Department of Homeland Security

Science and Technology Directorate

Budget Overview

Fiscal Year 2019

Congressional Justification

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Science and Technology Directorate

Appropriation Organization Structure

Organization Name	Level	Fund Type (* Includes Defense Funding)
Science and Technology Directorate	**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 Directorate
Strategic Context

Component Overview

The strategic context presents the performance budget by tying together strategy, budget resource requests, programs, or PPAs, and performance measures that gauge the delivery of results to our stakeholders. The Common Appropriation Structure (CAS) allows DHS to integrate the strategic programmatic view with our budget view of resources. With this structure, a significant portion of the Level 1 PPAs represent what DHS refers to as our mission programs. Mission support programs are also an important subset of our Level 1 PPAs that provide products and/or services to mission programs. Mission support capabilities include research and development, intelligence, training, and information sharing. Mission support programs may be crosscutting and support multiple mission programs. Mission support also includes enterprise leadership, management and/or business administration services and describes the capabilities and activities that support the day-to-day management and back office functions enabling the Department to operate efficiently and effectively. Performance measures associated with our programs are presented in two measure sets, strategic and management measures. Strategic measures communicate results delivered for our agency goals by programs and are considered our Government Performance and Results Act Modernization Act of 2010 (GPRAMA) measures. Science and Technology Directorate (S&T) mission support programs having publically reported measures are presented below.

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.

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 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Target:	21	21	21	18	18	18
Result:	22	17	18	10	TBD	TBD

Measure: Percent of Capability 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) Group 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), Research and Development (R&D) programs, standards community, and S&T that improve acquisition and R&D outcomes.

Fiscal Year:	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Target:	75%	75%	75%	75%	75%	75%
Result:	87%	100%	95%	100%	TBD	TBD

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 Homeland Security Enterprise (HSE) based on the strategic and programmatic needs of the DHS and S&T. The RDP assists in both "transmitting and receiving information" to stakeholders across the HSE. The RDP enables opportunities for evaluating, expediting and monitoring the execution of programs with an increased speed-of-execution compared to "in-house only" activities. RDP 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 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Target:	75%	75%	75%	75%	75%	75%
Result:	77%	80%	88%	81%	TBD	TBD

Research, Development, and Innovation: Research, Development, and Innovation is a portfolio of customer-focused and output-oriented research, development, testing, and evaluation programs. The FY 2019 program consists of portfolios to including: Border Security, Chemical/Biological/ Explosives Defense, Counter Terrorist, and First Responder and Disaster Resilience. These portfolios support the needs of the operational components of the Department and the first responder community to address capability gaps.

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 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Target:	---	80%	80%	80%	80%	80%
Result:	---	82%	100%	83%	TBD	TBD

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 S&T's Cyber Security Division (CSD) projects to government, commercial or open sources. The percent reported is reviewed using the number of planned transition milestones stated in the CSDs 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 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Target:	65%	80%	73%	80%	80%	80%
Result:	93%	60%	73%	71%	TBD	TBD

Management Measures

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 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'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 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Target:	75%	75%	75%	75%	75%	75%

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						
Result:	77%	62%	79%	80%	TBD	TBD

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 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Target:	75%	75%	75%	75%	75%	75%
Result:	78%	85%	75%	79%	TBD	TBD

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 DHS Centers of Excellence and Minority Serving Institutions, creating a consortium of universities generating groundbreaking ideas for new technologies and critical knowledge for the homeland security enterprise.

Management Measures

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 2014**	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Target:	75%	75%	75%	75%	75%	75%
Result:	86%	82%	92%	92%	TBD	TBD

Science and Technology Directorate
Budget Comparison and Adjustments

Budget Comparison with FY 2018 Annualized CR

Organization *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 Annualized CR	FY 2018 President's Budget	FY 2019 President's Budget
Operations and Support	**$311,122**	**$309,008**	**$254,618**	**$271,803**
Mission Support	$128,788	$127,913	$119,823	$118,732
Laboratory Facilities	$133,942	$133,032	$92,243	$110,519
Acquisition and Operations Analysis	$48,392	$48,063	$42,552	$42,552
Research and Development	**$470,624**	**$467,428**	**$372,706**	**$311,480**
Research, Development and Innovation	$430,124	$427,203	$342,982	$289,734
University Programs	$40,500	$40,225	$29,724	$21,746
Total	**$781,746**	**$776,436**	**$627,324**	**$583,283**

Science and Technology Directorate
Comparison of Budget Authority and Request

Organization (Dollars in Thousands)	FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Operations and Support	485	485	$311,122	431	455	$254,618	431	431	$271,803	-	(24)	$17,185
Research and Development	-	-	$470,624	-	-	$372,706	-	-	$311,480	-	-	($61,226)
Total	**485**	**485**	**$781,746**	**431**	**455**	**$627,324**	**431**	**431**	**$583,283**	**-**	**(24)**	**($44,041)**
Subtotal Discretionary - Appropriation	485	485	$781,746	431	455	$627,324	431	431	$583,283	-	(24)	($44,041)

*The FY17 Enactment included a permissive transfer of up to $2M from the Office of Health (OHA) to the Science and Technology Directorate R&D PPA for the purpose of advancing early detection capabilities related to a bioterrorism event. However, the funds were not transferred to S&T.

The S&T monitors evolving threats and capitalizes on technological advancements at a rapid pace; developing solutions, and bridging capability gaps in order to equip operational end-users with the best tools available to achieve mission success. S&T continues to develop innovative solutions to protect the Nation's people and critical infrastructure from biological, explosive, and cyber security threats, as well as provide new solutions to protect the borders. S&T supports the HSE in achieving near-term requirements by leveraging existing technologies from industry, other Federal agencies, and laboratories.

Funding requested in FY 2019 will to address strategic priorities in border security, immigration, explosives detection, and other mission areas of the HSE. Additionally, funding supports S&T priorities within available resources based on the Department's Integrated Product Team (IPT) process, which prioritize capability gaps from around DHS that require R&D. The proposed strategic adjustments to R&D ensure that S&T is rightsized for the future and allows S&T to focus on the highest priority needs of the HSE.

Science and Technology Directorate
Budget Authority and Obligations

Budget Authority *(Dollars in Thousands)*	FY 2017	FY 2018	FY 2019
Enacted/Request	**$781,746**	**$627,324**	**$583,283**
Carryover and/or Recoveries (Actual/Estimates/Projections)	$239,371	$232,610	$128,366
Rescissions to Current Year/Budget Year	($7,500)	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$1,013,617**	**$859,934**	**$711,649**
Collections – Reimbursable Resources	$42,654	$52,100	$52,100
Total Budget Resources	**$1,056,271**	**$912,034**	**$763,749**
Obligations (Actual/Projections/Estimates)	$777,448	$761,226	$664,230
Personnel: Positions and FTE			
Enacted/Request Positions	485	431	431
Enacted/Request FTE	485	455	431
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	485	431	431
FTE (Actual/Estimates/Projections)	485	455	431

Science and Technology Directorate
Personnel Compensation and Benefits

Pay Summary

Organization *(Dollars in Thousands)*	FY 2017 Enacted				FY 2018 President's Budget				FY 2019 President's Budget				FY 2018 to FY 2019 Total			
	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate
Operations and Support	485	485	$85,070	$175.25	431	455	$82,729	$180.61	431	431	$75,499	$174.13	-	(24)	($7,230)	($6.48)
Total	**485**	**485**	**$85,070**	**$175.25**	**431**	**455**	**$82,729**	**$180.61**	**431**	**431**	**$75,499**	**$174.13**	**-**	**(24)**	**($7,230)**	**($6.48)**
Discretionary - Appropriation	485	485	$85,070	$175.25	431	455	$82,729	$180.61	431	431	$75,499	$174.13	-	(24)	($7,230)	($6.48)

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

Pay by Object Class

Pay Object Classes *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
11.1 Full-time Permanent	$59,077	$55,361	$51,766	($3,595)
11.3 Other than Full-Time Permanent	$5,320	$5,256	$5,156	($100)
11.5 Other Personnel Compensation	$1,195	$1,125	$1,106	($19)
12.1 Civilian Personnel Benefits	$19,403	$20,437	$17,021	($3,416)
13.0 Benefits for Former Personnel	$75	$550	$450	($100)
Total - Personnel Compensation and Benefits	**$85,070**	**$82,729**	**$75,499**	**($7,230)**
Positions and FTE				
Positions - Civilian	485	431	431	-
FTE - Civilian	485	455	431	(24)

Science and Technology Directorate
Non Pay Budget Exhibits

Non Pay Summary

Organization *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Total Changes
Operations and Support	$226,052	$171,889	$196,304	$24,415
Research and Development	$470,624	$372,706	$311,480	($61,226)
Total	**$696,676**	**$544,595**	**$507,784**	**($36,811)**
Discretionary - Appropriation	$696,676	$544,595	$507,784	($36,811)

Non Pay by Object Class

Non-Pay Object Classes *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
21.0 Travel and Transportation of Persons	$3,435	$2,782	$2,781	($1)
22.0 Transportation of Things	$46	$34	$33	($1)
23.1 Rental Payments to GSA	$1,827	$2,100	-	($2,100)
23.2 Rental Payments to Others	$112	$89	$75	($14)
23.3 Communications, Utilities, and Misc. Charges	$87	$60	$86	$26
25.1 Advisory and Assistance Services	$162,936	$118,736	$126,242	$7,506
25.2 Other Services from Non-Federal Sources	$4,229	$3,372	$3,221	($151)
25.3 Other Goods and Services from Federal Sources	$312,607	$249,858	$238,833	($11,025)
25.4 Operation and Maintenance of Facilities	$6,146	$4,291	$4,291	-
25.5 Research and Development Contracts	$146,390	$118,025	$93,786	($24,239)
25.6 Medical Care	$3	$3	$3	-
25.7 Operation and Maintenance of Equipment	$6,080	$5,346	$5,400	$54
26.0 Supplies and Materials	$4,520	$3,299	$3,905	$606
31.0 Equipment	$10,108	$8,394	$8,179	($215)
32.0 Land and Structures	$652	$450	$550	$100
41.0 Grants, Subsidies, and Contributions	$37,498	$27,756	$20,399	($7,357)
Total - Non Pay Object Classes	**$696,676**	**$544,595**	**$507,784**	**($36,811)**

Science and Technology Directorate
Supplemental Budget Justification Exhibits
Working Capital Fund

Appropriation and PPA *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget
Operations and Support	**$27,630**	**$27,170**	**$27,179**
Mission Support	$27,630	$27,170	$27,179
Total Working Capital Fund	**$27,630**	**$27,170**	**$27,179**

Science and Technology Directorate
Status of Congressionally Requested Studies, Reports and Evaluations

Fiscal Year	Due Date	Reference/Citation	Requirement	Status
N/A	N/A	N/A	N/A	N/A

Science and Technology Directorate
Authorized/Unauthorized Appropriations

Budget Activity *Dollars in Thousands*	Last year of Authorization	Authorized Level	Appropriation in Last Year of Authorization	FY 2019 President's Budget
	Fiscal Year	Amount	Amount	Amount
Operations and Support	N/A	N/A	N/A	271,803
Mission Support	N/A	N/A	N/A	118,732
Laboratory Facilities	N/A	N/A	N/A	110,519
Acquisition and Operations Analysis	N/A	N/A	N/A	42,552
Research and Development	N/A	N/A	N/A	311,480
Research, Development and Innovation	N/A	N/A	N/A	289,734
University Programs	N/A	N/A	N/A	21,746
Total Direct Authorization/Appropriation				583,283

Science and Technology Directorate
Proposed Legislative Language

Operations and Support

For necessary expenses of the Science and Technology Directorate for operations and support, 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, $**[**254,618,000**]***271,803,000*, of which $**[**119,823,000**]***153,071,000* shall remain available until September 30, 2020: Provided, That not to exceed $7,650 shall be for official reception and representation expenses.

Language Provision	Explanation
$**[**254,618,000**]***271,803,000*	Dollar change only.
$**[**119,823,000**]***153,071,000*	Dollar change only.

Research and Development

For necessary expenses of the Science and Technology Directorate for research and development, as authorized by title III of the Homeland Security Act of 2002 (6 U.S.C. 181 et seq.), $**[**372,706,000**]***311,480,000*, to remain available until September 30, **[**2020**]***2021*.

Language Provision	Explanation
*$***[**372,706,000**]** *311,480,000*	Dollar change only.
[2020**]***2021*	Updated period of availability.

Science and Technology Directorate
Collections – Reimbursable Resources

Collections *(Dollars in Thousands)*		FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Change		
		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Agriculture - Department of Agriculture	**Source**	-	-	$95	-	-	$1,200	-	-	$1,200	-	-	-
Operations and Support	Location	-	-	$95	-	-	$700	-	-	$700	-	-	-
Laboratory Facilities	Location	-	-	$95	-	-	$700	-	-	$700	-	-	-
Research and Development	Location	-	-	-	-	-	$500	-	-	$500	-	-	-
Research, Development and Innovation	Location	-	-	-	-	-	$500	-	-	$500	-	-	-
Department of Defense - Department of Defense	**Source**	-	-	$2,987	-	-	$12,550	-	-	$12,550	-	-	-
Operations and Support	Location	-	-	$400	-	-	$1,500	-	-	$1,500	-	-	-
Mission Support	Location	-	-	-	-	-	$500	-	-	$500	-	-	-
Laboratory Facilities	Location	-	-	$400	-	-	$1,000	-	-	$1,000	-	-	-
Research and Development	Location	-	-	$2,587	-	-	$11,050	-	-	$11,050	-	-	-
Research, Development and Innovation	Location	-	-	$2,087	-	-	$10,550	-	-	$10,550	-	-	-
University Programs	Location	-	-	$500	-	-	$500	-	-	$500	-	-	-
Department of Energy - Department of Energy	**Source**	-	-	$400	-	-	$700	-	-	$700	-	-	-
Operations and Support	Location	-	-	$400	-	-	$500	-	-	$500	-	-	-
Acquisition and Operations Analysis	Location	-	-	$400	-	-	$500	-	-	$500	-	-	-
Research and Development	Location	-	-	-	-	-	$200	-	-	$200	-	-	-
Research, Development and Innovation	Location	-	-	-	-	-	$200	-	-	$200	-	-	-
Department of Homeland Security - Department of Homeland Security	**Source**	-	-	$572	-	-	$500	-	-	$500	-	-	-
Operations and Support	Location	-	-	$572	-	-	$500	-	-	$500	-	-	-
Mission Support	Location	-	-	$61	-	-	-	-	-	-	-	-	-
Acquisition and Operations Analysis	Location	-	-	$511	-	-	$500	-	-	$500	-	-	-
Department of Health and Human Services - Food and Drug Administration	**Source**	-	-	$208	-	-	$300	-	-	$300	-	-	-
Operations and Support	Location	-	-	$208	-	-	$300	-	-	$300	-	-	-

Collections		FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Change		
(Dollars in Thousands)		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Mission Support	Location	-	-	$208	-	-	$300	-	-	$300	-	-	-
Independent Agency - Central Intelligence Agency	**Source**	-	-	$250	-	-	-	-	-	-	-	-	-
Research and Development	Location	-	-	$250	-	-	-	-	-	-	-	-	-
Research, Development and Innovation	Location	-	-	$250	-	-	-	-	-	-	-	-	-
Department of Homeland Security - Federal Emergency Management Agency	**Source**	-	-	$76	-	-	$2,950	-	-	$2,950	-	-	-
Operations and Support	Location	-	-	$22	-	-	$250	-	-	$250	-	-	-
Laboratory Facilities	Location	-	-	-	-	-	$200	-	-	$200	-	-	-
Acquisition and Operations Analysis	Location	-	-	$22	-	-	$50	-	-	$50	-	-	-
Research and Development	Location	-	-	$54	-	-	$2,700	-	-	$2,700	-	-	-
Research, Development and Innovation	Location	-	-	$54	-	-	$2,700	-	-	$2,700	-	-	-
Department of Homeland Security - Transportation Security Administration	**Source**	-	-	$2,691	-	-	$4,500	-	-	$4,500	-	-	-
Operations and Support	Location	-	-	$965	-	-	$1,150	-	-	$1,150	-	-	-
Laboratory Facilities	Location	-	-	$704	-	-	$850	-	-	$850	-	-	-
Acquisition and Operations Analysis	Location	-	-	$261	-	-	$300	-	-	$300	-	-	-
Research and Development	Location	-	-	$1,726	-	-	$3,350	-	-	$3,350	-	-	-
Research, Development and Innovation	Location	-	-	$1,726	-	-	$3,350	-	-	$3,350	-	-	-
Department of Homeland Security - U.S. Immigration and Customs Enforcement	**Source**	-	-	-	-	-	$150	-	-	$150	-	-	-
Research and Development	Location	-	-	-	-	-	$150	-	-	$150	-	-	-
Research, Development and Innovation	Location	-	-	-	-	-	$150	-	-	$150	-	-	-
Department of Homeland Security - Citizenship and Immigration Services	**Source**	-	-	$101	-	-	$1,050	-	-	$1,050	-	-	-
Operations and Support	Location	-	-	$101	-	-	$50	-	-	$50	-	-	-
Mission Support	Location	-	-	$68	-	-	-	-	-	-	-	-	-
Acquisition and Operations Analysis	Location	-	-	$33	-	-	$50	-	-	$50	-	-	-
Research and Development	Location	-	-	-	-	-	$1,000	-	-	$1,000	-	-	-
Research, Development and Innovation	Location	-	-	-	-	-	$1,000	-	-	$1,000	-	-	-
Department of Homeland Security - United States Secret Service	**Source**	-	-	$1,410	-	-	$1,700	-	-	$1,700	-	-	-

Collections		FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Change		
(Dollars in Thousands)		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Operations and Support	Location	-	-	$1,410	-	-	$1,500	-	-	$1,500	-	-	-
Acquisition and Operations Analysis	Location	-	-	$1,410	-	-	$1,500	-	-	$1,500	-	-	-
Research and Development	Location	-	-	-	-	-	$200	-	-	$200	-	-	-
Research, Development and Innovation	Location	-	-	-	-	-	$200	-	-	$200	-	-	-
Department of Homeland Security - Office of the Inspector General	**Source**	-	-	$33	-	-	-	-	-	-	-	-	-
Operations and Support	Location	-	-	$33	-	-	-	-	-	-	-	-	-
Mission Support	Location	-	-	$33	-	-	-	-	-	-	-	-	-
Department of Homeland Security - Countering Weapons of Mass Destruction	**Source**	-	-	-	-	-	-	-	-	$2,350	-	-	$2,350
Operations and Support	Location	-	-	-	-	-	-	-	-	$1,250	-	-	$1,250
Mission Support	Location	-	-	-	-	-	-	-	-	$300	-	-	$300
Laboratory Facilities	Location	-	-	-	-	-	-	-	-	$50	-	-	$50
Acquisition and Operations Analysis	Location	-	-	-	-	-	-	-	-	$900	-	-	$900
Research and Development	Location	-	-	-	-	-	-	-	-	$1,100	-	-	$1,100
Research, Development and Innovation	Location	-	-	-	-	-	-	-	-	$1,100	-	-	$1,100
Department of Homeland Security - US Customs and Border Protection	**Source**	-	-	$130	-	-	$600	-	-	$600	-	-	-
Operations and Support	Location	-	-	$130	-	-	$600	-	-	$600	-	-	-
Mission Support	Location	-	-	$34	-	-	$500	-	-	$500	-	-	-
Acquisition and Operations Analysis	Location	-	-	$96	-	-	$100	-	-	$100	-	-	-
Department of Homeland Security - US Immigration and Customs Enforcement	**Source**	-	-	$221	-	-	$250	-	-	$250	-	-	-
Operations and Support	Location	-	-	$221	-	-	$250	-	-	$250	-	-	-
Acquisition and Operations Analysis	Location	-	-	$221	-	-	$250	-	-	$250	-	-	-
Independent Agency - Intelligence Community Management Account	**Source**	-	-	$400	-	-	$800	-	-	$800	-	-	-
Research and Development	Location	-	-	$400	-	-	$800	-	-	$800	-	-	-
Research, Development and Innovation	Location	-	-	$400	-	-	$800	-	-	$800	-	-	-
Department of Justice - Federal Bureau of Investigation	**Source**	-	-	$5,127	-	-	$5,250	-	-	$5,250	-	-	-
Research and Development	Location	-	-	$5,127	-	-	$5,250	-	-	$5,250	-	-	-

Collections		FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Change		
(Dollars in Thousands)		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Research, Development and Innovation	Location	-	-	$5,127	-	-	$5,250	-	-	$5,250	-	-	-
Department of Homeland Security - United States Coast Guard	**Source**	-	-	$2,209	-	-	$2,750	-	-	$2,750	-	-	-
Operations and Support	Location	-	-	$59	-	-	$100	-	-	$100	-	-	-
Acquisition and Operations Analysis	Location	-	-	$59	-	-	$100	-	-	$100	-	-	-
Research and Development	Location	-	-	$2,150	-	-	$2,650	-	-	$2,650	-	-	-
Research, Development and Innovation	Location	-	-	$2,150	-	-	$2,650	-	-	$2,650	-	-	-
Department of Homeland Security - National Protection and Programs Directorate	**Source**	-	-	$1,774	-	-	$2,400	-	-	$2,400	-	-	-
Operations and Support	Location	-	-	$824	-	-	$950	-	-	$950	-	-	-
Mission Support	Location	-	-	$80	-	-	-	-	-	-	-	-	-
Acquisition and Operations Analysis	Location	-	-	$744	-	-	$950	-	-	$950	-	-	-
Research and Development	Location	-	-	$950	-	-	$1,450	-	-	$1,450	-	-	-
Research, Development and Innovation	Location	-	-	$950	-	-	$1,450	-	-	$1,450	-	-	-
Department of Homeland Security - U.S. Customs and Border Protection	**Source**	-	-	$19,909	-	-	$8,500	-	-	$8,500	-	-	-
Research and Development	Location	-	-	$19,909	-	-	$8,500	-	-	$8,500	-	-	-
Research, Development and Innovation	Location	-	-	$19,909	-	-	$8,500	-	-	$8,500	-	-	-
Department of Homeland Security - Office of the Under Secretary for Management	**Source**	-	-	$1,148	-	-	$2,100	-	-	$2,100	-	-	-
Research and Development	Location	-	-	$1,148	-	-	$2,100	-	-	$2,100	-	-	-
Research, Development and Innovation	Location	-	-	$1,148	-	-	$2,100	-	-	$2,100	-	-	-
Department of State - Department of State	**Source**	-	-	-	-	-	$200	-	-	$200	-	-	-
Operations and Support	Location	-	-	-	-	-	$200	-	-	$200	-	-	-
Laboratory Facilities	Location	-	-	-	-	-	$200	-	-	$200	-	-	-
Department of Homeland Security - Office of Health Affairs	**Source**	-	-	$356	-	-	$500	-	-	-	-	-	($500)
Operations and Support	Location	-	-	$356	-	-	$400	-	-	-	-	-	($400)
Mission Support	Location	-	-	$299	-	-	$300	-	-	-	-	-	($300)
Acquisition and Operations Analysis	Location	-	-	$57	-	-	$100	-	-	-	-	-	($100)
Research and Development	Location	-	-	-	-	-	$100	-	-	-	-	-	($100)

Collections		FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Change		
(Dollars in Thousands)		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Research, Development and Innovation	Location	-	-	-	-	-	$100	-	-	-	-	-	($100)
Department of Homeland Security - Domestic Nuclear Detection Office	**Source**	-	-	$1,633	-	-	$1,850	-	-	-	-	-	($1,850)
Operations and Support	Location	-	-	$833	-	-	$850	-	-	-	-	-	($850)
Mission Support	Location	-	-	$55	-	-	-	-	-	-	-	-	-
Laboratory Facilities	Location	-	-	$11	-	-	$50	-	-	-	-	-	($50)
Acquisition and Operations Analysis	Location	-	-	$767	-	-	$800	-	-	-	-	-	($800)
Research and Development	Location	-	-	$800	-	-	$1,000	-	-	-	-	-	($1,000)
Research, Development and Innovation	Location	-	-	$800	-	-	$1,000	-	-	-	-	-	($1,000)
Canada	**Source**	-	-	$381	-	-	$300	-	-	$300	-	-	-
Operations and Support	Location	-	-	$381	-	-	-	-	-	-	-	-	-
Laboratory Facilities	Location	-	-	$381	-	-	-	-	-	-	-	-	-
Research and Development	Location	-	-	-	-	-	$300	-	-	$300	-	-	-
Research, Development and Innovation	Location	-	-	-	-	-	$300	-	-	$300	-	-	-
Library of Congress	**Source**	-	-	$493	-	-	$500	-	-	$500	-	-	-
Operations and Support	Location	-	-	$493	-	-	$500	-	-	$500	-	-	-
Acquisition and Operations Analysis	Location	-	-	$493	-	-	$500	-	-	$500	-	-	-
Sweden	**Source**	-	-	-	-	-	$200	-	-	$200	-	-	-
Research and Development	Location	-	-	-	-	-	$200	-	-	$200	-	-	-
Research, Development and Innovation	Location	-	-	-	-	-	$200	-	-	$200	-	-	-
United Kingdom	**Source**	-	-	$50	-	-	-	-	-	-	-	-	-
Research and Development	Location	-	-	$50	-	-	-	-	-	-	-	-	-
Research, Development and Innovation	Location	-	-	$50	-	-	-	-	-	-	-	-	-
Netherlands	**Source**	-	-	-	-	-	$300	-	-	$300	-	-	-
Research and Development	Location	-	-	-	-	-	$300	-	-	$300	-	-	-
Research, Development and Innovation	Location	-	-	-	-	-	$300	-	-	$300	-	-	-
Total Collections		**-**	**-**	**$42,654**	**-**	**-**	**$52,100**	**-**	**-**	**$52,100**	**-**	**-**	**-**

Department of Homeland Security

Science and Technology Directorate

Operations and Support

Fiscal Year 2019

Congressional Justification

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Operations and Support

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

Organization *(Dollars in Thousands)*	FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Mission Support	344	344	$128,788	324	334	$119,823	324	324	$118,732	-	(10)	($1,091)
Laboratory Facilities	141	141	$133,942	107	121	$92,243	107	107	$110,519	-	(14)	$18,276
Acquisition and Operations Analysis	-	-	$48,392	-	-	$42,552	-	-	$42,552	-	-	-
Total	**485**	**485**	**$311,122**	**431**	**455**	**$254,618**	**431**	**431**	**$271,803**	**-**	**(24)**	**$17,185**
Subtotal Discretionary - Appropriation	485	485	$311,122	431	455	$254,618	431	431	$271,803	-	(24)	$17,185

The Operations and Support (O&S) appropriation provides funding for the effective and efficient management of the Science and Technology Directorate (S&T) activities to ensure delivery of advanced technology solutions to DHS Components and first responders. This appropriation supports Systems Engineering, Standards, and Test and Evaluation (T&E) to ensure that S&T and Components develop and procure technologies that work, delivered on time, and on budget. This includes costs necessary for regular operations, salaries, facilities, mission support, headquarters management, and DHS Working Capital Fund (WCF) activities.

The Science and Technology Directorate requests $271.8 million, 431 full-time positions (FTP), and 431 full-time equivalents (FTE) for the O&S appropriation in FY 2019.

The O&S appropriation is comprised of three program, project, and activities (PPAs) to include Mission Support (MS), Laboratory Facilities, and Acquisition and Operations Analysis (AOA).

Mission Support: The Mission Support PPA provides funding for all corporate-level functions in S&T that enable the technical divisions to manage the Research, Development, Test, and Evaluation (RDT&E) programs. It also funds business operations costs for office supplies, utilities, and other operational functions associated with the S&T's headquarters offices. In addition, the MS PPA provides funding to cover salaries and benefits expenses and WCF's shared services costs as well as costs to cover training and travel requirements, financial management, facility planning, maintenance, and other administrative functions. MS also covers costs for the Office of General Counsel requirements including Intellectual Property (IP) on S&T's R&D projects as well as oversight of IP and trademark rights for DHS and its Components.

Laboratory Facilities: The Office of National Laboratories (ONL) manages the Laboratory Facilities Programs, the operations and maintenance of the facilities, and salaries and benefits expenses. The 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. Additionally, ONL facilitates the delivery of long-term capabilities vital to the homeland security mission through utilization of a coordinated network of S&T laboratories and the Department of Energy (DOE) national laboratories.

Acquisition and Operations Analysis: The AOA PPA 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.

Operations and Support
Budget Authority and Obligations

Budget Authority *(Dollars in Thousands)*	**FY 2017**	**FY 2018**	**FY 2019**
Enacted/Request	**$311,122**	**$254,618**	**$271,803**
Carryover and/or Recoveries (Actual/Estimates/Projections)	$89,473	$76,955	$44,191
Rescissions to Current Year/Budget Year	($7,500)	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$393,095**	**$331,573**	**$315,994**
Collections – Reimbursable Resources	$7,503	$10,300	$10,300
Total Budget Resources	**$400,598**	**$341,873**	**$326,294**
Obligations (Actual/Projections/Estimates)	$312,872	$296,977	$272,067
Personnel: Positions and FTE			
Enacted/Request Positions	485	431	431
Enacted/Request FTE	485	455	431
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	485	431	431
FTE (Actual/Estimates/Projections)	485	455	431

Operations and Support
Collections – Reimbursable Resources

Collections		FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget		
(Dollars in Thousands)		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Agriculture - Department of Agriculture	Source	-	-	$95	-	-	$700	-	-	$700
Department of Defense - Department of Defense	Source	-	-	$400	-	-	$1,500	-	-	$1,500
Department of Energy - Department of Energy	Source	-	-	$400	-	-	$500	-	-	$500
Department of Homeland Security - Department of Homeland Security	Source	-	-	$572	-	-	$500	-	-	$500
Department of Health and Human Services - Food and Drug Administration	Source	-	-	$208	-	-	$300	-	-	$300
Department of Homeland Security - Federal Emergency Management Agency	Source	-	-	$22	-	-	$250	-	-	$250
Department of Homeland Security - Transportation Security Administration	Source	-	-	$965	-	-	$1,150	-	-	$1,150
Department of Homeland Security - Citizenship and Immigration Services	Source	-	-	$101	-	-	$50	-	-	$50
Department of Homeland Security - United States Secret Service	Source	-	-	$1,410	-	-	$1,500	-	-	$1,500
Department of Homeland Security - Office of the Inspector General	Source	-	-	$33	-	-	-	-	-	-
Department of Homeland Security - Countering Weapons of Mass Destruction	Source	-	-	-	-	-	-	-	-	$1,250
Department of Homeland Security - US Customs and Border Protection	Source	-	-	$130	-	-	$600	-	-	$600
Department of Homeland Security - US Immigration and Customs Enforcement	Source	-	-	$221	-	-	$250	-	-	$250
Department of Homeland Security - United States Coast Guard	Source	-	-	$59	-	-	$100	-	-	$100
Department of Homeland Security - National Protection and Programs Directorate	Source	-	-	$824	-	-	$950	-	-	$950
Department of State - Department of State	Source	-	-	-	-	-	$200	-	-	$200
Department of Homeland Security - Office of Health Affairs	Source	-	-	$356	-	-	$400	-	-	-
Department of Homeland Security - Domestic Nuclear Detection Office	Source	-	-	$833	-	-	$850	-	-	-
Canada	Source	-	-	$381	-	-	-	-	-	-
Library of Congress	Source	-	-	$493	-	-	$500	-	-	$500
Total Collections		**-**	**-**	**$7,503**	**-**	**-**	**$10,300**	**-**	**-**	**$10,300**

Operations and Support
Summary of Budget Changes

Budget Formulation Activity *(Dollars in Thousands)*	Positions	FTE	Amount
FY 2017 Enacted	**485**	**485**	**$311,122**
FY 2018 President's Budget	**431**	**455**	**$254,618**
FY 2019 Base Budget	**431**	**455**	**$254,618**
NBAF Operations transfer to USDA	-	-	($42,000)
Transfer to USM/CFO from S&T for CFO Workforce Development Training	-	-	($34)
Transfer to USM/CHCO from S&T due to CHCO WCF Activity Cost Removal	-	-	($123)
Total Transfers	**-**	**-**	**($42,157)**
Annualization of 2018 Pay Raise	-	-	$393
Total, Pricing Increases	**-**	**-**	**$393**
Annualization of 2018 Personnel Reductions	-	(24)	($7,623)
Total, Pricing Decreases	**-**	**(24)**	**($7,623)**
Total Adjustments-to-Base	**-**	**(24)**	**($49,387)**
FY 2019 Current Services	**431**	**431**	**$205,231**
01 - NBACC Operations	2	2	$28,689
02 - NBAF Operations costs based on LCCE transfer to USDA	(2)	(2)	$35,000
03 - Information Technology	-	-	$2,883
Total, Program Increases	**-**	**-**	**$66,572**
FY 2019 Request	**431**	**431**	**$271,803**
FY 2018 TO FY 2019 Change	**-**	**(24)**	**$17,185**

Operations and Support
Justification of Pricing Changes

Pricing Changes *(Dollars in Thousands)*	FY 2019 President's Budget		
	Positions	FTE	Amount
Pricing Change 1 - Annualization of 2018 Pay Raise	**-**	**-**	**$393**
Mission Support	-	-	$294
Laboratory Facilities	-	-	$99
Pricing Change 2 - Annualization of 2018 Personnel Reductions	**-**	**(24)**	**($7,623)**
Mission Support	-	(10)	($1,228)
Laboratory Facilities	-	(14)	($6,395)
Total Pricing Changes	**-**	**(24)**	**($7,230)**

Pricing Change 1 - Annualization of 2018 Pay Raise: This pricing change reflects an increase of $0.4M for the annualization of the FY 2018 pay raise.

Pricing Change 2 - Annualization of 2018 Personnel Reductions: This pricing change reflects a decrease of $4.7M and reduction of 24 FTE in the Mission Support PPA resulting from the annualization of personnel reductions requested in the FY 2018 President's Budget.

Operations and Support
Justification of Program Changes

Program Changes *(Dollars in Thousands)*	FY 2019 President's Budget		
	Positions	**FTE**	**Amount**
Program Change 1 - 01 - NBACC Operations	**2**	**2**	**$28,689**
Laboratory Facilities	2	2	$28,689
Program Change 2 - 02 - NBAF Operations costs based on LCCE transfer to USDA	**(2)**	**(2)**	**$35,000**
Laboratory Facilities	(2)	(2)	$35,000
Program Change 3 - 03 - Information Technology	**-**	**-**	**$2,883**
Laboratory Facilities	-	-	$2,883
Total Program Changes	**-**	**-**	**$66,572**

Program Change 1 - National Biodefense Analysis and Countermeasures Center (NBACC) Operations

Description
S&T proposes to continue operations of the NBACC laboratory facility under a cost sharing agreement between S&T and the Federal Bureau of Investigations (FBI). The NBACC provides essential biological threat characterization for DHS as well as bioforensics analyses in support of Federal law enforcement cases for the FBI. Additionally, the NBACC is the Nation's biocontainment laboratory that responds to, and provides data required to support prevention, protection, mitigation, and recovery from, current and future biocrime and bioterrorism threats. This partnership between S&T and FBI supports efforts to effectively manage biological threats to our Nation.

Justification
S&T proposes to continue operations of NBACC due to its role in the Administration's forthcoming national biodefense strategy. Both S&T and FBI have primary roles in defending the United States against disease pandemics and biological attacks by terrorists. The FBI is the primary user of the National Bioforensic Analysis Center (NBFAC), which occupies half of the NBACC facility at Fort Detrick, and therefore, would assume 40 percent of NBACC's operational costs. S&T will continue to provide timely scientific biological threat characterization analyses to support intelligence assessments and preparedness planning; response to both events and identified potential threats; S&T will also ensure that the biological laboratory operations are continuously available as it is a national capability essential to an overall national strategy.

This cost sharing agreement will result in a more efficient operational model, which will ensure that the facility offers the greatest benefit possible to the Federal government. The NBACC is a critical resource to defend the United States against bioterrorism, and provides the scientific basis for characterization of biological threats and bioforensic analysis.

Performance

S&T and FBI will partner with their interagency biodefense counterparts, Department of Health and Human Services (HHS) and the intelligence community, to develop a more robust customer base for the NBACC. This collaboration will provide comprehensive analyses to inform the national biodefense activities and strategies.

Program Change 2 - National Bio and Agro-Defense Facility (NBAF) Operations costs based on LCCE transfer to USDA

Description

S&T proposes to transfer the responsibility for operational planning, and future operations of the NBAF to USDA. As a result, DHS will not request funding in support of operational planning functions as that will become the responsibility of USDA in FY 2019 and beyond. Ongoing DHS efforts for NBAF operational planning using funds appropriated to DHS in FY 2018, and prior, will continue in coordination with USDA for the remainder of FY 2018. A vehicle for use of such funding to support USDA operations planning efforts beyond FY 2018 will be determined at a later date, in coordination with USDA.

DHS will complete NBAF construction and commissioning activities, and continue the on-going operations planning activities through FY 2018, in coordination with USDA. Beginning in FY 2019, USDA will be responsible for the planning and execution of all other activities, including transition of activities from PIADC to NBAF, activities supporting the Select Agent registration process, procurement and installation of all systems and equipment not currently within the scope of the construction, and transfer of the Plum Island Animal Disease Center (PIADC) biorepository to NBAF. The current project milestone for achieving Select Agent registration will become the responsibility of USDA.

A joint-agency transition team is establishing plans that will identify the full breadth and timing of specific transition activities that address all requirements for the operational stand-up of NBAF, and the required integration of those activities with ongoing construction and commissioning functions performed by DHS.

Justification

Given that USDA is already responsible for the research programs that will be at this facility once construction is completed, it makes sense for USDA to manage the facility itself. USDA will ultimately operate NBAF as part of the national agricultural bioresearch laboratories, and therefore must begin establishing its operational policies, processes, and procedures for the facility.

Performance

In an effort to facilitate a seamless transition of NBAF, S&T and USDA will partner on a joint-agency transition team to develop a detailed transition plan for the facility. This transition plan will clearly describe the actions and timeframes associated with the successful transition of NBAF from S&T to USDA. Existing DHS operational resources, including current federal staff and the Operational Planning and Technology Integration Contract

(OPTIC) subject matter experts will be utilized to support the transition team.

Program Change 3 – Information Technology

Description
The additional resources will support ongoing CIO mandated requirements to maintain safe and secure network operations.

Justification
New technologies continue to emerge at a rapid pace and security threats grow increasingly sophisticated. S&T needs additional funding to cover increasing costs for HSDN refreshes at all the labs, classified VTC upgrades, unclassified VTC upgrades, and LAN-A.

Performance
This will ensure that S&T is compliance with Federal Information Security Management Act and that its IT systems are protected.

Operations and Support
Personnel Compensation and Benefits
Pay Summary

Organization (Dollars in Thousands)	FY 2017 Enacted				FY 2018 President's Budget				FY 2019 President's Budget				FY 2018 to FY 2019 Total			
	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate
Mission Support	344	344	$62,270	$180.8	324	334	$61,866	$184.33	324	324	$60,932	$187.14	-	(10)	($934)	$2.81
Laboratory Facilities	141	141	$22,800	$161.7	107	121	$20,863	$170.36	107	107	$14,567	$134.74	-	(14)	($6,296)	($35.62)
Total	**485**	**485**	**$85,070**	**$175.25**	**431**	**455**	**$82,729**	**$180.61**	**431**	**431**	**$75,499**	**$174.13**	**-**	**(24)**	**($7,230)**	**($6.48)**
Discretionary - Appropriation	485	485	$85,070	$175.25	431	455	$82,729	$180.61	431	431	$75,499	$174.13	-	(24)	($7,230)	($6.48)

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

Pay by Object Class

Pay Object Classes (Dollars in Thousands)	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
11.1 Full-time Permanent	$59,077	$55,361	$51,766	($3,595)
11.3 Other than Full-Time Permanent	$5,320	$5,256	$5,156	($100)
11.5 Other Personnel Compensation	$1,195	$1,125	$1,106	($19)
12.1 Civilian Personnel Benefits	$19,403	$20,437	$17,021	($3,416)
13.0 Benefits for Former Personnel	$75	$550	$450	($100)
Total - Personnel Compensation and Benefits	**$85,070**	**$82,729**	**$75,499**	**($7,230)**
Positions and FTE				
Positions - Civilian	485	431	431	-
FTE - Civilian	485	455	431	(24)

Operations and Support
Permanent Positions by Grade – Appropriation

Grades and Salary Range *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
Total, SES	17	17	17	-
GS-15	159	147	147	-
GS-14	112	96	96	-
GS-13	74	60	60	-
GS-12	43	39	39	-
GS-11	16	15	15	-
GS-9	14	12	12	-
GS-7	2	2	2	-
GS-6	1	-	-	-
GS-5	4	3	3	-
Other Graded Positions	43	40	40	-
Total Permanent Positions	**485**	**431**	**431**	**-**
Position Locations				
Headquarters	336	323	323	-
U.S. Field	148	107	107	-
Foreign Field	1	1	1	-
Averages				
Average Personnel Costs, ES Positions	182,572	184,260	185,964	1,704
Average Personnel Costs, GS Positions	124,169	124,713	124,796	83
Average Grade, GS Positions	14	14	14	-

Operations and Support
Non Pay Budget Exhibits
Non Pay Summary

Organization *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Total Changes
Mission Support	$66,518	$57,957	$57,800	($157)
Laboratory Facilities	$111,142	$71,380	$95,952	$24,572
Acquisition and Operations Analysis	$48,392	$42,552	$42,552	-
Total	**$226,052**	**$171,889**	**$196,304**	**$24,415**
Discretionary - Appropriation	$226,052	$171,889	$196,304	$24,415

Non Pay by Object Class

Non-Pay Object Classes *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
21.0 Travel and Transportation of Persons	$1,794	$1,487	$1,674	$187
22.0 Transportation of Things	$20	$13	$15	$2
23.1 Rental Payments to GSA	$1,827	$2,100	-	($2,100)
23.3 Communications, Utilities, and Misc. Charges	$84	$58	$84	$26
25.1 Advisory and Assistance Services	$96,837	$65,694	$81,570	$15,876
25.2 Other Services from Non-Federal Sources	$1,400	$1,131	$1,328	$197
25.3 Other Goods and Services from Federal Sources	$91,413	$74,698	$90,686	$15,988
25.4 Operation and Maintenance of Facilities	$6,146	$4,291	$4,291	-
25.5 Research and Development Contracts	$7,441	$6,653	-	($6,653)
25.6 Medical Care	$3	$3	$3	-
25.7 Operation and Maintenance of Equipment	$5,911	$5,212	$5,287	$75
26.0 Supplies and Materials	$3,628	$2,592	$3,308	$716
31.0 Equipment	$8,358	$7,008	$7,008	-
32.0 Land and Structures	$652	$450	$550	$100
41.0 Grants, Subsidies, and Contributions	$538	$499	$500	$1
Total - Non Pay Object Classes	**$226,052**	**$171,889**	**$196,304**	**$24,415**

Mission Support-PPA
Budget Comparison and Adjustments
Comparison of Budget Authority and Request

Organization *(Dollars in Thousands)*	FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Mission Support	344	344	$128,788	324	334	$119,823	324	324	$118,732	-	(10)	($1,091)
Total	**344**	**344**	**$128,788**	**324**	**334**	**$119,823**	**324**	**324**	**$118,732**	**-**	**(10)**	**($1,091)**
Subtotal Discretionary - Appropriation	344	344	$128,788	324	334	$119,823	324	324	$118,732	-	(10)	($1,091)

The MS program provides funding to support the functions of the Finance and Budget Division (FBD), Administration and Support Division (ASD), Office of Corporate Communications (OCC), Office of the Under Secretary, Compliance Assurance Program Office (CAPO), export controls, and DHS WCF Shared Services activities. Also funded by the MS program are the compliance assurance, export controls, legal intellectual property for S&T's R&D projects and oversight of intellectual property and trademark rights for all of DHS.

- FBD provides S&T with high quality, efficient, and cost-effective financial management services through six branches: Budget and Performance Branch, Acquisition Support Branch, Financial Services Branch, Financial Operations Branch, Internal Controls Branch, and Interagency Branch.
- DHS WCF provides shared services such as IT services, human resources, procurement operations, financial systems, and other DHS crosscutting activities.
- ASD manages facilities, personnel, security, and provides critical IT infrastructure support to S&T.
- OCC is comprised of teams of graphic artists, videographers, photographers, writers, editors and social media experts responsible for communicating S&T's mission and research opportunities internally and externally.
- CAPO performs compliance support and oversight functions to ensure DHS-funded activities are compliant with relevant international agreements, federal regulations, DHS policies, and related standards and guidance.

Additionally, the MS programs support the salaries and benefits, and administration for the four S&T groups with the important role of implementing RDT&E activities: First Responders Group (FRG), Homeland Security Advanced Research Projects Agency (HSARPA), Capability Development Support (CDS), and Research and Development Partnerships (RDP).

The 324 full-time positions requested in FY 2019 will provide executive direction to S&T for policy analysis, planning, financial management, and guidance formulation. These FTE also manage and oversee IP and trade mark rights, 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 AOA PPAs.

Mission Support
Budget Authority and Obligations

Budget Authority *(Dollars in Thousands)*	**FY 2017**	**FY 2018**	**FY 2019**
Enacted/Request	**$128,788**	**$119,823**	**$118,732**
Carryover and/or Recoveries (Actual/Estimates/Projections)	-	-	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$128,788**	**$119,823**	**$118,732**
Collections – Reimbursable Resources	$838	$1,600	$1,600
Total Budget Resources	**$129,626**	**$121,423**	**$120,332**
Obligations (Actual/Projections/Estimates)	$127,941	$120,209	$119,129
Personnel: Positions and FTE			
Enacted/Request Positions	344	324	324
Enacted/Request FTE	344	334	324
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	344	324	324
FTE (Actual/Estimates/Projections)	344	334	324

Mission Support
Collections – Reimbursable Resources

Collections *(Dollars in Thousands)*		FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget		
		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Defense - Department of Defense	**Source**	-	-	-	-	-	$500	-	-	$500
Department of Homeland Security - Department of Homeland Security	**Source**	-	-	$61	-	-	-	-	-	-
Department of Health and Human Services - Food and Drug Administration	**Source**	-	-	$208	-	-	$300	-	-	$300
Department of Homeland Security - Citizenship and Immigration Services	**Source**	-	-	$68	-	-	-	-	-	-
Department of Homeland Security - Office of the Inspector General	**Source**	-	-	$33	-	-	-	-	-	-
Department of Homeland Security - Countering Weapons of Mass Destruction	**Source**	-	-	-	-	-	-	-	-	$300
Department of Homeland Security - US Customs and Border Protection	**Source**	-	-	$34	-	-	$500	-	-	$500
Department of Homeland Security - National Protection and Programs Directorate	**Source**	-	-	$80	-	-	-	-	-	-
Department of Homeland Security - Office of Health Affairs	**Source**	-	-	$299	-	-	$300	-	-	-
Department of Homeland Security - Domestic Nuclear Detection Office	**Source**	-	-	$55	-	-	-	-	-	-
Total Collections		-	-	**$838**	-	-	**$1,600**	-	-	**$1,600**

Mission Support
Summary of Budget Changes

Budget Formulation Activity *(Dollars in Thousands)*	Positions	FTE	Amount
FY 2017 Enacted	**344**	**344**	**$128,788**
FY 2018 President's Budget	**324**	**334**	**$119,823**
FY 2019 Base Budget	**324**	**334**	**$119,823**
Transfer to USM/CFO from S&T for CFO Workforce Development Training	-	-	($34)
Transfer to USM/CHCO from S&T due to CHCO WCF Activity Cost Removal	-	-	($123)
Total Transfers	**-**	**-**	**($157)**
Annualization of 2018 Pay Raise	-	-	$294
Total, Pricing Increases	**-**	**-**	**$294**
Annualization of 2018 Personnel Reductions	-	(10)	($1,228)
Total, Pricing Decreases	**-**	**(10)**	**($1,228)**
Total Adjustments-to-Base	**-**	**(10)**	**($1,091)**
FY 2019 Current Services	**324**	**324**	**$118,732**
FY 2019 Request	**324**	**324**	**$118,732**
FY 2018 TO FY 2019 Change	**-**	**(10)**	**($1,091)**

Mission Support
Personnel Compensation and Benefits
Pay Summary

Organization *(Dollars in Thousands)*	FY 2017 Enacted				FY 2018 President's Budget				FY 2019 President's Budget				FY 2018 to FY 2019 Total			
	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate
Mission Support	344	344	$62,270	$180.8	324	334	$61,866	$184.33	324	324	$60,932	$187.14	-	(10)	($934)	$2.81
Total	**344**	**344**	**$62,270**	**$180.8**	**324**	**334**	**$61,866**	**$184.33**	**324**	**324**	**$60,932**	**$187.14**	**-**	**(10)**	**($934)**	**$2.81**
Discretionary - Appropriation	344	344	$62,270	$180.8	324	334	$61,866	$184.33	324	324	$60,932	$187.14	-	(10)	($934)	$2.81

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

Pay by Object Class

Pay Object Classes *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
11.1 Full-time Permanent	$42,673	$41,544	$40,776	($768)
11.3 Other than Full-Time Permanent	$4,660	$4,696	$4,696	-
11.5 Other Personnel Compensation	$850	$780	$780	-
12.1 Civilian Personnel Benefits	$14,012	$14,546	$14,380	($166)
13.0 Benefits for Former Personnel	$75	$300	$300	-
Total - Personnel Compensation and Benefits	**$62,270**	**$61,866**	**$60,932**	**($934)**
Positions and FTE				
Positions - Civilian	344	324	324	-
FTE - Civilian	344	334	324	(10)

Pay Cost Drivers

Leading Cost-Drivers *Dollars in Thousands*	FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Total Changes		
	FTE	Amount	Rate	FTE	Amount	Rate	FTE	Amount	Rate	FTE	Amount	Rate
Personnel Salaries & Benefits	344	$62,270	$181	334	$61,866	$184	324	60,932	$187	(10)	-	$2.81
Total – Pay Cost Drivers	**344**	**$62,270**	**$181**	**334**	**$61,866**	**$184**	**324**	**$60,932**	**$187**	**(10)**	**-**	**$2.81**

NARRATIVE EXPLANATION OF CHANGES

FTE Change FY 2018-2019: The FY 2019 request includes a decrease of 10 FTE resulting from the Annualization of personnel reductions proposed in the FY 2018 President's Budget.

PCB Change FY 2018-2019: The FY 2019 request includes a decrease of $934K in Personnel Compensation and Benefits aligned with the proposed personnel reductions of 10 FTE.

Average Cost Change FY 2018-2019: The average cost change of $2.8K is due to the personnel reduction as well as the FY 2018 pay annualization.

Mission Support
Non Pay Budget Exhibits
Non Pay Summary

Organization *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Total Changes
Mission Support	$66,518	$57,957	$57,800	($157)
Total	**$66,518**	**$57,957**	**$57,800**	**($157)**
Discretionary - Appropriation	$66,518	$57,957	$57,800	($157)

Non Pay by Object Class

Non-Pay Object Classes *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
21.0 Travel and Transportation of Persons	$604	$528	$615	$87
25.1 Advisory and Assistance Services	$17,403	$14,234	$15,168	$934
25.2 Other Services from Non-Federal Sources	$322	$282	$282	-
25.3 Other Goods and Services from Federal Sources	$34,916	$31,406	$32,016	$610
25.4 Operation and Maintenance of Facilities	$315	$275	$275	-
25.5 Research and Development Contracts	$2,045	$1,788	-	($1,788)
25.6 Medical Care	$3	$3	$3	-
25.7 Operation and Maintenance of Equipment	$3,527	$3,085	$3,085	-
26.0 Supplies and Materials	$510	$445	$445	-
31.0 Equipment	$6,873	$5,911	$5,911	-
Total - Non Pay Object Classes	**$66,518**	**$57,957**	**$57,800**	**($157)**

Non Pay Cost Drivers

Leading Non Pay Cost-Drivers *Dollars in Thousands*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Total Changes
Working Capital Fund	$27,630	$27,170	$27,179	$9
Advisory and Assistance Services	$17,403	$14,234	$15,168	$934
Equipment	$6,873	$5,911	$5,911	$0
Operations and Maintenance of Equipment	$3,527	$3,085	$3,085	$0
Other Costs	$11,085	$7,557	$6,457	($1,100)
Total – Non Pay Cost Drivers	$66,518	$57,957	$57,800	($157)

NON PAY NARRATIVE:

The Mission Support non-pay request for FY 2019 is $57.8M. The programs driving the cost in this category include the following:

Working Capital Fund: WCF provides shared services that the components rely on to execute their missions, such as IT services, human resources, procurement operations, and financial systems. Funds provided in the MS PPA also support DHS WCF services such as consolidated subscriptions, government-wide mandated services, and DHS crosscutting activities. In FY 2019, the One Net transfer to USM/CIO from S&T and the NFC Payroll transfer to USM/CHCO from S&T result in a $1.3M total decrease.

Advisory and Assistance Services: This account pays for contractor staff who support the execution of headquarters functions including financial management, facility planning, maintenance, and other administrative functions. S&T uses a Business Office Support Services (BOSS) contract to provide administrative, technical and management support services that will enhance the organizational strengths of S&T's ASD.

Operations and Maintenance of Equipment: Major costs include the purchase and maintenance of IT equipment, including hardware (i.e. laptops, monitors, printers, etc.) and software (i.e. Microsoft Office, McAfee, etc.) as well as upgrades of this equipment. This also includes unique software, such as Media Relations Software, which communicates S&T's efforts that ultimately reach the new media.

Other Costs: These costs include business operations functions that pay for office supplies, utilities, and other operational functions associated with the S&T's headquarters offices, including training and travel associated with senior management of S&T.

Laboratory Facilities-PPA

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

Organization *(Dollars in Thousands)*	FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Laboratory Facilities	141	141	$133,942	107	121	$92,243	107	107	$110,519	-	(14)	$18,276
Total	**141**	**141**	**$133,942**	**107**	**121**	**$92,243**	**107**	**107**	**$110,519**	**-**	**(14)**	**$18,276**
Subtotal Discretionary - Appropriation	141	141	$133,942	107	121	$92,243	107	107	$110,519	-	(14)	$18,276

The Laboratory Facilities PPA supports costs for operations, core capabilities, maintenance, and personnel requirements at S&T's lab facilities. The Office of National Laboratories (ONL) oversees the continued operations of S&T's laboratory facilities, NBACC, PIADC, and the Transportation Security Laboratory (TSL), to meet mission requirements while maintaining safe, secure, compliant, and efficient operations. Also managed by ONL is the construction of NBAF. Additionally, ONL maintains capabilities vital to DHS and the national homeland security mission through a coordinated network of S&T laboratories and the DOE national laboratories. This network of laboratories houses some of the most advanced scientific expertise and capabilities in the world, enabling the homeland security enterprise to leverage, apply, and share knowledge that helps to inform policy, improve operations, and advance research in support of homeland security.

Laboratory Facilities-PPA
Budget Authority and Obligations

Budget Authority *(Dollars in Thousands)*	**FY 2017**	**FY 2018**	**FY 2019**
Enacted/Request	**$133,942**	**$92,243**	**$110,519**
Carryover and/or Recoveries (Actual/Estimates/Projections)	$68,024	$60,462	$30,652
Rescissions to Current Year/Budget Year	($7,500)	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$194,466**	**$152,705**	**$141,171**
Collections – Reimbursable Resources	$1,591	$3,000	$3,000
Total Budget Resources	**$196,057**	**$155,705**	**$144,171**
Obligations (Actual/Projections/Estimates)	$131,609	$122,610	$103,506
Personnel: Positions and FTE			
Enacted/Request Positions	141	107	107
Enacted/Request FTE	141	121	107
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	141	107	107
FTE (Actual/Estimates/Projections)	141	121	107

Laboratory Facilities-PPA
Collections – Reimbursable Resources

Collections *(Dollars in Thousands)*		FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget		
		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Agriculture - Department of Agriculture	Source	-	-	$95	-	-	$700	-	-	$700
Department of Defense - Department of Defense	Source	-	-	$400	-	-	$1,000	-	-	$1,000
Department of Homeland Security - Federal Emergency Management Agency	Source	-	-	-	-	-	$200	-	-	$200
Department of Homeland Security - Transportation Security Administration	Source	-	-	$704	-	-	$850	-	-	$850
Department of Homeland Security - Countering Weapons of Mass Destruction	Source	-	-	-	-	-	-	-	-	$50
Department of State - Department of State	Source	-	-	-	-	-	$200	-	-	$200
Department of Homeland Security - Domestic Nuclear Detection Office	Source	-	-	$11	-	-	$50	-	-	-
Canada	Source	-	-	$381	-	-	-	-	-	-
Total Collections		**-**	**-**	**$1,591**	**-**	**-**	**$3,000**	**-**	**-**	**$3,000**

Laboratory Facilities
Summary of Budget Changes

Budget Formulation Activity *(Dollars in Thousands)*	**Positions**	**FTE**	**Amount**
FY 2017 Enacted	**141**	**141**	**$133,942**
FY 2018 President's Budget	**107**	**121**	**$92,243**
FY 2019 Base Budget	**107**	**121**	**$92,243**
NBAF Operations transfer to USDA	-	-	($42,000)
Total Transfers	**-**	**-**	**($42,000)**
Annualization of 2018 Pay Raise	-	-	$99
Total, Pricing Increases	**-**	**-**	**$99**
Annualization of 2018 Personnel Reductions	-	(14)	($6,395)
Total, Pricing Decreases	**-**	**(14)**	**($6,395)**
Total Adjustments-to-Base	**-**	**(14)**	**($48,296)**
FY 2019 Current Services	**107**	**107**	**$43,947**
01 - NBACC Operations	2	2	$28,689
02 - NBAF Operations costs based on LCCE transfer to USDA	(2)	(2)	$35,000
03 - Information Technology	-	-	$2,883
Total, Program Increases	**-**	**-**	**$66,572**
FY 2019 Request	**107**	**107**	**$110,519**
FY 2018 TO FY 2019 Change	**-**	**(14)**	**$18,276**

Laboratory Facilities
Personnel Compensation and Benefits
Pay Summary

Organization *(Dollars in Thousands)*	FY 2017 Enacted				FY 2018 President's Budget				FY 2019 President's Budget				FY 2018 to FY 2019 Total			
	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate
Laboratory Facilities	141	141	$22,800	$161.7	107	121	$20,863	$170.36	107	107	$14,567	$134.74	-	(14)	($6,296)	($35.62)
Total	**141**	**141**	**$22,800**	**$161.7**	**107**	**121**	**$20,863**	**$170.36**	**107**	**107**	**$14,567**	**$134.74**	**-**	**(14)**	**($6,296)**	**($35.62)**
Discretionary - Appropriation	141	141	$22,800	$161.7	107	121	$20,863	$170.36	107	107	$14,567	$134.74	-	(14)	($6,296)	($35.62)

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

Pay by Object Class

Pay Object Classes *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
11.1 Full-time Permanent	$16,404	$13,817	$10,990	($2,827)
11.3 Other than Full-Time Permanent	$660	$560	$460	($100)
11.5 Other Personnel Compensation	$345	$345	$326	($19)
12.1 Civilian Personnel Benefits	$5,391	$5,891	$2,641	($3,250)
13.0 Benefits for Former Personnel	-	$250	$150	($100)
Total - Personnel Compensation and Benefits	**$22,800**	**$20,863**	**$14,567**	**($6,296)**
Positions and FTE				
Positions - Civilian	141	107	107	-
FTE - Civilian	141	121	107	(14)

Pay Cost Drivers

Leading Cost-Drivers *Dollars in Thousands*	FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Total Changes		
	FTE	Amount	Rate	FTE	Amount	Rate	FTE	Amount	Rate	FTE	Amount	Rate
Personnel Salaries & Benefits	141	$22,800	$162	121	$20,863	$170	107	$14,567	$135	(14)	($6,296)	($35.6)
Total – Pay Cost Drivers	**141**	**$22,800**	$162	**121**	**$20,863**	$170	**107**	**$14,567**	$135	**(14)**	**($6,296)**	**($35.6)**

NARRATIVE EXPLANATION OF CHANGES

FTE Change FY 2018-2019: The FY 2019 request includes a decrease of 14 FTE resulting from the annualization of personnel reductions proposed in the FY 2018 President's Budget.

PCB Change FY 2018-2019: The FY 2019 request includes a decrease of $6.3M as a result of the annualization of positions in FY 2018 and the cost savings associated with the reduction of those 14 FTE.

Average Cost Change FY 2018-2019: The average rate change takes into account the 2.0 percent pay increase at the FY 2018 FTE levels for 121 FTE. The primary pay cost drivers for Laboratory Facilities are directly associated with personnel compensation costs.

Laboratory Facilities
Non Pay Budget Exhibits
Non Pay Summary

Organization *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Total Changes
Laboratory Facilities	$111,142	$71,380	$95,952	$24,572
Total	**$111,142**	**$71,380**	**$95,952**	**$24,572**
Discretionary - Appropriation	$111,142	$71,380	$95,952	$24,572

Non Pay by Object Class

Non-Pay Object Classes *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
21.0 Travel and Transportation of Persons	$605	$416	$516	$100
22.0 Transportation of Things	$20	$13	$15	$2
23.1 Rental Payments to GSA	$1,827	$2,100	-	($2,100)
23.3 Communications, Utilities, and Misc. Charges	$84	$58	$84	$26
25.1 Advisory and Assistance Services	$58,057	$33,979	$44,470	$10,491
25.2 Other Services from Non-Federal Sources	$632	$435	$632	$197
25.3 Other Goods and Services from Federal Sources	$38,182	$26,295	$41,673	$15,378
25.4 Operation and Maintenance of Facilities	$5,831	$4,016	$4,016	-
25.5 Research and Development Contracts	$599	$413	-	($413)
25.7 Operation and Maintenance of Equipment	$358	$247	$322	$75
26.0 Supplies and Materials	$3,118	$2,147	$2,863	$716
31.0 Equipment	$1,177	$811	$811	-
32.0 Land and Structures	$652	$450	$550	$100
Total - Non Pay Object Classes	**$111,142**	**$71,380**	**$95,952**	**$24,572**

Non Pay Cost Drivers

Leading Non Pay Cost-Drivers *Dollars in Thousands*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Total Changes
Advisory and Assistance Services	$58,057	$33,979	$44,470	$10,491
Other Goods and Services from Federal Sources	$38,182	$26,295	$41,673	$15,378
Operations and Maintenance of Facilities	$5,831	$4,016	$4,016	-
Supplies and Materials	$3,118	$2,147	$2,863	$716
Rental Payments to GSA	$1,827	$2,100	$0	($2,100)
Other Costs	$4,127	$2,843	$2,930	$87
Total – Non Pay Cost Drivers	**$111,142**	**$71,380**	**$95,952**	**$24,572**

NON PAY NARRATIVE:

The Laboratory Facilities non-pay request for FY 2019 is $96.0M. The increase of $24.6M from FY 2018 to FY 2019 is primarily associated with the National Biodefense Analysis and Countermeasures Center (NBACC) Operations. Major costs for each lab include: utilities, operations and management, IT, communications, physical security, Science and Research Support, and Other Costs such as vehicles, supplies, materials, etc.

Advisory and Assistance Services: This covers costs contract staff who support the execution of business functions including financial management, facility planning, engineering and technical services, and other administrative functions. S&T's PIADC relies heavily on contract support to maintain approximately 200,000 square feet and includes Biosafety-Level 2 (BSL-2), BSL-3, BSL-3 agriculture buildings and nine acres.

Other Goods and Services from Federal Sources: Interagency agreements for contractual services for the purchase of goods and services for jointly funded projects. S&T's Transportation Security Laboratory (TSL) has an agreement with the Federal Aviation Administration (FAA) for the FAA to provide facility support services to TSL on a reimbursable basis for various activities, including utilities, building maintenance, emergency services, air shuttle services, and IT services. The Federal Protective Services (FPS) provides security at PIADC.

Operations and Maintenance of Facilities: These costs cover the upkeep of facilities to meet mission requirements while maintaining safe, secure, compliant, and efficient operations. PIADC must be maintained on a 24/7 basis. O&M includes: labor, management, supervision, equipment, software, firmware, and materials for all services required for the safe, reliable, effective, efficient, and compliant operations and maintenance under normal, abnormal, and emergency conditions. Also includes service contracts and routine repair of facilities and upkeep of land.

Supplies and Materials: These costs include business operations functions that pay for the purchase and maintenance of IT equipment, including hardware and software as well as upgrades of this equipment. This also includes office supplies and materials and costs associated with using and maintaining vehicles.

Other Costs: These costs include payments to vendors such as or utilities at PIADC, fleet maintenance, training, supplies and other costs.

National Biodefense Analysis and Countermeasures Center (NBACC) Operations

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 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. NBACC is part of the National Interagency Biodefense Campus (NIBC), which includes the HHS, Department of Defense (DOD), Food and Drug Administration (FDA), National Cancer Institute (NCI), and the Department of Agriculture (USDA). NBACC also collaborates closely with the FBI and national security agencies. The unique missions of threat characterization and bioforensics enhance the Nation's overall biodefense capabilities.

NBACC continues to examine opportunities for the cooperative use of existing capacity to perform R&D for other Federal agencies. S&T will continue to operate NBACC as a Federally Funded Research and Development Center (FFRDC), which plans, manages, and executes the NBACC research programs and operates the facility. Additionally, NBACC has achieved all of the required certifications and registrations for its biosafety level (BSL) 2, 3, and 4 laboratories. Some of the major operational costs include safety, security, addressing and maintaining regulatory compliance, information technology and IT upgrades, utility and garrison support costs, major facility and equipment upgrades, and energy renewal.

FY 2017 Key Milestone Events

- Completed a site visit of animal care program administered by the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC) International.
- Received renewal of accreditation (valid three years) from AAALAC International.
- Received National Bioforensic Analysis Center (NBFAC) ISO 17025 Renewal Assessment and Accreditation, Nov. 2016 (valid two years from Jan. 2017).
- Completed annual testing of facility systems supporting BSL-3 operations and documented the findings in a report.
- Completed at least three Risk Assessments in compliance with ISO 31000 standard.
- .
- Implemented the insider threat program approved by NBACC leadership.

FY 2018 Key Milestone Events

- Achieve the required certifications and registrations for the NBACC biosafety level (BSL) 2, 3, and 4 laboratories.
- Operate and manage the NBACC facility to 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.
- Comply with NBACC Facility Operation and Maintenance plan to maintain, operate, manage, and protect Government owned/Government Furnished facilities and infrastructure.
- Complete the triennial Biological Select Agents and Toxins registration inspection.

FY 2019 Key Milestone Events

- Establish a cost sharing between DHS/S&T and FBI for the operation and management of the NBACC.
- Increase participation to Work for Others Program with non-DHS Federal agencies and DHS Components.
- Comply with all applicable regulatory requirements associated with the safe and ethical operation of a biocontainment facility.
- Comply with NBACC's facility operation and maintenance plan to maintain, operate, manage, and protect Government owned/Government furnished facilities and infrastructure.

National Bio and Agro-Defense Facility (NBAF) Construction

NBAF will be a biocontainment laboratory for the study of diseases that threaten both, America's animal agricultural industry and public health. It will strengthen our Nation with critical capabilities to conduct research, develop vaccines and other countermeasures, and train veterinarians in preparedness and response against these diseases. NBAF will serve as a replacement for the PIADC facility and S&T manages the construction of NBAF.

FY 2017 Key Milestone Events

- Awarded OPTIC to support the Government in the development of planning documents for NBAF operational planning, including the MORS acquisition.
- Completed development of the NBAF Operational Plan to serve as the guiding document for the operations of the laboratory.
- Completed concrete pours for the laboratories high containment walls.
- The $1.25B NBAF Acquisition project ended FY 2017 on schedule and on budget, 47 percent complete.

FY 2018 Planned Key Milestone Events

- Complete concrete and steel structure of the main lab building.
- Initiate application of high performance coatings in containment areas.
- Initiate planning for biorepository transfer from PIADC to NBAF.
- Complete initial draft of Select Agent Registration Strategy.

FY 2019 Planned Key Milestone Events

- Complete application of high performance coatings.
- Complete installation of steel impact wall.
- Initiate systems testing and start-up.
- Re-commission Central Utility Plant that has been in stand-by mode.
- Initiate pressure decay testing of containment areas.

Plum Island Animal Disease Center Operations

Since 1954, 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) and is the only laboratory in the nation that can work on live FMD virus (FMDV).

While PIADC provides a host of high-impact, indispensable preparedness and response capabilities to include vaccine R&D, diagnostics, training, and bioforensics, it also has an interagency mission to protect U.S. agriculture from the threat of high-consequence foreign animal diseases.

S&T is responsible for the operational management of PIADC. The biologic countermeasure development at PIADC supports S&T's agro-terrorism countermeasures program. Research at the facility occurs in biosafety level (BSL)-2, and BSL-3 Agricultural laboratory spaces. S&T is responsible for the management, operations, and maintenance of the facility. The laboratory is a self-sustaining operation, with its own power plant, boiler plant, fuel storage, fire protection, waste disposal, security systems, and other critical infrastructures. S&T provides the only ferry transport to and from the island, and is responsible for operation and maintenance of the ferries, docks, and harbor. S&T also manages day-to-day operational support, including the operations workforce and emergency response capabilities (fire, rescue, emergency medical). Major operational costs at PIADC include bio safety, security, operations and maintenance contract, Information Technology and periodic upgrades to support regulatory requirements and equipment replacement to ensure safe facility operations.

FY 2017 Key Milestone Events

- Completed 95 percent construction of the liquid waste decontamination plant.
- Completed conceptual site model to help inform decisions regarding legacy environmental conditions.
- Assessed laboratory infrastructure to identify necessary repairs required to ensure continued safe and secure operation of critical laboratory infrastructure until transition of the laboratory to the NBAF.
- Completed test and evaluation of new FMDV master seed, which supports the development of biologic countermeasures for high threat foreign animal diseases.

FY 2018 Planned Key Milestone Events

- Conduct decontamination and decommissioning of Building 102, a waste water decontamination plant, which will be replaced by a newly constructed waste water plant.
- Support final transition of the newly developed FMDV for manufacturing and safe storage of master seeds to ensure availability in the event of a potential outbreak of FMD.
- Complete the selection of a new contractor for the PIADC and move forward with the consolidation of approximately 10 contracts for improved operational efficiency.
- Complete commissioning, confidence testing, registration process, and commence full operations of the liquid waste decontamination plant.

FY 2019 Planned Key Milestone Events

- Fully define scope and develop project plan for island conveyance post mission to NBAF.
- Complete conceptual site model and differential actions for successful island transition to NBAF.

Transportation Security Laboratory (TSL) Operations

The TSL is a federal laboratory aligned under S&T and 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 the 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, requiring testing by the TSL prior to deployment. The TSL is located at the Federal Aviation Administration's William J. Hughes Technical Center in Atlantic City, NJ. Major operational costs include rent, operation support contracts, building maintenance, utilities, energy renewal projects/studies, security, and information technology.

FY 2017 Key Milestone Events

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

FY 2018 Planned Key Milestone Events

- Publish an Automation Roadmap that will identify cost-effective facilities, equipment, and operating procedures to help reduce risk and increase quality of synthesized improvised explosive materials.
- Ensure the TSL is positioned to execute Accessible Property Screening System testing in support of the Transportation Security Administration's (TSA) acquisition schedule.
- In cooperation with ONL, will complete all documentation necessary to support an ADE-2 decision on the TSL Detection Sciences Test and Research facility.
- Expand development and/or independent test & evaluation lines of business to at least one additional DHS component.
- Create a certification capability to verify/validate explosive simulants.

FY 2019 Planned Key Milestone Events

- Enhance cybersecurity profile at the TSL.
- Update equipment and non-explosives related inventories.
- Continue to establish explosive simulant validation/verification certification capabilities.
- Expand synthesis, handling, and disposal of non-conventional (homemade explosive) compounds.
- Award follow-on technical services contract essential to execution of T&E at the TSL.
- Engage partners (S&T's Capability Development Support Group, ONL, Explosive Defense Division, and TSA) in funding of foundational research labs at the TSL that will provide supportive technical assistance to developmental and independent test & evaluation.
- Continue to address potential fee for service business model.
- Initiate design of new Detection Science Test and Reporting facility.

Acquisitions and Operations Analysis-PPA

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

Organization *(Dollars in Thousands)*	FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Acquisition and Operations Analysis	-	-	$48,392	-	-	$42,552	-	-	$42,552	-	-	-
Total	**-**	**-**	**$48,392**	**-**	**-**	**$42,552**	**-**	**-**	**$42,552**	**-**	**-**	**-**
Subtotal Discretionary - Appropriation	-	-	$48,392	-	-	$42,552	-	-	$42,552	-	-	-

The Acquisition and Operations Analysis (AOA) program provides funding to support 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 program's life; standards to support the homeland security mission; and administration of the Support Anti-Terrorism by Fostering Effective Technologies (SAFETY) Act program.

Acquisitions and Operations Analysis - PPA
Budget Authority and Obligations

Budget Authority *(Dollars in Thousands)*	**FY 2017**	**FY 2018**	**FY 2019**
Enacted/Request	**$48,392**	**$42,552**	**$42,552**
Carryover and/or Recoveries (Actual/Estimates/Projections)	$21,449	$16,493	$13,539
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$69,841**	**$59,045**	**$56,091**
Collections – Reimbursable Resources	$5,074	$5,700	$5,700
Total Budget Resources	**$74,915**	**$64,745**	**$61,791**
Obligations (Actual/Projections/Estimates)	$53,322	$54,158	$49,433
Personnel: Positions 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 - PPA
Collections – Reimbursable Resources

Collections *(Dollars in Thousands)*		FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget		
		Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Energy - Department of Energy	Source	-	-	$400	-	-	$500	-	-	$500
Department of Homeland Security - Department of Homeland Security	Source	-	-	$511	-	-	$500	-	-	$500
Department of Homeland Security - Federal Emergency Management Agency	Source	-	-	$22	-	-	$50	-	-	$50
Department of Homeland Security - Transportation Security Administration	Source	-	-	$261	-	-	$300	-	-	$300
Department of Homeland Security - Citizenship and Immigration Services	Source	-	-	$33	-	-	$50	-	-	$50
Department of Homeland Security - United States Secret Service	Source	-	-	$1,410	-	-	$1,500	-	-	$1,500
Department of Homeland Security - Countering Weapons of Mass Destruction	Source	-	-	-	-	-	-	-	-	$900
Department of Homeland Security - US Customs and Border Protection	Source	-	-	$96	-	-	$100	-	-	$100
Department of Homeland Security - US Immigration and Customs Enforcement	Source	-	-	$221	-	-	$250	-	-	$250
Department of Homeland Security - United States Coast Guard	Source	-	-	$59	-	-	$100	-	-	$100
Department of Homeland Security - National Protection and Programs Directorate	Source	-	-	$744	-	-	$950	-	-	$950
Department of Homeland Security - Office of Health Affairs	Source	-	-	$57	-	-	$100	-	-	-
Department of Homeland Security - Domestic Nuclear Detection Office	Source	-	-	$767	-	-	$800	-	-	-
Library of Congress	Source	-	-	$493	-	-	$500	-	-	$500
Total Collections		-	-	**$5,074**	-	-	**$5,700**	-	-	**$5,700**

Acquisitions and Operations Analysis - PPA
Summary of Budget Changes

Budget Formulation Activity *(Dollars in Thousands)*	Positions	FTE	Amount
FY 2017 Enacted	**-**	**-**	**$48,392**
FY 2018 President's Budget	**-**	**-**	**$42,552**
FY 2019 Base Budget	**-**	**-**	**$42,552**
FY 2019 Current Services	**-**	**-**	**$42,552**
FY 2019 Request	**-**	**-**	**$42,552**
FY 2018 TO FY 2019 Change	**-**	**-**	**-**

Acquisitions and Operations Analysis - PPA
Non Pay Budget Exhibits

Non Pay Summary

Organization *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Total Changes
Acquisition and Operations Analysis	$48,392	$42,552	$42,552	-
Total	**$48,392**	**$42,552**	**$42,552**	-
Discretionary - Appropriation	$48,392	$42,552	$42,552	-

Non Pay by Object Class

Non-Pay Object Classes *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
21.0 Travel and Transportation of Persons	$585	$543	$543	-
25.1 Advisory and Assistance Services	$21,377	$17,481	$21,932	$4,451
25.2 Other Services from Non-Federal Sources	$446	$414	$414	-
25.3 Other Goods and Services from Federal Sources	$18,315	$16,997	$16,997	-
25.5 Research and Development Contracts	$4,797	$4,452	-	($4,452)
25.7 Operation and Maintenance of Equipment	$2,026	$1,880	$1,880	-
31.0 Equipment	$308	$286	$286	-
41.0 Grants, Subsidies, and Contributions	$538	$499	$500	$1
Total - Non Pay Object Classes	**$48,392**	**$42,552**	**$42,552**	**-**

Non Pay Cost Drivers

Leading Non Pay Cost-Drivers *Dollars in Thousands*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Total Changes
Advisory and Assistance Services	$21,377	$17,481	$21,932	$4,451
Other Goods and Services from Federal Sources	$18,315	$16,997	$16,997	-
Research and Development Contracts	$4,797	$4,452	-	($4,452)
Other Costs	$3,903	$3,622	$3,623	$1
Total – Non Pay Cost Drivers	**$48,392**	**$42,552**	**$42,552**	**-**

NON PAY NARRATIVE

The AOA non-pay request for FY 2019 is $42.5M. The five thrust areas driving the costs in this program are as follows: Operations and Requirements Analysis (ORA), SAFETY Act, Systems Engineering, Test and Evaluation (T&E), and Technology Transition Support. The Capability Development Support (CDS) Group manages four of the five thrusts.

Advisory and Assistance Services: Costs include contract services for business operations including financial management, studies, analyses, and evaluations in support of information technology and R&D activities, as well as other administrative functions. S&T's CDS Group relies on contracting services to provide analyses, engineering, test expertise, and products for operational end users within DHS and Joint Requirements Council (JRC).

Other Goods and Services from Federal Sources: Interagency agreements for contractual services for the purchase of goods and services for jointly funded projects. For example, the SAFETY Act Office relies heavily on the Institute of Defense Analyses (IDA) to provide studies, analyses, test and evaluation support in determining whether to designate a particular technology as a Qualified Anti-Terrorism Technology.

Research and Development Contracts: The decrease is due to assigning contracts to the appropriate object class.

Other Costs: Other Costs include travel, conferences, and direct support of major acquisitions and systems essential to planning, R&D, or maintenance of the acquisition or system.

Operations and Requirements Analysis Thrust - FY 2018: $4.9M. FY 2019 Request: $4.9M.
The Office of Operations and Requirements Analysis reviews homeland security operations to identify ways to prioritize cross-DHS 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 DHS capabilities and requirements analysis.

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 the investment decision process. 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, Nuclear, and Explosives (CBRNE) 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 the prioritization of shortfalls.

FY 2017 Key Milestone Events

- Performed capabilities analysis for the Domain and Situational Awareness and Securing and Law Enforcement JRC Portfolios.
- Completed a threat classification prediction analysis for CBP's Air and Marine Operations Center (AMOC). The analysis developed and delivered an analysis tool to the AMOC operators that enabled 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 for engagement of high-threat aircraft crossing the U.S. border.
- Completed a radar coverage analysis for CBP Air and 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 examined 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 Secretariat to characterize its responsiveness to time-critical Congressional correspondence. The results of the analysis, data driven, provided the Executive Secretariat with an overall understanding of their current process and outlined areas of their process that required improvement. In addition, ORA developed and delivered an analysis tool that automated the calculation of DHS executive correspondence response statistics for Congress enabling the Secretariat to generate statistical response reports in minutes versus hours.
- Completed Value Focused Modeling analysis for CBP's AMOC that accomplished a bottoms-up examination of AMOC operations. The analysis highlighted how each AMOC mission functions and tasks contributed to mission execution and value added by each of the functions and tasks. This resulted in a baseline "Value Model" for AMOC operations that now informs AMOC leadership on where to invest staff resources or capability enhancements to achieve the greatest impact of a mission.

FY 2018 Planned Key Milestone Events

- Perform capabilities analysis for at least two JRC Portfolios.

- Upon the request of the DHS Integrated Product Teams (IPTs), Components, and/or Joint Task Forces, deliver gap analyses reports that support the development of stronger air, land, and, maritime border defenses to include border surveillance and law enforcement.
- Complete Proof of Concept for System of Systems Operational Analytics (SoSOA) program to enhance Component and HQ analytic capabilities through reduced cost to produce analysis, less dependency on contractors/FFRDCs for analytic support, and quicker delivery of quality analysis.

FY 2019 Planned Key Milestone Events

- Perform capabilities analysis for at least two JRC Portfolios.
- Upon the request of the DHS IPTs, Components, and/or Joint Task Forces, complete the delivery of finalized gap analyses reports that support development of stronger air, land, and, maritime border defenses to include border surveillance and law enforcement.
- Complete the first phase of SoSOA program that will enhance Component and HQ analytic capabilities through reduced cost to produce analysis, less dependency on contractors/FFRDCs for analytic support, and quicker delivery of quality analysis.

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) provides centralized oversight and support to the Homeland Security Operational Analysis Center (HSOAC) and the Homeland Security Systems Engineering and Development Institute (HSSEDI), two of DHS's FFRDCs. These FFRDCs are working in the interest of the public to ensure the highest levels of excellence by bringing together the expertise and point-of-view of government, industry, and academia.

HSOAC provides DHS with expertise, analytic rigor, and timely analysis to support operations, policy development, and decision-making for DHS and its partners across the HSE. HSOAC provides support to meet DHS long-term needs that are integral to the mission and operations. It has seven functional areas that cut across its mission study categories: homeland security threats and opportunities; organizational structure and effectiveness; operational analysis; regulatory, doctrine, and policy analysis; requirements and acquisition management and oversight; research and development management; and innovation and technology acceleration. The close, but independent relationship between DHS and the FFRDC allows the latter to provide objective, independent research and analysis, free from conflicts of interest that result in actionable recommendations and candid advice rooted in the context of a long-term trusted relationship.

HSSEDI utilizes its independent and objective perspective, extensive knowledge of the DHS mission space, and deep technical expertise to identify and solve critical technical problems and accelerate to operational use, the technology and systems necessary to secure the homeland. HSSEDI provides specialized technical and systems engineering expertise to program managers and operating elements, enhancing the DHS's capabilities by recommending new technologies; developing prototypes and proof-of-concept demonstrations; reviewing systems design optimization and trade-space considerations; developing and integrating architectures and frameworks; applying enterprise systems engineering principles for improved interoperability and information sharing; establishing technical standards, measures and best practices; and, developing realistic test environments and scenarios.

FY 2017 Key Milestone Events

- 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.

FY 2018 Planned Key Milestone Events

- 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.
- Issue the necessary contracts to support and buildout the HSSEDI SCIF.
- Complete Comprehensive Review for HSSEDI and make a determination on renewing sponsoring agreement and associated contracts.

FY 2019 Planned Key Milestone Events

- 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.
- If supported by the findings of the Comprehensive Review conducted in FY 2018, award a contract for the operation of HSSEDI.

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 the 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.

System of Systems Operational Analytics Capability Development

The System of Systems Operational Analytics (SoSOA) Capability Development effort will incrementally construct the infrastructure to enable DHS Headquarters and Component analysts, operators, and decision makers to deliver comprehensive, integrated analysis to answer complex questions that span organizational and functional boundaries. Specifically, SoSOA will assimilates visualization and analytic tools with fused data sources in a user-friendly environment that will speed to provide timely analysis for decision-making and reduce costs for data-driven analysis. In addition, SoSOA will facilitate predictive and prescriptive "to be" analyses showing the operational trade-offs implicit in the future planning of DHS capabilities and operations. Overall, this effort will operationalize analytic capability within the Components to lessen cost to produce analysis, reduce dependency on contractors/FFRDCs for analytic support, and deliver quicker, high-quality analysis to improve operational efficiencies that impact DHS mission results.

Systems Engineering Thrust - FY 2018: $4.4M. FY 2019 Request: $4.4M

Systems Engineering is critical to the success of all DHS programs because it lays the framework for ensuring that acquisition programs are selecting technically mature and feasible solutions and R&D programs based on sound science.

The Office of Systems Engineering conducts Technical Assessments of DHS Acquisition and S&T R&D programs to identify major technical risks, provide recommendations to reduce those risks, support objective decision-making, and ensure that programs are technically sound. The Office of Systems Engineering also assists DHS Acquisitions and R&D programs in implementing systems engineering and engineering conformance into technical assessments and acquisition programs. Their other efforts include providing technical expertise to the DHS JRC to validate capability gaps, mission needs, and operational requirements; operating the DHS Systems Engineering Center of Excellence to disseminate systems engineering best practices to programs; developing and revising DHS Systems Engineering policy and guidance; and developing and managing DHS systems engineering, human systems integration, and engineering conformance workforce certifications. Additionally, this program manages the statutory functions of the Standards Executive for DHS coordination and oversight responsibilities and participates in standards committees.

FY 2017 Key Milestone Events

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

FY 2018 Planned Key Milestone Events

- Deliver at least four Letters of Technical Assessment that will 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.
- Coordinate and submit the annual report on standards usage per OMB Circular A-119.
- Provide draft ANSI/IEEE and ASTM standards to include standard test materials for acceptance testing and qualification of deployed trace explosive detection instruments; ground response robots. This includes promoting/coordinating international (ISO/IEC) standards for testing and evaluating the image quality of x-ray Computed Tomography (CT) systems used for screening by CBP and TSA.
- Provide draft ANSI/IEEE and ASTM standards to include standard test materials for acceptance testing and qualification of deployed trace explosive detection instruments; ground response robots. This includes promoting/coordinating international (ISO/IEC) standards for testing and evaluating the image quality of x-ray CT systems used for screening by CBP and TSA.

FY 2019 Planned Key Milestone Events

- Deliver at least four Letters of Technical Assessment to the DHS Acquisition Decision Authority to support acquisition decisions.
- Deliver two systems engineering certification courses, and host two Systems Engineering Center of Excellence forums.
- Review at least 24 artifacts sent by the DHS JRC to support the validation of capability gaps, mission needs, and operational requirements.
- Coordinate and submit the annual report on standards usage per OMB Circular A-119.

Test and Evaluation Thrust - FY 2018: $7.7M. FY 2019 Request: $7.7M.

Office of Test and Evaluation

The Office of Test and Evaluation 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 Component heads.
- Develops policy and procedures for the planning, execution, and assessment of T&E.
- Monitors and reviews T&E and provides guidance for those level 1 & 2 programs on the Major Acquisition Oversight List (MAOL).
- Assists in the development of the DHS T&E professional. This includes developing and/or updating T&E curriculum, providing instructor support, and hosting T&E learning seminars and workshops.

The 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. The T&E office also participates in Program Working Integrated Product Teams. Prior to Acquisition Decision Event 2C, in which a particular program begins production and delivery, the Office of T&E develops a Letter of Assessment (LOA) for Level 1 & 2 programs on the MAOL depicting the systems operational effectiveness, operational suitability, cybersecurity, and interoperability. They also work to ensure that DHS integrates test and evaluation processes into the acquisition lifecycle framework (ALF), and systems engineering life cycle (SELC).

FY 2017 Key Milestone Events

- Delivered four Letters of Assessment to support ARBs and the ADA.
- Provided DHS with T&E recommendations for inclusion in three Acquisition Decision Memoranda.
- Delivered six T&E training courses, workshops and learning seminars for DHS.
- Updated, coordinated, and approved three DHS T&E Policy documents.

FY 2018 Planned 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.
- Develop T&E policy and guidance in support of rapid acquisition planning, execution, and assessment.
- Complete development of two new T&E training courses.
- Update T&E Curriculum and deliver at least six T&E training courses, workshops, and learning seminars for DHS. Develop Cyber T&E guidance and best practices.

FY 2019 Planned 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.
- Deliver at least six T&E Training courses, workshops, and learning seminars to improve technical abilities of the DHS T&E professionals and support developing a future focused workforce.
- Develop guidance incorporating T&E into acquisition contracts, and best practices.

System Assessment and Validation for Emergency Responders

As technology advances, emergency response equipment is becoming more complex, and the overall safety, quality, reliability, and maintainability of the equipment in field environments may be significantly impacted as each equipment item functions as part of an operational system. Emergency response organizations need support from subject matter experts to decide what equipment and technology is best for their needs.

The System Assessment and Validation for Emergency Responders (SAVER) program was established to assist emergency responders making procurement decisions. DHS Grants programs fund a substantial portion of responder equipment purchases at the state and local levels. By conducting unbiased operational tests on commercial equipment and systems, SAVER acts as an honest broker of procurement-related information. SAVER provides assessment results along with other relevant equipment information to the community in an operationally useful form.

The SAVER "brand" is recognized by state and local emergency responders and federal agencies, and SAVER knowledge products (over 1,000 have been produced) are used as a resource for making acquisition and deployment decisions. SAVER answers two main questions: "What equipment is available," and "How does it perform." As a result, emergency responders have equipment and technology that allows them to accomplish their critical mission safer and better.

Technology Transition Support Thrust – FY 2018: $10.2M. FY 2019 Request: $10.2M.

This thrust facilitates the transition of S&Ts 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 20*02. 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. S&T also maintains partnerships with 13 Department of Energy (DoE) national laboratories that are vital to the national homeland security mission that provides S&T an opportunity to leverage R&D investments at the DoE laboratories. This combination of networks between agencies is the foundation for S&T technology scouting.

The 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.

FY 2017 Key Milestone Events

- Convened four Homeland Security Science and Technology Advisory Committees (HSSTAC), three quarterly in-person committee meetings and one webinar. As a result, the Interagency Programs Office (IAO) was able to manage the development of a report on the Internet of Things and defined threats and recommendations to mitigate cybersecurity risks. IAO also managed the development of a report on Best Practices for Social Media in Exercises to be distributed to the First Responder Community. Additionally, IAO managed the HSSTAC creation of five white papers on Cybersecurity, Artificial Intelligence, Autonomous Vehicles, Adaptive Manufacturing and Chemical, Biological, Radiological and Nuclear Detection. Included in the white papers were threat assessments, technological maturity, and recommendations to support DHS's mission success in using and/or countering these technology areas. They will be included as appendices to the 2018 Quadrennial Homeland Security Review.
- Updated the Science Advisory Guide for Emergencies to ensure currency of membership and relevancy of incidents.
- Hosted three meetings of the Capabilities Development Working Group that focused 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.
- Developed an interagency technology scouting standard operating procedure to strengthen collaborative efforts to fill technology gaps.

FY 2018 Planned Key Milestone Events

- The HSSTAC to meet four times in FY 2018, three quarterly in- person committee meetings and one webinar. Deliverables will be developed at the request of the Under Secretary for Science and Technology and will include appropriate tasking topics that have direct policy implications, require extensive stakeholder coordination, provide an understanding of research and development trends, horizon scanning and scouting recommendations and provide independent advice and recommendations that can be coordinated across the foremost experts in the R&D technology fields.
- Conduct 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.

FY 2019 Planned Key Milestone Events

- Complete integration of technology scouting with IAO partnership portfolios, complete 95 percent of all technology scouting requests, including support to the IPT process, DHS S&T, and DHS component requests. Pilot knowledge management, customer feedback and quality control for all tech scouting requests.
- Complete stand up of a proactive tech forecasting capability to identify, monitor, and disseminate intelligence on innovative technologies to inform strategic decision-making for R&D investments.
- Stage one Operational Experimentation event in collaboration with S&T's Office of Public Private Partnerships.
- The HSSTAC to meet four times, three quarterly in-person committee meetings and one webinar. Develop deliverables at the request of the Under Secretary for Science and Technology (USST) and include appropriate tasking topics that have direct policy implications, require extensive stakeholder coordination, provide an understanding of research and development trends, horizon scanning and scouting

recommendations, and provide independent recommendations that can be coordinated across the foremost experts in the R&D technology fields.

- Conduct 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.

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.

FY 2017 Key Milestone Events

- Facilitated nine bilateral meetings for the USST and Deputy Under Secretary for S&T that developed partnerships with foreign governments and international organizations for the enhancement of scientific and technical knowledge for the HSE.

FY 2018 Planned Key Milestone Events

- Facilitate nine bilateral meetings for the USST and Deputy Under Secretary for S&T to continue developing partnerships with foreign governments and international organizations to enhance scientific and technical knowledge for the HSE.

FY 2019 Planned Key Milestone Events

- Facilitate nine bilateral meetings for the USST and Deputy Under Secretary for S&T to continue developing partnerships with foreign governments and international organizations to enhance scientific and technical knowledge for the HSE.
- Facilitate at least five new international research projects or prototype demonstrations through formal collaborations under bilateral agreements or through new mechanisms to expand DHS's access to cutting – edge S&T research in support of homeland security missions.

Knowledge Management and Technology Scouting

This program enhances 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 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.

Office of the Chief Scientist
The Office of the Chief Scientist (OCS) serves as a senior advisor and analytic capability to the USST. 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 USST and S&T's senior leadership in prioritizing and aligning S&T's investments to address the highest priorities of the Administration and DHS, and the most challenging missions faced by the operational Components.

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 partner with industry to develop or adapt technology solutions and facilitate the transition of those solutions to homeland security end-users. These services and capabilities include industry partnerships and outreach, market analysis, innovation experimentation, prize competitions, Long Range Broad Agency Announcements, managing execution of the Small Business Innovation Research (SBIR) program, and technology transfer and commercialization support services.

P3 facilitates S&T partnerships with innovative companies and industry associations 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 HSE, through expanded partnerships with private sector innovators. P3 also coordinates implementation of S&T's Innovation Strategy, which integrates S&T efforts to identify and leverage technology innovation occurring within partnership networks for use by the HSE. P3 organizes its capabilities and services within the following three portfolios:

- Innovation Discovery: P3 provides capabilities for industry engagement, outreach, and experimentation. These capabilities ensure that S&T is actively engaging industry and can identify and leverage current or emerging technologies to support tech scouting and market analysis and 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, Long-Range Broad Agency Announcements, and the SBIR program, and programs that connect S&T with accelerator networks and the venture community to identify commercial solutions to address homeland security challenges.

• Technology Transfer and Commercialization: P3's transition 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. P3's goal is to ensure S&T's R&D investments are designed to transition to the homeland security end user.

FY 2017 Key Milestone Events

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

FY 2018 Planned Key Milestone Events

- Update S&T's Industry Guide to incorporate feedback received by industry on the inaugural version published in FY 2017.
- Conduct three outreach webinars to promote high priority R&D needs and business opportunities.

FY 2019 Planned Key Milestone Events

- Provide an integrated S&T interface and schedule for the private sector that clearly communicates capability needs and opportunities to engage with DHS S&T.
- Ensure that viable transition plans are in place for needs addressed through P3 programs to improve the likelihood of solution transfer to an end-user.

SAFETY Act Thrust – FY 2018: $8.0M. FY 2019 Request: $8.0M.

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.

FY 2017 Key Milestone Events

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

FY 2018 Planned Key Milestone Events

- 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.

FY 2019 Planned Key Milestone Events

- Develop plan to expand outreach to potential electric sector security technology applicants.
- Develop process and procedure for exhibitions and meetings venues to submit SAFETY Act applications based on guidelines promulgated by national venue management associations.
- Plan and conduct a series of anti-terrorism security workshops – both online and in person – that are designed to equip small businesses with the knowledge and understanding to submit a successful SAFETY Act application for their anti-terrorism product or service.

Department of Homeland Security

Science and Technology

Research and Development

Fiscal Year 2019
Congressional Justification

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Research and Development

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

Organization *(Dollars in Thousands)*	FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Research, Development and Innovation	-	-	$430,124	-	-	$342,982	-	-	$289,734	-	-	($53,248)
University Programs	-	-	$40,500	-	-	$29,724	-	-	$21,746	-	-	($7,978)
Total	**-**	**-**	**$470,624**	**-**	**-**	**$372,706**	**-**	**-**	**$311,480**	**-**	**-**	**($61,226)**
Subtotal Discretionary - Appropriation	-	-	$470,624	-	-	$372,706	-	-	$311,480	-	-	($61,226)

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

The mission of the Science and Technology Directorate (S&T) is to s*trengthen America's security and resiliency by providing knowledge products and innovative technology solutions for the Homeland Security Enterprise (HSE).* S&T was established under the Homeland Security Act of 2002 to, among other things, "[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 for explosives, border security, cyber security, biological and chemical threats, and conducting the research and development (R&D) required to meet homeland security needs. While S&T's work is often identified with technology development, equally important are S&T'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 detailed technical characterization of potential biological threat organisms to support both human and agricultural biodefense. In addition, S&T's capacity to engage R&D activities worldwide is 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 reducing costs, providing efficiencies, and increasing effectiveness of DHS's operational missions, and enhancing the safety, interoperability, and communications capabilities of the first responder community. S&T's contributions to DHS 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* – DHS 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:

S&T has two programs, projects, and activities (PPAs) in the R&D appropriation: 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 Research, Development, Test and Evaluation (RDT&E) programs that balance risk, cost, impact, and time to delivery. RD&I includes the following thrust areas: Apex; Border Security; Chemical, Biological, and Explosive (CBE) Defense; Counter Terrorist; and First Responder/Disaster Resilience.
- *University Programs* – UP 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. It includes COEs and Minority Serving Institutions, a consortium of universities generating groundbreaking ideas for new technologies and critical knowledge for the HSE.

Research and Development
Budget Authority and Obligations

Budget Authority *(Dollars in Thousands)*	**FY 2017**	**FY 2018**	**FY 2019**
Enacted/Request	**$470,624**	**$372,706**	**$311,480**
Carryover and/or Recoveries (Actual/Estimates/Projections)	$149,898	$155,655	$84,175
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$620,522**	**$528,361**	**$395,655**
Collections – Reimbursable Resources	$35,151	$41,800	$41,800
Total Budget Resources	**$655,673**	**$570,161**	**$437,455**
Obligations (Actual/Projections/Estimates)	$464,576	$464,249	$392,163
Personnel: Positions and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

Research and Development
Summary of Budget Changes

Budget Formulation Activity *(Dollars in Thousands)*	Positions	FTE	Amount
FY 2017 Enacted	**-**	**-**	**$470,624**
FY 2018 President's Budget	**-**	**-**	**$372,706**
FY 2019 Base Budget	**-**	**-**	**$372,706**
FY 2019 Current Services	**-**	**-**	**$372,706**
1 Border Security	-	-	$3,453
2 CBE Defense	-	-	$4,309
Total, Program Increases	**-**	**-**	**$7,762**
3 Cyber Security/Information Analysis transfer to NPPD	-	-	($46,248)
4 Apex Program	-	-	($10,762)
5 Counter Terrorist	-	-	($4,000)
6 Center of Excellence Reduction	-	-	($7,978)
Total, Program Decreases	**-**	**-**	**($68,988)**
FY 2019 Request	**-**	**-**	**$311,480**
FY 2018 TO FY 2019 Change	**-**	**-**	**($61,226)**

Research and Development
Justification of Program Changes

Program Changes *(Dollars in Thousands)*	FY 2019 President's Budget		
	Positions	FTE	Amount
Program Change 1 - Border Security	**-**	**-**	**$3,453**
Research, Development and Innovation	-	-	$3,453
Program Change 2 - CBE Defense	**-**	**-**	**$4,309**
Research, Development and Innovation	-	-	$4,309
Program Change 3 - Cyber Security/Information Analysis transfer to NPPD	**-**	**-**	**($46,248)**
Research, Development and Innovation	-	-	($46,248)
Program Change 4 - Apex Program	**-**	**-**	**($10,762)**
Research, Development and Innovation	-	-	($10,762)
Program Change 5 - Counter Terrorist	**-**	**-**	**($4,000)**
Research, Development and Innovation	-	-	($4,000)
Program Change 6 - Center of Excellence Reduction	**-**	**-**	**($7,978)**
University Programs	-	-	($7,978)
Total Program Changes	**-**	**-**	**($61,226)**

Program Change 1 – Border Security

Description
In an effort to improve operational effectiveness along the border, the FY 2019 President's Budget increases POE Security by $3.5M to develop technologies for collecting POE data including biometrics to improve screening efforts at POEs.

Justification
This realignment will support development of software and hardware upgrades for CBP legacy 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. The project will also provide CBP with the capability to detect the transport of contraband and counterfeit merchandise at the POEs.

Performance
The FY 2019 funding increase for the Border Security Thrust area will allow S&T to increase its efforts to assist in improving CBP's effectiveness in detecting contraband at Ports of Entry (POEs) while increasing the throughput of legitimate travel and commerce. Upgrades to CBP scanning systems will improve performance, while significantly reducing operational and maintenance costs. Improved targeting and screening technology will reduce the number of vehicles requiring scanning and/or manual inspection by CBP Officers, potentially reduce CBP annual labor and facility costs, and increase the throughput of legitimate cargo.

Program Change 2 – CBE Defense

Description
The FY 2019 President's Budget realigns funding to support the Administration's priority on combatting drug abuse, addiction, and overdoses. The Opioid and Fentanyl Detection project will develop cost-effective detection systems to rapidly collect and exploit information useful for detecting opioids and fentanyls. Specifically, this project will pursue rapid prototyping and operational utility assessment of each prototype for the two most challenging operational scenarios: land borders and international mail-handling facilities. This effort in close partnership with CBP's Office of Field Operations (OFO), with support from the S&T's Transportation Security Laboratory (TSL) focuses on the development, operational assessment, and testing of prototype systems.

Justification
CBP plays a critical role in combating the flow of dangerous illicit drugs into the United States has identified a critical need for technologies to better detect opioids and fentanyls at land border POEs and at facilities handling international mail and parcel shipments. Additionally, Executive Order 13784, *Establishing the President's Commission on Combating Drug Addiction and the Opioid Crisis*, has set as a national priority a strengthened effort to "combat the scourge of drug abuse, addiction, and overdose (drug addiction), including opioid abuse, addiction, and overdose (opioid crisis)."

Performance
This program will deliver rapid screening-at-speed technologies for the detection and interdiction of opioids and fentanyls, increasing opioids seizures and removal from the drug supply chain, thereby, protecting the public, critical infrastructure, and the economy. The new R&D will help strengthen CBP performance at POEs and other counter-drug efforts, to seize and remove illicit opioid and fentanyl from the supply chain.

Program Change 3 – Cyber Security/Information Analysis

Description
The FY 2019 President's Budget transfers the Cyber Security/Information Analysis funding to the National Protection and Programs Directorate (NPPD). 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.

Justification
The transfer to NPPD is intended to prevent duplication of efforts in cyber security R&D and to maximize efforts to address emerging threats.

Performance
The transfer is intended to eliminate potential redundancies and help ensure a more efficient Government. With oversight of Federal Government cybersecurity, NPPD will assume the responsibility of maintaining a centralized cybersecurity R&D capability to help ensure countermeasures are available for known and emergent threats.

Program Change 4 – Apex

Description
The FY 2019 President's Budget realigns funding from the Apex Thrust in Border Situational Awareness (BSA) to support Administration and Secretary's immigration and border security priorities. The Budget also proposes to eliminate the cyber.gov Apex program.

Justification
The realignment of funding from the Apex program supports an effort to improve biometric and screening technologies for U.S. Customs and Border Protection (CBP) Officers at POEs. The funding prioritizes the Administration's and Secretary's priorities within available resources based on DHS's Integrated Product Team (IPT) process, which prioritized capability gaps throughout DHS that require research and development. This realignment focuses on improving border security and supports Executive Order: Border Security and Immigration Enforcement Improvements.

Performance
This strategic realignment will allow S&T to focus on the highest priority needs of DHS and the HSE. The BSA program is at the end of its project lifecycle and this funding realignment will not impact the project's performance.

Program Change 5 – Counter Terrorist

Description
The FY 2019 President's Budget includes first-time funding for Opioid/Fentanyl Detection.

Justification
This funding realignment will help deliver rapid screening-at-speed technologies for the detection and interdiction of opioids and fentanyls at CBP POEs and at international mail-handling facilities. Illicit opioid and fentanyl use is a growing public health threat, and S&T's R&D is vital to helping to seize these deadly substances, and prevent them from being trafficked into the heartland of America.

Performance
S&T will continue to conduct R&D in the Counter Terrorist thrust area, albeit with a lower level of funding, which will have minimal impact. The new R&D will help strengthen CBP performance at POEs and other counter-drug efforts to seize and remove illicit opioid and fentanyl from the supply chain.

Program Change 6 – Centers of Excellence

Description
The FY 2019 President's Budget reduces the number of COEs from seven to five in FY 2019.

Justification
The strategic reduction will allow S&T to focus R&D resources on Administration and DHS immigration and border security priorities. COEs that will receive FY 2019 funding conduct R&D that is aligned to the Administration's priorities to strengthen border security, cyber security and infrastructure protection, and trans-national criminal investigations.

Performance
Federal designation of the Coastal Resilience Center and of the Center for Awareness and Localization of Explosives-Related Threats as COEs will be eliminated, and $8.0M in federal support will be realigned within S&T's R&D budget. Component access to the remaining COEs will continue to be available through basic ordering agreements maintained by S&T. The Office of University Programs (OUP) will continue to harness 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 HSE through the remaining COEs.

Research and Development
Non Pay Budget Exhibits
Non Pay Summary

Organization *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Total Changes
Research, Development and Innovation	$430,124	$342,982	$289,734	($53,248)
University Programs	$40,500	$29,724	$21,746	($7,978)
Total	**$470,624**	**$372,706**	**$311,480**	**($61,226)**
Discretionary - Appropriation	$470,624	$372,706	$311,480	($61,226)

Non-Pay by Object Class

Non-Pay Object Classes *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
21.0 Travel and Transportation of Persons	$1,641	$1,295	$1,107	($188)
22.0 Transportation of Things	$26	$21	$18	($3)
23.2 Rental Payments to Others	$112	$89	$75	($14)
23.3 Communications, Utilities, and Misc. Charges	$3	$2	$2	-
25.1 Advisory and Assistance Services	$66,099	$53,042	$44,672	($8,370)
25.2 Other Services from Non-Federal Sources	$2,829	$2,241	$1,893	($348)
25.3 Other Goods and Services from Federal Sources	$221,194	$175,160	$148,147	($27,013)
25.5 Research and Development Contracts	$138,949	$111,372	$93,786	($17,586)
25.7 Operation and Maintenance of Equipment	$169	$134	$113	($21)
26.0 Supplies and Materials	$892	$707	$597	($110)
31.0 Equipment	$1,750	$1,386	$1,171	($215)
41.0 Grants, Subsidies, and Contributions	$36,960	$27,257	$19,899	($7,358)
Total - Non Pay Object Classes	**$470,624**	**$372,706**	**$311,480**	**($61,226)**

Research, Development, and Innovation – PPA

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

Organization *(Dollars in Thousands)*	FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Research, Development and Innovation	-	-	$430,124	-	-	$342,982	-	-	$289,734	-	-	($53,248)
Total	**-**	**-**	**$430,124**	**-**	**-**	**$342,982**	**-**	**-**	**$289,734**	**-**	**-**	**($53,248)**
Subtotal Discretionary - Appropriation	-	-	$430,124	-	-	$342,982	-	-	$289,734	-	-	($53,248)

RD&I provides state-of-the-art technology and/or solutions to meet the needs of DHS's operational Components and the first responder community. The PPA includes customer-focused and output-oriented RDT&E programs that balance risk, cost, impact, and time to delivery. RD&I includes the following thrust areas: Apex; Border Security; CBE Defense; Counter Terrorist; and First Responder/Disaster Resilience.

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

Budget Authority *(Dollars in Thousands)*	**FY 2017** **Enacted**	**FY 2018** **President's Budget**	**FY 2019** **President's Budget**
Enacted/Request	**$430,124**	**$342,982**	**$289,734**
Carryover and/or Recoveries (Actual/Estimates/Projections)	$140,210	$144,837	$76,528
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$570,334**	**$487,819**	**$366,262**
Collections – Reimbursable Resources	$34,651	$41,300	$41,300
Total Budget Resources	**$604,985**	**$529,119**	**$407,562**
Obligations (Actual/Projections/Estimates)	$425,257	$433,660	$368,648
Personnel: Positions and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

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

Budget Formulation Activity *(Dollars in Thousands)*	Positions	FTE	Amount
FY 2017 Enacted	**-**	**-**	**$430,124**
FY 2018 President's Budget	**-**	**-**	**$342,982**
FY 2019 Base Budget	**-**	**-**	**$342,982**
FY 2019 Current Services	**-**	**-**	**$342,982**
1 Border Security	-	-	$3,453
2 CBE Defense	-	-	$4,309
Total, Program Increases	**-**	**-**	**$7,762**
3 Cyber Security/Information Analysis transfer to NPPD	-	-	($46,248)
4 Apex Program	-	-	($10,762)
5 Counter Terrorist	-	-	($4,000)
Total, Program Decreases	**-**	**-**	**($61,010)**
FY 2019 Request	**-**	**-**	**$289,734**
FY 2018 TO FY 2019 Change	**-**	**-**	**($53,248)**

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

Non Pay Summary

Organization *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Total Changes
Research, Development and Innovation	$430,124	$342,982	$289,734	($53,248)
Total	**$430,124**	**$342,982**	**$289,734**	**($53,248)**
Discretionary - Appropriation	$430,124	$342,982	$289,734	($53,248)

Non Pay by Object Class

Non-Pay Object Classes *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
21.0 Travel and Transportation of Persons	$1,531	$1,213	$1,025	($188)
22.0 Transportation of Things	$26	$21	$18	($3)
23.2 Rental Payments to Others	$112	$89	$75	($14)
23.3 Communications, Utilities, and Misc. Charges	$3	$2	$2	-
25.1 Advisory and Assistance Services	$63,512	$51,106	$43,172	($7,934)
25.2 Other Services from Non-Federal Sources	$2,827	$2,240	$1,892	($348)
25.3 Other Goods and Services from Federal Sources	$219,632	$173,991	$146,978	($27,013)
25.5 Research and Development Contracts	$136,823	$109,838	$92,786	($17,052)
25.7 Operation and Maintenance of Equipment	$169	$134	$113	($21)
26.0 Supplies and Materials	$892	$707	$597	($110)
31.0 Equipment	$1,750	$1,386	$1,171	($215)
41.0 Grants, Subsidies, and Contributions	$2,847	$2,255	$1,905	($350)
Total - Non Pay Object Classes	**$430,124**	**$342,982**	**$289,734**	**($53,248)**

Non Pay Cost Drivers

Leading Non Pay Cost-Drivers *Dollars in Thousands*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Total Changes
Advisory and Assistance Services	$63,512	$51,106	$43,172	($7,934)
Research and Development Contracts	$136,823	$109,838	$92,786	($17,052)
Other Goods and Services from Federal Sources	$219,632	$173,991	$146,978	($27,013)
Other Costs	$10,157	$8,047	$6,798	($1,249)
Total Non Pay Cost Drivers	**$430,124**	**$342,982**	**$289,734**	**(53,248)**

NON PAY NARRATIVE:

- **Advisory and Assistance Services:** The primary driver in the decrease in FY 2019 is due to the transfer of Cyber Security funding.
- **Research and Development Contracts:** The primary driver in the decrease in FY 2019 is due to the transfer of Cyber Security funding.
- **Other Goods and Services from Federal Sources:** The primary driver in the decrease in FY 2019 is due to the transfer of Cyber Security funding.
- **Other Costs:** The reduction to RD&I yields a decreased need for travel, supplies, and equipment to support R&D Contracts.

Research, Development, and Innovation – PPA
Research and Development
Technology Readiness Level Exhibit

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

RD&I Thrust	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget
APEX Core	$78,974	$53,346	$42,584
BORDER SECURITY	$55,999	$48,401	$51,854
CBE DEFENSE R&D	$62,289	$52,641	$56,950
COUNTER TERRORIST	$74,636	$81,051	$77,051
CYBER SECURITY/INFORMATION ANALYSIS	$70,986	$46,248	$0
FIRST RESPONDER/DISASTER RESILIENCE	$87,240	$61,294	$61,294
TOTAL	$430,124	$342,982	$289,734

Apex – FY 2018: $53.3M. FY 2019 President's Budget: $42.6M. Apex is comprised of two programs, Apex Programs and Apex Engines, and consists of crosscutting, multi-disciplinary projects agreed to between leadership of each requesting DHS Component and the Under Secretary for Science and Technology.

Apex Programs – FY 2018: $35.3M. FY 2019 President's Budget: $24.6M.

Apex Screening at Speed (SaS)

- **Problem:** The Transportation Security Administration (TSA) requires detection technologies that effectively and efficiently screen people for concealed explosive threats. Currently, as people move through checkpoints they must remove outerwear, footwear, belts and headwear, slowing the line and decreasing public acceptance. False alarms are frequent, causing inconvenient and intrusive pat-downs and searches. In addition, TSA requires detection technologies that effectively and efficiently screen carry-on bags and items for explosive threats. Present-day X-ray technologies require manual review and frequently stop the line for unnecessary alarms.

- **Solution:** Apex SaS is developing technology that would enable the scanning of walking passengers, acquiring data through most garments and reliably detecting a wider range of prohibited items regardless of concealment. Future systems that record and analyze a wide array of data from

each bag would provide greater security while limiting the number of invasive, time-consuming false alarms, all without the need for today's cumbersome restrictions on removing electronic devices, liquids, aerosols, and gels from the bag for scanning.

- **Impact:** The Apex SaS Program will integrate screening tools with wide-area surveillance, behavioral analysis, credential authentication, risk-based screening, and other technologies to further reduce overall risk throughout an airport. As Apex SaS technologies enable the rapid screening of passengers and their belongings, it is anticipated that other operational uses, such as at special events and stadiums, and in mass transit, will become feasible. 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 system with flexible and adaptable capabilities will reduce security risks, reduce lifecycle costs, and facilitate rapid, cost-effective system upgrades as threats evolve.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	6,400	4,000	12,600	8,000	7,691
Obligations	5,894	3,607	3,500	-	-

FY 2017 Key Milestone Events

- Held preliminary design review for Advanced Imaging Technology (AIT; "person scanner") prototype(s) that would scan walking (~1 meters/second) passengers.
- Kicked off a prize competition that challenges developers to find anomalies on people using higher-resolution data for an S&T-funded prototype millimeter-wave AIT system.
- Delivered a prototype system to TSL that uses X-ray diffraction to screen personal and carry-on-sized items.
- Accepted draft performance report for a prototype laser system that illuminates and energizes substances for optical trace detection.
- Delivered system-specific final reports for all Qualification Readiness Assistance and Qualification Readiness Testing activities conducted on systems provided by original equipment manufacturers (OEMs) such as: Active Millimeter Wave; X-ray Backscatter; Handheld Resolution Tools; Enhanced Metal Detectors; Advanced Technology X-Ray systems; Computed Tomography (CT) X-ray systems; alternative checkpoint technologies; Bottled Liquid Scanners and their alternatives.
- Delivered final report for a carry-on-sized bag scanner. Tests performed at the Transportation Security Laboratory (TSL) used stream-of-commerce items and/or real threats.
- Held a workshop with security stakeholders that will develop requirements for aviation security technologies.

FY 2018 Planned Key Milestone Events

- Using representative data, demonstrate algorithms to associate passengers and their belongings using video analytics. Passenger-baggage correlation is a required technology for risk-based screening in a single checkpoint lane.
- Complete testing and accept a test and evaluation report regarding a prototype capable of scanning for aviation-size threats, suitable for use if a passenger were in motion at a walking pace.

- Complete testing and accept report for a device capable of detecting trace explosive residue in a laboratory environment, at a standoff distance of 50 centimeters. The ability to detect explosive residues using non-contact technology may be used in the future in-line with carry-on screening systems to reduce false alarms, or as part of a curb-to-gate architecture to identify explosive residues at range.
- Transition a passenger screening algorithm to TSA, capable of processing inputs and detecting threats from any Digital Imaging and Communication for Security (DICOS) compliant passenger imaging system.

FY 2019 Planned Key Milestone Events

- Demonstrate the use of a third-party threat algorithm on an S&T prototype AIT system using open standards.
- Demonstrate an AIT system capable of screening passengers at a walking pace while scanning for aviation-size threats.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Reported on phase contrast imaging system.	FY 2017 Q1	FY 2018 Q3
Assessed phase contrast research prototype for applicability to TSA missions.	FY 2017 Q1	FY 2017 Q4
Refined design and performance of a Widely Tunable Infrared Source quantum cascade laser system.	FY 2017 Q1	FY 2017 Q2
Researched components and configuration, and design an AIT, "person scanner") prototype.	FY 2017 Q1	FY 2017 Q4
FY 2018		
Using representative data, demonstrate algorithms to associate passengers and their belongings using video analytics.	FY 2017 Q2	FY 2018 Q3
Complete testing and accept a test and evaluation report regarding a prototype capable of scanning for aviation-size threats, suitable for use if a passenger were in motion at a walking pace.	FY 2016 Q3	FY 2018 Q4
Complete testing and accept report for a device capable of detecting trace explosive residue in a laboratory environment, at a standoff distance of 50 cm.	FY 2017 Q2	FY 2018 Q3
Transition a passenger screening algorithm to TSA, capable of processing inputs and detecting threats from any DICOS-compliant passenger imaging system.	FY 2018 Q2	FY 2018 Q4
FY 2019		
Demonstrate a third party automatic threat recognition algorithm running on an S&T-funded prototype millimeter-wave AIT system using open standards.	FY 2018 Q1	FY 2019 Q3
Demonstrate a millimeter-wave AIT system capable of scanning for aviation-size threats, suitable for use if a passenger were in motion at a walking pace.	FY 2016 Q3	FY 2019 Q4

Type of Research

Developmental

Technical Readiness Level

The program plans to begin at Technology Readiness Level (TRL) 2 in FY 2016 and end at TRL 7 in FY 2021.

Transition Plans

- S&T is working closely with TSA to refine 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 TSL. Other Government customers may leverage this DT&E towards applications beyond the aviation environment.
- Screening device development spirals will be coordinated with TSA's recapitalization plans ensuring smooth and timely technology insertion.
- S&T will continue to engage industry through outreach events (Industry Days), Broad Agency Announcements, Prize Competitions 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 their 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 data into actionable information and intelligence, and (3) share that actionable information and intelligence with partner law enforcement agencies. The solution will be rolled-out in 3 phases or spirals:
  - Spiral 1 - focused on establishing enterprise information sharing capabilities for CBP.
  - Spiral 2 - focused on improving tactical response capabilities for CBP.
  - Spiral 3 - focused on providing strategic planning capabilities for CBP.

- **Impact**: This 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	2,913	8,794	9,279	5,800	2,347
Obligations	2,600	7,787	7,675	-	-

FY 2017 Key Milestone Events

- Conducted pilot of Spiral 1 of the BSA project focused on establishing enterprise information sharing for CBP.
- Performed Spiral 2 requirements analysis and develop requirements focused on tactical response for CBP.

FY 2018 Planned Key Milestone Events

- Perform integration and developmental testing of selected Spiral 2 solutions.
- Conduct pilot of Spiral 2 of the BSA project focused on improving tactical response for CBP.

FY 2019 Planned Key Milestone Events

- Initiate transition of selected Spiral 2 technologies into existing CBP system baseline, focused on improving tactical response.
- Perform integration and developmental testing of selected Spiral 3 solutions; focused on improving strategic planning for CBP.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Conducted pilot of Spiral 1 of the BSA project focused on establishing enterprise information sharing for CBP.	FY 2017 Q1	FY 2017 Q2
Transitioned Spiral 1 enterprise information sharing capability into existing CBP system baseline.	FY 2017 Q3	FY 2017 Q4
Performed Spiral 2 requirements analysis and develop requirements focused on tactical response for CBP.	FY 2017 Q1	FY 2017 Q2
FY 2018		
Perform integration and developmental testing of selected Spiral 2 solutions.	FY 2017 Q3	FY 2018 Q2
Conduct pilot of Spiral 2 of the Border Situational Awareness project focused on improving tactical response for CBP.	FY 2018 Q3	FY 2018 Q4
FY 2019		
Initiate transition of selected Spiral 2 technologies into existing CBP system baseline, focused on improving tactical response.	FY 2019 Q1	FY 2019 Q3
Perform integration and developmental testing of selected Spiral 3 solutions; focused on improving strategic planning for CBP.	FY 2019 Q1	FY 2019 Q4

Type of Research

Developmental

Technical Readiness Level

The program began TRL 5 in FY 2017 or higher (multiple technologies are being pursued) and will end at TRL 7 in FY2020.

Transition Plans

- Pilot integrated enterprise proof-of-concept situational awareness capabilities at select border locations.
- Establish operational utility and prove cost/benefit of situational awareness capabilities.

- Enhance situational awareness capabilities based on user-defined operational needs and field analysis.
- Demonstrate enterprise level initial operating capability and transition to CBP.
- Assist CBP in implementing enterprise level 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 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	13,090	10,039	10,000	4,000	5,000
Obligations	7,597	2,761	-	-	-

FY 2017 Key Milestone Events

- Completed Financial Sector Requirements Analysis.

FY 2018 Planned Key Milestone Events

- 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. Transition efforts will correspond to, and coincide with the two project / technology topic areas identified in the Tech Foraging phase each year.
- 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.

FY 2019 Planned Key Milestone Events

- Conduct testing and evaluation of technologies in three additional project areas to address cyber gaps in sector.
- Transition, or make available, proven prototype technologies in the areas of Orchestration, Metrics & Measurements, and Restoration to

Financial Services Sector Institutions or other Critical Infrastructure Sectors.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Partnered 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
Conducted 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
Established Other Transaction Authority agreement to rapidly test and transition technology solutions to the FSS.	FY 2017 Q2	FY 2017 Q3
Conducted 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 T&E 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 startup community to address high priority threat areas identified in market survey.	FY 2018 Q2	FY 2018 Q4
FY 2019		
Conduct testing and evaluation of technologies that address Orchestration for the FSS.	FY 2019 Q2	FY 2019 Q4
Continue to interface with the Silicon Valley Innovation Program (SVIP) to solicit new calls and select awards for the Restoration OTA.	FY 2019 Q1	FY 2019 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 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 the problem.

Apex Cyber.gov

- **Problem:** Government networks and those that run the Nation's 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 an architecture that mitigates modern threats by leveraging best practices and implementable solutions with minimal impact to workforce efficiency. S&T plans to develop a data correlation and data analytics capability in partnership with NPPD and other Federal agencies.

- **Impact:** This effort could 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.

- Program funding is not requested in FY 2019.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	-	10,000	10,000	8,000	-
Obligations	-	9,117	8,554	-	-

FY 2017 Key Milestone Events

- Draft of the cyber security architecture including presentation and detailed schemas.
- Draft of baseline requirements per components of the cyber architecture.

FY 2018 Planned Key Milestone Events

- Release final evaluation of the utility of classified signatures.

- Initiate internal red team review of Architecture Specification, Capabilities, and components documents, to include presentations and detailed schemas of architecture. Release documents via Federal Register to Cybersecurity Community.
- Construct a testbed replica(s) of selected D/As, to include the integration of Software Defined Perimeter, a Trust Central System and other new architecture components. Quality Assurance analysis will be conduct via Red Team review of integrated environment, prototype and pilot demonstrations.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
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 available to all interested government agencies.

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. In collaboration with Model & Simulation Engine (MS-E), Communications & Networking (CN-E), and Situational Awareness and Decision

Support (SANDS-E), 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	6,628	4,542	4,546	4,546	4,546
Obligations	6,632	3,657	3,424	-	-

FY 2017 Key Milestone Events

- Demonstrated NGFR technology, incorporating additional technologies and functionality of including the Wearable Communications Hub, advanced environmental and physiological monitoring, and enhanced data analytics.
- Conducted 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 Planned Key Milestone Events

- Conduct a PlugFest with industry vendors relevant to at least one portion of the NGFR system architecture (e.g., wearables).
- Develop working draft of the NGFR Interface Control Document to raise industry awareness of the standards, data formats and interfaces NGFR devises are using.
- Publish recommendations to better prepare public safety agencies to counter electronic threats, using the analysis from the 2017 First Responder Electronic Jamming Exercise.

FY 2019 Planned Key Milestone Events

- Conduct a Technology Integration Demonstration event (Spiral 4), incorporating additional technologies and functionality from the Spiral 3 and PlugFest events, including environmental and physiological monitoring augmented intelligence-enabled data synthesis, and personal protective equipment.
- Conduct the 2019 First Responder Electronic Jamming Exercise to evaluate how technologies and tactics reduce the impact of intentional and unintentional interference on first responder communications systems.
- Transition, commercialize, or make available through open source platforms at least three technologies (e.g., analyses, models, technology prototypes and/or knowledge products).

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Conducted DHS Component Communications Experiment in Boston, MA.	FY 2017 Q1	FY 2017 Q1
Completed technology foraging for 3D indoor mapping and visualization.	FY 2017 Q2	FY 2017 Q3
Updated the communication hub software to transmit voice data over the network.	FY 2017 Q2	FY 2017 Q4
Demonstrated 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
FY 2018		
Conduct a PlugFest with industry vendors relevant to at least one portion of the NGFR system architecture (e.g., wearables).	FY 2018 Q1	FY 2018 Q2
Publish recommendations to better prepare public safety agencies to counter electronic threats, using the analysis from the 2017 First Responder Electronic Jamming Exercise.	FY 2018 Q3	FY 2018 Q3
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
FY 2019		
Conduct a Technology Integration Demonstration event (Spiral 4), incorporating additional technologies and functionality from the Spiral 3 and PlugFest events, including environmental and physiological monitoring augmented intelligence-enabled data synthesis, and personal protective equipment.	FY 2019 Q1	FY 2019 Q4
Transition, commercialize, or make available through open source platforms at least three analyses, models, technology prototypes and knowledge products.	FY 2019 Q2	FY 2019 Q4
Conduct the 2019 First Responder Electronic Jamming Exercise to evaluate how technologies and tactics reduce the impact of intentional and unintentional interference on first responder communications systems.	FY 2019 Q1	FY 2019 Q4

Type of Research
Developmental

Technical Readiness Level
The program begins at TRL 2 and ends at TRL 6.

Transition Plans

- S&T's First Responder Group (FRG) has initiated a portfolio approach to integration of capabilities for the NGFR Apex program. All initiatives are 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:** Floods are the most common natural disaster in the United States, and have claimed countless lives and caused significant economic losses. Communities need new and emerging technologies to increase their resilience to flood disasters and provide flood predictive analytic tools to the Federal Emergency Management Agency (FEMA) and to state and local governments to reduce future flood fatalities and economic damages.

- **Solution:** This Apex program will develop new processes, products (sensors, data sets, analytic tools, imagery) and standards to improve operations and outcomes in FEMA (including the Flood Insurance and Mitigation Administration, flood assistance programs and dam safety programs), other Federal agencies and the insurance industry. It is developing low-cost, network-connected flood sensors to improve regional and local flood prediction; new machine learning algorithms to detect buildings and other structures in hi-res satellite imagery, which will in turn create a national inventory of structures to improve flood insurance risk evaluations and underwriting; and a variety of standards and

specifications to support individual and community investments in flood-proofing products. These innovations will 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: 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; and 6) reduce property damages and increase flood insurance cost savings options.

Sub Projects

- New flood sensors and alerting: 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. Create flood alert models, tuned to local terrain; that can provide longer lead-times and more accurate geo-targeting. Investigate the potential of adapting these technologies to dam/levee integrity monitoring.
- Smarter remote sensing and situational awareness: Utilize a cross-section of imaging technologies and practicality of developing, including aerial LiDAR and high-resolution satellite based synthetic aperture radar, plus emerging technologies such as unmanned aerial systems, to improve the image base, exploit historical satellite imagery, and exploit emerging digital elevation modeling technologies to improve the definition and accuracy of flood hazard areas, including flood hazards in areas not included in FEMA Special Flood Hazard Areas (SFHAs).
- New products from high performance computing and artificial intelligence: Apply computer learning technologies and facial recognition algorithms to the development of a national inventory of structures database for flood-prone areas, especially for identified FEMA Special Flood Hazard Areas; SFHAs, including type of structure, elevation, tax assessment, ownership and other relevant data. Work with private sector companies to investigate the feasibility of transitioning the national structures inventory to become a commercial product that supports flood and other disaster insurance underwriting.
- Realigned economic incentives and risk analysis: Support more cost-effective investment decisions improving the resiliency of residential properties, business continuity and public/private infrastructure resilience by improving the mitigation 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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	2,295	5,000	5,000	5,000	5,000
Obligations	2,114	4,544	3,278	-	-

FY 2017 Key Milestone Events

- Completed Tsunami Module for FEMA HAZUS program.

FY 2018 Planned Key Milestone Events

- Demonstrate the technical capability to issue geo-target flood alerts.
- Develop technology and plan to scale geo-targeted flood alerts nationally.
- Demonstrate the technical capability to issue geo-targeted flood alerts.
- Make a determination on the feasibility of near real-time monitoring of dam/levee integrity.
- Deploy the first phase of a structure-level data utility service that provides insurers, flood plain managers and consumers with DEM.
- Determine 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.
- Complete evaluation of the private flood insurance market and ways to close the flood insurance gap in the U.S.

FY 2019 Planned Key Milestone Events

- Complete demonstrations of flood modeling techniques that generate structure-level flood risk scores
- Complete demonstration of technologies that provide wide area rapid damage assessments
- Complete national guidelines for core flood decision information requirements for first responders and emergency managers
- Complete best practices for deployment of Internet of Things (IoT) sensors for high priority use cases
- Complete additional standards for flood-proofing for sealants, semi-permanent water barriers and for smart flood sensors.
- Develop criteria for national standards for assessment, monitoring, and reporting of state and municipally-owned dams in collaboration with the National Dam Safety Program.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Put SUMMIT into production at FEMA as the first generation release of a possible flood hazard modeling framework..	FY 2017 Q3	FY 2017 Q3
Completed development of technologies required for the National Structures Inventory.	FY 2017 Q4	FY 2017 Q4
Completed the Tsunami Module for the FEMA HAZUS program.	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 current and historical flood risk information.	FY 2017 Q3	FY 2018 Q4
Complete evaluation of the private flood insurance market and ways to close the flood insurance gap in the U.S.	FY 2018 Q4	FY 2018 Q4
FY 2019		
Pilot demonstration of flood modeling technologies to provide structure level flood risk scores for community resilience	FY 2019 Q1	FY 2019 Q1
Pilot demonstration of remote sensing technologies to provide wide area rapid damage assessments to streamline disaster assistance and restore community services	FY 2019 Q1	FY 2019 Q1
Develop national guidelines for core information requirements to meet Flood Decision support requirements for first responders and emergency managers	FY 2019 Q2	FY 2019 Q2
Develop best practices for low cost IOT flood sensors for storm water management	FY 2019 Q2	FY 2019 Q2
Develop best practices for low cost IOT snesors for dam/levee safety monitoring	FY 2019 Q3	FY 2019 Q3
Extend ANSI national flood abement standards for flood sealant and semi-permanent barrier products and smart flood sensors	FY 2019 Q4	FY 2019 Q4
Develop criteria for national standards for assessment, monitoring, and reporting of state and municipally owned dams in collaboration with the National Dam Safety Program	FY 2019 Q4	FY 2019 Q4

Type of Research

Applied

Technical Readiness Level

This program begins at TRL 2 and ends at TRL 6.

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 Engines: FY 2018: $18.0M. FY 2019 President's Budget: $18.0M. The Apex Engines provide a concentration of expertise, people, and knowledge capabilities that support multiple Apex programs and components. The Engines work across the S&T R&D portfolio to anticipate program needs and deliver quality support and services, as an example the SANDS-E is supporting Next Generation First Responder. 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 improves efficiency and serves the dynamic needs of S&T, mission critical operators, and the HSE.

Identity and Access Management Engine (IDAM-E)

- **Problem**: S&T programs 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 S&T program 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 programs.

- **Impact**: The IDAM Engine creates efficiencies for S&T 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	2,000	2,100	2,100	1,313	1,313
Obligations	1,585	1,927	1,728	-	-

FY 2017 Key Milestone Events

- Developed Global Entry Mobile Identity (GEMI) Solution proof of concept that will demonstrate enhancements to the Global Entry Process using mobile devices.

FY 2018 Planned Key Milestone Events

- Develop a tool, technology, or knowledge product that increases the security of the current CBP preclearance operations while improving the passenger experience.
- Develop 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 2019 Planned Key Milestone Events

- Develop and deliver synthetic data to support CBP, Global Travel Assessment System, Global Entry, and Electronics System for Travel Authorization programs.
- Develop and deliver identity management knowledge products that provide reusable best practices that allow organizations with online digital services to mitigate fraud and risk.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Develop a Global Entry Mobile Identity (GEMI) Solution proof of concept that will demonstrate enhancements to the Global Entry process using mobile devices.	FY 2017 Q1	FY 2017 Q4
FY 2018		
Enhancing Passenger Pre-Clearance 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
FY 2019		
Synthetic Data Generation and Tool Set.	FY 2018 Q3	FY 2020 Q3
Develop best practices for mitigating fraud and risk in online digital services.	FY 2018 Q3	FY 2020 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 S&T 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, DHS, and the HSE. The DA-E assists in problem definition and solutions development for DHS 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 DHS 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	4,461	4,250	5,000	5,211	5,211
Obligations	4,157	3,911	4,255	271	-

FY 2017 Key Milestone Events

- Delivered Knowledge Product report on text analysis functions of three big data platforms to inform future DHS investments based on the skill set of the end user, the type of problem that needs to be solved, and the product's financial resources.
- Completed evaluation of capabilities by subject matter experts to detect and characterize live streaming/video analytical capabilities to improve DHS and law enforcement abilities to find relevant, actionable content.
- Provided a tailored solution to complete two operational tests of open source and social medial analytic tools with DHS Components.
- Delivered report evaluating 275 open source and social media tools to support DHS screening and vetting missions and inform future R&D needs.

FY 2018 Planned Key Milestone Events

- Conduct experiments and deliver reports and recommendations regarding the use of automated image, video, and speech analytics to meet DHS mission needs for immigration and border security as well as other 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 including Smart Cities.
- Deliver an analysis of advanced analytic applications such as graph processing capabilities to U.S. 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.

FY 2019 Planned Key Milestone Events

- Partner with industry and universities to document, analyze and assess the performance of the latest advanced analytics and computational methods to identify significant threats and opportunities for DHS, Components and the HSE.
- Develop an advanced concept prototype, experiments and technical reports to help DHS discern data, analytics and computational architecture requirements for next generation mission and operations analytic systems.
- Deliver technical reports that are based upon laboratory analysis and experimentation with advanced analytics and computation technologies that pose significant homeland security threats and/or offer significant mission opportunities to improve enterprise knowledge and appropriately support acquisition decision making for components and HSE.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Delivered Knowledge Product report on text analysis functions of three big data platforms.	FY 2017 Q1	FY 2017 Q1
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, CBP, and CWMD that demonstrate significant mission impact for national security, including nuclear threat detection and critical infrastructure protection; customs fraud; adversarial activity; and counter-proliferation.	FY 2018 Q1	FY 2018 Q4
FY 2019		
Conduct experiments and deliver reports and recommendations regarding the use of automated image, video, and speech analytics to meet DHS mission needs for immigration and border security as well as other DHS missions.	FY 2019 Q1	FY 2019 Q4
Deliver technical reports that provide components and members of HSE with specific technical information regarding technology threats and opportunities related to advanced data analytics and computation environments.	FY 2019 Q1	FY 2019 Q4
Deliver technical reports, briefings, and demonstrations to components and members of HSE that form the basis for operational strategy and acquisitions to achieve next generation data, analytics and computational capabilities.	FY 2019 Q1	FY 2019 Q4

Type of Research

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

Technical Readiness Level

DA-E projects range from TRL 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**: Prior to the M&S Engine being formed, there was not a centralized organization within DHS to coordinate Modeling & Simulation (M&S) activities or to serve as a Subject Matter Expert (SME) on the subject. 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**: By creating the M&S Engine, S&T was established a highly-capable M&S team of SMEs, with significant inter- and intra-agency coordination linkage. 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 allows M&S analytical capabilities and best practices to be coordinated across programs.

- **Impact**: The M&S Engine increases the efficiency of DHS Component operators, eliminate duplication and save resources and money. The MS-E enhances S&T's collaboration with DOD and other agency partners in the M&S domain, and leverages best practices to ensure a coordinated M&S approach for S&T's programs and other Component efforts. This coordinated approach assists mission critical programs by providing emergent and impactful M&S capabilities leveraged from across the Government to ensure the safety of frontline agents and citizens.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	820	1,696	1,500	1,876	1,876
Obligations	1,005	1,657	1,879	-	-

FY 2017 Key Milestone Events

- Initiated the coordination of NGFR scenario development utilizing immersive simulation technologies supporting NGFR training development through subject matter expertise, knowledge products, and best practices.
- Began development of an 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 S&T M&S capabilities contributing to information sharing and delivering knowledge products.
- Established an initial Counter Unmanned Aerial System (CUAS) Modeling and Simulation environment for S&T and Component activities; contributes directly to 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 2018 Planned Key Milestone Events

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

FY 2019 Planned Key Milestone Events (Budget Year

- Establish and manage coordination of a DHS M&S Community of Practice (CoP) in coordination with DHS Component and inter-agency partners. This effort leverages enterprise information sharing tools, such as SharePoint, to maintain a collaborative environment for CoP members.
- Provide technical enhancements to the modeling and simulation capabilities executed on behalf of the PEO UAS, extending the fidelity of analysis provided to DHS Component and inter-agency HSE partners in the Counter-UAS domain.
- Develop augmented reality (AR) and virtual reality (VR) modeling capabilities in collaboration with the Federal Law Enforcement Training Centers (FLETC), and provide technical subject matter expertise support to FLETC in the M&S and virtual training domains.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Initiate the coordination of 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 S&T Modeling and Simulation Coordination Strategy in collaboration with the DOD DMSCO; extending DMSCO's existing M&S Catalog and EMBR to include S&T M&S capabilities contributing to information sharing and delivering knowledge products.	FY 2017 Q1	FY 2017 Q3
Establish an initial CUAS Modeling and Simulation environment for S&T and Component activities; contributes directly to S&T 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 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 2018 Q4
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 2018 Q3
Finalize co-development of DHS M&S Catalog in coordination with DMSCO using EMBR tools, and populate catalog with comprehensive list of S&T M&S capabilities.	FY 2017 Q3	FY 2018Q3
FY 2019		
Establish DHS M&S CoP in coordination with DHS Component and inter-agency partners. Leverage enterprise information sharing tools, such as SharePoint, to maintain a collaborative environment for CoP members.	FY 2018 Q1	FY 2019 Q4
Continue enhancement of C-SMART capabilities and execute analysis in support of DHS Component and inter-agency HSE partners in the Counter-UAS domain.	FY 2018 Q1	FY 2019 Q3
Develop augmented reality (AR) / virtual reality (VR) modeling capabilities in collaboration with the FLETC: virtualize a training site utilizing AR/VR technology.	FY 2018 Q1	FY 2019 Q4

Type of Research

Developmental and Applied

Technical Readiness Level

TRL 7 and above

Transition Plans

FY 2018

- Establish Counter Small Unmanned Aerial Systems Advisory and Review Toolkit (C-SMART) 2.0 capabilities for the PEO UAS. C-SMART enhancements provide significant additions 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, the U.S. Secret Service (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 S&T M&S capabilities. Transition Customers include: S&T CBD, S&T Apex Engines, and other M&S stakeholders.

FY 2019

- Establish and manage coordination of a DHS M&S Community of Practice (CoP) in coordination with DHS Component and inter-agency partners. This effort leverages enterprise information sharing tools, such as SharePoint, to maintain a collaborative environment for CoP members. DHS Component participants include, but not limited to TSA, CBP, USSS, FLETC, and other DHS Components; inter-agency partners include DOD agencies.
- Provide technical enhancements to the modeling and simulation capabilities executed on behalf of the PEO UAS, extending the fidelity of analysis provided to DHS Components and inter-agency HSE partners in the Counter-UAS domain. Transition Customers include DHS S&T's Program Executive Office Unmanned Aerial Systems (PEO UAS), DHS Component and inter-agency HSE partners to include the Federal Bureau of Investigations (FBI), etc.
- Develop AR/VR modeling capabilities in collaboration with the FLETC, and provide technical SME support to FLETC in the M&S and virtual training domains. Transition Customers include FLETC.

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

- **Problem**: Government-developed technologies risk failure in transition due an insufficient understanding of the ways in which new solutions will impact customers' missions before, during, and after implementation.

- **Solution**: BESS-E helps S&T's programs bridge the transition gap by providing independent and objective support prior to and during technology transition. Using social science methodologies such as focus groups, interviews, quantitative and qualitative data analyses, organizational assessments, logic models, and metrics development and evaluations, BESS-E helps S&T programs anticipate and mitigate potential barriers to adoption.

- **Impact**: BESS-E increases the likelihood of successfully technology transition by providing programs with actionable recommendations based on measures of short and long-term success in process, impacts, outcomes, and unintended consequences of technology implementation.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	1,101	1,479	1,500	1,500	1,500
Obligations	989	887	590	-	-

FY 2017 Key Milestone Events

- Identified the ways in which first responders recognize electronic jamming.
- Developed mitigation strategy knowledge products to be tested at the next First Responder Electronic Jamming Exercise.
- Utilized subject matter expertise to develop report prioritizing intelligence information for CBP to inform critical processes including managing requirements, operational planning, and resource allocation.

FY 2018 Planned Key Milestone Events

- Provide a knowledge product to FEMA with recommendations that to decrease uninsured flood losses.
- Provide knowledge product to NGFR assessing the effectiveness of selected electronic jamming mitigation strategies and recommended improvements for future exercises.
- Deliver a framework, based on data collections that enhances and streamlines the CBP Border Patrol's Capability Gap Analysis Process.
- Deliver a report detailing the types of footwear worn by airline passengers and passenger perceptions of millimeter-wave footwear scanners for use in the screening process; the findings will directly contribute to the joint development of this technology by DHS S&T and DOE's Pacific Northwest National Laboratory.
- Deliver report that includes best practices to integrate seamlessly with existing first responder processes and technologies, recommended technology improvements, and communication strategies targeting both the end users and the public regarding the purpose and impact of the technologies they may encounter.
- Use tailored solutions and best practices to support Apex Flood in understanding uninsured flood losses.
- Use tailored solutions and best practices to support Apex Flood to communicate risk and crisis warnings to the public for an imminent flood event
- Deliver report on end-user perceptions of new technologies used by the Innovation Task Force at TSA (Apex-Screening at Speed).

FY 2019 Planned Key Milestone Events

- Deliver a report identifying public perceptions surrounding first responder use of unmanned vehicles for several different use cases to DHS S&T's Program Executive Office Unmanned Aerial Systems. This information can be shared with local first responder organizations.
- Identify barriers and facilitators to technology transition at New York Police Department (NYPD) based on the 2018 Critical Incident Management Technology Assessment (CIMTA) Active Shooter Exercise.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Conducted process evaluation of PlugFest. Identified key participant perceptions about PlugFest events and provided recommendations for maximizing event value.	FY 2017 Q1	FY 2017 Q2
Conducted focus groups with Border Patrol agents to better understand their prioritization of intelligence information and quantified the data for use in Border Patrol's newly developed modeling and simulation system.	FY 2017 Q1	FY 2017 Q3

Evaluated current process and developed a process for improving the Android Tactical Assault Kit (ATAK) training and training materials.	FY 2017 Q3	FY 2017 Q4
Developed data collection plans and protocol for JamX 2017.	FY 2017 Q3	FY 2017 Q4
Developed process evaluation framework for US Border Patrol's Capability Gap Analysis Process.	FY 2017 Q2	FY 2017 Q3
Observed CIMTA exercise and conducted interviews with key stakeholders.	FY 2017 Q4	FY 2018 Q3
FY 2018		
Develop and field a survey in three Virginia counties to ascertain the reasons why residents do/not acquire flood insurance.	FY 2018 Q2	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
Delivered report containing data analysis and recommendations for more efficient planning of future exercises (JamX 17).	FY 2018 Q1	FY 2018 Q1
Deliver recommendations for enhancing and streamlining the Border Patrol's Capability Gap Analysis Process (CGAP).	FY 2018 Q2	FY 2018 Q3
Develop and implement evaluation of newly developed Android Tactical Assault Kit (ATAK) training process and materials.	FY 2018 Q2	FY 2018 Q4
Develop protocols and conduct data collection on the types of footwear worn by airline passengers.	FY 2018 Q2	FY 2018 Q3
Identify stakeholder and passenger perceptions on the use and integration of a millimeter-wave footwear scanner in the passenger screening process.	FY 2018 Q2	FY 2018 Q3
FY 2019		
Develop data collection plan to ascertain public perceptions of law enforcement use of UAS.	FY 2019 Q1	FY 2019 Q2
Deliver communications strategies to first responder organizations to aid them in improving public perception of UAS use.	FY 2019 Q2	FY 2019 Q3
Deliver report detailing potential facilitators and barriers to technology acceptance to NYPD for the technologies used in the CIMTA Exercise.	FY 2019 Q1	FY 2019 Q1

Type of Research

Applied

Technical Readiness Level

N/A – BESS-E develops and provides knowledge products tailored to individual program needs.

Transition Plans

BESS-E serves as a research support function for S&T programs. The research aids in the transition of federally developed technologies and contributes to increased effectiveness of S&T customers' missions.

Communications & Networking Engine (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 Communications and Network Engine (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 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**: CN-E will benefit S&T programs as they achieve greater level of communications interoperability between Federal, state, local and tribal agencies. This will dramatically impact the programs' ability to communicate mission-critical information as they carry out their daily tasks of saving lives and protecting properties.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	3,150	2,274	2,300	2,752	2,752
Obligations	2,874	2,600	2,111	-	

FY 2017 Key Milestone Events

- Documented the technology demonstration outcome from Next Generation First Responder Apex Program Spiral 2.
- Developed knowledge product to inform future path for voice and data communications interoperability at the Federal, state and local agencies.
- Provided subject matter expertise to support planning, integration, and on-site technology demonstration for a mobile ad-hoc networks (MANET) communications system.
- Offered tailored solutions by documenting field exercise results from the MANET's ability to support CBPs communication requirements in border areas.
- Offered tailored solutions by publishing user knowledge products focusing on the MANET's ability to support CBP's communication requirements in border areas.
- Transitioned to Broadband Communications Networks and Advanced Applications and Services: Datacasting Network in FY 2016 plus several follow-on upgrades deployed with the City of Houston during FY 2017.

FY 2018 Planned Key Milestone Events

- Datacasting System allows public safety officials and responders to securely send and stream encrypted video, text messaging, and other files using a dedicated portion of digital broadcast television spectrum. CN-E will pilot Datacasting with at least one additional state public safety agency during FY 2018.
- Offer tailored solutions by publishing user knowledge products focusing on the MANET's ability to support CBP's communication requirements in border areas.
- Provision a deployable communication 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.

- Phase 1 of the Speech Analytic project: Document the performance of existing voice recognition technology in First Responder operational environments and develop requirements for improved performance as needed.

FY 2019 Planned Key Milestone Events

- NGFR Apex Program's Spiral 3 Technology Integration and Experimentation – provide the communications and networking technologies funded by CN-E engine and other S&T projects to assist public safety first responders to exchange voice, data and video information to improve responders' situational awareness and to further foster the Internet of Things (IoT) sensor data communications.
- Phase 2 of the Speech Analytic project: Develop the Speech recognition and analytic project to implement mobile application on user device (e.g., smartphone). Document the performance of the improved voice recognition technologies at an S&T technology experimentation event.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Document the technology demonstration outcome from Next Generation First Responder Apex Program Spiral 2	FY 2017 Q1	FY 2017 Q4
Technology demonstration for the MANET communications system for the NYPD and document the outcome.	FY 2017 Q1	FY 2017 Q3
FY 2018		
Provision a standalone deployable communications 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
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
Conduct a pilot Datacasting system with at least one additional state public safety agency during FY 2018	FY 2018 Q1	FY 2018 Q4
FY 2019		
NGFR Apex Program's Spiral 3 Technology Integration and Experimentation – provide the communications and networking technologies funded by CN-E engine and other S&T projects to assist public safety first responders to exchange voice, data and video information to improve responders' situational awareness and to further foster the IoT sensor data communications.	FY 2019 Q1	FY 2019 Q3
Document the technology demonstration outcome from the Phase 2 of the Speech Analytic project at an S&T technology experimentation event (e.g., Spiral 3 or PlugFest).	FY 2019 Q1	FY 2019 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: Portable network device that will interface all band classes of public/commercial broadband carriers, enabling first responder communications where communications network infrastructure are unavailable – FY 2017/18 to NGFR Apex. MANET – FY 2017 Q3 to BSA Apex.
- 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 and 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-E provides S&T programs 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-E ensures that S&T programs 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 defined requirements.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	3,468	2,751	2,300	1,939	1,939
Obligations	3,193	2,522	2,101	-	-

FY 2017 Key Milestone Events

- Provided subject matter expertise to assess target architecture for National Maritime Domain Awareness Architecture (NMDAA) operations.
- Assessed Situational Awareness tools for inclusion within the NMDAA.
- Developed Data Framework for NMDAA.
- Provided subject matter expertise to assess architecture for the Flood Decision Support Tool including the review and assessment of existing architecture application environments.
- Designed an operational Request for Information (RFI) capability within DHS architecture environment for CBP.

FY 2018 Planned Key Milestone Events

- 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).

FY 2019 Planned Key Milestone Events

- IoT Intelligent Building Infrastructure Sensors – prototype, test and evaluate sensor suite (e.g. Smoke Alarms and Exit Signs) with integrated technology (e.g. Wi-Fi, Thermal and Imagery) for stakeholder acceptance and commercial industry adoption.
- Sensor Architecture Framework Environment – deliver Next Generation First Responder SmartHub (e.g. IoT sensors and Communications) framework for industry adoption.
- Prototype IoT Intelligent Building Infrastructure sensors with stakeholder community.
- Prototype UAS platform and sensor payload for mass transit tunnel search and reconnaissance.
- Test and evaluate Smart City Interoperable Reference Architecture (SCIRA) with selected stakeholder community for practical implementation and cyber security protocols.
- Counter Violent Extremism (CVE) – deploy, test and evaluate a CVE data architecture for online access of available, local service providers to deter or divert at-risk individuals that do not meet thresholds for law enforcement intervention.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Develop draft Public Safety & Communications ICAM Procurement Guidance and implementation for First Responder community (e.g. SAFECOM and FirstNet) in support of the NGFR Apex.	FY 2017 Q2	FY 2018 Q2
Deploy 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 Q4	FY 2018 Q3
Assess IoT Intelligent Building Infrastructure sensors and building codes for 3-D imaging, imagery and motion detection.	FY 2017 Q4	FY 2018 Q3
Assess UAS as a delivery platform for IoT sensors for mass transit tunnel search and reconnaissance.	FY 2017 Q4	FY 2018 Q3
FY 2018		
Build out, test and recommend Identity Credential and Access Management (ICAM) 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 Q4	FY 2019 Q2
CVE – design and develop a database to identify, collect and retrieve available local service providers to deter or divert at-risk individuals that do not meet thresholds for Law Enforcement intervention.	FY 2018 Q1	FY 2018 Q4
FY 2019		
Sensor Architecture Framework Environment – deliver Next Generation First Responder SmartHub (e.g. IoT sensors and Communications) framework for industry adoption	FY 2018 Q2	FY 2019 Q2
Prototype IoT Intelligent Building Infrastructure sensors with stakeholder community	FY 2018 Q3	FY 2019 Q3
Prototype UAS platform and sensor payload for mass transit tunnel search and reconnaissance.	FY 2018 Q3	FY 2019 Q3
CVE –deploy, test and evaluate a CVE data architecture for on-line access of available, local service providers to deter or divert at-risk individuals that do not meet thresholds for Law Enforcement intervention	FY 2019	FY 2019 Q4

Type of Research

Applied and Developmental.

Technical Readiness Level

TRL 2 to 7.

Transition Plans

FY 2018

- Evaluate Trust Framework capability solution(s) for Public Safety and Communications stakeholders and deliver results to SAFECOM and FirstNet in support of NGFR Apex. Transition: SAFECOM / FirstNet.

- Expand request for information tool functionality within DHS architecture environment for use on mobile, secure and disconnected communications by CBP field agents. Transition: CBP & OCIO.
- Deliver Identity, Credential and Access Management procurement and implementation guidance to SAFECOM and FirstNet for stakeholders (e.g. State and local government First Responder community)
- Release implementation guidance for Smart City Interoperable Reference Architecture (SCIRA) IoT Sensor standards framework through the standards body (e.g. Open Geospatial Consortium).

FY 2019

- Deliver prototype IoT Intelligent Building Infrastructure sensors to stakeholder partners (e.g. Boston Fire Department, National Institute of Building Standards, Government Service Administration) for test and evaluation.
- Deliver prototype UAS platform and sensor payload for mass transit tunnel search and reconnaissance. Transition: Boston Fire Department and industry stakeholders.
- Deliver Sensor Architecture Framework Environment an open architecture framework for industry evaluation and sponsor PlugFests to First Responder stakeholder community and support application development transitions.

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 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 DHS 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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	-	408	408
Obligations	-	-	-	-	-

FY 2018 Planned Key Milestone Events

- Compile and analyze S&T portfolio of biometric programs, to include working groups, capabilities, use cases, and customers.
- Build, maintain, and grow an accessible biometric "body of knowledge" for the HSE

- Execute test and evaluation activities at the Maryland Test Facility in collaboration with HSE stakeholders to assess innovative technologies

FY 2019 Planned Key Milestone Events

- Co-lead multi-agency biometrics challenge competition for biometric fingerprint, face or iris recognition collection technologies.
- Coordinate Biometric Technology Capabilities and Test Results in to complimentary activities such as DHS Systems Engineering and T&E reviews of Level 1 Acquisition Programs or SAFETY Act.
- Maintain and expand accessible biometric "body of knowledge" for the HSE with regard to non-contact fingerprint; face and iris recognition while moving; and speaker and DNA recognition.
- In coordination with the National Institute of Standards and Technology (NIST), contribute to the enhancement of biometric technologies, standards, and best practices and drive adoption of biometric standards across the HSE.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2018		
Compile and analyze S&T portfolio of biometric programs to include: working groups, capabilities, use cases, and customers.	FY 2018 Q1	FY 2018 Q3
Build, maintain, and grow an accessible biometric "body of knowledge" for 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
FY 2019		
Maintain and expand an accessible biometric "body of knowledge" for the HSE with regard to non-contact fingerprint; face and iris recognition while moving; and speaker and DNA recognition.	FY 2019 Q1	FY 2019 Q4
Facilitate multi-agency test and evaluation activities at the Maryland Test Facility in collaboration with HSE stakeholders to assess innovative face and iris recognition technologies.	FY 2019 Q1	FY 2019 Q4
Facilitate multi-agency test and evaluation activities at the Maryland Test Facility in collaboration with HSE stakeholders to assess innovative contact and non-contact fingerprint recognition technologies.	FY 2019 Q1	FY 2019 Q4
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 2019 Q1	FY 2019 Q4
Provide Technical Subject Matter Expertise and technical reports to inform DHS review of biometric technology acquisition programs.	FY 2019 Q1	FY 2019 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: products to DHS and HSE with specific applications for TSA, CBP, and USCIS.

FY 2019 - Develop Technology and Process Assessment report for Biometrics Technology Refresh and deliver updated biometrics "body of knowledge". Transition: Apex program to DHS Component and HSE.

Partnership Mechanisms and Technology Transition

- **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, manufacturers, distributors) in the development and transition of technology solutions for homeland security. The EMERGE Accelerator Program, Prize Program, and Technology Transfer and Commercialization Program are specifically designed to engage and partner with industry to develop and transition innovative technologies. 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 by working with a variety of industry partners to find commercial technology that is adaptable for use by the HSE. Influencing commercial technology supports S&T's goal to ensure transition of technology to end-users to close homeland security gaps. These capabilities allow 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 and transition efforts by increasing awareness of emerging technologies to inform S&T investments.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Budget	1,000	3,000	3,000	3,000	3,000
Obligations	963	1,326	233	-	-

FY 2017 Key Milestone Events

- Conducted prize competitions.

FY 2018 Planned Key Milestone Events

- Communicate DHS capability needs to industry via Long Range Broad Agency Announcement (LRBAA).
- Support the conduct of two Operational Experimentation events for DHS strategic priorities.

- Launch an updated S&T portal that provides a single landing point for the public to search for, identify, and apply for S&T business opportunities.
- Facilitate engagement with internal and external partners to identify opportunities where tech transfer agreements can have an impact and ensure that intellectual property produced through S&T-funded R&D is used, reported, patented, licensed, and/or commercialized to benefit the HSE.
- Execute two S&T personnel training cohorts to educate and build S&T expertise in commercialization planning.

FY 2019 Planned Key Milestone Events

- Establish new partnerships with industry associations and/or market-shaping companies that align to evolving S&T and DHS priorities.
- Execute a series of prize competitions aligned to DHS Component needs.
- Pilot an innovation pipeline model that quickly moves from technology discovery through transition to end-user.
- Expand the Technology Transfer and Commercialization Program to support the transition of S&T-funded technologies to end-users.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Conducted Prize Competition: HSARPA EXD/TSA Person Screening Algorithm Challenge	FY 2017 Q1	FY 2018 Q3
Conducted Prize Competition: HSARPA CBD Hidden Signals Challenge Phases I and II (formerly Biothreat Early Warning Challenge)	FY 2017 Q1	FY 2018 Q4
Conducted Prize Competition: Pocket Escape Mask Design Challenge.	FY 2017 Q1	FY 2018 Q4
Conducted *EMERGE* Wearables Accelerator.	FY 2017 Q1	FY 2017 Q4
Conduct Prize Competition: Entry and Exit Point People Screening.	FY 2018 Q1	FY 2018 Q4
FY 2018		
Launch an updated S&T portal that provides a single landing point for the public to search for, identify, and apply for S&T business opportunities.	FY 2018 Q1	FY 2018 Q4
Execute two S&T personnel training cohorts to educate and build S&T expertise in commercialization planning.	FY 2018 Q1	FY 2018 Q3
FY 2019		
Conduct Prize Competition: USCG Research & Development Center Enhanced Person in the Water (ePIW) Detectability Challenge.	FY 2018 Q3	FY 2019 Q4

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.

Border Security – FY 2018: $48.4M. FY 2019 President's Budget: $51.9M. 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.

Cargo and Port of Entry (POE) Security – FY 2018: $4.5M. FY 2019 President's Budget: $7.9M. 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.

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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	5,850	3,544	3,544
Obligations	-	-	4,855	-	-

FY 2017 Key Milestone Events

- Delivered final Technology and Process Assessment Report Counting & Measuring.
- Developed Concept of Operations (CONOPs) to enhance traveler identification validation and CBP operations by integrating biometrics validation or Pre-Clearance Technology into CBP capabilities.
- Delivered Business Case Report for Global Entry Evolution to support CBP acquisition planning.
- Conducted 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.
- Tested, evaluated, and analyzed new commercially available biometric technologies to assess performance, and determine business case for potential integration into DHS operations.

FY 2018 Planned Key Milestone Events

- Conduct operational readiness assessments of contact/non-contact fingerprint, face, and iris biometric recognition capabilities.
- Develop Global Entry Operational Readiness Assessment Report.
- Develop Business Case Analysis Report for Counting and Measuring to support CBP acquisition planning.
- Develop Enhanced Modified Egress Process Assessment Report to inform CBP acquisition decisions.
- Perform Rapid Usability Assessment of wearable systems to inform potential CBP Concepts of Operation and acquisition planning of emerging technologies to support more flexible and scalable traveler inspections (Pre-Clearance Technology).
- Develop Technology Scouting Report on Mobile Device Geolocation for Land Border Entry/Exit.
- Conduct facial recognition Operational Readiness Assessment.

FY 2019 Planned Key Milestone Events

- Develop next generation Face Recognition, Iris recognition, Fingerprint recognition collection device and matching algorithms operational readiness assessments final report for biometrics technology refresh.
- Develop an interface control document to enable airport, airlines, and DHS to share Counting and Measuring data between parties.
- Develop CONOPs to enhance traveler identification validation and operations in support of CBP Flexible Facilitation capabilities.
- Develop Face and Multi-Biometric Recognition Deep Learning Technical Feasibility Report.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Conducted technology readiness evaluations of fingerprint, face, and iris biometric recognition capabilities.	FY 2017 Q1	FY 2017 Q4
Performed Field Trial of Bluetooth/IR System in operational Federal Inspection Services (FIS) environment for passenger Counting an Measuring.	FY 2017 Q2	FY 2017 Q3
FY 2018		
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 Q2
Develop Business Case Analysis Report for Counting and Measuring to support CBP acquisition planning.	FY 2018 Q2	FY 2018 Q4
Develop Enhanced Modified Egress Process Assessment Report.	FY 2018 Q1	FY 2018 Q4
Perform Rapid Usability Assessment of wearable systems to inform potential CBP Concepts of Operation and acquisition planning of emerging technologies to support more flexible and scalable traveler inspections (Pre Clearance Technology).	FY 2018 Q1	FY 2018 Q2
Develop Technology Scouting Report on Mobile Device Geolocation for Land Border Entry/Exit.	FY 2017 Q2	FY 2018 Q1
Conduct facial recognition Operational Readiness Assessment.	FY 2018 Q1	FY 2018 Q3
FY 2019		
Develop next generation Face Recognition, Iris recognition, Fingerprint recognition collection device and matching algorithms operational readiness assessments final report for biometrics technology refresh.	FY 2019 Q1	FY 2019 Q4
Develop an interface control document to enable airport, airlines, and DHS to share Counting & Measuring data between parties.	FY 2019 Q1	FY 2019 Q4
Develop CONOPs to enhance traveler identification validation and operations in support of CBP Flexible Facilitation capabilities.	FY 2019 Q1	FY 2019 Q3
Develop Face and Multi-Biometric Recognition Deep Learning Technical Feasibility Report.	FY 2019 Q1	FY 2019 Q2

Type of Research

Developmental

Technical Readiness Level

The program begins at TRL 3 and ends at TRL 7.

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**: ICE has the need to share, query, and analyze law enforcement information to enhance their ability to process aliens and investigate transnational crime, child exploitation and human trafficking. In addition, CBP and ICE have limited capability to collect and analyze forensic 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.
- **Solution**: The project provides law enforcement entities access to near real-time data to enhance investigation and interdiction of illegal activity. In addition, 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.
- **Impact**: Integrated and timely access to investigations data can help detect and interdict illicit activity associated with human trafficking, child exploitation, and illegal immigration. 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.

Overall Project Funding

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	-	1,000	2,000
Obligations	-	-	-	-	-

FY 2018 Planned Key Milestone Events

- Automate Igloo Data Ingestion and Management. Igloo is a software tool that provides ICE the capability to analyze and correlate large data sets to identify illegal activity.
- Expand Pollen database to include regions of interest to CBP.
- Conduct requirements study to determine areas of R&D investment to enhance ICE's ability to track specific commodities through the global supply chain to support the investigation of illegal activity.
- Conduct requirements study to determine areas of R&D investment to enhance ICE's Law Enforcement investigation capability.

FY 2019 Planned Key Milestone Events

- Expand Igloo mission capabilities to other ICE operations and improve usability through visual analytics.
- Conduct market research and analyze alternative areas of R&D investment to enhance ICE's ability to track specific commodities through the global supply chain to support the investigation of illegal activity.
- Conduct market research and analyze alternative areas of R&D investment to enhance ICE's Law Enforcement investigation capability.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Developed draft requirements and Concept of Operations for Igloo (formerly CITRUS) data analytic tool.	FY 2017 Q3	FY 2017 Q4
FY 2018		
Automate Igloo Data Ingestion and Management.	FY 2018 Q1	FY 2018 Q4
Expand Pollen database to include regions of interest to CBP.	FY 2018 Q1	FY 2018 Q4
Conduct requirements study to determine areas of R&D investment to enhance ICE's ability to track specific commodities through the global supply chain to support the investigation of illegal activity.	FY 2018 Q1	FY 2018 Q4
Conduct requirements study to determine areas of R&D investment to enhance ICE's Law Enforcement investigation capability.	FY 2018 Q1	FY 2018 Q4
FY 2019		
Expand Igloo mission capabilities to other ICE operations and improve usability through visual analytics.	FY 2019 Q1	FY 2019 Q4
Conduct market research and analyze alternative areas of R&D investment to enhance ICE's ability to track specific commodities through the global supply chain to support the investigation of illegal activity.	FY 2019 Q1	FY 2019 Q4
Conduct market research and analyze alternative areas of R&D investment to enhance ICE's Law Enforcement investigation capability.	FY 2019 Q1	FY 2019 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 Igloo to ICE. Transition to include Igloo software, User Guide and Interface Manual.
- Transition to ICE capabilities to enhance their ability to track specific commodities through the global supply chain to support the investigation of illegal activity.
- Transition to ICE tools to enhance their law enforcement investigation capability.

POE Based Technologies

- **Problem:** Several CBP non-intrusive imaging systems are reaching the end of their service life and are exhibiting reduced performance and rising maintenance costs. Other systems are using technology that needs to be refreshed to maintain parity with the smuggling threat. In addition, CBP has limited ability to non-intrusively detect contraband in the main body and structural voids of commercial trucking and other vehicles, requiring them to use time intensive manual inspection techniques. CBP and ICE has limited ability to detect/interdict counterfeit merchandise entering the U.S. and the estimated $65B in bulk cash being illegally smuggled out of the U.S. each year. The lack of actionable information used in inspection targeting diverts resources from higher risk shipments, while reducing the efficient flow of low risk/legitimate goods and people. Inefficient targeting and lack of confidence in the security of the global supply chain costs U.S. importers billions in lost revenue per year. Moreover, the volume of inbound goods to 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 software and hardware upgrades for legacy imaging units, infusing state-of-the-art technology which will enhance their detection performance and extend their service life, and prototypes new non-intrusive imaging capabilities. This project also provides CBP with the capability to detect the transport of contraband and counterfeit merchandise at the POEs. This project develops technologies for collecting additional security data while also investing in analysis methods for transforming new and existing security data into actionable information. Improved imaging and targeting will lead to a higher probability of detecting illegal or hazardous materials while expediting the delivery of legitimate goods and people.

- **Impact:** S&T's efforts will enhance CBP's effectiveness in detecting contraband at POEs while increasing the throughput of legitimate goods and people. Upgrades to CBP imaging systems will improve performance, while significantly reducing operational and maintenance costs. Improved targeting and improvements in supply chain security through the use of technology will reduce the CBP imaging and/or manual inspection load, potentially reducing labor and facility costs while increasing the throughput of legitimate goods and people. The use of technology may yield income in additional tax revenue and would allow the automation of manual processes at the POEs, freeing up thousands of hours/year of CBP labor.

FY 2019 Planned Key Milestone Events

- Conduct POE demonstration of Common Viewer Workstation.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	-	-	-	-	2,453
Obligations	-	-	-	-	-

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2019		
Conduct POE demonstration of Common Viewer Workstation.	FY 2019 Q1	FY 2019 Q4

Type of Research
Developmental

Technical Readiness Level
TRL will vary between specific portfolio projects.

Transition Plans
- Deliver to CBP an ATS-integrated cargo trend analysis and anomaly detection capability.
- Deliver Common Viewer Workstation prototype to a POE.
- Deliver Through the Wall/Floor Detection System prototype to CBP.

Land Border Security – FY 2018: $27.8M. FY 2019 President's Budget: $27.8M. 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**: 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. In addition, 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 wing aircraft. 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 coordinate with and adhere to the standards set by S&T's Program Executive Office for Unmanned Aircraft Systems on 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, the U.S.Coast Guard (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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	5,250	1,468	7,173	6,879	6,879
Obligations	3,916	325	4,711	-	-

FY 2017 Key Milestone Events

- Conducted 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 Unmanned Aircraft System (sUAS) in operational environments.
- Delivered reports which assessed the performance of sUAS in land operational scenarios
- Modified design of existing Small Dark Aircraft (SDA) detection system to accommodate Southern Border changes.

FY 2018 Planned Key Milestone Events

- Build prototype Mission Management system.
- Deploy/Demonstrate/Test Mission Management System prototype.
- Conduct Robotic Aircraft Sensor Program (RASP) event at the new DHS Common UAS Site.
- Conduct Requirements Analysis for CBP-AMO's Air Domain Awareness mission.

FY 2019 Planned Key Milestone Events

- Transition Mission Management System.
- Develop communication system that fits on a sUAS.
- Build, integrate and demonstrate maritime ISR Sensor system.
- Conduct market research and assess technical feasibility of technologies for use in conjunction with CBP-AMO's Air Domain Awareness mission.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Modified design of existing SDA system to accommodate Southern Border changes.	FY 2017 Q2	FY 2017 Q4
Delivered reports assessing performance of sUAS in land operational scenarios.	FY 2017 Q1	FY 2017 Q2
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 sUAS in operational environments.	FY 2017 Q1	FY 2017 Q3
FY 2018		
Build prototype Mission Management system.	FY 2017 Q3	FY 2018 Q1
Deploy/Demonstrate/Test Mission Management System prototype.	FY 2018 Q1	FY 2018 Q4
Conduct Robotic Aircraft Sensor Program (RASP) event at the new DHS Common UAS Site.	FY 2018 Q1	FY 2018 Q3
Conduct Requirements Analysis for CBP-AMO's Air Domain Awareness mission.	FY 2018 Q1	FY 2018 Q4
FY 2019		
Transition Mission Management System.	FY 2018 Q4	FY 2019 Q3
Develop communication system that fits on a sUAS.	FY 2018 Q2	FY 2019 Q2
Build, integrate and demonstrate maritime ISR Sensor system.	FY 2018 Q2	FY 2019 Q2
Conduct market research and assess technical feasibility of technologies for use in conjunction with CBP-AMO's Air Domain Awareness mission.	FY 2019 Q1	FY 2019 Q4

Type of Research

Developmental

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- Deliver to CBP and USCG a Mission Management system including performance, procurement, and integration data.
- Deliver to CBP and USCG a communications capability on sUAS to enable/enhance the utilization of sUAS in border security operations.
- Deliver to CBP-AMO capabilities to enable and enhance AMO's Air Domain Awareness mission and inform CBP acquisition decisions. Deliverables to include performance, procurement, and integration data.

Ground Based Technologies

- **Problem**: Multiple DHS Components are in need of new or improved surveillance capabilities for border security and investigations – especially for difficult terrains, harsh weather, and remote locations – that effectively use resources, improve investigations, and enhance

frontline personnel safety. Increasing visibility and situational awareness of activity on both sides of a Border Wall infrastructure is critical to frontline personnel 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 by the 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, and improving target classification while minimizing false alarms. This project also enables capabilities that provide situational awareness above and below ground, coupled 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, and POE). Additionally, projects are underway to aid investigators by improving surveillance systems and the capture of evidence.

- **Impact**: Improved situational awareness of U.S. terrestrial borders between the POEs will result in higher interdiction and conviction rates of illegal activity and immigration through higher detection rates, fewer false alarms, more prosecutions, and more efficient and safer utilization of officers, agents, and assets. Improved capabilities will also aid broader investigations of illicit activities beyond the U.S. terrestrial borders into U.S. communities.

Overall Project Funding

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	7,300	7,261	8,200	15,729	15,729
Obligations	8,406	6,599	5,772	-	-

FY 2017 Key Milestone Events

- Conducted Border Wall technology requirements analysis for Border Research in Instrumented Construction (BRIC) effort.
- Conducted Remote Radio Link Pilot Preliminary Design Review for radio communications.
- Installed two pole configuration of the Slash Camera Pole system, a capability providing automated detection and alerting of human activity on the northern border slash, enhancing situational awareness.
- Transitioned Fiber-Optic Distributed Sensing (FODS) 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 Planned Key Milestone Events

- Conduct Border Wall technology requirements analysis for Border Research in Instrumented Construction (BRIC) effort. BRIC investigates technology application as an adjunct to the CBP Border Wall effort.
- Conduct market research and assess technical feasibility of technologies for use in conjunction with the Border Wall (part of BRIC effort).
- Install Northern Border Fiber-Optic Distributed Sensing (FODS) System Pilot a capability providing automated detection and alerting of human activity on the norther border, enhancing situational awareness.

- Conduct a design review of method to capture and distribute video and audio to improve situational awareness.
- Identify and analyze alternative methods for capturing encrypted interactions between field agents/confidential informants and suspects.
- Conduct Video Evidence Collection and Distribution requirements study for analysis of Covert Video Network.
- Conduct multi-season Test and Evaluation for Radio Frequency (RF) Sensing Unattended Ground (SG).
- Conduct multi-season Test and Evaluation for Tri-Axial Acoustic Sensor Units to detect low-flying gas-powered aircraft along the border.
- Develop Android Team Awareness Kit (ATAK) as a federated enterprise service providing handheld information sharing between agents in the field greatly enhancing shared tactical situational awareness.
- Demonstrate Mobile Surveillance Capability (MSC) ability to output data in standards based format, which is ingested by other CBP systems in an operational environment (part of the Land Automated Scene Understanding (LASU) effort providing automated detection and alerting of human activity on the border, enhancing situational awareness).
- Demonstrate coastal surveillance sensors ability to output data in standards based format, which is ingested by other CBP systems in an operational environment (part of the LASU effort).
- Provide ability for CBP and USCG to restrict and enable individuals to view data based on user entitlements stored by DHS headquarters within HSIN (part of the Border and Coastal Information System (BACIS) effort providing information sharing and data analytic capabilities cross-domain (land & maritime) and cross-component (CBP, USCG, ICE, state & local law enforcement agencies, etc.).
- Publish Information System Design Document and Interface Control Documents (version 1) to enable third party development of enterprise operational information services and applications (part of the BACIS effort).

FY 2019 Planned Key Milestone Events

- Deploy, test, and assess efficacy of prototype technologies for use in conjunction with the Border Wall under BRIC effort.
- Conduct a BACIS PlugFest enabling vendors the ability to showcase how their products will integrate with BACIS and provide actionable information.
- Develop prototype and operationally assess a capability to capture and distribute video and audio to improve situational awareness.
- Develop, integrate, and demonstrate system for capturing encrypted interactions between field agents and suspects.
- Identify and analyze alternative methods to reduce bandwidth requirements for ICE's Covert Video Network.
- Conduct verification testing for deployment of ATAK as a federated enterprise service in accredited environment.
- Conduct market study of automated scene understanding technologies (part of the LASU effort).
- Develop a NextGen UGS Shoreline / Submersible prototype capability.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Installed 2nd single pole configuration of the slash Camera Pole system.	FY 2017 Q3	FY 2017 Q4
Conduct Border Wall technology requirements analysis for BRIC effort.	FY 2017 Q4	FY 2017 Q4
Conducted FODS Northern Border Pilot Preliminary Design Review for radio communications.	FY 2017 Q4	FY 2017 Q4
FY 2018		
Conduct Border Wall technology requirements analysis for Border Research in Instrumented Construction (BRIC) effort.	FY 2017 Q4	FY 2018 Q1
Conduct market research and assess technical feasibility of technologies for use in conjunction with the Border Wall.	FY 2018 Q1	FY 2018 Q4
Install Northern Border Fiber Optic Distributed Sensing System Pilot.	FY 2018 Q1	FY 2018 Q4
Conduct a Design Review of method to capture and distribute video and audio to improve situational awareness.	FY 2018 Q1	FY 2018 Q2
Identify and analyze alternative methods for capturing encrypted interactions between field agents/confidential informants and suspects.	FY 2018 Q1	FY 2018 Q4
Conduct Video Evidence Collection and Distribution requirements study for analysis of Covert Video Network.	FY 2018 Q1	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
Develop Android Team Awareness Kit (ATAK) as a federated enterprise service.	FY 2018 Q1	FY 2018 Q3
Demonstrate Mobile Surveillance Capability (MSC) ability to output data in standards based format, which is ingested by other CBP systems in an operational environment (LASU).	FY 2018 Q1	FY 2018 Q2
Demonstrate coastal surveillance sensors ability to output data in standards based format, which is ingested by other CBP systems in an operational environment (LASU).	FY 2018 Q1	FY 2018 Q4
Provide ability for CBP and USCG to restrict and enable individuals to view data based on user entitlements stored by DHS headquarters within HSIN (BACIS).	FY 2018 Q1	FY 2018 Q3
Publish Information System Design Document and Interface Control Documents (version 1) to enable third party development of enterprise operational information services and applications (BACIS).	FY 2018 Q1	FY 2018 Q4
FY 2019		
Deploy, test and assess efficacy of prototype technologies for use in conjunction with the Border Wall.	FY 2019 Q1	FY 2019 Q4
Plan and conduct BACIS domain agnostic PlugFest.	FY 2019 Q1	FY 2019 Q4
Develop prototype and operationally assess a method to capture and distribute video and audio to improve situational awareness.	FY 2018 Q1	FY 2019 Q2
Develop, integrate and demonstrate system for capturing encrypted interactions between field agents and suspects.	FY 2018 Q2	FY 2019 Q2
Identify and analyze alternative methods to reduce bandwidth requirements for ICE's Covert Video Network.	FY 2018 Q3	FY 2019 Q3
Conduct verification testing for deployment of ATAK as a federated enterprise service in accredited environment.	FY 2019 Q1	FY 2019 Q3
Conduct market study of automated scene understanding technologies (LASU).	FY 2018 Q3	FY 2019 Q1
Develop NextGen UGS Shoreline / Submersible prototype capability.	FY 2019 Q1	FY 2019 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.
- Transition UGS technology to CBP to improve the detection and tracking illegal border crossings.
- Transition to ICE analyses, technology prototypes, and knowledge products to support future request for proposals for enhancing their video surveillance capabilities.
- Transition to CBP the capability to translate data from surveillance sensors to facilitate target identification through automatic detection of possible illicit behavior (LASU).
- Transition to DHS operational Components a handheld geospatial tool to provide access to situational awareness data and collaborate in real-time.
- Transition to DHS operational Components enhanced personal protection equipment and improved tools to more effectively execute their duties.

Tunnel Detection and Surveillance
- **Problem**: Cross-border tunnels dug by transnational criminal organizations to smuggle illegal contraband into the U.S. Current detection capabilities rely on random tips and laborious human intelligence collection processes, and when tunnels are discovered, CBP and ICE have limited 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 more 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 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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	5,800	4,119	4,300	4,700	4,700
Obligations	5,174	4,027	2,804	-	-

FY 2017 Key Milestone Events

- Performed Market Survey of unmanned tools for investigating tunnels (e.g. tunnel robots).
- Developed sensor requirements for UGS for investigating tunnels.
- Conducted a Field Test for Developmental Prototype of the complete Tunnel Detection System at the border.

FY 2018 Planned Key Milestone Events

- Plan and field test operational prototype Tunnel Detection system with CBP.
- Plan field test and evaluation of tunnel robot technologies with ICE.

FY 2019 Planned Key Milestone Events

- Conduct down selection of tunnel robotic systems for demonstration.
- Develop the technical approach for detecting unconventional tunnel threats and conventional tunnels at excessive depths greater than 80 feet.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Performed Market Survey of UGS (e.g. tunnel robots).	FY 2017 Q1	FY 2017 Q3
Planned and conducted 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 field test operational prototype Tunnel Detection system with CBP.	FY 2018 Q1	FY 2018 Q4
Plan field test and evaluation of tunnel robot technologies with ICE.	FY 2018 Q1	FY 2018 Q3
FY 2019		
Conduct down selection of tunnel robotic systems for demonstration.	FY 2019 Q2	FY 2019 Q4
Develop the technical approach for detecting unconventional tunnel threats and conventional tunnels at excessive depths greater than 80 feet.	FY 2019 Q1	FY 2019 Q4

Type of Research

Developmental

Technical Readiness Level

The program starts at TRL 2 and ends at TRL 6.

Transition Plans

- Delivered a Tunnel Age toolkit that can be routinely used by CBP and ICE agents to analyze and determine the age of discovered tunnels.
- 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 operational prototype(s) for operational evaluation by CBP.
  - Deliver final prototype Tunnel Detection system and Technical Data Package to CBP Acquisition Program Office.
- Deliver to ICE operational evaluations of unmanned tools for investigating tunnels and improving agent safety (e.g. tunnel robots) to include performance, procurement, and integration data.

Private Sector Outreach and Engagement

- **Problem:** DHS needs the ability to understand and clearly communicate R&D needs and to rapidly field prototypes and potential COTS solutions for assessment by homeland security operators. This ability improves our outreach and engagement with industry and informs decisions on how to address technological capability gaps identified through the DHS IPTs and gathers input for future acquisitions.

- **Solution:** This project enables communication of priority DHS needs to industry and provides for the delivery of high-priority technology prototypes to field operators. 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 needs are identified by DHS Components, the technologies will be jointly evaluated and needs refined as necessary, 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. This project provides industry with feedback on their technologies and allows operators to understand the state of emerging technology and how it may address their needs. 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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Budget	1,400	500	2,100	500	500
Obligations	1,400	419	0	-	-

FY 2017 Key Milestone Events

- Participated in planning and execution of border security-related Operational Experimentation (OpEx) events.

FY 2018 Planned Key Milestone Events

- Conduct quarterly vendor meetings to enable S&T-wide awareness of innovative technologies.
- Execute quarterly industry outreach videos to convey to non-traditional partners S&T's key priorities and available mechanisms for partnering with S&T.
- Identify relevant private sector entities and capabilities in support of two technology scouting projects.

FY 2019 Planned Key Milestone Events

- Execute a series of activities aligned to DHS priorities that provide an opportunity for industry to engage with operators.

Project Schedule

Research and 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.	FY 2018 Q1	FY 2018 Q1
OpEx opportunities identified for high-priority S&T programs.	FY 2018 Q1	FY 2018 Q1
FY 2019		
Participate in planning and execution of OpEx to support specific HSE needs.	FY 2019 Q1	FY 2019 Q4
OpEx opportunities identified for high-priority S&T programs.	FY 2019 Q1	FY 2019 Q4

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.

Maritime Border Security – FY 2018: $16.1M. FY 2019 President's Budget: $16.1M. 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. DHS operating agencies have limited capability to detect, track, and identify maritime threats such as Pangas, non-emitting small vessels and go-fast boats transporting contraband or people unlawfully into the U.S.

- **Solution**: This project contributes to the DHS'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. Efforts also (1) develop/evaluate sensor systems capable of automatically detecting and locating vessels of interest across the maritime domain, (2) perform R&D to improve the ability of sensors to detect and track waterborne threats and reduce clutter to improve detection rates and lower false alarms. The associated capabilities will provide economical, effective, and persistent domain awareness.

- **Impact**: The S&T developed technology will improve operational effectiveness and enhance 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 the 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. S&T developed technology will provide improved and more persistent detection of dark vessel activity, and assist the USCG and CBP in the acquisition and implementation of dark vessel detection capabilities.

Overall Project Funding

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	9,500	6,866	10,500	8,750	8,750
Obligations	9,402	6,869	8,790	-	-

FY 2017 Key Milestone Events

- Established an initial operational capability at CBP Air and Marine Operations Center for the use of space based imagery in tactical operations.
- Delivered an affordable, sustainable, OCIO-compliant, enterprise data integration/information sharing platform to DHS HQ.

FY 2018 Planned Key Milestone Events

- Complete Integrated Maritime Domain Enterprise-Coastal Surveillance System (IMDE-CSS) Operational Demonstration.
- Plan and execute IMDE-CSS Operational Assessment.
- Assess the impact of using commercial space based imagery for maritime surveillance operations.
- Perform analysis of alternatives for maritime domain awareness.
- Perform Maritime Domain Awareness (MDA) analysis of alternatives for Dark Vessel Detection.
- Perform Great Lakes sensor survey of Federally-owned maritime sensors for Dark Vessel Detection.

FY 2019 Planned Key Milestone Events

- Transition selected IMDE and CSS prototype capabilities to DHS Operational Components and DHS OCIO for further development and integration into operations.
- Complete a Gulf Coast USCG Sector Regional Command sensor survey of state, locally, and privately-owned maritime sensors (i.e. Dark Vessel Detection).
- Demonstrate ability of space-based technology concept to enhance maritime domain awareness.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Established an initial operational capability at CBP Air and Marine Operations Center for the use of space based imagery in tactical operations	FY 2017 Q1	FY 2017 Q2
FY 2018		
Complete IMDE-CSS Operational Demonstration.	FY 2018 Q1	FY 2018 Q4
Plan and execute IMDE-CSS Operational Assessment.	FY 2018 Q1	FY 2018 Q4
Assess the impact of using commercial space based imagery for maritime surveillance operations.	FY 2018 Q1	FY 2018 Q4
Perform analysis of alternatives for maritime domain awareness.	FY 2017 Q2	FY 2018 Q4
Perform MDA analysis of alternatives for Dark Vessel Detection.	FY 2018 Q1	FY 2018 Q3
Perform Great Lakes sensor survey of Federally-owned maritime sensors for Dark Vessel Detection.	FY 2018 Q1	FY 2018 Q4
FY 2019		
Transition selected IMDE and CSS prototype capabilities to DHS Operational Components and DHS OCIO for further development and integration into operations.	FY 2018 Q4	FY 2019 Q4
Complete a Gulf Coast USCG Sector Regional Command sensor survey of State, Locally, and Privately-owned maritime sensors (DVD).	FY 2018 Q4	FY 2019 Q4
Demonstrate ability of space-based technology concept to enhance maritime domain awareness.	FY 2018 Q2	FY 2019 Q3

Type of Research

Developmental

Technical Readiness Level

The program begins at TRL 4 and ends at TRL 7.

Transition Plans

- IMDE – Deliver to DHS HQ OCIO a compliant reference segment architecture integration platform for agile information sharing and discovery.
- CSS – Deliver to CBP and USCG a prototype 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.
- The Dark Vessel Detection project will inform CBP and USCG acquisition strategies for the deployment of a dark vessel detection capability.

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 DHS's maritime Components in the acquisition and implementation of capabilities in the Arctic, essential for safe and effective operations.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	750	-	1,000	6,300	6,300
Obligations	425	-	934	-	-

FY 2017 Key Milestone Events

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

FY 2018 Planned Key Milestone Events

- Perform analysis of alternatives for Arctic Communications.
- Conduct On-Orbit Test and Evaluation of space-based technologies to support arctic missions.

FY 2019 Planned Key Milestone Events

- Perform multi-intelligence demonstration of DHS Datahub analytics.
- Perform evaluation of commercial satellite communications.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
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 2018		
Develop ASAP Tool(s).	FY 2017 Q2	FY 2017 Q4
Limited Demonstration of ASAP.	FY 2017 Q2	FY 2018 Q3
Integrate NTM-derived data sources.	FY 2017 Q1	FY 2019 Q1
Perform an Analysis of Alternatives for Communications in the Arctic Region.	FY 2017 Q4	FY 2018 Q2
FY 2019		
Demonstration of DHS Datahub analytics.	FY 2019 Q2	FY 2020 Q2
Evaluation of commercial satellite communications.	FY 2019 Q1	FY 2019 Q4

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 and waterways. Currently, 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 or waterways in a post disaster or attack environment.

- **Solution**: Enhance the USCG's Waterways Analysis and Management System using more effective and user friendly computer-based technologies to update, visualize, and analyze data to monitor maritime Aids to Navigation (ATON). New or improved technology can be a force multiplier/enabler to help address DHS's maritime challenges while maintaining fiscal responsibility. The project will leverage work from S&T Centers of Excellence and other experts to develop risk-based strategies to enhance management of ports and waterways, including better ways to conduct health assessments, analyze the condition of ports and waterways, and support risk-based decision making.

- **Impact**: S&T 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 and waterways. The specific analytical port tool improves port resiliency by substantially reducing the time a port or waterway is closed to traffic and trade due to a significant disaster or attack event.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	-	-	1,000	1,000	1,000
Obligations	-	-	-	-	-

FY 2017 Key Milestone Events
- Assessed enterprise architecture alignment.
- Performed Program of Record database assessment.

FY 2018 Planned Key Milestone Events

- Develop prototype computer-based analytical tool to provide USCG with a more effective capability to monitor ATONs.

FY 2019 Planned Key Milestone Events

- Assess ability of prototype tool to enhance port and waterway resiliency.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Assess enterprise architecture alignment.	FY 2017 Q2	FY 2018 Q4
Perform Program of Record database assessment.	FY 2017 Q3	FY 2018 Q3
FY 2018		
Develop prototype analytical tool to monitor Aids to Navigation (ATON).	FY 2017 Q4	FY 2018 Q4
FY 2019		
Assess ability of prototype tool to enhance port and waterway resiliency.	FY 2018 Q4	FY 2019 Q4

Type of Research

Developmental

Technical Readiness Level

Begins at TRL 6 and completes at TRL 7.

Transition Plans

S&T plans to transition the software tool will be integrated into an existing program of record under the sponsorship of USCG Office of Navigation Systems (CG-NAV).

Chemical, Biological and Explosive Defense Research and Development (CBE Defense) FY 2018: $52.6M. FY 2019 President's Budget: $56.9M. 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.

Bioagent Detection – FY 2018: $21.0M. FY 2019 President's Budget: $25.0M. This program conducts research, 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.

Bioassays

- **Problem:** Numerous capability gaps exist for the analysis and identification of biothreat agents for internal customers and IPT members (e.g., USSS, CBP, and first responders). 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 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 performance criteria; and 3) rapid antimicrobial susceptibility assays (based on micro-culture and PCR) for deployment and employment through the IPT customers. Close 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. First Responder Actionable Assays are primarily Lateral Flow Devices, which detect antigens/toxins 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	4,000	2,000	5,165	3,000	-
Obligations	6,076	2,628	3,595	-	-

FY 2017 Key Milestone Events

- Designed review for Multiplexed Toxin Detector (SpinDx Platform): Finalized prototype platform and tests in advance of developmental testing and evaluation.

- Established the form, shape, and size of an aerosol sample capture cassette to include assay chemistry for viable capture and detection of signatures.
- Transitioned nucleic acid based detection assays for for Burkholderia mallei and pseudomallei (causing Glanders or Melioidosis, respectively) and Bacillus anthracis (causing Anthrax) to end users and stakeholders.
- Transitioned Rapid Antimicrobial Susceptibility tests for Burkholderia mallei and pseudomallei (causing Glanders or Melioidosis, respectively) to end users.
- Began transitioning and validation of multiplexed Variola (causing Smallpox) antigenic assays on the MesoScale Defense (MSD) Platform.
- Completed testing, evaluation, and validation of field deployable First Responder Actionable Assays for detection of Bacillus anthracis.
- Transitioned nucleic acid based detection assays for Burkholderia spp. (causing Glanders or Melioidosis) and Bacillus anthracis (causing Anthrax) to end users and stakeholders.
- Conducted assay optimization of Lassa Fever Virus (rodent-borne pathogen causing hemorrhagic fever) PHAA assays..

FY 2018 Planned Key Milestone Events

- 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.
- Finalize design (# of toxins to be detected in a single test/disk) of SpinDx assay disk and conduct testing and evaluation of prototype toxin detection platform and assays to USSS.

FY 2019 Planned Key Milestone Events

- N/A

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
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
FY 2018		
Bridging studies of nucleic acid-based PHAA assays and transition validated to USSS for in house evaluation.	FY 2018 Q1	FY 2020 Q1
SpinDx Multiplex toxin detector platform validation and transition of prototype assays to USSS for in house evaluation.	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 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 transition to FEMA and S&T's FRG to support screening of suspicious material in the field and public safety actions in a timely manner.

Opioid/Fentanyl Detection

- **Problem:** On March 29, 2017, the President signed an Executive Order establishing the President's Commission on Combating Drug Addiction and the Opioid Crisis and establishing the policy of the executive branch to "combat the scourge of drug abuse, addiction, and overdose (drug addiction), including opioid abuse, addiction, and overdose (opioid crisis)." The President's Commission interim report stated that "Fentanyl defies detection at our borders, as the small quantities involved for psycho activity of fentanyl and fentanyl analogs challenge CBP, USPS, and express consignment carriers' ability to detect and interdict." Further, the President's Commission final report identified specific challenges including the high volume of mail, fentanyl shipped in very small quantities, low number of available automated detection systems and trained canines, and inadequate infrastructure. Based upon the President's Executive Order and the findings of the President's Commission, CBP OFO has identified a critical need for technologies to be able to detect opioids and fentanyls in small quantities at land borders POEs and facilities handling international mail and parcel shipments.

- **Solution:** This project will develop cost-effective detection systems to rapidly collect and exploit information useful for detecting opioids and fentanyls. Specifically, this project will pursue rapid prototyping and operational utility assessment of each prototype for the two most challenging operational scenarios: land borders and international mail facilities. This effort will be conducted in close partnership with CPB OFO, with support from the S&T TSL for development, operational assessment, and testing of the prototype systems.

- **Impact:** As stated in the President's Commission interim report, "Our inability to reliably detect fentanyl at our land borders and at our international mail handling facilities creates untenable vulnerabilities." This program will deliver rapid screening-at-speed technologies for the detection and interdiction of opioids/fentanyls, increasing the likelihood that illicit opioids are seized and removed from the supply chain, thereby, protecting the public, critical infrastructure, and the economy.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	-	-	-	-	7,000
Obligations	-	-	-	-	-

FY 2019 Planned Key Milestone Events

- Release solicitation of proposals for advanced development of opioids/fentanyls detection capabilities to close identified gaps and meet operational requirements.
- Establish proposed system architecture for opioids/fentanyls detection capability for CBP at POEs that will not unreasonably restrict cross-border traffic.
- Initiate rapid prototyping of high-throughput scanning and field-screening equipment.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2019		
Draft test and evaluation master plan, including key system attributes (KSAs) and key performance parameters (KPPs).	FY 2019 Q1	FY 2019 Q4
Solicitation of proposals for advanced development of opioids/fentanyls detection capabilities to close identified gaps and meet operational requirements.	FY 2019 Q2	FY 2019 Q3
Initiate advanced development and rapid prototyping of selected technologies	FY 2019 Q4	FY 2020 Q1
Conduct systems engineering study (systems analysis) to develop system architecture to integrate proposed technologies into operational environment.	FY 2019 Q1	FY 2019 Q3
Deliver proposed system architecture for opioid/fentanyl detection capability for CBP at border check-points and mail facilities.	FY 2019 Q4	FY 2019 Q4

Type of Research

Applied, Developmental

Technical Readiness Level

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

Transition Plans

A concept of operations and systems architecture for opioids and fentanyls detection at land borders and international mail facilities will be developed in close coordination with CBP and other critical stakeholders. From there, customized technology architectures, which may include thermal sensing, multispectral imaging, volatile organic compound detection and/or canine detection, suited to the individual operational environments and budgets will be developed utilizing commercial off the shelt/government off the shelt technology where available and investing in new technology development as necessary. S&T will execute in partnership with the primary customer, CBP OFO, and will support development of the key acquisition artifacts required upon delivery and transition of the final products.

Biosurveillance Systems

- **Problem:** Rapid response to a biological incident of national concern (e.g., a biological attack or disease outbreak) is critical to save lives, protect critical infrastructure, and safe guard the economy. In the event of biological incident, there is a dearth of capabilities for prompt

detection, coordination, and rapid response actions amongst Federal, state, local governments and the private sector. The timely detection of, and confident response to, the release and/or exposure of biological threats and/or an infectious agents in a public space is a critical challenge to multiple DHS Components and other Federal, state, local, tribal, and territorial customers, including the public health and first responder communities.

- **Solution:** This project develops cost-effective systems to rapidly collect and exploit information required for rapid identification of biological incidents; thereby, enabling decision makers to more quickly initiate protective measures. To shorten the time required to deliver a prototype system, this program aims to pursue parallel tracks to solve multiple dimensions of the problem space and to make use of existing commercial- or government-off-the-shelf solutions. The objectives include developing: 1) sensors and architectures for interdiction and early warning of a threat agent, and 2) tools for data and information management and integration, and analysis tools for rapid threat awareness, decision support, and response. Developmental efforts will culminate in demonstrations of prototype technologies and systems conducted in partnership with DHS Components and stakeholders.

- **Impact:** Detection and interdiction of biological incidents through rapid field-based assessment for threat agents 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	6,900	10,000	13,714	5,000	5,000
Obligations	11,899	7,608	5,390	-	-

FY 2017 Key Milestone Events

- Conducted first full scale exercise of improved biosurveillance capabilities with a local jurisdiction partner, and document lessons learned and technology gaps.
- Produced a notional roadmap of potential RDT&E pathways for reaching needed capability via commercial and government off the shelf solutions.
- Initiated requirements and analysis of alternatives for advanced indoor and outdoor detection systems.

FY 2018 Planned Key Milestone Events

- 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.
- Deliver conceptual prototype architecture design based on stakeholder engagement for improved situational awareness (biosurveillance information and knowledge integration).

FY 2019 Planned Key Milestone Events

- Deliver national implementation protocol to include technical packages for transferring capabilities to additional jurisdictions and stakeholders.
- Deliver indoor aerosolized biological particle detection architectures, including sensors and field-based detection technologies, to testbed for test and evaluation in an operationally relevant environment.
- Deliver biodetection and biosurveillance systems architectures for DHS Components.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Completed assessment of detection systems against current biodetection capability baseline and CONOPS.	FY 2017 Q2	FY 2017 Q4
Conducted horizon scanning ("Tech Watch") for novel and emerging detection methodologies.	FY 2017 Q1	FY 2018 Q1
Developed baseline for national biodetection architecture to identify key gaps and requirements.	FY 2017 Q1	FY 2017 Q4
FY 2018		
Characterize state of art of technologies for biological assessment and information sharing.	FY 2018 Q1	FY 2018 Q4
Stakeholder engagement: Identify stakeholder capabilities, needs, and requirements; form a working group for biological information and knowledge integration.	FY 2018 Q1	FY 2019 Q4
Deliver current "as-is" baseline national biodetection systems architectures.	FY 2018 Q1	FY 2018 Q4
Conduct feasibility study to assess utlility and primary barriers to field-based biological assessment (technical, operational, legal, etc)	FY 2018 Q1	FY 2018 Q4
Solicitation of proposals for advanced development of biological detection capabilities to close identified gaps and meet operational requirements.	FY 2018 Q2	FY 2018 Q3
Design Conceptual Software Architecture for biosurveillance information and knowledge integration for local, state and Federal stakeholders.	FY 2018 Q2	FY 2018 Q4
Technical pilot prototype planning and recommendations development.	FY 2018 Q1	FY 2018 Q4
Deliver prototype software architecture for improved situational awareness.	FY 2018 Q4	FY 2018 Q4
Design and develop prototype sensor (e.g., triggered mass spectrometry) for detecting aerosolized biological particles.	FY 2018 Q2	FY 2019 Q2
Identify test and verification/validation strategies biological assessment and data analysis technologies.	FY 2018 Q3	FY 2019 Q2
FY 2019		
Conduct test and evaluation of individual system prototype components in relevant environments.	FY 2019 Q1	FY 2019 Q4
Conduct systems analysis and develop plans to integrate component technologies into unified capabilities.	FY 2019 Q1	FY 2019 Q4
Demonstrate utility of advanced analytic methods in biodetection and biosurveillance applications (e.g., reduce false alarms, identify anomalous data indicators).	FY 2019 Q2	FY 2019 Q3
Develop draft tiered technical packages for national implementation.	FY 2019 Q3	FY 2019 Q4
Deliver indoor detection sytem for test and evaluation in operationally relevant environment.	FY 2019 Q1	FY 2019 Q4
Deliver national implementation protocols and technical data packages to jurisdictions.	FY 2019 Q4	FY 2020 Q4
Deliver final biodetection and biosurveillance system archictures for DHS Components.	FY 2019 Q1	FY 2019 Q4

Type of Research
Applied, Developmental

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

Transition Plans
Systems architectures, concepts of operation, and implementation protocols for biodetection and biosurveillance systems will be developed for relevant DHS Components and other key stakeholders. These products will include customized, tiered technology architectures suited to the individual operational environments. With new technology development, preference will be given to technologies that have commercial markets beyond Component needs to ensure the availability of an infrastructure to maintain and improve technologies as needed. To ensure successful development, integration, and ultimate transition of the deliverables under this program, individual system components and integrated system will immediately transition to the S&T-sponsored test bed(s) for robust advanced test and evaluation of performance and suitability in operational environments. Following testing in the S&T-sponsored test bed(s), the Biosurveillance Systems program will collaborate with DHS Components and other stakeholders to complete test and evaluation of candidate systems and architectures in the relevant operational environments (OT&E).

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 would be widespread and a major public health crisis would 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 (MTA) 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 testbed 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. The outcomes will be transferrable to other subway systems in large urban areas.

Overall Project Funding

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	-	5,000	5,000
Obligations	-	-	-	-	-

FY 2018 Planned Key Milestone Events

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

FY 2019 Planned Key Milestone Events

- Begin Year 1 of testbed operation and evaluation.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2018		
Develop initial test bed plan in collaboration with subway partner.	FY 2018 Q1	FY 2018 Q2
Finalize test bed plan.	FY 2018 Q2	FY 2018 Q3
Acquire technologies for test bed.	FY 2018 Q2	FY 2019 Q2
Test bed fabrication and certification.	FY 2018 Q2	FY 2018 Q4
FY 2019		
Extend testbed deployment to encompass additional key urban locations and continue to test potential sensors and architectures.	FY 2019 Q2	FY 2020 Q1
Initial recommendations for Advanced BioDefense Architectures and the R&D necessary to fill both detection and mitigation capability gaps.	FY 2019 Q3	FY 2019 Q4

Type of Research

Applied

Technical Readiness Level

TRL 6 and 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

- **Problem**: Recent advancements in the field of life sciences, particularly synthetic biology, are risk to the HSE. The tremendous rate of scientific advancement in the fields of synthetic biology and genetic engineering, requires that the DHS community as well as the commercial gene synthesis community stay 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 BioInformatics program helps generate and develop requirements for CBDs Biological Threat Characterization Program and for other biodefense efforts within the HSE. BioInformatics 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	-	-	-	3,000	3,000
Obligations	-	-	-	-	-

FY 2018 Planned Key Milestone 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.

FY 2019 Planned Key Milestone Events

- Expand contents of database of potentially concerning genetic sequences for use in risk-based analysis of potential threats. Transition database to IARPA, other government D/As and select commercial companies.
- Coordinate with commercial gene synthesis companies and relevant Government departments and agencies to improve awareness and cooperation to prevent accidents or misuse in synthetic biology.

- Transition to biodefense community three pathways by which synthetic organism experimentation may be conducted, with emphasis on means of alerting in case of accident or misuse.

Project Schedule

Research and 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	
Expand Sequences of Interest database as repository for engineered sequences developed by IARPA.	FY 2018 Q1	FY 2018 Q4
Develop and deploy mechanisms of contact by which commercial gene synthesis companies may contact government to prevent malicious activity.	FY 2018 Q1	FY 2018 Q4
Transition to D/As scientific pathway data to differentiate natural from engineered organisms.	FY 2018 Q1	FY 2018 Q4
FY 2019		
Transition to D/As scientific pathway data to differentiate natural from engineered organisms.	FY 2019 Q1	FY 2019 Q4
Develop mechanisms for government, commercial, and academic communities to reduce risk through cooperative partnerships.	FY 2019 Q1	FY 2019 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 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 The Chemical Biological Integrated Product Team process.

Sub Projects

The Chemical Biological Integrated Product Team Solutions has identified these eight activities as the first gaps to address:

- Gap 1: Critical infrastructure and component installations 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 would be widespread and a major public health crisis would occur. Methods to support decision making on recovery from wide area contamination of urban areas, ports and installations are lacking and will delay return to operational and mission-readiness status.

- Gap 2: Law Enforcement VIP Protective Personnel lack an enhanced ability to discreetly carry 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 USCG 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 contaminates.

- 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. Improving situational awareness and better informing detector architectures through the integration of advanced modeling techniques is a critical step to saving lives. An integrated modeling suite that addresses all these areas is necessary to not only optimize detection resources, but also inform distribution of medical countermeasures from the Strategic National Stockpile, and assess attribution based on real-time detection data and other available air and environmental 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 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.

- Gap 7: Identification and confirmation of biological threat agents using techniques that orthogonal to those used presently (i.e. PCR), but which still provide equivalent levels of selectivity and sensitivity, on shorter analytical timelines, even in high background areas.

- Gap 8: Provision of high quality biological samples for assay development and operational proficiency testing are required to ensure rapid identification of traditional, emerging, enhanced and advanced biological threats.

Overall Project Funding

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	-	5,000	5,000
Obligations	-	-	-	-	-

FY 2018 Planned Key Milestone Events

- Develop protocols and strategies for wide area recovery of urban and maritime assets (Gap 1).
- Select Prize Competition winning PPE concept and develop initial prototype (Gap 2).
- Develop dynamically-integrated airflow model for large urban area (Gap 4).
- Develop test plan for simulated outdoor release of a biological agent in a major urban (Gap 5).
- Demonstrate prototype NMR capability to detection high-threat chemical agents in 3-1-1 containers (Gap 6).
- BAA for real-time biodetection technologies (Gap 1; Gap7).
- Select Prize Competition winning concept and prototype design (Gap 2).
- Develop prototype Next-Gen Sequencing methodology and platform to rapidly detect and characterize high consequence pathogens (Gap 7).
- Establish Biological Agent Repositories to supply key samples for assay development/ proficiency testing (Gap 8).

FY 2019 Planned Key Milestone Events

- Field evaluation of sampling and decontamination techniques of USCG assets contaminated with bioagent simulant (Gap 1).
- Deliver PPE functional prototype for Component evaluation (Gap 2).
- Execute test plan and identify best-of-breed respiratory systems for Component evaluation (Gap 3).
- Validate dynamically-integrated airflow model in New York City field test (Gap 4).
- Execute simulated outdoor release of biological agent in large urban setting and assess initial results (Gap 5).
- Deliver a fieldable NMR capability for liquid threats for Component evaluation (Gap 6).
- Deliver PPE functional prototype for Component evaluation (Gap 2).
- Execute test plan and identify best-of-breed respiratory systems for Component evaluation and acquisition (Gap 3).

- Validate dynamically-integrated airflow model in New York City field test (Gap 4).
- Execute simulated outdoor release of biological agent in large urban setting and assess results (Gap 5).
- Deliver a fieldable NMR capability for component evaluation (Gap 6).
- Initiate Testing, Evaluation and Validation of Next-Gen Sequencing methodology and platform to rapidly detect and characterize high consequence pathogens (Gap 7).
- Provision of samples for assay development/ proficiency testing from Biological Agent Repositories to customer and performer laboratories (Gap 8).

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2018		
Initiate GAP 1 Projects.	FY 2018 Q3	FY 2021 Q4
Initiate GAP 2 Projects.	FY 2018 Q2	FY 2019 Q2
Initiate GAP 3 Projects.	FY 2018 Q1	FY 2019 Q3
Initiate GAP 4 Projects.	FY 2018 Q1	FY 2019 Q1
Initiate GAP 5 Projects.	FY 2018 Q1	FY 2020 Q4
Initiate GAP 6 Projects.	FY 2017 Q4	FY 2020 Q3
Initiate GAP 7 projects	FY 2018 Q1	FY 2020 Q4
Initiate GAP 8 projects	FY 2018 Q1	FY 2019 Q2
FY 2019		
Complete development of sampling and decontamination methods and strategies for wide area recovery (Gap 1).	FY 2019 Q1	FY 2019 Q3
Functional PPE prototype delivery for component evaluation (Gap 2).	FY 2019 Q1	FY 2019 Q4
Complete master test and evaluation plan execution for USCG powered air-purifying respirator (Gap 3).	FY 2019 Q1	FY 2019 Q3
Verify dynamically integrated dispersion models functionality to support planned NYC field test (Gap 4).	FY 2019 Q2	FY 2019 Q4
Complete planning for large-scale simulated bioagent release (Gap 5).	FY 2019 Q1	FY 2019 Q4
Deliver fieldable low field NMR capability for evaluation of utility in screening unknown liquids in 3-1-1 packaging (Gap 6).	FY 2019 Q1	FY 2019 Q4

Type of Research

Development and Applied

Technical Readiness Level

TRL 6 and 7.

Transition Plans

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

Explosives Detection – FY 2018: $31.6M. FY 2019 President's Budget: $31.9M. 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.

Explosives Detection Canine Program

- **Problem:** The 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 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 TSA and the HSE with the tools, techniques, and knowledge to better understand, train, and utilize the detection canine, and improve proficiency of the DHS and HSE detection canine teams. Provide an enduring research and development capability to the HSE 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, 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 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 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 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.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	4,500	4,800	5,269	4,408	4,408
Obligations	4,145	4,341	4,756	-	-

FY 2017 Key Milestone Events

- Delivered results of the initial phase: Trained odor reduction testing conducted with TSA's Canine Training Center (CTC).
- Provided the results of TSA Passenger Screening canine operational assessment.
- Conducted feasibility assessment for the development of low-cost non-hazardous training aids for selected conventional explosives.
- Conducted prototype testing for canine mounted track and transmit device.
- Delivered report detailing results of the operational readiness testing conducted at TSA CTC. Study informed training strengths/weaknesses regarding TSA passenger screening canines.

FY 2018 Planned Key Milestone Events

- Complete odor reduction proof of principle. Provide briefing and report to Director of TSA CTC with study findings and recommendations. Findings will support specific recommendations to improve canine imprinting efficiencies and effectiveness.
- Deliver qualitative analysis of the initial series of regional canine events. Analysis will inform a better understanding of operational readiness, identify gaps, and validate storage and handling challenges. Analysis will result in a report to state and local law enforcement agencies with explosive detection canines outlining recommendations for best practices improving training efficiency and effectiveness of the explosive detection canine teams.
- Complete parametric testing of PBIED explosive detection canines in the operational environment; focus is on variations of explosive

placements in bags and concealments on the body. The findings of this parametric testing will be used as a baseline to build upon in future phases of test and evaluation. These findings have value to inform concepts of operations and risk mitigation based on probabilities of detection.

- Conduct operational readiness assessment on the initial class of the TSA CTC's FY 2018 Passenger Screening Canine Training Course Pilot program. Assessment will inform the level of effectiveness of the pilot program.
- Conduct an emerging threat assessment with explosive detection canine teams from Capital Region Partners; identify potential areas for proficiency improvement.
- Conduct three Regional Explosive Detection Dog Initiative (REDDI) events with state and local law enforcement agencies.
- Develop proof of principle prototype of conventional base explosive material for non-hazardous/non-detonable detection canine training aid.

FY 2019 Planned Key Milestone Events

- Conduct qualitative assessment and analysis of law enforcement explosive detection canine teams in an operational environment through the 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 needs.
- Deliver comprehensive report of mass transit/large crowd/force protection event canine operational assessments for the PBIED-trained canine.
- Conduct a comprehensive study of canine genomic criterion that provide the best predictors for selection of successful detection canines. Findings of this analysis will augment behavioral evaluation by canine trainers and significantly improve selection success and consequently reduce fiscal and manpower inefficiencies affiliated with canine failure.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
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 HSE. The program will conduct numerous assessments for TSA, at their request, including their domestic Passenger Screening Canine Program.	FY 2017 Q2	FY 2018 Q2
Deliver qualitative analysis of the initial series of regional canine events. Analysis will inform a better understanding of operational readiness, identify gaps, and validate storage and handling challenges. Analysis will result in a report to state and local law enforcement agencies with explosive detection canines outlining recommendations for best practices improving training efficiency and effectiveness of the explosive detection canine teams.	FY 2017 Q3	FY 2019 Q4
FY 2018		
Complete Phase I of Odor Reduction proof of principle.	FY 2017 Q1	FY 2018 Q1
Provide briefing and report to Director of TSA's CTC with study findings and recommendations. Findings support specific recommendations to improve canine imprinting efficiencies and effectiveness.	FY 2017 Q1	FY 2018 Q1
Finalize commercialization of second critical need non-hazardous peroxide based explosive canine training aid for use in the HSE.	FY 2018 Q1	FY 2018 Q3
Deliver qualitative analysis of the initial series of regional canine events. Analysis will inform a better understanding of operational readiness, identify gaps, and validate storage and handling challenges. Analysis will result in a report to state and local law enforcement agencies with	FY 2018 Q1	FY 2018 Q3

explosive detection canines outlining recommendations for best practices improving training efficiency and effectiveness of the explosive detection canine teams.		
Complete Phase 2 Parametric testing of PBIED explosive detection canines in the operational environment. Phase 2 focus is on variations of explosive placements in bags and concealments on the body. The findings of this phase of the parametric testing will be used as a baseline to build upon in future phases of test and evaluation. These findings have value to inform concepts of operations and risk mitigation based on probabilities of detection.	FY 2018 Q1	FY 2018 Q3
Conduct operational readiness assessment on the initial class of the TSA CTC's FY 2018 Passenger Screening Canine Training Course Pilot program. Assessment will inform the level of effectiveness of the pilot program	FY 2018 Q1	FY 2018 Q4
Conduct an emerging threat assessment with explosive detection canine teams from Capital Region Partners; identify potential areas for proficiency improvement	FY 2018 Q1	FY 2018 Q3
Conduct three REDDI events with state and local law enforcement agencies	FY 2018 Q1	FY 2018 Q4
Develop proof of principle prototype of conventional base explosive material for non-hazardous/non-detonable detection canine training aid.	FY 2018 Q1	FY 2018 Q3
FY 2019		
Conduct qualitative assessment and analysis of law enforcement explosive detection canine teams in an operational environment through the 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 Q1	FY 2019 Q4
Conduct a comprehensive study of canine genomic criterion that provide the best predictors for selection of successful detection canines. Findings of this analysis will augment behavioral evaluation by canine trainers and significantly improve selection success and consequently reduce fiscal and manpower inefficiencies affiliated with canine failure.	FY 2019 Q1	FY 2021 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.
  - Complete commercialization of second non-hazardous peroxide based canine training aid through rigorous quality assurance testing.
  - 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 Component updates to Detection Canine CONOPS.
  - Increased partner evaluation of first responder proficiency of canines using non-hazardous training aids.
  - Results inform U.S. and UK sharing for aviation threat vector.
  - Results from the REDDI inform the HSE with validation of capabilities and areas for further focus for both R&D and operational training.

Checked Baggage Program

- **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 innovative systems. The Checked Baggage program invests in high-performing enabling technologies that will be migrated into next generation checked baggage and checkpoint screening equipment.

  The Checked Baggage Program has three specific focus areas:
  1. *Advanced X-ray Systems Development* – Development and testing of full up system engineering design models (EDMs) (TRL 6-7 level of maturity).
  2. *Advanced Algorithms and System Integration* – Development/maturation of threat detection and false alarm reduction algorithms, integration into operational /prototype systems and demonstration of real time operation.
  3. *Supporting Component Technology Development* – Development/maturation of system components and subsystems (such as X-ray Sources and Detectors) necessary to evolve laboratory and experimental prototypes into full up X-ray system designs able to meet the Advanced X-ray Systems requirements.

- **Impact:** These next generation X-ray systems are anticipated to provide TSA with enhanced threat detection capabilities, improved onscreen alarm resolution, improved and expanded detection, lower false alarm rates, and reduced lifecycle costs, allowing TSA to be more efficient and effective in keeping pace with the threat as well as the pace of life for the traveling public. Future Program Capabilities will included the following:
  - An expanded library of explosives and explosives signatures that can be effectively detected
  - Improved automated explosives detection and false alarm performance
  - Improved imaging tools for operator alarm resolution
  - Improved system reliability, screening speed (throughput) and reduced cost of ownership compared with currently deployed explosives detection systems (EDS)

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	19,400	11,069	8,000	7,000	7,309
Obligations	19,038	10,088	564	-	-

FY 2017 Key Milestone Events

- Released Amendment to Apex Screening at Speed Broad Agency Announcement to include Advanced X-ray Systems Development Technical Topic Areas.
- Awarded four contracts at Transition Readiness Level of 5-7.
- Delivered one advanced algorithm for existing EDS or Advanced Technology (AT) systems.
- Developed a functional and testable X-ray diffraction explosive detection system suitable for acquiring data at government test facilities.
- Demonstrated enhanced materials discrimination using technologies developed under Broad Agency Announcement 13-05 projects.

FY 2018 Planned Key Milestone Events

- Transition standardized modular test kits and articles to DHS test centers for evaluation and integration into DT&E and OT&E
- Transition system concept knowledge products on laptops and prohibitied items algorithms to avaiation security stakeholders
- Build and deliver functional x-ray pre-prototype system based on initial design, modeling and architecture.
- Finalize Advanced x-ray Systems Development Remaining BAA 17-03 Awards. Transition knowledge products and engage in documented quarterly stakeholder exchange, in order to align with TSA acquisition.

FY 2019 Planned Key Milestone Events

- Monitor and manage remaining awards for BAA 17-03 in order to determine ability for prototype development at TRL 4 and progression to TRL 6-7 in the remaining 12-month period. This will include preliminary and critical design reviews with phased contracts.
- Initiate New Advanced X-ray Material Discrimination BAA for TRL 3-5.
- Complete three new automated threat recognition algorithms.
- Complete development for improvement of a currently TSA certified and deployed EDS system.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Advanced X-ray Systems Development Phase I Awards - Initial awards for BAA 17-03 phased in order to determine ability 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		
Transition standardized modular test kits and articles to DHS test centers for evaluation and integration into DT&E and OT&E.	FY 2016 Q3	FY 2018 Q2

Build and deliver functional x-ray pre-prototype system based on initial design, modeling and architecture	FY 2017 Q4	FY 2018 Q3
Finalize Advanced x-ray Systems Development Remaining BAA 17-03 Awards. Transition knowledge products and engage in documented quarterly stakeholder exchange, in order to align with TSA acquisition	FY 2015 Q3	FY 2018 Q2
FY 2019		
Advanced X-ray Systems Development Phase II Awards – Monitor and manage remaining awards for BAA 17-03, phased in order to determine ability for prototype development at TRL 4 and progression to TRL 6-7 in the remaining 12-month period	FY 2018 Q3	FY 2019 Q2
Initiate New Advanced X-ray Material Discrimination BAA for TRL 3-5. This effort will develop basic level research in an effort to apply novel techniques and approaches to current capability gaps and to expand the detection library.	FY 2019 Q2	FY 2019 Q4
Develop new automated threat recognition algorithms applicable to the current TSA threat assessment and requirements	FY 2017 Q4	FY 2019 Q4
Develop for improvement of a currently TSA certified and deployed EDS system in support of TSA recapitalization acquisition in 2020	FY 2017 Q4	FY 2019 Q2

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. Prototypes 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. Transition knowledge products upon delivery and coordinate direction of ongoing efforts.
- 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.
- Spiral development will be coordinated with TSA's recapitalization plans ensuring smooth and timely technology insertion.
- Initiate transition of prototypes through knowledge products and acquisition alignment with TSA by completing designated testing regime to qualify prototype and present data analysis and results to relevant stakeholders.
- Develop technology transition plans for qualifying prototypes which may include the development of additional prototype models though contracts or CRADA agreements.
- Complete transitions with delivery of prototypes to designated testing laboratories for certification readiness testing.
- Complete transition through document coordination evaluation sessions supported by interagency agreements and Technology Transfer agreements.

Primary Screening for Passengers

- **Problem:** High false alarm rates and extensive divestiture requirements associated with passenger screening create significant bottlenecks at aviation checkpoints. Whenever passenger screening systems predict a potential threat, TSA staff engages in a secondary, manual screening process that increases operational costs and negatively impacts the experience of the traveling public. As the number of travelers increases

every year and new threats emerge, TSA's capabilities must meet the increased demand. Additionally, currently qualified systems use proprietary architectures, which limits TSA's ability to engage a broader HSE to deploy improved capabilities.

- **Solution:** This Program develops people screening technologies that are safe, provide higher resolution scans, and have better automated detection 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 next-generation AIT systems. 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 improved image resolutions through the use of alternative frequency bands that acquire depth information to better image in three dimensions. Such approaches will provide higher screening throughput, fewer false alarms, 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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	9,957	6,000	6,000
Obligations	-	-	6,419	-	-

FY 2017 Key Milestone Events

- Conducted preliminary design reviews for systems selected for development for high-throughput screening at TSA's highest security standards.
- Demonstrated alpha prototype for stand-off passenger screening with reduced divestiture of clothing. Completed at least two Preliminary Design Reviews for systems selected for development for high-throughput screening at TSA's highest tier security standards.

FY 2018 Planned Key Milestone Events

- Accept all final submissions in the Passenger Screening Algorithm Challenge; S&T will receive all Prize-eligible automated threat detection algorithms and complete formal evaluation and scoring against a new test data set before independent verification and validation.
- Formally initiate the development of the capability to run third party automated threat recognition algorithms on an advanced imaging technology scanner using open architectures.

FY 2019 Planned Key Milestone Events

- Certify a high-resolution AIT portal for airport deployment that will be capable of automatically detecting threats at TSA's highest standards.
- Deliver system-specific Qualification Readiness Assistance and Qualification Readiness Testing reports on advanced systems such as Active Millimeter Wave screening systems, AIT automated target recognition, and/or alternative checkpoint passenger screening technologies.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Conducted Preliminary Design Reviews for systems selected for development for high-throughput screening at TSA's highest security standards.	FY 2017 Q1	FY 2017Q1
Demonstrated alpha prototype for stand-off passenger screening with reduced divestiture of clothing. Completed at least two Preliminary Design Reviews for systems selected for development for high-throughput screening at TSA's highest tier security standards.	FY 2017 Q4	FY 2018 Q4
FY 2018		
Accept all final submissions in the Passenger Screening Algorithm Challenge; S&T will receive all Prize-eligible automated threat detection algorithms and complete formal evaluation and scoring against a new test data set before independent verification and validation.	FY 2018 Q1	FY 2018 Q2
Formally initiate the development of the capability to run third party automated threat recognition algorithms on an advanced imaging technology scanner using open architectures.	FY 2017 Q3	FY 2018 Q1
FY 2019		
Certify a high-resolution AIT portal for airport deployment that will be capable of automatically detecting threats at TSA's highest standards.	FY 2018 Q1	FY 2019 Q4
Deliver system-specific Qualification Readiness Assistance and Qualification Readiness Testing reports on advanced systems such as Active Millimeter Wave screening systems, AIT automated target recognition, and/or alternative checkpoint passenger screening technologies.	FY 2018 Q1	FY 2019 Q4

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, 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 the number of travelers increases every year and new threats emerge, TSA's capabilities must meet the increased demand. The high false alarm rate during carry-on screening requires Transportation Security Officers (TSOs) to scrutinize on-screen images with even greater vigilance, resulting in lower passenger throughput and greater TSO fatigue.

- **Solution:** This project develops modular, dynamically upgradable carry-on baggage screening technologies to improve detection capability and increase passenger throughput, while maintaining or improving life cycle costs. Specifically, this project will deliver carry-on baggage screening systems with Automated Target Recognition (ATR) for explosives and other prohibited items. Technologies under development include X-ray systems that incorporate phase contrast, diffraction computed tomography, and/or energy-resolved detectors for enhanced material discrimination. These technologies will more effectively screens carry-on baggage that items such as bottles and personal electronic devices, while reducing the need for divestiture. New systems will be compatible with end-user standards and systems such as TSA's STIP and DARMS standards.

- **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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	-	-	4,609	4,000	4,000
Obligations	-	-	3,592	-	-

FY 2017 Key Milestone Events

- Completed two preliminary design reviews for systems selected for development for high-throughput screening at TSA's highest tier security standards.

FY 2018 Planned Key Milestone Events

- Complete System Concept Review for a system with the capability to automatically identify prohibited items (guns, knives, etc.) using a checkpoint CT X-ray scanner.
- Complete testing and accept a final report quantifying the feasibility of phase contrast imaging for detecting explosives and discriminating threats from innocuous items. Further developed, phase contrast imaging could augment primary screening systems for carry-on items to

significantly reduce false alarm rates.

FY 2019 Planned Key Milestone Events

- Demonstrate X-ray techniques capable of enhanced material discrimination when used in a configuration suitable for screening aviation carry-on items.
- Complete a Critical Design Review of a system using algorithms that automatically identify prohibited items using a checkpoint CT X-ray system.
- Deliver system-specific Qualification Readiness Assistance and Qualification Readiness Testing reports on advanced systems such as CT X-ray systems and/or alternative checkpoint baggage screening technologies.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Completed at least two Preliminary Design Reviews for systems selected for development for high-throughput screening at TSA's highest tier security standards.	FY 2016 Q2	FY 2017 Q4
FY 2018		
Complete System Concept Review for a system with the capability to automatically identify prohibited items using a checkpoint CT X-ray scanner.	FY 2017 Q3	FY 2018 Q1
Complete testing and accept a final report quantifying the feasibility of phase contrast imaging for detecting explosives and discriminating threats from innocuous items.	FY 2016 Q2	FY 2018 Q4
FY 2019		
Demonstrate X-ray techniques capable of enhanced material discrimination when used in a configuration suitable for screening aviation carry-on items.	FY 2016 Q2	FY 2019 Q4
Complete a Critical Design Review of a system using algorithms that automatically identify prohibited items using a checkpoint CT X-ray system.	FY 2017 Q3	FY 2019 Q2
Deliver system-specific Qualification Readiness Assistance and Qualification Readiness Testing reports on advanced systems such as CT X-ray systems and/or alternative checkpoint baggage screening technologies.	FY 2019 Q1	FY 2019 Q4

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 customers, 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 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 with 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 measurably improves performance and is directly correlated to increased preparedness, robustness, capacity for rapid recovery, and adaptability.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	500	500	1,033	1,033	1,033
Obligations	461	418	855	-	-

FY 2017 Key Milestone Events

- Developed capability to enhance imposter detection skills.
- Developed a sign cutting training video to enhance tracking skills.

FY 2018 Planned Key Milestone Events

- Conduct study to determine the pressure and patterns involved in law enforcement pat down procedures. Create new prototype pat down suites that can be transitioned for a training effectiveness evaluation.
- Develop prototype mannequins for PATT-M and PATT-F.
- Conduct at least three Training Effectiveness Evaluations at locations TBD
- Demonstrate technologies to at least two different components and/or first responder organizations to share research results and foster collaboration across DHS and the HSE
- Transition a capability to the HSE to enhance efficiency, effectiveness and safety of first responders and those on the front lines of national security

FY 2019 Planned Key Milestone Events

- Design at least two empirical evaluations with DHS Components focused on stress experienced during a simulated scenario-based training event.
- Develop a training interface that incorporates external triggers and presents the data graphically and interactively to instructors

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Developed capability to enhance imposter detection skills.	FY 2017 Q1	FY 2017 Q4
Developed a sign cutting training video to enhance tracking skills.	FY 2017 Q1	FY 2017 Q1
FY 2018		
Create static image functionality for ScreenADAPT®.	FY 2018 Q1	FY 2019 Q1
Create ID Validation functionality for Eye-dentify.	FY 2018 Q1	FY 2019 Q1
Expand Expert Tracker/Sign cutting training materials and methods to a stand-alone module for initial and recurrent training.	FY 2018 Q1	FY 2019 Q1
Conduct at least two data collection efforts focused on threat detection placement and pressure variants for Pat-down Accuracy Training Tool.	FY 2018 Q1	FY 2018 Q4
Conduct Training Effectiveness Evaluation for Pat-down Accuracy Training Tool.	FY 2018 Q1	FY 2018 Q4
FY 2019		
Conduct Training Needs Analysis for Behavior Detection and Pre-Assault Indicator tasks.	FY 2018 Q2	FY 2019 Q2
Create ScreenADAPT Functionality for Behavior Detection and Pre-Assault Indicator tasks.	FY 2018 Q2	FY 2019 Q2
Conduct Training Effectiveness Evaluation of ScreenADAPT® for behavior detection.	FY 2019 Q2	FY 2019 Q4

Develop a training interface that incorporates performance and stress as an output.	FY 2018 Q3	FY 2019 Q4
Develop real-time wireless physiological classifier of stress that is validated and customized for first responders.	FY 2018 Q3	FY 2019 Q4
Design an empirical evaluation of stress on learning for SMART.	FY 2018 Q3	FY 2019 Q2

Type of Research

Applied

Technical Readiness Level

TRL 4

Transition Plans

- A sign cutting training module will be transitioned to CBP's Border Patrol for enhancing tracking skills.
- Eye-dentify systems will be transitioned to CBP to enhance imposter detection and ID verifications skills.
- Pat-down Accuracy Training Tool (PATT) mannequins to be transitioned to TSA to enhance TSO skills and advance training and curriculum at TSA Academy.

Secondary Screening Technology Development

- **Problem:** The emergence of homemade explosive threats is a challenge for aviation security. The Secondary Screening Technology Development Program focuses on research, development, developmental testing and evaluation of the next generation of explosive trace detectors (ETDs) to enhance explosive detection capabilities across the HSE, including DHS Components:
  - TSA
  - CBP
  - USSS
  - USCG

  DHS Components use 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 ETD libraries are difficult to expand due to technical limitations. Sampling efficiency of these ETDs is also limited by current CONOPS (mostly contact sampling) and by Transportation Security Officers (TSOs) training and training curriculum.

- **Solution:** To increase ETD 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:** The program will enhance the capabilities of currently deployed ETDs and to develop the next generation of ETDs with capabilities such as specific identification of explosive threats, upgradable threat libraries and advanced sampling methodologies, including contact and non-contact sampling. The program also invests in scientific efforts that provide broadly applicable and foundational research to benefit the trace explosives detection R&D community. Examples include the characterization of explosive threats and their signatures, contact and non-contact sampling tools and methods, and other tools to enhance detection of homemade explosives. 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 Itemizer 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	-	-	5,343	5,200	5,200
Obligations	-	-	4,745	-	-

FY 2017 Key Milestone Events

- Tested and developed a retrofit ETD kit for enhanced explosives detection.
- Conducted Developmental Test and Evaluation of High Performance Ion Mobility Spectrometry - Mass Spectrometry ETD prototypes.
- Conducted Developmental Test and Evaluation of Triple Quadrupole Mass Spectrometry ETD.
- Conducted Critical Design Review of an ETD with integrated non-contact sampler.
- Conducted 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 Planned Key Milestone Events

- Critical Design Review (CDR) of an integrated Non-Contact 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. A major emphasis is on whether non-contact samplers can enhance explosives sampling efficiency and extend CONOPS for TSOs.
- Transition critical design knowledge products and outcomes of an assessment of a non-contact sampling technology to the HSE. The non-contact sampling technology will be evaluated for the ability to enhance trace explosives sampling efficiency.
- DT&E of Triple Quad Mass Spectrometry Explosives Trace Detectors, to be conducted in collaboration with the TSL. 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.

- Conduct an assessment of several mass spectrometry technologies in ETD prototypes in order to determine if these technologies hold promise for enhancing explosives trace detection by providing an expanded threat library while keeping false alarm rates low.
- Deliver results from government testing of reagent-enhanced swabs for use in currently deployed ETDs. Reagent-enhanced swabs have the potential of increased capability to detect a wider range of threats in resolution screening in the HSE.

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FY 2019 Planned Key Milestone Events

- Conduct DT&E of portable ETD prototype with enhanced threat library.
- Conduct T&E of electrostatic-based swabs.

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 the TSL. 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 was conducted in collaboration with the TSL. 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 CONOPS for TSOs	FY 2017 Q4	FY 2018 Q1
DT&E of Triple Quad MS ETDs. This DT&E will be conducted in collaboration with the TSL. 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 the TSL. 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
FY 2019		
DT&E of Portable Rapid Thermal Modulation Ion Mobility Spectrometer ETDs. This DT&E will be conducted in collaboration with the TSL. In addition to being tested and evaluated on their detection capabilities against conventional and homemade explosives and selected illicit drugs, the prototypes have to conform to a small footprint, and discern analytes from common background substances. These requirements ensure portable ETDs meet the challenging demands of field applications.	FY 2018 Q4	FY 2019 Q2
DT&E of Advanced Near Field Sampling Methods using electrostatic swabs. This DT&E will be conducted in collaboration with the TSL. Electrostatic swabs and Near Field Sampling Methods will be tested and evaluated in comparison to current CONOPS of swab-based contact sampling. Special emphasis is placed on whether Near Field Sampling using electrostatic swabs are effective in harvesting a wide range of	FY 2018 Q4	FY 2019 Q1

explosives.		

Type of Research
Applied

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

Transition Plans
This program currently has representatives from TSA, USSS, CBP, and USCG 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 enhancing ETD capabilities, 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 and transition two new capabilities: Advanced Itemizer DX ETD retrofit kit and reagent enhanced swabs.

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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	3,000	4,000	4,000
Obligations	-	-	2,744	-	-

FY 2017 Key Milestone Events

- Conducted Critical Design Review of Intelligent Video (IV) algorithm.

FY 2018 Planned Key Milestone Events

- 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.
- Integrate Intelligent Video (IV) algorithm into the Forensic Video Exploitation & Analysis (FOVEA) tool suite demonstrating automated detection and end-user cueing.
- Develop a non-divested image exploitation algorithm and integration with prototype mmW imager to scan the traveling public and their belongings without slowing throughput.
- Conduct simulation and analysis of layered sensing configurations for layered architecture prototyping effort to optimize sensor placement and system performance.
- Install FOVEA tool suite in Massachusetts Bay Transit Authority Operations & Communications Center for pilot demonstration.

FY 2019 Planned Key Milestone Events

- Conduct DT&E of integrated Intelligent Video /Forensic Video Exploitation & Analysis (IV/FOVEA) tool suite within WMATA SOCC to determine limits of detection performance in operational environment and impact to end-user.
- Conduct DT&E of centimeter (cmW) Flat Panel Imaging Array Technology in lab environment.
- Conduct OT&E of FOVEA tool suite in TSA ORCA mass transit test bed to determine limits of performance in operational environment in preparation for technology transition.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Conducted Critical Design Review of Intelligent Video (IV) algorithm**.**	FY 2017 Q1	FY 2017 Q4
FY 2018		
Conduct lab testing of prototype mmW imager to gauge effectiveness of preliminary integration of image exploitation algorithms for automatic target recognition.	FY 2018 Q1	FY 2018 Q4
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.	FY 2018 Q1	FY 2018 Q1
Integrate IV algorithm into FOVEA tool suite demonstrating automated detection and end-user cueing.	FY 2018 Q1	FY 2018 Q2
Develop a non-divested image exploitation algorithm and integration with prototype mmW imager to scan the traveling public and their belongings without slowing throughput.	FY 2018 Q2	FY 2018 Q3
Install FOVEA tool suite in Massachusetts Bay Transit Authority Operations & Communications Center for pilot demonstration.	FY 2018 Q2	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
FY 2019		
Conduct DT&E of integrated IV/FOVEA tool suite within WMATA SOCC to determine limits of detection performance in operational environment and impact to end-user	FY 2018 Q4	FY 2019 Q2
Conduct DT&E of centimeter (cmW) Flat Panel Imaging Array Technology in lab environment	FY 2019 Q1	FY 2019 Q3
Conduct OT&E of FOVEA tool suite within TSA ORCA mass transit test bed with industry partners in preparation for transition	FY 2019 Q2	FY 2019 Q4
Develop a Person Search capability within FOVEA tool suite and determine limits of detection performance in operational environment	FY 2019 Q2	FY 2019 Q4
Conduct Preliminary Design Review of Integrated Imaging System	FY 2019 Q1	FY 2019 Q2
Transition FOVEA tool suite to industry partner	FY 2019 Q4	FY 2020 Q1

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 ORCA Mass Transit Test Beds. When technologies reach appropriate maturity, they will be added to the approved grant list for purchase by surface transportation authorities.

Counter Terrorist – FY 2018: $81.1M. FY 2019 President's Budget: $77.1M. 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 2018: $16.4M. FY 2019 President's Budget: $16.4M. 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 HSE needs to prevent, protect, mitigate, respond and recover from biological terrorism. Homeland Security Presidential Directive 10 (HSPD-10) outlines the need for the comprehensive analysis of the Nation's biothreat defenses to help inform investments for national strategic biodefense planning, while identifying key knowledge and capability gaps and evaluating critical vulnerability mitigation strategies. In order to fulfill this mission, decision-makers require guidance to manage resources to reduce likelihood and impacts of bioterrorism.

- **Solution:** S&T's BTRA program prepares analysis-based knowledge products that guide decision-makers to improve our defense against bioterrorism. Decision support through variety of rapid analysis tools allow users to explore a variety of CONOPS and make judgments for scenarios that merit further investment to reduce risk. The BTRA program informs S&T's ITRA to provide guidance on the most efficient and cost-effective prevention, preparation and mitigation options across the HSE. The BTRA program is responsive to policy guidance provided by HSPD-10.

- **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. The BTRA program also provides support to the ITRA program in response to ITRA requirements.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	3,800	2,000	2,000	2,000	-
Obligations	2,882	1,700	3,538	-	-

FY 2017 Key Milestone Events

- Completed the economic consequence model.
- Developed 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 Planned Key Milestone Events

- Incorporate the economic consequence model into the BTRA analyses. A BTRA 5.1 analysis will be completed that estimates economic consequences of all attack scenarios.
- Implement a CMS for interactive operability with end-users.

FY 2019 Key Milestone Events

- N/A

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
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 transition to stakeholders and customers with DHS and across the interagency. The tools planned for transition:

- Risk Visualization Tool (RiViT).

- Biological Countermeasure Analysis and Planning Tool (Bio CAPT).
- Content Management System (CMS).

The products planned for transition:

- 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, input to ITRA 4.0.
- 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 HSE.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	4,500	3,000	3,000	3,000	3,000
Obligations	4,605	5,391	1,669	-	-

FY 2017 Key Milestone Events

- Published final MTA 2.0 (Ba) – 720 agent release scenarios; intelligence elicitation and overlay; multi-venue exposure modeling (indoor, outdoor, subway); main report plus seven appendices coordinated with HHS and interagency partners. 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.
- Integrated >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. Provided access to these records to >1,500 biodefense-community users per month.

FY 2018 Planned Key Milestone Events

- Deploy pathogen genomic alignment toolset and metadata analysis capability for the DHS Sequences of Interest database.
- Complete two national security sensitive, in-depth technical analyses of biothreat vulnerability pathways for biodefense community.

FY 2019 Planned Key Milestone Events

- Conduct bridging studies and transition validated tier 2 nucleic acid-based PHAA to USSS.
- Transition validated Conotoxin and Saxitoxin assays to USSS.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Delivered Material Threat Assessment 2.0 (Ba) to HHS customer, with 720 scenarios of possible agent use	FY 2017 Q2	FY 2017 Q2
Hosted Sequences of Interest database on Biodefense Knowledge Management System	FY 2017 Q1	FY 2017 Q2
Deployed chem-bio digital forensics capability to DHS Fusion Centers for use in tracking perpetrators of chem-bio attacks	FY 2017 Q2	FY 2017 Q4
FY 2018		
Brief the biodefense community on vulnerabilities related to an important emerging biothreat topic.	FY 2018 Q1	FY 2018 Q4
Update scientific and sensitive holdings in the Biodefense Knowledge Management System for the biodefense community	FY 2018 Q1	FY 2018 Q4
Identify and host threat-specific genomic databases and metagenomic analysis tools relevant to understanding and preventing biothreats in the genomic age	FY 2018 Q1	FY 2018 Q4
Maintain analytical support to the Chem-Bio Defense Division, as well as stakeholder requests for technical reach back support	FY 2018 Q1	FY 2018 Q4
FY 2019		
Deploy a metagenomic analysis capability within the Biodefense Knowledge Management System infrastructure for stakeholders to analyze potential genomic security risks	FY 2019 Q1	FY 2019 Q4
Deliver two in-depth technical analyses of biothreat capability pathways to Biodefense Knowledge Center stakeholders	FY 2019 Q1	FY 2019 Q4

Type of Research

Development

Technical Readiness Level

N/A

Transition Plans

Make BKC-developed technical reports and data analysis tools available to users across HSE via the Biodefense Knowledge Management System at multiple classification levels.

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 program 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	11,400	18,400	18,427	9,369	13,369
Obligations	10,498	23,513	11,663	-	-

FY 2017 Key Milestone Events

- Developed a framework to address non-traditional bio-threat agents.
- Established capabilities to measure the hygroscopic properties of biological threat agents in aerosols to provide data for improved aerosol hazard and consequence modeling of bioterrorism scenarios considered in the Bioterrorism Risk Assessment.

FY 2018 Planned Key Milestone Events

- Develop projects and experiments to address additional traditional biological threat-related knowledge gap requirements identified by stakeholders to provide actionable information to support informed policy and decision-making before, during, and in response to a biological incident.

- Address at least three critical knowledge gaps on the production, dissemination, persistence, and virulence of Tier 1 biological threat agents to inform the BTRA program, as well as, other government stakeholders responsible for biodefense preparedness and response.
- Produce and deliver at least three 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., BTRA), DHS and HSE biodefense strategy and policy development

FY 2019 Planned Key Milestone Events

- Provide flexible and agile Biological Threat Characterization capabilities for the execution of national security priority initiatives in support of DHS and the HSE that address traditional biological threat-related knowledge gap requirements identified by stakeholders to provide actionable information and data.
- Produce and deliver knowledge products that address additional critical knowledge gaps on the production, formulation, dissemination, persistence, and virulence of Tier 1 biological threat 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 and Development Description	Plan Start Date	Planned Completion
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 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 Yearly Project (portfolio) Review	FY 2018 Q3	FY 2018 Q4
FY 2019		

BTCP Projects execution	FY 2019 Q1	FY 2019 Q4
BTCP Projects next year planning	FY 2019 Q3	FY 2019 Q4
BTCP Projects review final reports	FY 2019 Q4	FY 2020 Q1
BTCP Yearly Project (portfolio) Review	FY 2019 Q3	FY 2019 Q4

Type of Research

Applied

Technical Readiness Level

N/A: Enduring capability that results in continuing 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 DOD 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, enabling policymakers to establish technically informed and sound policy, and enabling decision makers to appropriately prioritize biodefense spending on medical and non-medical countermeasure acquisition programs that impacts billions of dollars of Government spending.

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 prevention, preparedness, response, and recovery capabilities to mitigate risk of Chemical, Biological, Radiological, and Nuclear (CBRN) terrorism. In order to fulfill this mission, decision-makers require guidance to manage resources to reduce likelihood and impacts of CBRN terrorism.

- **Solution:** The ITRA program addresses this problem through the consolidation and integration of the DHS standalone risk assessments, namely, the Chemical Terrorism Risk Assessment (CTRA), BTRA, and Radiological/Nuclear Terrorism Risk Assessment (RNTRA). The ITRA program prepares analysis-based knowledge products that guide decision-makers to improve our defense against CBRN terrorism. The ITRA program is responsive to policy guidance provided by Homeland Security Presidential Directive 18 (HSPD-18). 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 HSE.

- **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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	3,800	2,000	2,000	2,000	-
Obligations	3,219	2,450	4,149	-	-

FY 2017 Key Milestone Events

- Delivered 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.
- Updated 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.
- Completed three Material Threat Assessments (MTAs) through the Integrated Terrorism Risk Assessment.

FY 2018 Planned Key Milestone Events

- Deliver ITRA 4.0 Final Report, a reference of the chemical, biological and radiological terrorism threat for the Federal Government and HSE.
- 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.

FY 2019 Planned Key Milestone Events

- N/A

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
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 Q4
MONA Methodology to Determine Addressable Risk of Programs	FY 2016 Q3	FY 2017 Q4
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
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

Explosives Threat Assessment- FY 2018: $18.2M. FY 2019 President's Budget: $18.2M. 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:** To determine the explosives that screening technologies need to detect, whether on passengers, in checked bags or air cargo, it is essential to first determine the effects that different explosive threats can cause to a variety of commercial aircraft. 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.
  - To provide TSA with this key information, EXD's Commercial Aircraft Vulnerability and Mitigation Program conducts analysis and live-fire tests on commercial aircraft to determine the potential for catastrophic structural failure while in flight.
  - EXD, supported by subject matter experts from the TSL, also identifies and evaluates countermeasures that can be used to mitigate the potential blast-effects of an explosive device onboard commercial aircraft. Testing has been conducted on a wide variety of countermeasures including blast resistant containers for transporting cargo and baggage and development of procedures that could counter a threat found in the passenger cabin while in flight.

- **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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	1,750	1,750	2,550	6,200	6,200
Obligations	1,611	1,544	2,302	-	-

FY 2017 Key Milestone Events

- Conducted 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.
- Delivered 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.
- Provided 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 Planned Key Milestone Events

- Conduct preliminary (unpressurized and pressurized) explosive vulnerability testing on Boeing 757 narrow body commercial aircraft test asset and deliver report to TSA.

- Conduct testing to evaluate aircraft cabin pressurization effects on curved/complex composite panel designs subjected to internal blast loads and report results to TSA.
- 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).
- Conduct live fire explosive vulnerability tests (multiple tests) on composite-construction commercial aircraft fuselage panels incorporating aircraft fuselage pressure differential effects.
- Deliver DHS-SharePoint resident update (e.g.; incorporates user feedback and test reports/data updates) Explosive Test Database to TSA user community (TSA Explosive Specialists).

FY 2019 Planned Key Milestone Events

- Deliver to TSA an updated classified commercial aircraft vulnerability analysis summary report, incorporating narrow and wide-body aircraft (aluminum and composite-based aircraft fuselage structures) explosive vulnerability live fire test data collected from FY 2017- present.
- Complete live fire explosive validation testing of TSA specified Modified Least Risk Bomb Location Procedures (M-LRBL) and report results to TSA.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Conducted 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
Updated classified wide and narrow body commercial aircraft explosive vulnerability analysis report and deliver to TSA.	FY 2017 Q1	FY 2017 Q3
Evaluated 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 preliminary (unpressurized and pressurized) explosive vulnerability testing on Boeing 757 narrow body commercial aircraft test asset and deliver report to TSA.	FY 2017 Q4	FY 2018 Q3
Conduct testing to evaluate aircraft cabin pressurization effects on curved/complex composite panel designs subjected to internal blast loads and report results to TSA.	FY 2017 Q4	FY 2018 Q4
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.	FY 2017 Q4	FY 2018 Q4
Deliver DHS-SharePoint resident update (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
FY 2019		
Deliver updated (incorporating aluminum and composite aircraft structures explosive vulnerability test results) classified wide and narrow body commercial aircraft explosive vulnerability analysis report to TSA.	FY 2019 Q1	FY 2019 Q3
Complete live fire explosive validation testing of TSA specified Modified Least Risk Bomb Location Procedures (M-LRBL) and report results to TSA.	FY 2018 Q4	FY 2019 Q4

Type of Research

Developmental

Technical Readiness Level

Completion of TMU technology development at TRL7.
Live fire test validated Modified Least Risk Bomb Location (MLRBL) procedures at TRL7.

Transition Plans

- Planned Demos and 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 to TSA customer (e.g.; Office of Security Operations Explosives Operations Branch, OSO-EOB) 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 threat of homemade explosives (HME) to the United States is not new, as evidenced by the 1995 Oklahoma City Bombing, and it is a threat that is continually evolving. Events after 9/11 such as the shoe bomber" in 2001, the London Underground bombings in 2005, and the "underwear bomber" in 2009 emphasized the threat, and the benefits of a strong domestic program. There have been a number of high profile attacks recently including the Paris attacks of October 2015, the 2016 Brussels HME Suicide Bombings, and the Daallo Airlines Flight 159 bombing in Somalia. These attacks have further bolstered the need for a strong explosive characterization program, and have served to re-

emphasize the benefits of the HME Characterization Program. As these threats are often made of common commercial items, it is a challenge to distinguish true HME threats from the many innocent gels and liquids in personal baggage or cargo. The use of homemade explosives (HMEs) creates emerging hazards for responders, complications for detection, and new challenges to intelligence organizations.

- **Solution:** The HME Characterization Program is a crosscutting portfolio, meaning the information collected in this program feeds into TSA and other DHS Components to benefit all the EXD programs and has focus areas on (1) explosive detection characterization, (2) threat assessments and prioritization, and (3) tests, tools and methodologies relating to explosives research and risk mitigation. The HME Characterization Program ensures the explosives community has a clear understanding of homemade and emerging explosive threats to improve detection technology, develops detection requirements, inhibits the unlawful use and manufacture of HMEs by providing data to inform regulatory decisions and provides a solid foundation for solutions to counter the threat, such as pre-planning tools for responders and event planners. It also examines the chemical and physical properties of these explosives in order to support the development of new screening capabilities. The program is developing decision support tools for responders to help mitigate HME incidents and respond more efficiently and safely.

- **Impact:** The HME Characterization program provides information that influences TSA's CONOPS, detection capabilities, 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 the deployment of solutions at 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	10,350	8,750	8,550	12,000	12,000
Obligations	9,532	7,957	7,440	82	-

FY 2017 Key Milestone Events

- Began testing and analysis for HME and sheet blast loading data.
- Delivered Homemade Explosives Safety Standards to Interagency users and International.
- Provided USSS with Anomaly Detection Prescreening test report.
- Delivered Homemade Explosives Training course for TSA-Office of Security Operations.
- Delivered 20 new HME detection windows to TSA for incorporation into existing and future bulk explosives screening systems (FY 2017). The output of these windows will lead to delivery of data to the TSA and vendors for algorithm development, certification of equipment and ultimately impact check- point and checked bag capabilities at the airport.
- Kicked off Homemade Explosive Simulant Certification Program.
- Completed Task II and III: Engineering Porosity in Energetic Materials with a PowderBed Printer.

- Kicked off the Explosive Threats Rapid Response Protocols project.
- Evaluated energy profiles of designated explosive materials identified by TSA's Detection Standards Analysis and Revision Methodology (DSARM) model for inclusion in the Scenario-and Target-Relevant Explosive Equivalency Tool (STREET) and TSL Commercial Aviation Vulnerability and Mitigation (CAV&M) research.
- Delivered HME Safety Protocols to HME International Homemade Explosives Working Group.
- Delivered DSARM to the TSA which will result in standard threat prioritization.
- Collected explosive performance on for several rapid response effort at the Tyndall Reactive Materials Site and delivered information to the TSA.
- Supported TSL DT&E and IT&E leads for system data collection at the Tyndall Reactive Materials Site.
- Kicked 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.
- Aided 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 Planned Key Milestone Events

- Deliver data results of the first 1-2 chemical precursor tests to NPPD Chemical Facility Anti-Terrorism Standards (CFATS)' program; enabling NPPD to assess the need for changes to their upcoming Notice for Proposed Rule Making on explosive and HME chemical precursor regulations.
- Transition software training package for X-ray image recognition to DHS customer.
- Deliver explosive characterization and equivalency information to TSA for updating their APSS detection standards.
- Completion and delivery of certification guidelines for Professional Standards for Explosives Design and Testing Engineers and Architect.
- Deliver up to six Defense Threat Reduction Agency U.S. Strategic Command Center for Combating Weapons of Mass Destruction (DTRA/SCC-WMD) hosted Vulnerability Assessment Protection Option (VAPO) classroom training courses (four Level 1 with three in DC Area and one in Albuquerque) and two Level 2 (in the DC Area).
- Conduct explosive material characterization studies against the DSARM threat list and incorporate the study's results into TSA detection standards.
- Initiate development of a library of tens of thousands of threat bag checkpoint CT images from multiple vendor platforms for a Passenger Baggage Object Database (PBOD).
- Develop and transition explosive characterization and detection training products to TSA Intelligence Operations for use in classroom exercises.
- Complete development and deliver a PED application prototype for additional checkpoint screening.

FY 2019 Planned Key Milestone Events

- Deliver results from Transportation Security Equipment to support at least 10 material characterization studies against the DSARM threat list and rapid responses, 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, TIEDS, and the TSL. The output of these tests will lead to

delivery of data to the TSA and vendors for algorithm development, certification of equipment and ultimately impact Checkpoint and Checked Bag capabilities at the airport.

- Deliver threat library data set to TSA for the Passenger Baggage Object Database, an extensible repository of images and metadata related to aviation security inspection modalities that can be provided as a common standard data set for third party developers of automated threat recognition algorithms.
- Deliver characterization data on five additional HME formulations by the Israel Security Agency. This data will aid the HME Program to deliver data to the TSA and vendors for algorithm development, certification of equipment and ultimately impact Checkpoint and Checked Bag capabilities at the airport.
- Deliver precursor percentage data to CFATS from FBI studies and hold first meeting on Global Initiative on precursor percentage regulations.
- Develop a C-4 Equivalency and data upload for the Scenario and Target Relevant Explosive Equivalency Tool (STREET), a software tool which calculates scenario-appropriate explosive equivalence for a wide variety of explosive materials for improving the TSA detection standards and vulnerability assessments.
- Conduct an explosives simulant validation and verification methodology for x-ray signatures to enable the completion of a pilot study

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Delivered 20 new HME detection windows to TSA for incorporation into existing and future bulk explosives screening systems (FY 2017). The output of these windows will lead to delivery of data to the TSA and vendors for algorithm development, certification of equipment and ultimately impact Check point and Checked Bag capabilities at the airport.	FY 2017 Q1	FY 2017 Q4
Kicked off Homemade Explosive Simulant Certification Program.	FY 2016 Q4	FY 2017Q1
Completed Task II and III: Engineering Porosity in Energetic Materials with a PowderBed Printer.	FY 2015 Q2	FY 2017 Q4
Kicked off the Explosive Threats Rapid Response Protocols project.	FY 2017 Q3	FY 2017 Q3
Evaluated 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 TSL Commercial Aviation Vulnerability and Mitigation (CAV&M) research.	FY 2017 Q1	FY 2017 Q4
Final review followed by delivery of published HME Safety Protocols to HME International Working Group.	FY 2017 Q2	FY 2017 Q4
Delivered the Detection Standards Analysis and Revision Methodology (DSARM) to the TSA which will result in standard threat prioritization.	FY 2016 Q3	FY 2017 Q
Collected explosive performance for several rapid response efforts at the Tyndall Reactive Materials Site and delivered information to the TSA.	FY 2017 Q1	FY 2017 Q4
Supported TSL DT&E and IT&E leads for system data collection at the Tyndall Reactive Materials Site.	FY 2017 Q1	FY 2017 Q4
Kicked off operations at the DHS Detection Technology Center.	FY 2014 Q4	FY 2017 Q1
FY 2018		
Completion and delivery certification guidelines for Professional Standards for Explosives Design and Testing Engineers and Architect	FY 2016 Q2	FY 2018 Q4

Transition software training package for X-ray image recognition to DHS customer.	FY 2016 Q4	FY 2018 Q2
Deliver data results of the first 1-2 chemical precursor test to NPPD CFATS' program; enabling NPPD to assess the need for changes to their upcoming Notice for Proposed Rule Making on explosive and HME chemical precursor regulations	FY 2017 Q4	FY 2018 Q4
Deliver explosive characterization and equivalency information to TSA for updating their detection standards	FY 2015 Q4	FY 2018 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 2016 Q3	FY 2018 Q4
Conduct explosive material characterization studies against the DSARM threat list and incorporate the study's results into the TSA detection standards.	FY 2018 Q1	FY 2018 Q4
Initiate development of a library of tens of thousands of threat bag checkpoint CT images from multiple vendor platforms for a Passenger Baggage Object Database (PBOD)	FY 2017 Q2	FY 2018 Q2
Develop and transition explosive characterization training products to TSA Intelligence Operations for use in classroom exercises	FY 2018 Q1	FY 2018 Q4
Complete development and deliver a PED application prototype for enhanced checkpoint screening	FY 2017 Q4	FY 2018 Q4
FY 2019		
Deliver results from Transportation Security Equipment to support at least 10 material characterization studies against the DSARM threat list and rapid responses, 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. The output of these tests will lead to delivery of data to the TSA and vendors for algorithm development, certification of equipment and ultimately impact Checkpoint and Checked Bag capabilities at the airport.	FY 2019 Q1	FY 2019 Q4
Deliver threat library data set to TSA for the Passenger Baggage Object Database, an extensible repository of images and metadata related to aviation security inspection modalities that can be provided as a common standard data set for third party developers of automated threat recognition algorithms.	FY 2019 Q1	FY 2019 Q4
Deliver characterization data on five additional HME formulations by the Israel Security Agency. This data will aid the HME Program to deliver data to the TSA and vendors for algorithm development, certification of equipment and ultimately impact Checkpoint and Checked Bag capabilities at the airport.	FY 2019 Q1	FY 2019 Q4
Deliver precursor percentage data to CFATS from FBI studies and hold first meeting on Global Initiative on precursor percentage regulations.	FY 2016 Q1	FY 2019 Q2
Develop a C-4 Equivalency and data upload for the Scenario and Target Relevant Explosive Equivalency Tool (STREET), a software tool which calculates scenario-appropriate explosive equivalence for a wide variety of explosive materials for improving the TSA detection standards and vulnerability assessments.	FY 2018 Q2	FY 2019 Q2
Conduct an explosives simulant validation and verification methodology for x-ray signatures to enable the completion of a pilot study.	FY 2016 Q1	FY 2019 Q2

Type of Research

Applied

Technical Readiness Level

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

Transition Plans

- Provided USSS with Anomaly Detection Prescreening test report. This report will aid the USSS in their efforts to catch suspicious items at checkpoint.

- 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 per year.
- Transition new capabilities within the Incident Management Preparedness and Coordination Toolkit (IMPACT) specifically tailored to United States Capital Police (USCP), Washington D.C. Metropolitan Police and other Law Enforcement agency applications. The rollout of major capability enhancements and law enforcement-specific upgrades for the Incident Management Preparedness and Coordination Tool Kit (IMPACT) will enhance situational awareness, communication, and collaboration during and for security events.
- Deliver a web enabled X-ray screening training to provide basic and recurring training to the USSS workforce will eliminate their need to travel to a physical training location to receive that training.
- Deliver safety protocols for homemade explosives which will provide Government personnel and their Contractors 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, FBI, DHS, DOD, and other mission partners.
- Delivered Homemade Explosives Training course for TSA-Office of Security Operations.
- Deliver a law enforcement version of VAPO and provide NYPD and other law enforcement and Government end users with DTRA/SCC-WMD hosted VAPO classroom training courses to enable them to effectively use VAPO for DHS.
- Provide Ammonium Nitrate Booster Study results to support TSA Freight and Rail Security Policy and Industry Partners. This will enable the development of more effective transportation infrastructure risk mitigation plans and Government supported voluntary self-regulation considerations.
- Transition a decision support tool prototype to the TSA. This tool will provide TSA with enhanced detection capabilities complementary to X-ray imaging that will offer additional screening measures for passenger's Personal Electronic Devices such as laptop computers in their carry-on bags at checkpoints.
- Deliver a decision support tool prototype to the TSA which will provide enhanced detection capabilities complementary to X-ray imaging offering additional screening measures for Passenger's Personal Electronic Devices such as lap-top computers in their carry-on bags at checkpoints.
- Transition and implement guidelines for a Certified Blast Protection Professional (CBPP) consisting of a credentialing model framework and best-practice knowledge, skills, and abilities for architectural and engineering professionals engaged in characterizing or mitigating the hazardous effects of explosives to the National Institute for Certification in Engineering Technologies (NICET).
- Deliver a standard energetic film aimed to minimize the variability in major factors to support inter and intra laboratory comparison of homemade explosives sensitivity data as well as identification of system changes or malfunctions improving the safety posture of the entire explosives safety testing community.
- Transition the Detection Standards Analysis and Revision Methodology (DSARM) to the TSA which will result in standard threat prioritization.
- Provide results from Transportation Security Equipment to support at least 10 material characterization studies against the DSARM threat list and rapid responses, including Region of Responsibility (ROR) research for X-ray based detection technologies, characterization studies of

HME, and quality control efforts. The transition of this product will lead to the delivery of data to the TSA and vendors for algorithm development, certification of equipment and ultimately impact Checkpoint and Checked Bag capabilities at the airport.
- Develop and transition a C-4 Equivalency and data upload for the Scenario and Target Relevant Explosive Equivalency Tool. This tool will improve the TSA detection standards and their vulnerability assessments.
- Provide precursor percentage data to CFATS studies, in partnership with the FBI to NPPD to inform the Global Initiative on precursor percentage regulations.

Hostile Behavior Predict and Detect - FY 2018: $44.9M. FY 2019 President's Budget: $40.9M. 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 continuing problem; however, the drivers behind violent extremism and the best methods of mitigating the risk of terrorism are not fully understood. Analyses of extremist violence are currently based on case studies as well as empirical, quantitative data (developed by S&T), but the effectiveness of terrorism prevention (TP) programs are often not clear.

- **Solution:** 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. This includes independent evaluation research, innovative capability development, and data analysis and development.

- **Impact:** New capabilities will support more efficient and accurate analysis of the threats posed by violent extremists and evidence-based TP 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 Terrorism Prevention Partnerships (OTPP), Offices of the Principal Deputy Counterterrorism Coordinator, Policy, Civil Rights and Civil Liberties, and local TP practitioners in assessing the impacts of policies and programs developed to counter violent extremism.

Sub Project

- International Expert Engagement and Analysis of TP Evaluations: S&T will host an international expert elicitation to share research, findings, and best practices, and discuss metrics, methods, results, and lessons learned from existing countering violent extremism program evaluations.
- Assessment Tools to Support Secondary and Tertiary Intervention for Violent Extremism: Determine the feasibility of, and potentially move closer to, the creation or validation of risk assessment tools specific to violent extremism.
- Evaluation of TP Community Grants: Independently evaluate the effectiveness of select programs initiated through the OTPP Grant Program.
- Text-Enabled Safe Referral Hotline Protocols and Evaluation: Develop protocols that can be used by existing hotlines to offer violence reduction and terrorism prevention services.

- TP Operation Roadmap: Identify stakeholder needs and requirements and develop a library of Terrorism Prevention research.

Overall Project Funding

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	1,001	2,500	1,000	1,000	1,000
Obligations	2,723	1,590	813	-	-

FY 2017 Key Milestone Events

- Delivered a formative evaluation of pilot city evaluations to prepare programs for subsequent impact evaluation.
- Delivered an impact evaluations of pilot city efforts to understand what activities have been successful.

FY 2018 Planned Key Milestone Events

- Develop a data and literature library on government TP policies, programs, and operational activities to establish an operational roadmap.
- Develop a catalog of common metrics used by evaluators of local extremist violence prevention and intervention programs internationally.

FY 2019 Planned Key Milestone Events

- Evaluate the effectiveness of violence prevention protocols at a 211.org crisis hotline
- Develop a crowdsourcing capability to identify appropriate social services that can be used to help individuals at risk of extremist violence.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Public Launch of TEVUS.	FY 2017 Q1	FY 2017 Q1
Public Launch of PIRUS.	FY 2017 Q2	FY 2017 Q2
Delivered Formative Evaluation in Los Angelas (LA) and Boston.	FY 2015 Q4	FY 2017 Q1
Developed transition plan for Hotline Protocols and identify transition partner.	FY 2016 Q4	FY 2017 Q1
FY 2018		
Deliver International Expert Engagement Final Report	FY 2017 Q2	FY 2018 Q1
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 OTTP.	FY 2017 Q3	FY 2018 Q3
Conduct a process evaluation for hotline protocols.	FY 2018 Q1	FY 2018 Q4
Finalize data and literature library for TP.	FY 2016 Q1	FY 2018 Q1
FY 2019		
Deliver an evaluation of hotline protocols	FY 2019 Q1	FY 2019 Q2
Develop a crowdsourcing app to identify available and appropriate violence prevention social services	FY 2019 Q1	FY 2019 Q3

Type of Research

Applied

Technical Readiness Level

TRL will vary between specific portfolio projects.

Transition Plans

- 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.
- Tools and techniques that are developed for local use are adopted, piloted, evaluated for impact and consequences, and transferred.

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

- **Problem:** Recent technology advances have resulted in a flood of inexpensive and easily obtainable, small and medium Unmanned Aerial Systems (UAS) capable of performing multiple flight applications with *no formalized training. Users* are no longer limited to law enforcement and military, but *include private* sector *entities* including commercial users, *researchers* and hobbyists. The FAA is currently engaged in ongoing rulemaking to *regulate this development.* DHS is responsible for the protection of American citizens and identified critical infrastructure against UAS/NTAT/AS used for nefarious purposes. Due to current statutor*y and regulatory restrictions,* DHS operating Components have limited capabilities to detect, track, identify, and respond to UAS. Additionally, different component operating environments require different solutions based on that components specific mission set. There is no "one size fits all solution". Given the rapid proliferation of highly capable UAS in the market and their ever increasing capabilities, DHS S&T must ensure there is an ability to predict and characterize future UAS threats and the capability to guide/incubate advanced countermeasures

- **Solution:** (1) Identify DHS Component requirements based on their specific mission sets. (2) Identify potential commercial solutions currently available that meets that component's need. (3) Exercise the DHS S&T developed Counter Small UAS Analysis and Review Tool (C-SMART), to assess, advise, integrate, and evaluate those commercially available capabilities. (4) Identify adaptations to commercial technologies to address urgent needs that cannot be met by the currently available commercial solutions; and, once validated, conduct OT&E within urban operational prototype platform (5) Conduct rapid test and evaluation of these adaptations in support of Component acquisitions as required.

- **Impact:** DHS Component UAS/C-UAS requirements identified and validated. Conduct and validate an initial review of commercially available solutions to will provide potential solutions to Components based on their specific requirements. DHS S&T will conduct operational test and evaluation for any follow-on component testing required for modification to systems or testing required for acquisition. S&T will also develop and provide technical upgrades for selected, high priority field capabilities, and will support the security planning for National Special Security Events (NSSE).

Overall Project Funding

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	20,000	19,386	19,000	19,000
Obligations	-	18,242	15,060	-	-

FY 2017 Key Milestone Events

- Under the auspices of the National Security Council Policy Coordination Committee (PCC), established a CUAS Technology Working Group delivering a compendium of CUAS technology to the PCC.
- Began collecting preliminary customer's requirements and use cases to inform C-SMART development.
- Released C-SMART 1.0 to support National Special Security Events.
- Began development of a CUAS test and evaluation capability within the National Capital Region for an urban operational prototype platform.
- Phase 1: DT&E of Technical Assessment of Counter UAS Technologies in Cities (TACTIC) I.
- Began characterization of future threats.

FY 2018 Planned Key Milestone Events

- Upgrade CSMART with geospatial information system extensions and virtual reality capabilities to improve accuracy and ease of use.
- Deliver Full Operational Capability (FOC) for DHS Component.
- Achieve Initial Operational Capability (IOC) for the Urban Counter-UAS Operation Prototype platform.
- Phase 2: OT&E of TACTIC.

FY 2019 Planned Key Milestone Events

- Develop FOC for NCR upgrades for CUAS detection and identification systems.
- Initial development of UCOP.
- Begin development of additional upgrades of UCOP.

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 IOC for Capability 1 for DHS Component.	FY 2017 Q2	FY 2017 Q4
Develop IOC for Capability 2 for DHS Component.	FY 2017 Q2	FY 2018 Q4
Future Threats Characterization.	FY 2017 Q3	Ongoing
TACTIC I	FY 2017 Q2	FY 2018 Q2
FY 2018		
Upgrade CSMART for geospatial and virtual reality.	FY 2018 Q1	FY 2018 Q4
Develop and Deliver FOC for DHS Component.	FY 2018 Q2	FY 2018 Q4
Achieve IOC for the Urban Counter-UAS Operation Prototype platform.	FY 2018 Q2	FY 2018 Q4
Phase 2: OT&E of TACTIC.	FY 2018 Q3	FY 2019 Q2
Stand up CUAS Sub-IPT.	FY 2018 Q1	FY 2018 Q2
FY 2019		
Develop FOC for NCR upgrades for CUAS detection and identification systems.	FY 2019 Q2	FY 2020 Q2
Initial development of Urban Counter-UAS Operation Prototype platform.	FY 2019 Q1	FY 2019 Q1
Begin development of additional upgrades of Urban Counter-UAS Operation Prototype platform.	FY 2019 Q2	FY 2020 Q2

Type of Research

Developmental and applied, depending on specific efforts.

Technical Readiness Level

TRL will vary depending on specific efforts.

Transition Plans

Capabilities transition to the USSS upon completion.

Evaluation results from the C-SMART tool transition to the customer in the form of a strategy document to assist in operational or acquisition efforts. For example: C-SMART v 1.0 was used to assist USSS and FBI in optimizing their C-UAS capabilities in support of the Republican National Convention, the Democratic National Convention, the Presidential Inauguration and the Independence Day celebration on the National Mall. Additional DHS Components and partners, such as the NPPD and FBI, have utilized C-SMART output to enhance security posture and planning at NSSEs and Special Event Assessment Rating (SEAR) identified events such as the 2017 Super Bowl, the Macy's Thanksgiving Parade in New York City and others. S&T is coordinating with TSA to use the C-SMART tool to assist the TSA's vulnerability assessments of the major domestic international airports.

The Urban Counter-UAS Operational Prototype (UCOP) will be an enduring T&E capability for S&T in partnership with the USSS. UCOP validated technologies will transition as interim or permanent operational capabilities for USSS and other components.

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 data 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 HSE 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 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	-	2,500	2,500	5,056	5,056
Obligations	-	338	526	-	-

FY 2017 Key Milestone Events

- Delivered report evaluating 275 open source and social media tools to support DHS screening and vetting missions and inform future R&D needs.
- Provide a tailored solution to complete two operational tests of open source and social media analytic tools with DHS Components.

FY 2018 Planned Key Milestone Events

- Deliver report on DHS social media gaps and requirements that would inform future investments.
- Develop and assess livestream prototypes and experiments.

FY 2019 Planned Key Milestone Events

- Deliver mission experiments, prototypes and pilots for automating video and speech analytics to improve open source and social media analytics in order to improve screening, vetting, situation awareness, and investigative missions of DHS Components including CBP, ICE, and USCIS.
- Partner with industry to improve government research and development relationships with regard to improving public safety and security using open source and social media data sources.
- Conduct research and development in cooperation with industry, universities, and other Government agencies as appropriate to improve and provide technical guidance to components and members of the HSE regarding open source and social media screening, vetting, situation awareness, and investigations methodologies.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Delivered report evaluating 275 open source and social media tools to support DHS screening and vetting missions and inform future R&D needs.	FY 2017 Q1	FY 2017 Q1
Provide a tailored solution to complete two operational tests of open source and social media analytic tools with DHS Components.	FY 2017 Q1	FY 2017 Q4

FY 2018		
Deliver report on DHS social media gaps and requirements that would inform future investments.	FY 2018 Q1	FY 2018 Q3
Develop and assess livestream prototypes and experiments.	FY 2018 Q1	FY 2018 Q4
FY 2019		
Deliver documented operationally relevant experiments, prototypes, and/or pilots to components and members of the HSE.	FY 2019 Q1	FY 2019 Q4
Partner with industry, participate in joint public-private workshops, and conduct joint experiments to improve public safety and security through the appropriate utilization of open source and social media.	FY 2019 Q2	FY 2019 Q3
Deliver technical notes, reports, and briefings to mission and operations leaders as appropriate in government and industry to improve screening, vetting, situation awareness, and investigations to improve public safety and security.	FY 2019 Q1	FY 2019 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. The program also 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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	-	10,000	10,000
Obligations	-	-	833	-	-

FY 2017 Key Milestone Events

- Released new solicitation calls in three to five specific areas covering broad DHS and critical infrastructure needs including finance sector cyber security, first responders and aviation security.
- Awarded Other Transaction Authority (OTA) Agreements in support of CBP, Financial Services Cyber Security Active Defense (FSCSAD), and IoT specific calls.
- Conducted outreach events in innovation communities beyond Silicon Valley including Boston, MA; Austin, TX; Washington, DC; and Seattle, WA.

FY 2018 Planned Key Milestone Events

- Release three to five new solicitation topics across two to three verticals covering broad DHS and critical infrastructure needs such as aviation security, seamless travel and cyber security.
- Complete development of a marketing and communications plan for the SVIP.
- Award one to four Phase 4 OT Agreements in support of the IoT Security Project.
- Conduct eight to 12 outreach events (e.g., Industry Days, Speaking Engagements, Webinars, etc.) in U.S. and internationally based innovation communities.
- Complete transition of at least one technology solutions under the IoT Security project. Transition may include limited, but is not limited to, DHS operational acquisition, initial commercialization of the DHS funded technology solution, or acquisition or licensing of a DHS-funded technology solution.

FY 2019 Planned Key Milestone Events

- Release new solicitation calls in three to five specific areas covering broad DHS and critical infrastructure needs.
- Transition completed projects into Component operational acquisition cycles or commercial products (project/solution dependent).

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
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
FY 2019		
Solicitation Call in Support of broad DHS needs.	FY 2019 Q1	FY 2019 Q4
Transition completed projects into component operations.	FY 2019 Q1	FY 2019 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**: Unmanned Aerial Systems (UAS) have increased in capability dramatically in recent years and offer substantial opportunities to support the missions of all first response domains: law enforcement, firefighting, emergency medical services, emergency management, HAZMAT, search and rescue and corrections. As UAS become increasingly integrated into the National Air Space, overcoming uncertainties in the limitations and legal requirements for their use, first responders need information on what vehicles and sensor packages meet their mission requirements, standard operating procedures for their use and guidance for integrating them into the entirety of their first response missions.

- **Solution**: S&T is initiating a program on enabling UAS for first responders. The project is divided into three initiatives: (1) testing and evaluation of platforms and sensor packages against the operational needs of first responders' field operations, (2) exercises to demonstrate and analyze the integration of UAS into the larger first response environment and (3) behavioral research into the public acceptability of UAS use by first responders in relation to such issues as privacy protection and public fears of accidents or property damage. The project is expected to expand into developing requirements for user training based on the results of the first three initiatives. PEO UAS is also addressing the need of DHS Components in border and maritime security, in collaboration with HSARPA's Borders and Maritime Security Division (BMD). Specific efforts to address the capability gaps of the Secure Border IPT are described under BMD's Air Based Technologies section.

- **Impact**: With support from S&T, first responders at the local, county and state levels will be able to invest cost-effectively in UAS platforms, sensors and ground control equipment that meet mission needs. They will be able to design local UAS programs that integrate into other ongoing operations and are also acceptable to local public opinion, privacy concerns and safety issues. This initiative will also provide the UAS industry with feedback on hardware, software and logistics priorities to support the evolving use of UAS.

Overall Project Funding

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	-	2,000	2,000
Obligations	-	-	-	-	-

FY 2018 Planned Key Milestone Events

- 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.

FY 2019 Planned Key Milestone Events

- Conduct First Responders Robotics Operational Systems Test (FRROST) on systems supporting Monitoring and Surveillance operations and, if possible, Tactical Operations.
- Conduct Disaster Response/Public Safety UAS Exercises.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
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
FY 2019		
Conduct FRROST.	FY 2019 Q1	FY 2019Q4
Conduct Disaster Response/Public Safety UAS Exercises.	FY 2019 Q1	FY 2019Q4

Type of Research

Applied

Technical Readiness Level

TRL will vary depending on specific efforts.

Transition Plans

- The project's test and evaluation results and associated analyses will be made available to first responder and emergency management service organizations at all levels.
- Directly involve first responder organizations in exercises to increase their knowledge and experience with UAS.

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. S&T is initiating 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 using a mission readiness cell. 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 DHS's go-to mission readiness project, this investment will mitigate the risk of unforeseen or emergent challenges in any mission area.

Overall Project Funding

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	-	7,926	3,927
Obligations	-	-	-	-	-

FY 2018 Planned Key Milestone Events

- 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.

FY 2019 Planned Key Milestone Events

- Increase S&Ts capabilities to predict and respond to time-critical tasks and emerging threats.
- Improve knowledge product that will integrate with predictive analytics capabilities and existing technical solutions.

Project Schedule

Research and Development Description	Planned 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
FY 2019		
Improve knowledge product capturing existing technical solutions to increase quantity and timeliness of responses to time-critical task requests.	FY 2019 Q1	FY 2019 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 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.

Identity Management Program FY 2018: $1.5M. FY 2019 President's Budget: $1.5M. 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

- **Problem:** Each week over 900,000 images are seized in new child exploitation cases and growing exponentially. There are over 220 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 the 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. 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 agents 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 officers 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.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	3,900	-	-	1,500	1,500
Obligations	3,623	-	-	-	-

FY 2018 Planned Key Milestone Events

- 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.

FY 2019 Planned Key Milestone Events

- Complete development of sensor pattern noise algorithms to scale to searching 200 million digital images
- Develop the ability to scrape the dark web for child exploitation imagery to include human trafficking, sex abuse and child war criminals.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2018		
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.	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
FY 2019		
Complete development of sensor pattern noise algorithms to scale to searching 200 million digital images in order to fully aide forensic law enforcement officials against human traficking and child exploitation. Scaling algorithms to this massive amount will require additional research and development to complete and verify operational effectiveness.	FY 2019	FY 2020
Develop the abilty to scrape the dark web for child exploitation imagery to include human traficking, sex abuse and child war criminals. Isolate faces from this imagery and format it for ingestion by the DHS IDENT database for use by DHS operational Components (and other trusted government agencies) who routinely screen people.	FY 2019	FY 2020

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

Transition Plans

- Child Exploitation Image Analysis Project: Technology Transition Agreement signed between 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.

Cyber Security/Information Analysis – FY 2018: $46.2M. FY 2019 President's Budget: $0.0M. 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.

Information Analytics – FY 2018: $4.0M. FY 2019 President's Budget: $0.0M. This program researches, analyzes, and develops technologies to strengthen interoperable communications and improve effective information sharing at all levels of government.

Decision Analytics

- **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, DHS, and HSE. 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 DHS 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	-	4,000	5,000	4,000	-
Obligations	-	0	3,526	-	-

FY 2017 Key Milestones

- 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.

FY 2018 Planned Key Milestones

- 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 (HPC) requirements.

FY 2019 Planned Key Milestones

- N/A

Project Schedule

Research and 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 HPC requirements.	FY 2017 Q1	FY 2018 Q4
FY 2018		
Conduct deep learning studies focused on potential DHS use cases.	FY 2018 Q1	FY 2018 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 2018: $42.2M. FY 2019 President's Budget: $0M. 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. Program funding ending in FY 2019.

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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	9,800	8,400	7,231	4,400	-
Obligations	8,490	6,312	4,614	-	-

FY 2017 Key Milestone Events

- Initiated two new research and development activities in an expanded portfolio of state-of-the-art cyber forensics tools and techniques.
- Completed privacy protecting network measurement research.
- Completed cryptocurrency forensics tool pilot with law enforcement agencies.
- Completed operational pilots of next generation technology architecture for transition to law enforcement customers.

FY 2018 Planned Key Milestone Events

- Transition reference materials for the forensic acquisition and analysis of 20 commercially available drones to Cyber Forensics Working Group member agencies.
- Expand developed cryptocurrency forensics tool to address additional operational requirements of DHS law enforcement officers.

FY 2019 Planned Key Milestones

- N/A

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Developed initial, test-ready cryptocurrency forensics tool.	FY 2016 Q2	FY 2017 Q1
Baselined requirements for privacy protecting network measurement and initiated research.	FY 2016 Q4	FY 2017 Q3
FY 2018		
Transition reference materials for the forensic acquisition and analysis of 20 commercially available drones to Cyber Forensics Working Group member agencies.	FY 2017 Q4	FY 2018 Q4
Expand developed cryptocurrency forensics tool to address additional operational requirements of DHS law enforcement officers	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, including each of the DHS law enforcement Components, 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. Program funding ended in FY 2018.

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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	1,151	-	3,822	2,606	-
Obligations	2,763	2,832	3,073	-	-

FY 2017 Key Milestone Events

- Transitioned research and development capabilities, especially using mobile devices, to the communities of interest in providing fine-grain secure information access and physical access.
- Provided 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 Planned Key Milestone Events

- Create tool for detecting personally identifiable information in network traffic, instrumented for IoT device.
- Prototype initial model Preserving Privacy While Affording Utility in Network and Computer Data Analytics.

FY 2019 Planned Key Milestones

- N/A

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
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		
Create tool for detecting personally identifiable information in network traffic, instrumented for IoT device.	FY 2018 Q1	FY 2018 Q4
Prototype initial model Preserving Privacy While Affording Utility in Network and Computer Data Analytics.	FY 2018 Q1	FY 2018 Q4

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 five percent of the U.S. Gross Domestic Product. Disrupting U.S. commercial aviation industry interests would have a significant national economic impact. Program funding ending in FY 2019.

Overall Project Funding

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	3,000	3,000	2,000	-
Obligations	-	2,685	2,631	-	-

FY 2017 Key Milestone Events

- Completed initial operational test and evaluation on commercial aircraft.

FY 2018 Planned Key Milestone Events

- Conduct a cyber vulnerability assessment of the full automated digital electronic control (FADEC) system to include test plan creation, test plan execution and test report generation.
- Conduct a cyber vulnerability assessment of the Flight Control System to include test plan creation, test plan execution and test report generation.
- Conduct a cyber vulnerability assessment of the Avionics Data Bus to include test plan creation, test plan execution and test report generation.

FY 2019 Planned Key Milestones

- N/A

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Conduct a cyber vulnerability assessment of the FADEC system to include test plan creation, test plan execution and test report generation.	FY 2017 Q2	FY 2018 Q3
FY 2018		
Conduct a cyber vulnerability assessment of the Flight Control System to include test plan creation, test plan execution and test report generation.	FY 2018 Q2	FY 2018 Q4
Conduct a cyber vulnerability assessment of the Avionics Data Bus to include test plan creation, test plan execution and test report generation.	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. Program funding ended in FY 2018.

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 this 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.
- Software Vulnerability Detection System - This project will focus on the development of a platform that will eliminate risk in the software supply chain, and provide the Government the ability to effectively evaluate software for potential security vulnerabilities that will significantly reduce security breaches.

Overall Project Funding

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	-	7,295	-
Obligations	-	-	-	-	-

FY 2018 Planned Key Milestone Events

- Produce STAMP Tool Study Report
- Deploy health and system check features into SWAMP-In-A-Box.

FY 2019 Planned Key Milestone Events

- N/A

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2018		
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 was 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 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 Proving Grounds, Commonwealth of Pennsylvania, and open-source developer community.

First Responder/Disaster Resilience – FY 2018: $61.3M. FY 2019 President's Budget: $61.3M. 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 level 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 2018: $5.0M. FY 2019 President's Budget: $5.0M. 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.

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

$ in Thousands	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	-	-	3,000	3,000
Obligations	-	-	-	-	-	-

FY 2018 Planned Key Milestone Events

- Initiate Wide-area Decontamination project

FY 2019 Planned Key Milestone Events

- Conduct field demonstration of sampling, decontamination and waste management methods and strategies for U.S. Coast Guard facilities and assets.

Project Schedule

Research and 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
FY 2019		
Task 2- Sampling and analysis protocols for urban areas including vegetation and USCG assets.	FY 2019 Q1	FY 2019 Q4
Task 3- Decontamination options for urban areas including vegetation and USCG assets.	FY 2019 Q1	FY 2019 Q4

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

$ in Thousands	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	-	-	2,000	2,000
Obligations	-	-	-	-	-	-

FY 2018 Planned Key Milestone Events

- Select performer(s) to deliver and prototype concept(s) for emergency escape hood.

FY 2019 Planned Key Milestone Events

- Complete development and fabrication of initial prototypes for component evaluation.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2018		
Select performer(s) to execute Prize Competition and deliver design of compact hooded escape respirator.	FY 2018 Q2	FY 2018 Q3
Initiate prototype development based on winning concept design.	FY 2018 Q3	FY 2019 Q3
FY 2019		
Complete development and fabrication of initial prototypes for component evaluation.	FY 2019 Q1	FY 2019 Q3

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 Components for operational deployment.

First Responder Capability – FY 2018: $17.8M. FY 2019 President's Budget: $17.8M. 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

- 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.
- Response and Defeat Operations Support (REDOPS): Establishes a systems analysis approach involving explosives countermeasures experts from all levels of government and direct RDT&E of technologies needed by state and local bomb squads (SLBS).

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	11,400	14,300	15,000	15,000	15,000
Obligations	13,031	15,580	7,962	-	-

FY 2017 Key Milestone Events

- Awarded contracts for the development of technologies that address the high priority needs identified by first responders.
- Transition and commercialize first responder technologies developed by R-Tech.

FY 2018 Planned Key Milestone Events

- 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.

FY 2019 Planned Key Milestone Events

- 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 and Development Description	**Plan Start Date**	**Planned Completion**
FY 2017		
Transition of the Personal Protective Equipment (NC State and LUNA).	FY 2017 Q3	FY 2018 Q1
Transition of the X-Ray Rover.	FY 2017 Q3	FY 2018 Q1

Continuing prototype testing of the Smoke Resistant Turnout Gear.	FY 2017 Q3	FY 2018 Q1
Transitioned 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 Q4
Design and Prototyping of the Respiratory Protection equipment.	FY 2017 Q3	FY 2018 Q4
Prototyping performed for the Body Worn Camera project.	FY 2016 Q3	FY 2018 Q2
Prototyping for Automated Driver and Responder Alert System (ADRAS) project.	FY 2016 Q4	FY 2018 Q4
Transition of Enhanced Dynamic Geo-Social Enviornment (EDGE) School.	FY 2016 Q2	FY 2018 Q1
Conduct four REDOPS operational assessments.	FY 2017 Q1	FY 2018 Q1
Transitioned four Counter-IED tools to public safety bomb technicians.	FY 2017 Q4	FY 2017 Q4
FY 2018		
Begin design of Emergency Vehicle to Civilian Vehicle Early Warrning System.	FY 2018 Q1	FY 2019 Q1
Begin design of Wildland Fire Respiratory Protection.	FY 2018 Q1	FY 2019 Q1
Begin design of Emergency Vehicle to Emergency Vehicle Early Warning System.	FY 2018 Q1	FY 2019 Q1
Begin design of Multi-Mission Disrupter.	FY 2018 Q1	FY 2019 Q1
Begin design of Multimeter Wire Attack Kit.	FY 2018 Q1	FY 2019 Q1
Begin design of Rescue Hoist Protective Glove.	FY 2018 Q1	FY 2019 Q1
Begin design of First Responder Routing Logic Guide.	FY 2018 Q1	FY 2019 Q1
Begin design of Integration of Public Data Feeds.	FY 2018 Q1	FY 2019 Q1
Perform OFA and Transition of the Body Warn Camera project.	FY 2018 Q2	FY 2018 Q2
Transition of Smoke Resistant Turnout Gear.	FY 2018 Q3	FY 2019 Q1
Transition of Respiratory Protection project.	FY 2018 Q3	FY 2019 Q1
Transition of Automated Driver and Responder Alert System (ADRAS) project.	FY 2018 Q3	FY 2019 Q1
Transition of the Indoor Navigation and Tracking for Emergency Responders (POINTER) project.	FY 2018 Q4	FY 2019 Q2
Develop a prototype of Emergency Vehicle to Civilian Vehicle Early Warrning System.	FY 2018 Q2	FY 2019 Q2
Develop a prototype of Wildland Fire Respiratory Protection.	FY 2018 Q2	FY 2019 Q2
Develop a prototype of Emergency Vehicle to Emergency Vehicle Early Warning System.	FY 2018 Q2	FY 2019 Q2
Develop a Prototype of Multi-Mission Disrupter.	FY 2018 Q2	FY 2019 Q2
Develop a Prototype of Multimeter Wire Attack Kit.	FY 2018 Q2	FY 2019 Q2

Develop a Prototype of Rescue Hoist Protective Glove.	FY 2018 Q2	FY 2019 Q2
Develop a Prototype of First Responder Routing Logic Guide.	FY 2018 Q2	FY 2019 Q2
Develop a Prototype of Integration of Public Data Feeds.	FY 2018 Q2	FY 2019 Q2
FY 2019		
Transition of the Indoor Navigation and Tracking for Emergency Responders (POINTER) project.	FY 2018 Q4	FY 2019 Q2
Transition Emergency Vehicle to Civilian Vehicle Early Warrning System.	FY 2019 Q3	FY 2020 Q1
Transition Emergency Vehicle to Emergency Vehicle Early Warning System.	FY 2019 Q3	FY 2020 Q1
Transition Multi-Mission Disrupter.	FY 2019 Q3	FY 2020 Q1
Transition Multimeter Wire Attack Kit.	FY 2019 Q3	FY 2020 Q1
Transition Rescue Hoist Protective Glove.	FY 2019 Q3	FY 2020 Q1
Transition First Responder Routing Logic Guide.	FY 2019 Q3	FY 2020 Q1
Transition Integration of Public Data Feeds.	FY 2019 Q3	FY 2020 Q1
Transition Wildland Fire Respiratory Protection.	FY 2019 Q3	FY 2020 Q1

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 (the actual URL is 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.
- 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. First Responder Communities of Practice is transitioning to an S&T hosting environment; however, the domain name, software platform, and overall purpose and capability offering will not change.
- 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	5,000	4,000	4,250	2,750	2,750
Obligations	2,911	3,541	3,503	-	-

FY 2017 Key Milestone Events

- Completed the transition of the FirstResponder.gov website to scitech.dhs.gov/first-responders to comply with the requirement to consolidate the number of DHS-related websites.
- Developed and expanded 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.
- Produced narrow-channel video programming targeted to the first responder community in the U.S.

FY 2018 Planned Key Milestone Events

- 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.
- 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.
- Conduct outreach to the first responder community by interacting with professional homeland security, public safety, responder, and criminal justice associations such as the Interagency Board (IAB), National Public Safety Telecommunications Council (NPSTC), International Association of Chiefs of Police (IACP), International Association of Fire Chiefs (IAFC), Association of Public-Safety Communications Officials (APCO), International Association of Emergency Managers (IAEM), etc.

FY 2019 Planned Key Milestone Events

- 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.
- Update the First Responder Communities of Practice collaboration site with relevant content, and promote the site, its communities, and features to stakeholders to facilitate usage of the site.
- 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.
- 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 provide information tailored for the first responder community.
- 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.
- 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.

Project Schedule

Research & Development Description – Tech Clearinghouse	Plan Start Date	Planned Completion
FY 2017		
Completed 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
Initiated the transition of First Responder Communities of Practice to the S&T EVMII to comply with the requirement to consolidate the number of DHS related websites.	FY 2017 Q2	FY 2017 Q4
Conducted outreach to the first responder community by interacting with professional homeland security, public safety, responder, and	FY 2017 Q1	FY 2017 Q4

criminal justice associations such as the IAB, NPSTC, IACP, IAFC, APCO, IAEM, etc.		
Updated 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		
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.	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 2018 Q1	FY 2018 Q4
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 Q1	FY 2018 Q4
FY 2019		
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 2019 Q1	FY 2019 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 2019 Q1	FY 2019 Q4
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 2019 Q1	FY 2019 Q4
Update the First Responder Communities of Practice collaboration site with relevant content, and promote the site, its communities, and features to stakeholders to facilitate usage of the site.	FY 2019 Q1	FY 2019 Q4

Type of Research

N/A

Technical Readiness Level

N/A

Transition Plan

N/A

Information Sharing and Interoperability – FY 2018: $11.9M. FY 2019 President's Budget: $11.9M. 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:** In collaboration with first responder stakeholders at international, national, state and local levels and commercial industry partners, 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. This project will provide the standard operating procedures, implementation guidance, product integration technologies and services needed to effectively and efficiently conduct response and recovery efforts.

- **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. Improve the ability of DHS and its HSE partners to quickly generate and receive, meaningful alert, warning and notification (AWN) messages regarding potential or ongoing threats to the Homeland. Expand commercial industry markets with new IoT sensors.

Sub Project

- Smart City IoT Interoperability Projects – collaboration between small business, local governments and commercial industry to develop and transition IoT sensors into the market for stakeholder adoption.
- Low-Cost IoT Flood Sensors – three small businesses were awarded innovation research contracts to develop cost-efficient flood sensors.
- Sensor and Architecture Framework Environment (SAFE) – designing interoperable, open standards-based on-body communications and sensors for first responder protected, connected and fully aware capabilities.
- Identity, Credential and Access Management (ICAM) – FirstNet and interagency collaboration to develop guidance for state/local stakeholder secure access to services.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	3,000	4,000	4,206	6,211	6,211
Obligations	2,744	3,586	5,097	-	-

FY 2017 Key Milestone Events

- Design, develop and prototype low-cost IoT flood sensors with three small businesses.
- Develop proof-of-concept for Smart Alert Engine (SALE) for flooding events and early warning.
- Expand the use and adoption of the National Incident Command System (NICS) with international, state and local government and not-for-

profit organizations.
- Expand Capability Maturity Model (CMM) 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 research.
- Developed (draft) ICAM procurement and implementation guidance; technology solution baseline comparison for FirstNet and SafeCom implementation strategy.

FY 2018 Planned Key Milestone Events

- Develop and deploy 300 low-cost IoT Flood Sensors with three small businesses and perform test and evaluation with state/local government stakeholders for adoption and industry commercialization.
- Design, integrate and commercialize Smart City & Internet of Things (IoT) Intelligent Building Infrastructure platforms (Unmanned Aerial Systems, EXIT signs and smoke alarms) with sensors (Wi-Fi detectors, 360 degree imaging and thermal) for search and detection.
- Initiate/originate an AWN message from a sensor (environment) into the FEMA IPAWS Test and Development Lab (TDL).

FY 2019 Planned Key Milestone Events

- IoT Intelligent Building Infrastructure Sensors – prototype, test and evaluate sensor suite (e.g. Smoke Alarms and Exit Signs) with integrated technology (e.g. Wi-Fi, Thermal and Imagery) for stakeholder acceptance and commercial industry adoption.
- Vehicle Inspection for Emergency Warning (VIEW) – Design a proof-of-concept and prototype of an auto/truck undercarriage imagining translator to detect modifications to manufacturing specifications to detect explosives and smuggled goods.
- Citizen Responder Training – enhance, expand a citizen centric training and capability to control bleeding from an injury from accidents or terrorist activities. Develop school-age appropriate training, materials, public service announcements and expand availability via state and local academic institutions and not-for-profit organizations.
- Deploy updated CMM Information Sharing Assessment Tool (ISAT) to expand on full stakeholder reporting and provision on advancement guidance.
- Sensor Architecture Framework Environment – deliver Next Generation First Responder SmartHub (e.g. IoT sensors and Communications) framework for industry market commercialization and stakeholder adoption.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Developed 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 Q3	FY 2018 Q3
Performed a CMM / ISC adoption and assessed review of select state and local first responder stakeholders to evaluate operational	FY 2017 Q3	FY 2017 Q3

readiness and maturity to determine gaps and requirements for S&T FRG.		
FY 2018		
Develop and deploy 300 low-cost IoT Flood Sensors with 3 small businesses and perform test and evaluation with State/local government stakeholders for adoption and industry commercialization.	FY 2018 Q1	FY 2018 Q4
Design, integrate and commercialize Smart City & Internet of Things (IoT) Intelligent Building Infrastructure platforms (Unmanned Aerial Systems, EXIT signs and smoke alarms) with sensors (Wi-Fi detectors, 360 degree imaging and thermal) for search and detection.	FY 2018 Q1	FY 2018 Q4
FY 2019		
IoT Intelligent Building Infrastructure Sensors – prototype, test and evaluate sensor suite (e.g. Smoke Alarms and Exit Signs) with integrated technology (e.g. Wi-Fi, Thermal and Imagery) for stakeholder acceptance and commercial industry adoption.	FY 2018 Q3	FY 2019 Q2
Smart ALert Engine (SALE) – Deliver and deploy a beta early detection capability for geo-targeted flooding events for machine-2-machine alerts warnings and notifications (e.g. cell phone, critical infrastructure, transportation, and first responders).	FY 2018 Q3	FY 2019 Q3
BAIT - Design a proof-of-concept and prototype of an auto/truck undercarriage imagining translator to detect modifications to manufacturing specifications to detect explosives and smuggled goods.	FY 2018 Q3	FY 2019 Q2
Stop The Bleed – enhance, expand and commoditize citizen centric training and capability to control bleeding from an injury from accidents or terrorist activities. Develop school-age appropriate training, materials, public service announcements and expand and availability via state and local academic institutions and not-for-profit organizations.	FY 2018 Q3	FY 2019 Q2
Deploy updated CMM Information Sharing Assessment Tool (ISAT) to expand on full stakeholder reporting and provision on advancement guidance.	FY 2019 Q2	FY 2019 Q3
Sensor Architecture Framework Environment (SAFE) – deliver Next Generation First Responder SmartHub (e.g. IoT sensors and Communications) framework for industry adoption.	FY 2018 Q2	FY 2019 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, the U.S. Department of Agriculture, etc.); government entities including the National Oceanic and Atmospheric Administration (NOAA), U.S. Geological Survey (USGS), and the U.S. Army Corps of Engineers (USACE); and state and local governments.
- SALE for Smart City technical feasibility prototype – Long Range Broad Area Announcement 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. The application open source code will be placed on the GitHub.org site for public, government, and commercial use.

- 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, General Service Administration, etc.) and other as part of the requirements, design, test and evaluation prior to a commercial transition. Will leverage industry Accelerator program partnering with the Center for Innovative Technology to support commercial partners for a product-to-market implementation strategy
- VIEW – will work with small business innovators to design, develop and commercialize a product-2-market strategy as part of the Broad Area Announcement solicitation. DHS Components, including CBP, Federal Protective Service and USSS are the primary stakeholders; however, state and local authorities and critical infrastructure industry partners are also market segments for commercialization.
- Citizen Responder Training – will work with the DOD Causality Care Research Center and the Uniformed Services University of Health Science to enhance, advance, and deploy the Stop The Bleed campaign to academic institutions and not-for-profits via a deployment strategy as part of the contracted services.
- CMM ISAT – Conduct phased transitions beginning with private-sector partner(s) and conclude with complete Federal transition to the DHS Office of Emergency Communications (OEC)/SAFECOM.
- Sensor Architecture Framework Environment (SAFE) – deliver open architecture framework for industry evaluation and sponsor PlugFests and fund application development for transition to First Responder stakeholder community

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.

- Demo Network – Examines ways in which first responders could access and communicate critical information using deployable networks 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.
- 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.
- Wearable Alert and Monitoring System - Composed of wearable devices called sensor nodes that connect to Internet of Things (IoT) sensors, as well as controller software that works with both local and remote artificial intelligence agents in the cloud to provide on demand communication and computing based on first responders' needs.
- Personal Area Network/ Wearable Internet of Things (IOT) Sensors - This project will assess the current state of standards for wireless sensors and to identify areas where the standards can be modified or enhanced to support public safety agendas. Additionally, this project will seek to drive or develop standards which will allow an open architecture for wireless sensors.
- Speech Analytic Technology - This project is intended to develop a speech analytics technology performance assessment methodology using suitable public safety relevant test data, and to measure current speech analytic systems capabilities in the context of public safety applications.
- Automatic Speech Recognition - This project will gather user requirements and develop a user profile for speech recognition technologies. Further, this project will examine the state of technology across industry and identify remaining gaps.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	5,338	4,000	4,206	5,700	5,700
Obligations	5,499	4,021	3,327	-	-

FY 2017 Key Milestone Events

- Utilized 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.
- Tested and evaluated at least one deployed capability in a communications-challenged environment.

FY 2018 Planned Key Milestone Events

- Conduct field demonstrations for one wireless broadband technology demonstrator solutions.
- Conduct tabletop exercise for two wireless broadband technology demonstrator solutions.

FY 2019 Planned Key Milestone Events

- Demonstrate datacasting utility with continued demonstrations/testing with public safety end users.
- Integrate a Sensor of Things API service infrastructure with Controller Core to support sensor discovery out in the field.
- Evaluate public safety oriented data against baseline performance measurements from Year 1 speech analytic research.

- Develop first iteration of future video analytics R&D interoperability testbed.

Project Schedule

Research & Development Description	Plan Start Date	Planned Completion
FY 2017		
Identified and prioritized user challenges and requirements with the first responder community.	FY 2017 Q1	FY 2017 Q3
Developed realistic network simulation tools and interference models for cellular network planning.	FY 2017 Q1	FY 2017 Q3
UtilizedBand 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
Published test results and/or knowledge products to better inform stakeholders about the state of the art technologies.	FY 2017 Q1	FY 2017 Q3
Developed field measurement method by which public safety can evaluate indoor broadband coverage in Band Class 14.	FY 2017 Q1	FY 2017 Q2
FY 2018		
Conduct field demonstrations for one wireless broadband technology demonstrator solutions.		
Conduct tabletop exercise for two wireless broadband technology demonstrator solutions.	FY 2018 Q1	FY 2018 Q4
Publish results in professional conference proceedings and journals.	FY 2018 Q1	FY 2018 Q4
FY 2019		
Demonstrate datacasting utility with continued demonstrations/testing with public safety end users.	FY 2019 Q1	FY 2019 Q4
Integrate a Sensor Things API service infrastructure with Controller Core to support sensor discovery out in the field.	FY 2019 Q1	FY 2019 Q4
Develop first iteration of future video analytics R&D interoperability testbed.	FY 2019 Q1	FY 2019 Q4
Evaluate public safety oriented data against baseline performance measurements from year 1 speech analytic research.	FY 2019 Q1	FY 2019 Q4

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.
- MOUs, MOAs, and other agreements are established with local, state, and Federal first responder agencies to allow for testing and evaluation of technology prototypes through demonstrations and pilot.

Natural Disaster Resiliency – FY 2018: $21.6M. FY 2019 President's Budget: $21.6M. 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

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	3,500	7,750	6,165	4,167	4,167
Obligations	3,086	7,058	5,417	-	-

FY 2017 Key Milestone Events

- Completed yearly oil and gas sector research project report and presented findings to oil and gas industry.
- Finalized requirements for future oil and gas PCS projects.
- Conducted threat assessment and best practice recommendation for building control security.

FY 2018 Planned Key Milestone Events

- 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 2019 Planned Key Milestone Events

- Develop and release final requirements and technical topic areas for CPS.
- Conduct and analyze preliminary research in cyber-physical system areas of context-awareness, ambient intelligence, and autonomous environments.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Academic and industry team provided draft best practices for building control security.	FY 2016 Q3	FY 2017 Q2
FY 2018		
Academic and industry team provided draft best practices for building control security.	FY 2017 Q2	FY 2018 Q2
FY 2019		
Release final requirements and technical topic areas for Cyber Physical Systems.	FY 2019 Q1	FY 2019 Q4
Conduct preliminary research and analysis in cyber-physical system areas of context-awareness, ambient intelligence, and autonomous environments.	FY 2019 Q1	FY 2019 Q4

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 opportunities.
- Due to the nature of the program focus, outcomes are applicable to a wide number of government and private sector agencies.

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.

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 NPPD's Office of Infrastructure Protection (OIP), define and validate PNT requirements for the critical infrastructure sectors through outreach to subject matter experts and critical infrastructure end-users.
- 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 much 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.
- Timing Vulnerability Testing for Critical Infrastructure: Perform system-level testing to understand the impact of timing disruptions on critical infrastructure.
- Impact Analysis of Power Grid Timing Service Disruptions: perform an impact analysis of timing service disruptions (both jamming and spoofing) on power grids through modeling and simulation and validation through hardware-in-the-loop simulation.
- 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.
- Adaptable Timing Manipulation Detection via Diverse Time Sources: Develop a timing manipulation detection capability by utilizing sensor fusion of a diverse ensemble of time sources and applying statistical models to monitor and detect anomalous timing errors.
- 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.

Overall Project Funding

$ in Thousands	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	-	1,000	6,702	10,830	10,830
Obligations	-	878	6,528	-	-

FY 2017 Key Milestone Events

- Coordinated with private sector GPS user equipment manufacturers and vendors to recommend mitigations and/or upgrades to next-generation products and production lines.
- Conducted open-air GPS testing on receivers and mitigation equipment or solutions (to include techniques, tactics, and procedures) to validate laboratory results.
- Transitioned intellectual property for commercialization of new equipment.

FY 2018 Planned Key Milestone Events

- Project Initiation: System-Level Timing Vulnerability Testing for Critical Infrastructure Timing.

FY 2019 Planned Key Milestone Events

- Host follow-on open-air GPS test event for testing of mitigation technologies or revised equipment from manufacturers.
- Release Best Practices for April 2019 GPS Week Number Rollover.
- Complete draft conformance standards framework.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Hosted 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
Hosted open-air GPS spoofing test event for GPS equipment manufacturers.	FY 2017 Q2	FY 2017 Q4
Finalized draft timing requirements report for the electricity subsector and wireless communications sector.	FY 2016 Q4	FY 2017 Q1
Finalized draft timing requirements report for the financial services and emergency services sectors.	FY 2017 Q1	FY 2017 Q3
Initiated project Multi-GNSS Evaluation.	FY 2017 Q2	FY 2017 Q2
Initiated project Impact Analysis of Power Grid Timing Service Disruptions.	FY 2017 Q2	FY 2017 Q3
Initiated project Adaptable Timing Manipulation Detection via Diverse Time Sources.	FY 2017 Q2	FY 2017 Q3
FY 2018		
Project Initiation: System-Level Timing Vulnerability Testing for Critical Infrastructure.	FY 2017 Q2	FY 2018 Q1
Project Initiation: Timing Manipulation Detection Capabilities.	FY 2017 Q2	FY 2018 Q2
Project Initiations: Assured Timing Technologies.	FY 2017 Q3	FY 2018 Q2
Host at least one workshop for the industry conformance framework.	FY 2018 Q2	FY 2019 Q2

FY 2019		
Host annual open-air GPS test event for industry.	FY 2019 Q1	FY 2019 Q4
Release Best Practices for April 2019 GPS Week Number Rollover.	FY 2018 Q3	FY 2019 Q2
Complete draft conformance standard framework.	FY 2018 Q4	FY 2019 Q2

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 the Homeland Security Systems Engineering and Development Institute FFRDC, the DoE Savannah River National Laboratory, the DoE Lawrence Livermore National Laboratory, the DoE Pacific Northwest National Laboratory, DoT (including the Volpe Center), NIST, and commercial industry groups for opportunities for commercialization or other transition or intellectual property.

National Hurricane Technology

- **Problem:** FEMA's National Hurricane Program's (NHP) current hurricane evacuation planning 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 as well as 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. Training is only available to around 250 individuals annually due to limitations in class size, available funding, and instructors, while the system has over 20,000 users that could all benefit from improved access to training. 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; USACE; USGS; NOAA; and state, local and tribal communities to create an integrated decision support 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 capabilities to analyze the impact and uncertainty assessments, a year round integrated training capability with simulated scenarios to enable serious gaming for improved training compliance and effectiveness, and planning tools to streamline pre-planning of evacuation zones and routes. Funds for FY 2018 support the transition of this prototype tool to an industry vendor to enable fulltime support and operations through a FEMA/USACE RFP. In addition, user feedback indicates that both the

evacuation alert and resource planning extensions piloted in FY 2017 should be integrated into HVX in FY 2018 and FY 2019, and that further work needs to be done to add newly developed products for inland flooding impacts as well as post-storm assessment capabilities.

- **Impact:** The modernized NHP decision support platform called HVX will enhance the ability of the end users at the state and local level in managing local hurricane evacuations and response to be better prepared in emergency management planning and decision making and more efficient and effective in the event of an emergency. 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 in 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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	1,000	1,000	1,000	1,000	1,000
Obligations	1,671	917	901	-	-

FY 2017 Key Milestone Events

- Deployment of functional prototype for operations during 2017 Hurricane season (May).
- Piloted products for evacuation alerting, resource allocation, and post-storm assessment.
- Provided HV-X software to FEMA as guidance to potential operations and maintenance vendors.

FY 2018 Planned Key Milestone Events

- Create prototype post-storm assessment capability.
- Integrate inland flooding impact products based on Hurricane Matthew/Hurricane Harvey experiences.
- Transition HVX software to FEMA/USACE selected industry O&M provider.

FY 2019 Planned Key Milestone Events

- Develop comprehensive hurricane evacuation planning training for emergency managers, covering all of FEMA's L-324 content and providing that content online, to all system users, year round.
- Enhance inland flood risk analysis capability.
- Develop capability to incorporate decision timelines from state/local operational response plans for various evacuation scenarios into timeline graphics.
- Enhance storm simulator functionality to ensure that users can create specific fully customizable storms and develop random storms to drive innovative training, and establish a capability for emergency managers (EMs) to practice critical decision making.
- Develop the capability to ingest and provide alerts from real-time traffic data.

- Integrate I-PAWS compatible functionality for public alerting.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Deployment of functional prototype for operations during 2017 Hurricane season.	FY 2017 Q1	FY 2017 Q2
FY 2018		
Create prototype post-storm assessment capability products.	FY 2018 Q2	FY 2018 Q4
Integrate evacuation alert pilot application (I-PAWS and current research).	FY 2018 Q1	FY 2018 Q4
Develop inland flooding impact capability.	FY 2018 Q2	FY 2018 Q4
HVX transition assistance.	FY 2018 Q1	FY 2018 Q4
Develop a graphical user interface that will allow EMs to easily add new questions to existing scenarios and build new training modules.	FY 2018 Q1	FY 2018 Q4
Integrate Transportation Analysis Capability.	FY 2018 Q1	FY 2018 Q4
FY 2019		
Develop comprehensive hurricane evacuation planning training for emergency managers, covering all of FEMA's L-324 content and providing that content online, to all system users, year round.	FY 2019 Q1	FY 2019 Q4
Enhance inland flood risk analysis capability.	FY 2019 Q1	FY 2019 Q4
Develop capability to incorporate decision timelines from State/Local operational response plans for various evacuation scenarios into timeline graphics.	FY 2019 Q1	FY 2019 Q4
Enhance storm simulator functionality to ensure that users can create specific fully customizable storms and develop random storms to drive innovative training, and establish a capability for EM's to practice critical decision making.	FY 2019 Q1	FY 2019 Q4
Develop the capability to ingest and provide alerts from real-time traffic data.	FY 2019 Q1	FY 2019 Q4
Integrate I-PAWS compatible functionality for public alerting.	FY 2019 Q1	FY 2019 Q4

Type of Research

Applied research.

Technical Readiness Level

TRL 5

Transition Plans

FEMA issued an RFP for transition and operations and maintenance (O&M) of S&T's HVX and awarded the O&M in October 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 $10B 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, over $100M in annual cost avoidance. 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

$ in Thousands	**FY 2014**	**FY 2015**	**FY 2017**	**FY 2018**	**FY 2019**
Project Funding	-	-	620	1,986	1,986
Obligations	-	-	37	-	-

FY 2017 Key Milestone Events

- Developed of program and project management plans.
- Identified key stakeholders and research collaboration partners.
- Initiated preliminary research in support of resiliency data development.
- Established initial transition concepts.

FY 2018 Planned Key Milestone Events

- Develop research plan.
- Initiate three resiliency research program with key stakeholders.

FY 2019 Planned Key Milestone Events

- Transition one or more technologies to operational use to increase community resilience.
- Continue research resiliency projects and identify additional stakeholders.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2017		
Development of program and project management plans.	FY 2017 Q2	FY 2017 Q4
Identified key stakeholders and research collaboration partners.	FY 2017 Q3	FY 2017 Q4
Initiated preliminary research in support of resiliency data development.	FY 2017 Q4	FY 2018 Q3
Established 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
FY 2019		
Transition one or more technologies to operational use to increase community resilience.	FY 2019 Q2	FY 2019 Q4
Continue research resiliency projects with two additional stakeholders.	FY 2019 Q1	FY 2019 Q4

Type of Research

Applied

Technical Readiness Level

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

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 of 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 services 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 (CREDC) – 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 cyber security 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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Project Funding	-	-	-	3,650	3,650
Obligations	-	-	-	-	-

FY 2018 Planned Key Milestone Events

- 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 draft gaps in the existing data and model set based on synthetic data preliminary award findings.

FY 2019 Planned Key Milestone Events

- Develop data to support infrastructure design, performance, and operation to identify predictive models and decision making for normalization, taxonomies, and repository requirements to support public and private efforts.
- Identify and characterize how the evolving demand for infrastructure services and new technologies, can be incorporated into new designs for more resilient interdependent critical infrastructure systems.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2018		
Finalize and release final report of a study on vulnerabilities on Safety Instrumented Systems (SIS) and basic Process Control Systems (PCS).	FY 2018 Q1	FY 2018 Q4
Select and develop specifications for the testing and evaluation procedures of a new project.	FY 2018 Q1	FY 2018 Q3
Identify and prioritize draft gaps in the existing data and model set based on synthetic data preliminary award findings.	FY 2018 Q1	FY 2018 Q4
FY 2019		
Collect, generate, validate, and publish existing, new, and synthetic data on critical infrastructure design and performance.	FY 2019 Q3	FY 2020 Q3
Identify and characterize how the evolving demand for infrastructure services and new technologies, can be incorporated into new designs for more resilient interdependent critical infrastructure systems.	FY 2019 Q2	FY 2020 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, the National Institute of Standards and Technology, the National Science Foundation 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. DHS-wide coordination is required to determine the R&D efforts needed to identify, monitor, and close those gaps and meet the most pressing needs of the Department.

- **Solution**: The R&D Integrated Product Teams (IPTs) were established by the DHS as the Department's primary collaboration mechanism for DHS-wide R&D coordination. Since 2015 the IPTs have become the central process for identifying and prioritizing R&D technological capability gaps. By developing 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 identified 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 R&D needs and sound investment strategies with close monitoring of budget activities.

- **Impact**: The institutionalization of a coordinated DHS R&D, based on prioritized technological capabilities gaps, is yielding significant results. The benefits start with a comprehensive profile of R&D being conducted across DHS. This profile provides a balanced DHS-wide R&D method for tracking current R&D within the Department and addressing emerging R&D and/or unanticipated R&D requests. 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 elimination of duplicative R&D efforts and the leveraging of other entities performing R&D: DOD, FBI, the U.S. Department of Energy and other Federal agencies along with industry, academia, and international partners. The successful DHS-wide collaboration advanced through the IPT Process is leading to improved accountability of small and large R&D projects. This data-driven IPT Process ensures seamless connectivity between operators and technical experts. Improvements, led by IPT advancements, focus on key areas:
    - Data quality – Continues to be a high priority of IPTs. Components provided an increased level of detail for funded R&D projects.
    - Data analytics – 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 continuance of 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* is informed by a ranking and prioritization system called Analytic Hierarchy Process (AHP) that results in more consistent outcomes and provides defendable data sets.

- 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

$ in Thousands	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Budget	-	-	2,000	5,000	5,000
Obligations	-	-	2,000	-	-

FY 2018 Planned Key Milestone Events

- Automate IPT processes for eliminating duplication and identifying R&D gaps solutions by implementing additional data analytics that will result in increased efficiencies and transition R&D results back to the stakeholders.
- 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.

FY 2019 Planned Key Milestone Events

- Develop a platform that will incorporate Predictive Analytics (based on current data analytics capabilities) into the IPT Process in order to improve overall effectiveness and efficiency of the IPT Process. Such a platform will not only provide a decision-making tool that will aid in predicting R&D readiness levels, but also fulfill the DHS R&D Plan Framework's goals and objectives of building private sector data management standards into Government operations.

Project Schedule

Research and Development Description	Plan Start Date	Planned Completion
FY 2018		
Complete a DHS-wide R&D Plan Framework that focuses on closing the high-priority R&D gaps by continuing to implement the IPT Decision Framework and IPT Gap Lifecycle.	FY 2018 Q1	FY 2018 Q4
Automate IPT processes for eliminating duplication and identifying R&D gaps solutions by implementing additional data analytics that will result in increased efficiencies and transition R&D results back to the stakeholders.	FY 2018 Q1	FY 2018 Q4
FY 2019		
Provide Phase I (the initial basis and data theory) operating platform that will incorporate Predictive Analytics into the data management of all IPT data operations. This will include a capability to; gather, sort, store, retrieve data that will result an R&D decision-making tool.	Phase I FY 2019 Q1	Phase I FY 2019 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 1-7.

Transition Plans

As noted earlier, the IPTs support and track the HSE customer/Component and assists 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

Organization *(Dollars in Thousands)*	FY 2017 Enacted			FY 2018 President's Budget			FY 2019 President's Budget			FY 2018 to FY 2019 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
University Programs	-	-	$40,500	-	-	$29,724	-	-	$21,746	-	-	($7,978)
Total	**-**	**-**	**$40,500**	**-**	**-**	**$29,724**	**-**	**-**	**$21,746**	**-**	**-**	**($7,978)**
Subtotal Discretionary - Appropriation	-	-	$40,500	-	-	$29,724	-	-	$21,746	-	-	($7,978)

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.

As part of this effort, 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. OUP's COE program priorities are developed by DHS operational Components, based on their long term mission needs. The COEs build homeland security expertise in the academic community, and create strategic partnerships with multiple Federal agencies, as well as other universities, the private sector, and state and local agencies. COE researchers work closely with DHS employees on DHS challenges. This approach has led to numerous new technologies and approaches that are being used to solve complex and challenging homeland security problems, such as: Advanced CIRCulation (ADCIRC) Storm Surge Modeling, ARMOR/PROTECT, HOAX Call location, Coast Guard Search and Rescue Visual Analytics (cgSARVA), Global Terrorism Database, etc. 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

Budget Authority *(Dollars in Thousands)*	**FY 2017**	**FY 2018**	**FY 2019**
Enacted/Request	**$40,500**	**$29,724**	**$21,746**
Carryover and/or Recoveries (Actual/Estimates/Projections)	$9,688	$10,818	$7,647
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$50,188**	**$40,542**	**$29,393**
Collections – Reimbursable Resources	$500	$500	$500
Total Budget Resources	**$50,688**	**$41,042**	**$29,893**
Obligations (Actual/Projections/Estimates)	$39,319	$30,589	$23,515
Personnel: Positions and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE; Includes Collections - Reimbursable Resources			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

University Programs – PPA
Summary of Budget Changes

Budget Formulation Activity *(Dollars in Thousands)*	Positions	FTE	Amount
FY 2017 Enacted	**-**	**-**	**$40,500**
FY 2018 President's Budget	**-**	**-**	**$29,724**
FY 2019 Base Budget	**-**	**-**	**$29,724**
FY 2019 Current Services	**-**	**-**	**$29,724**
6 Center of Excellence Reduction	-	-	($7,978)
Total, Program Decreases	**-**	**-**	**($7,978)**
FY 2019 Request	**-**	**-**	**$21,746**
FY 2018 TO FY 2019 Change	**-**	**-**	**($7,978)**

University Programs – PPA
Non Pay Budget Exhibits
Non Pay Summary

Organization *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Total Changes
University Programs	$40,500	$29,724	$21,746	($7,978)
Total	**$40,500**	**$29,724**	**$21,746**	**($7,978)**
Discretionary - Appropriation	$40,500	$29,724	$21,746	($7,978)

Non Pay by Object Class

Non-Pay Object Classes *(Dollars in Thousands)*	FY 2017 Enacted	FY 2018 President's Budget	FY 2019 President's Budget	FY 2018 to FY 2019 Change
21.0 Travel and Transportation of Persons	$110	$82	$82	-
25.1 Advisory and Assistance Services	$2,587	$1,936	$1,500	($436)
25.2 Other Services from Non-Federal Sources	$2	$1	$1	-
25.3 Other Goods and Services from Federal Sources	$1,562	$1,169	$1,169	-
25.5 Research and Development Contracts	$2,126	$1,534	$1,000	($534)
41.0 Grants, Subsidies, and Contributions	$34,113	$25,002	$17,994	($7,008)
Total - Non Pay Object Classes	**$40,500**	**$29,724**	**$21,746**	**($7,978)**

Non Pay Cost Drivers

Leading Non Pay Cost-Drivers *Dollars in Thousands*	**FY 2017 Enacted**	**FY 2018 President's Budget**	**FY 2019 President's Budget**	**FY 2018 to FY 2019 Total Changes**
Grants, Subsidies, and Contributions	$34,113	$25,002	$17,994	($7,008)
Advisory and Assistance Services	$2,587	$1,936	$1,500	($436)
Other	$3,800	$2,786	$2,252	($534)
Total – Non Pay Cost Drivers	**$40,500**	**$29,724**	**$21,746**	**($7,978)**

NON PAY NARRATIVE:

- **Grants, Subsidies, and Contributions**: The FY 2019 decrease is proportional to the reduction in funding to the COEs and S&T's investment in COEs.

- **Advisory and Assistance Services**: The FY 2019 decrease is proportional to the COE reduction. Advisory and Assistance services are contractual costs associated with administering COEs.

- **Other**: The FY 2019 decrease is proportional to the COE reduction. Includes: Research and Development Contracts are the direct cost of conducting research and development associated with COEs, and Travel.

University Programs – PPA
Research and Development
Technology Readiness Level Exhibit

Project Description:

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.

OUP Program Managers work with the COEs to structure and position projects to align with customer needs, beginning from conception, through testing, and piloting in the field. OUP technology development activities sync with the scientific and program management milestones appropriate for each project. These efforts differ depending upon the research gap being addressed, but involve partnerships with technology providers, data owners, commercialization entities, DHS Components, and other public sector agencies. OUP's management methods are designed to reduce the technical and programmatic risks of new technologies to the point where industry and other Federal customers are willing to invest in technology commercialization or move towards direct acquisition. OUP manages planned, formal technical and strategic annual and biennial reviews to assess individual project performance against key performance parameters. These reviews readjust overall research portfolio investments to respond to market forces and customer demand.

OUP Program Managers work with S&T's Office of General Counsel, the General Counsel of the performing institution(s), and COE Technology Commercialization Offices to support legal, privacy, market, and technology transfer elements of each project. DHS encourages COEs to 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.

Centers of Excellence Project Descriptions:
FY 2018: $26.3M. FY 2019 President's Budget: $18.4M.

Center for Accelerating Operational Efficiency (CAOE, formerly CHSQA): 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 CAOE 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, empirical data, and tested in operational settings, with the goal of transitioning 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 CAOE to transition analytical products and educational programs to DHS's workforce. DHS will work with multiple public and private stakeholders to test these capabilities in operational settings, and then make these solutions available and useful to all partners.

FY 2017 Key Milestone Events

- Selected COE performer for new COE topic area

FY 2018 Planned Key Milestone Events

- In FY 2018 Q1, CAOE will finalize its research agenda and thrust areas through a series of workshops for lead institution personnel, OUP officials, and the corresponding Board of Directors.
- In FY 2018 Q1, CAOE will explore innovative simulation and modeling methods to confront the challenges terrorism poses to DHS's mission set. Subtopics may include social media, critical infrastructure, or cyber security.

FY 2019 Planned Key Milestone Events

- In FY 2019 Q4, CAOE will identify an End-to-End project and develop milestones toward transitioning for operational use.

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 focusing on the dynamic interface between cyber and physical systems.

- **Problem:** Federal and state governments and the private sector need 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 with an emphasis on how computer hardware and software contribute to and threaten resiliency.
- **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 2017 Key Milestone Events

- Developed 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

- 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.

FY 2019 Planned Key Milestone Events

- Integrate, iteratively test, and refine prototype software components linking cyber-attack prediction and data sets to infrastructure models and risk assessment methods to support contextual based decision making that enhances the resilience of cyber physical systems.

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 2017 Key Milestone Events

- Conducted 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

- Reorient ADAC Research Program based on the results of the Biennial Review held in FY 2017 Q3.
- Conduct an RFP competition seeking research to address maritime technology challenges in the Arctic.

FY 2019 Planned Key Milestone Events

- Incorporate manufacturing efficiencies into the Long Range Autonomous Underwater Vehicle (LRAUV) design to create low cost productions.
- Implement new research focused on addressing challenges related to catastrophic oil spill events in the Arctic.

- Finalize a system prototype oil spill model for operation in the Arctic.

Borders, Trade, and Immigration (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 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 border management processes at ports of entry, identifying opportunities to counter weapons of mass destruction (WMDs) proliferation through export control enforcement, and improving biometric video and imagery capabilities that identify people in operational environments.

FY 2017 Key Milestone Events

- Conducted Immigration Workshop to identify knowledge and capability gaps regarding three major immigration issues.

FY 2018 Planned Key Milestone Events

- Issue report to address 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.
- Conduct Biennial Review in Q2 to evaluate BTI's research portfolio at both theme and project levels for research quality, good progress, and committed HSE customers.

FY 2019 Planned Key Milestone Events

- Reorient BTI research program based on results of the Biennial Review held in FY 2018 Q1
- Begin research to improve matching imagery or video under varying pose, inter-pupillary distance (IPD), and indoor uniform illumination collected in operation setting to existing datasets of 2D-2D, 3D-3D, and 3D aided-2D facial images.

Criminal Investigations and Network Analysis (CINA): 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. DHS's 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 Key Milestone Events

- Selected COE performer for new criminal investigations COE topic area.

FY 2018 Planned Key Milestone Events

- In FY 2018 Q1, CINA will finalize its research agenda and thrust areas through a series of workshops attended by lead institution personnel, OUP officials, and the corresponding Board of Directors.

FY 2019 Planned Key Milestone Events

- In FY 2019 Q3, CINA will identify a project with End-to-End potential and develop transition milestones with input from end users to be integrated into the work plan that will be executed by FY 2019 Q4.

Minority Serving Institutions (MSI): FY 2018: $3.4M. FY 2019 President's Budget: $3.4M. 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 need 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.
- I**mpact**: 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 2017 Key Milestone Events

- Made five MSI SLA awards available through an open competitive 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.
- Held a goal-setting workshop for the COEs and MSIs to streamline engagement collaboration and transition of students and research results. The DHS Coastal Resilience Center of Excellence (CRC) hosted their first Historically Black Colleges and Universities (HBCU) Flood and

Hurricane Meeting Aug. 3-4 on the campus of Tougaloo College in Jackson, MS. The HBCU representatives interacted with CRC researchers on issues related to response and recovery from natural disasters within minority communities. The meeting also provided the chance for HBCUs with ties to S&T and FEMA to interact and identify synergistic opportunities for future work and collaboration.

FY 2018 Planned Key Milestone Events

- 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 S&T and Components to access scientific expertise at academic MSI institutions and their partners.

FY 2019 Planned Key Milestone Events

- Make three to six MSI SLA awards available through an open competitive process with a focus on priority research needs across emergency management, border security, cybersecurity, counterterrorism, countering weapons of mass destruction, forensics, robotics for detection/response, and data analytics.
- 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.