doubled in the last 10 years. Similarly, DHS's limited capability to collect and analyze DNA samples from cargo and packages limits their ability to support prosecution of illegal activity. In addition, ICE has the need to share, query and analyze law enforcement investigations information on combatting transnational crime, investigating child exploitation and human trafficking, and processing aliens.
- **Solution:** This project provides CBP and ICE with the capability to detect and prosecute illegal activity through the forensic analysis of material collected from suspicious packages and cargo. The project also provides law enforcement entities access to near real-time data to enhance investigation and interdiction of illegal activity.
- **Impact:** Improved tools and methods to validate cargo and enforce trade compliance will increase the availability of forensic evidence enabling enhanced trade compliance enforcement. Improved enforcement of trade law will increase the collection of millions of dollars of currently uncollected tariffs and duties to support the U.S. economy. Integrated and timely access to investigations data can help detect and interdict illicit activity associated with human trafficking, child exploitation, and illegal immigration.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	-	1,000
Obligations	-	-	-	-	

FY 2018 Key Milestone Events (Budget Year)

- Perform an assessment of current networking tools in use by ICE – and others potentially available to ICE – to advance their investigative capabilities for combatting transnational crime and advancing child exploitation investigations.
- Perform a threat assessment to intellectual property rights as they relate to export controls and Additive Manufacturing (3-D printing) for the purpose of identifying methods for investigating/intercepting the process and resulting counterfeit goods.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Working with DoD, CBP, FBI and others, survey networking options available to ICE, as well as the processes for shared implementation.	FY 2018 Q1	FY 2018 Q4
Perform a threat assessment related to 3-D printing/additive manufacturing and intellectual property theft	FY 2018 Q1	FY 2018 Q2
Working with the National Intellectual Property Rights Coordination Center (IPRCC), survey potential processes and/or technologies that can be used to intercept counterfeit products	FY 2018 Q2	FY 2018 Q4

Type of Research

Applied

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- Transition to CBP (1) an in-house capability for pollen sample collection, preparation, analysis, and storage, (2) a robust regional pollen database, and (3) compiled reference material on the geographic distribution of pollen.
- Transition to CBP methods of the DNA analysis process; DNA purification, DNA extraction, PCR analysis versus other methods, and geo-location or criminal database comparison analysis.
- Transition to ICE enhanced networking tools to advance their investigative capabilities for combatting transnational crime and advancing child exploitation investigations.
- Transition to ICE enhanced processes and tools to advance their detection and interdiction of intellectual property theft and any resulting counterfeit products.

B. Land Border Security – FY 2017 Annualized Continuing Resolution: \$21.773M. FY 2018 Request: \$27.808M. This program develops and transitions technical capabilities that strengthen U.S. land border security by safeguarding lawful trade and travel and by helping to prevent illegal goods and people from crossing the border.

Air Based Technologies

- **Problem:** DHS operating components have the responsibility to reliably and accurately detect, track, and classify all low, medium, and high altitude threats including ultralights, gyrocopters, helicopters, and fixed wings. DoD and industry have developed airborne surveillance systems that could be repurposed/adapted/leveraged to dramatically improve situational awareness of remote regions of the U.S. border. The difficult terrain and harsh environment of the northern and southern borders poses extreme difficulties for a system to reliably and accurately detect, track, and classify aircraft of all sizes.
- **Solution:** This project identifies, tests, and evaluates sensors mounted on a variety of manned air platforms for possible use by DHS Components for improved detection, classification, and tracking of illicit activity. It also provides DHS Components and the First Responder community unbiased assessments of available airborne sensors in realistic, operationally relevant scenarios for improved situational awareness for law enforcement, search and rescue, disaster response, and border and maritime security missions. This project will also work with S&T's Program Executive Office for Unmanned Aircraft Systems to assist with UAS-specific operations.
- **Impact:** Airborne sensors and sensor systems will provide DHS operating Components and First Responders with invaluable situational awareness before making the decision to dispatch agents/assets to respond to and engage in potentially dangerous operations. The project will improve CBP, USCG, and the first responder community's awareness and usage of mature air based technologies for border security and public safety missions, resulting in more effective allocation of assets on local, regional, and national levels.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	2,618	5,250	1,468	7,173	6,879
Obligations	4,568	4,072	325	465	

FY 2016 Key Milestone Events (Prior Year)

- Demonstrate dismount movement target indicator on medium altitude long endurance UAS.
- Commence Operational Evaluation of Moving Target Indicator technology.
- Assess issues and recommend solutions to nonstandard UAS data protocols that prevent Unmanned Air Vehicle (UAV) track data or video from being readily ingested by data management systems.

FY 2017 Key Milestone Events (Year of Execution)

- Modify existing SDA system to accommodate Southern Border changes.

FY 2018 Key Milestone Events (Budget Year)

- Demonstrate mission management system with data link for real time sensor feed.
- Initiate integration of a maritime surveillance ISR sensor.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Build prototype Mission Management system	FY 2017 Q3	FY 2018 Q1
FY 2018		
Deploy/Demonstrate/Test Mission Management System prototype	FY 2018 Q1	FY 2018 Q4
Transition Mission Management System	FY 2018 Q4	FY 2019 Q3
Develop/Issue/Award RFP for maritime surveillance ISR Sensor System	FY 2017 Q3	FY 2018 Q2
Build, integrate and demonstrate maritime ISR Sensor system	FY 2018 Q2	FY 2019 Q2

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- Deliver to CBP and USCG operational evaluations of aircraft mounted ISR sensors to include performance, procurement, and integration data.
- Deliver to CBP and USCG a Mission Management system including performance, procurement, and integration data.

Private Sector Outreach and Engagement (formerly Border Trident Spectre)

- **Problem:** DHS needs the ability to rapidly field prototypes and potential COTS solutions for use and assessment with homeland security operators. This ability informs decisions on how to address technological capability gaps identified through the DHS IPTs and gathers input for future acquisitions.
- **Solution:** This project enables delivery of high-priority technology prototypes to the field. This project can assess COTS or near-COTS solutions for use in areas of critical need for border security and other high-priority homeland security needs. The need will

be identified by CBP and/or other DHS stakeholders, the near-term requirements will be jointly evaluated, and S&T will seek one or more technologies for field use and evaluation.

- **Impact:** This project will enhance DHS understanding of operator needs and provide the ability to quickly assess available technology to improve capabilities and/or reduce O&M costs of existing capabilities. In addition, this project captures experimentation events occurring within the interagency community that could be leveraged by DHS to further support S&T technology scouting efforts.

Overall Project Budget

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	-	1,400	500	2,100	500
Obligations	-	1,400	419	0	

Prior Year Key Milestone Events (FY 2016)

- Developed, tested, and evaluated technology (i.e., COTS and near-COTS) solutions.
- Delivered test reports and recommendations to CBP customer(s).
- Identify critical CBP capability gaps or area of potential cost savings, conducted in partnership with CBP Office of Technology, Integration and Acquisition (OTIA).
- Conducted detailed interviews of customer staff and field officers to define/validate requirements for rapid evaluation and integration of COTS and near-COTS technology.
- Performed tech foraging and an analysis of alternatives (with strong customer and user input) to identify a tech development strategy.

Current Year Key Milestone Events (FY 2017)

- N/A

Budget Year Key Milestone Events (FY 2018)

- Participate in additional Operational Experimentation events to inform and support DHS Component priorities.
- Capture observations and technologies from Operational Experimentation events to support technology scouting.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Participate in planning and execution of border security-related OpEx	FY 2017 Q3	FY 2017 Q4
FY 2018		
Participate in planning and execution of additional OpEx to support specific HSE needs	FY2018 Q1	FY 2018 Q1
OpEx opportunities identified for high-priority S&T programs	FY 2018 Q1	

Type of Research

Applied

Technical Readiness Level

TRL will vary based on individual vendor technologies expected to participate.

Transition Plans

Determined and developed based on Operational Experimentation observations and feedback.

Ground Based Technologies

- **Problem:** Multiple DHS Components are in need of new or improved border surveillance capabilities – especially for difficult terrains, harsh weather, and remote locations – that provide effective use of resources, improve investigations, and enhance Agent safety. Additionally, visibility and situational awareness of activity on both sides of a Border Wall infrastructure is critical to Agent safety and to the protection of U.S. assets and infrastructure.
- **Solution:** The projects address research and development gaps identified by Border Security IPTs, and U.S. Border Patrol Strategic Plan. Ground Based Technologies is a collection of multiple border surveillance projects that focus on: enhancing situational awareness, providing automated detections and alerts, improving target classification while minimizing false alarms, and maximizing battery life or renewable energy. This project is also enabling capabilities to provide situational awareness above and below ground with the construction and deployment of a Border Wall. An integrated and layered approach will prevent adversaries from exploiting other border security mission areas (e.g. Maritime, Air, Ports of Entry).
- **Impact:** CBP's improved situational awareness of U.S. terrestrial borders between the POEs will result in higher interdiction rates

of illegal activity and immigration through higher detection rates, fewer false alarms, and more efficient and safer utilization of officers, agents, and assets.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	5,219	7,300	7,261	8,200	15,729
Obligations	6,766	8,156	6,452	90	

FY 2016 Key Milestone Events (Prior Year)

- Transitioned Slash CameraPole (1 pole configuration).
- Tested SBIR UGS system by Independent Government team. Demonstrate Remote Imaging Device Engineering capability.

FY 2017 Key Milestone Events (Year of Execution)

- Conduct Border Wall technology requirements analysis for Border Research in Instrumented Construction (BRIC) effort.
- Conduct Remote Radio Link Pilot Preliminary Design Review for radio communications.
- Install three pole configuration of the slash Camera Pole system.
- Conduct assessment of a method to manage the amount of video collected for investigations.
- Transition Fiber Optic Distributed Sensing to provide high probability of detection and enhance classification capability to discriminate between humans, animals, vehicles, and aircraft without the use of imagers.

FY 2018 Key Milestone Events (Budget Year)

- Pilot Border Wall technology capabilities under BRIC effort.
- Install Northern Border Fiber Optic Distributed Sensing System Pilot.
- Conduct a Design Review of method to capture and distribute video and audio to improve situational awareness.
- Conduct multi-season Test and Evaluation for RF Sensing UGS.
- Conduct multi-season Test and Evaluation for Tri-Axial Acoustic Sensor Units.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Conduct assessment of a method to manage the amount of video collected for investigations	FY 2016 Q4	FY 2017 Q3
Conduct assessment of method to detect the presence of humans in an area under surveillance.	FY 2017 Q1	FY 2018 Q4
FY 2017		
Conduct a Design Review of method to capture and distribute video and audio to improve situational awareness	FY 2017 Q2	FY 2018 Q2
Conduct multi-season Test and Evaluation for RF Sensing UGS	FY 2017 Q3	FY 2018 Q4
Conduct multi-season Test and Evaluation for Tri-Axial Acoustic Sensor Units	FY 2017 Q3	FY 2018 Q4
Install 2 nd single pole configuration of the slash Camera Pole system	FY 2017 Q3	FY2017 Q4
Conduct Border Wall technology requirements analysis for Border Research in Instrumented Construction (BRIC) effort	FY 2017 Q4	FY2017 Q4
Conduct FODS Northern Border Pilot Preliminary Design Review for radio communications	FY 2017 Q4	FY 2017 Q4
Transition Fiber Optic Distributed Sensing Southern Border Pilot	FY 2017 Q1	FY 2017 Q4

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- Transition Fiber Optic Distributed Sensing to CBP to provide high probability of detection and enhance classification capability to discriminate between humans, animals, vehicles, and aircraft without the use of imagers.
- Transition Slash CameraPole technology to improve CBP's ability to detect and classify illegal border incursions.
- Transition Border Wall situational awareness capabilities to CBP for the BRIC effort.
- Transition UGS technology to CBP to improve the detection and tracking illegal incursions.
- Transition "trigger" sensor to ICE that detects the presence of humans in the field of view for the purpose of reducing the volume of video to be recorded, transmitted, viewed and archived.

Tunnel Detection and Surveillance

- **Problem:** Cross-border tunnels are dug by transnational criminal organizations to smuggle contraband into the U.S. Current detection capabilities rely on random tips and a laborious human intelligence (HUMINT) collection process, and when tunnels are discovered CBP and ICE lack the ability to exploit the tunnel to arrest and prosecute those involved in the creation and use of the tunnel.
- **Solution:** This project provides CBP and ICE the capability to locate clandestine tunnels, and the ability to perform forensic analysis of a detected tunnel to support investigations and prosecution.
- **Impact:** Using S&T's developed tunnel detection tools and systems CBP will be able to accurately detect and locate clandestine tunnels. This will result in a reduction in the flow of contraband smuggled into the U.S. via tunnels, keeping hundreds of tons of drugs off U.S. streets while saving thousands of CBP labor hours. Tunnel Age forensic tools/processes developed will enable ICE to assign attribution for tunneling activity and thereby increase the ability to arrest and prosecute individuals involved in the creation/use of tunnels for smuggling.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	4,626	5,800	4,119	4,300	4,700
Obligations	3,975	5,174	4,018	641	

FY 2016 Key Milestone Events (Prior Year)

- Field Test Developmental Prototype of Tunnel Detection Sub-Systems.
- Field Test and Operator Training of Tunnel Age Kits.

FY 2017 Key Milestone Events (Year of Execution)

- Perform Market Survey of Unmanned Ground Systems (aka Tunnel Robots).
- Develop sensor requirements for Unmanned Ground Systems (aka Tunnel Robots).
- Conduct a Field Test for Developmental Prototype of the complete Tunnel Detection System at the border.
- Test prototype Tunnel Detection system with CBP and provide a draft Technical Data Package to the Acquisition Program Office.

FY 2018 Key Milestone Events (Budget Year)

- Conduct field test and evaluation of tunnel robot technologies with Border Patrol in tunnel test bed.
- Test prototype of integrated Tunnel Detection system with CBP.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Plan and perform a Field Test Developmental Prototype of Tunnel Detection Sub-Systems	FY 2016 Q2	FY 2016 Q4
Plan and conduct a Field Tests for Developmental Prototype of the complete Tunnel Detection System at the border	FY 2016 Q3	FY 2017 Q3
FY 2018		
Plan and operationally test prototype integrated Tunnel Detection system with CBP.	FY 2018 Q1	FY 2018 Q4
Perform Market Survey of Unmanned Ground Systems (aka Tunnel Robots)	FY 2017 Q1	FY 2017 Q3
Plan and conduct field test and evaluation of tunnel robot technologies with Border Patrol in tunnel test bed	FY 2018 Q1	FY 2018 Q3

Type of Research

Developmental

Technical Readiness Level

The program starts at TRL2 and ends at TRL6.

Transition Plans

- Tunnel Detection Prototype:
 - Delivered to CBP a Sensor Performance Tool and Guidebook to inform which sensor types work best in the various border locations and the confidence level using each.
 - Conduct field testing of a prototype of a new tunnel detection system.
 - Deliver developmental and demonstration prototype(s) for operational evaluation by CBP.
 - Deliver final prototype Tunnel Detection system and Technical Data Package to CBP Acquisition Program Office.
- Deliver a Tunnel Age toolkit that can be routinely used by CBP and ICE agents to analyze and determine the age of discovered tunnels.
- Deliver to CBP and ICE operational evaluations of Unmanned Ground Systems (aka Tunnel Robots) to include performance, procurement, and integration data.

Maritime Border Security – FY 2017 Annualized Continuing Resolution: \$13.250M. FY 2018 Request: \$16.050M. This program develops and transitions technical capabilities that enhance U.S. maritime border security by safeguarding lawful trade and travel and helps to prevent illegal use of the maritime environment to transport illicit goods or people.

Port and Coastal Surveillance

- **Problem:** DHS components have insufficient ability to identify, prioritize, characterize, and share actionable information and intelligence on maritime threats in a tactically relevant manner to support unity of effort and intelligence-driven operations across the HSE. DHS operational components also need to leverage technology as a force multiplier to improve their operational effectiveness, improve efficiency, and/or reduce operations and maintenance costs.
- **Solution:** This project contributes to the department's unity-of-effort initiative and develops solutions to improve maritime situational awareness by establishing an enterprise capability to (1) access more data sources (including space based sensors), (2) make available decision support tools to translate the available data into actionable information and intelligence, and (3) share that actionable information and intelligence with federal, state, local, tribal, and international partners. This will enable an appropriate and rapid tactical response to maritime threats as well as enhance strategic planning/resource allocation at the Joint Task Forces (JTF), regional, and national level. Other project initiatives identify and develop technology to allow DHS operational components to more efficiently utilize and allocate resources and/or reduce their operations and maintenance costs.
- **Impact:** The S&T developed technology will improve operational effectiveness and enhance the maritime domain awareness

leading to increased detections, interdictions, and deterrence. Specifically, the increased effectiveness and situational awareness will result in:

- Improved measurement of illegal activity to understand current state and impacts from addition of resources or other actions taken to improve security.
- Improved assessment of risks by identifying current threats along with emerging patterns and trends.
- Improved *alignment of resources-to-risk for current and future operations on both a tactical and strategic level*

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	7,250	9,500	6,866	11,500	8,750
Obligations	5,735	9,355	6,861	2,950	

FY 2016 Key Milestone Events (Prior Year)

- Obtain Authority To Operate (ATO) for CSS General Support System (GSS).
- Install, test, and evaluate Coastal Surveillance System operational nodes at strategic locations to improve U.S. maritime domain awareness.
 - Expand accredited boundary to Maryland Natural Resources Police (MNRP) node.
 - Expand accredited boundary to Air & Marine Operations Center (AMOC) node.
 - Expand CSS Enterprise to include CBP OIC Detroit.
 - Expand CSS Enterprise to USCG Sector Puget Sound.
- Deliver Integrated Maritime Domain Enterprise (IMDE) Reference Architecture Package to OCIO.
- Plan and execute Technical Demonstration (TD-2).

FY 2017 Key Milestone Events (Year of Execution)

- Establish an initial operational capability at CBP Air and Marine Operations Center for the use of space based imagery in tactical operations.
- Complete Integrated Maritime Domain Enterprise-Coastal Surveillance System (IMDE-CSS) Operational Demonstration.
- Deliver to DHS HQ an affordable, sustainable, OCIO-compliant, enterprise data integration/information sharing platform.

FY 2018 Key Milestone Events (Budget Year)

- Perform IMDE-CSS Operational Assessment.

- Assess the impact of using commercial space based imagery for maritime surveillance operations.
- Perform an Analysis of Alternatives for maritime domain awareness.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Install, test, and evaluate Coastal Surveillance System (CSS) operational nodes at strategic locations to improve U.S. maritime domain awareness	FY 2016 Q1	FY 2016 Q4
Plan and execute Integrated Maritime Domain Enterprise (IMDE) -Coastal Surveillance System (CSS) Operational Assessment	FY 2016 Q1	FY 2018 Q4
Establish an initial operational capability at CBP Air and Marine Operations Center for the use of space based imagery in tactical operations	FY 2016 Q1	FY 2017 Q3
FY 2017		
Assess the impact of using commercial space based imagery for maritime surveillance operations	FY 2017 Q1	FY 2018 Q1
Perform Analysis of Alternatives for maritime domain awareness	FY 2017 Q4	FY 2018 Q4

Type of Research

Developmental

Technical Readiness Level

The program begins at TRL4 and ends at TRL7.

Transition Plans

- Integrated Maritime Domain Enterprise (IMDE) – Deliver to DHS HQ OCIO a compliant reference segment architecture integration platform for agile information sharing and discovery.

- Coastal Surveillance System (CSS) – Deliver to CBP and USCG a coastal maritime sensor fusion system that enables cooperative maritime awareness of non-emitting vessels and the sharing of that time-critical, mission-useful sensor information between DHS Components including USCG and CBP and State, local and regional partners.
- Transition capability to use commercial space-based imagery in support of maritime surveillance operations.

Arctic Communications and Technologies

- **Problem:** The United States is an Arctic nation with significant interests in the future of the region. DHS has specific statutory responsibilities in U.S. Arctic waters. DHS is responsible for ensuring safe, secure, and environmentally responsible maritime activity in U.S. Arctic waters. DHS is extending operations into the Arctic in areas that were once inaccessible but are now ice-free during summer months. The vast distances, lack of communications infrastructure, harsh weather, and high latitude ionic disturbances combine to make communications and operations in the Arctic difficult. Efforts must be accomplished in close coordination with DHS components, and involve facilitating commerce, managing borders, and improving resilience to disasters.
- **Solution:** This project will identify and evaluate appropriate technology to enable and enhance DHS maritime security and safety operations in the Arctic, including maritime domain awareness and voice and data communications.
- **Impact:** S&T developed technology solutions will assist the DHS maritime components in the acquisition and implementation of capabilities in the Arctic, essential for safe and effective operations.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	750	-	1,000	6,300
Obligations	-	425	-	805	

FY 2017 Key Milestone Events (Year of Execution)

- Deliver Adaptive Space-based Analytics Prototype (ASAP) reference architecture.
- Evaluate technology with the potential to improve/enhance mission performance.

FY 2018 Key Milestone Events (Budget Year)

- Perform Analysis of Alternatives (AoA) for Arctic Communications.
- Conduct On-Orbit Test and Evaluation of space-based technologies to support arctic missions.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Evaluate satellite technology with the potential to improve/enhance mission performance	FY 2016 Q2	FY 2017 Q4
Launch Hawkeye 360 (HE360), National Reconnaissance Office (NRO), Air Force Operationally Responsive Space (AF ORS) satellites	FY 2016 Q4	FY 2018 Q2
Plan for and conduct On Orbit Test and Evaluation of satellites to support arctic missions	FY 2016 Q4	FY 2018 Q4
FY 2017		
Develop ASAP Tool(s)	FY 2017 Q2	FY 2017 Q4
Limited Demonstration of ASAP	FY 2017 Q2	FY 2018 Q3
Integrate DoD Synthetic Aperture Radar (SAR) into ASAP	FY 2017 Q1	FY 2019 Q1
Perform an Analysis of Alternatives for Communications in the Arctic Region	FY 2017 Q4	FY 2018 Q2

Type of Research

Developmental

Technical Readiness Level

Begins at TRL 6 and completes at TRL 7.

Transition Plans

- The project will inform a DHS acquisition strategy for the deployment of an Arctic Maritime Domain Awareness capability.
- The project will inform a DHS acquisition strategy for the deployment of an Arctic Communications capability.
- Analytic capabilities developed will transition to become enterprise systems.

Port Resiliency

- **Problem:** DHS expends considerable time and resources to fulfill their mandate to provide for the safety and economic security of our maritime ports. Currently, the DHS has no computer-based tool to review, modify and/or design risk-based port resiliency strategies; nor does it possess the modeling and simulation capability to conduct port health assessments or analyze the condition of ports in a post disaster or attack environment.
- **Solution:** New or improved technology can be a force multiplier/enabler to help address the DHS maritime challenges. The project will leverage work from S&T Centers of Excellence to develop and design a port resiliency analytical tool that uses available computer-based technologies to provide our port managers with a more effective and user friendly capability while maintaining fiscal responsibility.
- **Impact:** S&T Directorate developed technology will allow DHS to maintain or increase their effectiveness while reducing their resource investment required to provide for the maritime safety and economic security of our ports. The specific analytical port tool improves port resiliency by substantially reducing the time a port is closed to traffic and trade due to a significant disaster or attack event.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	750	1,000
Obligations	-	-	-	0	

FY 2017 Key Milestone Events (Year of Execution)

- Assess enterprise architecture alignment.
- Perform Program of Record database assessment.

FY 2018 Key Milestone Events (Budget Year)

- Develop prototype port resiliency analytical tool that uses available computer-based technologies to provide port managers with a more effective capability to manage ports.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Assess enterprise architecture alignment	FY 2017 Q2	FY 2017 Q4
Perform Program of Record database assessment	FY 2017 Q3	FY 2017 Q4
Develop prototype port resiliency analytical tool	FY 2017 Q4	FY 2018 Q4

Type of Research

Developmental

Technical Readiness Level

Begins at TRL 6 and completes at TRL 7.

Transition Plans

- The software tool will be integrated into an existing Program of Record. USCG CG-1 is the operational sponsor, CG-6 and CG-7 are the resource sponsors.

4. Chemical, Biological and Explosive Defense Research and Development (CBE Defense) – FY 2017 Annualized Continuing Resolution: \$58.389M. FY 2018 Request: \$52.641M. S&T Directorate invests in R&D to support prevention and protective strategies and coordinated surveillance and detection to address CBE threats. R&D work includes: prevention of terrorism; reduction of vulnerability of critical infrastructure from terrorist attacks and other hazards; and prevention of the illicit movement and illegal entry or exit of people, weapons, dangerous goods, and contraband by providing technology, methods, and procedures to detect CBE threats.

Bioagent Detection – FY 2017 Annualized Continuing Resolution: \$18.079M. FY 2018 Request: \$21.000M. This program conducts research and develops and identifies tools to enable rapid detection and provide advanced warning of attacks or releases of biological threat agents against the population and agriculture of the United States. It defines the intended use and application, develops the requirements, and executes the technology developmental efforts to support early detection and warning of potential bioagent threats to humans.

Agricultural Screening and Surveillance

- **Problem:** High-priority threats to livestock wildlife, plants and food threaten the U.S. agricultural critical infrastructure.
- **Solution:** This collection of projects will develop and standardize technologies and protocols, including immunoassay-based approaches, information systems and mobile technologies, to enable the early identification of current and emerging agricultural threats within the U.S. and at the borders.
- **Impact:** The diagnostic screening tools, information technology, software applications and mobile technologies developed and deployed to the U.S. Department of Agriculture (USDA) domestically and both USDA and CBP at U.S. borders will help prevent importation, and/or mitigate the impact of outbreaks and attack with high-priority threats that could cause severe economic damage to U.S. agricultural critical infrastructure.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	7,273	750	2,000	3,099	0
Obligations	7,284	289	1,599	0	

Prior Year Key Events

- Down select applicable technologies for enhanced development and initial testing of Border Agricultural Screening System.
- Develop fit-for-purpose standard operating procedures with the user for implementation into the Border Agricultural Screening System.
- Deliver risk analysis and modeling tools (including spatial disease risk maps) and an analysis of countermeasure and strategies to mitigate and control disease in free ranging wildlife populations and feed biosurveillance systems.

Current Year Key Events

- Identify gaps in screening and surveillance of agricultural threats.
- Expand the development of diagnostic countermeasures.
- Host a Table Top Exercise/Workshop with key stakeholders to assist in developing target CONOPs.
- Down select applicable technologies for enhanced development and initial testing.
- Integrate data from wildlife foreign animal disease screening and surveillance testing into guidance for veterinarians.

Budget Year Key Events

- N/A

Project Schedule Including Milestones

N/A

Type of Research

Developmental

Technical Readiness Level

The program plans to begin at TRL 4 and end at TRL 6.

Transition Plans

N/A

Bioassays

- **Problem:** Numerous capability gaps exist for the analysis and identification of biothreat agents for CBD internal customers and IPT members, e.g., USSS, CBP, and First Responders Group (FRG). Comprehensively-validated biothreat agent detection assays and devices are being developed to enable the analysis of potential biothreat samples to inform on appropriate actions to enhance protection functions and ensure public safety.
- **Solution:** Development of “Gold Standard” repositories of high quality viral and bacterial agent samples to enable development, transition and operational use of robust dual-use detection and diagnostic assays for both field-based and laboratory use. The spectrum of dual-use assay development projects include 1) test, evaluation, and validation of nucleic acid detection assays (TaqMan Polymerase Chain Reaction (PCR)); 2) antigen detection assays (immunoassays); as per the Public Health Actionable Assay (PHAA) standards and First Responder Actionable Assay (FRAA) performance criteria; and 3) rapid antimicrobial susceptibility assays (based on micro-culture and PCR) for deployment and employment through the IPT customers and internal DHS components. Closes gaps to support rapid detection of an event, response to an event, and recover from an event as well as the First Responder Actionable Assays for First Responder Use in the field. The PHAA assays are intended to be dual-use assays that can be used for environmental sample analysis, and confirmation of biothreat agent identification, while the FRAA assays are primarily Lateral Flow Devices, and are strictly designed to be used in the field by First Responders for environmental powders evaluation and screening.

- **Impact:** Enables and expands capabilities to rapidly screen and detect high-consequence biological pathogens and toxins to provide critical information to support protection functions, and actions and decisions regarding public safety. The success of this project is dependent on the development and maintenance of robust reference strain collections and antibody repositories, to include appropriate standards to recognize and identify traditional, emerging, advanced, and enhanced threat agents, and bioinformatic resources for assay design and analytic capabilities to assess and predict robust assay performance.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	7,000	4,000	2,000	5,165	3,000
Obligations	4,653	6,076	2,628	330	

FY 2016 Key Milestone Events (Prior Year)

- Conduct assay optimization for the Coxiella burnetii PHAA assay.
- Complete Rapid Antimicrobial Susceptibility tests for Burkholderia mallei and pseudomallei.
- Conduct testing and validation of the nucleic acid based detection assays for Burkholderia spp.

FY 2017 Key Milestone Events (Year of Execution)

- Design Review for Multiplexed Toxin Detector (SpinDx Platform): Finalize prototype platform and tests in advance of developmental testing and evaluation.
- Establish the form, shape, and size of an aerosol sample capture cassette, to include assay chemistry for viable capture and detection of signatures.
- Transition nucleic acid based detection assays for Burkholderia spp. (causing Glanders or Melioidosis) and Bacillus anthracis (causing Anthrax) to end users and stakeholders.
- Acquire materials for the development of the T2 Mycotoxin and Saxitoxin toxin PHAA assays.
- Transition of Rapid Antimicrobial Susceptibility tests for Burkholderia mallei and pseudomallei to end users.
- Begin transitioning and validation of multiplexed Variola antigenic assays on the MesoScale Defense (MSD) Platform
- Complete testing, evaluation and validation of field deployable First Responder Actionable Assays for detection of Bacillus anthracis.

- Transition of nucleic acid based detection assays for Burkholderia spp. (causing Glanders or Melioidosis) and Bacillus anthracis (causing Anthrax) to end users and stakeholders.
- Conduct assay optimization of Lassa Fever Virus PHAA assays.

FY 2018 Key Milestone Events (Budget Year)

- Conduct bridging studies and transition validated nucleic acid-based PHAA to USSS.
- Transition multiplex toxin detector platform (SpinDx) and assays to USSS.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Begin Validation of Conotoxin and Saxitoxin reagents and prototype assays.	FY 2016 Q4	FY 2018 Q4
Transition of Rapid Antimicrobial Susceptibility tests for Burkholderia mallei and pseudomallei to end users.	FY 2016 Q1	FY 2017 Q4
Begin transitioning and validation of multiplexed Variola antigenic assays on the MesoScale Defense (MSD) Platform.	FY 2016 Q1	FY 2018 Q1
Finalize design of SpinDx assay disk and conduct testing and evaluation of prototype toxin detection platform and assays to USSS.	FY 2016Q1	FY 2018 Q2
Transition of nucleic acid based detection assays for Burkholderia spp. (causing Glanders or Melioidosis) and Bacillus anthracis (causing Anthrax) to end users and stakeholders.	FY 2016 Q4	FY 2017 Q4
FY 2017		
Begin optimization of Brucella spp. prototype TaqMan assays.	FY 2017 Q4	FY 2018 Q4
Conduct bridging studies and transition validated nucleic acid-based PHAA to USSS	FY 2017 Q3	FY 2018 Q4

Type of Research

Applied

Technical Readiness Level

The program plans to begin at TRL 5 and end at TRL 6-7.

Transition Plans

Transition validated assays to USSS and other DHS Components to support protection, national bio-preparedness defense missions. Rapid Biothreat Screening assays will be transitioned to FEMA and S&T's FRG to support screening of suspicious material in the field and public safety actions in a timely manner.

Biosurveillance Systems

- **Problem:** In the event of biological attack or disease outbreak, there is a lack of protocols for prompt recognition, coordination and early response action amongst Federal, state, local governments and the private sector. The timely detection of a biological threat and/or an infectious agent prior to release and/or exposure in a public space is a critical challenge to multiple DHS components including CBP, USSS as well as within Federal, State, local, and tribal governments, including the public health and first responder communities.
- **Solution:** This project develops cost-effective systems to rapidly collect and exploit information useful for identifying outbreaks or unusual events, enabling decision makers to more quickly initiate protective measures. Demonstrations will be conducted in partnership with DHS components and stakeholders.
- **Impact:** Detection and interdiction of biological hazards through rapid field based biological assessment and optimized collection and integration of relevant data will shorten the timeline between event occurrence and response; thereby, protecting the public, critical infrastructure, and the economy.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	1,046	6,900	10,000	9,814	5,000
Obligations	659	11,899	7,608	379	

FY 2016 Key Milestone Events (Prior Year)

- Build standard data set of biosurveillance information that will be used to evaluate model performance improvements throughout project.
- Initiate series of tabletop exercises with two local jurisdictions to demonstrate information aggregation tools for rapid awareness of a biological event.
- Demonstrate feasibility of a low-cost, sustainable environmental detection architecture (SenseNet) using dual-use technologies.

FY 2017 Key Milestone Events (Year of Execution)

- Conduct first full scale exercise of improved biosurveillance capabilities with a local jurisdiction partner, and document lessons learned and technology gaps.
- Deliver a report to DHS component stakeholders that characterizes the state-of-the-art for technology directly applicable to field based biological assessment and collect input on the feasibility of implementing currently available technology.
- Produce a notional roadmap of potential RDT&E pathways for reaching needed capability via commercial and government off the shelf solutions.
- Initiate requirements and analysis of alternatives for advanced outdoor detection systems.

FY 2018 Key Milestone Events (Budget Year)

- Pilot field testing and installation of rapid and sustainable environmental monitoring systems with a local community partner for indoor venues.
- Establish proposed system architecture for field based biological assessment capability for CBP primary active surveillance at Ports of Entry that will not unreasonably restrict cross-border traffic.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Conduct component interviews to develop detailed requirements and concept of operations for field based biological assessment.	FY 2017 Q2	FY 2017 Q3
Interagency interviews of CBP partners to document interagency component of field-based biological assessment concept of operations.	FY 2017 Q2	FY 2017 Q3
DHS component consensus requirements for field based biological assessment.	FY 2017 Q2	FY 2017 Q4
Conduct review of relevant literature focused on prior related efforts intended either to provide needed capability or mitigate impact of capability gaps.	FY 2017 Q3	FY 2017 Q4
Request for Information on field based biological assessment efforts and technologies directly applicable to field-based biological assessment released.	FY 2017 Q3	FY 2017 Q3
Summary of information received from RFI on field based biological assessment finalized.	FY 2017 Q4	FY 2017 Q4
FY 2018		
Report identifying potential threat characteristics and signatures for the infectious cycle of each of the DBPs and characterizing those signatures across the likely/known sensor range.	FY 2018 Q1	FY 2018 Q3
Report assessing overall threat detectability with options for detection strategies and methodologies.	FY 2018 Q1	FY 2018 Q3
Conduct feasibility study to assess primary barriers to field based biological assessment (technical, operational, legal, etc) and identify test and verification/validation strategies for field based biological assessment technologies.	FY 2017 Q2	FY 2018 Q3

Research & Development Description	Plan Start Date	Planned Completion
Draft options for system architecture for field based biological assessment capability for Customs and Border Protection primary active surveillance at Ports of Entry that will not unreasonably restrict cross-border traffic presented to CBP and CDC stakeholders.	FY 2018 Q3	FY 2018 Q3
Final proposed system architecture for field based biological assessment capability for Customs and Border Protection primary active surveillance at Ports of Entry that will not unreasonably restrict cross-border traffic presented to CBP and CDC stakeholders.	FY 2018 Q4	FY 2018 Q4
Pilot field testing and installation of rapid and sustainable environmental monitoring systems with a local community partner for indoor venues.	FY 2018 Q4	FY 2018 Q4

Type of Research

Applied

Technical Readiness Level

The program plans to begin at TRL 3 and end at TRL 6.

Transition Plans

A Department wide field-based biological assessment concept of operations and systems architecture will be developed that includes all relevant DHS components (CBP, USSS, TSA, and ICE) and stakeholders. From there, customized technology architectures suited to the individual operational environments, which may include thermal sensing, multispectral imaging, volatile organic compound detection and/or canine detection, and budgets, will be developed utilizing COTS technology where available and investing in new technology development when necessary. With new technology development, preference will be given to technologies that have commercial markets beyond component needs if at all possible, to ensure the availability of an infrastructure to maintain and improve technologies as needed.

Underground Transport Biodetection Test Bed

- **Problem:** Subway systems are attractive targets for potential acts of bioterrorism, particularly with aerosolized biological agents (e.g., *Bacillus anthracis*). Real-time detection of biological agents is currently not possible. An FY 2016 DHS field test in the New York City subway that simulated a biological agent release has confirmed dispersion model predictions that contamination will be widespread and a major public health crisis will occur.
- **Solution:** A permanent test bed in a major subway system will enable the evaluation of emerging bio-detection technologies, detection architectures, and mitigation strategies to limit agent transport and public exposure to an aerosolized threat. Testing of rapid detection technologies and architectures, and mitigation countermeasures is necessary to establish performance in the harsh environment of a subway and suitability for operational deployment. The Metropolitan Transportation Authority New York City Transit has expressed an interest to partner with DHS on implementing a test bed in the nation's largest subway system.
- **Impact:** A test bed in the operational environment will enable an assessment of the readiness of emerging biodetection technologies and mitigation strategies and countermeasures, with the goal to minimize the impact and consequences of a bioterrorism event in the subway. The test bed will enable subway system authorities to make informed decisions on new technology acquisition and deployment to enhance public safety and situational awareness.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	-	-	-	-	5,000
Obligations	-	-	-	-	

FY 2018 Planned Key Milestone Events (Budget Year)

- Down-select candidate detection architectures and acquire initial technologies.
- Fabricate and validate test bed operational readiness.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Execute Memorandum of Agreement with subway partner	FY 2017 Q2	FY 2017 Q4
Develop initial test bed plan in collaboration with subway partner	FY 2017 Q3	FY 2017 Q4
FY 2018		
Finalize test bed plan	FY 2018 Q1	FY 2018 Q2
Acquire technologies for test bed	FY 2018 Q1	FY 2018 Q2
Test bed fabrication and certification	FY 2018 Q2	FY 2018 Q4

Type of Research

Applied

Technical Readiness Level

TRL 6-7

Transition Plans

Technologies and mitigation strategies successfully demonstrated to be effective in the subway environment will be transitioned to MTA New York City Transit and other major subway systems for active deployment.

BioInformatics for BioDefense (BioFutures)

- **Problem:** Recent advancements in the field of life sciences, particularly synthetic biology, are a potential concern to the Homeland Security Enterprise (HSE). Especially with the tremendous rate of scientific advancement in the fields of synthetic biology and genetic engineering, the DHS community as well as the commercial gene synthesis community must be kept apprised about synthetic biology and ways it may be misused.
- **Solution:** Develop knowledge products and databases that inform decision-makers about the implications of synthetic biology. Active review of developing technologies, modeling of pathogen synthesis, and improving stakeholders' understanding of the science will increase awareness as technologies and their policy and privacy implications evolve. Develop and host interactions between government, industry and academics to foster increased awareness and understanding.

- **Impact:** The BioFutures program helps generate and develop requirements for CBDs Biological Threat Characterization Program and for other biodefense efforts within the HSE. BioFutures increases the awareness and understanding of synthetic biological threats across the HSE. This project increases the probability of preventing and minimizing the negative impact of synthetic biological risks at a time of rapid technological flux.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	-	-	-	-	3,000
Obligations	-	-	-	-	

Budget Year Key Events

- Develop system for ongoing monitoring and assessment of synthetic biology risks, based on risk spectrum developed by the Intelligence Advanced Research Projects Agency (IARPA).
- Transition to FBI two pathways by which synthetic organism experimentation may be conducted, with emphasis on means of alerting in case of accident or misuse.

Project Schedule Including Milestones

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Develop system for ongoing monitoring and assessment of synthetic biology risks, based on risk spectrum developed by IARPA.	FY 2018 Q4	

Type of Research

Development

Technical Readiness Level

N/A

Transition Plans

Make technical reports and databases available to users across the HSE and to appropriate commercial customers via the Bio-Defense Knowledge Center Management System.

Chemical and Biological Integrated Product Team Solutions

- **Problem:** DHS Components have the mission to protect the nation from acts of terrorism, including attacks with chemical and biological agents. Each of the components has a unique role in this mission and each has gaps in their current capabilities to prevent, protect, mitigate, respond to or recover from a chemical or biological agent attack. Operators in this mission space play a variety of roles and require detection, enhanced personal protection equipment, warning tools, modeling and predictive analytics capabilities.
- **Solution:** The Chemical Biological Integrated Product Team Solutions (CB IPT Solutions) project will interface with DHS components to develop detailed requirements and deliver technological solutions to fill capability gaps that impact diverse missions and operations in which chemical and biological agents may be encountered. Solutions will be provided based upon Component derived requirements.
- **Impact:** This program will deliver solutions to high-priority gaps identified by DHS components through the Chemical Biological IPT process.

Sub Projects

CB IPT Solutions has identified these six activities as the first gaps to be addressed:

- Gap 1: Subway systems are attractive targets for potential acts of bioterrorism, particularly with aerosolized biological agents (e.g., *Bacillus anthracis*). Real-time detection of biological agents is currently not possible. An FY 2016 DHS field test in the New York City subway that simulated a biological agent release has confirmed dispersion model predictions – contamination will be widespread and a major public health crisis will occur.
- Gap 2: Law Enforcement VIP Protective Personnel lack an enhanced ability to discreetly carry personal protective equipment (PPE) for the protection and safe extraction of senior leadership and other designated persons from a full range of operational environments where a hazardous biological, chemical or radiological (CBR) substance has been released. The lack of this enhanced ability prolongs exposure to a respiratory threat due to the inaccessibility of PPE in an emergency situation.

- Gap 3: The U.S. Coast Guard Maritime Security Response Teams (MSRT) are required to engage in physically-demanding tasks, including operating in a Chemical, Biological, Radiological and Nuclear environment, while conducting missions involving high-threat, non-compliant and opposed boarding operations. Such missions include prolonged operations against active aggressors in close quarters. Due to the physically-demanding nature of such missions, MSRT requires a lightweight, respiratory protective system that minimizes stress and exertion in order to enable optimal performance, while safeguarding the wearer against a range of contaminants.
- Gap 4: Releases of chemical or biological agents can affect multiple areas (or domains) such as outdoors, subways and integrated transit facilities or other interconnected infrastructure. OHA has identified a requirement to improve situational awareness and better inform detector architectures through integration of advanced modeling techniques. An integrated modeling suite that addresses all these areas is necessary to not only optimize detection resources, but also assess attribution based on real-time detection data and other available air and surface sampling data.
- Gap 5: The threat of a terrorist attack involving biological weapons within the U.S. remains a significant concern; this is particularly true for high population urban areas. To date, there is limited data validating existing threat dispersion models and a poor understanding of how complex urban airflows and fomite transfer will translate to contaminated areas and risk to populations.
- Gap 6: The safe identification of chemical threats at security checkpoints to prevent their use against the public requires the need for a state-of-the-art solution. The production of deadly chemical threat agents (CTAs) is within the capability of many state actors and unfortunately, some terrorist and/or home-grown violent extremists (HVEs). Development and demonstration of a fieldable system for chemical threat mapping to identify CTAs without opening their packaged containers thru the use of multi-modal Ultra-Low Magnetic Field Nuclear Magnetic Resonance (ULMF-NMR) signatures could detect and prevent such threats from reaching their targets.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	-	5,000
Obligations	-	-	-	-	

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Initiate GAP 1 Projects.	FY 2017 Q3	FY 2018 Q4
Initiate GAP 2 Projects.	FY 2017 Q3	FY 2018 Q4
Initiate GAP 3 Projects.	FY 2017 Q3	FY 2018 Q4
Initiate GAP 4 Projects.	FY 2017 Q4	FY 2018 Q4
Initiate GAP 5 Projects.	FY 2017 Q3	FY 2020 Q3
Initiate GAP 6 Projects.	FY 2017 Q3	FY 2020 Q3

Type of Research

Development, and Applied

Technical Readiness Level

TRL 6-7 for technologies.

Transition Plans

Technology solutions and knowledge products, developed in accord with component requirements, will be transitioned to component customers for acquisition programs or preparedness planning.

Chemical Detection – FY 2017 Annualized Continuing Resolution: \$3.099 M. FY 2018 Request \$0.

This program seeks to develop more reliable chemical detectors, which will promote their use and reduce vulnerabilities of the population and critical infrastructure in a wide array of operational applications.

Multifunction Detectors

- **Problem:** There is a lack of current reliable and chemical sensing technologies able to detect a broad range of chemical threats to include chemical warfare agents and toxic industrial chemicals yielding high quality data for high confidence response. High false alarm rates and high costs (acquisition and maintenance) remain significant hurdles for first responder deployment.
- **Solution:** Development of enhanced chemical detectors which incorporate advancements in optics, electronics, and algorithms toward the development of systems with high specificity, increased sensitivity with concomitant reduction in false alarm rates. Autonomous system for buildings that can be integrated with video/air quality control to create a smart system capable of detecting and mitigating multiple threats will also be evaluated.
- **Impact:** Successful demonstration of enhanced performance of detectors, in several forms (stationary, portable, handheld, and wearable) with reduction in false alarms is necessary to transition these systems into the field where they will serve to increase the security of critical infrastructure and occupants. If feasible, successful integration of chemical and biological detection capability into a single system will provide increased security indoors (high asset buildings, transit subways and terminals). Successful demonstration of capability to integrate with representative video and air quality controls will provide for low regret strategies. Successful demonstration of capability to integrate a secure, continuous data stream to a command and control center to allow for first responders access in-route to an incident.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	3,099	0
Obligations	-	-	-	0	

Prior Year Key Events

- Establish an independent testing effort for current detectors being purchased by our first responders/other users to validate performance outside of vendor claims
- Assess chemical using Chemical Security Analysis Center developed models for specific applications (subway setting vs building).
- Conduct workshop with other government agencies to establish R&D baseline.

Project Schedule Including Milestones

N/A

Type of Research

Applied

Technical Readiness Level

Completed system TRL5 – Fully functional in a relevant operational environment.

Transition Plans

N/A

Explosives Detection – FY 2017 Annualized Continuing Resolution: \$37.211M. FY 2018 Request: \$31.641M. This program researches, develops, and/or identifies tools to detect and locate explosives intended to be used as terrorist weapons and strengthens aviation security by bolstering the international aviation security system, processes, and technologies, and by encouraging partnerships with industry. It defines concepts, requirements, and procedures for improved techniques for early detection and warning of potential explosive threats, including explosive threats to the Nation's transportation systems and large public gatherings.

Canine Explosives Detection

- **Problem:** The Homeland Security Enterprise (HSE) maintains over 16,000 detection canine teams, encompassing all threat detection disciplines and spreads across the Federal, State, local and tribal law enforcement community. There is a need for a centralized focal point within DHS to address mission requirements, conduct operationally relevant research, and act as a repository of expert advice on common problems across Government, academia and the private sector. The detection canine teams have limited access to training materials and limited time where they can train on particular materials, thus decreasing their proficiency and ability to improve detection techniques. Non-hazardous training aids will allow the teams to train more frequently, maintain a high level of proficiency, facilitate a simplified training aid storage plan, and allow for the frequent assessment of the effectiveness of current concepts of operations (CONOPS). In the explosives threat vector, the growing threat of person-borne improvised explosive devices (PBIEDs) has led to the need for canine explosives detection teams to expand their CONOPS to include PBIED detection capabilities. Special consideration is given to high-throughput mass transit rail venues and large crowd public events. In another threat vector, an emerging need to determine if detection canines can be utilized in a meaningful way to detect persons with infectious diseases at U.S. border points of entry was validated in the 2016 DHS Integrated Process Team for Chemical and Biological Defense. Maintaining a large number of odors that canine teams must train with is resource intensive from both a manpower and fiscal perspective. The reduction in the number of odors required to maintain proficiency across the detection threat matrix would be a significant advancement and allow for improved training efficiency and detection proficiency. The lack of structured independent test and evaluation of detection canines in

their operational environment has increased uncertainty of the capability and proficiency of the detection canines throughout the HSE.

- **Solution:** Provide our customer base - TSA and the Homeland Security Enterprise (HSE) - with the tools, techniques, and knowledge to better understand, train, and utilize the detection canine, and improve proficiency of the DHS/HSE detection canine teams. Provide an enduring research and development capability to the Homeland Security Enterprise with a unique focal point and knowledge base for detection canines by establishing a scientifically rigorous, statistically significant approach for the detection canine community that is currently absent in the industry. The Program will provide regional reality-based events that will bring added value while enhancing canine teams' current capabilities. S&T will develop and test non-hazardous canine training aids to provide performance results equivalent to or better than performance on the actual threat material. S&T will provide the HSE, specifically the TSA National Explosive Detection Canine Team Program (NEDCTP), other DHS explosive canine team users and the first responder law enforcement canine community, with operational performance data to make decisions on improved concept of operations, techniques, and training. Lastly, through the inherent capabilities of laboratory and chemistry expertise established within the Program, S&T will bring scientific analysis and controlled testing of the combination of the refined odor sets and expanded knowledge base on basic canine olfaction and cognition. S&T will determine if significant efficiencies can be made to improve the operational performance of the detection canines while dramatically reducing the resources in time and cost needed to establish and maintain a high level of proficiency. The Program will partner with the DHS S&T Chemical and Biological Defense Program to develop and transition new and novel training aids for canine detection of biological hazards, infected people or infectious cargo in multiple settings, including at the borders.
- **Impact:** This Program establishes a Research, Development, Test and Evaluation (RDT&E) focal point for the HSE detection canine community. It improves the operational proficiency of DHS' and other HSE partners' fielded teams to more efficiently and effectively train and perform in the operational environment. Development of a formal testing capability and critical need training aids will significantly improve mission performance, lower lifecycle costs and expedite training and deployment of canine teams. The Program also provides a specific focus on determining the proof of concept for operational usefulness of the Person borne Improvised Explosive Device (PBIED) detection canine to protect the soft target realm of mass transit and large crowd events. The Program is creating a validated training and maintenance methodology for PBIED canines as well as determining the operational performance measures of effectiveness for the various threat types, concealment methods, crowd sizes and other operational parameters. The program is conducting this by establishing partnerships throughout the HSE to the national infrastructure.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	4,200	4,500	4,800	5,269	4,408
Obligations	3,652	4,415	4,341	724	

FY 2016 Key Milestone Events (Prior Year)

- Complete Odor Reduction proof of principle.
- Conduct operational assessments for person-search (mass transit, force protection, large crowd events), other TSA/partner testing.
- Determine operational performance parameters of person-search canine in large crowd venues.

FY 2017 Key Milestone Events (Year of Execution)

- Deliver results of the initial phase trained odor reduction testing conducted with TSA's Canine Training Center.
- Provide the results of TSA Passenger Screening canine operational assessment.
- Conduct feasibility assessment for the development of low-cost non-hazardous training aids for selected conventional explosives.
- Conduct Phase 2 prototype testing for canine mounted track and transmit device.

FY 2018 Key Milestone Events (Budget Year)

- Finalize commercialization of the second critical need non-hazardous peroxide-based explosive Canine Training Aid for use in the HSE.
- Complete qualitative analysis of initial series of regional canine events. Analysis will inform a better understanding of operational readiness, identify gaps, provide exposure to non-hazardous peroxide based explosive odor and validate storage and handling challenges.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
The program has sponsored the development of a state of the art laboratory capability to validate the presence of explosive chemical compounds down to a canine level of detection. This is a breakthrough for the scientific community who are focused on chemical analysis for trace detection machines and not for canine detection. The Massachusetts Institute of Technology / Lincoln Laboratory (MIT / LL) has published their findings in peer reviewed publications and has received recognition from the greater community of interest.	FY 2016 Q1	FY 2016 Q4
The program has developed an inherent capability for DHS/HSE to be able to test emerging threats to aviation (PEDS) and to the HSE (e.g. Inspire Magazine, Boston Marathon, threat concealments). The program has demonstrated its ability to respond in quick fashion with over two dozen regional canine teams at the request of Federal partners, such as the FBI, when intelligence warrants a comprehensive threat assessment.	FY 2015 Q2	FY 2016 Q1
Execution of Phase 2 Parametric testing of PBIED explosive detection canines in the operational environment. Phase 2 focus is on variations of explosive placements and concealments on the body. The findings of this phase of parametric testing will be used as a baseline to build upon in future phases of test and evaluation. In the interim, these findings have value to inform concepts of operations and risk mitigation based on probabilities of detection.	FY 2016 Q4	FY 2017 Q3
FY 2017		
The program has developed an independent test and evaluation (IT&E) process that has been deemed reliable by the Government Accounting Office as a benchmark for assessment of TSA's Passenger Screening Canine Program and by adjunct the greater Homeland Security Enterprise. The program will conduct numerous assessments for TSA, at their request, including their domestic Passenger Screening Canine (PSC) Program.	FY 2017 Q2	FY 2018 Q2
Conduct qualitative assessment and analysis of law enforcement	FY 2017 Q3	FY 2019 Q4

Research & Development Description	Plan Start Date	Planned Completion
explosive detection canine teams in an operational environment through the Regional Explosives Detection Dog Initiative (REDDI). Upon recursive execution, identify strengths and weaknesses and trends that validate current S&T R&D program and inform direction of investments going forward that address community need.		
FY 2018		
Execution of Phase 3 Parametric testing of PBIED explosive detection canines in the operational environment. Phase 3 focus is on variations of environmental conditions. The findings of this phase of parametric testing will be used as a baseline to build upon in future phases of test and evaluation. In the interim, these findings have value to inform concepts of operations and risk mitigation based on probabilities of detection.	FY 2018 Q1	FY 2019 Q4

Type of Research

Applied

Technical Readiness Level

- The program plans to begin at TRL 5 and end at TRL 7.

Transition Plans

- **Training Aids**
 - Delivered canine training aids for TSA regional rollout for homemade explosives detection.
 - Transferred Government owned design and manufacturing methodology to third party manufacturer.
 - Provide RFP to industry.
 - Integrate into TSA canine training aid acquisition programs.
- **Operational Test and Evaluation (OT&E)**
 - Results are guiding operational deployment decisions by TSA and HSE.
 - Inform TSA Passenger Screening Canine testing to support risk-based screening-managed inclusion (RBS-MI) deployment.
 - Increased partner evaluation of first responder proficiency of canines using non-hazardous training aids.

- Results inform U.S./UK sharing for recent aviation threat vector.
- Results inform TSA policy decisions for TSA air cargo screening with Remote Explosive Scent Tracing/Remote Air Sampling for Canine Olfaction (REST/RASCO) methods.

Checked Baggage

- **Problem:** TSA needs enhanced explosive detection systems (EDS) to detect the full array of potential improvised explosives threats in checked baggage. Modifying existing equipment to address these threats would result in greatly increased false alarm rates and an increase in operating costs.
- **Solution:** In collaboration with TSA, S&T is developing next generation X-ray systems that incorporate enhanced measurement techniques, novel detection algorithms, subsystem retrofits, and new standalone systems. There is a focus on collaboration between different performers to develop these innovative systems, relying in part, on the advancements produced by the Defense Advanced Research Projects Agency's Knowledge Enhanced Compressive Measurement (KECoM) program. The Checked Baggage program invests in high-performing enabling technologies that will be migrated into next generation checkpoint screening equipment.
- **Impact:** These next generation X-ray systems are anticipated to provide TSA with enhanced threat detection capabilities, improved onscreen alarm resolution, lower false alarm rates (below 10 percent), and reduced lifecycle costs, allowing TSA to be more efficient and effective.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	21,700	19,400	11,069	9,000	7,000
Obligations	20,174	14,149	10,088	498	

FY 2016 Key Milestone Events (Prior Year)

- Deliver X-ray diffraction based (XRD) hold baggage screening system prototype.
- Deliver System Design Document.
- Finalize Topological Data Analysis (TDA) Tool Application Tutorial document.
- Complete TeleSecurity Science's Final Classification and Metrics Review.
- Deliver General Electric (GE) Global's System Design Document.
- Deliver GE Global's software tool kit.

- Complete live demonstration of Quantum Magnetic's (QM) Partially Observable Markov Decision Process (POMDP).
- Deliver QM's System Design Document.
- Complete QM's Final Architecture and Critical Design Review.
- Complete AQT Critical Design Review and Final Trade Study.
- Deliver AQT System Design Document.
- Complete Rapiscan's Critical Design Review and Final Trade Study.
- Deliver Rapiscan DHS Facility Test Plan.
- Deliver initial Nottingham Trent University (NTU) Functional Test Bed and Final Technical Report.
- Deliver initial American Science & Engineering (AS&E) Functional Test Bed and Final Technical Report.
- Deliver GE Global Research Characterization Report, Software Toolkit and Monolithic Optic Design.
- Deliver Battelle initial Test Kit Articles that will lead into manufacturing of production test sets.

FY 2017 Key Milestone Events (Year of Execution)

- Release Amendment to Apex Screening at Speed Broad Agency Announcement to include Advanced X-ray Systems Development Technical Topic Areas.
- Award a minimum of two contracts at Transition Readiness Level 5-7.
- Transition one Next Gen Checked Baggage solution (TRL 6-7) to either Systems development or to TSA OSC/OSO (FY 2016).
- Deliver one advanced algorithm for existing Explosives Detection System (EDS) or Advanced Technology (AT) systems.
- Develop a functional and testable X-ray diffraction explosive detection system suitable for acquiring data at government test facilities.
- Demonstrate enhanced materials discrimination using technologies developed under Broad Agency Announcement 13-05 projects.

FY 2018 Key Milestone Events (Budget Year)

- Award up to three contracts developing advanced X-ray architecture, algorithms, and components on the Broad Agency Announcement.
- Conduct system concept review.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Next Generation X ray Diffraction Imaging.	FY 2016 Q4	FY 2017 Q2
HALO X-Ray Imaging PhaseII (build pre-prototype EDS system based on Phase I design, modeling, and architecture).	FY 2016 Q4	FY 2017 Q3
Advanced Material Discrimination X-ray Architectural Design Concepts Phase II.	FY 2016 Q4	FY 2017 Q3
FY 2017		
Advanced X-ray Systems Development Phase I Awards - Intial awards for BAA 17-03 phased in order to determine abiliity for prototype development at TRL 4 and progression to TRL 6-7 in a 24 month period. This will include preliminary and critical design reviews.	FY 2017 Q2	FY 2018 Q2
FY 2018		
Advanced X-ray Systems Development Phase I Awards - Remaining awards for BAA 17-03, phased in order to determine abiliity for prototype development at TRL 4 and progression to TRL 6-7 in a 24 month period. This will include preliminary and critical design reviews Number of awards will be reduced from eight to three.	FY 2018 Q3	FY 2019 Q2
Conduct system concetp reivew.	FY 2018 Q1	FY 2018 Q3

Type of Research

Developmental

Technical Readiness Level

The program plans to begin at TRL 5 and end at TRL 7.

Transition Plans

- Develop a fully functional and testable X-ray diffraction explosive detection system suitable for acquiring data at airports and government test facilities. Prototype will be subject to independent certification readiness testing and preliminary operational evaluation at TSA's Transportation Systems Integration Facility. Effectiveness of product will be proven to TSA.
- Demonstrate enhanced materials discrimination using technologies based on Defense Advanced Research Projects Agency/Knowledge Enhanced Compressive Measurement (DARPA/KECOM) and University Research Programs. Perform

independent readiness testing to determine detection, identification, and false alarm performance characteristics. Complete trade study analysis of probability of detection, probability of false alarm.

- Development spirals will be coordinated with TSA's recapitalization plans ensuring smooth and timely technology insertion.

Primary Screening for Passengers

- **Problem:** Current people screening technology is not fast enough nor does it automatically detect all of the threats that operational components require. Current technology and processes require people to remove items from their pockets, remove outerwear, pause, and wait for results. For example, passenger screening involving current Advanced Imaging Technology (AIT) is slow and cumbersome. It requires passengers to remove shoes, outerwear, belts, jewelry, and personal items, which must then be screened by X-ray or other screening devices or procedures. Relatively high false alarm rates result in secondary inspections such as pat-downs or trace analysis. Other issues include high operational costs, privacy concerns, and the potential dissatisfaction of the traveling public.
- **Solution:** This Program will develop people screening technologies that are safe, provide higher resolution scans, and have better automated targeting algorithms. These systems will substantially reduce the need for divestiture of shoes, headwear, outerwear, and small personal items. Novel approaches to solving these problems include a Prize Competition to develop improved algorithms for an S&T-developed next-generation AIT. New capabilities under development for AIT systems include the ability to screen passengers while they walk, the ability to screen through bulky outerwear and shoes, and alternative frequency bands that acquire depth information to better image in three dimensions. Such approaches will provide higher screening throughput, improved imaging resolution, and richer signatures that enable detection at TSA's highest tier (i.e., can detect more challenging threats). New systems will be compatible with end-user standards and systems such as TSA's Security Technology Integration Program (STIP) and Dynamic Aviation Risk Management System (DARMS) standards.
- **Impact:** When integrated with other advanced checkpoint technologies, these systems will provide a faster, less invasive, and less costly screening of passengers. Limited divestiture will decrease passenger inconvenience and increase checkpoint throughput. Systems with material discrimination will confirm whether suspect items are potentially harmful or benign, reducing the rate of pat-downs and other intrusive security measures.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	9,957	6,000
Obligations	-	-	-	2,122	

FY 2017 Key Milestone Events (Year of Execution)

- Conduct Preliminary Design Reviews for systems selected for development for high-throughput screening at TSA's highest security standards.
- Demonstrate alpha prototype for stand-off passenger screening with reduced divestiture of clothing. Complete at least two Preliminary Design Reviews for systems selected for development for high-throughput screening at TSA's highest tier security standards.

FY 2018 Key Milestone Events (Budget Year)

- Receive a laboratory prototype for a walking-speed passenger screening system with reduced passenger divestiture requirements.
- AIT Algorithm Prize Competition Review and Award.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Person Screening Technology method alternative analysis	FY 2016 Q4	FY 2017 Q4
Person Screening Technology prototype requirements	FY 2016 Q4	FY 2017 Q3
FY 2017		
Preliminary Design Review for Passenger Screening	FY 2017 Q1	FY 2017Q1
Person Screening Technology laboratory prototype development	FY 2017 Q4	FY 2018 Q4
AIT Algorithm Prize Competition planning	FY 2017 Q1	FY 2017 Q2

AIT Algorithm Prize Competition development time	FY 2017 Q2	FY 2018 Q1
Complete Analysis of Alternatives for System Architecture	FY 2017 Q4	FY 2017Q4
FY 2018		
AIT Algorithm Prize Competition Review and Award	FY 2018 Q1	FY 2018 Q1

Type of Research

Applied

Technical Readiness Level

The program plans to begin at TRL 3 and end at TRL 7.

Transition Plans

- The Program team will continue working closely with customers, DHS S&T's Integrated Product Teams (IPTs) and Joint Requirements Council (JRC) to ensure that system requirements comply with customer needs.
- Screening device development spirals will be coordinated with TSA's recapitalization plans ensuring smooth and timely technology insertion.

Primary Screening for Carry-On Baggage

- **Problem:** TSA's primary screening of carry-on bags and other personal items is slow, labor-intensive, and subject to significant operator performance variability. Passengers must remove large electronics, liquids, and gels from their bags. As emerging threats compel TSA to add more threats to the detection requirements, the added complexity substantially increases false alarm rates. This high false alarm rate requires Transportation Security Officers (TSOs) to scrutinize on-screen images with even greater vigilance, resulting in lower passenger throughput and greater TSO fatigue.
- **Solution:** S&T will develop modular, dynamically upgradable carry-on baggage screening technologies to improve detection capability and increase passenger throughput, while maintaining or improving life cycle costs which is complementary to the Apex Screening at Speed program. Specifically, this project will deliver carry-on baggage screening systems with Automated Target Recognition (ATR) for both explosives and other prohibited items. Technologies under development include X-ray systems that incorporate X-ray diffraction computed tomography, and/or energy-resolved detectors for enhanced material discrimination. These enhancements are critical to develop hardware and software that more effectively screens carry-on baggage that includes commonly carried items such as bottles and personal electronic devices, without the need to remove them from baggage. Risk- and threat-specific performance will be possible by developing carry-on screening equipment compatible with TSA's Security Technology Integration Program (STIP) and Dynamic Aviation Risk Management System

(DARMS) initiatives. Primary Screening for Carry-On Baggage will seek novel technologies and techniques complementary to other explosives detection efforts, most notably Primary Screening for Passengers, Apex Screening at Speed, and Secondary Screening Technology Development.

- **Impact:** Improved carry-on baggage screening technologies will automatically and reliably identify explosives and other prohibited items, enabling TSOs to focus on resolving alarms and assisting passengers through the process. The systems will detect a wider range of prohibited items in carry-on baggage and have lower false alarm rates. TSA will be able to dynamically adjust the performance of the systems to address known risks or emerging threats. When integrated with other advanced checkpoint technologies, these systems will provide faster, less invasive and less costly screening of passengers and their carry-on items.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	6,609	4,000
Obligations	-	-	-	0	

FY 2017 Key Milestone Events (Year of Execution)

- Complete at least two Preliminary Design Reviews for systems selected for development for high-throughput screening at TSA's highest tier security standards.

FY 2018 Key Milestone Events (Budget Year)

- Deliver X-ray diffraction (XRD) system prototype for carry-on baggage screening to discriminate threats among various liquids, gels, and aerosols.
- Test and evaluation of novel X-Ray diffraction screening system.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Design and review of novel phase contrast screening system.	FY 2017 Q1	FY 2017 Q3
FY 2018		
Test and evaluation of novel X-Ray diffraction screening system.	FY 2017 Q3	FY 2018 Q2
Phase contrast data collection on threats and simulants.	FY 2017 Q4	FY 2018 Q1
Analyze and report phase contrast data. Refine X-ray diffraction prototype design.	FY 2018 Q1	FY 2018 Q3

Type of Research

Applied

Technical Readiness Level

The program plans to begin at TRL 3 to 5 and end at TRL 7.

Transition Plans

- The Program team will continue working closely with DHS S&T's Integrated Product Teams (IPTs) and Joint Requirements Council (JRC) to ensure that system requirements comply with customer needs.
- Screening device development spirals will be coordinated with TSA's recapitalization plans ensuring smooth and timely technology insertion.

Training and Performance Optimization (formerly Screening Training and Selection)

- **Problem:** The efficiency and effectiveness of first responders and those on the front lines of national security is directly related to the preparedness and robustness, capacity for rapid recovery, and adaptability achieved in training. Improved training, including associated materials, methods and tools and technologies lead to increased operational capabilities in the field and results in more efficient and effective DHS end users, federal, state and local stakeholders and the general public, when responding to local, national or international disasters or emergencies.
- **Solution:** S&T will work across DHS components and the first responder community to identify common capability gaps and operational needs that can be addressed through improved training methods, tools and technologies. These DHS end users and

first responders require training that leverages the latest cutting edge training methods and innovative technologies to ensure their skills are flexible to respond under a variety of conditions, thereby making them more prepared and resilient, and increasing national security. Improved training in areas such as the underlying components of decision making (e.g., perceptual skills, critical thinking, alternate option weighing) are critical, particularly when such critical decision making is required under uncertainty within a time-constrained or hazardous environment. Improving training and optimizing the performance of first responders and those on the front lines of national security technologies will include maximizing human performance as well optimizing the integration of humans with the systems they use, whereby the collective synergy will be optimized to improve operational efficiency, effectiveness and overall national security.

- **Impact:** Providing DHS Enterprise end users and first responders with improved training methods, technologies and tools will result in operational performance increases in those individuals and an increase in national security. More effective and efficient training improves performance and is directly correlated to increased preparedness, robustness, capacity for rapid recovery, and adaptability.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	501	500	500	1,033	1,033
Obligations	460	461	418	0	

FY 2016 Key Milestone Events (Prior Year)

- N/A

FY 2017 Key Milestone Events (Year of Execution)

- N/A

FY 2018 Key Milestone Events (Budget Year)

- Conduct study to determine the pressure and patterns involved in law enforcement pat down procedures. Create new prototype pat down suits that can be transitioned for a training effectiveness evaluation.
- Conduct at least two Training Effectiveness Evaluations (TEEs) at locations TBD for wearable pat down training prototypes.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Development of prototype mannequins for PATT-M and PATT-F.	FY 2017 Q1	FY 2017 Q4
Fully Integrated Unit with Physical Characteristics and Software.	FY 2017 Q1	FY 2017 Q4
Implementation and Transition Plan development.	FY 2017 Q1	FY 2018 Q1
Training Effectiveness Evaluation of PATT-M and PATT-F.	FY 2017 Q4	FY 2018 Q1

Type of Research

Basic

Technical Readiness Level

TRL 4

Transition Plans

8 PATT-M and 8 PATT-F systems will transition to TSA Office of Security Capabilities (OSC), Office of Training and Workforce Engagement (OTWE), and Office of Security Operations (OSC) at TSA Headquarters.

Secondary Screening Technology Development

- Problem:** DHS components (i.e., TSA, USSS, CBP, and U.S. Coast Guard) use Explosives Trace Detectors (ETDs) as a screening tool for detection of explosives. The ETDs' ability to detect evolving explosive threats requires an expandable and upgradable explosive threat library. Current ETDs have limited ability to expand their threat libraries. Sampling efficiency of these ETDs is also limited by current Concepts of Operations (CONOPs, mostly contact sampling) and by Transportation Security Officers (TSOs) training and training curriculum.
- Solution:** To increase ETDs' detection capabilities, the Secondary Screening Technology Development program develops Next Generation (Next Gen) ETDs with more easily upgradable and expandable threat library that can selectively identify current and emerging explosives. New capabilities are sought with smaller, more portable ETDs while keeping costs as low as possible. Concurrently, the Program seeks to increase ETD sensitivity by developing novel sampling technologies with higher collection efficiency and training tools to help increase TSOs explosives sampling proficiency.

- **Impact:** Novel detection capabilities and improved sampling technologies and methods enable ETD operators to optimize ETDs for detecting current and future explosive threats. Short-term impact includes developing Advanced Itemiser DX retrofit kits that provide ETD operators with improved explosives detection capability and provide TSA with an option to retrofit currently deployed ETDs. For mid- and long-term impact, Next Gen ETDs, in combination with enhanced sampling technologies, will provide TSA and other DHS components with the ability to quickly detect and identify emerging threats. These ETDs will be lighter, smaller, use fewer consumables, and have lower life-cycle costs than currently deployed ETDs. In addition, the Program's Supporting Sciences effort is developing knowledge products and test and evaluation tools for supporting TSA's interest in developing non-contact explosives vapor/particulate detection standards.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	5,343	5,200
Obligations	-	-	-	719	

FY 2017 Key Milestone Events (Year of Execution)

- Demonstrate a prototype's ability to produce three-dimensional transmission, diffraction, phase and/or dark-field X-ray data useful for security screening.
- Test and develop a retrofit (ETD kit for enhanced explosives detection)
- Conduct Developmental Test and Evaluation of High Performance Ion Mobility Spectrometry - Mass Spectrometry ETD prototypes.
- Conduct Developmental Test and Evaluation of Triple Quadrupole Mass Spectrometry ETD.
- Conduct Critical Design Review of an ETD with integrated non-contact sampler.
- Conduct quarterly meetings of Working Group for Sample Preparation Standards and Methods for operationally relevant testing of screeners for residual explosives using optical detection.

FY 2018 Key Milestone Events (Budget Year)

- Conduct Critical Design Review of a High Throughput In-Line ETD Screener for checked baggage.
- Conduct Developmental Test and Evaluation at TSL of Non-contact High Volume Vapor and Particle Sampler prototypes.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
DT&E of three retrofit ETD kits. This DT&E was conducted in collaboration with DHS Transportation Security Lab. The prototypes were tested and evaluated on their detection capabilities against conventional and homemade explosives. DT&E testing showed the temperature-ramping thermal desorber in this Adv IT-DX retrofit provided an expanded threat library capability.	FY 2016 Q4	FY 2017 Q1
DT&E of IMS–MS ETDs. This DT&E will be conducted in collaboration with DHS Transportation Security Lab. The prototypes are tested and evaluated on their detection capabilities against conventional and homemade explosives. Special emphasis is placed on the IMS' ability to detect and route analytes of interest to the Mass Spec and the Mass Spec engine's ability to confirm identities of conventional and homemade explosives.	FY 2017 Q3	FY 2017 Q3
FY 2018		
Critical Design Review (CDR) of an integrated Non-particle Vapor Sampler. This CDR will focus on evaluating detailed design of the non-contact sampler including hardware and software, explosives detection performance, and systems tradeoffs and rationales. The CDR will focus on whether non-contact samplers can enhance explosives sampling efficiency and extend Concepts of Operations (CONOPs) for Transportation Security Officers.	FY 2017 Q4	FY 2018 Q1
DT&E of Triple Quad MS ETDs. This DT&E will be conducted in collaboration with DHS Transportation Security Lab. The prototypes are tested and evaluated on their detection capabilities against conventional and homemade explosives. Special emphasis is placed on the Mass Spec engine's ability to confirm identities of conventional and homemade explosives.	FY 2017 Q4	FY 2018 Q1
DT&E of Non-contact High Volume Vapor and Particle Sampler. This DT&E will be conducted in collaboration with DHS Transportation Security Lab. The prototypes are tested and evaluated on their detection capabilities against conventional and homemade explosives and their throughput of screening passengers and carry-on bags at checkpoints.	FY 2017 Q4	FY 2018 Q3

Type of Research

Applied

Technical Readiness Level

The program plans to begin at TRL 3 and end at TRL 7.

Transition Plans

The Program currently has representatives from TSA, USSS, CBP, and US Coast Guard reviewing developmental goals and progress of the ETD prototypes. Pending successful development of the ETD prototypes, the Secondary Screening Technology Development is working to develop Transition Plans with these representatives. With regard to the Advanced Itemiser DX ETD retrofit project, the Program Manager is in the process of coordinating with the TSA Office of Requirements and Capabilities Analysis (ORCA) and TSA Office of Acquisition Program Management (OAPM) to debrief them on the potential of this new capability.

Surface Transportation Explosive Threat Detection (STETD) Program

- **Problem:** Current security capabilities for screening people and baggage in surface transportation environments are extremely limited. The unique requirements of the surface transportation end-user community drives the need for an open system with no fixed checkpoints, extremely high throughput, and an unalterable existing infrastructure within which technologies for explosives detection must fit. Developing these capabilities necessitates a dedicated program to address vulnerabilities to terrorist attack.
- **Solution:** Develop intelligent video capabilities to automatically detect and rapidly assess leave behind packages, continue the evaluation of advanced security technologies for surface transportation applications, provide the surface transportation end-user community with a layered and integrated capability to detect and mitigate explosive threats, develop a system capable of detecting Person-borne (PB) and Leave-behind (LB) Improvised Explosive Devices (IED) in a surface transportation environment during rush hour without impeding passenger throughput, and develop high throughput/high-speed anomaly detection technologies [Active millimeter wave (mmW), intelligent video (IV) algorithm, etc.] to provide rapid screening of passengers.
- **Impact:** The program will develop next generation security technology to screen people for threats in the high-throughput environment of surface transportation systems. The program will also deliver assessments of COTS/near-COTS and emerging “state-of-the-art” technologies that have potential to address security vulnerabilities within the surface transportation environment. The result will address a vulnerability by providing affordable solutions for mitigating the explosive threat for the surface transportation end-user community.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	-	4,000
Obligations	-	-	-	-	

FY 2018 Planned Key Milestone Events (Budget Year)

- Conduct lab testing of prototype mmW imager to gauge effectiveness of preliminary integration of image exploitation algorithms for automatic target recognition.
- Conduct DT&E of mmW Flat Panel Imaging Array technology in simulated operational environment to determine limits of detection performance in operational environment and impact to end-user.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Integrate IV algorithm into FOVEA tool suite demonstrating automated detection and end-user cueing.	FY 2018 Q1	FY 2018 Q2
Development of non-divested image exploitation algorithm and integration with prototype mmW imager to scan traveling public and their belongings without slowing throughput.	FY 2018 Q1	FY 2018 Q3
Conduct simulation and analysis of layered sensing configurations for layered architecture prototyping effort to optimize sensor placement and system performance.	FY 2018 Q2	FY 2018 Q4

Type of Research

Developmental

Technical Readiness Level

Project begins at TRL5 and ends at TRL7.

Transition Plans

DT&E and OT&E will be conducted with surface transportation end-users within TSA OCRA Mass Transit Test Beds. When technologies reach appropriate maturity, they will be added to the approved grant list for purchase by surface transportation authorities.

5. Counter Terrorist – FY 2017 Annualized Continuing Resolution: \$99.506M. FY 2018 Request: \$81.051M. S&T invests in the R&D technologies, methods, and procedures to counter terrorists. Efforts include R&D to identify individuals or groups that intend to conduct terrorist attacks or to illicitly move weapons, dangerous goods, and contraband. It also includes providing threat assessments of the high-consequence attack methods such as CBE that terrorists may use to attack the Nation.

Bioagent Threat Assessment – FY 2017 Annualized Continuing Resolution: \$23.628M. FY 2018 Request: \$16.369M. This program addresses biological knowledge gaps and develops defensive strategies to counter potential threats. It also supports a full spectrum of knowledge products (e.g., reports/studies) to better inform policy makers on the attributes, risks, and consequences associated with the intentional release of a biological agent.

Biological Terrorism Risk Assessment (BTRA)

- **Problem:** The Homeland Security Enterprise (HSE) needs to prevent, protect, mitigate, respond and recover from biological terrorism with limited resources. Homeland Security Presidential Directive 10 (HSPD-10) outlines the need for the comprehensive analysis of our nation's biothreat defenses to help inform investments for national strategic biodefense planning, while identifying key knowledge and capability gaps and also evaluating critical vulnerability mitigation strategies.
- **Solution:** The BTRA program produces periodic risk assessments that estimate terrorism risk as the probability of an attack occurring, and the consequences of an attack, should it occur. It incorporates the judgments of the intelligence and law enforcement communities with input from the scientific, medical, and public health communities to integrate risk as a function of threat, vulnerability, and consequences. This project responds to the needs of interagency partners by enhancing reliance on national strategic guidance to frame the problem space; redesign the analytic process to ensure maximal partner input; and refining, updating, and validating BTRA models. A variety of rapid analysis tools are being developed to allow users to explore a variety of CONOPS and make judgments for scenarios that merit further investment to reduce risk.
- **Impact:** The BTRA informs decision-making and shapes resource allocations across HSE. The BTRA program provides data, models, tools, and analyses to evaluate and compare the potential benefits of various strategies across the biodefense solution space, and provides decision support to guide investments that lower risk of a bioterrorist attack.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	4,072	3,800	2,000	2,000	2,000
Obligations	3,468	2,882	1,670	233	

FY 2016 Key Milestone Events (Prior Year)

- CAPT-Bio V 1.0 was released, and transitioned to Joint Task Force Civil Support to help them develop their planning exercises
- CBRN Economic Consequence Model development was initiated to improve the economic consequence estimates for the TRAs.

FY 2017 Key Milestone Events (Year of Execution)

- Completion of the economic consequence model, and integration into BTRA results. A BTRA 5.1 analysis will be completed that estimates economic consequences of all attack scenarios.
- Development of an interactive Content Management System (CMS) to provide a central information hub on Homeland Secure Data Network (HSDN) and Joint Worldwide Intelligence Communications Systems (JWICS).

FY 2018 Key Milestone Events (Budget Year)

- Incorporate the economic consequence model into the BTRA analyses.
- Create a Content Management System (CMS) for interactive operability with end-users

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
BTRA 5.0 Draft Results Review	FY 2016 Q3	FY 2016 Q3
FY 2017		
BTRA 5.0 Final Report	FY 2017 Q1	FY 2017 Q2
BTRA 5.0 Tailored Assessments	FY 2017 Q3	FY 2017 Q3
BTRA 6.0 Initiation	FY 2017 Q2	FY 2017 Q3
BTRA 6.0 Data Review	FY 2017 Q4	FY 2018 Q1
BTRA 6.0 Model Review	FY 2017 Q4	FY 2018 Q1
FY 2018		
BTRA 6.0 Intelligence Survey	FY 2018 Q1	FY 2018 Q4
BTRA 6.0 Draft Results Review	FY 2018 Q3	FY 2018 Q3

Type of Research

Development

Technical Readiness Level

N/A: Periodic delivery of Knowledge Products.

Transition Plans

The BTRA tools and products will be transitioned to stakeholders and customers with DHS and across the interagency, as requested. The tools to be transitioned will be:

- Risk Visualization Tool (RiViT)
- Biological Countermeasure Analysis and Planning Tool (Bio CAPT)
- Content Management System (CMS)

The products to be transitioned will be:

- Pre-harvest agro-terrorism risk model report, data, and results of analyses
- Subway 2.0 Model Report
- Economic 2.0 model report
- UAV Model Report
- BTRA 5.1
- BTRA 6.0

Biodefense Knowledge Center (BKC)

- **Problem:** Customers from around the HSE require vetted information, knowledge and expertise to help them make decisions that involve biological sciences and biological threats. HSE customers' information and decision needs vary considerably across DHS Components, multiple Federal, State, and local agencies.
- **Solution:** The Biodefense Knowledge Center is an enduring DHS center of expertise, with knowledge products that bridge science, technology, intelligence, health threats, and law enforcement. BKC provides customer requested biothreat and bioscience assessments as well as in-depth analyses of biodefense issues and biotechnologies. Its key assessments and analytical products include: in-depth analyses of genomic and advanced biothreats; biological threat agent fact books; a knowledge management system available at multiple levels of classification, which extracts, hosts and analyzes information for multiple Federal, State, and local users.
- **Impact:** The Biodefense Knowledge Center increases the awareness and understanding of biological threats across the HSE at multiple levels of classification. This project increases the probability of preventing and minimizing the impact of biological

threat attacks. The BKC helps generate and develop requirements for CBD's Biological Threat Characterization Program and for other biodefense efforts within the homeland security enterprise.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	6,000	4,500	3,000	3,000	3,000
Obligations	6,070	4,605	5,092	0	

Prior Year Key Events

- Published final MTA 2.0 (Ba) – 720 agent use scenarios; intelligence elicitation and overlay; main report plus seven appendices; multi-venue exposure modeling (indoor, outdoor, subway).
- Published survey of mission-relevant unmanned aerial vehicles in support of USG characterization and research initiatives.
- Hosted Sequences of Interest database in the Biodefense Knowledge Management System (BKMS).
- Deployed chem-bio digital forensics capabilities at two DHS Fusion Centers in California.

Current Year Key Events

- Deploy pathogen genomic alignment toolset and metadata analysis capability for the DHS Sequences of Interest database.
- Complete two in-depth technical analyses of biothreat capability pathways for biodefense community.
- Integrate >300M genomic records, 50M biodefense-related genomic reports, >2M full-text scientific articles and >750K new reports per quarter from >15 interagency data sources for biodefense community analysis on unclassified and classified BKMS networks.

Budget Year Key Events

- Develop novel genomic analysis capabilities for biothreat pathways identified previous year.
- Deploy advanced biothreat pathway visualization capabilities and dynamic tracking for emerging biotechnologies and impact of scientific information.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Expand use of BKMS as trusted third party review of government biothreat research programs within and outside DHS.	FY 2017 Q1	FY 2017 Q4
Update scientific and sensitive holdings in the Biodefense Knowledge Management System for the biodefense community.	FY 2017 Q1	FY 2017 Q4
Host databases and tools relevant to understanding and preventing biothreats in the genomic age	FY 2017 Q1	FY 2017 Q4
Collaborate with FBI on instantiation of digital forensics capability	FY 2017 Q1	FY 2017 Q2
Maintain BKMS and GKC to support Chem Bio Defense, as well as stakeholder requests and reach back support	FY 2017 Q1	FY 2017 Q4

Type of Research

Development

Technical Readiness Level

N/A

Transition Plans

Make technical reports available to users across the Homeland Security Enterprise via the Biodefense Knowledge Management System.

Bio-threat Characterization (BTC)

- **Problem:** The HSE lacks essential data on the characteristics of many biological threat agents, and the impact of technological advances on those characteristics. Improved data is needed to estimate the risk and consequences of a bioterrorist attack on the U.S., and to operationally plan for and respond to such an event.

- **Solution:** BTC projects provide knowledge products (technical reports) generated through laboratory experimentation describing the properties of potential bioterrorism agents that influence assessments of consequences and risk. Knowledge products are made available to U.S. Government biological hazard assessment, policy, and modeling communities and to operational elements for use in planning for and responding to natural and intentional disease outbreaks.
- **Impact:** The BTC project establishes and leverages innovative science-based capabilities to provide the HSE with data and knowledge products which improve pre-event planning and event-specific operational decisions. BTC provides the knowledge products and capabilities required for effective preparedness and response to current and future biological threats.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	14,000	11,400	18,400	16,628	9,369
Obligations	13,953	10,498	23,513	11,663	

FY 2016 Key Milestone Events (Prior Year)

- Develop plans and experimentation to address additional traditional biological threat-related knowledge gap requirements identified by stakeholders to provide actionable information.
- Address additional critical knowledge gaps on the production, formulation, dissemination, persistence, and virulence of Tier 1 biological threat agents to support the Biological Terrorism Risk Assessment (BTRA) program and other government stakeholders responsible for biodefense preparedness and response. Transition six knowledge products to the BTRA program for utilization in modeling bioterrorism risk.

FY 2017 Key Milestone Events (Year of Execution)

- Develop projects and experiments to address additional traditional biological threat-related knowledge gap requirements identified by stakeholders to provide actionable information.
- Address at least three critical knowledge gaps on the production, dissemination, persistence, and virulence of Tier 1 biological threat agents to inform the Biological Terrorism Risk Assessment (BTRA) program, as well as, other government stakeholders responsible for biodefense preparedness and response.

FY 2018 Key Milestone Events (Budget Year)

- Provide flexible and agile Biological Threat Characterization capabilities to execute national security priority initiatives in

support of DHS and the HSE that provide timely and high quality data on the characteristics of biological threat agents and technologies to support informed policy and decision-making before, during, and in response to a biological incident.

- Produce and deliver knowledge products addressing high priority knowledge gaps along the attack pathway (i.e., agent acquisition, production and processing, storage stability, dissemination, persistence, and infection/intoxication, disease and treatment in appropriate models) for biological agents to inform and improve DHS and national consequence and risk assessment efforts (e.g., the DHS Biological Terrorism Risk Assessment), DHS and HSE biodefense strategy and policy development

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
NBACC Annual Plan review	FY 2016 Q1	FY 2016 Q2
NBACC Annual Plan execution	FY 201 6Q2	FY 2017 Q2
NBACC Final Reports	FY 2017 Q2	FY 2017 Q3
BTCP Projects execution	FY 2016 Q1	FY 2016 Q4
BTCP Projects next year planning	FY 2016 Q3	FY 2016 Q4
BTCP Projects review final reports	FY 2016 Q4	FY 2017 Q1
BTCP Yearly Project (portfolio) Review	FY 2016 Q3	FY 2016 Q4
FY 2017		
NBACC Annual Plan review	FY 2017 Q1	FY 2017 Q2
NBACC Annual Plan execution	FY 2017 Q2	FY 2018 Q2
NBACC Final Reports	FY 2018 Q2	FY 2018 Q3
BTCP Projects execution	FY 2017 Q1	FY 2017 Q4
BTCP Projects next year planning	FY 2017 Q3	FY 2017 Q4
BTCP Projects review final reports	FY 2017 Q4	FY 2018 Q1
BTCP IPT Projects execution	FY 2017 Q1	FY 2017 Q4

Research & Development Description	Plan Start Date	Planned Completion
BTCP IPT Projects next year planning	FY 2017 Q3	FY 2017 Q4
BTCP IPT Projects review final reports	FY 2017 Q4	FY 2018 Q1
BTCP Yearly Project (portfolio) Review	FY 2017 Q3	FY 2017 Q4
FY 2018		
BTCP Projects execution	FY 2018 Q1	FY 2018 Q4
BTCP Projects next year planning	FY 2018 Q3	FY 2018 Q4
BTCP Projects review final reports	FY 2018 Q4	FY 2019 Q1
BTCP IPT Projects execution	FY 2018 Q1	FY 2018 Q4
BTCP IPT Projects next year planning	FY 2018 Q3	FY 2018 Q4
BTCP IPT Projects review final reports	FY 2018 Q4	FY 2019 Q1
BTCP Yearly Project (portfolio) Review	FY 2018 Q3	FY 2018 Q4

Type of Research

Applied

Technical Readiness Level

N/A: Enduring capability that results in periodic delivery of Knowledge Products.

Transition Plans

BTC regularly delivers/transitions the knowledge and insight produced through laboratory studies through reports delivered to the DHS/S&T Bioterrorism Risk Assessment, and shared with the HSE, including the Intelligence Community and the Department of Defense through the Biodefense Knowledge Management System (BKMS) and other information portals. These reports and knowledge products provide the essential technical foundation for confidence in both DHS and national consequence and risk assessments, enable policymakers to establish technically informed and sound policy, and enable decision makers to appropriately prioritize biodefense spending on medical and non-medical countermeasure acquisition programs that cost the Government billions of dollars.

Integrated CBRN Terrorism Risk Assessment (ITRA)

- **Problem:** The HSE has a need to effectively manage and administer limited resources that contribute to U.S. national preparedness for the risks of Chemical, Biological, Radiological, and Nuclear (CBRN) terrorism. In order to fulfill this mission, decision-makers require information related to potential threats and risks posed by CBRN terrorism.
- **Solution:** Homeland Security Presidential Directive 18 (HSPD-18) directs the S&T Directorate to prepare an Integrated Chemical, Biological, Radiological, and Nuclear Terrorism Risk Assessment (ITRA) on a biennial basis to provide decision-makers with information on the relative risks associated with all-CBRN terrorism. The ITRA program addresses this requirement through the consolidation and integration of the S&T Directorate's standalone risk assessments, namely, the Chemical Terrorism Risk Assessment (CTRA), Biological Terrorism Risk Assessment (BTRA), and Radiological/Nuclear Terrorism Risk Assessment (RNTRA). As a consolidation of the full spectrum of CBRN risks, the ITRA is uniquely positioned to provide information on the most efficient and cost-effective prevention, preparation and mitigation options across the Homeland Security Enterprise.
- **Impact:** The ITRA program improves senior government leadership decision-making by providing risk information and decision support tools to guide and prioritize resource allocation and investments that lower the risks of CBRN terrorism. More specifically, the ITRA program generates data, models, tools, and analyses that allow decision-makers to evaluate and compare the potential benefits of risk mitigation strategies that have tangible strategic, operational, and tactical impact across the CBRN defense solution space.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	3,800	3,800	2,000	2,000	2,000
Obligations	3,549	3,219	2,450	0	

FY 2016 Key Milestone Events (Prior Year)

- Delivered the CBRN Risk Visualization Tool (RiViT).
- Complete and deliver the Final ITRA 3.0 Report.

FY 2017 Key Milestone Events (Year of Execution)

- Deliver first iteration of the Mitigation Optimization Net Assessment (MONA) methodology. MONA will increase the utility and function of the ITRA results by serving as the foundation for delivering risk-mitigation planning tools for end users.

- Update Adversary Decision Model (ADM) by developing Adversary Capabilities Levels (ACLs). The ACLs are a list of attributes that are used to describe an adversary type or class. These attributes will then be populated with data to be used by the ADM to determine the choices an adversary is likely to make.

FY 2018 Key Milestone Events (Budget Year)

- Deliver ITRA 4.0 Final Report, a reference of the chemical, biological and radiological terrorism threat for the federal government and homeland security enterprise.
- Develop the CBRN Longitudinal Investment Strategy Analytics (LISA) tool. Based on the MONA methodology, this tool will support decision makers by providing program analyses that determines the amount of risk each program could potentially buy down, and to optimize investment portfolios for maximum ROI and risk reduction.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
ITRA 4.0 Initiation	FY 2016 Q2	FY 2016 Q3
FY 2017		
ITRA 4.0 Data Review	FY 2017 Q1	FY 2017 Q2
ITRA 4.0 Model Review	FY 2017 Q2	FY 2017 Q3
ITRA 4.0 Intelligence Survey	FY 2017 Q2	FY 2017 Q3
ITRA 4.0 Draft Results Review	FY 2017 Q4	FY 2018 Q1
FY 2018		
ITRA 4.0 Final Report	FY 2018 Q1	FY 2018 Q1
ITRA 4.0 Tailored Assessments	FY 2018 Q3	FY 2018 Q4
ITRA 5.0 Initiation	FY 2018 Q2	FY 2018 Q3
Adversary Capability Levels/Adversary Decision Model Update	FY 2017 Q2	FY 2018 Q1
MONA Methodology to Determine Addressable Risk of Programs	FY 2016 Q3	FY 2017 Q4

Research & Development Description	Plan Start Date	Planned Completion
LISA Risk Mitigation Planning Tool	FY 2018 Q1	FY 2019 Q2

Type of Research

Development

Technical Readiness Level

N/A: Periodic delivery of Knowledge Products.

Transition Plans

The ITRA tools will be transitioned to stakeholders. The tools to be transitioned will be:

- Risk Visualization Tool (RiViT)
- Biological Countermeasure Analysis and Planning Tool(Bio CAPT)
- Content Management System (CMS)
- Longitudinal Investment Strategy Analytics (LISA)

The products to be transitioned will be:

- Mitigation Optimization Net Assessment (MONA)
- ITRA 4.0
- ITRA 5.0
- Adversary Decision Model Report

Chemical Threat Assessment – FY 2017 Annualized CR: \$16.463M. FY 2018 Request: \$0. This program researches and identifies current and potential chemical threats to understand the risk posed to the United States by their illicit use. This program encompasses risk-based, chemical threat agent characterization programs, domestic defense strategic planning, and analytical technologies, strategies, and procedures.

Chemical Security Analysis Center (CSAC)

- **Problem:** The need exists for a capability to identify and assess chemical threats and vulnerabilities in the United States and develop the best responses to potential chemical hazards. Included is a single centralized repository of chemical threat

information (hazard and characterization data) for analysis of the nation's vulnerabilities to chemical events to serve key customers.

- **Solution:** The Chemical Security Analysis Center (CSAC) conducts key analytical assessments, including the Chemical Terrorism Risk Assessment (CTRA), hazard assessments and Material Threat Assessments (MTAs). In addition, CSAC develops cheminformatics tool capabilities for acquiring, storing, indexing, evaluating and making strategically available cheminformatic data, technical reports and other threat and risk knowledge products. Products include, the chemical agent reactions database (CARD), and several other user-specific electronic libraries. In FY 2017, CSAC will deliver CTRA 4.0, complete the analysis of the Jack Rabbit II chlorine releases, measure sensory threshold values of toxic chemicals, and initiate a new effort to focus on comprehensive chemical surveillance and response.
- **Impact:** CSAC serves key customers such as NPPD, USSS, OHA, TSA, and I&A within DHS, as well as several Interagency partners. CSAC is the nation's only Federal studies, analysis, and knowledge management center for assessing the threat or hazard associated with an accidental or intentional large-scale chemical event or chemical terrorism event in the U.S.

Funding for CSAC will be eliminated in FY 2018 to allow S&T to focus on Administration and DHS priorities. One statutorily required element, the Chemical Terrorism Risk Assessment (CTRA) task will be combined with the Integrated Terrorism Risk Assessment (ITRA) program.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	7,000	7,000	6,300	5,593	0
Obligations	7,569	6,747	6,142	0	

FY 2016 Key Milestone Events (Prior Year)

- Completed Chemical Terrorism Risk Assessment (CTRA) tailored assessments in support of USSS, NPPD, OHA, and other stakeholders within the HS enterprise.
- Delivered 2 hazard assessments or material threat assessments based on customer/stakeholder requirements.
- Delivered 5 chemical bulletins.
- Delivered updated human toxicity estimates for a select number of high risk toxic chemical threat materials.
- Completed all chlorine testing with larger quantity releases (phase II) of Jack Rabbit II.

FY 2017 Key Milestone Events (Year of Execution)

- Deliver an MTA on pharmaceutical based agents.
- Complete and deliver 2 tailored/targeted risk based analyses.
- Deliver the Chemical Terrorism Risk Assessment v4.0.
- Complete data analysis of Jack Rabbit II series of chlorine tests.
- Complete one hazard assessment on toxic chemical threats.
- Initiate system study on comprehensive chemical surveillance and response. Form stakeholder group to perform a systematic search of current CONOPs related to chemical detection and identify gaps for chemical surveillance and response.

FY 2018 Key Milestone Events (Budget Year)

- N/A

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
CTRA	FY 2017 Q2	FY 2018 Q4
Jack Rabbit II	FY 2017 Q2	FY 2018 Q3
Organoleptics for food security	FY 2017 Q2	FY 2018 Q1
Hazard Analysis	FY 2017 Q2	FY 2018 Q2
Cheminformatics	FY 2017 Q2	FY 2018 Q2

Type of Research

Applied

Technical Readiness Level

The program plans to begin at TRL 5 and end at TRL 7

Transition Plans

Funding for CSAC will be eliminated in FY18, final reports for work initiated in FY17 as described in the Milestones will be delivered by the end of 2Q FY18.

- A. Explosives Threat Assessment-** FY 2017 Annualized Continuing Resolution: \$11.100M. FY 2018 Request: \$18.200M. This program researches and identifies current and potential explosive threats to understand the risk posed to the United States, strengthens aviation security by bolstering the international aviation security system, improves security processes and technologies, and encourages partnerships with industry. It encompasses risk-based threat characterization, attribution, strategic planning, prediction of magnitude of explosive disasters, and analytical technologies, strategies, and procedures.

Aircraft Vulnerability

- **Problem:** Vulnerability of the great variety of commercial aircraft types (e.g., wide body, narrow body, regional jet) to the broad range of conventional and emerging IED threat configurations is not thoroughly understood and/or characterized. This includes the blast effects vulnerability of new composite aircraft structures currently entering the civil transport fleet (e.g., Airbus A380, A350, and Boeing B787).
- **Solution:** Identify the minimum size of the explosive threat that would result in catastrophic aircraft loss and develop commercial aircraft blast mitigation technology that will provide protection to commercial aircraft.
- **Impact:** Commercial aircraft vulnerability data collected under this project will be used by TSA to validate and refine explosives detection standards for checkpoints, checked baggage, and air cargo. TSA will ensure that EDS threat mass detection thresholds are sufficient to prevent introduction of explosive threats onboard the aircraft that would otherwise result in catastrophic aircraft loss if detonated during operational flight. Blast mitigation efforts provide a means to reduce the vulnerability of commercial aircraft to internal explosive threats and form a basis for countermeasures that can be leveraged for non-aviation use by other DHS components. Project efforts also support test and analysis that provide information on commercial aircraft vulnerability to emerging terrorist-based explosive threats.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	1,750	1,750	1,750	2,550	6,200
Obligations	1.608	1,611	1,544	2,302	

FY 2016 Key Milestone Events (Prior Year)

- Deliver updated (incorporating TSA User Feedback updates) DHS SharePoint-based Explosive Testing Database (ETDB) to TSA.

- Conduct follow-on explosive testing on primary structure composites (curved test panels) used in new commercial aircraft designs (e.g., B787, A380, A350) and deliver initial report on IED blast effects on commercial aircraft composite design vulnerability.
- Complete pressurized testing and deliver Wide Body Commercial Aircraft Vulnerability Report, Boeing 767 Explosive Vulnerability Testing.
- Deliver explosive TMU prototype(s) to USSS Technical Security Division (USSS-TSD) for use in operational pilot testing.

FY 2017 Key Milestone Events (Year of Execution)

- Conduct pressurized explosive testing on primary structure composites (curved-complex test panels) used in new commercial aircraft designs (e.g., B787, A380, A350) and deliver initial report on IED blast effects on commercial aircraft composite design vulnerability.
- Deliver to TSA sponsors an updated classified commercial aircraft vulnerability analysis summary report, based on recently collected narrow and wide-body aircraft vulnerability live fire test data.
- Provide TSA with the results of live fire testing and analysis conducted to confirm continued effectiveness of Modified Least Risk Bomb Location Procedures (M-LRBL) in anticipation of air carrier future operational changes (e.g. phase out of removable passenger seat cushions).

FY 2018 Key Milestone Events (Budget Year)

- Conduct preliminary (unpressurized and pressurized) explosive vulnerability testing on Boeing 757 narrow body commercial aircraft test asset and deliver report.
- Conduct testing to evaluate aircraft cabin pressurization effects on curved/complex composite panel designs subjected to internal blast loads and report results to TSA.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Completed design, fabrication, and explosive testing of explosive Threat Mitigation Unit (TMU) for DHS Component customer.	FY 2015 Q1	FY 2016 Q3
Completed fabrication and delivery of 2 TMU prototype(s) to DHS Component customer for use in operational pilot testing.	FY 2016 Q3	FY 2016 Q4
Completed wide body aircraft passenger cabin threats pressurized explosive vulnerability testing (multiple B767 tests/test series) and delivered reports	FY 2015 Q1	FY 2016 Q4
Delivered updated (incorporating TSA requested user feedback updates) DHS SharePoint-based Explosive Testing Database (ETDB) to TSA.	FY 2016 Q2	FY 2016 Q4
Completed follow-on explosive vulnerability testing on primary structure composites (curved, non-reinforced test panels) used in new commercial aircraft designs (e.g., B787, A380, A350) and delivered initial report on IED blast effects on commercial aircraft composite design vulnerability.	FY 2015 Q3	FY 2016 Q4
FY 2017		
Conduct live fire explosive testing on TSA specified Modified Least Risk Bomb Location Procedures (M-LRBL) to confirm the procedures continued effectiveness in light of future airline/airframe mfg. operational and design changes.	FY 2017 Q1	FY 2017 Q4
Update classified wide and narrow body commercial aircraft explosive vulnerability analysis report and deliver to TSA.	FY 2017 Q1	FY 2017 Q3
Evaluate blast effects of improvised explosive charges on curved composite aircraft panel designs (both non-reinforced and reinforced panel designs) and report.	FY 2016 Q4	FY 2017 Q3
FY 2018		
Conduct and document (test plans and test reports) preliminary narrow body aircraft (B757) live fire explosive vulnerability testing (multiple tests with both pressurized and unpressurized conditions).	FY 2017 Q4	FY 2018 Q3
Conduct live fire explosive vulnerability tests (multiple tests) on composite-construction commercial aircraft fuselage panels incorporating aircraft fuselage pressure differential. effects.	FY 2017 Q4	FY 2018 Q4
Deliver DHS-SharePoint resident updated (e.g.; incorporates user feedback and test reports/data updates) Explosive Test Database to TSA user community (TSA Explosive Specialists).	FY 2018 Q1	FY 2018 Q3

Type of Research

Developmental

Technical Readiness Level

Completion of HULD technology at TRL7.

Completion of TMU technology development at TRL7.

Transition Plans

- Planned Demos & Deliverables/Transitions
 - Deliverable of preliminary blast testing of composite aircraft panels.
 - Deliverable of reduced weight/cost, airworthiness certified HULD design.
 - Demo – Explosive testing of explosive TMU.
 - Deliverable of multiple (2) full-scale TMU's (and associated TMU design package) to DHS Component customer for operational testing.
 - Demo – Modified Least Risk Bomb Location Procedures.
 - Deliverable of composite aircraft design blast testing and modeling report.
- Transition Products
 - Deliver knowledge products that support requirements development, risk assessment and policy decisions (e.g. setting minimum detection requirements).
 - Deliver technology and methodologies for blast mitigation protection of commercial aircraft (e.g., Least Risk Bomb Location Procedures).
 - Prototype explosive TMU finalized design and full-scale prototype(s) for DHS Component customer operational pilot.

Homemade Explosives Characterization

- **Problem:** The use of homemade explosives (HMEs) creates emerging hazards for responders and new challenges to detection and intelligence organizations. A large number of fuels, oxidizers, and synthesis procedures that can be combined to form HMEs, present an enormous problem set with respect to detection, incident management, and planning for first responders.
- **Solution:** S&T investment in the HME Characterization program provides capabilities for improved prevention, detection, analysis, and decision support for homeland security operations. This program will provide HME signature data for vendor development of HME detection, threat validation data, and tools to more safely manage incidents. The HME Characterization program identifies and characterizes explosive threats and their performance; collects chemical and radiographic signatures of HMEs for use in EDS training and testing; and provides input into detection standards and certification of detection equipment for the TSA (the primary customer).

- **Impact:** Knowledge products provided by the HME Characterization program influence TSA's CONOPS and policy decisions in Checked Baggage, Air Cargo, and Primary and Secondary Screening domains and are leveraged in systems development, training, and testing. The results of this work is evident in airports across the country, and is shared with government aviation security organization around the world. Data will have a direct impact on policy influencing the commercial availability of precursors. Pre-planning tools will help first responders and engineers more safely navigate future incidents involving HMEs.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	10,850	10,350	8,750	8,550	12,000
Obligations	9,936	9,532	7,962	0	

FY 2016 Key Milestone Events (Prior Year)

- Complete European-U.S. Region of Responsibility Data Collection.
- Deliver 11 Material Assessment Reports to TSA that will inform Federal decision makers on chemical explosive properties, threat intelligence, X-ray signatures and a Region of Responsibility for each of these materials. These new HME detection windows will be incorporated into existing and future bulk explosives screening systems in coordination with the European Civil Aviation Council.
- Assist in the incorporation of Region of Responsibility Recommendations for 18 materials and formulations of interest into the 2016 Detection Standards for EDS and AT.
- Deliver Homemade Explosives Safety Standards to the International Homemade Explosives Working Group.
- Transition of the Interagency HME Database to reside at the Federal Bureau of Investigation's Terrorist Explosive Device Analytical Center Improvised Explosive Detection and Synthesis (TIEDS) Center.
- Deliver RDX Round Robin Test Results to the International Homemade Explosive Working Group to improve small scale safety test standards.
- Deliver 16 HME Characterization Reports which contain a full data analysis including synthesis procedures, and physical and chemical characterization for each of the HME formulations.
- Begin HME Simulant Certification and Validation Program.
- Deliver red team test articles and emerging explosive threat information to the TSA Office of Security Operations.
- Begin New Threats Detection work to lower HME False Alarm Rate in EDS.

- Deliver Explosives Terrorism Risk Assessment (ExTRA) methodology report to develop a probabilistic risk analysis for explosives.
- Provide TSA with a methodology and analysis for reviewing and updating transportation security equipment detection standards.
- Document the capability to perform dual energy basis material decomposition analysis with micro CT data, and deliver source code, phantoms, and a final report to TSA.

FY 2017 Key Milestone Events (Year of Execution)

- Begin testing and analysis for HME and sheet blast loading data.
- Deliver Homemade Explosives Safety Standards to Interagency users.
- Deliver Ammonium Nitrate Booster Study results to support TSA Freight and Rail Security Policy.
- Provide USSS with Anomaly Detection Prescreening test report.
- Deliver Homemade Explosives Training course for Transportation Security Administration-Office of Security Operations.
- Deliver eight new HME detection windows to TSA for incorporation into existing and future bulk and trace explosives screening systems (FY 2017).
- Kick off Homemade Explosive Simulant Certification Program.
- Complete Task II and III: Engineering Porosity in Energetic Materials with a PowderBed Printer.
- Kick off the Explosive Threats Rapid Response Protocols project.
- Evaluate energy profiles of designated explosive materials identified by TSA's DSARM model for inclusion in the Scenario- and Target-Relevant Explosive Equivalency Tool (STREET) and DHS's Transportation Security Laboratory (TSL) Commercial Aviation Vulnerability and Mitigation (CAV&M) research.
- Deliver HME Safety Protocols to HME International Working Group.
- Deliver the Detection Standards Analysis and Revision Methodology (DSARM) to the TSA which will result in standard threat prioritization.
- Collect explosive performance on a rapid response effort at the Tyndall Reactive Materials Site and deliver information to the TSA.
- Support TSL DT&E and IT&E leads for system data collection at the Tyndall Reactive Materials Site.
- Kick off operations at the DHS Detection Technology Center in close collaboration with the FBI's Terrorist Explosives Device Analytical Center (TEDAC) Improvised Explosives Detection and Synthesis (TIEDS) Center.
- Aid the DoD and Law Enforcement by providing data on the impact of a large scale potassium chlorate study which will enable better protection for vulnerable targets and infrastructure.

FY 2018 Key Milestone Events (Budget Year)

- Obtain results from Transportation Security Equipment to support material characterization studies, including Region of Responsibility (ROR) research for X-ray based detection technologies, characterization studies of Homemade Explosives (HME), and quality control efforts supporting testing services by the TRMG, LLNL, TIEDS, and the TSL.
- In collaboration with the FBI, provide results to the Chemical Facility Anti-terrorism Standards for precursor detonability data which will enable NPPD to make changes to their upcoming Notice for Proposed Rule Making on explosive and HME chemical precursors using validated scientific data.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Delivered data collected at the Tyndall Reactive Materials Group and analyzed at LLNL in response to intelligence information. This data was used to validate the FY16 TSA Detection Standards updates for AIT, Advanced Technology (AT) systems, and EDS.	FY 2014 Q4	FY 2016 Q3
Completed a Feasibility Study Final Report for the Explosive Terrorism Risk Assessment (ExTRA) and concluded that the expansion of the Chemical Terrorism Risk Assessment (CTRA) methodology to include the treatment of explosives is very feasible with a high probability of success.	FY 2015 Q2	FY 2016 Q2
Delivered new HME detection windows to TSA for incorporation into existing and future bulk and trace explosives screening systems in coordination with the European Civil Aviation Council.	FY 2014 Q4	FY 2016 Q2
Completed a series of tests to determine if threat quantity amounts of a series of powdered metals and precursors would alarm on metal detectors that are on the GSA/TSA Qualified Product List.	FY 2016 Q2	FY 2016 Q3
FY 2017		
Characterize the chemical, physical, and explosive properties of HMEs and report findings to TSA and interagency partners to support requirements development.	FY 2014 Q4	FY 2017 Q4
Completion of a 10,000 lbs Potassium Chlorate VBIED demonstration	FY 2016 Q4	FY 2017 Q3

Research & Development Description	Plan Start Date	Planned Completion
and delivery of an accompanying quick look report.		
Delivery of a demonstration on the ability to print a nominal object with an engineered porosity as well as data showing the detonation properties of printed objects.	FY 2015 Q4	FY 2017 Q4
Complete consequence model development for the Explosives Terrorism Risk Assessment.	FY 2016 Q2	FY 2017 Q4
Deliver Homemade Explosives Training course for TSA-Office of Security Operations.	FY 2015 Q4	FY 2017 Q1
Deliver a software training package for X-ray image recognition to the United States Secret Service.	FY 2017 Q1	FY 2017 Q4
Develop new capabilities within IMPACT specifically tailored to United States Capital Police (USCP), Washington D.C. Metropolitan Police and other Law Enforcement agency applications.	FY 2017 Q1	FY 2017 Q4
FY 2018		
Deliver explosive equivalency information to the TSA for updating their detection standards.	FY 2015 Q4	FY 2018 Q4
Completion and delivery of certification guidelines for Professional Standards for Explosives Design and Testing Engineers and Architect.	FY 2016 Q2	FY 2018 Q3
Obtain results from the MicroCT X-ray systems support material characterization studies, including Region of Responsibility (ROR) research for X-ray based detection technologies, characterization studies of HME, and quality control efforts supporting testing services by the TRMG, LLNL and the TSL.	FY 2014 Q4	FY 2020 Q4
Deliver up to six DTRA/SCC-WMD hosted VAPO classroom training courses (four Level 1 with three in DC Area and one in Albuquerque) and two Level 2 (in the DC Area).	FY 2017 Q2	FY 2018 Q3
Deliver precursor percentage data to CFATS from FBI studies and hold first meeting on Global Initiative on precursor percentage regulations.	FY 2016 Q1	FY 2018 Q1

Type of Research

Applied

Technical Readiness Level

The program plans to begin at TRL 6 and end at TRL 7.

Transition Plans

- The development of five to ten Regions of Responsibility per year that will update the TSA detection standards and lead to improved detection algorithms being deployed at airports.
- Provide the HME Working Group with explosives characterization data to include safety information, data to assist with explosive detection equipment and the sensitivity of explosive detection technologies, and threat validation documentation at least once a year.
- The development of safety protocols will provide personnel working with and testing homemade explosives with standardized safety guidelines that will decrease the risk of accident and/or injury. This will benefit end users from the National Laboratories, Federal Bureau of Investigation, DHS, DOD, and other mission partners.
- In partnership with the FBI, and the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF), S&T will facilitate the CFATS and explosives desensitization efforts for DHS NPPD.
- The rollout of Incident Management Preparedness and Coordination Tool Kit (IMPACT) will enhance situational awareness, communication, and collaboration during and for security events. Transition the HME Database to a permanent database, with a designated U.S. government agency, for use by the HME community.

Hostile Behavior Predict and Detect - FY 2017 Annualized Continuing Resolution: \$47.515M. FY 2018 Request: \$34.493M. This program leverages social and behavioral science research, data, and theory to understand the determinants and timing of group conversions to terrorism and the intent to engage in violence. Knowledge from this program informs analytical, operational, and policy concerns related to terrorists and terrorist activities. This program also develops and builds the capability to noninvasively detect suspicious behavior that indicates the intent to cause harm.

Actionable Indicators and Countermeasures

- **Problem:** Violent extremism in the U.S. is a growing problem; however, the drivers behind violent extremism are not fully understood. Analyses of extremist violence are currently based on a limited number of case studies, and the effectiveness of programs developed to counter violent extremism (CVE) is often not clear.
- **Solution:** DHS S&T conducts evidence-based research to meet the policy, operational and public needs to improve the effectiveness of violence prevention and intervention efforts implemented by federal, state, local, tribal, territorial and non-governmental stakeholders.

- **Impact:** New capabilities will support more efficient and accurate analysis of the threats posed by violent extremists and evidence-based CVE policies, programs, and interventions. This project improves the capability of the Office of Intelligence and Analysis (I&A), DHS Fusion Center analysts, and Federal, State, and local law enforcement to identify indicators that individuals and groups are moving toward extremist violence. It will also support the Office of Community Partnerships (OCP), Offices of the Principal Deputy Counterterrorism Coordinator, Policy, Civil Rights and Civil Liberties, and local CVE practitioners in assessing the impacts of policies and programs developed to counter violent extremism.

Sub Project

- Metrics Development and Evaluation of DHS CVE Community Awareness Briefings (CAB): Evaluate the effectiveness of the existing community awareness briefings, historically delivered by the DHS Office of Civil Rights and Civil Liberties and the National Counterterrorism Center. The results will be used to assist with the update and modification of the program as it transitions to the DHS Office for OCP.
- International Expert Engagement and Analysis of CVE Evaluations: DHS S&T hosted international expert elicitation convened to share research, findings, and best practices, and discuss metrics, methods, results, and lessons learned from existing countering violent extremism program evaluations.
- Evaluation of CVE Community Grants: Independently evaluate the effectiveness of select programs initiated through the OCP CVE Grant Program.
- Text-Enabled Safe Referral Hotline Protocols and Evaluation: Develop protocols that can be used by existing hotlines to offer CVE services.
- CVE Operation Roadmap: Identify CVE stakeholder needs and requirements and develop a library of CVE research.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	1,001	1,000	2,500	1,000	1,000
Obligations	1,086	2,663	983	0	

FY 2016 Key Milestone Events (Prior Year)

- Transition Terrorism and Extremist Violence in the United States (TEVUS) Database.
- Complete update of data Included in TEVUS.

FY 2017 Key Milestone Events (Year of Execution)

- Develop a data and literature library on government CVE policies, programs, and operational activities to establish an operational roadmap.
- Deliver a formative evaluation of pilot city evaluations to prepare programs for subsequent impact evaluation.

FY 2018 Key Milestone Events (Budget Year)

- Deliver an impact evaluations of pilot city efforts to understand what activities have been successful.
- Develop a catalog of common metrics used by evaluators of local extremist violence prevention and intervention programs internationally.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Complete Data upload for TEVUS.	FY 2016 Q1	FY 2016 Q4
Final report of Risk and Crisis Communication priorities submitted.	FY 2015 Q4	FY 2016 Q2
Interim Reports of needs and requirements of CVE Stakeholders across Interagency, National NGOs, and local communities submitted.	FY 2015 Q4	FY 2016 Q4
FY 2017		
Public Launch of TEVUS.	FY 2017 Q1	FY 2017 Q1
Public Launch of PIRUS.	FY 2017 Q2	FY 2017 Q2
Deliver Formative Evaluation in Los Angeles (LA) and Boston.	FY 2015 Q4	FY 2017 Q1
Develop transition plan for Hotline Protocols and identify transition partner.	FY 2016 Q4	FY 2017 Q1
FY 2018		
Deliver Impact Evaluation in LA and Boston.	FY 2017 Q1	FY 2018 Q2
Transition common metrics used for evaluation by the international community to researchers and community stakeholders.	FY 2017 Q3	FY 2018 Q2
Deliver metrics and evaluation of Community Awareness Briefings to OCP.	FY 2017 Q3	FY 2018 Q3

Research & Development Description	Plan Start Date	Planned Completion
Conduct a process evaluation for hotline protocols.	FY 2018 Q1	FY 2018 Q4
Finalize Data and Literature library for CVE.	FY 2016 Q1	FY 2018 Q1

Type of Research

Applied

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- Each project activity benefits from the direct involvement of DHS and interagency end users, who shape the project, ensure it continues to address their requirements, and provides feedback on all deliverables.
- No additional investment is required to transition the knowledge products this project produces, which are generated throughout the project and are being incorporated into official DHS analytic products and training materials.
- Tools such as databases will be maintained by the researchers who create them as they have been developed for the public good and their maintenance is essential to these entities' future research activities.

Counter Unmanned Aerial Systems (UAS) / Non-Traditional Aviation Technologies (NTAT) and Autonomous Systems (AS)

- **Problem:** DHS operating components have the responsibility to protect people and critical infrastructure against UAS/NTAT/AS systems used for nefarious purposes. Small and medium Unmanned Aerial Systems (UASs) have entered the market in the last few years and have become inexpensive, easily obtainable, and capable of performing many functions for a number of applications. These applications include law enforcement, aerial photography, agricultural inspections, firefighting and emergency response, and wildlife management just to mention a few. The use of UASs are now not limited to law enforcement and military, but the general public. Users include hobbyists, researchers, and commercial users. The Federal Aviation Administration is in the process of setting rules for the use of UAS/NTAT/AS to prevent interference with general aviation. DHS is responsible for securing the national airspace against nefarious UAS use. Currently, DHS Components have limited capabilities to detect, track, identify, and respond.
- **Solution:** (1) Connect DHS Components needs to available solutions by first developing a tool, the Counter Small UAS Analysis and Review Tool (C-SMART) then exercising C-SMART to assess, advise, integrate, and evaluate CUAS capabilities. This tool includes modeling & simulation, databases of CUAS performance data, libraries of UAS threat

characteristics, and cost/benefit analytics; (2) Embark on specific endeavors to modify/tailor technologies to address urgent needs that cannot be met by COTS; and, (3) With the rapid pace of change in the UAS market and its technologies, ensure there is an ability to predict and characterize future UAS threats in order to guide future RDT&E.

- **Impact:** Through the leadership role of DHS at the interagency level and our technical efforts, DHS Components will be well advised and positioned to acquire CUAS capabilities that are most effective and efficient, employing those capabilities with the most suited concepts of operations informed by clear policies and rules of engagement. The project will inform DHS Components' acquisition strategy of new CUAS capabilities, upgrade targeted capabilities, all while supporting National Special Security Events (NSSE).

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	20,000	19,386	19,000
Obligations	-	-	18,241	0	

FY 2016 Key Milestone Events (Prior Year)

Note: S&T stood up a new Program Executive Office for UAS in May 2016 to better focus all of our UAS-related activities (enabling as well as countering UAS) and to better collaborate at the interagency level. The originally planned effort to develop a specific new CUAS system, starting in 2016, was re-directed under this new thrust. As such, the key 2016 milestones were revised as shown below:

- Develop a UAS Strategy for DHS S&T and begin implementation.
- Develop a mobile capability to conduct experimentation, testing, and evaluation of CUAS systems in-situation.

FY 2017 Key Milestone Events (Year of Execution)

- Under the auspices of the National Security Council Policy Coordination Committee (PCC), establish a CUAS Technology Working Group delivering a compendium of CUAS technology to the PCC.
- Begin collecting preliminary customer's requirements and use cases to inform C-SMART development.
- Release C-SMART 1.0 to support National Special Security Events.
- Upgrade C-SMART 1.0 to allow more complex and flexible analysis.

- Begin development of a CUAS test and evaluation capability within the National Capital Region for an urban operational prototype (UCOP).
- Conduct Technical Assessment of Counter UAS Technologies in Cities (TACTIC) I Phase 1
- Develop and deliver Initial Operation Capability 1 for the USSS.
- Begin development of Capability 2 for USSS.
- Begin characterization of future threats.

FY 2018 Key Milestone Events (Budget Year)

- Release CSMART 1.X versions with geospatial information system extensions and virtual reality capabilities
- Integrate multi-sensor capabilities into UCOP.
- Conduct TACTIC I Phase 2.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Inter-Agency & International Collaborations	FY 2017 Q1	Ongoing
Customers' Requirements Assessment & Refinement	FY 2017 Q1	Ongoing
C-SMART Development	FY 2017 Q1	Ongoing
UCOP Spiral 1 Development	FY 2017 Q3	FY 2018 Q2
Develop Initial Operation Capability 1 for USSS	FY 2017 Q2	FY 2017 Q4
Develop Initial Operation Capability 2 for USSS	FY 2017 Q2	FY 2018 Q2
Future Threats Characterization	FY 2017 Q3	Ongoing
TACTIC I	FY 2017 Q2	FY 2018 Q2

Type of Research

Developmental

Technical Readiness Level

TRL will vary depending on specific efforts.

Transition Plans

Capability 1 and Capability 2 systems will transition to the USSS.

Results of using C-SMART to assist a customer will transition to that customer to assist in operation or acquisition efforts. For example: C-SMART v 1.0 was exercised to assist USSS and FBI in laying out their CUAS capabilities on hand in support of the Republican National Convention, the Democratic National Convention, and the Presidential Inauguration.

The UCOP will be an enduring T&E capability for PEO UAS and USSS. Certain UCOP components might transition as interim or permanent operational capabilities for USSS if deemed beneficial.

Hostile Intent Detection and Surveillance

- **Problem:** TSA screens approximately two million passengers daily. This number is projected to increase at a rate of approximately four percent per year and it is unclear if the number of security screeners will keep pace with the projected increase in the traveling population. With passenger volumes increasing, the challenge is to increase the scale and accuracy of the existing screening processes while continuing to secure aviation and ground transportation portals without a similar increase in the number of screening personnel.
- **Solution:** S&T will develop non-invasive technologies to enable screening at speed with an increased observation/screening area (to include the entire portal). These technologies will result in faster passenger throughput in lieu of increased volume and increased screening accuracy with fewer false positives. These solutions will also remain sensitive to the privacy concerns of the traveling public as well as their civil rights/civil liberties.
- **Impact:** Increased efficiency and effectiveness through screening higher passenger volumes with fewer operational personnel (force multiplier) and increased screening accuracies.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	4,950	8,700	4,000	2,000	0
Obligations	4,824	3,763	3,329	1,500	

Prior Year Key Events

Awarded new contract for transition of FAST capabilities and research.

Current Year Key Events

Conduct of subject matter expert (SME) working group to discuss potential improvements to Advanced Screening Research (ASR) research agenda and methodology.

Budget Year Key Events

N/A

Project Schedule Including Milestones

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Complete data ingest from collection activities at Providence International Airport (PVD).	FY 2016	FY 2016
Complete video data annotation and obtain input from Behavior Detection Officers (BDO).	FY 2016	FY 2016
Field Test for BDO surveillance via telepresence/Readiness Research Field Test/operational technology presence.	FY 2016	FY 2016
FY 2017		
Field Test for BDO surveillance via telepresence/Readiness Research Field Test/operational technology presence.	FY 2017	FY 2017
Operational technology demonstration and evaluation of centralized	FY 2017	FY 2017

Research & Development Description	Plan Start Date	Planned Completion
screening. ASR Settling Time and Real-Time Decision Analysis Scientific Study		

Type of Research:

Applied

Technical Readiness Level:

This program begins at TRL3 and ends at TRL7.

Transition Plans

The products will be transitioned to TSA in accordance with the component's acquisition strategy and per transition agreements.

Social Media Research

- **Problem:** Leveraging open source and social media (OSSM) effectively has become increasingly important to DHS missions, as an increasing amount of data becomes available online. OSSM tools that support DHS missions are in an immature, early stage. There are major challenges including but not limited to the need to scale tools to the levels of DHS operations; controlling the vast amount of “noise” while respecting privacy and civil liberties; and automatically processing non-text data such as video and images to efficiently cue information of interest for analysts, officers, and agents.
- **Solution:** Piloting commercial tools within the Homeland Security Enterprise enables DHS to fully explain OSSM challenges in operational contexts, develop and improve OSSM methodologies, capture gaps in commercial tools and architectures, develop first generation capabilities for non-text data, and work with industry to develop additional capabilities.
- **Impact:** OSSM methodologies that have been incorporated into operations at DHS Components. DHS also delivered a market survey of 275 commercial tools that included laboratory testing of the top tools. DHS is able to explain the OSSM challenges, backed by data and metrics collected during the pilots, to inform future investments.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	2,500	2,500	5,056
Obligations	-	-	0	0	

Prior Year Key Events

- Completed two pilots (K-1 and Iraqi/Syrian Refugees) that led to developing an OSSM methodology incorporated into USCIS operations and identifying major gaps in commercial capabilities.
- Completed one pilot for CBP's Electronic System for Travel Authorization (ESTA) that supports the visa waiver program. This pilot resulted in the potential to improve efficiency and effectiveness of OSSM research.
- Completed one test of capabilities for processing speech, images, and videos to inform future investments.

Current Year Key Events

- Finalize market survey of commercial OSSM tools.
- Conduct operational tests for USCIS, CBP, and TSA using commercial capabilities. Measure improvements, capture gaps, and inform USCIS, CBP, and TSA procurement decisions.
- Develop and evaluate new capabilities for processing speech, images, and videos.

Budget Year Key Events

- Complete report on findings of DHS OSSM needs based on S&T pilots.
- Conduct tests of image, video, and speech within the HSE.
- Deliver reports on image, video, and speech analytic experiments to improve open source and social media analytics for DHS missions.

Project Schedule Including Milestones

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Deliver report on image, video, and speech analytic experiments to improve open source and social media analytics for DHS missions.	FY 2018 Q1	FY 2018 Q2
Deliver report on DHS social media gaps and requirements that would inform future investments.	FY 2018 Q1	FY 2018 Q2
Develop and assess livestream prototypes and experiments.	FY2017 Q2	FY 2018 Q4

Type of Research

Social Media Research projects include elements of Basic, Applied, and Developmental research.

Technical Readiness Level

Projects range from Technology Readiness Level 2 to 7.

Transition Plans

Social Media tools undergo an operational test pilot with end users. Pilots enable end users to make acquisition decisions. The pilots are supported by the respective DHS Component leadership who hosts S&T staff onsite to conduct the testing. The DHS Social Media Task Force, consisting of DHS-wide organizations, including the Office of the Chief Financial Officer, Office of Privacy, and Office of Civil Rights and Civil Liberties, oversees the pilots and addresses oversight issues before pilots begin to facilitate future transition.

Silicon Valley Innovation Program (SVIP)

- **Problem:** As the needs and technology gaps of DHS operational agencies and critical infrastructure partners continue to evolve, DHS needs to pursue multiple paths to innovative solutions for these needs. Lengthy procurement processes have created barriers for entry for innovative high-tech commercial small businesses thus limiting the Government's access to relevant and timely solutions to meet these evolving needs.
- **Solution:** The SVIP expands DHS's reach to find new technologies that strengthen national security with the goal of reshaping how government, entrepreneurs and industry work together to find cutting-edge solutions. The SVIP reaches out to innovation

communities across the nation and around the world to harness the commercial R&D ecosystem for government applications, co-invest in ideas, and accelerate transition-to-market. The SVIP also involves DHS operational components and end users and HSE stakeholders throughout each project, thereby increasing the likelihood of successful transitions that meet operational needs.

- **Impact:** The SVIP aims to provide novel solutions for component and HSE requirements that can be used in operations in as little as 12-24 months. Further the program is drawing new companies into interactions with and work in support of the Government who may not have previously engaged with the Government. Bringing in new companies increases avenues by which DHS and its partners can obtain and leverage innovative technology and solutions.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	5,000	10,000
Obligations	-	-	-	0	

FY 2016 Key Milestone Events (Prior Year)

- Release the umbrella Innovation Other Transaction Solicitation (OTS).
- Release call under the Innovation OTS for IoT Security, and four calls under the OTS for requirements in support of Customs and Boarder Protection: K9 Wearable Technologies, Enhancements to the Global Travel Assessments System (GTAS), Enhancing CBP Airport Passenger Processing, and Small Unmanned Aircraft Systems (sUAS) Capabilities.
- Award five (5) Phase I Other Transaction (OT) Agreements and two (2) Phase II OT Agreements to companies under the IoT Security solicitation.

FY 2017 Key Milestone Events (Year of Execution)

- Release new solicitation calls in 3 – 5 specific areas covering broad DHS and critical infrastructure needs including finance sector cyber security, first responders and aviation security.
- Award OT Agreements in support of CBP, Financial Services Cyber Security Active Defense (FSCSAD), and IoT specific calls.
- Conduct outreach events in innovation communities beyond Silicon Valley including Boston, MA, Austin, TX, Washington, DC, and Seattle, WA.

FY 2018 Key Milestone Events (Budget Year)

- Release new solicitation calls in 3 – 5 specific areas covering broad DHS and critical infrastructure needs.
- Award Phase IV OT Agreements in support of IoT Security call and assess operational readiness for IoT Security solutions that have completed Phase IV.
- Award Phase III and Phase IV OT Agreements in support of CBP specific calls.
- Award Phase II and Phase III OT Agreements in support of FSCSAD call.
- Award Phase I and Phase II OT Agreements in support of additional calls released in FY17.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Umbrella Innovation Other Transaction Solicitation	FY 2016 Q1	FY 2021 Q1
IoT Security Solicitation supporting IoT Security requirements	FY 2016 Q1	FY 2017 Q1
FY 2017		
Solicitation Calls in Support of CBP Requirements	FY 2016 Q4	FY 2017 Q4
Solicitation Call in Support of Financial Sector Cybersecurity Requirements	FY 2017 Q1	FY 2018 Q1
Solicitation Call in Support of First Responder Requirements	FY 2017 Q2	FY 2018 Q2
FY 2018		
Solicitation Call in Support of Aviation Security Requirements	FY 2018 Q1	FY 2018 Q4

Type of Research:

Developmental

Technical Readiness Level

Specific company solutions are expected to begin Phase I at a minimum TRL-3 and solutions that successfully progress through Phase IV should finish at a TRL-7.

Transition Plans

- The transition plan is specific to each solicitation call and the operational partner a given call is supporting. Typically the plan will lead to commercialization of a technology solution that would then be purchased either by a specific DHS operational component (e.g., CBP) or the appropriate HSE critical infrastructure partner (e.g., Financial Sector, First Responders). Phase III and IV of the SVIP involve operational pilots and customers/end users are involved throughout each phase of the program to increase the likelihood of successful transitions.

Enabling UAS Technologies

- **Problem:** First Response and Disaster Management agencies will benefit from the use of UAS to help command and control response, restore communications, improve situational awareness and damage assessments, all while protecting the lives of First Responders. Moreover, while the FAA/NASA led unmanned traffic management system will address flight safety, DHS needs to ensure its security concerns are addressed.
- **Solution:** This project identifies, tests and evaluates small UAS with integrated sensors in realistic, operationally relevant scenarios for First Responders. Some examples include search and rescue, firefighting, emergency medical services, emergency management and disaster response. Additionally, the project provides the unmanned aerial traffic community use cases that address specific security concerns.
- **Impact:** First Responders will be capable of making better acquisition decisions. The future unmanned traffic management system will enable the safe, secure and reliable integration of UAS into the national airspace.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	-	2,000
Obligations	-	-	-	-	

Prior Year Key Events (FY 2016)

- First Responders Resource Working Group (FRRG) on Emerging Technologies identified small UAS as a topic both for their benign use and countering nefarious uses.

Current Year Key Events (FY 2017)

- Conduct analysis of technologies for countering the threat of illicit techniques (GPS spoofing, network hacking, cell data skimming, etc.) in order to enable safe and effective use of small UAS in operational environments.
- Establish a dedicated FRRG small UAS work group to develop use cases and mission requirements of small UAS.

Budget Year Key Events (FY 2018)

- Identify and refine testing requirements from the First Responder community.
- Award contract(s) for one or more test sites supporting all necessary testing for First Responders enabling small UAS

*Up to 2017, all efforts related to Enabling UAS were funded and executed as part of the Air-Based Technologies project. Starting in 2018, Enabling UAS will become a separate project.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Develop and prioritize a list of test scenarios for the First Responder mission	FY 2017 Q4	FY 2018 Q2
Identify and evaluate commercially available First Responder Test/Training centers for use as small UAS test sites	FY 2018 Q2	FY 2018Q3
Contract with selected test sites to provide test environments and test services	FY 2017 Q2	FY 2018 Q1
FY 2018		
Identify homeland security use cases for the unmanned traffic management system	FY 2018 Q2	FY 2018 Q3
Incorporate homeland security use cases into planned unmanned traffic management demonstrations	FY 2018 Q3	Ongoing

Type of Research

Developmental

Technical Readiness Level

TRL will vary depending on specific efforts.

Transition Plans

- The project's test and evaluation results and associated analysis will be made available the First Responder community and posted on the DHS First Responder website.

Threat Horizon

- **Problem:** The threat landscape facing the HSE is constantly evolving with technology or modification of existing tactics and methods. S&T's R&D is devoted to enhancing or adding capabilities for the HSE to strengthen the nation's overall security posture in the short- to long-term. New threats come up throughout any FY that require immediate attention to provide Components and operational partners with the knowledge or technical solutions needed to maintain or advance their security posture and tempo. The Directorate does not currently have a mission readiness cell dedicated to providing a quick-turnaround analysis and R&D response to emerging situations.
- **Solution:** The Threat Horizons program will anticipate and respond quickly to any emerging, novel, or previously undetected threats facing the homeland. Identification of such threats may come from a number of channels, including Components, the Secretary's office, or through interagency partners. Threat Horizon will first determine whether such a request qualifies as "time-critical task" under established S&T procedures. If it does, Threat Horizon will utilize its resources and subject matter expertise across S&T to create a time critical task action plan to be submitted to the Under Secretary. The action plan will provide an analysis of each threat and provide options for response. Should the Under Secretary accept the action plan, Threat Horizons will coordinate assignments of personnel and financial resources to execute and sustain the plan. Any program-initiated efforts that need to be sustained beyond the short-term may be transitioned to existing R&D programs or scaled to be stand-alone efforts. In addition, Threat Horizons will produce quarterly status reports for the Chief Scientist describing all ongoing responses and providing a brief overview of the landscape.
- **Impact:** Under this program, DHS will be able to assess and respond rapidly to emerging, novel, or previously undetected threats, while maintaining continuity of coverage in other mission areas covered by S&T. By serving as the go-to mission readiness cell for the Department, this investment will mitigate the risk of unforeseen or emergent challenges in any mission area.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	-	7,926
Obligations	-	-	-	-	

FY 2018 Planned Key Milestone Events (Budget year)

- Respond to time-critical tasks and emergent threats that require rapid action plans, resourcing and knowledge products or technical solutions.
- Provide quarterly reports to the Chief Scientist describing future or emerging threats.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Respond to time-critical tasks as requested by the Secretary, Under Secretary, Components, or interagency partners.	FY 2018 Q1	FY 2018 Q4
Provide a year-end closeout report providing a summary of trends in the threat landscape and a review of impact and outcomes for all time-critical tasks managed in the Fiscal Year.	FY 2018 Q4	FY 2018 Q4

Type of Research

Applied

Technical Readiness Level

This program will manage activities with varying TRLs, depending on the nature of threats and potential solutions.

Transition Plans

- S&T will work closely with operational partners who request assistance from Threat Horizons to ensure that customer needs are addressed in all knowledge products or technical solutions.
- Any Threat Horizons analysis or recommendation that identifies the need for continued R&D beyond a very short time horizon may be transitioned to existing S&T R&D programs, or used as the basis to initiate stand-alone programs, as appropriate.

Identity Management Program FY 2017 Annualized CR: \$0.800M. FY 2018 Request: \$1.500M. This program researches and develops biometrics-based technologies, procedures, CONOPS, and information to identify known terrorists and criminals and prevent their movement into and out of the United States through effective, interoperable multi-biometrics in diverse areas, including border crossings, ports of entry, and visa application sites.

Digital Forensics (formerly Non-Cooperative Biometrics)

- **Problem:** Each week over 900,000 images are seized in new child exploitation cases and growing exponentially. There are over 190 million child exploitation images in the current database. With only 6,000 law enforcement personnel available to fight child exploitation, agents are overwhelmed and outnumbered and find it nearly impossible to identify and locate innocent victims and heinous perpetrators who will continue their abuse until forced to stop. While technological advances have improved our ability to identify human traffickers over the last decade, research into the social and behavioral factors that can be used to identify human traffickers and perpetrators of child exploitation is lacking.
- **Solution:** This Program will design, develop, test and integrate new algorithms that will give law enforcement agents the ability to sift through massive amounts of digital data much quicker than their current manual process and therefore locate victims and perpetrators much faster. DHS S&T will conduct evidence-based research to meet the policy, operational and public needs to improve the effectiveness of understanding how to identify human traffickers and perpetrators of child exploitation on and off line.
- **Impact:** This Program will provide agents with the ability to dramatically speed up the process of initial triage and the subsequent necessary forensic deep dive analysis of seized child exploitation digital imagery, increasing an agent's effectiveness while drastically limiting the amount of time an agent must subject themselves to traumatizing material, thus increasing the number of children recognized and therefore saved from a life of abuse. New capabilities will support more efficient and accurate analysis. This project improves the capability of the DHS ICE and DHS Homeland Security Investigations (HSI).

Sub Project

- Operational Roadmap - Human Trafficking: Identify human trafficking stakeholder needs and requirements to assist in building a research portfolio that is useful to end-users.
- Operational Roadmap- Child Exploitation: Identify child exploitation stakeholder needs and requirements to assist in building a research portfolio that is useful to end-users.

- Consumer or Producer: Develop a method for identifying consumers of child pornography and producers of child pornography based on online behavior.
- Child Exploitation Image Analysis Project: Design, develop, test and integrate new face, text and object detection and recognition algorithms that will allow agents to sift through massive amounts of data much faster and efficiently than their current manual process.
- Camera ID Project: Design, develop, test and integrate new algorithms that characterize a camera's sensor pattern noise (like finger prints for each individual camera) allowing forensic analysts to match still and video images from the same camera thus giving law enforcement agents the ability to identify and locate victims and perpetrators when the illicit material does not include faces but other non-illicit material from the same camera does. This work will also allow forensic analysts to cluster images from the same camera based on the sensor noise pattern (unique signature/fingerprint) which will drastically reduce the amount of time necessary to locate victims and perpetrators.
- Electric Network Frequency: Design, develop, test and integrate new algorithms that identify unique electric frequency signals imprinted on video and voice recordings that are indicative of the electric grid of a region, e.g. U.S, vs. Europe, Southwest U.S. vs. East Coast, where the recordings were created thus allowing law enforcement agents to narrow down a geographic location where the recordings were created.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	2,000	3,900	-	800	1,500
Obligations	1,792	3,593	-	50	

FY 2016 Key Milestone Events (Prior Year)

Child Exploitation Image Analysis Project

- Ground truthed seized child exploitation video and still digital data for faces and text in preparation for testing.
- Assessed performance of face and text detection and recognition algorithms against the child exploitation data set (phases 1 & 2).

FY 2017 Key Milestone Events (Year of Execution)

- Integrate face detection and recognition algorithm(s) into the current ICE HSI forensic tool using the application programming interface created in FY 2016.
- Develop a software development kit, application programming interface, and data interchange format in preparation for a full system integration of sensor pattern noise algorithms for Camera ID.

FY 2018 Key Milestone Events (Budget Year)

- Complete literature reviews that identify and address current research in human trafficking and child exploitation. Match this literature review to stakeholder needs and requirements.
- Perform operational test pilot of system in forensic tool for Camera ID and Child Exploitation Image Analysis.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Design, develop and test new face detection & recognition algorithms and sensor pattern noise algorithms that will give law enforcement agents the ability to sift through massive amounts of data much quicker than their current manual process and therefore locate victims and perpetrators much faster.	FY 2018	FY 2019
FY 2017		
Integrate new face detection & recognition capability into current forensic tool and complete design and development of sensor pattern noise algorithms that will give law enforcement agents the ability to sift through massive amounts of data much quicker than their current manual process and therefore locate victims and perpetrators much faster.	FY 2017	FY 2020
Operational Roadmap- Human Trafficking: Identify operational human trafficking stakeholders, and select the methods by which their needs and gaps will be elicited. Survey current social and behavioral research pertaining to human trafficking.	FY 2017	FY 2019
FY 2018		

Research & Development Description	Plan Start Date	Planned Completion
Complete testing and piloting face detection and recognition algorithms. Integrate, test and pilot new sensor pattern noise algorithms within current forensic tool that will give law enforcement agents the ability to sift through massive amounts of data much quicker than their current manual process and therefore locate victims and perpetrators much faster. Design, develop and prepare to test and integrate new Electric Network Frequency algorithms that will give law enforcement agents the ability to sift through massive amounts of data much quicker than their current manual process and therefore locate victims and perpetrators much faster.	FY 2018	FY 2019
Budget Year: Operational Roadmap- Human Trafficking: Identify operational human trafficking stakeholders, and select the methods by which their needs and gaps will be elicited. Survey current social and behavioral research pertaining to human trafficking.	FY 2018	FY 2019
Budget Year: Operational Roadmap- Child Exploitation: Identify operational human trafficking stakeholders, and select the methods by which their needs and gaps will be elicited. Survey current social and behavioral research pertaining to child exploitation.	FY 2018	FY 2019

Type of Research

Applied

Technical Readiness Level

TRL will vary between specific portfolio projects.

Child Exploitation Image Analysis Project - TRL 6

Camera ID Project - TRL 5

Electric Network Frequency - TRL 5

Transition Plans

- Each project activity benefits from the direct involvement of DHS and interagency end users, who shape the project, ensure it continues to address their requirements, and provides feedback on all deliverables.
- No additional investment is required to transition the knowledge products this project produces, which are generated throughout the project and are being incorporated into official DHS analytic products and training materials.

- Child Exploitation Image Analysis Project: Technology Transition Agreement signed between DHS S&T FRG and ICE Child Exploitation Investigations Unit (CEIU) who stress their need for these technologies and operational ease in integrating new algorithms to their current forensic tool set for immediate operational use.
- Camera ID Project: Technology Transition Agreement signed between S&T FRG and ICE CEIU who stress their need for these technologies and operational ease in integrating new algorithms to their current forensic tool set for immediate operational use.
- Electric Network Frequency: Technology Transition Agreement signed between S&T FRG and ICE CEIU who stress their need for these technologies and operational ease in integrating new algorithms to their current forensic tool set for immediate operational use.

6. Cyber Security/Information Analysis – FY 2017 Annualized Continuing Resolution: \$66.483M. FY 2018 Request: \$46.248M. Conducts and supports RDT&E and transition for advanced cybersecurity and information assurance technologies to secure the Nation’s current and future cyber and critical infrastructures. These solutions include user identity and data privacy technologies, end system security, law enforcement forensic capabilities, secure protocols, and software assurance.

Cyber Security Research Infrastructure – FY 2017 Annualized Continuing Resolution: \$10.847M. FY 2018 Request: \$0. This program provides the infrastructure necessary to support the R&D that is critical for matching and adapting cyber threats. Much like testing for CBE R&D, special testbeds and data sets must be made available to the cyber research community, and unlike CBE, there is not a large selection of facilities or capabilities like missile ranges or BSL-4 laboratories that can be used to safely test malicious code somewhere other than on the live Internet or on real data.

Experimental Research Testbed

- **Problem:** Due to the increasing sophistication of cybersecurity attacks, it is necessary to test new cybersecurity defenses and research in a repeatable manner at a realistic scale in order to determine the best approach. Furthermore, such research and experimentation must be conducted in a secure environment to allow for testing against “live” threats, without endangering the larger Internet.
- **Solution:** Provide the Defense Technology Experimental Research (DETER) Testbed, which provides a contained “virtual Internet” environment to conduct large scale, repeatable cybersecurity research experiments.

Impact: As the only freely available testbed of this scale, DETER improves attack mitigation and confinement strategies and the quality of new cybersecurity technologies as it is used by hundreds of organizations, including other government agencies, for test and evaluation purposes. Furthermore, DETER is also used as a tool for academia to enhance the educational experience of cybersecurity

students, providing a realistic hands-on experimentation platform for thousands of university students.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	3,940	4,000	3,500	4,132	0
Obligations	3,623	3,272	970	336	

Prior Year Key Events

Increase overall testbed capacity and scaling capabilities.

Current Year Key Events

Awarded follow on work for next generation experimental research testbed, new experimentation tools, and independent testing and evaluation services.

Expand the educational security courses and material offered through DETER.

Budget Year Key Events

N/A

Project Schedule Including Milestones

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Increase overall testbed capacity and scaling.	FY 2016	FY 2016
FY 2017		
Award follow on work for next generation experimental research testbed, new experimentation tools and independent testing and evaluation services.	FY 2017	FY 2017

Type of Research

Applied

Technical Readiness Level

N/A

Transition Plans

The Experimental Research Testbed project is a resource for the cybersecurity research community and does not currently have a plan to transition but rather will exist as an enduring testing and experimentation resource for the entire cybersecurity R&D community to use.

Research Data Repository

- **Problem:** Without access to large scale, real-world data, cybersecurity technology developers and evaluators often have to determine the value of their technical solutions based on anecdotal evidence or small-scale test experiments.
- **Solution:** Further develop and maintain the Protected Repository for the Defense of Infrastructure Against Cyber Threats (PREDICT), the only freely-available, legally and ethically collected repository of large-scale datasets containing real network traffic and system logs for use by cybersecurity researchers.
- **Impact:** PREDICT is helping users accelerate the design, production, and evaluation of next-generation cybersecurity solutions, including commercial products by allowing solutions to be based on more comprehensive real-world data. Further, PREDICT is improving the ethics of cybersecurity research on a larger scale through the development of an ethics framework and disclosure control principles available to the broader community.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	3,515	4,000	4,000	3,616	0
Obligations	3,229	3,683	3,485	756	

Prior Year Key Events

Created a program structure to support the cataloging, hosting, and/or mirroring of International datasets.
Established agreements with the EU and individual countries in Europe.

Current Year Key Events

Expand legal framework to support sharing data collected internationally.

Budget Year Key Events

N/A

Project Schedule Including Milestones

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Create a program structure to support the cataloging, hosting and/or mirroring of International datasets.	FY 2016	FY 2016
Establish agreements with the EU or individual countries in Europe and Singapore.	FY 2016	FY 2016
FY 2017		
Expand legal framework to support sharing data collected internationally.	FY 2017	FY 2017

Type of Research

Applied

Technical Readiness Level

N/A

Transition Plans

The Research Data Repository is a resource for the cybersecurity research community and does not currently have a plan to transition, but rather will exist as an enduring infrastructure level resource.

Cyber Transition and Outreach – FY 2017 Annualized Continuing Resolution: \$6.715M. FY 2018 Request: \$0. This program accelerates the transition of new and existing cybersecurity technologies, including open-source solutions, into commercial products and

services through robust internal assessments, evaluations, pilots, and experiments. This program also improves the human element of cybersecurity through multi-disciplinary research into workforce development, education, team, and multi-team training.

Transition to Practice

- **Problem:** Each year the Federal Government spends a significant amount of money on cybersecurity research. However, only a minimal amount of that research transitions into operational and commercial products.
- **Solution:** Transition research that addresses imminent needs in cybersecurity systems and strengthens national security. These activities include test and evaluation of technologies, setting up forums to introduce technologies to potential transition partners, and funding pilots of technologies in a variety of operational environments.
- **Impact:** By creating a heightened focus around transition, technology that could have otherwise “sat on the shelf” is now introduced to partners and end users who can take advantage of solutions to enhance the cybersecurity of the systems the Nation relies on. S&T is leveraging millions of dollars of research investment while ensuring that technologies and solutions developed with federal research dollars meet operational needs to protect the Nation’s critical infrastructure and systems.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	11,108	7,460	5,000	5,165	0
Obligations	10,172	9,024	5,670	2,565	

Prior Year Key Events

Conducted five industry specific technology demonstrations with the public and private sectors to include the finance and energy sectors.

Transitioned three technologies via license or open source in order to make commercially available.

Piloted three technologies in production environments with public or private sector partners.

Conducted a comparative analysis of past red-teaming efforts and developed cross-cutting lessons learned.

Conducted four collaboration events.

Provided two red-teaming reports and vulnerabilities assessments.

Current Year Key Events

Conduct four to six collaboration events (IT Security Entrepreneur Forums, Infosec Technology Transition Council, and others).

Transition three technologies to the commercial market.
 Pilot three to six technologies in production environments in the HSE.
 Identify six to ten technologies that are candidates for transition.

Budget Year Key Events

N/A

Project Schedule Including Milestones

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Conduct five industry specific technology demonstrations with the public and private sectors to include the Finance and Energy sectors.	FY 2016	FY 2016
Pilot three to six technologies in production environments with public or private sector partners.	FY 2016	FY 2016
Conduct four to six collaboration events.	FY 2016	FY 2016
FY 2017		
Conduct four to six collaboration events (IT Security Entrepreneur Forum, Infosec Technology Transition Council and others).	FY 2017	FY 2017
Identify and test/pilot/deploy at least two CSD funded technologies based on customer requirements.	FY 2017	FY 2017
Transition three technologies to the commercial market.	FY 2017	FY 2017
Pilot three to six technologies in production environments in the HSE.	FY 2017	FY 2017
Identify six to ten technologies that are candidates for transition.	FY 2017	FY 2017

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

Technologies going through the Transition to Practice project will transition in a variety of manners including commercially available products, open source, and direct use by federal agencies depending on the technology and community need.

Cybersecurity Outreach

- **Problem:** As cybersecurity becomes significantly more important each year, there is a growing need to improve awareness, training, and education.
- **Solution:** Improve cybersecurity training and education of the cybersecurity workforce. In particular, S&T sponsors cybersecurity competitions for high school and college students.
- **Impact:** S&T's sponsored cybersecurity competitions improve the quality and skill set of the next generation of cybersecurity professionals by providing an opportunity for students in a competitive environment and exposing them to the latest defense technologies and solutions, including those developed by S&T.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	2,481	1,500	1,700	1,550	0
Obligations	2,280	1,798	1,206	394	

Prior Year Key Events

Tested DHS S&T funded technologies in cyber gaming challenges.

Current Year Key Events

Test DHS S&T funded technologies in cyber gaming challenges.

Conduct National and Regional Collegiate Cyber Defense Competition to provide leadership in the National Initiative for

Cybersecurity Education (NICE).

Budget Year Key Events

N/A

Project Schedule Including Milestones

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Test DHS S&T funded technologies in cyber gaming challenges.	FY 2016	FY 2016
FY 2017		
Conduct National and Regional Collegiate Cyber Defense Competition to provide leadership in the National Initiative for Cybersecurity Education (NICE).	FY 2017	FY 2017

Type of Research

Applied

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

The developed Computer Security Incident Response Team (CSIRT) best practices and guidebook will be transitioned and available for use by all CSIRT teams. Funding for cybersecurity competitions at the high school and collegiate level is viewed as an enduring need to improve the quality of the future cybersecurity workforce, and therefore there is no current plan to transition S&T's activities in this area. However, other developed technologies and tools will continue to be deployed and used within the competition frameworks.

Information Analytics – FY 2017 Annualized Continuing Resolution: \$5.000M. FY 2018 Request: \$4.000M. This program researches, analyzes, and develops technologies to strengthen interoperable communications and improve effective information sharing at all levels of government.

Decision Analytics (formerly Predictive Analytics and Informatics)

- **Problem:** Leveraging data sources to compute threats, impacts, risks, decision support, and situational awareness continues to become increasingly challenging due to the exponential growth of data, particularly data associated with the Internet-of-Things. Further, data analytics technologies, including computational, methodological, and systems components, rapidly evolve on six month innovation cycles making it difficult to track solution options.
- **Solution:** Keeping pace with growing data sets and rapidly evolving solutions requires an agile core technical service that can quickly diagnose privacy, security, computation, and analytics for the missions of S&T, the Department, and the extended Homeland Security Enterprise. HSARPA has created the Data Analytics Engine (DA-E) and work center to assist in problem definition and solutions development for Department programs using relevant data sets, analytic methodology, technologies, and systems in collaboration with subject matter experts from government, industry, and academia. Further, DA-E works across disciplines to illuminate next generation problem sets and technologies (including social media and video analytics) to inform program planning, avoid technical obsolescence and prevent mission surprise.
- **Impact:** DA-E helps analysts, operators, and agents across DHS increase mission effectiveness by better leveraging data for decision-making. DA-E provides S&T and Department programs with coordinated information, subject matter expertise, mission studies, analysis of alternatives, experiments, prototypes, business methodologies, and transition planning to improve program efficiency, share best practices, and improve security and privacy protection across DHS analytics system investments.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	4,000	-	4,000
Obligations	-	-	0	1,503	

Prior Year Key Events

- Transitioned private cloud solution for information sharing to ICE Cyber Crimes Center, Child Exploitation Investigations Unit, to enable faster evidence sharing so that HSI agents around the world can respond more quickly to crimes occurring in their geographic area.
- Completed prototype for case deconfliction across 33 agencies and 8 Departments to improve inter-agency coordination on counter-proliferation.

- Created Red Hat compliance script to automate the validation of configuration compliance (i.e., checking configuration against specific DHS security requirements) to facilitate S&T and DHS FISMA scorecard reporting.

Current Year Key Events

- Complete cloud security studies, including cloud management tools, to enable DHS agencies to make informed decisions regarding cloud implementations.
- Complete a report comparing big data query tools.
- Evaluate advanced capabilities for fraud detection to support USCIS.

Budget Year Key Events

- Demonstrate automated reporting tools on a DHS use case to improve efficiency in operations.
- Conduct deep learning studies focused on potential DHS use cases.
- Document high-level gaps in High Performance Computing requirements.

Project Schedule Including Milestones

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Demonstrate automated reporting tools on a DHS use case to improve efficiency in operations.	FY 2017 Q4	FY 2018 Q2
Document high-level gaps in High Performance Computing requirements.	FY 2017 Q1	FY 2018 Q4
FY 2018		
Conduct deep learning studies focused on potential DHS use cases.	FY 2018 Q1	FY2018 Q4

Type of Research

Decision Analytics projects include elements of Basic, Applied, and Developmental research.

Technical Readiness Level

Decision Analytics projects range from Technology Readiness Level 2 to 7.

Transition Plans

Deliver targeted exploratory, developmental, and operational capabilities directly to sustained component operations. Many deliverables will be transitioned through the commercial market place in the form of commercially supported open source products.

Network and System Security and Investigations – FY 2017 Annualized Continuing Resolution: \$43.921M. FY 2018 Request: \$42.248M. This program produces technologies needed to secure information and software that resides on the networks and systems that make up the Internet and provide analytic tools for the law enforcement community to investigate crimes committed in cyberspace.

Cybersecurity for Law Enforcement

- **Problem:** A significant barrier for law enforcement is keeping abreast of technology changes. New technology, both hardware and software, is released into the market at a very rapid pace and used in criminal and terrorist activity almost immediately.
- **Solution:** Develop new technologies, capabilities, and standards to assist law enforcement in cyber-crime investigations and the forensic analysis of technologies used in criminal activity.
- **Impact:** These technologies, capabilities, and standards will reduce the amount of time needed to analyze technology used in illicit activity, reduce the cost of acquisition for law enforcement agencies whose budgets are stretched thin, and narrow the technology capability gap between criminals and law enforcement.

Sub Projects

- **Anonymous Networks and Currencies** - Criminals are increasingly exploiting the built-in privacy-enhancing protections for the legitimate use of anonymous networks and cryptocurrencies. The project works with the law enforcement community to develop cost-effective solutions to complement and expand their abilities to investigate online criminal activity.
- **Cybersecurity Forensics** - Almost all criminal investigations today include digital evidence. The project works with the law enforcement community to gather requirements and develop cost-effective solutions and capabilities for quick acquisition and analysis of information from a wide variety of electronic devices including cell phones, GPS devices, tablets, and vehicle infotainment systems.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	9,704	9,800	8,400	7,231	4,400
Obligations	8,507	8,140	6,531	1,000	

FY 2016 Key Milestone Events (Prior Year)

- Completion of additional open source module development for law enforcement forensics.
- Completion of Vehicle Infotainment and Navigation Forensics project including transition of enhanced capabilities.
- Transition of hand-held hardware to law enforcement customer for operational use.
- Transition of additional protocol support capabilities.
- Completion of online fraud and illicit commerce study.

FY 2017 Key Milestone Events (Year of Execution)

- Initiate two new research and development activities in an expanded portfolio of state-of-the-art cyber forensics tools and techniques.
- Completion of privacy protecting network measurement research.
- Completion of cryptocurrency forensics tool pilot with law enforcement agencies.
- Complete operational pilots of next generation technology architecture for transition to law enforcement customers.

FY 2018 Key Milestone Events (Budget Year)

- Transition reference materials for the forensic acquisition and analysis of then commercially available devices to Cyber Forensics Working Group member agencies.
- Expansion of developed cryptocurrency forensics tool to address additional operational requirements of DHS law enforcement officers.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Pilot Vehicle Infotainment and Navigation Forensics project.	FY 2016 Q1	FY 2016 Q4
Complete law enforcement field interviews for illicit commerce requirements report.	FY 2016 Q1	FY 2016 Q3
FY 2017		
Develop initial, test-ready cryptocurrency forensics tool.	FY 2016 Q2	FY 2017 Q1
Baseline requirements for privacy protecting network measurement and initiate research.	FY 2016 Q4	FY 2017 Q3
FY 2018		
Complete acquisition and analysis tests for ten commercial devices.	FY 2017 Q4	FY 2018 Q2
Develop and test capability for operational expansion of cryptocurrency forensics tool.	FY 2018 Q1	FY 2018 Q4

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- End-users and customers test developed tools and technologies, and at times, the project provides limited hardware/software licenses to support transition. Otherwise, tools and technologies are transitioned into commercially available tools or integrated into law enforcement field deployment.

Data Privacy and Identity Management

- **Problem:** Agencies and organizations lack processes and tools to share and coordinate information effectively because of an inadequate amount of security, trust, usable tools, policies, and procedures.
- **Solution:** Enhance the security of information sharing environments and the protection of users by improving authentication for persons, hardware devices, and software applications across all levels of government.
- **Impact:** This project provides interoperable access control technologies that provide a cost effective solution to all levels of government, including state and local levels. Additionally, this work enables information sharing without compromising the privacy of individuals (i.e. personally identifiable information) or organizations.

Sub Projects

- Identity Management - The Identity Management project develops, tests, and evaluates interoperable tools, technologies, and standards to help manage authentication, identification, access control, fraud analytics, and compensating controls. This project seeks to identify solutions to increase security and productivity, while reducing costs and security risks.
- Data Privacy - The Data Privacy project develops, tests, and evaluates tools and standards for the management of personally identifiable information, automation of privacy controls, privacy implications of connected devices, big data, and anomaly detection. The project is working to ensure the protection of personal information consistent with public policy.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	4,837	1,151	0	3,822	2,606
Obligations	4,444	2,763	2,832	2,832	

FY 2016 Key Milestone Events (Prior Year)

- Delivered a tool, technology, or knowledge product for securing personally identifiable information within DHS.
- Transitioned research and development capabilities, especially using mobile devices, to the communities of interest in providing fine-grain secure information access and physical access.

FY 2017 Key Milestone Events (Year of Execution)

- Transition research and development capabilities, especially using mobile devices, to the communities of interest in providing fine-grain secure information access and physical access.
- Provide Communities of Interest an identity and data privacy technology landscape to enable an understanding of areas of technology gaps and where R&D investments should be made.

FY 2018 Key Milestone Events (Budget Year)

- Develop a tool, technology, or knowledge product that identifies non-person entities on a network in order to support homeland security applications such as Internet of Things identity, anti-spoofing and attribution.
- Catalogue, analyze, and create security and privacy compensating control design patterns that could be implemented by digital services to mitigate session and transactional behavior risks.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Backend Attribute Exchange	FY 2015 Q1	FY 2016 Q4
Mobile Visitor Log for PIV-I	FY 2015 Q3	FY 2016 Q4
FY 2017		
A Platform for Contextual Mobile Privacy	FY 2016 Q2	FY 2018 Q4
Identity and Data Privacy Ecosystem Map	FY 2016 Q2	FY 2018 Q4
FY 2018		
SuperIdentity for Non-Person Entities	FY 2017 Q3	FY 2019 Q3
Survey of Session and Transactional Behavior Risk Management Approaches	FY 2018 Q1	FY 2020 Q1

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- Transition Plans in this project consist of a mixture of open source releases of technology and knowledge products as well as direct transitions to Federal Government agencies.

Aviation Cyber Security

- **Problem:** In today's global and interconnected economy, the safe movement of people and cargo across the open skies is a crucial factor in promoting free trade and advancing prosperity and freedom. Detecting, identifying, and defeating the array of cyber threats to the Global Air Domain is a national imperative. Unfortunately, when the current majority of aircraft were designed, decades ago, cyber security was not considered. Commercial aircraft flying today are extremely vulnerable to cyber-attacks.
- **Solution:** Conduct the research to identify aircraft cyber vulnerabilities and develop mitigations to those vulnerabilities. Identify areas for strengthening cybersecurity within aircraft systems, but also create a robust assessment methodology and process that will be implemented to identify and eliminate threats to safe operation that emerge in the future.
- **Impact:** The commercial aviation industry represents roughly 5 percent of the U.S. Gross Domestic Product (GDP). Disrupting U.S. commercial aviation industry interests would have a significant national economic impact.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	3,000	3,000	2,000
Obligations	-	-	2,685	2,123	

FY 2016 Key Milestone Events (Prior Year)

- Secured a commercial aircraft and demonstrated a remote, non-cooperative penetration.

FY 2017 Key Milestone Events (Year of Execution)

- Conduct a cyber vulnerability assessment of the aircraft electrical system, the full automated digital electronic control (FADEC) system, and the flight management system (FMS).

FY 2018 Key Milestone Events (Budget Year)

- Cyber vulnerability assessment of aircraft telemetry system
- Cyber vulnerability assessment of aircraft power plant/engines

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Secure a commercial aircraft and demonstrate a remote, non-cooperative penetration	FY 2016 Q2	FY 2016 Q4
FY 2017		
Assessment of full automated digital electronic control (FADEC) system	FY 2017 Q3	FY 2017 Q4
Assessment of flight management system (FMS).	FY 2017 Q2	FY 2017 Q4
FY 2018		
Cyber vulnerability assessment of aircraft telemetry system	FY 2018 Q2	FY 2018 Q4
Cyber vulnerability assessment of aircraft power plant/engines	FY 2018 Q2	FY 2018 Q4

Type of Research

Applied

Technical Readiness Level

Technology Readiness Level 3 and Level 7

Transition Plans

- As vulnerabilities are discovered and mitigations developed, the results and findings will be shared with the Federal Aviation Administration (FAA) to determine the level of risk and seriousness. If assessed as a “safety of flight” issue, the FAA, as the regulator, will take appropriate action. If deemed less than a “safety of flight” issue, then DHS will work with the industry partners to implement mitigation strategies, process, and procedures.

Software Assurance

- **Problem:** There is a need to advance the science and technology for software quality assurance tools used to find defects in software. Modern software quality assurance tools generate too many false-positives and miss a good portion of actual defects in software.
- **Solution:** Maintain a collaborative research environment to advance software quality assurance capabilities by offering a collection of software quality assurance tools and assurance services. Allow developers to test and evaluate code for weaknesses that expose vulnerabilities in software, and provide tool developers an environment where they can test, calibrate, and improve the coverage area in their tools. Lead research and development efforts to modernize static analysis capabilities, improve synergies and integration with continuous delivery platforms, advance mobile application analysis, and proactive and automated threat analysis for application security.
- **Impact:** Solutions will reduce the number of weaknesses found in software, minimizing the attack surface of software. By applying the principle of continuous assurance throughout the software development process, developers are afforded the opportunity to detect bugs and defects in their software early in the software development process. Modernizing software quality assurance tools achieves security at-speed for tighter and seamless integration with continuous delivery platforms. The total cost of ownership to build and maintain software will be reduced as a result.

Sub Projects

- **Application Security Threat and Attack Modeling (ASTAM)** - ASTAM is a proactive analysis capability that monitors and actively protects systems and applications by identifying potential risks, security threats, and exposures to the system environment, and then developing appropriate countermeasures to prevent or mitigate the effects of threats to the system environment by bringing together independent assessment activities to build better situational awareness regarding potential threats.
- **Static Tool Analysis Modernization Project (STAMP)** - The goal of STAMP is to modernize a list of candidate software analysis tools (open-source) to improve tool performance and coverage, to seamlessly integrate and support continuous integration and developmental operational environments, provide stronger analysis of results by reducing false-positives, and provide more visibility into false-negatives that often leave residual risks. STAMP should advance the state-of-the-art capabilities found in software analysis tools.
- **Software Assurance Marketplace (SWAMP)** - Software has become an essential component of the Nation's critical infrastructure. It has grown in size, capability, and complexity at a rate that exceeds our ability to keep pace with quality software. The SWAMP is S&T's response to address the growing concern. This project provides a broad range of software assurance services and capabilities to help improve the quality and security of software as well as improve the overall capabilities in software quality assurance tools. SWAMP helps to formalize software assurance in organizations and

provides a collaborative research environment for tool developers and researchers to advance software assurance capabilities. This national-level resource will benefit the software assurance community for years to come.

- Software Quality Assurance - The growing reliance on software makes everyone vulnerable to cyberattacks. The complexity and size of software make it difficult for software quality assurance tools to identify potential vulnerabilities in software. The project is working to create and improve the techniques and capabilities used in static, binary, and dynamic analysis tools to help create a healthier and more secure software ecosystem.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	-	7,295
Obligations	-	-	-	-	-

FY 2018 Key Milestone Events (Budget Year)

- Develop working prototypes for Hybrid Analysis, Attack Threat Modeling, Attack Simulation and Countermeasures, and Compliance Monitoring and Assessment
- Develop test case and test datasets for STAMP to be transitioned to SWAMP.
- Develop tool modernization framework report and tool improvement analysis report.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
ASTAM functional prototypes of components	FY 2018 Q1	FY 2018 Q4
Develop STAMP Modernization Framework	FY 2018 Q1	FY 2018 Q2
Transition STAMP working prototype of modernized tools to the SWAMP	FY 2018 Q3	FY 2018 Q4
STAMP Scoring and Benchmark draft document	FY 2018 Q1	FY 2018 Q3
Transition of STAMP data set/test cases to SWAMP	FY 2018 Q2	FY 2018 Q3

Type of Research

Applied

Technical Readiness Level

TRL 5-6

Transition Plans

- The SWAMP has been set up as an enduring infrastructure resource for the cybersecurity research community and thus does not currently have a plan to transition.
- Resultant STAMP deliverables will be transitioned to the SWAMP and identified stakeholders including Software Assurance sub-IPT members, NIST, NSA Center for Assured Software and existing transition customers such as – banking/financial industry, Aberdeen Proven Grounds, Commonwealth of Pennsylvania, and open-source developer community.

Network System Security

- **Problem:** As the Internet continues to grow organically and exponentially, the protection of cyber infrastructure depends on the ability to identify critical Internet resources that are subject to attack and to develop robust metrics to determine the impact of cyber-attacks in a rapidly evolving environment. These resources include routing infrastructure, distributed denial of service defenses (DDoSD), and cloud-based systems.
- **Solution:** This program executes research in order to improve the multiple facets of network systems security. Effective network systems security needs to address multiple threats, provide a layered defensive approach and include both hardware and software solutions.
- **Impact:** The development and application of capabilities will better predict and defend against cyber-attacks on Federal Government installations and other critical infrastructure. This is accomplished at numerous points including DDoSD, routing infrastructure, and cloud-based systems.

Sub Projects

- Distributed Denial of Service Defense (DDoSD) - Distributed denial of service attacks are growing and frequently target critical infrastructure sectors and government agencies. The goal of the DDoSD project is to slow attack growth by promoting best practices and building technologies to mitigate new and current attack types. Through these strategies, critical infrastructure sectors and government agencies will have the ability to withstand one terabit per second attacks. This new level of defense will push the defender into the lead.

- Security of Cloud-Based Systems - The Security of Cloud-based Systems project is developing technologies that will help mitigate the security implications of cloud computing, as well as leverage the dynamic nature of the cloud to provide enhanced defense for operational environments.
- Secure Protocols for the Routing Infrastructure - Routing infrastructure is one of the most critical components of the Internet, yet it is susceptible to spoofing and other attacks in which cyber criminals can redirect users to unsafe websites or pathways. The Secure Protocols for the Routing Infrastructure project's goal is to add security to the Internet's core routing protocol, namely Border Gateway Protocol (BGP), so communications follow the intended path between organizations.
- Application of Network Measurement Science - This project involves strengthening the certificate authority system, securing embedded systems and detecting network outages in real time.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	-	16,567
Obligations	-	-	-	-	-

FY 2018 Key Milestone Events (Budget Year)

- Expand the system for protecting emergency management systems (e.g. 9-1-1 system) so that other critical call centers can also withstand large bursts of calls (e.g. Telephony Denial of Service attacks) and successfully pilot the technology in a critical call center.
- Develop tools and techniques for defending a medium scale Internet organization against 1 Terabit per second (1 Tbps) Denial of Service attack. At the project creation, 1Tbps attack far exceeded any attack that has occurred, but attackers are improving rapidly with attackers getting close to the 1 Tbps size. It is essential defenses be in place before attackers reach that scale.
- Integration of dynamic defense technology with command and control over multiple physical enclaves across multiple sites.
- Develop and deploy authentication services that validate certificates and address weaknesses in the Internet's current Certificate Authority authentication system.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Demonstrate defense against a 250 Mbps (1/4 Tbps) attack	FY 2017 Q2	FY 2018 Q1
Evaluation of TDoS defense pilot in a major data center	FY 2017 Q3	FY 2018 Q4
Demonstrate defense against a 750 Mbps (3/4 Tbps) attack	FY 2017 Q3	FY 2018 Q4
Delivery of FC2 Source Code and Executable Virtual Machines	FY 2017 Q2	FY 2018 Q2
SDNA Physical Enclave Setup Report	FY 2017 Q4	FY 2018 Q1
Demonstration of full SDNA-FC2 multi-site system	FY 2018 Q2	FY 2018 Q4
Develop certificate validation, certificate revocation, notary-based pinning, and TLS proxy inspection and authentication services to the Windows operating system	FY 2016 Q3	FY 2018 Q3

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects

Transition Plans

- The transition plan is multi-faceted with plans that are specific to each individual effort with final transitions to open source software, commercial licensing, and knowledge products.
- A variety of methods will be used to transition the tools, technologies, and methods produced under this project to include commercialization, transition to specific Federal Government organizations and both limited and open source licensing, depending on the product.

Mobile Security

- **Problem:** Threats to the government's use of mobile devices are real and exist across all elements of the mobile ecosystem. Many critical communication paths remain unprotected and leave the overall ecosystem vulnerable to attacks.

- **Solution:** The program will address the problems in securing the mobile ecosystem by taking a comprehensive R&D approach to securing the mobile ecosystem targeted toward architectural components and based on security capability gaps identified by HSE stakeholders.
- **Impact:** The program will facilitate a more secure mobile ecosystem not only for the Federal Government, but also for the commercial marketplace.

Sub Projects

- **Mobile Device Security** - Mobile technology has changed how people communicate, make daily decisions, and execute business transactions. However, the lack of security has prevented enterprise organizations from fully embracing mobile technology. The Mobile Device Security project is developing innovative security technologies to accelerate the secure adoption of mobility for mission use.
- **Mobile Application Security** - This project is developing innovative approaches to provide continuous automated assurance for security throughout a mobile application's lifecycle by monitoring commercial and federal threat intelligence sources, correlating vulnerabilities across app stores, responsibly sharing threat information, and developing methods to provide actionable information to developers or security analyst to address threats and vulnerabilities.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	-	5,211
Obligations	-	-	-	-	-

Milestones:

FY 2018 Planned Key Milestone Events (Budget Year)

- Transition mobile security technology in continuous authentication to the commercial marketplace.
- Demonstrate mobile application development tools with functionality that, transparently to the developer, incorporate secure mechanisms as mobile apps are developed.
- Demonstrate capabilities for validating security throughout a mobile application's operational use, as measured against the National Information Assurance Partnership (NIAP) criteria or other federal or commercial criteria.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Assessment and identification of NIAP criteria that can be automated	FY 2018 Q1	FY 2018 Q2
6 months Go/No-Go evaluations for Mobile Device Security R&D projects	FY 2018 Q2	FY 2018 Q4
6 months Go/No-Go evaluations for Mobile Application Security projects	FY 2018 Q2	FY 2018 Q4

Type of Research

Applied

Transition Plans

- All of the deliverables from this project will be openly available, either as commercial products, open source tools, or publicly available data sets. While the work of this program will benefit the entire HSE, the focus of the program is the Federal Government. In order to encourage transition into the Federal Government and DHS, promising solutions will be deployed to allow for hands on evaluation.

Human Aspects of Cybersecurity

- **Problem:** Improving cybersecurity requires investments in non-technical, social, economic and behavioral elements. The human user or operator is often a significant inherent vulnerability.
- **Solution:** Develop fundamentally different approaches to improve cybersecurity with activities focused on areas outside traditional approaches. Support research into the business, legal, technical, and behavioral aspects of the economics of cyber threats, vulnerabilities, and controls.
- **Impact:** By disrupting the status quo through radically different techniques, S&T will be able to address some of the most difficult cybersecurity issues. By facilitating value-based and more effective investments in cybersecurity, S&T will also improve value-based decision making by those who own, operate, protect, and regulate the Nation's vital data assets and critical infrastructure and will ultimately reduce the risks of cybercrime and cyberattacks.

Sub-Projects

- Cyber Risk Economics - Despite the growing national focus on cybersecurity, there has been little attention from the research community on economic, behavioral, and business factors that persuade a private organization to select and implement cybersecurity measures. The Cyber Economic Incentives project examines where, why, and how much cyber-infrastructure owners and operators should invest in cybersecurity. This project is researching adoption incentives, the reputations of commercial network operators for preventing attacks, and understanding criminal behaviors to mitigate risks.
- Insider Threat - Cybersecurity defenses most often focus on threats from outside an organization rather than threats posed by untrustworthy insiders even though insider threats frequently are the source of loss of financial or sensitive information and harm to critical infrastructure industries and national security. The Insider Threat project is developing approaches to detect and mitigate insider threats that will benefit a wide range of government and private-sector customers.
- Cybersecurity Metrics and Measurements - Developing meaningful cybersecurity metrics has been challenging, particularly as information technology and cyberattack methods change and evolve. This constantly changing environment makes it difficult for organizations to evaluate their cybersecurity defenses effectively. The project addresses this challenge by developing practical and useful decision aids and techniques that enable organizations to better gauge and measure their security posture and help users make informed decisions based on threats and cost.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	-	4,169
Obligations	-	-	-	-	-

FY 2018 Key Milestone Events (Budget Year)

- Complete operational pilot and assessment of insider threat detection tool with identified partner.
- Initial execution of Cyber Risk Economics R&D Strategy in the areas of Investment, Impact, Value and/or Incentives.
- Market analysis of cyber security economics gaps and needs.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Initiate 3 Cyber Risk Economics R&D projects	FY 2017 Q2	FY 2018 Q1
Complete development of pilot-ready insider threat detection tool	FY 2017 Q2	FY 2018 Q1
Convene Cyber Risk Economics R&D Stakeholder's Exchange Meeting	FY 2018 Q1	FY 2018 Q2

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- A variety of methods will be used to transition the tools, technologies, and methods produced under this project to include commercialization, transition to specific Federal Government organizations and both limited and open source licensing, depending on the product. Due to the nature of the program focus, outcomes are applicable to all government and private sector agencies.

7. First Responder/Disaster Resilience – FY 2017 Annualized Continuing Resolution: \$72.850M. FY 2018 Request: \$61.294M. Work includes reduction of vulnerability of critical infrastructure, key leadership, and events to terrorist attacks and other hazards; working with State, local, tribal, and territorial governments to secure their information systems; working with local and regional partners to identify hazards, assess vulnerabilities, and develop strategies to manage risks associated with all hazards; increasing the state of preparedness of State, local, regional, tribal, and territorial partners, as well as nongovernmental organizations, the private sector, and the general public; advancing and improving disaster emergency and interoperable communications capabilities; and, improving the capabilities of DHS to lead in emergency management.

Bioagent Attack Resiliency – FY 2017 Annualized Continuing Resolution: \$10.027M. FY 2018 Request: \$5.000M. This program provides advanced planning; develops CONOPS; develops and provides capabilities to support forensics, laboratory response,

personnel protection, and decontamination; and utilizes exercises and training for responding to and recovering from a biological disaster.

Bio-Forensics R&D

- **Problem:** Bioforensics research and development is required to improve the ability to identify and characterize source material collected from a bio-crime in order to pursue legal prosecution against the responsible party (or parties). This research provides law enforcement investigators such as FBI and USSS with critical tools that provide investigative leads for attribution.
- **Solution:** This project develops advanced forensic capabilities to determine the source and production method of biological threat agents (BTAs) collected from crime scenes. Specifically, the project develops protocols for characterization and identification of BTAs, and utilizes a robust sample management, molecular signatures, and physical/chemical analysis research program. Bioforensics R&D is currently focused on establishing a methods-based approach to BTA characterization, which does not depend on prior knowledge of the organism and can detect novel and/or emerging organisms. Establishment of this approach includes development of orthogonal approaches to agent characterization initiation of an effort to build a national sequence database for whole genome comparison and development of computational algorithms for data analysis.
- **Impact:** The Bioforensics R&D project leads national research efforts in microbial forensics and transitions analytical techniques to the National Bio-forensics Analysis Center (NBFAC) and other government stakeholders. The Bioforensics R&D project will support intelligence assessments, preparedness planning, response, emerging threat characterization, bioforensic analyses, and evidence associated with biocrime incidents.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	4,000	6,500	6,500	5,682	0
Obligations	5,032	5,186	3,171	0	-

FY 2016 Key Milestone Events (Prior Year)

- Develop analytical standards for whole genome sequencing.
- Fill gaps in infectious organism biology and publish results to support legal admissibility of analytical results into court.
- Develop methods that support definitive bioforensics identification and characterization for emerging, enhanced, chimeric, engineered and purely synthetic threat agents to forensics investigations.

FY 2017 Key Milestone Events (Year of Execution)

- Fill gaps in infectious organism biology and publish results to support legal admissibility of analytical results into court.
- Develop methods that support definitive bioforensics identification and characterization for emerging, enhanced, chimeric, engineered, and purely synthetic threat agents to law enforcement.
- Establish capability for the identification and characterization of rare variants and quasi species to support bioforensic casework.
- Develop metagenomics and host based capabilities to support bioforensic casework.
- Populate comparative genomics databases with emerging agent data.
- Transition methods for ricin and abrin mass-spec-based identification and characterization to forensics investigations.

FY 2018 Key Milestone Events (Budget Year)

- N/A

Project Schedule

N/A

Type of Research

Applied

Technical Readiness Level

The program plans to begin at TRL 4 and end at TRL 6.

Transition Plans

- N/A

National Bioforensics Analysis Center (NBFAC)

- **Problem:** The anthrax mailings of 2001, demonstrated the need for a dedicated capability to conduct the scientific analysis and support the traditional forensic analysis of evidentiary samples from biocrime and bioterror investigations or from an actual event to support attribution investigations. This capability must provide high quality, validated processes and methods that meet admissibility requirements for federal prosecution of crimes involving biological agents.

- **Solution:** The NBFAC, located at the NBACC, is the Nation's lead facility for technical analysis of samples from biocrime and bioterror investigations. NBFAC has established the necessary dedicated staff, equipment and biocontainment laboratories to provide scientific data to support attribution investigations. The NBFAC provides a 24/7 capability using ISO 17025 accredited processes, agent based assays and genomics to identify and characterize traditional, non-traditional, emerging, genetically engineered and synthetic biological agents. NBFAC's ISO 17025 accredited capabilities ensure rigorous chain-of-custody, third party review and quality-controlled procedures to ensure the integrity of evidentiary samples and their analysis.
- **Impact:** NBFAC provides the Federal Bureau of Investigation with centrally coordinated and validated capabilities for sample handling, sample processing, and bioforensic analyses of evidentiary material derived from biocrime and bioterror investigations or from the actual use of a biological agent.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	5,875	6,500	6,500	6,715	0
Obligations	5,365	6,246	5,825	3,839	

FY 2016 Key Milestone Events (Prior Year)

- Provide 24/7 bioforensic casework support.
- Establish capability for the identification and characterization of rare variants and quasi species to support bioforensic casework

FY 2017 Key Milestone Events (Year of Execution)

- Provide 24/7 bioforensic casework support.
- Develop metagenomics and host based capabilities to support bioforensic casework.
- Establish capability for the identification and characterization of rare variants and quasi species to support bioforensic casework.

FY 2018 Key Milestone Events (Budget Year)

- N/A

Project Schedule

N/A

Type of Research

Development

Technical Readiness Level

The program plans to begin at TRL5 and at TRL7.

Transition Plans

N/A

Foreign Animal Disease Vaccines, Diagnostics, and Countermeasures

- **Problem:** The United States is at risk for outbreaks of high-priority foreign animal diseases (FADs) that would cause major economic disruption to the agriculture sector critical infrastructure resulting in billions of dollars of losses to U.S. livestock producers and the U.S. government. These diseases include Foot-and-Mouth Disease (FMD), Classical Swine Fever (CSF) and African Swine Fever (ASF) which may be introduced to the U.S. through natural, accidental or deliberate means.
- **Solution:** This project provides new, next-generation vaccines and other countermeasures to government and industry stakeholders to ensure that USDA and other first responders in the animal agriculture community, have the countermeasures needed to effectively identify, respond and recover from foreign animal disease outbreaks. In addition to investing in novel technologies to rapidly respond to and recover from these threats, this project works with commercial animal health industry partners to ensure completion of U.S. regulatory requirements (master-seed, pre-licensing serials, clinical trials) for high-priority countermeasures so that they are readily available in an outbreak situation.
- **Impact:** This project strengthens the defense of the U.S. agricultural infrastructure by ensuring that USDA and other first responders in the animal agriculture community, have effective countermeasures needed to respond to foreign animal disease outbreaks. Efforts to develop multi-serotype countermeasures are underway to provide faster and more comprehensive protection to limit the spread and size of an outbreak. Data from this project will support the regulatory licensing and/or availability of new countermeasures in the event of a high-consequence outbreak in the United States.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	14,125	12,300	13,800	15,496	0
Obligations	11,562	12,415	4,402	0	

FY 2016 Key Milestone Events (Prior Year)

- Obtain USDA CVB approval of up to 5 AdFMD master seeds for use in manufacturing of pre-licensing serials towards product licensure.
- Conclude assessment of broad spectrum countermeasure alternatives to address emerging disease threats.

FY 2017 Key Milestone Events (Year of Execution)

- Obtain USDA CVB Approval of at least two additional Adenovirus vectored foot-and-mouth disease virus vaccines for use in manufacturing of pre-licensing serials towards product licensure.
- Work with a U.S. animal health industry partner to transition two, next generation FMD monovalent vaccine candidates to late-stage product development.

FY 2018 Key Milestone Events (Budget Year)

- N/A

Project Schedule

N/A

Type of Research

Applied

Technical Readiness Level

This project funds the development of multiple vaccines, diagnostic assays, and molecular tools for new and more effective vaccines and diagnostics, the vast majority of which start at TRL3 and end at TRL7.

Transition Plans

N/A

USCG/EPA Wide Area/Vessel Decontamination Project

- **Problem:** The Environmental Protection Agency (EPA) along with S&T are looking for ways to improve capabilities for response to a wide area release of *Bacillus anthracis* spores. A long standing problem is the rapid ability to characterize contamination, conduct decontamination, and manage waste (including wash water).
- **Solution:** To develop decontamination procedures that would address fate and transport, including natural weathering, inform response and remediation decisions.
- **Impact:** Rapid and efficient recovery of metropolitan and coastal areas from a biological terrorist event.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	-	3,000
Obligations	-	-	-	-	-

FY 2018 Planned Key Milestone Events (Budget Year)

- Develop and determine wide area sample collection methods - determine appropriate environmental sample collection methods for outdoor matrices, including collection from concrete, pavement, dirt, air, water and vegetation and methods for sampling vehicles and large vessels.
- Understand wide area fate and transport to inform decision making - evaluate fate/transport/weathering of spores on various surfaces to inform mitigation and sampling strategies.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Task 1A – Develop and determine wide area sample collection methods - determine appropriate environmental sample collection methods for outdoor matrices, including collection from concrete, pavement, dirt, air, water and vegetation and methods for sampling vehicles and large vessels;	FY 2018 Q1	FY 2019 Q2

Task 1B – Understand wide area fate and transport to inform decision making - evaluate fate/transport/weathering of spores on various surfaces to inform mitigation and sampling strategies.	FY 2018 Q1	FY 2019 Q4
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Type of Research

Applied

Technical Readiness Level

TRL 6-7

Transition Plans

Technology solutions and knowledge products, developed in accord with component requirements, will be transitioned to USCG and EPA for acquisition programs or preparedness planning.

Compact Personal Protective Equipment

- **Problem:** Law Enforcement VIP Protective Personnel lack an enhanced ability to discreetly carry personal protective equipment (PPE) for the protection and safe extraction of senior leadership and other designated persons from a full range of operational environments where a hazardous biological, chemical or radiological (CBR) substances has been released. The lack of this enhanced ability can prolong exposure to a respiratory threat due to the inaccessibility of PPE in an emergency situation.
- **Solution:** A compact, lightweight ‘hooded escape respirator’ that can be rapidly deployed and provide respiratory protection against hazardous CBR substances as well as providing for visual acuity and oral communications. The escape hood must be certified by the National Institute for Occupational Safety and Health (NIOSH) as protective against CBR contaminants. These escape hoods are designed for use only in emergency situations for rapid egress from CBR-containing environments of individuals under the protection of First Responders and Law Enforcement.
- **Impact:** Improvements in Protective Personnel technology will enable more compact, readily accessible, equipment suitable for tactical emergency response operations in a contaminated environment. Personnel charged with protection of VIPs will be better able to discreetly carry the full ensemble of equipment in support of their mission without a need in a time-critical situation to return to a designated location to retrieve the PPE. The PPE will find use within the tribal/local/State/federal Law Enforcement and First Responder communities.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	-	2,000
Obligations	-	-	-	-	-

FY 2018 Planned Key Milestone Events (Budget Year)

- Complete Materials Testing and Evaluation (MTE) on the selected PPE product.
- Complete Verification and Validation (V&V) with DHS component.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Materials Testing and Evaluation (MT&E) on the selected PPE product.	FY 2018 Q1	FY 2018 Q4
V&V completed.	FY 2018 Q2	FY 2018 Q4

Type of Research

Applied

Technical Readiness Level

TRL 6-7

Transition Plans

Hooded escape respirators developed with NIOSH-certification for use by First Responders and Law Enforcement Community members will be transitioned to DHS component(s) for operational deployment.

Chemical Attack Resiliency – FY 2017 Annualized Continuing Resolution: \$2.000M. FY 2018 Request: \$0. Provides advanced planning; develops CONOPS; develops and provides capabilities in forensics, laboratory response, personnel protection, and decontamination; and utilizes exercises and training for responding to and recovering from a chemical disaster.

Chemical Forensics

- **Problem:** There is a need to provide timely and comprehensive forensic support to investigations of chemical terrorist and criminal acts by collecting, preserving, analyzing, and matching chemical samples collected at scenes with samples obtained from people, places, and other events, as well as production sources. The Supreme Court has ruled that it must be demonstrated that chemical forensics and attribution findings are sufficiently reliable for admissibility in judicial proceedings.
- **Solution:** The Chemical Forensics project develops and maintains a robust and enduring national capability for the collection, preservation, and processing of chemical threat agents and associated evidence to provide comprehensive and timely forensic analysis and attribution. This project is incrementally developing and transitioning additional collection and preservation methods and devices, as well as expanded laboratory analytical methods to provide the capability to address the numerous chemical threat agents of interest in a prioritized manner.
- **Impact:** This project is providing law enforcement with the capability to promptly conduct chemical forensics analyses and attribute terrorist acts to their source, and thus providing highly valuable investigative leads that can identify perpetrators and prevent follow-on and copycat attacks.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	3,500	-	900	2,000	0
Obligations	3,216	3,635	2,615	0	-

Prior Year Key Events

- Published and transitioned to customers four Chemical Forensics Standard Methods for the collection or analysis of Chemical Threat Agents of interest.
- Submitted and published nine Chemical Forensics articles in relevant scientific journals.

Current Year Key Events

- Continued development, upgrading, and coordination with Chemical Agent Reactions Database (CARD) maintained by CSAC.
- Continued collaborative research project efforts (chemical warfare agent synthesis pathways and biotoxin studies) with Sweden

Budget Year Key Events

- N/A

Project Schedule Including Milestones

- N/A

Type of Research

Applied

Technical Readiness Level

The program plans to begin at TRL 3 and end at TRL 4

Transition Plans

Performers are strongly encouraged to publish the results of research efforts in a relevant scientific journal, if possible. Final reports and methods are provided directly to primary customer (FBI) and archived in Chemical Library maintained at Chemical Security Analysis Center, Aberdeen Proving Ground (APG), Maryland.

Explosives & Rad/Nuc Attack Resiliency – FY 2017 Annualized Continuing Resolution: \$5.000M. FY 2018 Request: \$0. This program provides advanced planning, develops CONOPS, develops advanced materials, and funds exercises and training for responding to and recovering from a disaster employing explosives.

Radiological/Nuclear Response and Recovery (RNRR)

- **Problem:** The detonation of a Radiological Dispersal Device or an Improvised Nuclear Device would pose tremendous challenges to the first responder community and HSE, and have high consequences to the economy and national security posture. The presence of radiation during an emergency drastically increases the complexity of response operations, and requires advanced data collection and specialized capabilities to ensure the safety of the public and responders.
- **Solution:** Increase responder preparedness for radiological incident response and recovery operations by working with partner agencies, Federal interagency working groups, and state and local first responders to identify impactful research and development opportunities that address technology requirements and capability needs in the areas of radiological response management, incident characterization, initial response capabilities, medical care/triage, casualty/evacuee care, impacted area stabilization/control, and site cleanup/decontamination.

- **Impact:** This research and development will improve radiological response capabilities at the local, state, and national level, improve Government understanding of the impacts and risks of radiological emergencies, and find technological solutions to radiological capability gaps and mission needs. It will also increase preparedness and responder capabilities in advance of an incident and minimize the impact of a radiological or nuclear detonation.

Sub Project

- Use of Radar for Radiological Response: Research on how radar systems can track plume clouds for incident characterization.
- Organic Radiochromic Compounds (ORC) Development: Engineering and testing on ORCs sensitive to radiation for use on PPE and other responder equipment.
- Using Preventive Radiological/Nuclear Detection Equipment for Response & Recovery: Research and guidance for first responders on leveraging already existing equipment used for detection missions for consequence management missions.
- Enhanced Urban Dispersion Model: Expanded modeling capability to visualize and understand urban dispersion of radiological contaminants in major U.S. cities.
- Assessment of International Radiological/Nuclear Tools & Resources: Evaluations and focus group to determine IAEA tools and resources that are useful to U.S. responders.
- WEST Development and Use of Public Works Assets for Radiological Response: Improvements to the EPA's Waste Estimation Support Tool (WEST) to incentivize increased user base; research on using municipal equipment to manage radiological contamination.
- ROSS Resource Development: Advancements to the Radiological Operations Support Specialist (ROSS) program, which is a certification to provide health physics expertise to incident commanders during a radiological emergency.
- National Council on Radiation Protection and Measurements (NCRP) Guideline and Commentary Development: Development of specific guidelines and operational guidance for emergency dosimetry practices for response agencies.
- Rapid IND Hazard Tool Development: Provide a shelter-in place and evacuation zone identification tool for state and local emergency operations centers that is connected to federal modeling and decision support functions.
- Simulation and Modeling of RDD Detonation Response Actions: Develop simulations of immediate material disposition and first responder actions to better understand how to minimize radiation hazard to the public and maximize safety of response personnel.
- Expansion of Rad Responder Tool: Support FEMA by building out the capability of RadResponder, the nation's radiological data sharing platform to include additional radiological response guidance, technical references, and tools.
- Distribute and support National Urban Security Technology Laboratory's (NUSTL) Developed RDD Response Guidance: Provide technical support to city, state, and federal radiological response agencies as they incorporate science-based best practices into their response procedures, protocols, and plans.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	5,000	3,250	2,000	5,000	0
Obligations	4,226	2,923	1,622	834	

FY 2016 Key Milestone Events (Prior Year)

- Continue to fund Investment Plan priorities and conduct review of existing technology used by specialized radiological response operators to identify technologies and tools with potential for increasing operational capabilities of State/local agencies.
- Work closely with the Federal interagency to ensure Rad/Nuc Response and Recovery research and development projects meet the operational requirements of end users and assist in filling identified gaps and needs.

FY 2017 Key Milestone Events (Year of Execution)

- Develop tools and resources to better integrate health physics into the local decision making processes of the incident command post and emergency operations center during a radiological emergency.
- Document responder operational requirements through a technical review of recently drafted local radiological emergency response plans, radiation specific response safety tactics, and available radiological data products.

FY 2018 Key Milestone Events (Budget Year)

- Test and evaluation of Rapid IND Hazard Tool for shelter-in-place and evacuation decision making, and documentation of lessons learned on additional technical and operational requirements from federal, state, and local users.
- Finalize and distribute technical guidance to first responders on how to use preventative radiological/nuclear detection equipment to perform consequence management operations.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
NCRP Report Draft Developed and Reviewed.	FY 2016 Q4	FY 2016 Q4
FY 2017		
Detection equipment CONOPS written and validated.	FY 2016 Q4	FY 2017 Q2

Research & Development Description	Plan Start Date	Planned Completion
Operational capability report on ORCs.	FY 2016 Q4	FY 2017 Q4
Focus group review of IAEA tools/guidance.	FY 2016 Q4	FY 2017 Q3
NCRP Report Published.	FY 2016 Q1	FY 2017 Q3
Study complete for radar application in fall-out tracking/modeling.	FY 2017 Q1	FY 2017 Q4
Recommendations for PRND equipment.	FY 2017 Q3	FY 2017 Q4
Urban Dispersion 3D Model demonstration.	FY 2016 Q2	FY 2017 Q4
FY 2018		
Rapid IND Hazard Tool Operational Requirements Documented.	FY 2017 Q3	FY 2018 Q1
Initiate Simulation and Modeling of RDD Detonation Response Actions.	FY 2017 Q3	FY 2018 Q1
Initiate Expansion of FEMA Rad Responder Tool.	FY 2018 Q1	FY 2018 Q2
Release and Distribute NUSTL Developed RDD Response Guidance.	FY 2018 Q1	FY 2018 Q1
Research on public works equipment for decontamination Published.	FY 2017 Q1	FY 2018 Q2
Prototype Software, content and usability improvements.	FY 2017 Q1	FY 2018 Q2
Completed model, user guide and distribute example products.	FY 2017 Q4	FY 2018 Q4
Finalize report on IAEA products, tools, and responder feedback.	FY 2017 Q4	FY 2018 Q1
Transition PRND validated CONOPS to DNDO and responders.	FY 2018 Q1	FY 2018 Q4
Transition to FEMA improved ROSS tools and training.	FY 2018 Q1	FY 2018 Q4

Type of Research

Developmental

Technical Readiness Level

The TRL of the Rad/Nuc Response and Recovery program varies between specific projects. Some exploratory research is at a TRL of 3 to 5, but the majority of portfolio projects in support of FEMA and first responders are TRL 7 or higher.

Transition Plans

- Leverage existing radiological training and preparedness organizations to assist in distributing and integrating developed technology and knowledge products into State/local radiological /nuclear preparedness and response activities:
 - Conference of Radiation Control Program Directors (CRCPD)
 - National Council on Radiation Protection and Measurements (NCRP)
 - DOE National Laboratories
 - FEMA Center for Domestic Preparedness
 - DOE CTOS - Center for Radiological/Nuclear Training at Nevada Test Site
 - Defense Threat Reduction Agency
 - Domestic Nuclear Detection Office (DNDO)
- Utilize project partners to connect first responders with Federal agencies and specialized radiological assets that will assist them during a radiological response:
 - Environmental Protection Agency's Regional Field Coordinators
 - National Guard Bureau – Civil Support Teams (CST)
 - Interagency Modeling and Atmospheric Assessment Center (IMAAC)
 - Department of Energy – Federal Radiological Monitoring and Assessment Center (FRMAC)
 - Department of Energy – Radiological Assistance Program (RAP)

First Responder Capability – FY 2017 Annualized Continuing Resolution: \$20.250M. FY 2018 Request: \$17.750M. This program develops technologies, information, procedures, and CONOPS to aid first responders, emergency managers, and incident commanders as they respond to hazardous situations. It assists the emergency response communities to establish requirements and tests technologies and assesses them for usability to help make the technologies available across all first responder communities.

First Responder Technologies

- **Problem:** The response environment that our Nation's first responders operate in on a day to day basis is constantly changing and requires an ongoing evaluation of needs, required capabilities, and potential investments and/or innovations, to allow them to conduct their missions more safely, effectively, and efficiently. In addition, commercializing technology that fully meet these challenges is typically a lengthy process. Developing near term innovative technologies that address high priority capability gaps identified by Federal, State, local, and tribal first responders is critical to ensure their safety, performance and well-being.
- **Solution:** Identify high priority needs, develop prototype solutions, and conduct operational field assessments of next generation technologies to address gaps, with the goal of rapidly developing (12 to 18 months) and transitioning (an additional 12 months) technologies that meet at least 80 percent of the operational requirement.

- **Impact:** This will strengthen the response community's ability to protect the homeland, respond to disasters, and save lives through the increased availability and reliability of technology for first responders.

Sub Project

- **Wildland Fire Respiratory Protection:** A new low profile, lightweight piece of equipment that reduces the weight a firefighter has to carry and allows for a wider range of motion.
- **Emergency Vehicle to Civilian Vehicle Early Warning System:** A notification system that provides civilian vehicles warning of a nearby responding emergency vehicle.
- **Emergency Vehicle to Emergency Vehicle Early Warning System:** A notification system that provides other emergency vehicles warning of an active emergency vehicle traveling within their proximity.
- **Multi-Mission Disrupter:** An agile light-weight disrupter system that can be easily assembled to support bomb squads in multiple operations such as land or water environments.
- **Multimeter Wire Attack Kit:** A tool that combines the functions of a multimeter with a wire attack kit into one device in order to conduct electronic diagnostics of detonator wires and switches.
- **Rescue Hoist Protective Glove:** A proposed new glove made of advanced materials or replaceable/attachments that assists with increasing the duration of gloves used in rescue hoisting operations.
- **First Responder Routing Logic Guide:** Emergency responder routing system that informs responders of upcoming road and traffic conditions and can suggest alternate routes to safely navigate their vehicles.
- **Integration of Public Data Feeds:** A platform that provides first responders with a single stream of eyewitness, social media, and open source data and shared information feeds.
- **3D Indoor Dynamic Mapping and Visualization:** Technology that provides real-time 3D mapping and visualization scanning within a multi-story building under hazardous conditions.
- **Energy Harvesting Fabrics:** Energy-harvesting, smart fabric incorporated into first responder uniforms that either powers electronics or a daily uniform.
- **Responder Technology Alliance:** Characterizes future challenges and opportunities within the next 15 years while proposing new and innovative solutions.
- **Response and Defeat Operations Support (REDOPS):** Establishes a systems analysis approach involving explosives countermeasures experts from all levels of government and direct Research, Development, Testing & Evaluation (RDT&E) of technologies needed by state and local bomb squads (SLBS).

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	7,978	11,400	14,300	15,000	15,000
Obligations	6,678	10,304	11,057	1,937	

FY 2016 Key Milestone Events (Prior Year)

- Developed a multi threat base ensemble/duty uniform that provides enhanced splash, puncture, and thermal protection.
- Tested and transitioned Special Purpose Low Impact Threat Rupture system, a render safe technology for improvised explosive devices that is used by SLBS.

FY 2017 Key Milestone Events (Year of Execution)

- Make contract awards for the development of technologies that address the high priority needs identified by first responders.
- Transition eleven first responder technologies/knowledge products developed by S&T's FRG.

FY 2018 Key Milestone Events (Budget Year)

- Make contract awards for the development of technologies that address the high priority needs identified by first responders.
- Transition and commercialize first responder technologies developed by S&T's FRG.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Prototyping of Personal Protective Equipment (NC State and LUNA).	FY 2015	FY 2016
Prototyping of Smoke Resistant Turnout Gear.	FY 2015	FY 2016
Test documents and protocols developed to be incorporated into ambulance standards.	FY 2015	FY 2016
Design period begins for the Body Worn Camera project.	FY 2016 Q3	FY 2017 Q4
Prototyping of the Precision Outdoor and Indoor Navigation and Tracking for Emergency Responders (POINTER) project.	FY 2015 Q2	FY 2018 Q2

Research & Development Description	Plan Start Date	Planned Completion
Operational Field Assessments of the X-Ray Rover.	FY 2016 Q3	FY 2016 Q3
Beginning of Automated Driver and Responder Alert System (ADRAS) project.	FY 2016 Q4	FY 2017 Q2
Prototyping and OFA of Physiological and Environmental Monitoring (WiPEM) project.	FY 2015 Q3	FY 2017 Q2
Prototype for Enhanced Dynamic Geo-Social Environment (EDGE) School.	FY 2016 Q2	FY 2017 Q2
Conduct four REDOPS operational assessments.	FY 2016 Q1	FY 2017 Q1
Transition two Counter-IED tools to public safety bomb technicians.	FY 2016 Q4	FY 2017 Q1
FY 2017		
Transition of the Personal Protective Equipment (NC State and LUNA).	FY 2017 Q3	FY 2017 Q3
Transition of the X-Ray Rover.	FY 2017 Q3	FY 2017 Q1
Continuing prototype testing of the Smoke Resistant Turnout Gear.	FY 2017 Q3	FY 2018 Q2
Transition of Ambulance Standards .	FY 2017 Q3	FY 2017 Q2
Continuing of prototyping for Indoor Navigation and Tracking for Emergency Responders (POINTER) project.	FY 2017 Q3	FY 2018 Q2
Design and Prototyping of the Respiratory Protection equipment.	FY 2017 Q3	FY 2018 Q2
Prototyping performed for the Body Worn Camera project.	FY 2017 Q3	FY 2018 Q2
Prototyping for Automated Driver and Responder Alert System (ADRAS) project.	FY 2017 Q3	FY 2018 Q2
Transition of Wireless Physiological and Environmental Monitoring (WiPEM) project.	FY 2017 Q3	FY 2017 Q3
Transition of Enhanced Dynamic Geo-Social Environment (EDGE) School.	FY 2017 Q3	FY 2018 Q1
Begin design of Emergency Vehicle to Civilian Vehicle Early Warning System.	FY 2017 Q3	FY 2018 Q3
Begin design of Wildland Fire Respiratory Protection.	FY 2017 Q3	FY 2018 Q3

Research & Development Description	Plan Start Date	Planned Completion
Begin design of Emergency Vehicle to Emergency Vehicle Early Warning System.	FY 2017 Q3	FY 2018 Q3
Begin design of Multi-Mission Disrupter.	FY 2017 Q3	FY 2018 Q3
Begin design of Multimeter Wire Attack Kit.	FY 2017 Q3	FY 2018 Q3
Begin design of Rescue Hoist Protective Glove.	FY 2017 Q3	FY 2018 Q3
Begin design of First Responder Routing Logic Guide.	FY 2017 Q3	FY 2018 Q3
Begin design of Integration of Public Data Feeds.	FY 2017 Q3	FY 2018 Q3
Begin design of 3D Indoor Dynamic Mapping and Visualization.	FY 2017 Q3	FY 2018 Q3
Begin design of Energy Harvesting Fabrics.	FY 2017 Q3	FY 2018 Q3
Conduct four REDOPS operational assessments.	FY 2017 Q1	FY 2018 Q1
Transition two Counter-IED tools to public safety bomb technicians.	FY 2017 Q4	FY 2017 Q4
FY 2018		
Perform OFA and Transition of the Body Warn Camera project.	FY 2018 Q3	FY 2018 Q3
Transition of Smoke Resistant Turnout Gear.	FY 2018 Q3	FY 2018 Q3
Transition of Respiratory Protection project.	FY 2018 Q3	FY 2018 Q3
Transition of Automated Driver and Responder Alert System (ADRAS) project.	FY 2018 Q3	FY 2018 Q4
Transition of the Indoor Navigation and Tracking for Emergency Responders (POINTER) project.	FY 2018 Q4	FY 2018 Q4
Begin design of Emergency Vehicle to Civilian Vehicle Early Warning System.	FY 2018 Q3	FY 2018 Q3
Begin design of Wildland Fire Respiratory Protection.	FY 2018 Q3	FY 2018 Q3
Begin design of Emergency Vehicle to Emergency Vehicle Early Warning System.	FY 2018 Q3	FY 2018 Q3
Develop a Prototype of Multi-Mission Disrupter.	FY 2018 Q3	FY 2018 Q3
Develop a Prototype of Multimeter Wire Attack Kit.	FY 2018 Q3	FY 2018 Q3

Research & Development Description	Plan Start Date	Planned Completion
Develop a Prototype of Rescue Hoist Protective Glove.	FY 2018 Q3	FY 2018 Q3
Develop a Prototype of First Responder Routing Logic Guide.	FY 2018 Q3	FY 2018 Q3
Develop a Prototype of Integration of Public Data Feeds.	FY 2018 Q3	FY 2018 Q3
Develop a Prototype of 3D Indoor Dynamic Mapping and Visualization.	FY 2018 Q3	FY 2018 Q3
Develop a Prototype of Energy Harvesting Fabrics.	FY 2018 Q3	FY 2018 Q3

Type of Research

Developmental

Technical Readiness Level

The program plans begin at TRL 3 and end at TRL 7.

Transition Plans

- The program's main stakeholders are Federal, State, local, tribal, and territorial first responders who do not generally make bulk group purchases or enter into technology transition agreements, due to the uncertain nature of funding availability. Therefore FRG works with the vendor at the onset of a project to develop a commercialization plan that requires the vendor to invest its own funds to transition the technology to the first responder community.

Technology Clearinghouse

- **Problem:** S&T must maintain effective communication with the first responder and emergency preparedness and response communities to gather necessary information for its program and to keep those communities informed about the technologies and knowledge products S&T is developing on their behalf.
- **Solution:** A three-pronged communications effort that includes: a website platform to provide the first responder community with information about federal resources on products, standards, testing and evaluation, grants and training, and best practices to develop or deploy technologies to enhance homeland security; a collaboration platform for sharing of documents and best practices; and overall outreach and stakeholder engagement that includes conferences, via social media, and more.
- **Impact:** The Tech Clearinghouse increases first responder awareness of the S&T's work, facilitates the flow of important information throughout the emergency response community, and enables S&T to design and manage projects that truly meet

its mission. It is a cost-effective, multi-faceted communications effort that expands S&T's reach into stakeholder communities, and enables the first responder community to make better informed purchasing decisions.

Sub Project

- FirstResponder.gov (now known as scitech.dhs.gov/first-responders): FirstResponder.gov has transitioned to scitech.dhs.gov/first-responders, and remains a key web-based resource that enables federal, state, local, tribal, and territorial first responders to easily access and leverage federal resources on products, standards, testing and evaluation, grants and training, and best practices to develop or deploy technologies to enhance homeland security. The website provides original content through Responder News articles and videos, which highlight federal programs, initiatives, webinars, and research. The scitech.dhs.gov/first-responders site also provides a user feedback mechanism via email at: first.responder@hq.dhs.gov, and opportunities to engage via DHS social media platforms linked to the site (Facebook, Twitter, Flickr, and Instagram). Visit scitech.dhs.gov/first-responders.
- First Responder Communities of Practice: A vetted online forum that enables first responders to collaborate and share best practices while also providing: 1) developers with operational requirements and information needed to design and manufacture increasingly useful tools and technologies, as well as 2) users with information related to procuring, deploying, and maintaining technologies and training for their proper use.
- Outreach and Stakeholder Engagement: An ongoing suite of communications activities that enables internal and external stakeholders in the responder community and the general public to gain a fuller understanding of the capability gaps, needs and requirements of first responders and thus strengthen its focus on essential technologies with the greatest potential for transition to use.

Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	2,000	5,000	4,000	4,250	2,750
Obligations	934	2,851	3,423	1,863	-

FY 2016 Key Milestone Events (Prior Year)

Initiate transition of the FirstResponder.gov website to the S&T Microsite on DHS.gov to comply with the requirement to consolidate the number of DHS related websites.

Enhance and expand FRG presence on current and future social media (i.e., Facebook, Twitter, YouTube, Instagram, etc.) and produce project-based videos targeted to the first responder community with the intent of increasing traffic to FirstResponder.gov.

FY 2017 Key Milestone Events (Year of Execution)

Complete the transition the FirstResponder.gov website to scitech.dhs.gov/first-responders to comply with the requirement to consolidate the number of DHS related websites.

Develop and expand FRG presence on current and future social media pages (i.e., Facebook, Twitter, YouTube, Instagram, etc.) to increase traffic to First Responder content on scitech.dhs.gov/first-responders and providing information tailored for the first responder community.

FY 2018 Key Milestone Events (Budget Year)

Produce project-based videos targeted to the first responder community, and publish them on scitech.dhs.gov/first-responders to inform them of progress and status and/or how to engage with S&T/FRG.

Assess the current software platform and transition the First Responder Communities of Practice collaboration site to comply with the requirement to consolidate the number of DHS related websites.

Project Schedule

Research & Development Description – Tech Clearinghouse	Plan Start Date	Planned Completion
FY 2016		
Initiate the transition the FirstResponder.gov website to the S&T Microsite on DHS.gov to comply with the requirement to consolidate the number of DHS related websites.	FY 2016 Q1	FY 2016 Q4
Enhance and expand FRG presence on current and future social media pages (i.e., Facebook, Twitter, YouTube, Instagram, etc.) with the intent of increasing traffic to FirstResponder.gov	FY 2016 Q1	FY 2016 Q4
Conduct outreach to the first responder community by interacting with professional homeland security, public safety, responder, and criminal justice associations such as the IAB, NPSTC, IACP, IAFC, APCO, IAEM, etc.	FY 2016 Q1	FY 2016 Q4
FY 2017		
Complete the transition from FirstResponder.gov website to the S&T Microsite on DHS.gov to comply with the requirement to consolidate the number of DHS related websites.	FY 2017 Q1	FY 2017 Q2
Initiate the transition of First Responder Communities of Practice to the DHS S&T EVMII to comply with the requirement to consolidate the number	FY 2017 Q2	FY 2017 Q4

Research & Development Description – Tech Clearinghouse	Plan Start Date	Planned Completion
of DHS related websites.		
Conduct outreach to the first responder community by interacting with professional homeland security, public safety, responder, and criminal justice associations such as the IAB, NPSTC, IACP, IAFC, APCO, IAEM, etc.	FY 2017 Q1	FY 2017 Q4
Update scitech.dhs.gov/first-responders with relevant content, including internal and external information on first responder related projects/programs and increase usage by first responders via marketing.	FY 2017 Q1	FY 2017 Q4
FY 2018		
Update scitech.dhs.gov/first-responders with relevant content, including internal and external information on first responder related projects/programs and increase usage by first responders via marketing.	FY 2018 Q1	FY 2018 Q4
Conduct outreach to the first responder community by interacting with professional homeland security, public safety, responder, and criminal justice associations such as the IAB, NPSTC, IACP, IAFC, APCO, IAEM, etc.	FY 2016 Q1	FY 2016 Q4

Type of Research

N/A

Technical Readiness Level

N/A

Transition Plan

N/A

Information Sharing and Interoperability – FY 2017 Annualized Continuing Resolution: \$10.967M. FY 2018 Request: \$11.911M. This program creates an integrated information sharing architecture and links that architecture to interagency efforts to prevent terrorism while protecting privacy, civil rights, and civil liberties.

Emergency Response and Management Tools for First Responders

- **Problem:** First responders often lack timely access to the information they need to operate safely and enhance their ability to save lives and protect property. Whether they are not sharing due to unfamiliarity with their response partners or because their systems are not interoperable, decisions are not made in the most effective and timely manner.
- **Solution:** Develop and transition to operational use the situational awareness technologies required so that emergency managers and first responders will have the incident information they require when and how they need it. In addition, this project will provide the standard operating procedures, training, and governance needed to effectively and efficiently conduct response and recovery efforts from day-to-day incidents to large-scale emergencies, including visualization, geospatial and analytics technologies. Improve the ability of DHS and its HSE partners to quickly generate and receive, respectively, meaningful alert, warning and notification (AWN) messages regarding potential, impending, or ongoing threats to the Homeland.
- **Impact:** Increased safety of U.S. citizens and first responders, more effective incident response and recovery leading to fewer lives lost, decreased property damages, and increased national resilience from incidents of all types and scales.

Sub Project

- Smart City Functionality Framework – define and develop the HSE functionality framework for an interoperable Smart City.
- IoT Sensor Integration – design, develop and transition IoT sensors using open-standards for First Responder situational awareness.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	2,000	3,000	4,000	4,206	6,211
Obligations	6,343	2,553	3,360	0	-

FY 2016 Key Milestone Events (Prior Year)

- Performed 2 IoT sensor open standard integration spiral/demonstrations for interoperable sensors and communications.
- Integrated IoT Low-Cost Flood Inundation Sensor prototype development with Smart Alert Engine (SALE) for Smart City technical feasibility prototype.
- Developed Essential Elements of Information as core open data exchange requirements targeted to Public Safety community and establish as National Information Exchange Model (NIEM) standards.

FY 2017 Key Milestone Events (Year of Execution)

- Develop and deploy 300 IoT Flood Sensors to refine sensor functionality in operational flood environment for Smart Alert Engine test and evaluation.
- Assess and design IoT Intelligent Building Infrastructure sensors and building codes for 3-D imaging, imagery and motion detection.

FY 2018 Key Milestone Events (Budget Year)

- Initiate/originate an AWN message from a sensor (environment) into the FEMA IPAWS Test and Development Lab (TDL).
- Assess and design Unmanned Aerial Systems (UAS) as a delivery platform for IoT sensors for mass transit tunnel search & reconnaissance.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Performed 2 IoT sensor open standard integration spiral/demonstrations for interoperable sensors and communications.	FY 2016 Q1	FY 2016 Q4
Integrated IoT Low-Cost Flood Inundation Sensor prototype development with SALE for Smart City technical feasibility prototype.	FY 2016 Q2	FY 2017 Q1
Develop Essential Elements of Information as core open data exchange requirements targeted to Public Safety community and establish as National Information Exchange Model (NIEM) standards.	FY 2017 Q1	FY 2017 Q2
FY 2017		
Develop proof of concept for IoT Low-Cost Flood Inundation Sensor.	FY 2016 Q3	FY 2017 Q1
Design, develop and deliver a Data component (as opposed to just voice) into the Capability Maturity Model (CMM) and Information Sharing Continuum (ISC) and vet with the First Responder community.	FY 2017 Q2	FY 2017 Q4
Perform a CMM / ISC adoption and assess review of select State and local first responder stakeholders to evaluate operational readiness and maturity to determine gaps and requirements for S&T FRG.	FY 2017 Q1	FY 2017 Q4
Assess and design IoT Intelligent Building Infrastructure sensors and building codes for 3-D imaging, imagery and motion detection.	FY 2017 Q2	FY 2017 Q4

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Develop and deploy 300 IoT Flood Sensors to refine sensor functionality in operational flood environment for Smart Alert Engine test and evaluation.	FY 2017 Q3	FY 2018 Q2
Initiate/originate an AWN message from a sensor (environment) into the FEMA IPAWS Test and Development Lab (TDL).	FY 2018 Q1	FY 2018 Q3
Assess and design Unmanned Aerial Systems (UAS) as a delivery platform for IoT sensors for mass transit tunnel search & reconnaissance.	FY 2017 Q3	FY 2018 Q3
Develop prototype of Smart Alert Engine (Flood Alert) test and evaluation that is complementary to IoT Flood Sensors.	FY 2017 Q3	FY 2018 Q2

Type of Research

Developmental

Technical Readiness Level

TRL 3 – 7

Transition Plans

- IoT Flood Sensor transitions includes SBIR Phase 2 - commercialization plan focuses upon; water authorities, precision agriculture, alerting services, grants (FEMA, DOA, FIMA, etc.), government entities (NOAA, USGS, US ACE) and other market segments.
- SALE for Smart City technical feasibility prototype – Long Range Broad Area Announcement Phase 2 includes commercialization plan to be developed. The SALE initiative will have a prototype development effort in year 2 with a usage and transition plan as part of the scope of work.
- Next Generation Incident Command System – has been successfully transitioned to the State of California; Emergency Management Victoria, Australia; Worldwide Incident Command (WICS) not-for-profit; and to the GitHub open-source code repository for open access and download.
- Smart City / IoT sensor development will work with stakeholder partners (e.g. Boston Fire Department, National Institute of Building Standards, Government Service Administration, etc.) and other as part of the requirements, design, test and evaluation prior to a commercial transition.

Interoperability and Compatibility Standards

- **Problem:** The proliferation of new technologies makes it difficult for first responders to communicate with each other during emergencies. In addition, equipment manufacturers often use different technical approaches that leave their products incompatible.
- **Solution:** Identify and accelerate the development of standards essential to ensure that new technologies are interoperable as well as develop testing standards and promote the use of compliance documentation so first responder agencies can make good decisions about new technologies.
- **Impact:** These new and strengthened standards will help first responders to make smart choices of new technologies so they will be interoperable and can migrate successfully to the new nationwide public safety broadband network without putting a \$7 billion national investment at risk.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	2,000	0	3,000	1,504	0
Obligations	6,343	2,553	3,360	0	-

Prior Year Key Events

- Reconvened the P25 CAP Advisory Panel (formerly known as Governing Board) under the existing Charter.
- Updated the P25 CAP Advisory Panel (formerly known as Governing Board) Charter.
- Drafted Local Control Requirements document.
- Added P25 Common Air Interface Conventional Interoperability Tests to the program.

Current Year Key Events

- Leverage 3rd Generation Partnership Project specifications and other appropriate standards development organizations to identify and prioritize first responder broadband requirements and develop solutions for locally deployed applications.

Budget Year Key Events

- N/A

Project Schedule including Milestones

- N/A

Type of Research

Developmental

Technical Readiness Level

N/A

Transition Plans

- P25 CAP will continue to update the test requirements to include P25 CAP interoperability, performance, and conformance testing so that first responder agencies can make more confident acquisition decisions for their P25 systems. Additionally, this program will continue to focus on public safety broadband requirements as a means to accelerate the development of common standards and in an effort to enhance interoperability and compatibility among broadband systems.

Wireless Communications

- **Problem:** Technologies capable of bridging disparate but essential communications systems are not currently available, making it difficult for first responders to communicate with each other during emergencies.
- **Solution:** Conduct viable research, development, testing, and evaluation to develop capabilities to ensure first responders are able to communicate regardless of the type of network.
- **Impact:** This project provides a critical testing and evaluation capability for first responders to gain knowledge on how communication devices work on broadband networks and determine how the systems will meet user needs. This project brings together public safety practitioners, Federal partners, manufacturers, and representatives of standards making bodies to improve the way in which video and other technologies serve the public safety community.

Sub Project

- Datacasting - Performs technical and operational evaluations of datacasting as a telecommunications capability in support of public safety. Datacasting is using existing broadcast television signals to deliver encrypted, targeted public safety video and data.
- Video Quality in Public Safety - Develops assessment tools and guidance documents that enable first responder agencies to purchase and deploy appropriate video technology to meet their operational needs.

- Video Analytics – Develops a public safety video analytics Community of Interest, develops R&D, Standards, and Collaboration priorities and strategy, as well as develops initial research in content- based video quality measurement (CBVQM).
- Demo Network – Deployables - Examines ways in which first responders could access and communicate critical information during incidents that arise in areas that are not served or are under-served by the fixed Nationwide Public Safety Broadband Network or alternative access networks, such as commercial carriers or public Wi-Fi.
- Demo Network – Indoor- Provides procedures and techniques to both quantify and improve in-building performance and coverage for band class 14 LTE Systems.
- Voice Intelligibility Testing over Long-Term Evolution (LTE) - Tests and identifies speech codecs (the systems that encode and decode voice data) to provide responders with a reliable system that maintains a high-level of intelligibility in even the most difficult noise environments.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	8,500	5,338	4,000	4,206	5,700
Obligations	6,469	5,499	4,021	0	-

FY 2016 Key Milestone Events (Prior Year)

- Conduct field demonstrations for one wireless broadband technology demonstrator solutions.
- Contribute results to 3rd Generation Partnership Project (3GPP) Release 13 & 14.

FY 2017 Key Milestone Events (Year of Execution)

- Utilize Band Class 14 LTE Test Network to test, evaluate, and demonstrate new features, services, and technologies that can be integrated into the public safety broadband network.
- Test and evaluate at least one deployed capability in a communications-challenged environment.

FY 2018 Key Milestone Events (Budget Year)

- Assist with the rollout of a nationwide datacasting system and develop technical enhancements to the system.
- Formulate test system architecture and build use cases for speech quality and intelligibility testing of LTE voice communications.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Conduct field demonstrations for one wireless broadband technology demonstrator solutions.	FY 2016 Q1	FY 2016 Q4
Conduct tabletop exercise for two wireless broadband technology demonstrator solutions.	FY 2016 Q1	FY 2016 Q4
Create extended simulation models to support additional PROSE functionality.	FY 2016 Q1	FY 2016 Q1
Contribute results to 3GPP Release 13 & 14.	FY 2016 Q1	FY 2016 Q3
Publish results in professional conference proceedings and journals.	FY 2016 Q1	FY 2016 Q2
FY 2017		
Identify and prioritize user challenges and requirements with the first responder community.	FY 2017 Q1	FY 2017 Q3
Develop realistic network simulation tools and interference models for cellular network planning.	FY 2017 Q1	FY 2017 Q3
Utilize Band Class 14 LTE Test Network to test, evaluate, and demonstrate new features, services, and technologies that can be integrated into the public safety broadband network.	FY 2017 Q1	FY 2017 Q3
Publish test results and/or knowledge products to better inform stakeholders about the state of the art technologies.	FY 2017 Q1	FY2017 Q3
Develop field measurement method by which public safety can evaluate indoor broadband coverage in Band Class 14.	FY 2017 Q1	FY 2017 Q2
FY 2018		
Assist with the rollout of a nationwide datacasting system and develop technical enhancements to the system.	FY 2018 Q1	FY 2018 Q4
Provide technical subject matter expertise for the APEX program by conducting R&D, demonstrations, and technical tests and evaluations.	FY 2018 Q1	FY 2018 Q3
Formulate test system architecture and build use cases for speech quality and intelligibility testing of LTE voice communications.	FY 2018 Q1	FY 2018 Q3
Configure in-house load tester and build an LTE system to execute speech quality and intelligibility of LTE voice communications tests.	FY 2018 Q1	FY 2018 Q4
Evaluate public safety oriented data against baseline performance measurements from year 1 speech analytic research.	FY 2018 Q1	FY 2018 Q4

Research & Development Description	Plan Start Date	Planned Completion
Develop first iteration of future video analytics R&D interoperability testbed.	FY2018 Q1	FY 2018 Q3

Type of Research

Developmental

Technical Readiness Level

TRL levels vary across each sub-project within wireless communications. As a whole wireless communications includes efforts that begin as early as TRL 2 and will be carried through to TRL 7.

Transition Plans

- The maintenance of a 700MHz broadband demonstration network capable of providing first responders with a test environment, as FirstNet creates a nationwide public safety broadband network, will remain a critical resource for testing and evaluating technology solutions.
- In addition to aiding first responders through publishing of test results, this project will also develop knowledge products to better inform stakeholders about the state of the art technologies.
- Publish a lessons learned document on public safety broadband performance and impacts after operational test and evaluation.

Natural Disaster Resiliency – FY 2017 Annualized Continuing Resolution: \$16.302M. FY 2018 Request: \$26.634M. This program develops and provides advanced planning, CONOPS, disaster management tools, and training aids for responding to and recovering from a large-scale natural disaster. This includes providing assistance to the private sector to design greater resilience for critical infrastructure and providing DHS with more robust tools for disaster response, disaster logistics, individual and public assistance programs, and national continuity programs.

Cyber Physical Systems (formerly Cyber Physical Security)

- **Problem:** Cyber Physical Systems (CPS) have enabled dramatic increases in productivity and efficiency in sector operations, resulting in their widespread proliferation in the Nation's Critical Infrastructure (CI). Advances in networking, computing, sensing, and control systems have enabled a broad range of new applications. Device manufactures and operators are increasingly seeing the potential of adding computational power and network connectivity to a wide range of devices, known as the IoT. As the IoT continues to expand, the need to be able to quickly integrate IoT devices and sensors into legacy enterprise systems and networks is becoming critical. Securing these devices is necessary to ensure safe operational use while minimizing the risks and vulnerabilities. Increasing reliance on automated cyber systems creates the potential for unintentional

design and implementation errors as well as intentional cyber-attacks. This requires a combination of industry innovation, fundamental science, and crucially cross-cutting applied research.

- **Solution:** S&T has a principal goal of identifying and investing in technological solutions that can be transitioned to industry and DHS operational components to provide capability and mission improvements. Within the CPS mission space, S&T's goal is to coordinate and invest in solutions that enable systems that are trusted, hardened, and able to recover from large-scale failures. Project solutions align with government missions and present the highest risk to safety and security. S&T will directly fund efforts that target challenging problems faced by specific or multiple sectors that emphasize technology transition of usable products. DHS recognizes that different sectors are at varying stages and engages individual sectors based on industry and component requirements and S&T's assessment of where its investment can have the greatest impact.
- **Impact:** S&T investments in CPS, in conjunction with other Federal agencies and Industry efforts, will marshal applied R&D initiatives to achieve: enhanced security in CPS practices and designs; enhance capabilities to detect, defend, and mitigate threats related to CPS; explore recovery and reconstitution areas; and explore the development of countermeasures that will fundamentally change the way CPS risk and security is considered today. DHS intends to anticipate and combat evolving CPS threats in near-term applications as well as over the long-term.

Sub Projects

- **Cyber Physical Systems Security** – This project is looking at the systems which are often a source of competitive advantage in today's innovation economy, but also increase cyber security risks and attack surfaces. The consequences of unintentional faults or malicious attacks could have severe impact on human lives and the environment.
- **Cyber-Enabled Networked Physical Systems** - CPS and IoT are designed with computation and communication, including machine-to-machine communication capabilities. This has resulted in new cyber security challenges and the risks only increase as CPS/IoT systems are scaled and designed to work in autonomous situations. This applied research will address issues in security, trust, context-awareness, ambient intelligence, and reliability issues.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	8,242	3,500	7,750	6,165	4,167
Obligations	6,191	5,915	7,040	7,040	-

FY 2016 Key Milestone Events (Prior Year)

- Engage key stakeholders in transportation (automotive and maritime), healthcare, and building controls.
- Develop pre-competitive research consortium with key sectors the automotive industry.
- Develop systems for securely delivering firmware updates for cyber physical systems, including automobiles.

FY 2017 Key Milestone Events (Year of Execution)

- Complete yearly oil and gas sector research project report and present findings to oil and gas industry.
- Finalize requirements for future oil and gas PCS projects.
- Conduct threat assessment and best practice recommendation for building control security.

FY 2018 Key Milestone Events (Budget Year)

- Develop and deploy Medical Device Risk Assessment Platform.
- Develop a system for securely updating the electronic control unit in automobiles and implement the system in two or more tier one automotive suppliers.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Established a pre-competitive research consortium.	FY 2015 Q4	FY 2017 Q1
Established an industry group dedicated to developing secure update standards.	FY 2015 Q4	FY 2016 Q3
FY 2017		
Academic and industry team provided draft best practices for building control security.	FY 2016 Q3	FY 2017 Q2
FY 2018		
Evaluate the risk assessment platform using data from at least one major hospital chain.	FY 2017 Q2	FY 2018 Q2
Pilot the risk assesment platform at two or more hospital chains.	FY 2017 Q4	FY 2018 Q4
Release a design requirements document for securely updating automobiles.	FY 2017 Q1	FY 2018 Q1
Work with at least two auto manufacturers to implment and pilot the system.	FY 2018 Q1	FY 2018 Q1

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- Solutions will be developed that are practical and ready to be deployed at full operating capability.
- Beta testing and evaluation opportunities will be investigated and determined early on and agreements will be made with partners for such.

GPS Vulnerability Assessment in the Critical Infrastructure

- **Problem:** U.S. critical infrastructure is dependent on GPS for many applications to maintain operations. In addition to the use of GPS for position and navigation, timing is an essential element for many critical infrastructures such as the electric grid, telecommunications, transportation, emergency services, etc. Timing is typically derived and maintained in these networks through GPS receivers and as the threats to GPS from jamming and spoofing continue to grow, so do the vulnerabilities within our critical infrastructure. Initial testing by S&T showed that the GPS receivers used within critical infrastructure do not always behave as desired, further increasing the vulnerability.
- **Solution:** This assessment will conduct comprehensive testing on GPS receivers used within the critical infrastructure networks against various jamming and spoofing threats. The project will also engage with the receiver manufacturers and others to begin developing and fielding mitigations at low cost to the critical infrastructure owner and operators. Additionally, research will be done on possible complementary timing sources to supplement the timing from GPS to enable assured timing for critical infrastructure needs.
- **Impact:** This project will identify GPS interference vulnerabilities (intentional and unintentional) and educate critical infrastructure owners and operators enabling them to take action to mitigate and protect against these threats. With the engagement of the receiver manufacturers, identified issues can be addressed and implemented on new receivers prior to being placed on the market as well as the possibility of software or firmware upgrades to protect legacy equipment within the critical infrastructure. Additionally, alternate mitigations developed by the project will enable a layered approach to ensure robust Position Navigation and Timing (PNT) solutions to meet critical infrastructure needs.

Sub Project

- **Commercial GPS Receiver Performance Characterization:** Test commonly used GPS receivers in critical infrastructure to identify their performance characteristics and vulnerabilities.
- **PNT Requirements for Critical Infrastructure:** In collaboration with National Protection and Programs Directorate's (NPPD) Office of Infrastructure Protection (IP), define and validate PNT requirements for the critical infrastructure sectors through outreach to subject matter experts and critical infrastructure end-users.
- **PNT Enhancements:** Develop specific mitigation techniques and technologies that can be transitioned to the private sector to protect critical infrastructure against GPS/GNSS interference. This includes development of a low-cost anti-jam antenna for fixed infrastructure.
- **Assured Timing Iridium Precision Time Base for Critical Infrastructure Applications:** Develop a complementary timing technology using Iridium satellites as a source of time. Due to the lower orbit of Iridium satellites, their signals are 1,000 times stronger than GPS signals, making them more difficult to jam and spoof.

- Multi-GNSS Evaluation: Understand the implications of using multi-GNSS enabled receivers on critical infrastructure.
- System-Level Testing: Perform system-level testing to understand the impact of timing disruptions on critical infrastructure.
- Timing Manipulation Detection Capabilities: Develop capabilities to detect GPS timing signal interference that can be easily integrated into critical infrastructure and/or utilizes existing critical infrastructure assets, sensors, or networks.
- Assured Timing Technologies: Develop complementary timing technologies that are robust, low-cost, easily integrated into existing critical infrastructure operations, and provides comparable or better timing performance as GPS.
- GPS and RF Interference Detection: Develop real-time monitoring technology that can detect, identify, and locate radiofrequency (RF) interference events in a way that is low-cost and utilizes existing infrastructure assets and sensors.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	1,000	6,702	10,830
Obligations	-	-	-	-	-

FY 2016 Key Milestone Events (Prior Year)

- Transition intellectual property and/or transition paths for commercialization of new equipment or other mitigation solutions and best practices.
- Conduct analysis and research for development of mitigation designs and practices for commercialization potential and/or use by critical infrastructure to mitigate risks of jamming/spoofing.

FY 2017 Key Milestone Events (Year of Execution)

- Coordinate with private sector GPS user equipment manufacturers and vendors to recommend mitigations and/or upgrades to next-generation products and production lines.
- Conduct open-air GPS testing on receivers and mitigation equipment or solutions (to include techniques, tactics, and procedures) to validate laboratory results.

FY 2018 Key Milestone Events (Budget Year)

- Host open-air GPS test event for industry as part of outreach efforts with GPS equipment manufacturers and critical infrastructure end-users.
- Project Initiation: GPS and RF Interference Detection.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
eLoran demonstration at the New York Stock Exchange.	FY 2016 Q1	FY 2016 Q3
Initial classified outreach meetings with a GPS receiver manufacturer to discuss S&T's GPS receiver vulnerability test results.	FY 2016 Q1	FY 2016 Q3
PNT program participation in the 2016 FRG Electronic Jamming Exercise to validate laboratory test results of GPS vulnerabilities in a live-sky jamming and spoofing environment.	FY 2016 Q4	FY 2016 Q4
Release best practices guidance.	FY 2016 Q1	FY 2016 Q4
FY 2017		
Host open-air GPS and Iridium test event at Savannah River Site to test capability of Iridium receivers to provide timing information in GPS denied environment.	FY 2016 Q4	FY 2017 Q1
Host open-air GPS spoofing test event for GPS equipment manufacturers.	FY 2017 Q2	FY 2017 Q4
Final draft timing requirements report for the electricity subsector and wireless communications sector.	FY 2016 Q4	FY 2017 Q1
Final draft timing requirements report for the financial services and emergency services sectors.	FY 2017 Q1	FY 2017 Q3
Project initiation: Multi-GNSS Evaluation.	FY 2017 Q2	FY 2017 Q2
Project Initiation: System-Level Testing.	FY 2017 Q2	FY 2017 Q3
Project Initiation: Timing Manipulation Detection Capabilities.	FY 2017 Q2	FY 2017 Q3
Project Initiation: Assured Timing Technologies.	FY 2017 Q3	FY 2017 Q4
FY 2018		

Research & Development Description	Plan Start Date	Planned Completion
Project Initiation: GPS and RF Interference Detection.	FY 2018 Q1	FY 2018 Q3
Host open-air GPS test event for testing of mitigation technologies or revised equipment from manufacturers.	FY 2018 Q2	FY 2019 Q1

Type of Research

Developmental

Technical Readiness Level

TRL varies 4-7. Current GPS-PNT user equipment are commercial and in use. New designs and/or other mitigation solutions for jamming/spoofing risks may vary (e.g., user equipment, antennas).

Transition Plans

- Partnership and coordination with DHS NPPD OIP for communication and dissemination of GPS knowledge products to critical infrastructure Sectors and owners/operators. Coordination with private sector manufactures and vendors for knowledge products and testing results for improvements or upgrades to product lines. Coordination with FFRDC and National Laboratories and others for opportunities for commercialization or other transition or intellectual property.

National Hurricane Technology

- **Problem:** FEMA's National Hurricane Program's (NHP) current system relies upon legacy systems and requires too many resources and too much time to provide timely and actionable results. The most significant challenges are to understand the potential impacts of storm surge, winds, and inland flooding and the level of uncertainty of these forecasts as storms approach. Planning and training often use different sets of tools that cause challenges in translating plans and training into action during real life events. Once evacuation decisions are made, the challenge becomes alerting the public whom often are not aware that they are in a hazard zone or what they should do. After an event, the process of understanding lessons-learned requires a lengthy and cumbersome review process that faces significant issues in gathering accurate and timely critical data.
- **Solution:** S&T is working across multiple agencies including FEMA, USGS, NOAA and State, local and tribal communities to create an integrated platform that meets the needs of the entire hurricane response community. Previous work has culminated in a prototype decision support tool (HVX) that provides enhanced data analytics for impact and uncertainty assessments, integrated training with simulated scenarios to enable serious gaming for improved training compliance, and planning tools to

streamline pre-planning of evacuation zones and routes. Funds for FY18 support the transition of this prototype tool to a private vendor to enable fulltime support and operations through a FEMA RFP. In addition, user feedback indicates that both the evacuation alert and resource planning extensions piloted in FY 2017 should be integrated into HVX. And that further work needs to be done to add newly developed products for inland flooding impacts and to extend HVX more fully into post-storm assessment.

- **Impact:** The modernized NHP will enhance the ability of the end users at the state and local level in managing local hurricane evacuations and response. Successful transition of HVX will allow FEMA to eliminate legacy systems and integrated training will enable the delivery of training to all users at reduced cost. Improvements for evacuation alerting, resource planning and inland flooding products will improve evacuation effectiveness and automated post-storm assessment capture and reporting will reduce paperwork and increase the timeliness of these critical reports.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	1,000	1,000	1,000	1,000
Obligations	-	1,671	917	917	-

FY 2016 Key Milestone Events (Prior Year)

- Guidance document of best practices for hurricane evacuations.
- Pilot products for integrated training, hurricane evacuation study modularization.

FY 2017 Key Milestone Events (Year of Execution)

- Deployment of functional prototype for operations during 2017 Hurricane season (May).
- Pilot products for evacuation alerting, resource allocation, and post-storm assessment.

FY 2018 Key Milestone Events (Budget Year)

- Create prototype post-storm assessment products.
- Integrate evacuation alert pilot application (I-PAWS and current research).
- Enhance inland flooding impact products based on Hurricane Matthew experience.
- Support for transition of HVX to private O&M provider.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Technology pilots to improve the quality and speed of impact capture.	FY 2018 Q2	FY 2018 Q4
Full integration of evacuation alert application	FY 2018 Q1	FY 2018 Q4
Enhanced inland flooding impact products	FY 2018 Q2	FY 2018 Q4
HVX transition assistance	FY 2018 Q1	FY 2018 Q4

Type of Research

Applied research.

Technical Readiness Level

TRL-5

Transition Plans

FEMA is issuing an RFP for transition and operations and maintenance of the current HVX platform (expected spring 2017).

Regional Resilience Assessment Technology Modernization

- Problem:** The United States is being increasingly impacted by disasters of all types - natural, technological and man-made. Existing science and technologies available at the Federal, state and community levels are not adequate to meet the challenges of assessing the multiple risks and hazards effectively and efficiently. This negatively impacts the ability of organizations to spend mitigation funds effectively to reduce risks, and to respond and recover from disasters of all types. New science and technology is required to fully meet the goals of PPD-21, which defines resilience “as the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions.” Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.
- Solution:** FRG will work with key stakeholders at Federal, state and local levels to understand and prioritize gaps in science and technology needed to increase resiliency at all levels of government. Coordinate with the research community, industry and other practitioners to identify, develop, test and transition to operational use new tools to increase resiliency. Leverage existing research partnerships with FEMA for flood resiliency and modernization of hurricane technologies and other relevant programs.

- **Impact:** Severe weather events alone, including floods and hurricanes, now cause over \$10 billion dollars per year in damages in the United States. If this program can reduce the future costs of disasters related to weather by 1% due to improved resiliency, the impact will be over \$100M in annual benefits. In addition, Federal, state and local organizations will have improved tools to guide mitigation investments, and manage response and recovery operations, resulting in improve community and national resiliency.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	620	1,986
Obligations	-	-	-	-	-

FY 2017 Key Milestone Events (Year of Execution)

- Development of program and project management plans.
- Identify key stakeholders and research collaboration partners.
- Initiate preliminary research in support of resiliency data development.
- Establish initial transition concepts.

FY 2018 Key Milestone Events (Budget Year)

- Develop research plan.
- Initiate three resiliency research program with key stakeholders.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Development of program and project management plans.	FY 2017 Q2	FY 2017 Q4
Identify key stakeholders and research collaboration partners.	FY 2017 Q3	FY 2017 Q4
Initiate preliminary research in support of resiliency data development.	FY 2017 Q4	FY 2018 Q3
Establish initial transition concepts.	FY 2017 Q4	FY 2018 Q2
FY 2018		
Develop and coordinate research plan with stakeholders.	FY 2018 Q1	FY 2018 Q2
Initiate and complete three resiliency research programs with key stakeholders.	FY 2018 Q3	FY 2019 Q3

Type of Research

Applied

Technical Readiness Level

The program plans to begin at TRL3 and end at TRL 8.

Transition Plans

- Transition will be accomplished through partnership and collaboration with key partners. Initially, it is envisioned that tools developed from this activity will be adopted incrementally by Federal, state and local organizations to replace and update existing infrastructure used to plan mitigation programs and respond to and recover from disasters.

Cyber for Critical Infrastructure

- **Problem:** Critical infrastructure is vital to our national security, economy, public health and well-being. This infrastructure has become increasingly global, complex, and susceptible to disruptions. DHS needs enhanced awareness of potential disruptions and the ability to design in flexibility and resilience to mitigate the effects of such disruptions. Current risk assessment and management approaches often do not incorporate all of the relevant linkages, such as sector interdependencies and cybersecurity risk factors. As a result, formulation of risk-informed designs that can incorporate resilience remains a challenge. Such things as cyber intrusions, natural hazards, and a range of human factors, including inadvertent errors and malicious acts, affect the resilience of critical infrastructure systems.
- **Solution:** Develop the technical basis and analytical tools needed to support cross-domain risk assessment and identify standards of practice to support the expanded use of risk methodologies for cyber and physical systems and response planning. Work with NPPD, sectors, and international partners to build on existing risk assessment tools and platforms to incorporate cross-sector interdependencies.
- **Impact:** The global economy has become increasingly dependent on legacy and complex systems and the infrastructure that supports them. The efficiency and reliability of these interconnected and interdependent systems is an important element for maintaining American competitiveness. Enhancing and making these new risk assessment tools available to a wider user group will enable design and implementation of more effective measures to monitor and adapt critical infrastructure systems and increase resilience. Critical infrastructure will be more flexible, less susceptible to disturbances, and able to withstand, absorb, recover, and adapt to ensure that the needed level of functionality is provided.

Sub Projects

- *Critical Infrastructure Design and Adaptive Resilient Systems (CIDARS)* - the CIDARS project is examining innovative approaches to plan and design adaptive performance into critical infrastructure systems. The goal is to create common capabilities and quantitative approaches that facilitate the development and implementation of integrated solutions that will enable secure and resilient service provisioning.
- *Cyber Resilient Energy Delivery Consortium* - The consortium is developing solutions through R&D, education and industry engagement. CREDC will generate research, evaluate the results and deploy solutions in the marketplace. The project's foci include cyber protection technologies; cyber monitoring, metrics, and event detection; risk assessment of Energy Delivery Systems (EDS) technology; data analytics for cyber event detection; resilient EDS architectures and networks; and identifying the impact of disruptive technologies such as the Internet of Things and cloud computing on EDS resiliency.
- *Cybersecurity for Oil & Gas Systems (COGS)* – This project facilitates research, development, testing and evaluation procedures to improve cybersecurity in petroleum industry digital control systems. The project undertakes collaborative R&D projects to improve the level of cybersecurity in critical systems of interest to the oil and natural gas sector. The objective is to promote the interests of the sector while maintaining impartiality, the independence of the participants and vendor neutrality.
- *CISR Characterization* - This project identifies and characterizes functional interactions among critical infrastructure sectors with a focus on key physical, social, and behavioral dependencies.
- *Risk Informed CISR Restoration* – This project focuses on the development of risk-informed, integrated resource allocation decision support for critical infrastructure restoration, renewal, and redesign.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Project Funding	-	-	-	-	3,650
Obligations	-	-	-	-	-

FY 2018 Key Milestone Events (Budget Year)

- Finalize and release final report of a study on vulnerabilities on Safety Instrumented Systems (SIS) and basic Process Control Systems (PCS).
- Select and develop specifications for the testing and evaluation procedures of a new project.
- Identify and prioritize gaps in the existing data and model set based on synthetic data solicitation findings.
- Develop a framework for a pilot mapping of sector interdependencies at the community, industry, regional, and national levels, that identifies the key relationships necessary to support model development.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Analyze and review findings from test and evaluation, begin drafting final report.	FY 2018 Q1	FY 2018 Q1
Compare existing tools and methodologies for modeling critical infrastructure systems with proposed synthetic data approaches developed based on FY17 solicitation.	FY 2018 Q1	FY 2018 Q3
Create scalable framework application of synthetic data approach to consider interdependencies as a pilot program.	FY 2018 Q2	FY 2019 Q2
Coordinate with NPPD, sector, and international partners to enhance impact of synthetic framework application.	FY 2018 Q1	FY 2019 Q2

Type of Research

Applied

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- Tools, findings, reports, and methodologies will be shared with other organizations, such as NPPD, sector, and international partners, to improve the formulation of risk-informed designs for critical infrastructure that can incorporate resilience and improve DHS's awareness of potential disruptions.

Aligning Departmental R&D with DHS Goals (Integrated Product Teams)

- Problem:** There is a need in DHS to identify and prioritize R&D capability gaps. Department-wide coordination is required to determine the R&D efforts needed to close those gaps and meet the most pressing needs of the Components.
- Solution:** In 2015, DHS established the R&D Integrated Product Teams (IPTs) as the Department's primary collaboration mechanism for DHS-wide R&D coordination. Over these last two years, IPTs have played a central role in identifying and prioritizing R&D technological capability gaps. By introducing more advanced data methodologies and standards, IPTs are shifting the R&D culture within DHS to provide a reproducible mechanism that results in a list of high priority R&D gaps by

documenting, tracking, and closing-out the required R&D. IPTs accomplish this by mapping prioritized R&D technological capability gaps to specific R&D projects. As a consequence, IPTs have moved DHS from a Component-dependent R&D profile to a more agile enterprise that is based on an R&D needs and sound investment strategies.

- **Impact:** The institutionalization of coordinated DHS R&D needs to close prioritized technological capabilities gaps is yielding significant results. The benefits start with a comprehensive profile of R&D being conducted across the Department. This profile encourages a balanced DHS-wide R&D approach to address current R&D needs, emerging R&D needs, and unanticipated R&D needs. Meeting the short and long term objectives is directly attributable to the emergence of an agile IPT Process. In addition, cost savings are realized through the leveraging of the elimination of duplicative R&D efforts and other entities performing R&D: DoD, federal agencies, industry, academia, and international partners. The successful DHS-wide collaboration advanced through the IPT Process is leading to improved accountability and reduced duplications. This data-driven IPT Processes ensure seamless connectivity between operators and technical experts. Improvements, led by IPT advancements, focus on key areas:
 - Data quality – Components provided an increased level of detail for funded R&D projects.
 - Data analytics – DHS S&T develops a portfolio management tool focused on machine learning and natural language recognition to better map high priority technology gaps to R&D projects.
 - Standardized prioritization criteria – IPT stakeholders coordinated the Component-led IPT Prioritization Working Group that established standards and definitions for ranking R&D technological capability gaps.
 - Increased decision transparency – The *FY 2017 IPT Report* was informed by a ranking and prioritization system called Analytic Hierarchy Process (AHP).
 - Improved alignment of R&D projects to high-priority areas – IPT Operations introduced a data analytical process to transform collected IPT data into useful characteristics and enable natural sorting into mission critical bins and categories.

Overall Project Funding

	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018
Budget	-	-	-	-	5,000
Obligations	-	-	-	-	-

FY 2018 Key Milestones (Budget Year)

- Automate IPT Processes for eliminating duplication and identifying R&D gaps solutions by implementing

additional data analytics that will result in increased efficiencies. Develop a DHS-wide R&D plan based on the data gathered via the IPT Process.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2016		
Developed the mechanism and protocols necessary to gather Department-wide R&D data and priorities and report prioritization. results.	FY 2016 Q1	FY 2016 Q4
FY 2017		
Improve the mechanism and protocols necessary to gather Department-wide R&D data; establish a standardized profile of R&D gaps and R&D projects; and deliver an annual report on prioritized R&D gaps in order to close-out GAO findings.	FY 2017 Q1	FY 2017 Q4
FY 2018		
Complete a DHS-wide R&D plan that focuses on closing the high-priority R&D gaps by continuing to implement the IPT Design Framework and IPT Gap Lifecycle. Provide the necessary tools and support to R&D gap owners (Components) to ensure gaps continue to reflect mission priorities; define R&D requirements to close the gaps; and ensure gap closure approaches are tracking programatically and within budget.	FY 2018 Q1	FY 2018 Q4

Type of Research

The IPT process applies to all types of R&D Basic, Applied or Developmental.

Technical Readiness Level

The IPT mechanisms and process provide a variety of TRL levels 1-7.

Transition Plans

As noted earlier, the IPTs support and track the HSE customer/Component and assists the components with the necessary tools (operation of a technology or knowledge products) to transition the R&D gap.

University Programs - PPA

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

Dollars in Thousands

Organization	FY 2016 Revised Enacted			FY 2017 Annualized CR			FY 2018 President's Budget			FY 2017 to FY 2018 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
University Programs	-	-	\$39,724	-	-	\$39,724	-	-	\$29,724	-	-	(\$10,000)
Total	-	-	\$39,724	-	-	\$39,724	-	-	\$29,724	-	-	(\$10,000)
Subtotal Discretionary - Appropriation	-	-	\$39,724	-	-	\$39,724	-	-	\$29,724	-	-	(\$10,000)

PPA DESCRIPTION: University Programs

S&T Requests \$29.724M for University Programs in FY 2018.

University Programs PPA: The Office of University Programs (OUP) supports homeland security-related research and education at U.S. colleges and universities to address high-priority DHS-related issues and to enhance homeland security capabilities over the long term. The program brings together scientists, mathematicians, and engineers from many academic disciplines and institutions. These researchers are investigating research questions important to DHS, as well as developing new technologies and approaches to solve complex and challenging homeland security problems. OUP's COEs program focuses on building homeland security expertise in the academic community, creating strategic partnerships among universities, commercial interests, and public agencies, and developing a new science and engineering workforce dedicated to homeland security. The primary customers for OUP are S&T's divisions, DHS Components, and Federal, State, and local government agencies.

University Programs – PPA
Budget Authority and Obligations
Dollars in Thousands

Budget Authority	FY 2016	FY 2017	FY 2018
Enacted	\$39,724		
Transfers & Reprogrammings	-		
Delta in Enacted Fee Estimate to Fee Actuals	-		
Enacted Rescissions to Prior Year	-		
Revised Enacted/Request	\$39,724	\$39,724	\$29,724
Carryover and/or Recoveries (Actual/Estimates/Projections)	\$3,519	\$7,090	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	\$43,243	\$46,814	\$29,724
Collections – Reimbursable Resources	\$460	\$500	\$500
Total Budget Resources	\$43,703	\$47,314	\$30,224
Obligations (Actual/Projections/Estimates)	\$36,532	\$39,550	\$25,265
Personnel: Positons and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

The FY 2018 estimated obligation is \$25.265M out of an estimated \$30.224M of total budgetary resources. Total budget obligations for FY 2017 and FY 2018 are based on FY 2016 execution totals.

University Programs – PPA
Summary of Budget Changes
Dollars in Thousands

Budget Formulation Activity	Positions	FTE	Amount
FY 2016 Enacted	-	-	\$39,724
FY 2016 Revised Enacted	-	-	\$39,724
FY 2017 Annualized CR	-	-	\$39,724
FY 2018 Base Budget	-	-	\$39,724
FY 2018 Current Services	-	-	\$39,724
S&T - University Programs Centers of Excellence R&D	-	-	(\$10,000)
Total, Program Decreases	-	-	(\$10,000)
FY 2018 Request	-	-	\$29,724
FY 2017 TO FY 2018 Change	-	-	(\$10,000)

PPA Description

S&T requests \$29.724M for University Programs in FY 2018.

University Programs PPA: The OUP supports homeland security-related research and education at U.S. colleges and universities to address high-priority DHS-related issues and to enhance homeland security capabilities over the long term. The program brings together scientists, mathematicians, and engineers from many academic disciplines and institutions. These researchers are investigating research questions important to DHS, as well as developing new technologies and approaches to solve complex and challenging homeland security problems. OUP's COE program focuses on building homeland security expertise in the academic community, creating strategic partnerships among universities, commercial interests, and public agencies, and developing a new science and engineering workforce dedicated to homeland security. The primary customers for OUP are S&T's divisions, DHS Components, and Federal, State, and local government agencies.

The \$10.000M reduction in funding for the Centers of Excellence will result in the elimination of one COE, the Maritime Security COE, and the non-recompete of two other COEs, the Cross Border Threat Screening and Supply Chain COE, and the Counterterrorism COE. This will allow S&T to focus its R&D efforts on DHS and Administration priorities.

Component access to the centers will remain available through basic ordering agreements maintained by S&T. OUP will continue to

harnesses the intellectual power of America's universities for homeland security research, development and education to deliver tools, technologies, knowledge products, training and expertise to the Homeland Security Enterprise through the remaining COEs.

Adjustments to Base Justification

There are no adjustments to base in FY 2018.

University Programs – PPA Non Pay Budget Exhibits

Non Pay Summary

Dollars in Thousands

Organization	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
University Programs	\$39,724	\$39,724	\$29,724	(\$10,000)
Total	\$39,724	\$39,724	\$29,724	(\$10,000)
Discretionary - Appropriation	\$39,724	\$39,724	\$29,724	(\$10,000)

The non-pay request for FY 2018 is \$29.724M. The decrement of \$10.000M is associated with the elimination of one COE, and the non-recompete of two other COEs.

University Programs – PPA
Non Pay by Object Class
Dollars in Thousands

Non-Pay Object Classes	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Change
21.0 Travel and Transportation of Persons	\$110	\$110	\$82	(\$28)
25.1 Advisory and Assistance Services	\$2,587	\$2,587	\$1,936	(\$651)
25.2 Other Services from Non-Federal Sources	\$2	\$2	\$1	(\$1)
25.3 Other Goods and Services from Federal Sources	\$1,562	\$1,562	\$1,169	(\$393)
25.5 Research and Development Contracts	\$2,050	\$2,050	\$1,534	(\$516)
41.0 Grants, Subsidies, and Contributions	\$33,413	\$33,413	\$25,002	(\$8,411)
Total - Non Pay Object Classes	\$39,724	\$39,724	\$29,724	(\$10,000)

Reduction in object class is directly proportional with the decrease in the FY 2018 request.

Non Pay Cost Drivers

Dollars in Thousands

Leading Non Pay Cost-Drivers	FY 2016 Revised Enacted	FY 2017 Annualized CR	FY 2018 President's Budget	FY 2017 to FY 2018 Total Changes
Grants, Subsidies, and Contributions	\$33,413	\$33,413	\$25,002	(\$8,411)
Advisory and Assistance Services	\$2,587	\$2,587	\$1,936	(\$651)
Research and Development Contracts	\$2,050	\$2,050	\$1,534	(\$516)
Other Goods and Services from Federal Sources	\$1,562	\$1,562	\$1,169	(\$393)
Travel and Transportation of Persons	\$110	\$110	\$82	(\$28)
Other Services from Non-Federal Sources	\$2	\$2	\$1	(\$1)
Total – Non Pay Cost Drivers	\$39,724	\$39,724	\$29,724	(\$10,000)

NARRATIVE EXPLANATION OF CHANGES

Grants, Subsidies, and Contributions: The decreases are proportional to the reduction in funding to the Centers of Excellence.

Grants, Subsidies and Contributions are the financial assistance funding that invests in the Centers of Excellence.

Advisory and Assistance Services: The decreases are proportional to the Centers of Excellence reductions. Advisory and Assistance services are contractual costs associated with administering the Centers of Excellence.

Research and Development Contracts: The decreases are proportional to the Centers of Excellence reductions. Research and Development Contracts are the direct cost of conducting research and development associated with the Centers of Excellence.

Other Goods and Services from Federal Sources: The decreases are proportional to the Centers of Excellence reductions. Other Goods and Services from Federal Sources represents funding that is placed with other government agencies under the authority of the Economy Act.

Travel and Transportation of Persons: The decreases are proportional to the Centers of Excellence reductions.

Other Services from Non-Federal Sources: The decreases are proportional to the Centers of Excellence reductions.

Research and Development

Technology Readiness Level Exhibit

Project Description:
University Programs

PPA DESCRIPTION: University Programs

OUP supports homeland security-related research and education at U.S. colleges and universities to address high-priority DHS-related issues and to enhance homeland security capabilities over the long term. The program brings together scientists, mathematicians, and engineers from many academic disciplines and institutions. These researchers are investigating research questions important to DHS, as well as developing new technologies and approaches to solve complex and challenging homeland security problems. OUP's COEs program focuses on building homeland security expertise in the academic community, creating strategic partnerships among universities, commercial interests, and public agencies, and developing a new science and engineering workforce dedicated to homeland security. The primary customers for OUP are S&T's divisions, DHS Components, and Federal, State, and local government agencies.

Centers of Excellence Project Descriptions:

FY 2017 Annualized Continuing Resolution: \$36.328M. FY 2018 Request: \$26.328M.

The Center for Homeland Security Quantitative Analysis (CHSQA):

New COE - This Center will conduct DHS component-focused research to enhance the development and application of quantitative approaches to counter security threats and natural hazards. Also, the CHSQA COE will develop quantitative education and training for DHS staff to modernize operations and improve data analysis, increase operational efficiency, identify the economic impact of security threats, and assess future risks to homeland security.

Problem: Given the increased numbers and types of threats, as well as rapidly expanding data management needs, security agencies at all levels need new approaches and technologies to improve analysis for decision makers. The challenges to security require new and targeted products that can provide security professionals with an operational advantage. These products must be based on sound research, tested in operational settings and transitioned to operational users.

Solution: The Center will develop and transition the next generation of mathematical, computational, and statistical tools to advance DHS's capabilities in quantitative analysis.

Impact: In partnership with operational DHS agencies and others, OUP will work with CHSQA to transition analytical products and

educational programs to the DHS workforce. DHS will work with multiple public and private stakeholders to test these capabilities in operational and strategic settings, and then make these solutions available and useful to all partners.

FY 2016 Key Milestone Events (Prior Year)

- NA

FY 2017 Planned Key Milestone Events (Year of Execution)

- NA

FY 2018 Planned Key Milestone Events (Budget Year)

- In FY 2018 Q1, CHSQA will finalize its research agenda and thrust areas through a series of workshops for lead institution personnel, OUP officials, and the corresponding Federal Coordinating Committee (FCC).
- In FY 2018 Q1, CHSQA will explore innovative simulation and modeling methods to confront the challenges terrorism poses to the DHS mission set. Subtopics may include social media, critical infrastructure, or cyber security.

Critical Infrastructure Resilience Institute (CIRI): This Center conducts research and education to enhance the resiliency of the Nation's critical infrastructures, and the businesses and public entities that own and operate them. This research will provide a better understanding of risk management of catastrophic disruptions to infrastructure operations.

Problem: The Federal government needs industries and regional economies working again as soon as possible after catastrophic events, particularly in locales that also host critical infrastructure systems and industries. Therefore, DHS must understand the complex public and private sector linkages that comprise an infrastructure system and community and how the severe stress of catastrophic events impacts them.

Solution: The Center will develop business cases for preparing for and mitigating the effects of catastrophic incidents, as well as how to integrate community considerations into business decisions.

Impact: The Center's work will result in data-rich quantitative analyses, technologies, and other tools that assist DHS and the critical infrastructure industry in understanding threats and vulnerabilities, risk management strategies, and costs and trade-offs of risk management decisions.

FY 2016 Key Milestone Events (Prior Year)

- Developed and formalized the Center's vision, strategy, and business practices necessary to establish a high quality and relevant research portfolio.
- Conducted 10 research projects focused on helping infrastructure owners and operators better understand their dependency on critical infrastructures in general.

- Conducted 10 research projects focused on how to better understand what the risks and threats are to cyber assets.
- Conducted 10 research projects focused on understanding how business decisions concerning risk are made. CIRI identify gaps in cyber-physical technologies that improve resiliency, and will develop prototypes of new technologies.

FY 2017 Planned Key Milestone Events (Year of Execution)

- Develop a transition framework to be used by the CIRI to guide advanced technical development, integrate outputs, and provide the supporting business elements necessary to transfer intellectual property to third parties in the public and private sectors.

FY 2018 Planned Key Milestone Events (Budget Year)

- By FY 2018 Q2, conduct Biennial Review to evaluate CIRI's research portfolio at both theme and project levels for research quality, progress, and interest of homeland security customer segments, and implement recommendations to adjust portfolio investment by Q3.
- By FY 2018 Q3, integrate research outputs into three concentrations supporting the refinement of projects in: next generation risk assessment approaches, approaches to understand the mitigation of risks posed by cyber-attacks to manufacturing, and the role that market based incentives can play in stimulating private sector resilience investment.

Cross Border Threat Screening and Supply Chain Defense (CBTS): New COE - This COE will conduct research and develop solutions, protocols, and capabilities to support the identification of biological threats and/or hazards at ports of entry, land borders, and other critical nodes within the supply chain.

Problem: The fields of biology, bioengineering, and supply chain analytics are rapidly evolving, bringing with them new biological threats and hazards. DHS needs to ability to better understand current and emerging biological threats that are faced at ports of entries (POE) and land borders that may significantly affect the health and well-being of people, animals, plants, and therefore the Nation's critical infrastructure and economy.

Solution: The Center will assist DHS by developing innovative technologies, optimized operational procedures, and a skilled workforce trained in the latest methods to identify and respond to biological threats and their impacts on health and the economy.

Impact: S&T will eliminate this COE in FY 2018 due to competing DHS priorities in a fiscally constrained environment.

FY 2016 Key Milestone Events (Prior Year)

- NA

FY 2017 Planned Key Milestone Events (Year of Execution)

- Developed a Notice of Funding Opportunity (NOFO) announcement in FY2017 Q2 using OUP processes for engaging DHS Components.

FY 2018 Planned Key Milestone Events (Budget Year)

N/A

Counterterrorism Center of Excellence (CTCOE): New COE - This Counterterrorism COE will examine adversarial behavior within the homeland and beyond our borders to better understand and anticipate evolving threats and the effectiveness of counterterrorism efforts. The thrust areas of this COE continue to be developed, guided by literature review and subject matter expert interviews from DHS Components and other Federal agencies. Potential themes or topics include: the effectiveness of counterterrorism efforts and technologies and their application to the homeland, security concerns related to preventing attacks on U.S. critical infrastructure including cyber systems, emerging threats of foreign terrorist fighters returning to the United States, and technological capabilities to identify homegrown violent extremists.

Problem: Protecting the homeland requires preventing terrorist threats and anticipating how the threat will evolve. In order for the U.S. government to develop evidence-based counterterrorism policy that is lawful, rational, and effective, the impact of U.S. government counterterrorism tactics, strategies, and tools must be evaluated.

Solution: This COE will equip DHS Components and other Federal agencies with the tools, technologies, and training capabilities needed to deter terrorist activity and to protect the country from extremist-inspired attacks within the homeland. A more detailed approach will become available when this COE is formally announced and competed.

Impact: S&T will eliminate this COE in FY 2018 due to competing DHS priorities in a fiscally constrained environment.

FY 2016 Key Milestone Events (Prior Year)

- N/A

FY 2017 Planned Key Milestone Events (Year of Execution)

- N/A

FY 2018 Planned Key Milestone Events (Budget Year)

- N/A

Arctic Domain Awareness Center (ADAC): This Center develops and transitions technology solutions, innovative products, and educational programs to improve situational awareness and crisis response capabilities related to emerging challenges posed by the dynamic Arctic environment.

Problem: The lack of Arctic domain knowledge inhibits situational awareness in the Arctic for the USCG and DHS security and response missions. Imagery, data, and communications, and scientific understanding of the operating environment are insufficient to develop reliable operational responses to mission needs.

Solution: ADAC conducts relevant research and development that benefits USCG operations, with particular emphasis on mission areas of high consequence: vessel intrusion, threats to navigation, search and rescue, humanitarian assistance, and disaster response. Results serve USCG, other DHS Arctic missions.

Impact: ADAC's impact will affect future operations by advancing knowledge in Arctic Domain Awareness research areas that improve USCG's Arctic operator coordination, control, and decision making.

FY 2016 Key Milestone Events (Prior Year)

- Developed an accurate, high resolution (from 4km to 2km) regional High-resolution Ice-Ocean Modeling and Assimilation System (HIOMAS) using the Regional Ocean Modeling System (ROMS).
- Used distributed human observers (comprised of two Bering Strait communities) as sensors to systematically observe and document Arctic environmental and globalization changes.
- Improved oil spill modeling and planning in the arctic by providing higher resolution (from 4 km to a target of 2 km) ocean current and sea ice data.

FY 2017 Planned Key Milestone Events (Year of Execution)

- Conduct Biennial Review to evaluate the ADAC's research portfolio at both theme and project levels for research quality, good progress, and committed HSE customers.

FY 2018 Planned Key Milestone Events (Budget Year)

- Reorient ADAC Research Program based on the results of the Biennial Review held in FY 2017 Q3.
- Finalize Basic Polar Navigation Course curriculum for arctic mariner by FY 2018 Q2.

Maritime Security Center (MSC): The Center conducts research to support DHS's and other Federal agencies' Arctic security missions. This includes improving detection and interdiction capabilities, enhancing catastrophic event response, and increasing marine transportation system security and efficiency.

Problem: Understanding what is on, above, and below the water is critical to operations. Transparency in the maritime domain is a key challenge for USCG and CBP's Air & Marine Operations.

Solution: MSC develops solutions and educational programs to improve Maritime Domain Awareness capabilities for preventing and responding to events in the maritime domain, increasing the resiliency of the Nation's Marine Transportation System, and enhancing the technical skills and leadership capabilities of the country's current and prospective maritime security workforce.

Impact: Operational impacts include the ability to improve wide area surveillance of large open areas of ocean, increased fidelity of vessel traffic in the approaches to U.S. coastal and port areas, and tools to improve the assessment of resiliency in port areas to assist in the response and recovery after a significant event. S&T will eliminate this COE in FY 2018 due to competing DHS priorities in a fiscally constrained environment.

FY 2016 Key Milestone Events (Prior Year)

- Connected at least 10 students with MSC stakeholders and engaged them in research projects (e.g. improving port resilience) that are responsive to and directly impact the knowledge and technology needs of maritime and homeland security practitioners.

FY 2017 Planned Key Milestone Events (Year of Execution)

- Conduct Biennial Review to evaluate MSC's research portfolio at both theme and project levels for research quality, good progress, and committed HSE customers.

FY 2018 Planned Key Milestone Events (Budget Year)

- N/A.

Borders, Trade, and Immigration Institute (BTI Institute): BTI conducts research and provides education to enhance the Nation's ability to secure its borders and facilitate legitimate trade and travel. It also conducts research to help CBP, ICE, and U.S. Citizenship and Immigration Services (USCIS) effectively enforce immigration and customs laws; promoting awareness and understanding of citizenship; and ensuring the integrity of the U.S. immigration system.

Problem: Transnational challenges associated with border security and immigration require innovations in technology-based tools and techniques for border management, trade facilitation, targeting, and enforcement. R&D is necessary to determine the principal global transnational and national influences and factors that impact border, trade, security, and immigration activities.

Solution: BTI Institute delivers technology solutions, data-informed policies, and trans-disciplinary education to address the Nation's challenges as they relate to border control, customs, trade and travel facilitation, security, and enforcement.

Impact: BTI impacts include improving the operational effectiveness of cargo security processes at ports of entry, identifying opportunities to counter weapons of mass destruction (WMDs) proliferation through export control enforcement, and improving video and imagery capabilities that identify people in operational environments.

FY 2016 Key Milestone Events (Prior Year)

- Established 17 projects with the CBTIR research consortium to address knowledge and technology gaps and provide targeted education resources to address the Nation's challenges as they relate to border control, customs, trade, immigration and enforcement.
- Devised a strategy to identify opportunities for improved administration and enforcement of nonproliferation-specific

export controls.

FY 2017 Planned Key Milestone Events (Year of Execution)

- Conduct Immigration Workshop to identify knowledge and capability gaps regarding three major immigration issues; conduct a competition seeking research to address gaps.

FY 2018 Planned Key Milestone Events (Budget Year)

- Conduct Biennial Review to evaluate BTI Institute's research portfolio at both theme and project levels for research quality, good progress, and committed HSE customers.
- Finalize the impact of the ongoing Export Control Reform Initiative on U.S. Government efforts to enforce export controls in support of counters the proliferation of WMDs.

Center of Excellence for Coastal Resilience (CRC): This Center conducts research and education to enhance the Nation's ability to safeguard people, infrastructure, and economies from natural hazards such as floods and hurricanes. It also considers the impact of future climate trends on coastal resilience.

Problem: Damage caused by floods and hurricanes poses a near-constant threat to lives and property. A lack of resilience to natural hazards at the individual and community level is contributing to the increasing public share of disaster response and recovery costs. The 30-year average losses from flooding alone through 2014 are nearly \$8 billion per year in property damage and 82 deaths (<http://www.nws.noaa.gov/hic/>).

Solution: CRC's work directly addresses key challenges associated with growing coastal vulnerability and assists S&T, FEMA, USCG, NPPD and local communities in coordination with public and private sector partners. Coastal Infrastructure Resilience examines new methods to assess vulnerability and assist practitioners. Building Resilient Communities conducts research and education to help communities mitigate, recover, and adapt to natural hazard risks. Disaster Dynamics advances coastal storm surge and flood forecasting capabilities and communicates the results to improve coastal resilience through flood risk maps and other mechanisms.

Impact: CRC's work produces tangible research and education results for use by DHS, other Federal agencies, state and local governments, and other relevant entities that help reduce the adverse impacts of coastal natural disasters on the Nation's citizens, infrastructure, and economy.

FY 2016 Key Milestone Events (Prior Year)

- Finalized project work plans and initiate research and education projects with a goal of expanding coastal resilience understanding through rigorous, integrated, and interdisciplinary research.
- Developed at least two new tools and methods to assess and enhance physical, social, economic, environmental, and institutional resilience.

FY 2017 Planned Key Milestone Events (Year of Execution)

- Host a minimum of five students from MSIs through the Coastal Resilience Summer Research Experience.

FY 2018 Planned Key Milestone Events (Budget Year)

- Quantify hurricane rainfall statistics and their contributions to total hurricane flooding to enable development of a method for including rainfall-runoff effects into FEMA's joint probability method for coastal flood hazard studies.
- Revise Center project transition plans based on outcomes of its Biennial Review.

Criminal Investigations and Network Analysis (CINA): New COE -This Center will conduct end user-focused research to enhance investigation strategies to address transnational criminal organizations (TCO) activities and other homeland security-related crimes. This COE will also provide education and professional development to improve the cost-effectiveness of criminal investigations, prosecution, prediction, and prevention.

Problem: Trans-national criminal organizations are committing heinous crimes in both physical and cyber space. This COE will focus on a major, cross-cutting DHS mission area, criminal law enforcement that the COEs have not yet addressed. The DHS QHSR contains the goals of Preventing Terrorism and Enhancing Security, Securing and Managing Our Borders, Enforcing and Administering Immigration Laws, and Securing Cyberspace.

Solution: The overarching goal of the Center will be to develop tools and methods for agents, officers, and investigators to better coordinate investigative strategies with on-the-ground and cybersecurity activities to predict, thwart, and prosecute crime.

Impact: Research outcomes will include analytical tools, technologies, and knowledge products for the workforce. The Center will produce new capabilities, test them in operational settings, and make validated solutions available and useful to law enforcement agencies at all levels.

FY 2017 Planned Key Milestone Events (Year of Execution)

- Select COE performer for new criminal investigations COE topic area.

FY 2018 Planned Key Milestone Events (Budget Year)

- In FY 2018 Q1, CHSQA will finalize its research agenda and thrust areas through a series of workshops attended by lead institution personnel, OUP officials, and the corresponding Federal Coordinating Committee (FCC).

Center for Awareness and Localization of Explosives-Related Threats (ALERT): This Center conducts transformational research, technology development, and education initiatives for effective characterization, detection, and response to the explosives-related threats facing the country and the world.

Problem: Technology developers require improved characterization of illicit explosives to enhance capabilities such as ultra-reliable

screening, detection at a distance, and actionable trace sampling.

Solution: ALERT works with industry and government partners in the security community to transition solutions that address explosives threat detection capability gaps identified by the DHS components. Examples of cutting-edge project topics include: new improvised explosives, stand-off spectroscopy, multi-modality imaging, and video analytics and signature analysis. With the collaboration of its industry and national laboratory partners, ALERT transitions research into field-able systems, such as a video analytics-based threat detection system for use in airports and other venues. ALERT also provides training and education to professionals and students to enter the DHS workforce.

Impact: ALERT is providing cutting-edge projects to include: study of new improvised explosives, stand-off spectroscopy, multi-modality imaging, and video analytics and signature analysis. With the collaboration of its industrial and national laboratory partners, ALERT will also focus on transitioning research into field able systems, such as a video analytics-based threat detection system for use in airports and other venues.

FY 2016 Key Milestone Events (Prior Year)

- Demonstrated standoff (>2 meters) concealed explosive simulant detection and measurement capability using multi-modality testbed.
- Expand the first-year engineering hands-on laboratory class to members of ALERT and community college partners.

FY 2017 Planned Key Milestone Events (Year of Execution)

- Complete laboratory development of prototype millimeter wave standoff detection and measurement capability in an ALERT laboratory for collaboration and demonstrations of relevance with TSA and/or homeland security vendors.
- Complete a mock checkpoint for use in video analytics studies relevant to TSA.

FY 2018 Planned Key Milestone Events (Budget Year)

- Complete algorithm development of concealed penetrable-dielectric-material-on-body characterization (specifically for high explosives) to be used in conjunction with existing fielded millimeter wave AIT detection systems. Establish collaborative interaction with homeland security vendors and demonstrate the effectiveness to TSA.

Training Institute for Quantitative Analysis (TIQA): *New –Workforce Development and Training* –The Quantitative Analysis Training pilot is in the exploration and planning phase. The goal is to maximize DHS S&T's return on investment in university-based research and education by leveraging the research and knowledge developed within the COE network and applying it to DHS workforce requirements. TIQA would develop one or more pilot programs that deliver quantitative analysis training to DHS Components based upon identified needs. The performers would work with the S&T's OUP to design curricula, leverage existing research knowledge and tools, and deliver training to DHS personnel.

Problem: About 70 percent of the DHS workforce is classified as law enforcement personnel. About 10 percent of the DHS

workforce is classified as STEM professionals. To successfully achieve its mission goals, DHS must increase the quantitative analyses capabilities of its workforce.

Solution: This proposed effort would (1) assess gaps that exist between current HSE workforce capabilities and job requirements and (2) determine the best approaches to deliver effective training to enhance the HSE workforce's capabilities to conduct quantitative analyses.

Impact: Enhance HSE workforce capabilities to conduct quantitative analyses in support of operations or intelligence analysis.

FY 2016 Key Milestone Events (Prior Year)

- NA

FY 2017 Planned Key Milestone Events (Year of Execution)

- NA

FY 2018 Planned Key Milestone Events (Budget Year)

- In FY 2018 Q1, develop SOW for framework of Training Center.

Minority Serving Institutions (MSI): FY 2017 Annualized Continuing Resolution: \$3.396M. FY 2018 Request: \$3.396M. This program enhances the capabilities of Minority Serving Institutions (MSIs) to develop homeland security-related science, technology, engineering, and mathematics research and curricula, and prepare MSI students for successful HSE careers. Current MSI programs, including the Scientific Leadership Award (SLA) program and the Summer Research Team (SRT) program, are developing course content and training in areas critical to homeland security while they also build enduring partnerships with COEs. With small investments, S&T expects to realize significant returns in the development the next generation of scientists and engineers focused on homeland security.

Problem: Federal security agencies needs a diverse, well-qualified analysts and technologists to enter the homeland security science and engineering workforce.

Solution: OUP will provide funding to MSIs to design innovative HS-STEM curricula; support academic enhancements; provide student internships and other experiential learning opportunities; and support DHS-relevant research projects or initiatives with significant involvement of early career faculty and in coordination with DHS COEs.

Impact: MSI students will enter HS-STEM related careers or obtain admission to graduate school to continue HS-STEM related research, increasing diversity and representation within the future homeland security science and engineering workforce.

FY 2016 Key Milestone Events (Prior Year)

- Made SLA awards available through an open competitive process and completed competition process.
- Completed a 10 week SRT program for MSIs that provides experience for teams consisting of a faculty member and up

to two students to perform research at a DHS COE that aligns with the agency's mission.

FY 2017 Planned Key Milestone Events (Year of Execution)

- Make three to six MSI SLA awards available through an open competitive process.
- Complete a 10-week SRT program for MSIs that provides experience for teams consisting of a faculty member and up to two students to perform research at a DHS COE that aligns with the agency's mission.
- Hold a goal-setting workshop for the COEs and MSIs to streamline engagement collaboration and transition of students and research results.

FY 2018 Planned Key Milestone Events (Budget Year)

- Award MSI grants to colleges and universities at or above funding levels report in the prior fiscal year's MSI report to the Office of Civil Rights Executive Order Summary Report.
- Provide award management activities for 10 SLA awardees and 16 SRT awardees that enable DHS S&T and Components to access scientific expertise at academic MSI institutions and their partners.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
<u>Prior Year</u>		
FY 2015 Annual report review.	FY 2016 Q1	FY 2016 Q1
FY 2016 Work plan, development and submission.	FY 2016 Q2	FY 2016 Q2
FY 2016 Work plan approval and Project Initiation or continuation.	FY 2016 Q3	FY 2016 Q3
FY 2016 Annual report development and submission.	FY 2016 Q4	FY 2016 Q4
<u>Year of Execution</u>		
FY 2016 Annual report review.	FY 2017 Q1	FY 2017 Q1
FY 2017 Work plan, development and submission.	FY 2017 Q2	FY 2017 Q2
FY 2017 Work plan approval and Project Initiation or continuation.	FY 2017 Q3	FY 2017 Q3
FY 2017 Annual report development and submission.	FY 2017 Q4	FY 2017 Q4
<u>Budget Year</u>		
FY 2017 Annual report review.	FY 2018 Q1	FY 2018 Q1
FY 2018 Work plan, development and submission.	FY 2018 Q2	FY 2018 Q2
FY 2018 Work plan approval and Project Initiation or continuation.	FY 2018 Q3	FY 2018 Q3
FY 2018 Annual report development and submission.	FY 2018 Q4	FY 2018 Q4

Type of Research

COE research is categorized as basic and is subject to change with the overall strategic approach since it may evolve over time. COEs manage a range of projects that span from early applied research through development. The balance of research depends upon the scientific domain, strategic needs, and the project progress.

Applied	Applied research is defined as systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met.
Developmental	Development is defined as 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.

Technical Readiness Level

The COEs execute projects that span the TRL range. Primarily, COEs conduct projects between TRL 2 through 6, from technology concepts to system prototypes in a relevant environment.

Transition Plans

OUP Program Managers work with the COEs to structure and position projects to align with end-user needs during concept development, testing, and piloting. COE transition activities differ depending upon the research gap being addressed, but often involve partnerships with service and technology providers, such as data owners, commercialization entities, and even DHS Components. OUP's management methods are designed to reduce the technical and programmatic risks of a new technology to the point where industry and other Federal customers are willing to invest in the technology or acquire it directly.

OUP Program Managers work with S&T's Office of General Counsel, the General Counsel of the performing institution(s), and the Technology Commercialization Offices, and they recognize the Bayh-Dole Act, which was designed to improve technology transfer by shifting the responsibility of protecting intellectual property to universities in exchange for Federal funding. DHS encourages COEs work with their technology transfer offices to attract investments, address legal concerns, and leverage university infrastructures to execute the plans necessary to enable long-term sustainment of technologies.