Department of Homeland Security

Science and Technology Directorate

Budget Overview

Fiscal Year 2023

Congressional Justification

Table of Contents

Science and Technology Directorate 1
Appropriation Organization Structure 3
Budget Comparison and Adjustments 4
Personnel Compensation and Benefits 8
Non Pay Budget Exhibits 9
Supplemental Budget Justification Exhibits 11

Science and Technology Directorate

Appropriation Organization Structure

	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**	
Construction and Facility Improvements	PPA	
Critical Repair/Replacement Requirement	Investment,PPA Level II	Discretionary - Appropriation
Plum Island Closure and Support	Investment,PPA Level II	Discretionary - Appropriation
Detection Sciences Testing and Applied Research Center	Investment,PPA Level II	Discretionary - Appropriation
Research and Development	**Appropriation**	
Research, Development and Innovation	PPA	
Border Security Thrust Area	R&D Project,PPA Level II	Discretionary - Appropriation
Chemical, Biological, and Explosive Defense Thrust Area	R&D Project,PPA Level II	Discretionary - Appropriation
Counter Terrorist Thrust Area	R&D Project,PPA Level II	Discretionary - Appropriation
Cyber Security / Information Analysis Thrust Area	R&D Project,PPA Level II	Discretionary - Appropriation
First Responder / Disaster Resilience Thrust Area	R&D Project,PPA Level II	Discretionary - Appropriation
Innovation Research and Foundational Tools Thrust Area	R&D Project,PPA Level II	Discretionary - Appropriation
Physical Security and Critical Infrastructure Resilience Thrust Area	R&D Project,PPA Level II	Discretionary - Appropriation
University Programs	PPA	
Centers of Excellence	R&D Project,PPA Level II	Discretionary - Appropriation
Minority Serving Institutions (MSI)	R&D Project,PPA Level II	Discretionary - Appropriation

Science and Technology Directorate
Budget Comparison and Adjustments
Appropriation and PPA Summary
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2022 President's Budget	FY 2023 President's Budget
Operations and Support	**$302,703**	**$302,703**	**$310,590**	**$353,107**
Mission Support	$122,591	$122,591	$133,966	$151,710
Laboratory Facilities	$122,816	$122,816	$123,691	$127,522
Acquisition and Operations Analysis	$57,296	$57,296	$52,933	$73,875
Procurement, Construction, and Improvements	**$18,927**	**$18,927**	**$8,859**	**$89,466**
Construction and Facility Improvements	$18,927	$18,927	$8,859	$89,466
Critical Repair/Replacement Requirement	-	-	-	$35,750
Plum Island Closure and Support	$18,927	$18,927	$8,859	$13,466
Detection Sciences Testing and Applied Research Center	-	-	-	$40,250
Research and Development	**$443,928**	**$443,928**	**$503,454**	**$458,718**
Research, Development and Innovation	$399,417	$399,417	$452,417	$407,681
Border Security Thrust Area	$121,808	$121,808	$111,297	$83,007
Chemical, Biological, and Explosive Defense Thrust Area	$32,015	$32,015	$32,592	$21,510
Counter Terrorist Thrust Area	$56,542	$56,542	$69,361	$60,983
Cyber Security / Information Analysis Thrust Area	$25,091	$25,091	$53,600	$48,567
First Responder / Disaster Resilience Thrust Area	$43,473	$43,473	$64,716	$55,950
Innovation Research and Foundational Tools Thrust Area	$76,792	$76,792	$79,793	$95,106
Physical Security and Critical Infrastructure Resilience Thrust Area	$43,696	$43,696	$41,058	$42,558
University Programs	$44,511	$44,511	$51,037	$51,037
Centers of Excellence	$39,354	$39,354	$45,880	$45,880
Minority Serving Institutions (MSI)	$5,157	$5,157	$5,157	$5,157
Total	**$765,558**	**$765,558**	**$822,903**	**$901,291**

Science and Technology Directorate
Comparison of Budget Authority and Request

(Dollars in Thousands)

	FY 2021 Enacted			FY 2022 President's Budget			FY 2023 President's Budget			FY 2022 to FY 2023 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Operations and Support	507	499	$302,703	530	511	$310,590	565	540	$353,107	35	29	$42,517
Procurement, Construction, and Improvements	-	-	$18,927	-	-	$8,859	-	-	$89,466	-	-	$80,607
Research and Development	-	-	$443,928	-	-	$503,454	-	-	$458,718	-	-	($44,736)
Total	**507**	**499**	**$765,558**	**530**	**511**	**$822,903**	**565**	**540**	**$901,291**	**35**	**29**	**$78,388**
Subtotal Discretionary - Appropriation	507	499	$765,558	530	511	$822,903	565	540	$901,291	35	29	$78,388

Component Budget Overview

The FY 2023 Budget includes $901.3M; 565 positions; and 540 full-time equivalents (FTE) for the Science and Technology Directorate (S&T). This funding level represents an increase of $78.4M from the FY 2022 President's Budget.

S&T's Research, Development, Test, and Evaluation (RDT&E) efforts are critical to maintaining threat awareness, delivering mitigation strategies, and creating novel technology and approaches for the Department of Homeland Security's (DHS) Components and partners in the homeland security enterprise (HSE). S&T's enduring research provides the essential building blocks for incremental scientific advances in collaboration with public and private sector research partners. S&T conducts this vital work with public and private sector research partners in collaboration with our Office of National Laboratories, Office of University Programs/Centers of Excellence, Technology Centers and SBIR program. S&T seeks to meet future needs by expanding capabilities in Advanced Computing, Information Security, and Communications to better understand the next generation of computing capabilities and their impacts to the full spectrum of homeland security operations. S&T's budget supports Component capability gap requirements and aligns with Administration and DHS priorities.

S&T focuses its resources on rapidly transitioning existing and new technology capabilities to operations in order to help the HSE respond more quickly to emerging threats. S&T leverages existing technologies to expedite the development of vital capabilities critical to mission operations. Advanced technologies, knowledge products, technical analyses, laboratories, and university-based research contributes to the effectiveness and efficiency of DHS operations and the safety and interoperability of the first responder community.

Science and Technology Directorate
Budget Authority and Obligations

(Dollars in Thousands)

	FY 2021	FY 2022	FY 2023
Enacted/Request	**$765,558**	**$822,903**	**$901,291**
Carryover - Start of Year	$164,972	$207,873	$158,900
Recoveries	$947	-	-
Rescissions to Current Year/Budget Year	($137)	-	-
Net Sequestered Resources	-	-	-
Reprogramming/Transfers	($267)	-	-
Supplementals	-	-	-
Total Budget Authority	**$931,073**	**$1,030,776**	**$1,060,191**
Collections - Reimbursable Resources	$79,325	$79,325	$79,325
Collections - Other Sources	-	-	-
Total Budget Resources	**$1,010,398**	**$1,110,101**	**$1,139,516**
Obligations (Actual/Estimates/Projections)	$802,699	$895,978	$928,285
Personnel: Positions and FTE			
Enacted/Request Positions	507	530	565
Enacted/Request FTE	499	511	540
Onboard and Actual FTE			
Onboard (Actual/Estimates/Projections)	507	530	565
FTE (Actual/Estimates/Projections)	499	511	540

Science and Technology Directorate
Collections – Reimbursable Resources

(Dollars in Thousands)

	FY 2021 Enacted			FY 2022 President's Budget			FY 2023 President's Budget		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Canada	-	-	$300	-	-	$300	-	-	$300
Department of Agriculture	-	-	$3,600	-	-	$3,600	-	-	$3,600
Department of Defense	-	-	$6,000	-	-	$6,000	-	-	$6,000
Department of Energy	-	-	$700	-	-	$700	-	-	$700
Department of Health and Human Services - Food and Drug Administration	-	-	$300	-	-	$300	-	-	$300
Department of Homeland Security - U.S. Citizenship and Immigration Services	-	-	$1,070	-	-	$1,070	-	-	$1,070
Department of Homeland Security - Countering Weapons of Mass Destruction	-	-	$2,400	-	-	$2,400	-	-	$2,400
Department of Homeland Security	-	-	$500	-	-	$500	-	-	$500
Department of Homeland Security - Federal Emergency Management Agency	-	-	$2,770	-	-	$2,770	-	-	$2,770
Department of Homeland Security - Federal Law Enforcement Training Centers	-	-	$10	-	-	$10	-	-	$10
Department of Homeland Security - Management Directorate	-	-	$2,100	-	-	$2,100	-	-	$2,100
Department of Homeland Security - Transportation Security Administration	-	-	$4,195	-	-	$4,195	-	-	$4,195
Department of Homeland Security - U.S. Customs and Border Protection	-	-	$20,600	-	-	$20,600	-	-	$20,600
Department of Homeland Security - U.S. Immigration and Customs Enforcement	-	-	$430	-	-	$430	-	-	$430
Department of Homeland Security - United States Coast Guard	-	-	$1,950	-	-	$1,950	-	-	$1,950
Department of Homeland Security - United States Secret Service	-	-	$1,700	-	-	$1,700	-	-	$1,700
Department of Justice - Federal Bureau of Investigation	-	-	$26,250	-	-	$26,250	-	-	$26,250
Department of State	-	-	$200	-	-	$200	-	-	$200
Intelligence Community Management Account	-	-	$800	-	-	$800	-	-	$800
Library of Congress	-	-	$500	-	-	$500	-	-	$500
Netherlands	-	-	$300	-	-	$300	-	-	$300
Sweden	-	-	$200	-	-	$200	-	-	$200
Department of Homeland Security - Cybersecurity and Infrastructure Security Agency	-	-	$2,450	-	-	$2,450	-	-	$2,450
Total Collections	**-**	**-**	**$79,325**	**-**	**-**	**$79,325**	**-**	**-**	**$79,325**

Science and Technology Directorate
Personnel Compensation and Benefits

Pay Summary
(Dollars in Thousands)

	FY 2021 Enacted				FY 2022 President's Budget				FY 2023 President's Budget				FY 2022 to FY 2023 Total			
	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate
Operations and Support	507	499	$94,703	$184.69	530	511	$104,738	$199.80	565	540	$116,909	$208.75	35	29	$12,171	$8.95
Total	**507**	**499**	**$94,703**	**$184.69**	**530**	**511**	**$104,738**	**$199.80**	**565**	**540**	**$116,909**	**$208.75**	**35**	**29**	**$12,171**	**$8.95**
Subtotal Discretionary - Appropriation	507	499	$94,703	$184.69	530	511	$104,738	$199.80	565	540	$116,909	$208.75	35	29	$12,171	$8.95

Pay by Object Class
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
11.1 Full-time Permanent	$61,107	$67,263	$74,301	$7,038
11.3 Other than Full-time Permanent	$5,694	$6,195	$6,450	$255
11.5 Other Personnel Compensation	$1,957	$2,096	$2,328	$232
11.8 Special Personal Services Payments	$2,542	$2,639	$4,184	$1,545
12.1 Civilian Personnel Benefits	$23,403	$26,545	$29,646	$3,101
Total - Personnel Compensation and Benefits	**$94,703**	**$104,738**	**$116,909**	**$12,171**
Positions and FTE				
Positions - Civilian	507	530	565	35
FTE - Civilian	499	511	540	29

Science and Technology Directorate
Non Pay Budget Exhibits

Non Pay Summary
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
Operations and Support	$208,000	$205,852	$236,198	$30,346
Procurement, Construction, and Improvements	$18,927	$8,859	$89,466	$80,607
Research and Development	$443,928	$503,454	$458,718	($44,736)
Total	**$670,855**	**$718,165**	**$784,382**	**$66,217**
Subtotal Discretionary - Appropriation	$670,855	$718,165	$784,382	$66,217

Non Pay by Object Class

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
21.0 Travel and Transportation of Persons	$1,927	$2,092	$2,096	$4
22.0 Transportation of Things	$78	$78	$126	$48
23.1 Rental Payments to GSA	$613	$613	$613	-
23.2 Rental Payments to Others	$225	$228	$2,315	$2,087
23.3 Communications, Utilities, & Miscellaneous	$540	$1,013	$1,342	$329
24.0 Printing and Reproduction	$131	$154	$382	$228
25.1 Advisory & Assistance Services	$223,688	$224,690	$235,965	$11,275
25.2 Other Services from Non-Federal Sources	$4,352	$4,572	$6,090	$1,518
25.3 Other Purchases of goods and services	$33,166	$33,901	$38,906	$5,005
25.4 Operations & Maintenance of Facilities	$2,886	$2,932	$3,059	$127
25.5 Research & Development Contracts	$335,715	$379,090	$338,347	($40,743)
25.7 Operation & Maintenance of Equipment	$8,841	$9,263	$10,198	$935
25.8 Subsistence and Support of Persons	-	-	$4	$4
26.0 Supplies & Materials	$7,026	$2,625	$2,855	$230
31.0 Equipment	$13,450	$11,323	$46,694	$35,371
32.0 Land and Structures	$1,000	$3,000	$48,620	$45,620
41.0 Grants, Subsidies, and Contributions	$37,217	$42,591	$46,731	$4,140
42.0 Insurance Claims and Indemnities	-	-	$39	$39
Total - Non Pay Budget Object Class	**$670,855**	**$718,165**	**$784,382**	**$66,217**

Science and Technology Directorate
Supplemental Budget Justification Exhibits
FY 2023 Counter Unmanned Aerial Systems (CUAS) Funding

Appropriation and PPA	*(Dollars in Thousands)*
Science and Technology Directorate Total	**$26,165**
Research and Development	**$26,165**
Research, Development and Innovation	$26,165
Border Security Thrust Area	$26,165

Narrative description of how the above funding will be used can be found in the associated Chapter of this Budget.

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

Fiscal Year	Due Date	Reference/Citation	Requirement	Status
2021	1/26/2021	Explanatory Statement to the FY 2021 Omnibus and COVID Relief and Response Act, Division F Department of Homeland Security	S&T is directed to brief the Committees not later than 30 days after the date of enactment of this Act on the proposed allocation of R&D funds by project and to subsequently update the Committees on any changes from the planned allocation of resources.	Transmitted – 2/26/2021
2021	2/25/2021	Explanatory Statement to the FY 2021 Omnibus and COVID Relief and Response Act, Division F Department of Homeland Security	The bill provides the requested funding level for biological decontamination, completing environmental regulatory compliance activities, and preserving historic assets at the Plum Island Animal Disease Center. The Science and Technology Directorate (S&T) is directed to brief the Committees not later than 60 days after the date of enactment of this Act on the expenditure plan for these activities, and to provide semi-annual updates thereafter.	Transmitted – 2/26/2021
2021	2/25/2021	House Report 116-458	Biosurveillance Systems.—The Committee directs S&T and the Countering Weapons of Mass Destruction Office (CWMD) to provide a joint report to the Committee, within 60 days of the date of enactment of this Act, on the status of developing and testing a successor bio-threat detection system to Biowatch, along with plans to complete development and field the new capability. The report shall also describe planned changes to biodetection operations to improve upon the legacy program and how CWMD and S&T will coordinate their respective biodetection roles and activities. The report should include information on the progress of the Homeland Security Advanced Research Projects Agency Chemical and Biological Defense Division in developing novel prototype sensors for real-time detection of aerosolized biological threat agents, using newer technologies, such as using matrix assisted laser desorption ionization-time of flight mass spectrometry technology.	Transmitted – 12/22/2021

Fiscal Year	Due Date	Reference/Citation	Requirement	Status
2021	3/27/2021	Explanatory Statement to the FY 2021 Omnibus and COVID Relief and Response Act, Division F Department of Homeland Security	Silicon Valley Innovation Program (SVIP). - Within 90 days after the date of enactment of this Act, S&T is directed to brief the Committees on the SVIP's current and project return on investment.	Transmitted – 3/18/2021
2021	3/27/2021	Explanatory Statement to the FY 2021 Omnibus and COVID Relief and Response Act, Division F Department of Homeland Security	Election Security - Within 90 days of the date of enactment of this act, S&T, in partnership with CISA, is directed to brief the Committees on the feasibility of funding a Center of Excellence focused on election security, the minimum qualifications for potential applicants, and an estimated timeline for when such a Center of Excellence could be established.	Transmitted – 4/14/2021
2021	3/27/2021	Explanatory Statement to the FY 2021 Omnibus and COVID Relief and Response Act, Division F Department of Homeland Security	Work for Others - Within 90 days of the date of enactment of this Act and annually thereafter, S&T is directed to brief the Committees on the implementation and execution of the Work for Others program within the NBACC.	Transmitted – 3/31/2021
2021	3/27/2021	Explanatory Statement to the FY 2021 Omnibus and COVID Relief and Response Act, Division F Department of Homeland Security	S&T shall provide a report of projects which are not in the allocation not later than 90 days after the date of enactment of this Act, as required in House Report 116-458.	Transmitted – 4/15/2021
2021	3/27/2021	Explanatory Statement to the FY 2021 Omnibus and COVID Relief and Response Act, Division F Department of Homeland Security	Opioid and Fentanyl Detection.-S&T is encouraged to increase its development of rapid screening technology. Within 90 days of the date of enactment of this Act, S&T is directed to provide a report to the Committees on any S&T research or development efforts to incorporate rapid scanning into the department's screening methods for drug interdiction. The report shall include screening methods for Schedule 1 drugs as categorized by the FDA and an implementation plan to increase drug interdiction through scanning, electronic detection, or canine detection.	Transmitted – 6/11/2021

Fiscal Year	Due Date	Reference/Citation	Requirement	Status
2021	3/27/2021	Explanatory Statement to the FY 2021 Omnibus and COVID Relief and Response Act, Division F Department of Homeland Security	Software Assurance Tools.—Not later than 90 days after the date of enactment of this Act, CISA, in conjunction with the Science and Technology Directorate, is directed to brief the Committees on their collaborative efforts to transition cyber-related research and development initiatives into operational tools that can be used to provide continuous software assurance. The briefing should include an explanation for any completed projects and activities that were not considered viable for practice or were considered operationally self-sufficient. Such briefing shall include software assurance projects, such as the Software Assurance Marketplace.	Transmitted – 9/21/2021
2021	3/27/2021	House Report 116-458	Cyber-Related Project Transitions.—The Committee is concerned that past funding provided to S&T for cyber-related research and development projects and activities has not resulted in timely transition to intended stakeholders. Not later than 90 days after the date of enactment of this Act, S&T and CISA are directed to brief the Committee on the status of each cyber-related R&D project and activity that received funding in fiscal years 2018 through 2020; the status of a transition to practice plan for each; and details regarding any completed projects or activities that were not considered viable for practice. Such briefing shall include the status of software assurance projects, such as the Software Assurance Marketplace.	Transmitted – 9/21/2021
2021	3/27/2021	Explanatory Statement to the FY 2021 Omnibus and COVID Relief and Response Act, Division F Department of Homeland Security	Datacasting Public Safety.-Within 90 days of the date of enactment of this Act, S&T, in consultation with the National Institute for Standards and Technology, the Corporation for Public Broadcasting, and the First Responder Network Authority, is directed to brief the Committees on the feasibility of developing a pilot program to support the efforts of local public broadcasters in demonstrating and evaluating the benefits of datacasting technology to public safety agencies.	Transmitted – 4/16/2021

Fiscal Year	Due Date	Reference/Citation	Requirement	Status
2021	To be submitted with FY 2022 President's Budget	House Report 116-458	The Committee is aware of infrastructure requirements for several S&T labs and directs S&T to complete an assessment of unmet requirements to be submitted in conjunction with the President's fiscal year 2022 budget request. This assessment shall include a prioritized list of maintenance and repair requirements, an inventory of equipment and systems that require routine replacement or upgrades; an inventory and assessment facility capacity and additional space requirements; and a prioritized schedule for the replacement of and/or upgrades to equipment and systems.	Transmitted – 8/19/2021
2021	6/25/2021	Explanatory Statement to the FY 2021 Omnibus and COVID Relief and Response Act, Division F Department of Homeland Security	Within 180 days of the date of enactment of this Act, S&T is directed to update the Committees on efforts to coordinate with interagency partners and universities with expertise in unmanned aerial systems to research, develop, test, and evaluate CUAS capabilities; to develop CUAS policies; and to assess the need for a permanent organization to integrate and coordinate interagency capabilities, research, and policies and ensure a consistent and efficient Federal approach to countering the misuse of UAS in the national airspace. S&T is urged to prioritize collaboration with qualified research universities and interagency partners that have demonstrated UAS expertise and to use test ranges already established by the Department and the Federal Aviation Administration (FAA) to the maximum extent possible.	Transmitted – 8/3/2021
2021	6/25/2021	Explanatory Statement to the FY 2021 Omnibus and COVID Relief and Response Act, Division F Department of Homeland Security	The agreement supports ….and $2,000,000 to continue the Binational Cooperative Pilot program. S&T is directed to report to the Committees on the outcomes of grants awarded through this pilot not later than 180 days after the date of enactment of this Act.	Transmitted – 9/27/2021

Fiscal Year	Due Date	Reference/Citation	Requirement	Status
2021	8/26/2021	Explanatory Statement to the FY 2021 Omnibus and COVID Relief and Response Act, Division F Department of Homeland Security	The bill provides the requested funding level for biological decontamination, completing environmental regulatory compliance activities, and preserving historic assets at the Plum Island Animal Disease Center. The Science and Technology Directorate (S&T) is directed to brief the Committees not later than 60 days after the date of enactment of this Act on the expenditure plan for these activities, and to provide semi-annual updates thereafter.	Transmitted – 8/2/2021
2021	Prior to Reduction	House Report 116-458	Notify the Committee of any plan or proposal to reduce funding for, diminish the role of, or eliminate COEs prior to taking any action to do so.	Not applicable

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 2023 President's Budget
	Fiscal Year	Amount	Amount	Amount
Operations and Support	**N/A**	**N/A**	**N/A**	**$353,107**
Mission Support	N/A	N/A	N/A	$151,710
Laboratory Facilities	N/A	N/A	N/A	$127,522
Acquisition and Operations Analysis	N/A	N/A	N/A	$73,875
Procurement, Construction, and Improvements	**N/A**	**N/A**	**N/A**	**$89,466**
Construction and Facility Improvements	N/A	N/A	N/A	$89,466
Research and Development	**N/A**	**N/A**	**N/A**	**$458,718**
Research, Development and Innovation	N/A	N/A	N/A	$407,681
University Programs	N/A	N/A	N/A	$51,037
Total Direct Authorization/Appropriation	**N/A**	**N/A**	**N/A**	**$901,291**

Science and Technology Directorate
Proposed Legislative Language

Operations and Support

For necessary expenses of the Science and Technology Directorate for operations and support, including the purchase or lease of not to exceed 5 vehicles, [$310,590,000] *$353,107,000*, of which [$176,624,000] *$201,397,000* shall remain available until September 30, [2023]*2024*: Provided, That not to exceed $10,000 shall be for official reception and representation expenses.

Language Provision	Explanation
… [$310,590,000] *$353,107,000*	Dollar change only. No substantial change proposed.
… [$176,624,000] *$201,397,000*	Dollar change only. No substantial change proposed.
… [2023] *2024*	Fiscal year change; updated period of availability. No substantial change proposed. S&T continues two-year funding for Acquisition and Operations Analysis (AOA) and Laboratory Facilities PPAs in O&S appropriation. AOA supports the multi-year Research, Development, and Innovation PPA within the Research and Development appropriation. The activities such as test and evaluation, systems engineering, technology transition and international cooperative programs, support R&D projects that span multiple fiscal years. Two-year funding in this PPA is necessary to ensure S&T's R&D programs ability to access these resources when needed, enabling timely program execution – for example. test and evaluation of systems used for screening by TSA and CBP. In effort to support DHS operational components effectively for systems engineering, and test and evaluation it is vital that AOA is two-year funding. Laboratory Facilities PPA supports the operations and facility maintenance of S&T's aging laboratories. The funding requirements for S&T's laboratory facilities are unique due to the nature of the assets and their complex operational needs. S&T's facility maintenance can only be planned to a certain point, and many unforeseen costs arise as part of maintaining laboratory facilities and operations. Some of S&T's facilities are 40 to 50 years old, including TSL and PIADC, and require replacement of failing equipment. S&T's bio-safety laboratories often costly have repairs including water tank and pipe leakages in decontamination areas, and two-year funding allows S&T to maintain contingency funding for these types of repairs.

Procurement, Construction, and Improvements

For necessary expenses of the Science and Technology Directorate for Procurement, Construction, and Improvements, [$*8,859,000*] *$89,466,000*, to remain available until September 30, [2026] *2027*.

Language Provision	Explanation
… [$*8,859,000*] *$89,466,000*	Dollar change only. No substantial change proposed.
… [2026] *2027*	Fiscal year change only. No substantial change proposed.

Research and Development

For necessary expenses of the Science and Technology Directorate for research and development, [$503,454,000] *$458,718,000*, to remain available until September 30, [2024] *2025*.

Language Provision	Explanation
… [$503,454,000] *$458,718,000*	Dollar change only. No substantial change proposed.
… [2024] *2025*	Fiscal year change. S&T continues three-year funding for both its R&D PPAs, University Programs and Research, Development and Innovation. The nature of University Programs mission is to look at problems with uncertain outcomes through an innovative and fresh lens. Three-year funding allows time for team formulation, business/contract establishment between lead and subs, and experimentation and refinement of the technical approaches. This allows the Office of University Programs to make lower-risk determinations on whether a project and its resulting information will generate useful outcomes. In Research, Development, and Innovation, S&T conducts basic, applied and developmental research to support DHS Components and First Responders. Concepts must be developed, tested and validated to ensure that acquisition results in purpose-driven outcomes that lead to increased effectiveness, efficiency and safety for departmental missions. Depending to the capability gap efforts to identify technologies, concepts and processes that can be incorporated into environments for the purpose of increasing the effectiveness, efficiency and safety of operations, R&D efforts can take months or years.

Department of Homeland Security

Science and Technology Directorate

Strategic Context

Fiscal Year 2023

Congressional Justification

Science and Technology Directorate
Strategic Context

Component Overview

The Science and Technology Directorate (S&T) is the primary research and development arm of the Department. It provides Federal, state, and local officials with the technology and capabilities to protect the homeland.

The strategic context presents the performance budget by tying together programs with performance measures that gauge the delivery of results to our stakeholders. DHS has integrated a mission and mission support programmatic view into a significant portion of the Level 1 Program, Project, or Activities (PPAs) in the budget. A mission program is a group of activities acting together to accomplish a specific high-level outcome external to DHS, and includes operational processes, skills, technology, human capital, and other resources. Mission support programs are those that are cross-cutting in nature and support multiple mission programs. Performance measures associated with S&T's mission support program are presented in two measure sets, strategic and management measures. Strategic measures communicate results delivered for our agency mission and are considered our Government Performance and Results Act Modernization Act (GPRAMA) measures. Additional supporting measures, known as management measures, are displayed to enhance connections to resource requests. The measure tables indicate new measures and those being retired, along with historical data if available.

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

Management Measure

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, or those that can be considered new and innovative (i.e. a new technological application in the homeland security arena). These technologies are actively sought out to address the ever-changing nature of terrorism. The SAFETY attempts to help industry transition these developmental technologies into the commercial marketplace.							
Fiscal Year:	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
Targets:	18	18	18	18	18	N/A	N/A
Results:	10	18	19	9	1	N/A	N/A

Research, Development, and Innovation: The Research, Development, and Innovation program provides state-of-the-art solutions to meet the needs of DHS Components and the first responder community. This includes customer-focused and output-oriented Research, Development, Test, and Evaluation (RDT&E) programs that balance risk, cost, impact, and time to delivery.

Strategic Measure

Measure: Percent of technology or knowledge products transitioned to customers for planned improvements in the Homeland Security Enterprise							
Description: This measure reflects the percent at which the Science and Technology Directorate (S&T) meets its planned fiscal year transitions of technology or knowledge products for research and development funded programs/projects. A successful transition is the ownership and/or operation of a technology or knowledge product by a customer within the Homeland Security Enterprise. Technology product is a piece of equipment, system, or component of a system, such as an algorithm to be embedded into a piece of software. Knowledge products may be assessments, standards, training, or documents for decision support. The transition of technology or knowledge products reflects the value that S&T provides in delivering solutions to secure key assets, enhance operational efficiencies and effectiveness, and enable the Department and first responders to do their jobs safer, better, and smarter.							
Fiscal Year:	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
Targets:	---	---	---	75%	75%	75%	75%
Results:	---	---	---	66%	72%	TBD	TBD

Management Measures

Measure: Percent of research, development, and innovation program milestones that are met, as established in the fiscal year's budget execution plan							
Description: This measure reflects the percent at which S&T meets its research, development, and innovation (RD&I) milestones planned for the fiscal year. A milestone is defined as a scheduled point or event in a project signifying the completion of a major deliverable or a phase of work. The research, development, and innovation (RD&I) program refers to the Program, Project, and Activity (PPA) funding area for the Science and Technology Directorate (S&T) within the DHS Common Appropriations Structure. RD&I provides state-of-the-art technology and/or solutions to meet the needs of DHS Components and the first responder community. Completing these milestones indicate satisfactory progress toward advancing technology within the Department and its stakeholders.							
Fiscal Year:	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
Targets:	---	---	75%	75%	75%	75%	75%
Results:	---	---	70%	69%	76%	TBD	TBD

Measure: Percent of stakeholder counterdrug related requests fulfilled							
Description: This measure reflects the percent at which the Science and Technology Directorate (S&T) fulfills requests from its stakeholders for counterdrug-related research and development program outputs and accomplishments. Stakeholder requests are information, data, or technology needs related to the detection, identification, and investigation of narcotics, such as opioids/fentanyl, and trafficking networks. Outputs and accomplishments encompass the delivery, demonstration, transfer, or transition of knowledge or technology products. Knowledge products include, but are not limited to, standards, technology assessments, test and evaluation results, training, data, and documents for decision support. Technology product is a piece of equipment, system, or component of a system, such as an algorithm to be embedded into a piece of software. This measure reflects the value that ST provides in delivering capabilities to meet critical needs to support and improve homeland counterdrug missions.							
Fiscal Year:	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
Targets:	---	---	---	---	65%	65%	70%
Results:	---	---	---	---	100%	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 Measure

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 the programmatic and technical events, accomplishments, or intermediate goals in the life of programs and projects. A milestone is defined as a scheduled point or event in a project signifying the completion of a major deliverable or a phase of work. The Office of University Programs (OUP) engages the academic community to conduct research and analysis, provides education and training to enhance homeland security capabilities, 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. The percent of milestones met reflects the programmatic and technical events, accomplishments, or intermediate goals in the life of projects and programs. These milestones indicate satisfactory progress toward achieving long-term ST performance goals and Department-wide goals and objectives.							
Fiscal Year:	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
Targets:	75%	75%	75%	75%	75%	75%	75%
Results:	92%	78%	83%	88%	86%	TBD	TBD

Department of Homeland Security

Science and Technology Directorate

Operations and Support

Fiscal Year 2023

Congressional Justification

Table of Contents

Operations and Support **1**
Budget Comparison and Adjustments 3
Summary of Budget Changes 7
Justification of Transfers 9
Justification of Pricing Changes 10
Justification of Program Changes 12
Personnel Compensation and Benefits 29
Non Pay Budget Exhibits 31
Mission Support – PPA 33
Budget Comparison and Adjustments *33*
Personnel Compensation and Benefits *37*
Non Pay Budget Exhibits *39*
Laboratory Facilities – PPA 41
Budget Comparison and Adjustments *41*
Personnel Compensation and Benefits *47*
Non Pay Budget Exhibits *49*
Acquisitions and Operations Analysis – PPA 51
Budget Comparison and Adjustments *51*
Non Pay Budget Exhibits *59*

Operations and Support

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

(Dollars in Thousands)

	FY 2021 Enacted			FY 2022 President's Budget			FY 2023 President's Budget			FY 2022 to FY 2023 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Mission Support	374	366	$122,591	397	378	$133,966	432	407	$151,710	35	29	$17,744
Laboratory Facilities	133	133	$122,816	133	133	$123,691	133	133	$127,522	-	-	$3,831
Acquisition and Operations Analysis	-	-	$57,296	-	-	$52,933	-	-	$73,875	-	-	$20,942
Total	**507**	**499**	**$302,703**	**530**	**511**	**$310,590**	**565**	**540**	**$353,107**	**35**	**29**	**$42,517**
Subtotal Discretionary - Appropriation	507	499	$302,703	530	511	$310,590	565	540	$353,107	35	29	$42,517

The Operations and Support (O&S) appropriation for the Science and Technology Directorate (S&T) provides funding to ensure delivery of advanced technology solutions to Department of Homeland Security (DHS) Components and first responders. This appropriation also supports Systems Engineering, Standards, and Test and Evaluation (T&E) to ensure that S&T and DHS Components develop effective technologies that work in the operational environment. This includes costs necessary for operations and support activities to advance S&T's mission, as well as salaries and benefits, and operating costs for five laboratory facilities.

The O&S appropriation has three Programs, Projects, and Activities (PPA):

Mission Support: The Mission Support PPA supports all S&T corporate-level functions enabling technical divisions to manage the Research, Development, Test, and Evaluation (RDT&E) programs and provides funding for salaries and benefits, training and travel requirements, financial management, facility planning, maintenance, and other administrative functions. Offices supported under Mission Support include the Finance and Budget Division, Administration and Support Division, Contract Acquisition Program Support, Program Support Office, Communications and Outreach, Office of the Under Secretary, Chief Scientist, Office of Strategy and Policy, Office of Strategic Engagement and Analysis, Chief Information Office, and Compliance. Additionally, this appropriation finances the Office of General Counsel requirements including Intellectual Property (IP) and trademark rights for DHS and its Components.

Laboratory Facilities: The Laboratory Facilities PPA provides funding for the operations and maintenance of S&T's five laboratory facilities and salaries and benefits expenses. These laboratory facilities provide the Nation with a coordinated, enduring core of productive science, technology and engineering laboratories that produce knowledge products and technologies required to secure our Homeland. Additionally, Laboratory Facilities coordinates the delivery of long-term capabilities vital to the homeland security mission through utilization of a coordinated network of S&T laboratories and Department of Energy (DOE) national laboratories.

Acquisition and Operations Analysis: The Acquisition and Operations Analysis (AOA) PPA provides resources that support 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
(Dollars in Thousands)

	FY 2021	FY 2022	FY 2023
Enacted/Request	**$302,703**	**$310,590**	**$353,107**
Carryover - Start of Year	$20,469	$24,768	$24,692
Recoveries	$947	-	-
Rescissions to Current Year/Budget Year	($137)	-	-
Net Sequestered Resources	-	-	-
Reprogramming/Transfers	($200)	-	-
Supplementals	-	-	-
Total Budget Authority	**$323,782**	**$335,358**	**$377,799**
Collections - Reimbursable Resources	$34,325	$34,325	$34,325
Collections - Other Sources	-	-	-
Total Budget Resources	**$358,107**	**$369,683**	**$412,124**
Obligations (Actual/Estimates/Projections)	$333,202	$344,991	$384,076
Personnel: Positions and FTE			
Enacted/Request Positions	507	530	565
Enacted/Request FTE	499	511	540
Onboard and Actual FTE			
Onboard (Actual/Estimates/Projections)	507	530	565
FTE (Actual/Estimates/Projections)	499	511	540

Operations and Support
Collections – Reimbursable Resources
(Dollars in Thousands)

	FY 2021 Enacted			FY 2022 President's Budget			FY 2023 President's Budget		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Agriculture	-	-	$3,100	-	-	$3,100	-	-	$3,100
Department of Defense	-	-	$1,500	-	-	$1,500	-	-	$1,500
Department of Energy	-	-	$500	-	-	$500	-	-	$500
Department of Health and Human Services - Food and Drug Administration	-	-	$300	-	-	$300	-	-	$300
Department of Homeland Security - U.S. Citizenship and Immigration Services	-	-	$70	-	-	$70	-	-	$70
Department of Homeland Security - Countering Weapons of Mass Destruction	-	-	$1,300	-	-	$1,300	-	-	$1,300
Department of Homeland Security	-	-	$500	-	-	$500	-	-	$500
Department of Homeland Security - Federal Emergency Management Agency	-	-	$320	-	-	$320	-	-	$320
Department of Homeland Security - Federal Law Enforcement Training Centers	-	-	$10	-	-	$10	-	-	$10
Department of Homeland Security - Transportation Security Administration	-	-	$1,195	-	-	$1,195	-	-	$1,195
Department of Homeland Security - U.S. Customs and Border Protection	-	-	$600	-	-	$600	-	-	$600
Department of Homeland Security - U.S. Immigration and Customs Enforcement	-	-	$280	-	-	$280	-	-	$280
Department of Homeland Security - United States Coast Guard	-	-	$450	-	-	$450	-	-	$450
Department of Homeland Security - United States Secret Service	-	-	$1,500	-	-	$1,500	-	-	$1,500
Department of Justice - Federal Bureau of Investigation	-	-	$21,000	-	-	$21,000	-	-	$21,000
Department of State	-	-	$200	-	-	$200	-	-	$200
Library of Congress	-	-	$500	-	-	$500	-	-	$500
Department of Homeland Security - Cybersecurity and Infrastructure Security Agency	-	-	$1,000	-	-	$1,000	-	-	$1,000
Total Collections	**-**	**-**	**$34,325**	**-**	**-**	**$34,325**	**-**	**-**	**$34,325**

Operations and Support
Summary of Budget Changes
(Dollars in Thousands)

	Positions	FTE	Amount
FY 2021 Enacted	**507**	**499**	**$302,703**
FY 2022 President's Budget	**530**	**511**	**$310,590**
FY 2023 Base Budget	**530**	**511**	**$310,590**
Total Technical Changes	**-**	**-**	**-**
Transfer of Cyber Reserve from MGMT/OS/OCIO to Components	-	-	$100
Total Transfers	**-**	**-**	**$100**
Civilian Pay Raise Total	-	-	$3,636
Annualization of Prior Year Pay Raise	-	-	$646
FPS Fee Adjustment	-	-	($668)
Pay Raise Annualization of FY 2022 Program Changes	-	-	$86
Annualization of NonMajor Investment Sustainment	-	-	$13
Annualization of R&D Support Staff Increase	-	11	$2,176
Annualized Staffing Increases	-	-	$400
Increased Charges for FFMS from ICE	-	-	$290
IT Investments Reduction	-	-	($1,200)
Total Pricing Changes	**-**	**11**	**$5,379**
Total Adjustments-to-Base	**-**	**11**	**$5,479**
FY 2023 Current Services	**530**	**522**	**$316,069**
AOA-Acquisition Support	-	-	$8,844
AOA-Change Appropriations for Partnership Intermediary Agreements	-	-	$2,000
AOA-Federally Funded Research and Development Centers (FFRDC)	-	-	$1,001
AOA-SAFETY Act	-	-	$4,707
AOA-Standards Program	-	-	$1,300
AOA-Technology Scouting and Transition	-	-	$3,090
LF-Laboratory Facilities Operations	-	-	$3,291
LF-Realign Costs of CSAC Detailees	-	-	$1,436

MS-Compliance	4	2	$3,255
MS-Critical Positions	26	13	$3,890
MS-IT Modernization	5	3	$4,224
Total Program Changes	**35**	**18**	**$37,038**
FY 2023 Request	**565**	**540**	**$353,107**
FY 2022 TO FY 2023 Change	**35**	**29**	**$42,517**

Operations and Support
Justification of Transfers

(Dollars in Thousands)

	FY 2023 President's Budget		
	Positions	**FTE**	**Amount**
Transfer 1 - Transfer of Cyber Reserve from MGMT/OS/OCIO to Components	**-**	**-**	**$100**
Mission Support	-	-	$100
Total Transfer Changes	**-**	**-**	**$100**

Transfer 1 – Transfer of Cyber Reserve from MGMT/OS/OCIO to S&T:

The FY 2022 Budget Request included Cyber Reserve funding targeting critical cybersecurity needs and prioritizes basic cybersecurity enhancements, including cloud security, Security Operations Center (SOC) enhancements, encryption, Multi-Factor Authentication (MFA), increased logging functions, and enhanced monitoring tools. This transfer realigns funds to S&T from this Cyber Reserve to ensure S&T is in a better position to mitigate any reoccurrence of another SolarWinds type breach, strengthen its cyber security posture, provide an automated alert mechanism as threats are identified, provide improved visibility to stakeholders, and provide independencies on forest and external-trust infrastructures with a more efficient and secure architecture. Resources will enable S&T to proactively detect and prevent SolarWinds type breaches in the future and conduct a comprehensive, enterprise-wide audit of account transactions with incident management support.

Operations and Support
Justification of Pricing Changes

(Dollars in Thousands)

	FY 2023 President's Budget		
	Positions	FTE	Amount
Pricing Change 1 - Civilian Pay Raise Total	**-**	**-**	**$3,636**
Mission Support	-	-	$2,846
Laboratory Facilities	-	-	$790
Pricing Change 2 - Annualization of Prior Year Pay Raise	**-**	**-**	**$646**
Mission Support	-	-	$496
Laboratory Facilities	-	-	$150
Pricing Change 3 - FPS Fee Adjustment	**-**	**-**	**($668)**
Laboratory Facilities	-	-	($668)
Pricing Change 4 - Pay Raise Annualization of FY 2022 Program Changes	**-**	**-**	**$86**
Mission Support	-	-	$54
Laboratory Facilities	-	-	$32
Pricing Change 5 - Annualization of NonMajor Investment Sustainment	**-**	**-**	**$13**
Mission Support	-	-	$13
Pricing Change 6 - Annualization of R&D Support Staff Increase	**-**	**11**	**$2,176**
Mission Support	-	11	$2,176
Pricing Change 7 - Annualized Staffing Increases	**-**	**-**	**$400**
Mission Support	-	-	$400
Pricing Change 8 - Increased Charges for FFMS from ICE	**-**	**-**	**$290**
Mission Support	-	-	$290
Pricing Change 9 - IT Investments Reduction	**-**	**-**	**($1,200)**
Laboratory Facilities	-	-	($1,200)
Total Pricing Changes	**-**	**11**	**$5,379**

Pricing Change 1 – Civilian Pay Raise Total: This pricing change reflects increased pay costs due to the first three quarters of the 4.6 percent civilian pay increase for FY 2023. It reflects these costs for all pay funding included in the base, modified by any transfers of pay funding.

Pricing Change 2 – Annualization of Prior Year Pay Raise: This pricing change reflects the increased pay costs due to the fourth quarter of the 2.7 percent civilian pay increase for 2022. It reflects these costs for all pay funding included in the base, modified by any transfers of pay funding.

Pricing Change 3 – FY 2023 FPS Basic Security Assessment: This pricing change reflects anticipated decreases in Federal Protective Service (FPS) support.

Pricing Change 4 – Pay Raise Annualization of FY 2022 Program Changes: This pricing change reflects the increased pay costs of the 4.6 percent civilian pay increase for FY 2023 for all program changes proposed in the FY 2022 President's Budget.

Pricing Change 5 – Annualization of Non-Major Investment Sustainment: This pricing change reflects the increased pay costs due to the fourth quarter of the 2.7 percent civilian pay increase for 2022, and specific to positions that manage S&T's IT investments. It reflects these costs for all pay funding included in the base, modified by any transfers of pay funding.

Pricing Change 6 – Annualization of R&D Support Staff Increase: This pricing change reflects the increased pay costs due to the fourth quarter of the 2.7 percent civilian pay increase for 2022, and specific to the additional positions requested in FY 2022. It reflects these costs for all pay funding included in the base, modified by any transfers of pay funding.

Pricing Change 7 – Annualized Staffing Increases: This pricing change reflects the actual cost of positions based on enacted appropriation. The salaries and benefits and administration for non-laboratory personnel are essential to implementing RDT&E activities across S&T.

Pricing Change 8 – Increased charges for FFMS from ICE: This pricing change will fund increased charges for the use and management of the Federal Financial Management System (FFMS), owned and managed by U.S. Immigration Customs Enforcement (ICE).

Pricing Change 9 – IT Investments Reduction: This pricing change reflects efficiencies gained through improved procurement and economies of scale.

Operations and Support
Justification of Program Changes
(Dollars in Thousands)

	FY 2023 President's Budget		
	Positions	FTE	Amount
Program Change 1 - AOA-Acquisition Support	**-**	**-**	**$8,844**
Acquisition and Operations Analysis	-	-	$8,844
Program Change 2 - AOA-Change Appropriations for Partnership Intermediary Agreements	**-**	**-**	**$2,000**
Acquisition and Operations Analysis	-	-	$2,000
Program Change 3 - AOA-Federally Funded Research and Development Centers (FFRDC)	**-**	**-**	**$1,001**
Acquisition and Operations Analysis	-	-	$1,001
Program Change 4 - AOA-SAFETY Act	**-**	**-**	**$4,707**
Acquisition and Operations Analysis	-	-	$4,707
Program Change 5 - AOA-Standards Program	**-**	**-**	**$1,300**
Acquisition and Operations Analysis	-	-	$1,300
Program Change 6 - AOA-Technology Scouting and Transition	**-**	**-**	**$3,090**
Acquisition and Operations Analysis	-	-	$3,090
Program Change 7 - LF-Laboratory Facilities Operations	**-**	**-**	**$3,291**
Laboratory Facilities	-	-	$3,291
Program Change 8 - LF-Realign Costs of CSAC Detailees	**-**	**-**	**$1,436**
Laboratory Facilities	-	-	$1,436
Program Change 9 - MS-Compliance	**4**	**2**	**$3,255**
Mission Support	4	2	$3,255
Program Change 10 - MS-Critical Positions	**26**	**13**	**$3,890**
Mission Support	26	13	$3,890
Program Change 11 - MS-IT Modernization	**5**	**3**	**$4,224**
Mission Support	5	3	$4,224
Total Program Changes	**35**	**18**	**$37,038**

Program Change 1 – AOA-Acquisition Support:

Description
The FY 2023 Budget includes an increase of $8.8M to provide expert assistance for 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. The base for this program is $25.6M.

Justification
DHS conducts over $7.0B in acquisitions annually. S&T currently lacks the resources to fully support all DHS acquisitions programs throughout the acquisition life cycle. Activities such as testing and evaluation, systems engineering, technology transition, and international cooperative programs support Research and Development (R&D) projects and span multiple fiscal years. Additional AOA funds are required to increase the number of Systems Engineering and Technical Assistance (SETA) contractors and provide support from the Department of Defense's Scientific Test and Analysis Techniques Center of Excellence and establish a community of best practices for T&E of major acquisition programs across DHS. Additional funding will also be provided for:

- Operations and Requirements Analysis (ORA): ($2.5M)
    - ORA has been designated to provide direct support to the S&T Evaluation Officer (EO). This new role includes support to:
        - Building evidence to inform DHS and S&T decision-making in line with Evidence Act, Title 1 requirements (and OMB guidance to include M-21-27 and M-20-12).
        - Executing ORA's assigned program evaluation specified in the DHS FY22-26 Learning Agenda and FY 2023 Annual Evaluation Plan (both Evidence Act Title 1 deliverables) and developing required Component-level input to the Department's annual update cycle for the DHS Learning Agenda.
        - Building S&T evaluation capacity in line with OMB guidance, DHS policy (Directive #069-03, Instruction #069-03-001) and Deputy Secretary Policy Statement 076-01), and findings from the DHS FY 2021 Capacity Assessment (an Evidence Act Title 1 deliverable).
    - This funding request covers the additional contract support needed to meet the rising demand for ORA's requirements analysis support. ORA supports S&T's mission to provide efficient and effective solutions and support responsible acquisitions. It does this by ensuring that DHS' R&D requirements are accurately captured, defined, and traced to essential mission areas. ORA applies a highly structured requirements analysis process to inform S&T leadership's investment decisions. This process includes a rigorous decomposition of operational capability gaps from across DHS. As the homeland security landscape evolves, these gaps have become increasingly complex. ORA's requirements analysis and gap decomposition processes help DHS components:
        - Unravel the complexity of operational capability gaps.
        - Bring vague and complex R&D needs into sharper focus.
        - Allow for a more efficient solution development process.

- System of Systems Operational Analytics (SoSOA): ($3.0M) SoSOA was developed to scope and solve complex problems across multiple DHS components, systems or mission areas. The SoSOA virtual environment provides access to the tools necessary to conduct operations analytics at all levels of complexity. The environment was designed as an DHS-wide capability and is accessible to analysts from across the DHS Enterprise. Additionally, the SoSOA program provides DHS analysts with subject matter expertise in areas such as, data analysis, visualization, analytic programming, and modeling and simulation. As DHS's analytic capability has grown, so has the demand for access to both SoSOA's environment as well as its subject matter support. This funding request will address several aspects of SoSOA's capability:
    - Improve the environment's stability and scalability by augmenting investment in its cloud infrastructure and improving system integration. This will allow SoSOA to continue to serve its growing user base without fear of service disruption due capacity or other system limitations.
    - Adding more tools, such as Alteryx and Analyst Explorer, to the environment. These additions will enable DHS analysts to reduce the time needed to produce analytic results.
    - Expand its capacity to support analytic projects with subject matter expertise (SME). As stated above, SoSOA provides to subject matter expertise to analysts from across DHS. This support has contributed to the success of major DHS efforts to include Operations Allies Welcome. The funding requested would allow SoSOA to increase its SME support with the addition of time and contract staff.
- Systems Engineering: ($2.0M) Effective, efficient component acquisition program execution; specifically expand Human Systems Integration, Systems Engineering Life Cycle (SELC) policy development, Digital Engineering, Cyber Threat Assessment, Architecture, and Tech Assessment capacity to fulfill increasing support requirements as more DHS major acquisition programs enter the Analyze/Select phase of the Acquisition Lifecycle Framework (ALF). Thus, these efforts will transform current acquisition processes to a digital environment that will reduce the amount of paper documents and enable the ALF, SELC, and Enterprise Architecture processes to consolidate technical reviews and leverage the same digital artifacts – a significant efficiency multiplier. ($2.0M)
- Test and Evaluation (T&E): ($1.3M) Provide T&E the ability to provide a greater level of support to the current 39 Level 1 & 2 major acquisition programs and expand support to more than the current nine (9) Science & Technology Research & Development programs. This would afford the capability to provide in-depth review of developmental test and evaluation for these programs – thereby an enhanced ability to recognize risk and mitigate early-on within a programs T&E execution – "Shifting Left". For example, of the 39 programs, T&E is only capable of providing reliability, cyber resilience T&E, and statistical analysis to 15 of these programs. This increase would allow T&E an opportunity to (for the first time) to provide guidance and support to the Departments more than 50 Level 3 major acquisition programs. Test and evaluation supports capability development throughout the lifecycle, starting early within the program planning phase. T&E provides a mechanism by which programs can better understand the capabilities and limitations of the system within a mission context environment.

Performance

Increased funding for ORA and SoSOA will allow S&T to address growing demand for its requirements analysis support, access to the SoSOA virtual environment, and SoSOA analytic SME support. Each of these ORA services share the common objective of providing DHS leadership with the analysis it needs to make informed strategic and operational decisions. Additionally, it will allow ORA to directly support S&T's implementation of Evidence Act Title 1 (and related OMB guidance as previously noted); both execute an ORA program evaluation assigned in and annually provided S&T's required component-level input to the current DHS Learning Agenda; and further build S&T evaluation capacity in line with OMB and DHS expectations. Contractor support staffing needs and equipment which will result in more successful R&D programs and operational support services.

Resources for Systems Engineering will satisfy the increasing demand for Technical Assessments, Human Systems Integration, Architecture, Cybersecurity Threat Assessments, and support major acquisition program risk management. Absent the additional resources, the time to complete analysis results in DHS Component acquisition programs with limited ability to develop/deploy effective systems in a timely manner. Moreover, additional resources will facilitate more efficient Component program execution through a digital environment that will reduce the amount of paper documents and consolidate technical reviews using a common set of digital artifacts -- resulting in faster, cheaper capability deliveries with lower technical risk.

Increased funding for T&E will afford an opportunity to engage and improve acquisition outcomes (thereby shifting Left) to a greater depth for the Departments major acquisition programs, while opening the door to programs we've not had resources to support in the past. Funding will provide additional critical subject matter expertise support in the area of: Scientific Test Analysis Techniques, Reliability, and Cyber Resilience T&E; all of which has proven invaluable to many programs. The Department operates in a wide spectrum of contested operational environments. Maintaining operational effectiveness, suitability, and resiliency in these vast environments is a challenge for the Department's acquisition programs, requiring establishment of a community of best practices focused on T&E, in order to develop and employ novel approaches to T&E in order to keep pace with technologies and counter the ever present threat to our homeland security operators and their everyday mission. This funding would support such novel endeavor, impacting the Departments acquisition outcomes. T&E is key is successful acquisition and research and developmental outcomes.

Program Change 2 – AOA-Change Appropriation for Partnership Intermediary Agreements:

Description

The FY 2023 Budget includes an increase of $2.0M, which changes the appropriation for Partnership Intermediary Agreements (PIA) from R&D to O&S. Within the R&D appropriation, Research, Development, and Innovation (RD&I) PPA, PIAs were funded for $4.0M in the FY 2022 President's Budget Request.

Justification

A PIA is an agreement between the government and a Partnership Intermediaries (PI), which are State or local government agencies or nonprofit organizations, to assist the Federal agency with its technology transfer and commercialization function. PIs perform services for Federal laboratories that increase the likelihood of success in the conduct of cooperative or joint activities of such Federal laboratories with small business firms and institutions of higher learning. PI's assists, counsels, evaluates or otherwise cooperates with small businesses, educational institutions, or institutions of higher learning making use of Federal laboratories. The PI may analyze alternative business practices, models, commercially applied or emerging processes, and tools to enhance technology transfer opportunities for federally-funded DHS-relevant technologies. PIAs, however, cannot be used to conduct R&D activities or develop technology solutions for DHS.

Under the DHS Common Appropriations Structure (CAS), the R&D appropriation includes costs to develop technologies and knowledge products with the expectation of maintaining or increasing capacity or yielding future benefits, while the O&S appropriation includes costs necessary for regular operations, including services, maintenance, salaries, training, mission support, headquarters and management, as well as the sustainment costs for investments. Since PIAs cannot be used to conduct R&D, this request realigns funding for PIAs from the R&D appropriation to the O&S appropriation.

Performance

This realignment confirms compliance with the CAS. Also, the additional resources will support technology transfer and commercialization of products developed by non-profits and State and local government agencies. The requested level of funding will not result in significant performance impacts.

Program Change 3 – AOA-Federally Funded Research and Development Centers:

Description

The FY 2023 Budget includes an increase of $1.0M to fund the operations of the Federally Funded Research and Development Center (FFRDC) Program Management Office (PMO). The base for the FFRDC PMO is $3.2M.

Justification

The FFRDC PMO has the unique requirement, as delegated by the Under Secretary for Science and Technology (USST), to manage two strategically sourced Indefinite-Delivery, Indefinite-Quantity (IDIQ) contracts exceeding $1.0B and ensure that the systems engineering and studies and analysis R&D technical expertise is available to S&T and DHS Components. The two FFRDCs managed by the PMO are the Homeland Security Systems Engineering and Development Institute (HSSEDI) and Homeland Security Operational Analysis Center (HSOAC). Both FFRDCs are instrumental in helping S&T, DHS Headquarters (HQ), DHS Components and the broader HSE solve complex functional and operational challenges.
The FFRDC PMO provides centralized oversight and support of HSSEDI's and HSOAC's Indefinite Delivery Indefnite Quantity (IDIQ) on behalf of the entire Department and performs an additional set of services for S&T (e.g., performing contracting officer representative duties on task orders).

Fullfillment of the request will fund three requirements for the PMO:

- HSSEDI Frontier Sensitive Compartmented Information Facility (SCIF): DHS requested the construction of a SCIF in Mclean, VA. The new SCIF received its accreditation in FY 2021 and opened for business as an additional resource for HSSEDI to conduct classified work for the Department. The PMO is required to cover secure facility costs including voice circuits, HSDN lines and maintenance, EIS transition and replacement equipment for the new DHS accredited HSSEDI Frontier SCIF. For FY 2023, the cost is $70,500.
- FFRDC IT Enclaves: In FY 2020, S&T Privacy and S&T CIO determined that the FFRDCs needed to complete their research for the Department in a more secure space in order protect the Department's sensitive information. With that determination, the FFRDCs began the development of the their respective information technology (IT) Enclaves. The FFRDC IT Enclaves are DHS-accredited, cloud-based and physical environments to collect, use, maintain and disseminate DHS sensitive information and DHS data in accordance with DHS Sensitive Systems Policy Directive 4300A, and as required by Homeland Security Acquisition Regulation (HSAR) 15-01. They are the first strategic solutions where DHS accredited DHS-wide spaces for research activity and achieved DHS compliance with policies and requirements. Each FFRDC IT Enclave conforms to the DHS standard architecture leveraging OneNet and the Trusted Internet Connection. To maintain these IT Enclave the PMO is required to fund two (2) Information Systems Security Officers (ISSO); for FY 2023, the cost is $0.7M.
- Finally, with the increasing use of the FFRDCs, the PMO continues to rely on its SETA support team to assist with the day-to-day operations. The PMO desires to stabilize our SETA support contract by awarding a multi-year support contract. The remaining $0.3M will be combined with existing program funding to accomplish this.

Performance

In FY 2021, the PMO established a three-year strategic plan that documents FFRDC PMO's plan for the growth of business operations due to increased FFRDC usage and PMO visibility. In FY 2021, the PMO facilitated the procurement and award of 73 HSSEDI Task Orders valued at $302.0M and 151 HSOAC Task Orders valued at $247.0M. In FY 2022, the PMO continues to drive towards completion of strategic objectives while executing its day-to-day responsibilities. And in FY 2023, the PMO will maintain its technical expertise contractor support and continue to strive towards its long-term goals through the effective solutions delivery and award of HSSEDI and HSOAC Task Orders. The PMO will continue to increase access to technical expertise at HSSEDI and HSOAC including an increase in awareness of the FFRDCs and their unique capabilities. The PMO will also expand outreach to the DHS component users and continue educating Program Managers, Contracting Officer Representatives, and Contracting Officers for maximizing their opportunities with the FFRDCs.

The FFRDC PMO Office is necessary as it provides the gateway to FFRDCs. Additional funding will allow the PMO Office to improve IDIQ management through effective business and contract administration, enhance and expand information sharing and security through safeguarding sensitive information, as well as optimize access through engagement and outreach to the HSE. This request corresponds to the demand for the program and will maintain and grow the PMO's ability to deliver FFRDC solutions. The PMO will continue to provide services to the Department that bring systems engineering and studies and analysis technical expertise of FFRDCs to those that need to solve the nation's hardest problems.

Program Change 4 – AOA-SAFETY Act:

Description
The FY 2023 Budget includes an increase of $4.7M to fully fund program activities to implement the Support Anti-Terrorism by Fostering Effective Technologies (SAFETY) Act. The base for this program is $10.0M.

Justification
As part of the *Homeland Security Act of 2002 - Subtitle G of Title VIII (Public Law 107-296)*, the SAFETY Act was enacted by Congress to incentivize the private sector to develop and deploy innovative and effective anti-terrorism technologies, products, services, and layered security programs (Qualified Anti-Terrorism Technologies or "QATTs"). These QATTs may prevent, detect, identify, deter, or limit the harm that may be caused by an "Act of Terrorism". Following the September 11, 2001 terrorist attacks, the private sector was hesitant to deploy any type of technology or service due to fear of business-ending litigation. As the private sector owns and operates the majority of the Nation's critical infrastructure, it is imperative that DHS engages and incentivizes the private sector to continue investing their resources to make Americans safer.

This request for an additional $4.7M will fully fund program activities undertaken by the Office of SAFETY Act Implementation (OSAI) to include agreements with FFRDCs, program support, legal counsel, senior subject matter experts, training and travel costs. Additional funding will afford OSAI an opportunity to clear the ongoing backlog, increase outreach and engagement efforts with the applicant community, and enhance the web application and automated workflow tool used to administer application processing.

This program is not inwardly focused or limited to projects and programs undertaken by S&T, DHS, or the Federal Government. The SAFETY Act provides tangible results and improvements to critical infrastructure security. Congressional intent was to make this list as broad and inclusive as possible to ensure that the maximum amount of protective technology and services becomes available to protect the United States. Private sector entities have found value in OSAI's review of their anti-terrorism offering. Consequently, over the years, there has been a significant increase in the volume and complexity of applications, and application materials submitted (cyber related). Since 2020, the program office regularly receives applications for highly complex systems and multi-layer security programs; applications are now 75 percent larger, spanning 1,500-plus pages, as the complexity of these technologies increase. In the early years of the program, applications were for single technologies, such as bollards and magnetometers; these applications were relatively simple, spanning some 20 to 25 pages. In evaluating these types of technologies, OSAI was able to rely heavily on existing industry standards, applicable regulatory requirements and mature software and system development best practices. As the number of successful applications that were accepted into the program grew, the volume of applications began steadily increasing. In 2008, OSAI started to see more involved technologies (security services, event management services, commercial facilities). Then, in 2013, S&T began receiving an influx of massive systems of systems, multi layered, highly integrated technologies and large venue security program applications. S&T is continuing to see technology applications that are precedent setting for the SAFETY Act Program from the hospitality arena as well as the banking and financial industry, technologies with artificial intelligence and machine learning capabilities, an increase in cybersecurity-related applications and applications for uncontrolled publicly accessible locations such as large shopping malls. To conduct a complete and thorough evaluation, the Program Office may need to establish policy to support repeatable, consistent evaluation standards and guidelines. In some cases, the technology is still evolving, and the evaluation methods are a moving target for OSAI.

As a result of OSAI's efforts to increase awareness and use of the SAFETY Act Program, DHS has curated a valuable partnership with the sports and entertainment industry. Their advocacy has attributed to a steady increase in the number of stadium and arena applications, not only from the National Football League, but also from Major League Baseball and the National Basketball Association. Over the past few years, the timeline for these types of applications, typically take 270 days or more to evaluate. These applications are simply more challenging, with lots of documentation to review. OSAI has traditionally encouraged stadium applicants to take advantage of the pre-application process to closely work with them to ensure a seamless and successful application submission. As the numbers of applications have increased, OSAI has not had the bandwidth to provide that one-on-one support that OSAI has historically been able to do. This has been frustrating for our applicant community and has impacted our ability to adhere to the regulatory timeline.

The program is having difficulty keeping up with demand, with delays in reviewing applications often exceeding the number of days required under the Regulation (6 CFR Part 25) DHS Final Rule. As of February 15, 2022, there were 96 application items in review and 44 percent applications have been in evaluation beyond the regulatory timeline of 165 days, with a 368-day average processing time in FY 2022 Q1. On average, OSAI receives 10-15 application submissions each month. Although there are a number of applications received that can undergo evaluation in the 165 days as established in the regulations, there is a significant amount of applications that simply requires additional time to conduct a quality, thorough review. The ongoing delays in application processing has resulted in SAFETY Act protections for some technologies expiring resulting in a gap in protections.

On average, OSAI case managers are managing anywhere from 15-25 cases at a given time; reviewing massive amounts of artifacts. For example, the average venue security or critical infrastructure application can have over 400 artifacts for our small team to review. One of our most complex applications consisted of over 30 thousand pages of material. And although OSAI's evaluation and review is largely a paper review, OSAI also conducts research, site visits, and contacts applicants to validate the use of technologies.

Funding requested will address the demand issues and support:

- Increase technical evaluation staff with much-needed subject matter expertise to aid in establishing consistent, repeatable evaluation guidelines for new and emerging technologies that are precedent setting for OSAI. Contractor staff would also support application processing, clear the existing backlog, and enable sustainable management of application processing within regulatory timelines. ($2.7M)
- Enhance the SAFETY Act Management System (SAMS), Business Process Workflow Tool, and SAFETY Act Website. This will afford OSAI the opportunity to streamline existing business processes and program operations; develop a refreshed public-facing website with an information portal for applicants that provides tools to support full and complete application submissions; and continue to maintain and secure SAMS to ensure industry data is protected. The current system was designed and developed in 2006. Ongoing degradation in system performance and usability has impacted OSAI's ability to process applications efficiently, resulting in manual workarounds and slower program operations. ($2.0M)

Performance
The SAFETY Act Program is necessary as it provides a true third-party assessment to determine capability and effectiveness of security technologies, products and systems. Additional funding will allow S&T to fulfill its responsibility for implementation of the Congressionally mandated SAFETY Act program. This request is commensurate with the demand for the program will maintain and grow DHS's capability to interact with private sector entities developing new anti-terrorism technologies for the protection of critical infrastructure, national economic security, and public safety. DHS will be able to effectively carry out its mission in safeguarding the American people.

Program Change 5 – AOA-Standards Program:

Description
The FY 2023 Budget includes an increase of $1.3M for the Standards Program. The base for this program is $5.0M.

Justification
Funding for this program will ensure the Standards Program is able to fulfill its various responsibilities on behalf of DHS as well as enable staff to participate in training, conferences, and technical committees, corporate membership fees of Standards Development Organizations (SDOs), as well as customer meetings and conferences. The requested funding will enable the Standards to deliver national and international standards for S&T, DHS Components and responders' requirements and mission needs.

The Standards Branch carries out the functions, duties, and responsibilities set forth in 6 United States Code §112(g) as they relate to the implementation of OMB Circular A-119 and Title 15 Code of Federal Regulations Part 287. The Standards Branch executes DHS's statutory responsibilities for the utilization of and participation in consensus standards development, facilitating the successful deployment of standards-enabled capabilities. This is conducted in six main areas: 1) providing advice and overseeing standardization and conformity assessment policy; 2) coordinating DHS standards and conformity assessment activities; 3) training and educating DHS personnel on standards and conformity assessment, enabling them to effectively engage in the standards process; 4) integrating standards into DHS programs and activities; 5) providing technical resources, subject matter expertise and strategic vision and direction on standardization; and 6) supporting and funding critical standardization projects or anticipatory standards development for rapidly emerging requirements when existing standards are insufficient for the missions.

The Standards program faces growing demands of R&D projects and DHS Component's programs implementation of executive/presidential orders such as U.S./Federal participation at international standard bodies. Additional funding is needed to deliver national and international standards for S&T, DHS Components and first responders' requirements and mission needs. These include: 1) measurement/testing standards requirements for wastewater COVID and other pathogen detection; 2) open system standards such as the National Electrical Manufacturers Association's Digital Imaging and Communication in Security 3.0 for TSA checkpoint screening systems to increase competition and U.S. leadership in aviation security systems consistent with presidential executive order; 3) supply chain and small unmanned aircraft system cybersecurity standards for Federal procurement actions and CISA guidance/policy making; 4) certification and accreditation of unmanned systems test facilities for mission needs of first responders; 5) federal/US representation at Telecommunications Industry Association 5G/xG and International Organization for Standardization/International Electrotechnical Commission international standard bodies and supply chain security standards in line with presidential executive orders; 6) National Information Exchange Model (NIEM) standards to close information sharing gaps at the port/regional level, and CBP Air and Marine Operations Center (AMOC); 7) NIEM OASIS Open Project Initiatives and data quality metrology for enterprise/Federal data strategy and governance to include implementation of the 2019 evidence-based policy making act; 8) measurement/testing standards for response aquatic robotics and certification and accreditation of unmanned systems test facilities to include resilient community standards; and 9) technical support services for standardization and oversight of OMB Circular A-119 in R&D programs consistent with S&T new/updated Business Process Flow.

Performance

Increased funding will enable Standards Branch to establish and set national and international standards that reduce risk and total cost of equipment ownership and achieve interoperability/integration of systems across the homeland security enterprise. These industry standards are developed consistent with OMB guidance to ensure competition and protect U.S. interests in security technologies.

In addition, the Standards Program will be able to deliver on R&D and DHS programs' standardization requirements and oversight of OMB Circular A-119 in the implementation of executive/presidential orders such as U.S./Federal participation at international standard bodies, Make America Buy America and Cybersecurity. Additional resources will ensure delivery of enabling standards for TSA's open system architecture, ensure TSA's ability to reduce cost, maintain vendor lock-in and reduce competition. Moreover, this program increase will support NIEM's continued adoption/implementation, which requires capability in data technology and standardization to implement in enterprise solutions and data strategies/governance.

Program Change 6 – Technology Scouting and Transition:

Description

The FY 2023 Budget includes an increase of $3.1M to expand technology scouting and transition activities, particularly the Operational Experimentation (OpEx) program and increase the level of support Technology Scouting and Transition's (TST) four branches; Operational Experimentation, Technology Clearinghouse, Technology Scouting, and Technology Transition provide to S&T's technical programs and DHS component acquisition programs. The base for this program is $1.8M.

Justification

TST conducts activities that inform and support R&D decisions and the transition and knowledge sharing of solutions to meet DHS's customer requirements through technology scouting, OpEx, transition planning and the Technology Clearinghouse. The OpEx program facilitates and conducts operational experimentations with S&T program managers and DHS Component customers in order to evaluate the technical capabilities and operational use of new and emerging technologies. OpEx will maintain a multi-disciplinary capability to conduct technology demonstrations, field assessments, and discussion-based activities. Discussion based activities can be used to explore end user requirements for emerging technologies and the technology transitions to mission operations. Technology demonstrations can expose end users to commercially available technologies in order to evaluate if these available technologies meet end user requirements. Field assessments allow end users to deploy emerging technologies in simulated operational scenarios in order to get an in-depth understanding of how emerging technologies perform in the operational setting.

Increased funding will allow for TST to plan and conduct additional activities to gather data on operational requirements, the operational utility of a technology, or identification of gaps in tactics, techniques, or procedures (TTPs) in support of DHS Operational Component's requirements. This will enable operators to understand how these technologies will fundamentally shift the way they do business and execute their missions. TST will be able to conduct more activities designed to inform State and local first responders technology acquisition decisions.

Performance

Increased funding for TST support provides additional resources and expanded capabilities to support program and project managers resulting in more informed decisions, greater risk management to avoid R&D efforts that are not needed or will not be used by DHS Components and customers, and accelerate the integration of innovative technologies into operational "front line" use. These activities include collaboration to integrate DHS requirements into Federal partner experimentation activities, technology demonstrations, field assessments, and facilitated discussions such as tabletop exercises. The OpEx program will make use of the experimentation labs and operational testbeds established to provide a full-spectrum approach to experimentation, operational field tests, and demonstrations.

Program Change 7 – LF-Laboratory Facilities Operations:

Description

The FY 2023 Budget includes an increase of $3.3M to support laboratory operations. The base for this program is 133 positions, 133 FTE, and $123.7M.

Justification

Laboratory facility funding has remained constant, creating a growing gap between the funding necessary to support lab operations, including all pertinent compliance requirements, and the amount appropriated to S&T. This has resulted in an increasing number of facility maintenance projects and equipment replacements that have either remained unfunded or – out of necessity – leveraged scarce operations funding that was reserved for other anticipated needs.

S&T's request for laboratory facilities operations ensures operating funding levels maintain pace with anticipated operating costs. This increase represents standard rate escalations for an operating environment. The S&T Laboratory Infrastructure Requirements Assessment identified the National Biodefense Analysis and Countermeasures Center (NBACC) Operations, National Urban Security Technology Laboratory (NUSTL), and Plum Island Animal Disease Center (PIADC) Operations require increased funding in order to modernize and repair its laboratory facilities, in addition to funding included in the PC&I account.

S&T's network of laboratories houses some of the most advanced scientific expertise and capabilities in the world, enabling the HSE to leverage, apply, and share knowledge that helps to inform policy, improve operations, and advance research in support of homeland security. S&T's laboratories are a vital contributor to technology efforts and deliver scientifically based RDT&E solutions. This supports an enduring capability of subject matter expertise and dedicated technical infrastructure critical to the success in each of S&T's RD&I thrust areas.

Performance
With requested resources, S&T will continue to maintain current services ensuring S&T's laboratories are compliant with environmental and safety regulations and safeguards mission operations, as lack of robust facilities impacts test and evaluation effectiveness. Additionally, funding as requested will enable current laboratory operations costs to be met and current level of effort to be sustained. Resources will help meet evolving laboratory requirements and maintain state of the art facilities.

Program Change 8 – LF-Realign Costs of CSAC Detailees:

Description
The FY 2023 Budget includes an increase of $1.4M to realign costs for detailees at the Chemical Security Analysis Center (CSAC) from laboratory operations costs to personnel costs. The base for personnel costs is $22.7M.

Justification
S&T has a reimbursable agreement in place for CSAC detailees from the Department of Defense. Costs for these detailees should be accounted for within laboratory personnel costs, rather than laboratory operational costs.

Performance
No impact to performance as this is a realignment in accounting of costs.

Program Change 9 – MS-Compliance Division:

Description
The FY 2023 Budget includes an increase of 4 positions, 2 FTE, and $3.3M to support both the compliance assurance and privacy functions within S&T's Compliance Division. The base for this program is 4 positions, 2 FTE, and $3.8M.

Justification

This increase in funding will provide for S&T's Compliance Division additional resourcing needs in the Compliance Assurance Program Office (CAPO) and Privacy Office. CAPO has responsibilities that are DHS-wide, and its services are available to all DHS Components. The Privacy Office is required to review and approve contracts as required by the Office of the Chief Procurement Officer (OCPO) and Homeland Security Acquisition Manual (HSAM); and is responsible for oversight, policy, compliance, and incident functions.

To sustain the increasing workload expected by S&T, the Privacy Office needs an additional two Federal positions and additional contractor support to assist S&T in addressing the DHS Privacy Office audit findings regarding workload and appropriate planning and reviews including early engagement to accelerate Appendix G approval. These approvals are required for all contract actions; which serves as the high risk determination required by Homeland Security Acquisition Regulation (HSAR) Class Deviation 15-01: "Safeguarding of Sensitive Information" in determining whether a contract poses a risk for unauthorized access to or disclosure of sensitive information. In addition, CAPO will require two additional Federal positions and contract support staff to continue performing compliance support and oversight functions that ensure DHS-conducted/-funded/-sponsored activities are compliant with relevant U.S. laws and regulations, international agreements, Federal and DHS policies, and related standards and guidance.

Performance

The support provided by both Federal employees and contractors is vital to the success of S&T's mission. Receiving funds to fully staff S&T's Compliance Division will ensure timely review of compliance and privacy functions not only for S&T but for the entire DHS. The protection of sensitive information is critical to the DHS mission.

Program Change 10 – MS-Fill Critical Positions:

Description

The FY 2023 Budget includes an increase of 26 positions, 13 FTE and $3.9M to maintain adequate staffing levels and ensure S&T has a robust permanent full-time workforce in order to meet mission essential requirements. The base for this increase includes 397 positions, 378 FTE, and $82.0M within the Mission Support PPA.

Justification

Staff are the foundational resource for any organization. S&T requires a cadre Federal staff to perform inherently governmental functions such as project management, contracting, intellectual property, financial and human capital functions, security and other activities.

R&D support work is diverse and requires additional Federal employees to meet goals, and S&T requires more Federal staff to effectively manage contract work. Critical functions must be filled by Federal employees as to not expose the Agency to risk of mission failure if performed entirely by contractors. Strong Federal oversight is non-optional for R&D programs and projects. Duties that are inherently-federal cannot be performed by contractor personnel and present a risk of organizational conflict of interest, including: approving Agency policy, determining program priorities for budget requests, awarding/administering/terminating contracts, participating in award source selections, determining which supplies and services are to be acquired, approving agency responses to Freedom of Information Act (FOIA) requests, or serving as Contracting Officer Representatives (CORs.)

Increases in Federal positions will support:

- Enterprise Services: Six positions to carry out S&T's mission and deliver effective and innovative methods, business processes and solutions to the critical management needs of the Directorate.
    - One position for Administration and Support, specifically for Human Capital to oversee workforce acquisition, management, and optimization, workforce planning and strategy, recruitment, employee training and development.
    - One position for Contract Acquisition Program Support (CAPS) as a COR to free up Program Managers from these currently dual duties resulting in effective implementation of a directorate wide acquisition strategy, better management of procurements, better funds control and management and more efficient contract processing and management.
    - Two positions for Finance and Budget:
        - One position for the Budget and Performance Branch, which is responsible for managing S&T's budget throughout the DHS's resource management process (Planning, Programming, Budgeting, and Execution or PPBE), respond to budgetary inquiries from DHS, OMB, and Congress, and fulfill reporting requirements, including those from the *Government Performance and Results Act Modernization Act of 2010*.
        - One position in financial management to assist in financial control and reporting, processing invoices, recording obligations and accounting functions.
    - Two positions within the Office of the Under Secretary to assist the Chief of Staff and Chief Scientist.

- Mission Support and Capability: Two positions for program management in order to execute programs based on validated priorities, gaps, and requirements while providing timely, transparent, and agile support to the full spectrum of its customers (DHS HQ, DHS operational Components, and the HSE). Program Management involves aligning multiple projects to achieve the program goals and allows for optimized or integrated cost, schedule, and effort.
    - Two positions for Program Managers to ensure programs and related projects are achieving organizational goals and objectives, often in the context of a strategic plan.

- Science and Engineering: Thirteen positions for capabilities needed by S&T program and project managers and DHS acquisition programs to deliver solutions effectively and efficiently to the priority needs of DHS and the HSE.
    - One position is required within Operations Requirements Analysis (ORA), to perform the critical function associated with the OMB *Evidence Policy Making Act of 2018*. ORA was tasked with S&T's implementation and oversight of the Evidence Act and the subsequent responsibilities associated with creating and implementing the Learning Agenda.

- Eleven positions are required for the Technology Centers.
  - Four of these positions are associated with the increased research in climate resilience, advanced computing, innovative systems, and biological and chemical threats. These Federal staff members will be required to lead and execute the research activities on climate resilience, experimentation with cutting edge computing, advanced analytics, and quantum information sciences that identify appropriate homeland security applications to increase mission effectiveness, emerging risks in digital identity technologies, advanced communications for operational missions, and filling critical knowledge gaps that enable DHS to move into a proactive stance for threat situations that need rapid answers and response.
  - Seven of the positions are associated with statistical collection and reporting, initially focused on terrorism statistics, who will have expertise in statistics and be able to manage contracts and contractors regulated to key performance and support functions including data collection, methods, data standards, data storage, data protection analysis, and dissemination.
- One position is required for Technology Scouting and Transition to meet transition requirements associated with the 2017 National Defense Authorization Act reporting requirements.

- Innovation and Collaboration: Five positions in order to provide DHS Components and offices with access to qualified scientific, engineering and business partners.
  - One position is required by the Office of Industry Partnerships (OIP) to manage expanded innovation funding programs, including the Small Business Innovation Research Program and Silicon Valley Innovation Program, and to support S&T's efforts in commercialization and transfer of funded research outcomes.
  - Four positions needed to assist OSAI leadership in serving as a case manager role conducting application reviews and evaluations for the Congressionally mandated program activities implementing Subtitle G of Title VIII of the Homeland Security Act of 2002—the Support Antiterrorism by Fostering Effective Technologies Act (SAFETY Act). The OSAI program provides critical incentives for the development and deployment of anti-terrorism technologies by providing liability protections for the providers of qualified anti-terrorism technologies.

Performance

S&T must address the size and capability of its Federal workforce to meet growing demands. Additional personnel are urgently needed to manage, administer, and oversee S&T's growing portfolio of R&D programs and projects. An increase to the budget brings additional demand for knowledge, skills, and abilities across a diverse series of disciplines, including government administration to evaluate performance of programs and projects, direct work for large government contracts, measure and evaluate contract performance, and to protect S&T from fraud, waste, abuse, and mismanagement of Federal funds.

Program Change 11 – MS-IT Modernization:

Description

The FY 2023 Budget includes an increase of 5 positions, 3 FTE, and $4.2M to boost S&T's cybersecurity, engineering and infrastructure, cloud development, and service offerings to the HSE. The base for this program is 14 positions, 7 FTE, and $10.1M.

Justification

DHS has embarked on a more comprehensive plan to bolster the network security of the infrastructure. S&T must modernize its core network infrastructure to cloud computing to meet its goal to achieve a Zero Trust Networking (ZTN) model. ZTN is a recent initiative, and funding has not been previously requested. In addition, this request supports S&T's plans to meet President Biden's Executive Order (EO) 14028 on Improving the Nation's Cybersecurity.Major initiatives include conducting a study of ZTN security framework, defining a plan for and then implementing the ZTN environment, and ultimately incorporating a shift to a proactive cybersecurity approach.

To secure S&T's classified and unclassified networks from evolving threats, we must deploy new capabilities such as: penetration testing, security logging, intrusion detection, unauthorized access prevention, and real-time cybersecurity risk reporting. Focusing on the DHS cybersecurity mission goals, S&T seeks to strengthen its IT security posture for all applications, systems, mobile devices, and hosting infrastructure.

S&T must fully transition to Cloud Computing to modernize and secure its network infrastructure. Secure cloud application development and deployment requires moving existing systems to the cloud environment which offers better security mechanisms. Mission goals require funding to continue building upon S&T's cloud environment to improve operations and migrate applications. Cloud technologies offer an opportunity to establish new service offerings and applications across the HSE.

S&T will utilize this increase in funding towards the following efforts:

- Enterprise Cybersecurity: ZTN**, s**ecurity logging, and penetration testing efforts aim to enhance and monitor network and system activity logs: The enterprise system collects and aggregates log data regarding, network traffic, resource access actions, administrative activities and other events that provide real-time (or near real-time) feedback on the security posture of enterprise information systems. Information generated in a ZTN environment combined with new machine learning tools use ZTN data to improve detection and better inform event impact quantification assessments. Additional logs from ZTN may be saved for after-the fact analyses by incident responders. With this capability, ZTN would allow developers and administrators to have sufficient flexibility to satisfy their business requirements while using logs and audit actions to identify access behavior patterns. Also, the network operators would closely monitor the logs and make adjustment.

- Cloud Modernization: S&T seeks to adopt hybrid, multi cloud, and SaaS strategies into our current S&T Cloud environment. This includes leveraging the hybrid cloud (On-Prem & Cloud) resources for operational consistency and rapid application portability for different use case scenarios that arise. This line item is to expand and enhance those capabilities in addition to further expand into cloud services. Planned activities also include implementation of a West Coast Data Center ; extending cloud connectivity from the East Coast under two contracts; and purchasing Federal Risk and Authorization Management Program (FedRAMP) Software as a Service (SaaS) and Platform as a Service (PaaS) cloud service offerings. This also supports the ZTN initiative DHS is working towards as the engineering FTEs will be available to develop and incorporate those constructs into the S&T IT ecosystem.

- Network Security Modernization: S&T seeks to increase monitoring capabilities for Insider Threat for all current and future growth, including mobile monitoring with geolocation, geo fencing government furnished equipment, enhanced user (General & Privileged) monitoring analysis.

- S&T seeks five Federal personnel to oversee and implement S&T's IT Modernization efforts. These positions will require unique experience in areas such as cyber security, cloud computing, network engineering, applications, and DevOps.

Performance

S&T may lag other DHS Components and offices if unable to implement some of the prescriptions necessary as a result of the recent network, infrastructure and supply chain exploits. Operationally, the S&T staff may not be able to access resources if we do not modernize our own infrastructure and collaborative work to bring tenants of zero-trust networking (ZTN) to our systems and platforms. Inclusive of this request are improvements that use the cloud environment such that additional security is derived from the platform to help protect, defend, detect and mitigate threats. This is a capability that currently exists only in an embryonic form and in a very limited deployment on S&T platforms. These licensing enhancements will assist S&T in preventing nation-state threat actors probing and accessing our infrastructure. This request includes implementation of the logging capability for ZTN activities. This will enable the foundation of the S&T Zero Trust activities and future enhancements required to meet the EO 14028 requirements.

While both S&T and DHS are implementing changes and improvements in the hardware and software, there are efforts to augment end-user monitoring and analysis. Currently, S&T has limited visibility into this behavior analysis, account monitoring and insider threat. These efforts, in conjunction with DHS HQ OCIO, will strive to rectify those gaps and work towards gaining additional insight into personnel under the insider threat constructs for a more holistic understanding of the threat landscape. Additionally, 24x7 SOC Services and security logging will be implemented by the end of FY 2023 in coordination with DHS HQ OCIO.

Operations and Support
Personnel Compensation and Benefits

Pay Summary
(Dollars in Thousands)

	FY 2021 Enacted				FY 2022 President's Budget				FY 2023 President's Budget				FY 2022 to FY 2023 Total			
	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate
Mission Support	374	366	$72,777	$192.14	397	378	$82,005	$210.21	432	407	$91,768	$218.96	35	29	$9,763	$8.75
Laboratory Facilities	133	133	$21,926	$164.18	133	133	$22,733	$170.23	133	133	$25,141	$177.50	-	-	$2,408	$7.28
Total	**507**	**499**	**$94,703**	**$184.69**	**530**	**511**	**$104,738**	**$199.80**	**565**	**540**	**$116,909**	**$208.75**	**35**	**29**	**$12,171**	**$8.95**
Subtotal Discretionary - Appropriation	507	499	$94,703	$184.69	530	511	$104,738	$199.80	565	540	$116,909	$208.75	35	29	$12,171	$8.95

Pay by Object Class
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
11.1 Full-time Permanent	$61,107	$67,263	$74,301	$7,038
11.3 Other than Full-time Permanent	$5,694	$6,195	$6,450	$255
11.5 Other Personnel Compensation	$1,957	$2,096	$2,328	$232
11.8 Special Personal Services Payments	$2,542	$2,639	$4,184	$1,545
12.1 Civilian Personnel Benefits	$23,403	$26,545	$29,646	$3,101
Total - Personnel Compensation and Benefits	**$94,703**	**$104,738**	**$116,909**	**$12,171**
Positions and FTE				
Positions - Civilian	507	530	565	35
FTE - Civilian	499	511	540	29

Operations and Support
Permanent Positions by Grade – Appropriation
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
Total, SES	25	25	25	-
EX	1	1	1	-
GS-15	186	193	201	8
GS-14	126	142	154	12
GS-13	83	83	88	5
GS-12	45	45	48	3
GS-11	8	8	8	-
GS-9	6	6	9	3
GS-8	1	1	1	-
GS-5	1	1	1	-
Other Grade Positions	25	25	29	4
Total Permanent Positions	**507**	**530**	**565**	**35**
Total Perm. Employment (Filled Positions) EOY	499	511	542	31
Unfilled Positions EOY	8	19	23	4
Position Locations				
Headquarters Civilian	372	395	430	35
U.S. Field Civilian	133	133	133	-
Foreign Field Civilian	2	2	2	-
Averages				
Average Personnel Costs, ES Positions	$195,584	$195,584	$195,584	-
Average Personnel Costs, GS Positions	$146,972	$146,972	$145,958	($1,014)
Average Grade, GS Positions	14	14	14	-

Operations and Support
Non Pay Budget Exhibits

Non Pay Summary
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
Mission Support	$49,814	$51,961	$59,942	$7,981
Laboratory Facilities	$100,890	$100,958	$102,381	$1,423
Acquisition and Operations Analysis	$57,296	$52,933	$73,875	$20,942
Total	**$208,000**	**$205,852**	**$236,198**	**$30,346**
Subtotal Discretionary - Appropriation	$208,000	$205,852	$236,198	$30,346

Non Pay by Object Class

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
21.0 Travel and Transportation of Persons	$1,052	$1,102	$1,233	$131
22.0 Transportation of Things	$78	$78	$126	$48
23.1 Rental Payments to GSA	$613	$613	$613	-
23.2 Rental Payments to Others	-	-	$2,090	$2,090
23.3 Communications, Utilities, & Miscellaneous	$300	$755	$1,097	$342
24.0 Printing and Reproduction	$131	$154	$382	$228
25.1 Advisory & Assistance Services	$153,629	$148,989	$168,351	$19,362
25.2 Other Services from Non-Federal Sources	$2,845	$2,866	$4,544	$1,678
25.3 Other Purchases of goods and services	$29,246	$29,460	$33,268	$3,808
25.4 Operations & Maintenance of Facilities	$2,886	$2,932	$3,059	$127
25.7 Operation & Maintenance of Equipment	$7,874	$8,168	$9,205	$1,037
25.8 Subsistence and Support of Persons	-	-	$4	$4
26.0 Supplies & Materials	$1,130	$1,176	$1,449	$273
31.0 Equipment	$7,716	$9,059	$10,036	$977
32.0 Land and Structures	-	-	$20	$20
41.0 Grants, Subsidies, and Contributions	$500	$500	$682	$182
42.0 Insurance Claims and Indemnities	-	-	$39	$39
Total - Non Pay Budget Object Class	**$208,000**	**$205,852**	**$236,198**	**$30,346**

Mission Support – PPA

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

(Dollars in Thousands)

	FY 2021 Enacted			FY 2022 President's Budget			FY 2023 President's Budget			FY 2022 to FY 2023 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Mission Support	374	366	$122,591	397	378	$133,966	432	407	$151,710	35	29	$17,744
Total	**374**	**366**	**$122,591**	**397**	**378**	**$133,966**	**432**	**407**	**$151,710**	**35**	**29**	**$17,744**
Subtotal Discretionary - Appropriation	374	366	$122,591	397	378	$133,966	432	407	$151,710	35	29	$17,744

PPA Level 1 Description

Mission Support provides funding for financial management and procurement operations, IT management and critical infrastructure support, human capital and personnel security, real estate and facilities management, internal and external mission and research centric communications, and compliance support and oversight. Mission Support also funds compliance assurance, export controls, legal intellectual property services for R&D projects, and oversight of intellectual property and trademark rights for all of DHS. The administrative activities of non-laboratory personnel and offices have the important role of implementing RDT&E activities are supported by Mission Support resources.

The 407 FTE included in FY 2023 will support S&T's policy analysis, planning, financial management, and guidance formulation. These FTE also manage and oversee IP and trademark rights, conduct program management, execution, oversight, and analysis, as well as operations and maintenance support for all S&T R&D programs in the RD&I, University Programs (UP), and AOA PPAs.

Mission Support – PPA
Budget Authority and Obligations
(Dollars in Thousands)

	FY 2021	FY 2022	FY 2023
Enacted/Request	**$122,591**	**$133,966**	**$151,710**
Carryover - Start of Year	-	-	-
Recoveries	-	-	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Reprogramming/Transfers	($200)	-	-
Supplementals	-	-	-
Total Budget Authority	**$122,391**	**$133,966**	**$151,710**
Collections - Reimbursable Resources	$2,225	$2,225	$2,225
Collections - Other Sources	-	-	-
Total Budget Resources	**$124,616**	**$136,191**	**$153,935**
Obligations (Actual/Estimates/Projections)	$124,479	$136,191	$153,766
Personnel: Positions and FTE			
Enacted/Request Positions	374	397	432
Enacted/Request FTE	366	378	407
Onboard and Actual FTE			
Onboard (Actual/Estimates/Projections)	374	397	432
FTE (Actual/Estimates/Projections)	366	378	407

Mission Support – PPA
Collections – Reimbursable Resources
(Dollars in Thousands)

	FY 2021 Enacted			FY 2022 President's Budget			FY 2023 President's Budget		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Defense	-	-	$500	-	-	$500	-	-	$500
Department of Health and Human Services - Food and Drug Administration	-	-	$300	-	-	$300	-	-	$300
Department of Homeland Security - U.S. Citizenship and Immigration Services	-	-	$20	-	-	$20	-	-	$20
Department of Homeland Security - Countering Weapons of Mass Destruction	-	-	$350	-	-	$350	-	-	$350
Department of Homeland Security - Federal Emergency Management Agency	-	-	$70	-	-	$70	-	-	$70
Department of Homeland Security - Federal Law Enforcement Training Centers	-	-	$10	-	-	$10	-	-	$10
Department of Homeland Security - Transportation Security Administration	-	-	$45	-	-	$45	-	-	$45
Department of Homeland Security - U.S. Customs and Border Protection	-	-	$500	-	-	$500	-	-	$500
Department of Homeland Security - U.S. Immigration and Customs Enforcement	-	-	$30	-	-	$30	-	-	$30
Department of Homeland Security - United States Coast Guard	-	-	$350	-	-	$350	-	-	$350
Department of Homeland Security - Cybersecurity and Infrastructure Security Agency	-	-	$50	-	-	$50	-	-	$50
Total Collections	**-**	**-**	**$2,225**	**-**	**-**	**$2,225**	**-**	**-**	**$2,225**

Mission Support – PPA
Summary of Budget Changes
(Dollars in Thousands)

	Positions	FTE	Amount
FY 2021 Enacted	**374**	**366**	**$122,591**
FY 2022 President's Budget	**397**	**378**	**$133,966**
FY 2023 Base Budget	**397**	**378**	**$133,966**
Total Technical Changes	**-**	**-**	**-**
Transfer of Cyber Reserve from MGMT/OS/OCIO to Components	-	-	$100
Total Transfers	**-**	**-**	**$100**
Civilian Pay Raise Total	-	-	$2,846
Annualization of Prior Year Pay Raise	-	-	$496
Pay Raise Annualization of FY 2022 Program Changes	-	-	$54
Annualization of NonMajor Investment Sustainment	-	-	$13
Annualization of R&D Support Staff Increase	-	11	$2,176
Annualized Staffing Increases	-	-	$400
Increased Charges for FFMS from ICE	-	-	$290
Total Pricing Changes	**-**	**11**	**$6,275**
Total Adjustments-to-Base	**-**	**11**	**$6,375**
FY 2023 Current Services	**397**	**389**	**$140,341**
MS-Compliance	4	2	$3,255
MS-Critical Positions	26	13	$3,890
MS-IT Modernization	5	3	$4,224
Total Program Changes	**35**	**18**	**$11,369**
FY 2023 Request	**432**	**407**	**$151,710**
FY 2022 TO FY 2023 Change	**35**	**29**	**$17,744**

Mission Support – PPA
Personnel Compensation and Benefits

Pay Summary
(Dollars in Thousands)

	FY 2021 Enacted				FY 2022 President's Budget				FY 2023 President's Budget				FY 2022 to FY 2023 Total			
	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate
Mission Support	374	366	$72,777	$192.14	397	378	$82,005	$210.21	432	407	$91,768	$218.96	35	29	$9,763	$8.75
Total	**374**	**366**	**$72,777**	**$192.14**	**397**	**378**	**$82,005**	**$210.21**	**432**	**407**	**$91,768**	**$218.96**	**35**	**29**	**$9,763**	**$8.75**
Subtotal Discretionary - Appropriation	374	366	$72,777	$192.14	397	378	$82,005	$210.21	432	407	$91,768	$218.96	35	29	$9,763	$8.75

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
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
11.1 Full-time Permanent	$45,757	$51,445	$57,809	$6,364
11.3 Other than Full-time Permanent	$5,259	$5,747	$5,983	$236
11.5 Other Personnel Compensation	$1,489	$1,613	$1,825	$212
11.8 Special Personal Services Payments	$2,452	$2,546	$2,651	$105
12.1 Civilian Personnel Benefits	$17,820	$20,654	$23,500	$2,846
Total - Personnel Compensation and Benefits	**$72,777**	**$82,005**	**$91,768**	**$9,763**
Positions and FTE				
Positions - Civilian	374	397	432	35
FTE - Civilian	366	378	407	29

Pay Cost Drivers

	FY 2021 Enacted			FY 2022 President's Budget			FY 2023 President's Budget			FY 2022 to FY 2023 Total Changes		
	FTE	Amount	Rate	FTE	Amount	Rate	FTE	Amount	Rate	FTE	Amount	Rate
Mission Suppport Personnel	366	$70,325	$192.14	378	$79,459	$210.21	407	$89,117	$218.96	29	$9,658	$8.75
Other PC&B Costs	-	$2,452	-	-	$2,546	-	-	$2,651	-	-	$105	-
Total - Pay Cost Drivers	**366**	**$72,777**	**$192.14**	**378**	**$82,005**	**$210.21**	**407**	**$91,768**	**$218.96**	**29**	**$9,763**	**$8.75**

Explanation of Pay Cost Drivers

Mission Support Personnel: These costs support personnel compensation, benefits, and performance awards for non-laboratory personnel supporting S&T's operations and mission. The FY 2023 Budget supports 432 positions, 407 FTE, to maintain S&T's current staffing from FY 2022 President's Budget and an increase of 35 positions, 29 FTE in FY 2023.

Other PC&B Costs: These costs support subject matter experts that S&T uses from other government agencies on a reimbursable detailee basis.

Mission Support – PPA
Non Pay Budget Exhibits

Non Pay Summary
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
Mission Support	$49,814	$51,961	$59,942	$7,981
Total	**$49,814**	**$51,961**	**$59,942**	**$7,981**
Subtotal Discretionary - Appropriation	$49,814	$51,961	$59,942	$7,981

Non Pay by Object Class
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
21.0 Travel and Transportation of Persons	$615	$665	$708	$43
23.3 Communications, Utilities, & Miscellaneous	$300	$755	$1,083	$328
24.0 Printing and Reproduction	$117	$140	$140	-
25.1 Advisory & Assistance Services	$28,418	$28,073	$32,138	$4,065
25.2 Other Services from Non-Federal Sources	$1,183	$1,204	$1,671	$467
25.3 Other Purchases of goods and services	$6,682	$6,896	$7,805	$909
25.4 Operations & Maintenance of Facilities	$275	$321	$321	-
25.7 Operation & Maintenance of Equipment	$7,291	$7,585	$8,604	$1,019
26.0 Supplies & Materials	$445	$491	$748	$257
31.0 Equipment	$4,488	$5,831	$6,724	$893
Total - Non Pay Budget Object Class	**$49,814**	**$51,961**	**$59,942**	**$7,981**

Non Pay Cost Drivers

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Total Changes
Contract Support Services	$28,418	$28,073	$32,138	$4,065
Information Technology Equipment	$4,488	$5,831	$6,724	$893
Other Costs	$16,908	$18,057	$21,080	$3,023
Total - Non-Pay Cost Drivers	**$49,814**	**$51,961**	**$59,942**	**$7,981**

Explanation of Non Pay Cost Drivers

Contract Support Services: This cost driver reflects pay for contractor staff supporting the execution of headquarters functions including financial management, facility planning, personal property, maintenance, and other administrative functions.

Information Technology Equipment: This cost driver includes data centers, security and compliance software, the purchase and maintenance of IT equipment, including hardware (e.g., laptops, monitors, printers, etc.) and software (e.g., Microsoft Office, McAfee) as well as upgrades of this equipment.

Other Costs: This cost driver supports S&T's headquarters operational functions including business utilities, travel, training, office supplies, printing services, legal services, consolidated subscriptions, government-wide mandated services, and DHS FOIA system.

Laboratory Facilities – PPA

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

(Dollars in Thousands)

	FY 2021 Enacted			FY 2022 President's Budget			FY 2023 President's Budget			FY 2022 to FY 2023 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Laboratory Facilities	133	133	$122,816	133	133	$123,691	133	133	$127,522	-	-	$3,831
Total	**133**	**133**	**$122,816**	**133**	**133**	**$123,691**	**133**	**133**	**$127,522**	**-**	**-**	**$3,831**
Subtotal Discretionary - Appropriation	133	133	$122,816	133	133	$123,691	133	133	$127,522	-	-	$3,831

PPA Level I Description

The Laboratory Facilities PPA provides funding to support operations, infrastructure capabilities, maintenance, and personnel requirements at S&T's laboratory facilities. Laboratory Facilities is managed by the Office of National Laboratories (ONL) which oversees the continued operations of S&T's laboratory facilities to include the NBACC, PIADC, Transportation Security Laboratory (TSL), NUSTL, and CSAC to meet mission requirements while maintaining safe, secure, compliant, and efficient operations. ONL also manages the construction of the National Bio and Agro-Defense Facility (NBAF) and maintains capabilities vital to DHS and the national homeland security mission through a coordinated network of S&T laboratories and DOE national laboratories. This network of laboratories houses some of the most advanced scientific expertise and capabilities in the world, enabling the HSE to leverage, apply, and share knowledge that helps to inform policy, improve operations, and advance research in support of homeland security.

ONL is a crucial contributor to technology efforts and is a key resource in S&T's matrixed organization providing scientifically based RDT&E to deliver solutions. ONL provides an enduring capability of subject matter expertise and dedicated technical infrastructure critical to the success in each of S&T's RD&I thrust areas.

The following operations and facilities are supported in this PPA:

National Biodefense Analysis and Countermeasures Center Operations: NBACC provides the capability to characterize current and future biological threats, assess their impacts, and inform the development of countermeasures and vaccines in response to events and identified threats. NBACC is part of the National Interagency Biodefense Campus. 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. Maintaining this cutting-edge capability and technology at NBACC has allowed S&T to pivot to emerging events like the COVID-19 pandemic. For example, NBACC added a new online calculator tool that estimates the natural decay of SARS-CoV-2 (the virus that causes COVID-19) in the air under various environmental

conditions to assist response efforts and minimize person-to-person transmission by analyzing environmental factors that may impact the ability of the virus to spread.

NBACC is also utilized across the Federal Government and private sector through its work for others program. The work for others program conducts work for other Federal agencies and non-Federal entities on a reimbursable basis. NBACC examines opportunities for the cooperative use of existing capacity to perform R&D for other Federal agencies. S&T operates NBACC as a Federally Funded Research and Development Center (FFRDC), which plans, manages, and executes the NBACC research programs and operates the facility. Some of the major operational costs include safety, security, addressing and maintaining regulatory compliance, IT and IT upgrades, utility and garrison support costs, major facility and equipment upgrades, and energy renewal. NBACC is a certified and registered biosafety level (BSL) 2, 3, and 4 laboratory and has completed the triennial Biological Select Agents and Toxins registration inspection.

Plum Island Animal Disease Center Operations: PIADC has an interagency mission to protect U.S. agriculture from the threat of high-consequence foreign animal diseases such as foot and mouth disease (FMD). In carrying this mission. PIADC provides a host of high-impact, indispensable preparedness and response capabilities to include vaccine R&D, diagnostics, training, and bioforensics. The biologic countermeasure development at PIADC supports S&T's agro-terrorism countermeasures program. Research at the facility occurs in 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 management, IT and periodic upgrades to support regulatory requirements and equipment replacement to ensure safe facility operations. PIADC will be heavily involved in support of the safe and efficient transfer of the United States DHS of Agriculture (USDA) biorepository to the National Bio and Agro-Defense Facility starting in FY 2022 through FY 2023 and beyond.

Transportation Security Laboratory Operations: The TSL 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. All TSA threat detection systems are certified by TSL's Independent Test and Evaluation Division. TSL supports TSA as its primary customer, but also provides test and evaluation services to the U.S. Customs and Border Protection (CBP), United States Coast Guard, United States Secret Service (USSS), and other government organizations. TSL's main campus is located at the Federal Aviation Administration's (FAA) William J. Hughes Technical Center in Atlantic City, NJ. A remote test facility located at Tyndall Air Force Base, FL, collects homemade explosive detection data supporting transportation security equipment developmental testing and certification testing, while another TSL capability, the Detection Technology Center at Redstone Arsenal in Huntsville, AL, co-locates S&T alongside the FBI within the FBI Terrorist Explosive Device Analytical Center Improvised Explosive Detection and Synthesis Center, to conduct rapid home-made explosive characterization and assessment of detection system performance against emerging threats. Major operational costs include rent, operation support contracts, certification testing support, building maintenance, utilities, security, and IT.

National Urban Security Transportation Laboratory: NUSTL's capabilities in T&E and R&D help first responders prepare, protect and respond to and recover from homeland security challenges, threats, and hazards. NUSTL provides independent technology evaluations and assessments, thereby enabling informed acquisition and deployment decisions to ensure first responders have the best tools and technologies available to do their jobs safely and effectively. NUSTL is a preferred and trusted resource for first responder agencies across all levels of the government and works with end-users to promote the successful deployment of both commercial and emerging technologies into field use for law enforcement, fire and other emergency response agencies. Staff experts work side-by-side with the Nation's first responders to effectively plan and execute tests, evaluations and assessments in operational scenarios, assist with the fielding of technologies, sponsor Radiological/Nuclear Response and Recovery R&D, support the development of Concept of Operations (CONOPS) and provide post-deployment advisory support. Major operational costs include rent for its laboratory facility, T&E equipment purchase, maintenance and upgrades such as radiation detectors and radiation sources, contractor support, IT and security. NUSTL is located in Manhattan, New York due to the criticality of the partnership with the first responder community and access to complex urban test environments.

Chemical Security Analysis Center Operations: CSAC is the Nation's only Federal studies, analysis, and knowledge management center for assessing the threat or hazard associated with an accidental or intentional large-scale chemical event or chemical terrorism event in the United States. CSAC is co-located at the DOD U.S. Army Combat Capabilities Development Command Chemical Biological Center at Aberdeen Proving Ground-Edgewood in Maryland. CSAC supports a variety of customers within DHS, the Federal Government, and the HSE, to include but not limited to S&T's Chemical and Biological work, DHS Components such as CISA, CWMD, USSS, TSA, and other Federal agencies as well as the National Security Council. The CSAC provides science- and technology-based quality assured information capabilities for acquiring, storing, indexing, evaluating and making strategically available cheminformatic data, technical reports and other knowledge products across the chemical threat spectrum to support the unified effort to secure the Nation. Operational costs for this facility include rent, security, utilities, shared laboratory space, and IT. In FY 2021, responding to a new demand signal, CSAC led a matrixed team with the Probabilistic Analysis of National Threat, Hazards, and Risks (PANTHR) program and the Hazard Awareness Characterization – Technology Center to develop and analyze potential indoor and outdoor chemical and biological release scenarios to support special event planning for U.S. cities, including Los Angeles, Las Vegas, and San Francisco. Additionally, improvements to CSAC's Chemical Agents Reactions Database resulted in a reinvigoration of the Chemical Forensics Program, particularly with regard to chemical warfare agents and illicit drugs. CSAC responded to multiple Requests for Information including on the chemical supply chain, illicit drugs, and risk management planning and produced bulletins on emergent incidents potentially effecting safe drinking water and the environment in Florida. CSAC is planning for safe, green energy with its Jack Rabbit program and studies of ammonia. Using its Risk Prioritization Matrix, CSAC identified priority data gaps. CSAC also published the Synthetic Opioids Master Question List and evaluated the portability of Multi-Function Detectors.

National Bio and Agro-Defense Facility Construction: S&T manages the construction of NBAF. 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. Construction funding was provided in prior appropriations. As of July 2021, NBAF construction is 96 percent complete, with completion scheduled for FY 2022. In 2019, USDA assumed full responsibility for ongoing operations planning and future operation of NBAF, and S&T NBAF staff in Manhattan, KS were transferred to USDA.

Laboratory Facilities – PPA
Budget Authority and Obligations

(Dollars in Thousands)

	FY 2021	FY 2022	FY 2023
Enacted/Request	**$122,816**	**$123,691**	**$127,522**
Carryover - Start of Year	$13,115	$16,258	$16,635
Recoveries	$381	-	-
Rescissions to Current Year/Budget Year	($137)	-	-
Net Sequestered Resources	-	-	-
Reprogramming/Transfers	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$136,175**	**$139,949**	**$144,157**
Collections - Reimbursable Resources	$26,400	$26,400	$26,400
Collections - Other Sources	-	-	-
Total Budget Resources	**$162,575**	**$166,349**	**$170,557**
Obligations (Actual/Estimates/Projections)	$146,317	$149,714	$153,422
Personnel: Positions and FTE			
Enacted/Request Positions	133	133	133
Enacted/Request FTE	133	133	133
Onboard and Actual FTE			
Onboard (Actual/Estimates/Projections)	133	133	133
FTE (Actual/Estimates/Projections)	133	133	133

Laboratory Facilities – PPA
Collections – Reimbursable Resources

(Dollars in Thousands)

	FY 2021 Enacted			FY 2022 President's Budget			FY 2023 President's Budget		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Agriculture	-	-	$3,100	-	-	$3,100	-	-	$3,100
Department of Defense	-	-	$1,000	-	-	$1,000	-	-	$1,000
Department of Homeland Security - Countering Weapons of Mass Destruction	-	-	$50	-	-	$50	-	-	$50
Department of Homeland Security - Federal Emergency Management Agency	-	-	$200	-	-	$200	-	-	$200
Department of Homeland Security - Transportation Security Administration	-	-	$850	-	-	$850	-	-	$850
Department of Justice - Federal Bureau of Investigation	-	-	$21,000	-	-	$21,000	-	-	$21,000
Department of State	-	-	$200	-	-	$200	-	-	$200
Total Collections	**-**	**-**	**$26,400**	**-**	**-**	**$26,400**	**-**	**-**	**$26,400**

Laboratory Facilities – PPA
Summary of Budget Changes
(Dollars in Thousands)

	Positions	FTE	Amount
FY 2021 Enacted	**133**	**133**	**$122,816**
FY 2022 President's Budget	**133**	**133**	**$123,691**
FY 2023 Base Budget	**133**	**133**	**$123,691**
Total Technical Changes	**-**	**-**	**-**
Total Transfers	**-**	**-**	**-**
Civilian Pay Raise Total	-	-	$790
Annualization of Prior Year Pay Raise	-	-	$150
FPS Fee Adjustment	-	-	($668)
Pay Raise Annualization of FY 2022 Program Changes	-	-	$32
IT Investments Reduction	-	-	($1,200)
Total Pricing Changes	**-**	**-**	**($896)**
Total Adjustments-to-Base	**-**	**-**	**($896)**
FY 2023 Current Services	**133**	**133**	**$122,795**
LF-Laboratory Facilities Operations	-	-	$3,291
LF-Realign Costs of CSAC Detailees	-	-	$1,436
Total Program Changes	**-**	**-**	**$4,727**
FY 2023 Request	**133**	**133**	**$127,522**
FY 2022 TO FY 2023 Change	**-**	**-**	**$3,831**

Laboratory Facilities – PPA
Personnel Compensation and Benefits

Pay Summary
(Dollars in Thousands)

	FY 2021 Enacted				FY 2022 President's Budget				FY 2023 President's Budget				FY 2022 to FY 2023 Total			
	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate	Pos.	FTE	Amount	Rate
Laboratory Facilities	133	133	$21,926	$164.18	133	133	$22,733	$170.23	133	133	$25,141	$177.50	-	-	$2,408	$7.28
Total	**133**	**133**	**$21,926**	**$164.18**	**133**	**133**	**$22,733**	**$170.23**	**133**	**133**	**$25,141**	**$177.50**	**-**	**-**	**$2,408**	**$7.28**
Subtotal Discretionary - Appropriation	133	133	$21,926	$164.18	133	133	$22,733	$170.23	133	133	$25,141	$177.50	-	-	$2,408	$7.28

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
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
11.1 Full-time Permanent	$15,350	$15,818	$16,492	$674
11.3 Other than Full-time Permanent	$435	$448	$467	$19
11.5 Other Personnel Compensation	$468	$483	$503	$20
11.8 Special Personal Services Payments	$90	$93	$1,533	$1,440
12.1 Civilian Personnel Benefits	$5,583	$5,891	$6,146	$255
Total - Personnel Compensation and Benefits	**$21,926**	**$22,733**	**$25,141**	**$2,408**
Positions and FTE				
Positions - Civilian	133	133	133	-
FTE - Civilian	133	133	133	-

Pay Cost Drivers

	FY 2021 Enacted			FY 2022 President's Budget			FY 2023 President's Budget			FY 2022 to FY 2023 Total Changes		
	FTE	Amount	Rate	FTE	Amount	Rate	FTE	Amount	Rate	FTE	Amount	Rate
Laboratory Personnel	133	$21,836	$164.18	133	$22,640	$170.23	133	$23,608	$177.50	-	$968	$7.28
Other PC&B Costs	-	$90	-	-	$93	-	-	$1,533	-	-	$1,440	-
Total - Pay Cost Drivers	**133**	**$21,926**	**$164.18**	**133**	**$22,733**	**$170.23**	**133**	**$25,141**	**$177.50**	**-**	**$2,408**	**$7.28**

Explanation of Pay Cost Drivers

Laboratory Personnel: These costs support personnel compensation, benefits, and performance awards for laboratory personnel overseeing the operations, core capabilities, and maintenance requirements at S&T's laboratory facilities.

Other PC&B Costs: These costs support subject matter experts from other government agencies on a reimbursable detailee basis.

Laboratory Facilities – PPA
Non Pay Budget Exhibits

Non Pay Summary
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
Laboratory Facilities	$100,890	$100,958	$102,381	$1,423
Total	**$100,890**	**$100,958**	**$102,381**	**$1,423**
Subtotal Discretionary - Appropriation	$100,890	$100,958	$102,381	$1,423

Non Pay by Object Class
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
21.0 Travel and Transportation of Persons	$222	$222	$228	$6
22.0 Transportation of Things	-	-	$17	$17
23.1 Rental Payments to GSA	$613	$613	$613	-
23.2 Rental Payments to Others	-	-	$2,090	$2,090
23.3 Communications, Utilities, & Miscellaneous	-	-	$14	$14
24.0 Printing and Reproduction	-	-	$222	$222
25.1 Advisory & Assistance Services	$83,218	$83,286	$84,080	$794
25.2 Other Services from Non-Federal Sources	$501	$501	$516	$15
25.3 Other Purchases of goods and services	$9,585	$9,585	$7,774	($1,811)
25.4 Operations & Maintenance of Facilities	$2,611	$2,611	$2,687	$76
25.7 Operation & Maintenance of Equipment	$533	$533	$533	-
26.0 Supplies & Materials	$634	$634	$634	-
31.0 Equipment	$2,973	$2,973	$2,973	-
Total - Non Pay Budget Object Class	**$100,890**	**$100,958**	**$102,381**	**$1,423**

Non Pay Cost Drivers

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Total Changes
Other Goods and Services from Federal Sources	$44,630	$44,630	$45,697	$1,067
Laboratory Contract Support	$44,354	$44,422	$45,484	$1,062
Laboratory Facilities Operations and Maintenance	$4,013	$4,013	$4,109	$96
Other Costs	$2,930	$2,930	$3,000	$70
Laboratory Supplies and Materials	$2,863	$2,863	$2,150	($713)
Rental Payments to General Services Administration	$2,100	$2,100	$1,941	($159)
Total - Non-Pay Cost Drivers	**$100,890**	**$100,958**	**$102,381**	**$1,423**

Explanation of Non Pay Cost Drivers

Other Goods and Services from Federal Sources: These costs are driven by contractor services, interagency agreements for the purchase of goods and services for jointly funded projects. Examples include TSL's agreement with the FAA for the FAA to provide facility support services on a reimbursable basis for various activities, including utilities, building maintenance, emergency services, air shuttle services, and IT services. FPS provides security at PIADC.

Laboratory Contract Support: This cost driver supports contractor staff required to assist in managing the execution of business operations including financial management, facility planning, engineering and technical services, and other administrative functions.

Rental Payments to GSA: This cost driver is associated with rental payment to GSA for NUSTL.

Laboratory Facilities Operations and Maintenance: These costs cover the upkeep of facilities to meet mission requirements while maintaining safe, secure, compliant, and efficient operations. In general, for laboratory facilities 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 included are service contracts, routine repair of facilities and upkeep of land. PIADC must be maintained on a 24/7 basis.

Laboratory 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 equipment. This cost driver also includes office supplies, materials, and vehicle maintenance.

Other Costs: These costs include operations and maintenance of the laboratories' IT systems, payments to vendors, utilities, fleet maintenance, travel, training, supplies, and other costs.

Acquisitions and Operations Analysis – PPA

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

(Dollars in Thousands)

	FY 2021 Enacted			FY 2022 President's Budget			FY 2023 President's Budget			FY 2022 to FY 2023 Total Changes		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Acquisition and Operations Analysis	-	-	$57,296	-	-	$52,933	-	-	$73,875	-	-	$20,942
Total	**-**	**-**	**$57,296**	**-**	**-**	**$52,933**	**-**	**-**	**$73,875**	**-**	**-**	**$20,942**
Subtotal Discretionary - Appropriation	-	-	$57,296	-	-	$52,933	-	-	$73,875	-	-	$20,942

PPA Level I Description

The AOA PPA 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. This includes providing technological assessment of major acquisition programs in DHS to help ensure that technologies, 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 SAFETY Act program.

FFRDC Program Management Office (PMO): The FFRDC PMO increases the strategic value and utilization of the FFRDCs by advancing and sharing the work products, delivered by each FFRDC, that provide solutions to DHS's most complex R&D issues. The PMO provides centralized oversight and support to the two FFRDCs, the HSOAC and the HSSEDI. These FFRDCs work 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. The close, but independent relationship between DHS and the FFRDC allows the FFRDCs 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. The 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 to transform mission-level goals into strategies, operational requirements, and performance metrics. The HSSEDI utilizes its independent and objective perspective, extensive knowledge of the DHS mission space, and deep technical and systems engineering expertise to identify and solve critical technical problems and accelerate to operational use, the technology and systems necessary to secure the homeland.

International Cooperative Programs Office (ICPO): ICPO implements the Under Secretary's unique authorities within DHS: to establish priorities for international cooperative RDT&E; to exchange personnel, classified information, and equipment in support of these cooperative RDT&E activities; and, to implement activities through mechanisms that he or she deems appropriate under the legislative authority. This is done via bilateral and multilateral cooperation, including the Five Country Ministerial and North American Treaty Organization (NATO). ICPO is responsible for coordinating across DHS operational Components, DHS Policy Office of International Affairs, and with the USG interagency, especially the Department of State, in the development of strategic priorities for such activities. ICPO is responsible for identifying, selecting, and oversight of S&T's international attachés who serve as regional RDT&E subject matter experts to DHS operational Component deployed staff. The United States and its allies mutually benefit from the sharing of information and technological expertise to combat domestic and international threats and other high consequence events. ICPO establishes enduring relationships to provide access to innovative, international RDT&E knowledge across the innovation ecosystem (i.e., government, academia, laboratories, and industry), funding, and other unique capabilities and resources. The office accelerates capability development and transition, enhances affordability, and takes advantage of emerging ideas and solutions, globally.

Partnership Intermediary Agreements: The transfer and commercialization of federally funded technologies is frequently a time consuming and expensive undertaking especially when resources are constrained at Government agencies, including DHS. S&T utilizes its network of qualified Partnership Intermediary organizations to increase the maturity and market readiness of DHS funded technologies to prepare them for transfer and commercialization to meet DHS's operational needs and the needs of the wider HSE. This program allows S&T Technology Transfer and Commercialization (T2C) to expand its reach to promote and market DHS technologies; gain increased partnerships with a variety of businesses and educational institutions; gain insight on industry perspectives on DHS technologies; and increase the likelihood of impact from research outcomes. Multiple PIAs are required to capitalize on State and local relationships across the United States to identify subject matter experts and benefit from local economic development resources; tap regional angel and venture capital networks; and leverage existing contacts with State and local first responder/law enforcement/mass transit communities.

Office of the Chief Scientist: The Chief Scientist (CS) serves as a senior technology advisor and offers an analytic capability to the USST. The CS conducts technology reviews and delivers insights into the effectiveness of S&T's technology investments. These reviews present a picture of how well S&T's programs are filling capability identified and validated gaps. The office scans the technical horizon, and reviews and produces advanced scientifically sound analysis of emerging technologies focused on enhancing security and countering the constantly evolving threat environment.

Operations and Requirements Analysis (ORA): Through the S&T-managed DHS IPT process and in coordination with the DHS Joint Requirement Council (JRC), S&T identifies common or similar operational R&D needs by DHS Components, and delivers operational analyses that support technical solutions to increase DHS overall efficiency and effectiveness. ORA's management of the IPT process provides the mechanism to carry out these activities. The IPT process occurs annually, with ORA having responsibility to deliver the following: validated and coordinated list of DHS-wide R&D strategic priorities and capability gaps, and traceability of capability gaps to DHS missions and operations. ORA is also responsible for decomposing new capability gaps into actionable R&D requirements. Collectively, these outputs inform S&T leadership decision-making on near and long-term R&D planning and resource allocation. The outputs also enable S&T to successfully deliver impactful solutions to DHS Components and first responders that meet their mission needs and make their operations safer and more efficient and effective. ORA also fulfills activities required by the *Foundations for Evidence-Based Policymaking Act of 2018* (Evidence Act), which mandates DHS to develop a quadrennial learning agenda, annual evaluation plans, and a quadrennial capacity assessment, products which are to be used to assess, improve, and advise evidence building activities across DHS. S&T promotes the use of evidence to inform decision-making and developing the quadrennial DHS Learning Agenda to identify priority questions related to the programs, policies, regulations, and operations of the agency. S&T supports development of annual evaluation plans and provides capacity assessment information, which provide a baseline measure of the DHS's capacity to build and use evidence for decision-making.

SAFETY Act: This program provides liability protections for Sellers of qualified anti-terrorism technologies (QATTs) that could save lives in the event of a terrorist attack. The program incentivizes the private sector to commit additional resources to significantly improve anti-terrorism preparedness and resilience. The Program is intended to serve the American public and interests by improving the anti- terrorism capability of the Nation. The Program thus has a public security mission. It is an outward-facing program; it serves private and public-sector stakeholders as they seek to manage risk from deployments of anti-terrorism capabilities. 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 HSE. 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.

Standards: S&T performs the statutory functions of the Standards Executive for DHS and implements DHS's statutory responsibilities for the utilization of and participation in the development of consensus standards, facilitating the successful deployment of standards-enabled capabilities. This is conducted in six main functional areas executed across DHS by 1) providing advice and overseeing standardization and conformity assessment policy; 2) coordinating standards and conformity assessment activities, ensuring DHS component standards activities are harmonized and compatible with the mission, authority, and priorities of DHS; 3) training and educating DHS personnel on standards and conformity assessment, enabling them to effectively engage in the standards process; 4) integrating standards into DHS programs and activities; 5) providing technical resources, subject matter expertise and strategic vision and direction on standardization; and 6) supporting and funding critical standardization projects or anticipatory standards development for rapidly emerging requirements when existing standards are insufficient for the missions. These responsibilities are enabled through membership, participation, and leadership in, and coordination with multiple national and international standards development organizations and interagency groups. S&T provides technical standards, test methods, test kits and guidance to DHS Components and the HSE. DHS and HSE equities are represented in over 1,000 new standards each year that deliver interoperable and counter-terrorism technologies and solutions to the DHS, other Federal agencies, the first responder community and the private sector.

Strategy and Policy Office: S&T's Strategy and Policy Office (SPO) oversees S&T-wide strategy development and sets strategic direction for the organization. SPO is responsible for developing and maintaining the S&T Strategy, leading interagency/international/industry strategies engagement, and leading S&T planning, policy, and program alignment. This includes administering the Homeland Security Science and Technology Advisory Committee (HSSTAC), by supporting the USST in nominating the 20-member HSSTAC that includes emergency first-responders or representatives of organizations or associations of emergency first-responders in addition to representatives of citizen groups, including economically disadvantaged communities. Knowledge Management is another capability under the realm of program alignment. This discipline enhances the ability to gather, curate, and manage accumulated mission-related knowledge and essential information for easy retrieval and use. SPO also manages S&T's Interagency Programs, which addresses high-priority homeland security needs through facilitation and collaboration with cooperative science, technology, and RDT&E endeavors with other Federal agencies, academia, and the private sector. This interagency function 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.

Systems Engineering: Systems Engineering enables DHS programs to improve the efficiency of identifying and transforming Component requirements into operational capabilities by applying a disciplined, consistent process for managing technical frisk that facilitates achievement of cost, schedule, and performance objectives from concept definition to deployment. S&T conducts Technical Assessments of DHS Acquisition programs to identify major technical risks, provide recommendations to reduce those risks, support objective decision-making, and ensure that programs are technically sound. S&T assists DHS Acquisition and R&D programs in implementing systems engineering, leads the DHS Systems Engineering Center of Excellence, and instructs the DHS Systems Engineering certification courses. S&T provides technical expertise to DHS Acquisition oversight offices including the Office of Program Accountability and Risk Management, Office of the Chief Information Officer, and the DHS JRC.

System of Systems Operational Analytics (SoSOA): This effort supports transforming SoSOA to an enterprise-level capability to increase the effectiveness and efficiency of DHS data analytics as a whole and enables the analysis of highly complex systems of interdependent components (system of systems) for Components, Headquarter Offices, and the JRC. The demand for a fully mature, enterprise-wide SoSOA capability is strong amongst the HSE, based on what SoSOA has been able to provide to date through various proofs-of-concept. SoSOA provides Components an Enterprise-level capability with common analytic frameworks, tools, and training. Increasing analyses capability for DHS results in cost and time savings - freeing up operators and resources for mission-critical operations execution. Planned capabilities include:

- Assimilated visualization and analytic tools with fused data from disparate sources to improve reporting efficiency.
- Faster delivery of analyses to support decision making.
- Reduce costs for data-driven analysis by ensuring DHS Components leverage, share, reuse, and repurpose previously developed analyses.
- Enterprise analytic applications that include business analytics and visualization, statistical packages, modeling and simulation, decision analysis tools, and a library of online SoSOA analytics training manuals for 2500 users across DHS.

Test and Evaluation (T&E): T&E is the authoritative designee that provides a mechanism by which programs can better understand the capabilities and limitations of the system when operated and supported by trained users within the intended operational environment. S&T's T&E is also designated to support DHS by training the DHS Acquisition Workforce Test & Evaluation (T&E) Career Field members. T&E performs these critical functions in support of delivering enhanced capabilities to DHS Operators to improve acquisition outcomes through comprehensive engagement in major acquisition programs and R&D efforts. T&E supports every major program on the Master Acquisition Oversight List; providing input at each Acquisition Review Board; reviewing and providing comments on each program Operational Requirements Document; reviewing and approving the selection of Independent Test Agents, T&E Master Plans, and Operational Test Plans. T&E prepares and issues Letters of Assessment, in support of initial and full production or deployment decisions that address operational effectiveness, operational suitability, and operational resilience. T&E provides support to development and certification for members of the T&E career field in the acquisition workforce. T&E, including utilization of our ONL capabilities at NUSTL, provides assistance and guidance to programs regarding Cyber Resilience T&E, First Responder Technology T&E, Scientific Test and Analysis Techniques, Reliability assessments, and effective mapping of government test facilities.

Technology Scouting and Transition (TST): TST conducts activities that inform and support R&D decisions and the transition and knowledge sharing of solutions to meet DHS's customer requirements through technology scouting, operational experiments, transition planning and the Technology Clearinghouse. TST supports S&T strategic and tactical R&D investment decision-making by providing a better understanding of the state of technology, including new and emerging technology and the private sector innovation landscape. Technology Scouting shapes the way S&T discovers, monitors, and assesses new and emerging technologies critical to HSE missions. Technology Scouting program goals are to improve alternative options, increase speed of project execution, and reduce costs for projects. Technology Transition's role is to provide centralized support management in planning for and executing the transitioning of knowledge products, capabilities, and technologies to DHS Components. Transition collaborates across S&T to understand the factors that will shape the transition effort and delivery of new solutions to customers and identify opportunities to accelerate successful fielding of solutions or manage and mitigate risks to transition. TST also tracks, assesses, and reports transitions to comply with DHS's 2017 National Defense Authorization Act reporting requirements to Congress. TST leads the development, operation and maintenance of the DHS Technology Clearinghouse that serves as the repository for S&T program and project reports and artifacts to aid in knowledge sharing to enhance the successful development and deployment of innovative homeland security technology solutions. TST also manages the OpEx program, which facilitates and conducts operational experimentations with S&T program managers and DHS Component customers in order to evaluate the technical capabilities and operational use of new and emerging technologies.

Acquisitions and Operations Analysis – PPA
Budget Authority and Obligations
(Dollars in Thousands)

	FY 2021	FY 2022	FY 2023
Enacted/Request	**$57,296**	**$52,933**	**$73,875**
Carryover - Start of Year	$7,354	$8,510	$8,057
Recoveries	$566	-	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Reprogramming/Transfers	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$65,216**	**$61,443**	**$81,932**
Collections - Reimbursable Resources	$5,700	$5,700	$5,700
Collections - Other Sources	-	-	-
Total Budget Resources	**$70,916**	**$67,143**	**$87,632**
Obligations (Actual/Estimates/Projections)	$62,406	$59,086	$76,888
Personnel: Positions and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

Acquisitions and Operations Analysis – PPA
Collections – Reimbursable Resources

(Dollars in Thousands)

	FY 2021 Enacted			FY 2022 President's Budget			FY 2023 President's Budget		
	Pos.	FTE	Amount	Pos.	FTE	Amount	Pos.	FTE	Amount
Department of Energy	-	-	$500	-	-	$500	-	-	$500
Department of Homeland Security - U.S. Citizenship and Immigration Services	-	-	$50	-	-	$50	-	-	$50
Department of Homeland Security - Countering Weapons of Mass Destruction	-	-	$900	-	-	$900	-	-	$900
Department of Homeland Security	-	-	$500	-	-	$500	-	-	$500
Department of Homeland Security - Federal Emergency Management Agency	-	-	$50	-	-	$50	-	-	$50
Department of Homeland Security - Transportation Security Administration	-	-	$300	-	-	$300	-	-	$300
Department of Homeland Security - U.S. Customs and Border Protection	-	-	$100	-	-	$100	-	-	$100
Department of Homeland Security - U.S. Immigration and Customs Enforcement	-	-	$250	-	-	$250	-	-	$250
Department of Homeland Security - United States Coast Guard	-	-	$100	-	-	$100	-	-	$100
Department of Homeland Security - United States Secret Service	-	-	$1,500	-	-	$1,500	-	-	$1,500
Library of Congress	-	-	$500	-	-	$500	-	-	$500
Department of Homeland Security - Cybersecurity and Infrastructure Security Agency	-	-	$950	-	-	$950	-	-	$950
Total Collections	**-**	**-**	**$5,700**	**-**	**-**	**$5,700**	**-**	**-**	**$5,700**

Acquisitions and Operations Analysis – PPA
Summary of Budget Changes
(Dollars in Thousands)

	Positions	FTE	Amount
FY 2021 Enacted	**-**	**-**	**$57,296**
FY 2022 President's Budget	**-**	**-**	**$52,933**
FY 2023 Base Budget	**-**	**-**	**$52,933**
Total Technical Changes	**-**	**-**	**-**
Total Transfers	**-**	**-**	**-**
Total Pricing Changes	**-**	**-**	**-**
Total Adjustments-to-Base	**-**	**-**	**-**
FY 2023 Current Services	**-**	**-**	**$52,933**
AOA-Acquisition Support	-	-	$8,844
AOA-Change Appropriations for Partnership Intermediary Agreements	-	-	$2,000
AOA-Federally Funded Research and Development Centers (FFRDC)	-	-	$1,001
AOA-SAFETY Act	-	-	$4,707
AOA-Standards Program	-	-	$1,300
AOA-Technology Scouting and Transition	-	-	$3,090
Total Program Changes	**-**	**-**	**$20,942**
FY 2023 Request	**-**	**-**	**$73,875**
FY 2022 TO FY 2023 Change	**-**	**-**	**$20,942**

Acquisitions and Operations Analysis – PPA
Non Pay Budget Exhibits

Non Pay Summary
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
Acquisition and Operations Analysis	$57,296	$52,933	$73,875	$20,942
Total	**$57,296**	**$52,933**	**$73,875**	**$20,942**
Subtotal Discretionary - Appropriation	$57,296	$52,933	$73,875	$20,942

Non Pay by Object Class
(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
21.0 Travel and Transportation of Persons	$215	$215	$297	$82
22.0 Transportation of Things	$78	$78	$109	$31
24.0 Printing and Reproduction	$14	$14	$20	$6
25.1 Advisory & Assistance Services	$41,993	$37,630	$52,133	$14,503
25.2 Other Services from Non-Federal Sources	$1,161	$1,161	$2,357	$1,196
25.3 Other Purchases of goods and services	$12,979	$12,979	$17,689	$4,710
25.4 Operations & Maintenance of Facilities	-	-	$51	$51
25.7 Operation & Maintenance of Equipment	$50	$50	$68	$18
25.8 Subsistence and Support of Persons	-	-	$4	$4
26.0 Supplies & Materials	$51	$51	$67	$16
31.0 Equipment	$255	$255	$339	$84
32.0 Land and Structures	-	-	$20	$20
41.0 Grants, Subsidies, and Contributions	$500	$500	$682	$182
42.0 Insurance Claims and Indemnities	-	-	$39	$39
Total - Non Pay Budget Object Class	**$57,296**	**$52,933**	**$73,875**	**$20,942**

Non Pay Cost Drivers

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Total Changes
Contract Support Services	$36,676	$32,313	$45,097	$12,784
Other Goods and Services from Federal Sources	$16,997	$16,997	$23,722	$6,725
Other Costs	$3,623	$3,623	$5,056	$1,433
Total - Non-Pay Cost Drivers	**$57,296**	**$52,933**	**$73,875**	**$20,942**

Explanation of Non Pay Cost Drivers

Contract Support Services: Costs include contract services for business operations including financial management, studies, analyses, and evaluations in support of IT and R&D activities, as well as other administrative functions. S&T's AOA programs rely on contracting services to provide analyses, engineering, test expertise, and products for operational end users within DHS and JRC. This overall increase includes services that support: advisory assistance in technology scouting, vulnerability/risk assessment and mitigation, project justification and defense, program planning, evaluation and analyses of programs, projects, budgets and performance, project execution, transition and commercialization, programmatic support, various administrative support/assistance, and administrative assistance providing additional support to the program office toward mission goals and day-to-day business support.

Other Goods and Services from Federal Sources: Funding supports Interagency agreements for contractual services for the purchase of goods and services for jointly funded projects. For example, Office of SAFETY Act Implementation (OSAI) relies heavily on the Institute of Defense Analyses and the RAND Corporation to provide studies, and analyses, in determining whether to designate a particular technology as a Qualified Anti-Terrorism Technology. Increasing the funding level from FY 2022 to FY 2023 allows OSAI to continue to identify major technical risks, improve process effectiveness and efficiency, support objective decision-making, and ensure the program adheres to the timelines called out by the DHS, Office of the Secretary, 6 CFR Part 25, (Regulations Implementing the Support Anti-terrorism by Fostering Effective Technologies Act of 2002 (the SAFETY Act).

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

Department of Homeland Security

Science and Technology Directorate

Procurement, Construction, and Improvements

Fiscal Year 2023

Congressional Justification

Table of Contents

Procurement, Construction, and Improvements **1**
Budget Comparison and Adjustments 3
Summary of Budget Changes 5
Non Pay Budget Exhibits 6
Capital Investment Exhibits 7
Construction and Facility Improvements – PPA 8
Budget Comparison and Adjustments 8
Non Pay Budget Exhibits 13
Capital Investment Exhibits 14
Critical Repair/Replacement Requirement– Investment 15
Plum Island Closure and Support– Investment 24
Detection Sciences Testing and Applied Research Center– Investment 28

Procurement, Construction, and Improvements

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
Construction and Facility Improvements	$18,927	$8,859	$89,466	$80,607
Total	**$18,927**	**$8,859**	**$89,466**	**$80,607**
Subtotal Discretionary - Appropriation	$18,927	$8,859	$89,466	$80,607

S&T's Procurement, Construction & Improvements (PC&I) appropriation supports requirements to ensure laboratory infrastructures remain aligned to S&T mission requirements. PC&I funding allows S&T to make essential investments in construction, expansion, maintenance, modernization, or removal as necessary to support requirements generated by DHS Components. In addition, PC&I funding allows S&T the ability to invest in equipment and information technology to ensure that S&T laboratories maintain accreditation.

S&T performs cutting edge Research, Development, Test and Evaluation (RDT&E) at its laboratories to maintain foundational science capabilities in direct support of identified DHS and Homeland Security Enterprise (HSE) capability gaps.

Construction and Facilities Improvement PPA: This PPA supports all major construction and improvements for S&T's laboratories above the real property threshold of $2.0M set for minor construction in Operations and Support (O&S) appropriation.

Procurement, Construction, and Improvements
Budget Authority and Obligations

(Dollars in Thousands)

	FY 2021	FY 2022	FY 2023
Enacted/Request	**$18,927**	**$8,859**	**$89,466**
Carryover - Start of Year	-	$8,359	$4,993
Recoveries	-	-	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Reprogramming/Transfers	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$18,927**	**$17,218**	**$94,459**
Collections - Reimbursable Resources	-	-	-
Collections - Other Sources	-	-	-
Total Budget Resources	**$18,927**	**$17,218**	**$94,459**
Obligations (Actual/Estimates/Projections)	$10,568	$12,225	$68,783
Personnel: Positions and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

Procurement, Construction, and Improvements
Summary of Budget Changes
(Dollars in Thousands)

	Positions	FTE	Amount
FY 2021 Enacted	**-**	**-**	**$18,927**
FY 2022 President's Budget	**-**	**-**	**$8,859**
FY 2023 Base Budget	**-**	**-**	**-**
Critical Repair/Replacement Requirement	-	-	$35,750
Plum Island Closure and Support	-	-	$13,466
Detection Sciences Testing and Applied Research Center	-	-	$40,250
Total Investment Elements	**-**	**-**	**$89,466**
FY 2023 Request	**-**	**-**	**$89,466**
FY 2022 TO FY 2023 Change	**-**	**-**	**$80,607**

Procurement, Construction, and Improvements
Non Pay Budget Exhibits

Non Pay by Object Class

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
21.0 Travel and Transportation of Persons	$27	$29	$31	$2
23.2 Rental Payments to Others	$200	$200	$200	-
23.3 Communications, Utilities, & Miscellaneous	$100	$100	$100	-
25.1 Advisory & Assistance Services	$4,600	$1,530	$2,135	$605
25.5 Research & Development Contracts	$2,000	$1,000	$1,000	-
26.0 Supplies & Materials	$5,500	$1,000	$1,000	-
31.0 Equipment	$5,500	$2,000	$36,400	$34,400
32.0 Land and Structures	$1,000	$3,000	$48,600	$45,600
Total - Non Pay Budget Object Class	**$18,927**	**$8,859**	**$89,466**	**$80,607**

Procurement, Construction, and Improvements
Capital Investment Exhibits

Capital Investments

(Dollars in Thousands)

	Acquisition Level	IT/ Non-IT	MAOL	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
N/A - Critical Repair/Replacement Requirement	Non-Major	Non-IT	No	-	-	$35,750
N/A - Plum Island Closure and Support	Level 3	Non-IT	No	$18,927	$8,859	$13,466
N/A - Detection Sciences Testing and Applied Research Center	Non-Major	Non-IT	No	-	-	$40,250

Construction and Facility Improvements – PPA

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
Critical Repair/Replacement Requirement	-	-	$35,750	$35,750
Plum Island Closure and Support	$18,927	$8,859	$13,466	$4,607
Detection Sciences Testing and Applied Research Center	-	-	$40,250	$40,250
Total	**$18,927**	**$8,859**	**$89,466**	**$80,607**
Subtotal Discretionary - Appropriation	$18,927	$8,859	$89,466	$80,607

PPA Level I Description

The Construction and Facility Improvements PPA supports all major construction and improvements for S&T's laboratories above the real property threshold set for minor construction in O&S appropriation. S&T's laboratory facilities include the National Biodefense Analysis and Countermeasures Center (NBACC) located at Fort Detrick in Frederick, Maryland, Plum Island Animal Disease Center (PIADC) located on Plum Island, New York, Transportation Security Laboratory (TSL) located in Atlantic City, New Jersey, National Urban Security Transportation Laboratory (NUSTL) located in New York, New York, and Chemical Security Analysis Center (CSAC) located at Aberdeen Proving Ground in Maryland. S&T's five laboratories are vital to the national homeland security mission, enabling America's brightest scientists and engineers to apply their expertise and develop solutions that address our most dangerous threats and homeland security vulnerabilities.

This PPA provides funding for replacing outdated and substandard laboratory facilities, completing basic facility maintenance and repair, replacing outdated laboratory equipment, and investing in capital improvements – including IT modernization – to meet evolving mission requirements. All investments support critical scientific and technical capabilities necessary to conduct RDT&E for DHS and HSE. This PPA also includes funding required to close PIADC prior to the transfer of function to the National Bio and Agro-Defense Facility (NBAF).

This PPA is comprised of the following investments:

Critical Repair/Replacement Requirement: The FY 2023 Budget supports investments to ensure that the S&T laboratory infrastructure can address deficiencies and substantial capacity shortcomings to meet evolving mission requirements. S&T identified capital improvements, facility maintenance and repair, and equipment replacement priorities to enable the S&T laboratories to effectively meet mission requirements, ensure staff safety, meet security and regulatory requirements, and maintain laboratory readiness and 24x7 operations and research support capability. S&T documented these investments in its *S&T Laboratory Infrastructure Requirements Assessment* that was issued in 2021 and includes the following investments to address the backlog of maintenance and repairs, equipment priorities, laboratory upgrades and capital improvements, and IT modernization necessary to enable S&T to continue to effectively support the HSE:

- Laboratory Capital Investment Program
- NBACC Facility Maintenance and Repair Backlog
- TSL Facility Maintenance and Repair Backlog
- NBACC Electron Microscope Replacement
- NBACC Facility Expansion Scoping Study
- Information Technology (IT) Modernization

Plum Island Closure and Support: The FY 2023 Budget continues to support the Plum Island Closure and Support (PICS) program and activities required for the transition, closure, and conveyance of all Plum Island real property and all related personal property and transportation assets (including the Orient Point property) after the PIADC science mission is fully transferred to the NBAF. PICS activities include the following:

- Biological decontamination of the laboratory facilities
- Completion of environmental regulatory compliance activities (e.g., remediation of remaining waste management areas)
- Facility maintenance and closure activities
- Disposition of all records, personal property, real property, and IT assets; and
- Preservation/disposition of historic assets

S&T is managing the PICS program as a Level III non-acquisition program. The PICS current total estimate of $150.0M will enable S&T to achieve closure of the island while enabling PIADC operations through mission transition to USDA. Once the PICS program is completed, Plum Island will be closed and available for release from DHS to another entity through the General Services Administration (GSA).

Detection Sciences Testing and Applied Research (DSTAR) Center: The FY 2023 Budget supports the design and construction of the DSTAR Center located in Atlantic City, NJ. The DSTAR Center facility will improve capacity and productivity by providing partially automated, state-of-the-art laboratories for the safe and effective validation of explosive screening devices. The DSTAR Center facility will include an applied research laboratory, a dedicated homemade explosives synthesis/preparation facility, an explosives safety testing laboratory, flexible laboratory space for testing of explosive detection technologies, and new office space to replace temporary structures. It will include sterile areas for test and evaluation of trace detection devices. DSTAR will advance detection science by providing modern computational infrastructure for analyzing and archiving threat images from computed tomography and millimeter wave threat screening devices and by incorporating more effective use of machine learning, artificial intelligence and other advanced techniques.

The estimated 50,000 sq. ft. DSTAR Center project includes the DSTAR Center, the Facility for Energetic Materials Research (FEMR), removal of 2,000 sq. ft. existing temporary facility and reconfiguration of existing warehouse facilities back to their intended use, as well as parking and roadway improvements. This project is consistent with S&T's congressionally mandated Infrastructure Master Plan for the TSL from 2010 through present day and will resolve ongoing operations and maintenance issues.

Construction and Facility Improvements – PPA
Budget Authority and Obligations
(Dollars in Thousands)

	FY 2021	FY 2022	FY 2023
Enacted/Request	**$18,927**	**$8,859**	**$89,466**
Carryover - Start of Year	-	$8,359	$4,993
Recoveries	-	-	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Reprogramming/Transfers	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$18,927**	**$17,218**	**$94,459**
Collections - Reimbursable Resources	-	-	-
Collections - Other Sources	-	-	-
Total Budget Resources	**$18,927**	**$17,218**	**$94,459**
Obligations (Actual/Estimates/Projections)	$10,568	$12,225	$68,783
Personnel: Positions and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

Construction and Facility Improvements – PPA
Summary of Budget Changes
(Dollars in Thousands)

	Positions	FTE	Amount
FY 2021 Enacted	**-**	**-**	**$18,927**
FY 2022 President's Budget	**-**	**-**	**$8,859**
FY 2023 Base Budget	**-**	**-**	**-**
Critical Repair/Replacement Requirement	-	-	$35,750
Plum Island Closure and Support	-	-	$13,466
Detection Sciences Testing and Applied Research Center	-	-	$40,250
Total Investment Elements	**-**	**-**	**$89,466**
FY 2023 Request	**-**	**-**	**$89,466**
FY 2022 TO FY 2023 Change	**-**	**-**	**$80,607**

Construction and Facility Improvements – PPA
Non Pay Budget Exhibits

Non Pay by Object Class

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
21.0 Travel and Transportation of Persons	$27	$29	$31	$2
23.2 Rental Payments to Others	$200	$200	$200	-
23.3 Communications, Utilities, & Miscellaneous	$100	$100	$100	-
25.1 Advisory & Assistance Services	$4,600	$1,530	$2,135	$605
25.5 Research & Development Contracts	$2,000	$1,000	$1,000	-
26.0 Supplies & Materials	$5,500	$1,000	$1,000	-
31.0 Equipment	$5,500	$2,000	$36,400	$34,400
32.0 Land and Structures	$1,000	$3,000	$48,600	$45,600
Total - Non Pay Budget Object Class	**$18,927**	**$8,859**	**$89,466**	**$80,607**

Construction and Facility Improvements – PPA
Capital Investment Exhibits

Capital Investments

(Dollars in Thousands)

	Acquisition Level	IT/ Non-IT	MAOL	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
N/A - Critical Repair/Replacement Requirement	Non-Major	Non-IT	No	-	-	$35,750
N/A - Plum Island Closure and Support	Level 3	Non-IT	No	$18,927	$8,859	$13,466
N/A - Detection Sciences Testing and Applied Research Center	Non-Major	Non-IT	No	-	-	$40,250

Critical Repair/Replacement Requirement– Investment
Capital Investment Exhibits

Construction

(Dollars in Thousands)

	Acquisition Level	IT/ Non-IT	MAOL	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
N/A - Critical Repair/Replacement Requirement	Non-Major	Non-IT	No	-	-	$35,750

Description

This investment includes major PC&I facility infrastructure, replacement, and upgrade or improvement projects associated to S&T's laboratory facilities, which include NBACC, PIADC, TSL, NUSTL, and CSAC. Critical repairs and replacements are needed in S&T's laboratories to ensure the safety of its people, enduring science capability, and the delivery of its mission. Additionally, these investments will allow S&T to meet regulatory requirements and maintain 24x7 operations and research support capability as required in support of operators. Specifically, action will be driven by the facility condition assessment (FCA) program that identified several repairs and modifications necessary to maintain regulatory compliance and full facility functionality; and to address safety issues that can no longer be deferred until a failure in infrastructure occurs.

This request ensures each respective laboratories' ability to perform their duties in a safe and reliable manner. Investing in improvements to S&T laboratories, to include IT infrastructure, will maximize the use of shared resources and reduce the maintenance and troubleshooting burden on IT staff that results from managing diverse legacy equipment and software. Additionally, this request will improve the availability and reliability of the IT infrastructure upon which the critical RDT&E work of the S&T laboratories depends. S&T labs will be able to share large data set with both internal and external partners, including vendors and other government organizations, at both unclassified and classified levels.

Justification

The FY 2023 Budget includes $35.8M to support and address deficiencies at the following laboratory facilities to meet evolving mission requirements:

- Laboratory Capital Investment Program
- NBACC Facility Recapitalization, Maintenance and Repair Backlog
- TSL Facility Recapitalization, Maintenance and Repair Backlog
- NBACC Electron Microscope Replacement
- NBACC Facility Expansion Scoping Study
- ONL Information Technology (IT) Infrastructure Modernization.

Project #1: Laboratory Capital Investment Program

Funding Requirement: The FY 2023 Budget includes $10.0M to support a capital investment program that enables S&T labs to continue to meet regulatory requirements, maintain modern technological standards, and perform end-of-life replacements for mission-critical equipment.

Description: To sustain S&T's labs, funding must cover depreciation of the laboratory buildings and assets to maintain the current functionality of facilities, systems, and equipment and prevent them from degrading to a state of dysfunction. The establishment of this investment to support NBACC, TSL, CSAC and NUSTL will sustain existing laboratory capabilities by completing facility maintenance and repairs for real and personal property assets, to include replacing laboratory equipment, based on expected service lifecycles. The basis for prioritizing and addressing individual lab needs on a cyclical basis are FCA, environmental, safety, and health (ESH) inspections, as well as internal lab facilities and equipment inspections and audits.

Justification: S&T maintains laboratory assets (including facilities and equipment) in excess of $270.0M. S&T completed an analysis of the replacement lifecycles and depreciation costs of infrastructure across multiple labs and systems to determine the requirement for approximately $10.0M to maintain the current functionality of facilities and systems to prevent them from degrading to a state of dysfunction and to fund equipment modernization that enables the labs to meet their respective mission requirements. S&T lab's physical infrastructure (i.e., real property) is depreciating at a rate of $6.0M per year. Real property items at NBACC, NUSTL, CSAC, and TSL include all aspects of physical buildings including the physical structure, HVAC, waste disposal systems, electrical systems. The S&T labs' critical scientific and IT equipment is experiencing obsolescence at an annual rate of $4.0M based on their expected service lives. S&T estimated the amount of funding necessary to sustain its physical laboratory-based assets by calculating their depreciation rates based Internal Revenue Service (IRS) Publication 946, which provides a basis for how depreciation should be calculated and how assets degrade over time. The funding will enable the laboratories to maintain state of the art facilities while allowing for flexibility in procuring items that are not easily repaired or replaced as well as accommodating longer lead times in procurement timelines for more specialized laboratory equipment and improvements which are not as readily available. Specific equipment and capabilities repaired or replaced will vary on a year-to-year basis at each laboratory based upon their specific asset inventories. For example, at NBACC this equipment includes instrumentation and supply equipment to include genomics IT equipment, and equipment for aerobiology, bacteriology, comparative medicine, molecular biology, toxinology, and virology. Equipment replacement is projected based on known asset lifecycles and equipment obsolescence, internal inspections, FCAs, ESH inspections; however, replacements are prioritized on a cyclical basis to address immediate repair and replacement needs.

Deferring maintenance adds significant operational risk and increases outyear maintenance costs based on inflation. There will also be a significantly reduced risk of equipment and system failures that result in full or partial laboratory shutdowns, diminished laboratory capabilities, and the inability to execute mission-critical work for the HSE. Due to rapidly changing technology making complex lab equipment obsolete, the S&T labs can invest in modern equipment so that equipment no longer degrades to a point where it is not serviced by its manufacturer and becomes inoperable, risking the laboratories' ability to execute mission-critical work.

Impact: Sustained funding will enable S&T laboratories to maintain compliance with regulatory requirements, modern technology standards, and perform end of life replacements for mission-critical equipment. S&T will be able to bring aging facilities up to current standards, thereby enabling core science work to be completed at the laboratories. Facility maintenance and equipment replacements will no longer be deferred until a failure occurs impacting mission execution, and more importantly, the safety of our laboratory employees. Finally, S&T can continue to ensure regulatory compliance with increasing facility codes and standards.

Project #2: NBACC Facility Recapitalization, Maintenance, and Repair Backlog

Funding Requirement: The FY 2023 Budget includes $7.3M to address NBACC's backlog of critical facility and infrastructure system deficiencies.

Description: NBACC requires funding to perform repairs to meet regulatory and contractual requirements and to maintain 100 percent 24/7 operation and research capability. A 2019 facility condition assessment identified a backlog of repairs and modifications necessary to maintain regulatory compliance and full facility functionality including, but not limited to, the following:

- Repair and recertify the building lightning protection system which is required to meet inspection and certification requirements.
- Replace eight Biosafety Level 3 (BSL-3) dunk tanks which are at least 12 years old and have been showing corrosion since 2013 due to the interaction of the disinfectant used (10% bleach) and the stainless-steel construction of the tanks; a catastrophic failure will shut down the suite. Replacement dunk tanks will be made of High Density Polyethylene (i.e., plastic) with an expected useful life of 15 years.
- Replace pitting autoclave bioseals.
- Upgrade the Effluent Decontamination System (EDS) control system to provide better monitoring and response capability while also enhancing safety compliance.

NBACC has a strategic timeline to facilitate the necessary repairs and equipment purchases to maintain regulatory compliance and facility functionality while also increasing efficiency and safety.

Justification: The critical work performed at NBACC is necessary for the continued understanding of current and emerging biological threats against the Homeland. These R&D efforts require the highest levels of safety and containment to protect both NBACC staff and surrounding facilities. This one-time investment allows both DHS and partner agencies to conduct constant scientific research resulting in the characterization of high-level threats which have become a world focus. NBACC is a maximum containment (biosafety level 4) facility requiring compliance with DHS, the Centers for Disease Control and Prevention (CDC), the United States Department of Agriculture (USDA), the Nuclear Regulatory Commission (NRC), and other Federal regulations. S&T must perform critical facility repairs to meet regulatory and contractual requirements and to maintain 100 percent 24 hours per day/7 days per week operation and research capability.

Critical repairs that were identified from the 2019 FCA include replacing the Biosafety Level 3 (BSL-3) dunk tanks which are showing corrosion and upgrading the EDS control system to meet operational and safety requirements. In addition, each biocontainment pass-through autoclave is equipped with a synthetic rubber bio-seal that acts like a gasket separating the biocontainment laboratory from the uncontrolled "clean" hallway. Over time, the

bio-seal degrades due to oxidation, attack by naturally occurring ozone, and exposure to UV light which results in pitting and cracking of the bio-seal. Continuing to defer maintenance and equipment replacements will increase operating and maintenance costs and increase the risk of equipment and system failures.

Impact: This investment will benefit NBACC R&D efforts in both throughput and overall capability. As equipment ages, the lack of necessary maintenance quickly reduces its performance capabilities and accelerates its end of service life. Properly maintained systems will enable S&T to maintain safety, comply with regulations, and eliminate the need for NBACC to curtail a large percentage of its R&D work to fund maintenance and repair requirements.

Construction / Lease Award Schedule:

Activity	Estimated Schedule
Contract Solicitation	FY 2023 Q1
Construction Award	FY 2023 Q3
Construction Start	FY 2023 Q3
Construction Complete	FY 2024 Q4

Project #3: TSL Facility Recapitalization, Maintenance, and Repair Backlog

Funding Requirement: The FY 2023 Budget includes $3.0M to address TSL's backlog of facility and infrastructure system issues and deficiencies.

Description: TSL requires funding to perform repairs, replacements, and recapitalization of facilities in to maintain operational readiness and fulfill mission requirements. In 2017, a facility condition assessment identified critical actions to address building conditions over ten years. The main buildings are all over twenty years old with many of the components at or beyond their estimated design life.

Justification: TSL is an aging and degrading facility in need of repairs and refurbishments. Execution of the TSL mission requires state-of-the-art scientific and laboratory equipment to ensure that test articles are representative of actual threats and reproducible in a manner that ensures system developers are not presented with inconclusive or incomplete data. The ability of most of the components to continue operating effectively at this point is only made possible by unsustainable high levels of maintenance, repair, and modification. Examples of failing facilities include:

- The Homemade Explosives (HME) synthesis lab trailer, which experienced a 20 percent throughput reduction as a result of a burst pipe that caused major electrical failure and mold growth requiring a short-term corrective action consisting of pipe repair and mold remediation pipe repair and mold remediation. Long-term corrective action is addressed by the DSTAR project, which will provide purpose-built laboratory space.
- The need to remediate mold growth in office and lab areas.

- Repair and/or replace failed heating, ventilation, and air conditioning (HVAC) components.
- Replace sensitive IT equipment because of over-heating failures caused by poorly ventilated and inadequate HVAC.
- Spurious fire alarms caused by poorly ventilated spaces and an aging fire detection system.

Impact: This investment will allow TSL to maintain its present work schedules, supporting TSA, other DHS Components, interagency partners and the test and evaluation (T&E) support it provides to commercial vendors supplying detection equipment Government-wide. This will enable the safe and effective synthesis, handling and testing of sensitive and sometimes unstable materials. As emerging materials and combinations are constantly being identified by many agencies, TSL will not be limited in its ability to apply its scientific expertise in the characterization and mitigation of these threats.

Construction / Lease Award Schedule:

Activity	Estimated Schedule
Contract Solicitation	FY 2023 Q1
Construction Award	FY 2023 Q2
Construction Start	FY 2023 Q2
Construction Complete	FY 2024 Q2

Project #4: NBACC Electron Microscope Replacement

Funding Requirement: The FY 2023 Budget includes $3.0M to replace a Scanning Electron Microscope and a Transmission Electron Microscope with new equivalent microscopes.

Description: NBACC has two electron microscopes that are operating beyond their expected service life of 2019. In addition, the manufacturer will no longer provide service for these microscopes as of 2025. They must be replaced to meet research requirements and keep NBACC capabilities ready to address current and emerging biological threats. The equipment replacement will remove and dispose of the existing microscopes prior to obsolesce and acquire and install the replacement microscopes with an expected useful life of 10 years.

Justification: To continue to meet current mission requirements successfully and to support HSE customers, NBACC must replace microscope equipment which are necessary to execute mission requirements. Two of NBACC's electron microscopes will no longer be serviced as of 2025. One of the microscopes is required for the morphological analysis of bio forensic casework samples and elemental analysis of casework samples. The other is required for the morphological analysis of bio forensic casework samples. Unfortunately, the software upgrades or patches for these microscopes will no longer be supported in 2025.

Impact: These microscopes will enable S&T to fully satisfy responsibilities in preparing for and responding to biological threats to the homeland. These strategic responsibilities have been set forth in both presidential directives and national strategies for biodefense.

Construction / Lease Award Schedule:

Activity	Estimated Schedule
Contract Solicitation	FY 2023 Q1
Construction Award	FY 2023 Q3
Construction Start	FY 2024 Q1
Construction Complete	FY 2024 Q2

Project #5: NBACC Facility Expansion Scoping Study

Funding Requirement: The FY 2023 Budget includes $2.5M to perform a scoping study to understand the program and technical requirements for additional NBACC space.

Description: A scoping study for the NBACC Facility Expansion will include an updated mission needs statement, an analysis of alternatives, a requirements definition, and conceptional design. The proposed expansion would accommodate additional BSL-2 laboratories (which are used for studying agents with moderate health hazards, such as HIV); the required mechanical support and storage space for the generation of data; a data center with state-of-the-art computational and network infrastructure that is capable of supporting analysis, storage, and transfer of large data sets; and additional SCIF space required for the sensitive nature of the work performed. To support the increasing mission work, NBACC will also expand office/administrative space adjacent to the current NBACC laboratory facility.

Justification: Biotechnology will deliver solutions to major challenges facing the United States and the world, including in the health, energy, food, climate, agriculture, and industrial sectors. As these biotechnologies are developed, the United States will face novel risks and threats stemming from their potential misuse. We must take steps to reduce the risks associated with advances in biotechnology and ensure that it is not accidentally or deliberately used to harm people, animals, or the environment. The NBACC facility was designed and constructed more than 10 years ago, and since that time, biotechnologies and bioinformatics that rely on and result in the generation of large data sets have advanced. The current infrastructure at NBACC is no longer sufficient to support the transfer, analysis, and storage of such large data sets. For example, just a single set of experiments now taking place using "systems biology" approaches is generating 50GB of data, which is comparable to the amount of data accumulated over the course of a whole year previously in the National Biological Threat Characterization Center (NBTCC). NBTCC will be performing at least 10 more iterations of data gathering and analysis for just one task, thus generating over 500GB of raw data. NBTCC does not have redundant back up data storage or server solutions for these large next generation data sets. In addition, because of the unique national security mission of NBACC, the current needs for classified life sciences research projects and generation and analyses of data sets that are classified are greater than the current

NBACC capacity can accommodate, while demand signals for such information is increasing. There are instances where work has been performed in higher level containment spaces because of sensitivity of the work and lack of adequate space rated for lower classification levels.

Impact: The proposed facility expansion will provide additional facility capabilities required to support the current science and technology programs and requests from the HSE that would allow the DHS to gain an understanding of the many beneficial applications of biotechnology, as well as potential misuses of biotechnology. Funding will enable DHS and other government sponsors to adapt to and counter the changing threat environment. BSL-2 spaces that could be operated from unclassified up to Top Secret/Sensitive Compartmented Information (TS/SCI) would be ideal for NBTCC mission execution so that BSL-2 work could be done safely and securely in the appropriate containment laboratories, without unduly occupying higher level containment spaces that are in high demand..

Construction / Lease Award Schedule:

Activity	Estimated Schedule
Contract Solicitation	FY 2023 Q1
Study Award	FY 2023 Q3
Study Complete	FY 2024 Q1

Project #6: ONL Information Technology (IT) Infrastructure Modernization – Mission Critical

Funding Requirement: The FY 2023 Budget includes $10.0M to support the design and implementation of ONL IT infrastructure modernization.

Description: Lab mission requirements must keep pace with modern technological and scientific advancements to remain effective. S&T labs are increasingly handicapped by insufficient IT infrastructure. Currently, S&T provides IT resources at five site locations and many other satellite locations affecting more than 650 Federal staff and contractors. The IT infrastructure on which the mission relies does not keep pace with technological improvements and has become a risk to mission execution.

S&T will address the IT modernization in three phases. Phase I will include IT system replacement and upgrades that are necessary to maintain the current mission capabilities. Phase II will address new capabilities that are critical to meeting evolving mission requirements and that require additional facility capacity, space requirements, or specialized equipment. Phase III includes IT investments to enhance the S&T labs' ability to support mission execution that are not deemed critical. S&T is also coordinating with MGMT/OCIO, where necessary, to ensure a smooth implementation process.

Justification: S&T's IT systems for its labs were developed and implemented over many years and no longer meet the current demands of programs and facilities that they support. Without proper capabilities, S&T lab Directors are left with finding workaround solutions. Examples include:

- Several S&T labs are responsible for collecting and analyzing large amounts of data on emerging terrorist threats in cooperation with other governmental partners and have had to resort to physically mailing external hard drives, significantly delaying work while increasing the risk to the mission.
- NBACC requires large network bandwidth to download publicly available genome sequencing data. Currently, lab personnel download these sequences offsite and transfer them by means of encrypted external hard drives.

A summary of the most pressing IT issues at the S&T labs include:

- Network Improvements: Laboratory actions are slowed due to inadequate network capacity and data transfer speeds.
- Infrastructure Upgrades: Equipment currently used for IT operations have become insufficient to meet the growing data requirements of the labs or have approached the end of service life. The inventory of equipment also varies greatly, which increases the burden to manage configurations, updates, and troubleshooting.
- File Sharing: The S&T labs lacks the IT infrastructure to share large amounts of data, some of which may be classified, to both internal and external partners, such as vendors and other government organizations.
- IT Service Support: Currently, IT services are administered by both local lab IT staff and S&T IT staff. Therefore, the ticketing systems, change management policies, and configuration controls are often not aligned or are administered through different systems.

Impact: Modernization would reduce the maintenance and troubleshooting burden on IT staff that result from managing diverse legacy equipment and software. Additionally, this initiative improves the availability and reliability of the IT infrastructure upon which the critical research, development, test, and evaluation work of the S&T laboratories depends on, in support of its HSE customer base. In combination with cloud migration, equipment upgrades will replace outdated or inadequate HVAC systems, ductwork, power supplies, and IT closets. This request resolves inadequate network capacity and data transfer speeds. The S&T labs will be able to share large amounts of data with both internal and external partners, including vendors and other government organizations, at both unclassified and classified levels. Lab service desks, ticketing systems, and service request tools will be streamlined and standardized to improve IT workflow efficiency and reduce recurring IT costs by eliminating application and system redundancies.

Construction / Lease Award Schedule:

Activity	Estimated Schedule
Contract Solicitation	FY 2023 Q1
Phase I Award	FY 2023 Q2
Phase I Complete	FY 2024 Q2
Phase II Award	FY 2024 Q2
Phase II Complete	FY 2025 Q2
Phase III Award	FY 2025 Q2
Phase III Complete	FY 2026 Q2

Plum Island Closure and Support– Investment
Capital Investment Exhibits

Construction

(Dollars in Thousands)

	Acquisition Level	IT/ Non-IT	MAOL	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
N/A - Plum Island Closure and Support	Level 3	Non-IT	No	$18,927	$8,859	$13,466

Description

The PICS program and activities are required for the transition, closure, and conveyance of all Plum Island real property and all related personal property and transportation assets (including the Orient Point property) after the PIADC science mission is fully transferred to the NBAF. PICS activities include the following:

S&T is managing the PICS program as a Level III non-acquisition program. The PICS current total estimate of $150.0M will enable S&T to achieve closure of the island while enabling PIADC operations through mission transition to USDA. Once the PICS program is completed, Plum Island will be closed and available for release from DHS to another entity through the GSA.

Justification

The FY 2023 Budget includes $13.5M to continue support for the PICS Program.

PICS Program

Funding Requirement: The FY 2023 Budget includes $13.5M to continue support for the PICS Program, including support for the Program Management Office, continued planning/development and implementation of the approach for surface and terminal decontamination and decommissioning of Building 101, continued reduction of the contaminated waste areas within Building 101, execution of required decontamination efforts for Buildings 102 and, potentially, 257 as required by the New York State Department of Environmental Conservation (NYSDEC), completion of remaining Waste Management Areas remediation as required by the NYSDEC (planning and design for potential WMA capping for remediation), continued planning for future utility service changes for remaining post-closure buildings, and continued records disposition activities as required by law for facility mission transfer. There are a number of other minor activities associated with these projects.

Description: The PICS program involves the transition, closure, and conveyance of all real and personal Plum Island property and transportation assets (including the Orient Point Property), after the PIADC mission is fully transferred to NBAF located in Manhattan, Kansas. The PICS program is a unique, multi-year effort which S&T is managing as a Level III non-acquisition program (ADE-2B milestone achieved in September 2021, enabling the transition to project execution). The first several years of funding were largely comprised of planning and analysis activities (including

regulatory requirements), equipment purchases and targeted decontamination activities. The remainder of the project focuses on the decontamination of the BSL-3 containment facilities and other structures to meet regulatory health, safety, and environmental requirements prior to conveyance.

Justification: The program total cost is $150.0M with a proposed six-year funding profile and eight-year multi-phased execution effort, in coordination with PIADC operations, to achieve closure of the island, currently estimated in FY 2028. Once the PICS program is completed, Plum Island will be considered closed. This program is the largest closure of a biocontainment facility ever in the United States.

The scope of activities, which are considered key performance objectives required to close the PIADC facility and prepare the island for conveyance include:

- biological decontamination of the laboratory facilities.
- completion of environmental regulatory compliance activities (e.g., remediation of remaining waste management areas).
- facility maintenance and closure activities.
- disposition of all records, personal property, real property, and IT assets; and
- preservation/disposition of historic assets.

The FY 2023 funding continues support for the PMO, continued planning/development and implementation of the approach for terminal decontamination and decommissioning of Building 101, continued reduction of the contaminated waste areas within Building 101, execution of required decontamination efforts for Buildings 102 and 257 as required by the NYSDEC, completion of remaining Waste Management Areas remediation as required by the NYSDEC (planning and design for potential WMA capping for remediation), continued planning for future utility service changes for post-closure remaining buildings, and continued records disposition activities as required by law for facility mission transfer.

- Facilities: The assessment, sampling, preparation and ultimate decontamination of real property to regulatory standards to support the closure and conveyance of Plum Island; and the engineering and modification associated with maintaining valued assets to prepare for transfer. ($9.7M)

- Program Management: The programmatic and administrative support to manage the PICS program; records management activities; and historic preservation/disposition of PIADC assets. ($3.4M)

- Regulatory Compliance: Costs associated with maintaining current regulatory compliance and decommissioning/decontamination activity compliance with the State of New York, Environmental Protection Agency, and USDA's Agriculture Select Agent Services (AgSAS). ($0.3M)

- Mission Closeout: The drafting of plans to end the DHS science mission at PIADC and associated records management; and the transfer of assets to NBAF or other Federal entities, and transfer of records to National Archives & Records Administration. ($3K)

FY 2021 and FY 2022 projects within the PICS Program largely provided baseline assessment and engineering direction for the remainder of the program; FY 2023 and out-year projects through FY 2028 will mature those efforts through project plan execution. There are several long-lead specialty devices included that will ensure S&T has the needed capabilities to start the physical decontamination of PIADC biocontainment facilities

in FY 2024 when the science mission transfers. Funding also supports decontamination efforts in two older, smaller facilities, to ensure acceptance of the regulatory agreement with our chosen decontamination methodologies on PIADC's larger (and currently in-use) infrastructure moving forward. The overall value of this approach is ultimately cost avoidance for decontamination re-work for the much larger facilities later in the project, while concurrently benefiting from regulatory buy-in of our chosen processes.

In January 2009, DHS issued a Record of Decision documenting its decision to construct NBAF in Manhattan, Kansas as a replacement for the aging PIADC. DHS has the responsibility to close and convey Plum Island through the FY 2012 DHS Appropriations Act (P.L. 112-74). Public Law 116-260 (Division FF, Title V, Section 501) repeals all previous 'direct sale' language and mandates the Administrator of GSA to dispose of all personal and real property and transportation assets "as a single consolidated asset" under the Property Act. S&T has the responsibility to manage the closure of Plum Island to prepare all its real and personal property assets for closure and conveyance by the GSA on behalf of DHS.

Impact: The rate of completion of the various phases of the PICS program, as well as their congruity with the completion of the NBAF facility, is critical to the success of and maintaining the cost estimate for this program. This funding will allow S&T the ability to execute key activities critical to maintaining the Program schedule for completion of PICS. In addition, the PICS will prepare the island for closure and conveyance by mid-FY 2028, reducing future outlays of DHS funding to secure and maintain the PIADC facility after its science mission is complete. At present, S&T non-PICS funding related to Plum Island operations is upwards of $50.0M annually. PICS is reliant on operations and maintenance (O&M) for key services such as transportation and utilities, among others. Once the PICS program is completed, the current operations funding estimate will decrease to $10.0M annually, which is enough to sustain basic operations, maintenance, and security until Plum Island is conveyed.

The execution of the PICS program is reliant on the continued funding for operations, contracted programmatic support and Federal staffing of PIADC beyond the transition of science programs to NBAF until the completion of the PICS program. The PICS program execution also requires PIADC operations and staff to provide island logistics, utilities, security, and regulatory compliance in accordance with environmental and USDA Select Agent requirements. A PICS Program Management Office (PMO) has been established to coordinate PICS planning activities with PIADC operations, regulators, DHS Management, GSA, and other key stakeholders.

De-Construction Schedule:

Activity	Estimated Schedule
Start Building 102 Interior Surface Decontamination Planning	FY 2021 Q4
Start Planning Discussions for Terminal Decontamination Validation Verification	FY 2021 Q4
Prepare Building 101 New Autoclaves Planning Package and Procurement	FY 2021 Q4
Start Building 101 Decontamination Planning Package	FY 2022 Q1
Start development of Science, Technical, Engineering and Decontamination Support Planning Package	FY 2022 Q1

Activity	Estimated Schedule
Prepare Bio-Indicator Test Lab Planning Package	FY 2022 Q2
Provide procurement requisition (PR) package into system for Historical Records Management Activities	FY 2022 Q2
Provide PR Package into system for Science, Technical, Engineering and Decontamination Support Planning Package	FY 2022 Q3
Complete Building 102 Interior Surface Decontamination Planning	FY 2022 Q3
Start Validation Studies	FY 2022 Q4
Start Building 102 Interior Surface Decontamination (pending regulatory approval)	FY 2022 Q4
Award Package for Science, Technical, Engineering, and Decontamination Support Planning Package	FY 2023 Q1
Provide request for information (RFI) package into system for Building 257 Sampling and Decontamination (pending decision by regulatory agency)	FY 2023 Q1
Deliver Bio-Indicator Test Lab	FY 2023 Q1
Complete Building 102 Interior Surface Decontamination	FY 2023 Q2
Deliver Building 101 New Autoclaves	FY 2023 Q2
Start Building 101 New Autoclaves Installation	FY 2023 Q3
Complete Terminal Decontamination Validation Verification	FY 2023 Q3
Start Building 102 Final Fumigation (pending regulatory approvals)	FY 2023 Q3
Complete Building 102 Final Fumigation (pending regulatory approvals)	FY 2024 Q1
Complete Building 101 new autoclaves install and validation (pending regulatory approvals)	FY 2024 Q2
End Building 101 Decontamination Planning	FY 2024 Q3

Detection Sciences Testing and Applied Research Center– Investment
Capital Investment Exhibits

Construction

(Dollars in Thousands)

	Acquisition Level	IT/ Non-IT	MAOL	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
N/A - Detection Sciences Testing and Applied Research Center	Non-Major	Non-IT	No	-	-	$40,250

Construction Description

TSL 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. Working closely with security equipment manufacturers and DHS component acquisition managers, TSL ensures that operational components of the HSE acquire detection and mitigation solutions that meet their respective operational requirements, with a primary customer focus on TSA's explosives screening needs.

TSL's aging scientific equipment and outdated infrastructure limits the ability of the lab to fully meet its mission. The construction and facility improvement projects for TSL will allow S&T to better fulfill its mission and ensure its lasting impact in the future.

This investment is critical to ensure that the TSL maintains its ability to conduct RDT&E of explosive and threat screening devices.

Justification

The FY 2023 Budget includes $40.3M to support the following project:

TSL Detection Sciences Testing and Applied Research (DSTAR) Center

Funding Requirement: The FY 2023 Budget includes $40.3M to support the design and construction of the DSTAR Center.

Description: The DSTAR Center facility will be located in Atlantic City, NJ, and will include an applied research laboratory, a dedicated homemade explosives synthesis/preparation facility, an explosives safety testing laboratory, flexible laboratory space for testing of explosive detection technologies, and new office space to replace temporary structures. This project is consistent with S&T's congressionally mandated Infrastructure Master Plan for the TSL from 2010 through present day. Initial design documentation was completed in December 2017 and initial environmental planning was completed in March 2017, but further analysis was postponed due to lack of construction funds. In addition, S&T will award a contract to complete design and associated environmental planning. The estimated 50,000 sq. ft. DSTAR Center project includes the DSTAR Center, the Facility for Energetic Materials Research (FEMR), removal of 2,000 sq. ft. existing temporary facility (B315 Annex trailers and connector, which are

in poor condition as noted in recent FCAs) and reconfiguration of existing warehouse facilities back to their intended use, parking and roadway improvements.

Justification: In the past, technologies were evaluated against a small number of commercial and military explosives historically employed in terrorist plots. The present suite of possible threats continues to expand and now includes marginally stable and highly sensitive homemade explosives with many variations. TSL has also begun testing systems capable of detecting opioids. These new threats create an additional testing burden on TSL and corresponding safety and disposal concerns. TSL is often asked to test technology solutions for an expanded network of transportation systems and potential targets such as government facilities, ports, and event venues (e.g., sports stadiums).

Much of TSL's work is done in makeshift facilities, including warehouses and trailers that require increasing maintenance and repair. Currently, many TSL staff work in office trailers and temporary buildings that have water penetration resulting in mold issues and are beyond their useful life. Substantial advances have been made in the development and application of explosives and weapons detection and mitigation technologies. To keep pace with new generations of detection equipment, TSL has developed rigorous processes, certifying to ISO 17025, 9000 and A2LA for testing and calibration laboratories. Without a purpose-built applied research space, in addition to the degraded facilities as noted above, create conditions that are not conducive to maintaining these certifications. TSL was originally designed to conduct T&E on a small number of detection systems focused on conventional explosives. This required T&E space and explosive storage bunkers, but little in the way of scientific laboratories. There are now many more systems as well as new and emerging threat types that must be synthesized and characterized in scientific laboratories.

Impact: The DSTAR Center will replace substandard aged facilities including a trailer that was installed in 2002 and warehouses which were modified into makeshift laboratory spaces based on urgent mission needs and ensure that TSL maintains the ability to conduct RDT&E of explosive and threat screening devices for TSA. The return on investment of the facility is estimated to be $5.0M each year, and this new, state-of-the-art facility will enable TSL to assist TSA and other customers with more efficiency and effectiveness in testing and evaluating threat screening devices. The DSTAR Center's design features automated, state-of-the-art laboratories to provide safe and effective validation of explosive screening devices. It also will include sterile areas for test and evaluation of trace detection devices and modern computational infrastructure for analyzing and archiving threat images from computed tomography and millimeter wave threat screening devices. The DSTAR Center will also have areas for HME assembly and will provide the means to synthesize hazardous and benign test articles. These areas are vital because of terrorists' increasing preference for HME, which has made the test and evaluation of explosive screening devices much more complex and time-consuming.

Construction / Lease Award Schedule:

Activity	Estimated Schedule
Contract Solicitation	FY 2023 Q1
Design Award	FY 2023 Q2
Design Complete	FY 2024 Q3
Construction Award	FY 2025 Q1
Construction Start	FY 2025 Q1
Construction Complete	FY 2027 Q3

Department of Homeland Security

Science and Technology Directorate

Research and Development

Fiscal Year 2023

Congressional Justification

Table of Contents

Research and Development **1**
Budget Comparison and Adjustments 3
Summary of Budget Changes 6
Non Pay Budget Exhibits 7
Research and Development Projects 8
Research, Development, and Innovation – PPA 9
Budget Comparison and Adjustments 9
Non Pay Budget Exhibits 13
Research and Development Projects 14
University Programs – PPA 235
Budget Comparison and Adjustments 235
Non Pay Budget Exhibits 238
Research and Development Projects 239

Research and Development

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
Research, Development and Innovation	$399,417	$452,417	$407,681	($44,736)
University Programs	$44,511	$51,037	$51,037	-
Total	**$443,928**	**$503,454**	**$458,718**	**($44,736)**
Subtotal Discretionary - Appropriation	$443,928	$503,454	$458,718	($44,736)

The scope and diversity of the Department of Homeland Security's (DHS) missions require the Science and Technology Directorate (S&T) to address a wide range of programs supporting DHS Components' near-term needs for new operational capabilities, improved operational effectiveness, efficiency, and safety for the Homeland Security Enterprise (HSE). S&T has Research, Development, Test and Evaluation (RDT&E) responsibilities related to understanding and creating solutions for threats related to explosives, border security, cyber security, biological, chemical, and asymmetrical Threats. S&T's enduring research provides the essential building blocks for incremental scientific advances in collaboration with public and private sector research partners. S&T's analytics and knowledge products also are equally important to supporting analysis of alternatives for technology options; risk and threat assessments; operational testing and evaluation of technologies proposed for acquisition; and detailed technical characterization of potential biological threat organisms for both human and agricultural biodefense. S&T's RDT&E efforts are prioritized to the homeland's highest threats. 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 14 bilateral international agreements.

S&T's Research and Development (R&D) appropriation provides resources necessary to identify, explore, and demonstrate new technologies and capabilities that enable DHS and its partners to prevent, protect against, respond to, and mitigate nuclear, chemical, radiological, and biological threats and incidents. Additionally, S&T's Small Business Innovation Research (SBIR) Program ensures U.S. small businesses participation in Federal research and development programs by offering competitive programs to bring innovative homeland security solutions to reality with the potential for commercialization. R&D funds support Technology Readiness Levels (TRLs) 1-7:

Basic Research		Applied Research		Technology Development		Technology Demonstration	System Development
TRL-1	TRL-2	TRL-3	TRL-4	TRL-5		TRL-6	TRL-7
Basic Principles Observed/Reported	Technology Concept/Application Formulated	Critical Function or Characteristic Proof of Concept	Validation in Lab Environment	Validation in Relevant Environment		System Prototypes in Relevant Environment	System Prototypes in Operational Environment

S&T has two programs, projects, and activities (PPAs) in its R&D appropriation:

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. RD&I includes customer-focused, near-term, and output-oriented RDT&E programs that balance risk, cost, impact, and time to delivery. S&T's enduring research supports scientific advances in collaboration with public and private sector research partners. In addition, S&T explores emerging science and technology areas and their potential threat or application to future DHS missions. S&T's research and development activities also include technology demonstrations, university and industry partnerships, technology transfer and commercialization.

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. UP includes COEs and Minority Serving Institutions (MSI), a consortium of universities generating groundbreaking ideas for new technologies and critical knowledge for the HSE.

Research and Development
Budget Authority and Obligations
(Dollars in Thousands)

	FY 2021	FY 2022	FY 2023
Enacted/Request	**$443,928**	**$503,454**	**$458,718**
Carryover - Start of Year	$144,503	$174,746	$129,215
Recoveries	-	-	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Reprogramming/Transfers	($67)	-	-
Supplementals	-	-	-
Total Budget Authority	**$588,364**	**$678,200**	**$587,933**
Collections - Reimbursable Resources	$45,000	$45,000	$45,000
Collections - Other Sources	-	-	-
Total Budget Resources	**$633,364**	**$723,200**	**$632,933**
Obligations (Actual/Estimates/Projections)	$458,929	$538,762	$475,426
Personnel: Positions and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

Research and Development
Summary of Budget Changes
(Dollars in Thousands)

	Positions	FTE	Amount
FY 2021 Enacted	**-**	**-**	**$443,928**
FY 2022 President's Budget	**-**	**-**	**$503,454**
FY 2023 Base Budget	**-**	**-**	**-**
Border Security Thrust Area	-	-	$83,007
Chemical, Biological, and Explosive Defense Thrust Area	-	-	$21,510
Counter Terrorist Thrust Area	-	-	$60,983
Cyber Security / Information Analysis Thrust Area	-	-	$48,567
First Responder / Disaster Resilience Thrust Area	-	-	$55,950
Innovation Research and Foundational Tools Thrust Area	-	-	$95,106
Physical Security and Critical Infrastructure Resilience Thrust Area	-	-	$42,558
Centers of Excellence	-	-	$45,880
Minority Serving Institutions (MSI)	-	-	$5,157
Total Research and Development Projects	**-**	**-**	**$458,718**
FY 2023 Request	**-**	**-**	**$458,718**
FY 2022 TO FY 2023 Change	**-**	**-**	**($44,736)**

Research and Development
Non Pay Budget Exhibits

Non-Pay by Object Class

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
21.0 Travel and Transportation of Persons	$848	$961	$832	($129)
23.2 Rental Payments to Others	$25	$28	$25	($3)
23.3 Communications, Utilities, & Miscellaneous	$140	$158	$145	($13)
25.1 Advisory & Assistance Services	$65,459	$74,171	$65,479	($8,692)
25.2 Other Services from Non-Federal Sources	$1,507	$1,706	$1,546	($160)
25.3 Other Purchases of goods and services	$3,920	$4,441	$5,638	$1,197
25.5 Research & Development Contracts	$333,715	$378,090	$337,347	($40,743)
25.7 Operation & Maintenance of Equipment	$967	$1,095	$993	($102)
26.0 Supplies & Materials	$396	$449	$406	($43)
31.0 Equipment	$234	$264	$258	($6)
41.0 Grants, Subsidies, and Contributions	$36,717	$42,091	$46,049	$3,958
Total - Non Pay Budget Object Class	**$443,928**	**$503,454**	**$458,718**	**($44,736)**

Research and Development
Research and Development Projects

Summary of Projects

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
Border Security Thrust Area	$121,808	$111,297	$83,007
Chemical, Biological, and Explosive Defense Thrust Area	$32,015	$32,592	$21,510
Counter Terrorist Thrust Area	$56,542	$69,361	$60,983
Cyber Security / Information Analysis Thrust Area	$25,091	$53,600	$48,567
First Responder / Disaster Resilience Thrust Area	$43,473	$64,716	$55,950
Innovation Research and Foundational Tools Thrust Area	$76,792	$79,793	$95,106
Physical Security and Critical Infrastructure Resilience Thrust Area	$43,696	$41,058	$42,558
Centers of Excellence	$39,354	$45,880	$45,880
Minority Serving Institutions (MSI)	$5,157	$5,157	$5,157

Research, Development, and Innovation – PPA

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
Border Security Thrust Area	$121,808	$111,297	$83,007	($28,290)
Chemical, Biological, and Explosive Defense Thrust Area	$32,015	$32,592	$21,510	($11,082)
Counter Terrorist Thrust Area	$56,542	$69,361	$60,983	($8,378)
Cyber Security / Information Analysis Thrust Area	$25,091	$53,600	$48,567	($5,033)
First Responder / Disaster Resilience Thrust Area	$43,473	$64,716	$55,950	($8,766)
Innovation Research and Foundational Tools Thrust Area	$76,792	$79,793	$95,106	$15,313
Physical Security and Critical Infrastructure Resilience Thrust Area	$43,696	$41,058	$42,558	$1,500
Total	**$399,417**	**$452,417**	**$407,681**	**($44,736)**
Subtotal Discretionary - Appropriation	$399,417	$452,417	$407,681	($44,736)

PPA Level I Description

The RD&I PPA provides state of the-art technology and/or solutions to meet the needs of DHS's operational Components and the First Responder community. This PPA supports customer-focused and output-oriented RDT&E programs that balance risk, cost, impact, and time to delivery as well as technology demonstrations and transfer to DHS Components. It includes the following Thrust Areas:

Border Security: Invests in 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.

Chemical, Biological, and Explosive (CBE) Defense: Funds R&D in technologies and solutions in order to support the development of prevention and protective strategies and coordinated surveillance and detection to address CBE threats.

Counter Terrorist: Invests in technologies, methods, and procedures to counter terrorism.

Cyber Security / Information Analysis R&D: Conducts and supports RDT&E and the transition for advanced cybersecurity and information assurance technologies in order to secure the Nation's current and future cyber and critical infrastructures.

First Responder / Disaster Resilience: Invests in technologies and solutions, which reduce vulnerability to key leadership, critical infrastructure, and events from terrorist attacks and other hazards. Also increases the level of preparedness of State, local, regional, tribal, and territorial partners, as well as non-governmental organizations, private sector, and public, while improving the capabilities of DHS to lead in emergency management.

Innovative Research and Foundational Tools: Identifies gaps through analysis and requirements prioritization and focuses on identifying and analyzing potential solutions while working with customers to select the best approach to delivering solutions, including knowledge and advice.

Physical Security and Critical Infrastructure Resilience: R&D technologies, methods, and procedures to enhance the physical security of the Nation's critical infrastructure which includes the Nation's air travel system, mass transportation systems, and schools as well as soft targets such as mass public gatherings.

Research, Development, and Innovation – PPA
Budget Authority and Obligations
(Dollars in Thousands)

	FY 2021	FY 2022	FY 2023
Enacted/Request	**$399,417**	**$452,417**	**$407,681**
Carryover - Start of Year	$120,084	$144,532	$117,368
Recoveries	-	-	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Reprogramming/Transfers	($67)	-	-
Supplementals	-	-	-
Total Budget Authority	**$519,434**	**$596,949**	**$525,049**
Collections - Reimbursable Resources	$44,500	$44,500	$44,500
Collections - Other Sources	-	-	-
Total Budget Resources	**$563,934**	**$641,449**	**$569,549**
Obligations (Actual/Estimates/Projections)	$419,713	$476,818	$428,175
Personnel: Positions and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

Research, Development, and Innovation – PPA
Summary of Budget Changes
(Dollars in Thousands)

	Positions	FTE	Amount
FY 2021 Enacted	**-**	**-**	**$399,417**
FY 2022 President's Budget	**-**	**-**	**$452,417**
FY 2023 Base Budget	**-**	**-**	**-**
Border Security Thrust Area	-	-	$83,007
Chemical, Biological, and Explosive Defense Thrust Area	-	-	$21,510
Counter Terrorist Thrust Area	-	-	$60,983
Cyber Security / Information Analysis Thrust Area	-	-	$48,567
First Responder / Disaster Resilience Thrust Area	-	-	$55,950
Innovation Research and Foundational Tools Thrust Area	-	-	$95,106
Physical Security and Critical Infrastructure Resilience Thrust Area	-	-	$42,558
Total Research and Development Projects	**-**	**-**	**$407,681**
FY 2023 Request	**-**	**-**	**$407,681**
FY 2022 TO FY 2023 Change	**-**	**-**	**($44,736)**

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

Non Pay by Object Class

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
21.0 Travel and Transportation of Persons	$784	$888	$809	($79)
23.2 Rental Payments to Others	$25	$28	$25	($3)
23.3 Communications, Utilities, & Miscellaneous	$140	$158	$145	($13)
25.1 Advisory & Assistance Services	$63,768	$72,232	$64,810	($7,422)
25.2 Other Services from Non-Federal Sources	$1,507	$1,706	$1,546	($160)
25.3 Other Purchases of goods and services	$3,920	$4,441	$4,025	($416)
25.5 Research & Development Contracts	$327,011	$370,403	$334,000	($36,403)
25.7 Operation & Maintenance of Equipment	$967	$1,095	$993	($102)
26.0 Supplies & Materials	$396	$449	$406	($43)
31.0 Equipment	$234	$264	$239	($25)
41.0 Grants, Subsidies, and Contributions	$665	$753	$683	($70)
Total - Non Pay Budget Object Class	**$399,417**	**$452,417**	**$407,681**	**($44,736)**

Research and Development
Research and Development Projects

Summary of Projects

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
Border Security Thrust Area	$121,808	$111,297	$83,007
Chemical, Biological, and Explosive Defense Thrust Area	$32,015	$32,592	$21,510
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Physical Security and Critical Infrastructure Resilience Thrust Area	$43,696	$41,058	$42,558

Border Security Thrust Area
Research and Development

Technology Readiness Level Exhibit

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
Border Security Thrust Area	$121,808	$111,297	$83,007

R&D Thrust Area Description

BORDER SECURITY THRUST AREA: 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 illicit movement and illegal entry or exit of people, weapons, dangerous goods, and contraband, and manage risks posed by people and goods in transit. The table that follows identifies initiatives and funding levels for FY 2023.

BORDER SECURITY THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
Total –Border Security Thrust		**$121,808**	**$111,297**	**$83,007**
Air, Land and Port of Entry (POE) Security		**$52,713**	**$39,047**	**$28,592**
	Air Security	$16,830	$18,300	$14,000
	Enhanced Trade Technologies	$1,001	$655	$1,100
	Ground Based Technologies	$9,522	$4,150	$4,150
	POE Data Visualization and Emerging Analytics (formerly POE Forensics and Investigations)	$5,000	$3,500	$2,500
	POE Mail	-	$1,975	$1,974
	POE Non-Intrusive Inspection and Alternate Technologies (formerly POE Scanning Technologies and Analytics (NII))	$17,995	$8,717	$3,368
	Tunnel Detection and Surveillance	$2,365	$1,750	$1,500

BORDER SECURITY THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
Biometrics and Identity Management		**$5,708**	**$5,950**	**$3,250**
	Biometrics and Identity Screening	$5,708	$5,950	$3,250
Counter Unmanned Aircraft Systems (CUAS)		**$35,940**	**$29,165**	**$26,165**
	Counter UAS	$35,940	$29,165	$26,165
Forensics and Criminal Investigations		**$2,035**	**$12,350**	**$9,800**
	Digital Forensics	$1,485	$3,800	$3,800
	Illegal Immigration Investigations	$550	$1,000	$1,000
	Transnational Organized Crime and Counter Networks	-	$7,550	$5,000
Immigration Services		**$550**	**$1,500**	**$1,500**
	Immigration-Based Technologies	$550	$1,500	$1,500
Maritime Safety & Security		**$24,863**	**$23,285**	**$13,700**
	Integrated Multi-Domain Enterprise (IMDE)	-	$2,600	$2,600
	Port and Coastal Surveillance	$13,789	$3,700	$1,500
	Port and Waterway Resiliency	$2,181	$1,500	-
	Remote Maritime Technologies	$8,894	$15,485	$9,600

Air, Land and Port of Entry (POE) Security – This program develops and transitions technical capabilities that strengthen the security of our national airspace and land border by detecting and preventing the flow of illicit goods and people through the land and air domain while facilitating and safeguarding lawful trade and travel through the ports of entry.

Air Security

- **Problem:** DHS lacks aerospace technologies that enable persistent domain awareness of the national border-space and the DHS operational mission areas. This deficiency negatively impacts the DHS mission both strategically and tactically as it limits DHS's abilities to detect potential threats, analyze risks, and maintain command and control of its operations. The resultant impact on DHS operations is an increased strain on critical resources such as manpower, assets, and budgets. The domain of this problem extends to all DHS operational components who utilize technologies germane to small unmanned aircraft systems (sUAS), manned and large unmanned aircraft, as well as tools and data from satellite systems.

  Additionally, the convergence of component mission requirements, emerging asymmetric threats, evolving technologies, and critically strained resources makes it imperative for S&T to advance technologies that produce efficient force-multiplying aerospace for operational elements of DHS and the Nation's law enforcers and first responders. This results in the HSE having to meet the following three enduring challenges:
  - Produce air-based intelligence, surveillance, and reconnaissance (ISR) technology solutions that enable mission space dominance.
  - Provide a focal point where the whole of the HSE can operationally evaluate emerging sUAS platforms and sensors.
  - Enable enhancements that improve command, control, communications, and computers of air-based platforms and sensors.

- **Solution:** The Air Security projects within this program advance critical technologies to close capability gaps via aircraft (manned and unmanned), and satellite platforms. Projects and activities executed within Air Security shall perform the following:
  - Big Wing: This project transforms the aging MQ-9 fleet by enabling it with multi-fold increases in range, endurance, and weather operational availability. In addition, it develops critically needed software enhancements to the command and control of the assets. These enhancements automate critical operational tasks and significantly reduce the risk of loss of the flight crew and aircraft. "ISR Sensors": This project advances key sensor capabilities (Advanced Maritime Radar and VADER GEN II). Leveraging DoD baseline technology, this project will advance the sensor's performance capability as well as develop the adaptations necessary for the DHS mission.

  - Unmanned Aircraft Systems (UAS) Operations Beyond Visual Line of Sight (BVLOS): This effort works to develop collision avoidance technology solutions to allow CBP and USCG unmanned aircraft systems to routinely deploy.

  - Commercial Space-Based Data Link Technologies: This project will focus on developing and evaluating system architecture technologies which transform DHS's capabilities to communicate command and control via a high-speed data link network. DHS will develop a series of technical baselines and integration kits which enable both manned and unmanned aircraft to communicate via a high-speed data network. This will enable real time support for tactical elements from manned aircraft surveillance as well as provide a force multiplier for CBP fixed wing and rotary wing patrol aircraft. Also within this project area is the advancement of the tools and systems to enable persistent RADAR-based change detection capabilities of the entire border of the CONUS. Developments within this area will leverage collaborations with other government agencies and the commercial sector.

- Joint Unmanned Systems Testing In Collaborative Environment (JUSTICE): This project establishes the capacity for DHS to test and evaluate sUAS technologies (sensors and platforms) in a secure and safe environment in collaboration with the FAA's center of excellence at Mississippi State University and the Raspet Flight Test Research Center.

- Air Domain Awareness (ADA) – The ADA activity establishes the ability to detect, track and identify small aircraft, both manned and unmanned, to enable safe operations in the national airspace. S&T is collaborating with the U.S. Air Force and the National Aeronautics and Space Administration (NASA) to understand how to integrate and effectively use the data feed containing legitimate air traffic that will come from UAS Traffic Management (UTM). The ADA activity is also working collaboratively with CBP Air and Marine Operations to integrate and test sensors that can detect, track, and identify aircraft that are not part of the UTM to aid DHS Components in determining which aircraft may be nefarious.

- **Justification:** The FY 2023 Budget for this project will be used to advance the development and the transition of innovative and evolving aerospace technologies, such as UAS, ISR sensors, and sUAS technologies, and commercial satellite technology applicable to HSE operational scenarios. In addition, funds will provide DHS Components and nationwide first responders with the mission-critical air security tools needed for enhanced detection, classification, and tracking of illicit activities, augmented emergency response capabilities, and improved resiliency and systems interoperability.

- **Impact:** The Air Security project supports ICE, USSS, CBP, I&A, and USCG and will: 1) continue cyclic testing and evaluating sensors to detect, track and classify manned and unmanned aircraft; 2) advance the development, integration and transition of ISR sensor technology with command and control (C^2) and advance air mobility for applicable HSE operational scenarios; 3) maintain awareness of tech trends and forecasts by identifying sUAS platforms, sensors, and related technologies to close operational gaps limited by current technology, as sUAS technology continues to evolve; 4) improve baseline operational asset technologies to enable a measurable increase in operational flight hours and area of operation while reducing life cycle costs. ICE, CBP, USCG, and first responders at the local, county, and State levels will be able to cost-effectively invest in aircraft technologies, sensors, sUAS platforms, and ground control equipment that will close capability gaps and meet mission needs. Based on the results of S&T's work, these stakeholders will be able to invest in systems that integrate into their ongoing operations and that are also acceptable to public opinion, privacy concerns, and safety issues.

Type of Research

Developmental

Technical Readiness Level

TRL for project efforts range from TRL-5 to TRL-7. This project's R&D efforts typically start by performing a market survey of available commercial off the shelf (COTS) and government off the shelf (GOTS) technology that could be adapted for DHS component use. Identified technology is then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition. Examples from the R&D milestones detailed below:

- Currently initiating R&D efforts to prototype and evaluate ISR technologies such as Joint Unmanned Systems Testing in Collaborative Environments (JUSTICE) and Vehicle and Dismount Exploitation Radar (VADER) in a relevant environment (TRL-6).
- Individual air detection, track, and ID systems (TRL-7); integration of the disparate sensors and system (TRL 5 to start, then 6-7, and completion).

Transition Plans

- Provide resources to enable the development of ISR capability for use by CBP and USCG.
- Develop capability on second generation (GEN II) VADER technology for CBP Air and Marine Operations (AMO).
- Provide test and evaluation results and enable operational assessments for ICE and CBP U.S. Border Patrol (USBP) to determine best value of BVLOS capabilities.
- Publish JUSTICE demonstration, test and evaluation results, and associated analyses to DHS Components, first responder and emergency management service organizations.
- Develop technologies to enable the transfer of mission data and live video from patrol assets to command and control elements within CBP, USCG and ICE.
- Develop high speed data infrastructure prototype to enable the transfer of large amounts of data from patrol assets to command and control elements within CBP, USCG and ICE.
- Develop technologies to advance the high endurance and all-weather capability of large UAS for CBP-AMO and sUAS USBP.
- Design and develop the “Big Wing” modification kit with de-Ice capability for AMO’s MQ-9.
- Develop advance ground control station software.
- Develop next generation Maritime radar system.
- Develop Federal UAS Service Supplier software based on NASA-proposed data standard and integrate into appropriate air domain awareness operations center.
- Plan and execute joint test with CBP-AMO to demonstrate integration of below 500 ft. (smaller radar cross section platforms) and above 500 ft. (General Aviation aircraft) detection, tracking and ID in the Air Domain and transition system architecture and integration pattern to CBP-AMO.
- Deliver automated suspicious UAS detection and reporting to CBP AMO through advanced data analytics using data collected from multiple sources.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Provide resources to enable the development of ISR capability for use by CBP and USCG.	FY 2021 Q1	FY 2021 Q4	6-7
Provide test and evaluation results and enable operational assessments for ICE and CBP USBP to determine best value of emerging sUAS capability.	FY 2021 Q1	FY 2021 Q4	6-7
Develop technologies to advance the high endurance and multi-weather capability of large UAS for CBB-AMO and sUAS for USBP.	FY 2021 Q1	FY 2021 Q4	6-7
Design and develop the "Big Wing" modification kit with de-Ice capability for AMO's MQ-9.	FY 2021 Q1	FY 2021 Q4	6-7
Perform six operational assessments of identified sUAS technology to improve HSE.	FY 2020 Q1	FY 2021 Q2	6-7
Demonstrate and evaluate ADA systems for the northern border.	FY 2020 Q4	FY 2021 Q4	6-7
Evaluate capability to enable Beyond Visual Line of Sight (BVLOS).	FY 2021 Q3	FY 2021 Q3	6
Conduct Operational Tests for GEN II VADER technology.	FY 2021 Q1	FY 2021 Q4	6-7
Support testing and evaluation of sUAS platforms (fixed-wing, Vertical take-off and landing (VTOL) and hybrid) to enhance mission domain awareness for DHS Components and agencies.	FY 2021 Q4	FY 2021 Q4	6-7
Initiate transition of sUAS enabling technology to DHS Components and HSE customers for deployment.	FY 2021 Q4	FY 2021 Q4	7
	FY 2022		
Test and evaluate increased endurance and weather capability.	FY 2021 Q1	FY 2022 Q4	5-7
Test the enhanced detection capabilities and operating altitudes of SVMR.	FY 2021 Q1	FY 2022 Q4	6-7
Conduct demonstration and evaluation of ADA systems, and provide analyses results.	FY 2021 Q2	FY 2022 Q1	7
Develop Federal UAS Service Supplier software based on NASA proposed data standard.	FY 2021 Q2	FY 2022 Q4	6
Initiate project High Speed Data Transfer to develop technologies to enable the transfer of mission data between patrol aircraft and land based C2 elements.	FY 2022 Q1	FY 2022 Q4	6-7
	FY 2023		
Coordinate development of joint BVLOS flight capabilities for CBP, USCG, ICE.	FY 2023 Q1	FY 2023 Q4	6-7
Provide sUAS testing and evaluation facilities.	FY 2023 Q1	FY 2023 Q4	6-7
Develop ISR Technology Improvements for CBP patrol aircraft.	FY 2023 Q1	FY 2023 Q4	6-7

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Conduct evaluation of High-Speed Data Technology solutions.	FY 2023 Q1	FY 2023 Q4	6-7
Deliver UAS Service Supplier to appropriate Air Domain Awareness Operations center.	FY 2023 Q1	FY 2023 Q4	6-7
Execute joint test with CBP/AMO to demonstrate integration of below 500 ft (smaller radar cross section platforms) and above 500 ft (General Aviation aircraft) detection, tracking and ID in the Air Domain.	FY 2023 Q1	FY 2023 Q4	6-7
Deliver automated suspicious UAS detection and reporting capability to CBP AMO.	FY 2023 Q1	FY 2023 Q4	6-7

Enhanced Trade Technologies

- **Problem:** CBP's Office of Trade works to secure and facilitate imports arriving in the United States, collecting duties, taxes, and other fees, targeting illegal or fraudulent commerce, and enforcing U.S. trade law. CBP needs to leverage technology to safeguard the American public and promote legitimate international commerce, considering the increasing volume and complexities of international trade. The capability for target agencies to enforce trade laws against counterfeit, unsafe, and fraudulent inbound goods, and to facilitate lawful trade requires advanced analytics and machine learning analysis to enhance trade operations.

- **Solution:** This program identifies and develops technology to enhance the ability of CBP to facilitate, secure, and reduce costs related to the import of trade goods. The program's goal is to identify, develop and assess new technologies within the parameters of CBP's business needs, to inform CBP's acquisition of technology so the agency can proactively pursue improvements in the execution of their duties.

- **Justification:** The FY 2023 Budget for this project will be used to target international trade violators, high risk shipments, counterfeit, unsafe, and fraudulent goods, as well as cover research into the economic impact of trade law violations.

- **Impact:** Impacts include: (1) expedited processing of legitimate commerce, (2) enhanced ability to target illegal or fraudulent cargo, (3) enhanced ability to efficiently collect duties, taxes, and tariffs, and (4) improved ability to enforce U.S. Trade law.

Type of Research

Applied and Developmental

Technical Readiness Level

The targeted initial TRL for projects ranges from TRL-4 to TRL-7. This project's R&D efforts will start by performing a market survey of available COTS and GOTS technology that could be adapted for CBP use. Identified technology is then adapted and validated in a laboratory or relevant environment (TRL-4/5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition. Using electronic systems to expedite the clearance of merchandise entries and to ensure effective customs controls (TRL-4).

Transition Plans

Transition analyses and knowledge products to CBP Office of Trade to support future request for proposals for enhancing targeting capabilities.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Initiate Blockchain study with the University of Houston.	FY 2020 Q3	FY 2021 Q1	N/A
	FY 2022		
Initiate trade targeting effort.	FY 2022 Q2	FY 2022 Q4	6-7
	FY 2023		
Fund technological investment to improve examinations and enforce counterfeit, unsafe, and fraudulent goods inspection.	FY 2023 Q1	FY 2023 Q4	6-7

Ground Based Technologies

- **Problem:** CBP and ICE lack or have a limited capability to reliably and accurately detect, identify, classify, track, and interdict illegal ground-based activity. Further, commercial telecommunications companies are deploying new networks across the country that may pose challenges to law enforcement investigators who use digital tools to legally locate and investigate cross-border criminal and terrorist activity on telecommunications networks.

- **Solution**: The program is partnering with DHS Components to identify, develop, and transition innovative technologies that can be leveraged to enhance land border security between the POEs as well as improve agent safety and law enforcement investigative capabilities. This will include developing and deploying technology that will permit law enforcement officers to maintain the ability to perform lawful telecommunications investigations.

- **Justification:** The FY 2023 Budget for this project will be used to develop, test, and evaluate technologies designed to enhance the detection, identification, classification, and tracking of illicit activity in remote areas of the U.S. land border; assist USSS in evaluating changes in threats and potential countermeasures to current and emergent technologies, methods, and tactics, techniques and procedures (TTPs); and test, validate and transition products to assist ICE in locating and investigating criminal suspects.

- **Impact:** Impacts include: (1) enhanced land domain awareness, (2) increased detection and tracking of illicit border activity, (3) enhanced data sharing and analytics to support CBP and ICE Homeland Security Investigations (HSI) intelligence and investigations, (4) increased interdiction of illicit border activity, (5) enhanced effectiveness of field agents/officers while carrying out their duties, and (6) new tools and methods to lawfully investigate and prosecute criminal and terrorist suspects.

Type of Research
Developmental

Technical Readiness Level
TRL varies for specific portfolio projects between TRL-5 and TRL-7. This project's R&D efforts typically start by performing a R&D requirements analysis and market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology is then adapted and validated in a relevant environment (TRL-5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition. Examples from the R&D milestones detailed below:

- Transition Automated Ground Surveillance Vehicle (AGSV) prototypes to CBP for operational analysis and testing. Integration of tactical communications (TRL-7) with iTAK (TRL-6) under Agent Situational Awareness Handheld (ASAH).
- Development of new products and methods to lawfully investigate and prosecute criminal and terrorist suspects.

Transition Plans

- Transition to DHS Components a handheld geospatial tool to provide access to situational awareness data and collaborate in real-time.
- Transition enhanced cross-domain (Air, Land, Maritime, Space, Cyber) enterprise information sharing capabilities such as Tactical Chat, all-domain tracks, and sensor system information to the IMDE.
- Transition tactical communications integration into iTAK (ASAH).
- Transition products to assist ICE in locating and investigating criminal suspects.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Develop and test deployment concepts for AGSV.	FY 2021 Q1	FY 2021 Q4	5
Transition guide used to define contractual requirements for sensors to output data in standards-based format which can be ingested by other CBP systems LASU.	FY 2021 Q2	FY 2021 Q4	7
Perform a BACIS technology demonstration across one domain with two or more systems.	FY 2021 Q1	FY 2021 Q4	5-6
BACIS: Award contract for BACIS Software and Systems Integration Services.	FY 2021 Q1	FY 2021 Q2	N/A
BACIS: Achieve TD-2A.	FY 2019 Q2	FY 2021 Q3	N/A
BACIS: Execute Great Lakes Marine Security Operations Center (GL-MSOC) data sharing with Canada.	FY 2020 Q3	FY 2021 Q1	N/A
Transition USSS iTAK software baseline to USSS for continued operations and sustainment.	FY 2021 Q1	FY 2021 Q3	7
Border Situational Awareness: Complete transition of selected Spiral 3 solutions of the BSA project focused on improving strategic planning into existing CBP system baseline.	FY 2021 Q1	FY 2021 Q3	7
Border Situational Awareness: Closeout the Border Situational Awareness project and provide a final report on its performance.	FY 2021 Q2	FY 2021 Q4	7
	FY 2022		
Document concept of employment for leveraging emerging networked tactical assets to improve border security outcomes.	FY 2022 Q2	FY 2022 Q4	5
Initiate integration of land and maritime information sharing services using IMDE.	FY 2021 Q4	FY 2022 Q3	6-7
Integrate tactical communications into the iTAK baseline and demonstrate use during an operational event. (ASAH)	FY 2022 Q1	FY 2022 Q4	7
Perform R&D requirements analysis and market survey for Vegetation Penetration.	FY 2022 Q1	FY 2022 Q4	5

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Communications Security: Deliver tools for use by investigators to apprehend nefarious actors.	FY 2022 Q1	FY 2022 Q4	5
Update IMDE accredited system and initiate preparations to formally establish a DHS Program of Record.	FY 2021 Q1	FY 2022 Q1	7
Transition IMDE to DHS Office of Operations Coordination and support the establishment of a joint program office.	FY 2021 Q2	FY 2022 Q1	7
Support geoPDF integration and testing of iTAK platform for wildland fire response.	FY 2022 Q1	FY 2022 Q4	7
	FY 2023		
Deliver products for use by investigators to apprehend nefarious actors.	FY 2023 Q1	FY 2023 Q4	7
Perform R&D activities to evaluate changes in threats and potential countermeasures environment that come from technology, methods, and TTPs.	FY 2023 Q1	FY 2023 Q4	6
Evaluate and modernize existing software capabilities, including enhancement of 4-screen simulation system and upgrade of Unreal Engine platform for immersive visualization capabilities	FY 2023 Q1	FY 2023 Q4	7

POE Data Visualization and Emerging Analytics

- **Problem:** CBP Office of Field Operations (OFO) Port of Entry Security has an imperative need to develop advanced technologies to address supply chain security and to test those technologies for functionality and ultimately for certification as acceptable security devices and/or methodologies.

- **Solution:** S&T is working with CBP OFO and a university partnerto pursue R&D related to data visualization and emerging analytics that can enhance tracking for cargo and people from origin to destination with advanced interactive visual analytics to better identify transnational activity and provide additional insights into customs recovery, threat detection in the supply chain, while expediting trade.

- **Justification:** The FY 2023 Budget for this project will be used to support emergent CBP OFO requirements and determine the physical limitations of Automated Threat Recognition (ATR) algorithms. In addition, S&T will develop Adaptive Information Sharing (AIS) with the ability to run multiple detection algorithms on a single x-ray scan and provide the complete information for visual evaluation to a human operator.

- **Impact:** Impacts include (1) enhanced ability to investigate illegal activity and detection of illegal goods and (2) potential to save thousands of CBP labor hours. This activity has the potential to replace the current manual inspection methods and streamline CBP inspection activities.

Type of Research
Developmental

Technical Readiness Level
TRL 5-7. This project's R&D efforts will leverage earlier work done with University of Arkansas and Sandia National labs. The Technology Readiness Level of this effort between S&T with the university has not been determined yet. To date, the program has focused on developing methods to improve image quality of non-intrusive inspection systems. Following successful validation, the solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition.

Transition Plans
This project's R&D efforts are TRL 5-7. Software design requirements and deliverables will be developed in conjunction with customer and technical personnel. Transition will follow demonstration of these systems in a laboratory environment.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Conducted verification & validation utilizing algorithms of interest for detection of agricultural items.	FY 2021 Q4	FY 2021 Q4	5
	FY 2022		
Begin project execution on advance tech initiative.	FY 2021 Q1	FY 2022 Q3	5
	FY 2023		
Test prototypes to enhance ability to investigate illegal activity and detection of illegal goods and save thousands of CBP labor hours.	FY 2023 Q1	FY 2023 Q4	5
Develop software solutions to enhance ability to investigate illegal activity and detection of illegal goods and save thousands of CBP labor hours.	FY 2022 Q1	FY 2023 Q2	5

POE Mail

- **Problem:** CBP has ineffective processes and technology to support international mail inspection. Despite legislative requirements to target and prevent illegal imports, CBP inspects only a limited number of the hundreds of thousands of pieces of incoming international mail each day, largely due to inadequate guidance, equipment, and resources. These international mail inspection deficiencies hinder CBP's efforts to prevent prohibited items from entering the United States.

- **Solution:** The project will review operational capabilities to improve technology and adequately address the large volume of international mail. The project will conduct analyses to determine what additional staff and technology solutions are needed to adequately address the large volume of international mail.

- **Justification:** The FY 2023 Budget for this project will be used to support emergent CBP Office of Field Operations requirements. CBP has R&D requirements to improve international mail inspection. Changes in international mail and fast parcel inspection require CBP to inspect thousands of pieces of mail per day.

- **Impact:** Impacts include: (1) expedited processing of mail; (2) enhanced ability to interdict illegal or fraudulent mail; and (3) enhanced ability to efficiently collect duties, taxes, and tariffs.

Type of Research
Applied and Developmental

Technical Readiness Level
We anticipate the TRL will vary between TRL-6 and TRL-7 depending on the activity. This project's R&D efforts will typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology will then adapted and validated in a laboratory or relevant environment . Following successful validation, the most promising solution(s) will then be prototyped and evaluated first in a relevant environment (TRL-6-7) then in an operational environment (TRL-7) prior to transition.

Transition Plans
Transition technology to CBP conveyance and security division for improvements in CBP international mail inspection.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Modeling analysis and other knowledge products delivered to CBP Office Field Operations to support future mail equipment decisions.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
Conduct concept studies and initiate technology demonstration for International Mail and Express Consignment Facilities.	FY 2022 Q1	FY 2022 Q4	N/A
Initiate requirements analysis.	FY 2021 Q2	FY 2022 Q4	N/A
	FY 2023		
Identify technologies for International Mail and Express Consignment Facilities.	FY 2023 Q1	FY 2023 Q4	6-7

POE Non-Intrusive Inspection and Alternate Technologies

- **Problem:** CBP Non-Intrusive Inspection (NII) systems technology requires R&D improvements to maintain parity with emerging threats. The volume of inbound goods and people passing through the POEs is projected to increase from year to year, however, CBP manpower will not be increased proportionately. New or improved technology or alternate technology can be a force multiplier to help address these challenges.

- **Solution:** This program develops alternate technology and future NII R&D technologies in order to enhance their detection performance and expand the range of detectable threats. These technologies will improve data integration and remote image analysis at common NII viewers. Other improvements include NII imaging for high-throughput package screening, automated anomaly detection, next-generation composite container and improvement in NII software algorithms, machine learning and threat detection and other advanced technologies.

- **Justification:** The FY 2023 Budget for this project will be used to improve the current CBP OFO scanning technologies of people and goods. Improved image quality, increased threat detection, and greater system throughput will expedite contraband detection while facilitating legitimate trade and travel.

- **Impact:** Impacts include: (1) dramatic increase in interdiction rates without additional staffing, (2) increase in the speed of commerce (greater/faster throughput), and (3) improved resource loading providing a significant increase in efficiency.

Type of Research
Developmental

Technical Readiness Level
TRL varies for specific project activities between TRL-6 and TRL-7. This project's R&D efforts typically start by performing a market survey of available COTS and GOTS technology that could be adapted for CBP use. Identified technology is then adapted and validated in a relevant environment. Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment then in an operational environment (TRL-6-7) prior to transition.

- Imaging systems technology to inspect and screen at CBP Ports of Entry (POE).

Transition Plans
Upon successful completion and operational assessment of the software/hardware upgrades, S&T will deliver prototype systems for laboratory testing, and if successful for operational demonstration. S&T will then deliver assessments of developed technologies and techniques to CBP to inform their acquisition process.

- Transition Technology integrating new imaging technology to the CBP Office Field Operations.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Perform Technology Demonstration for Common Viewer Air System.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
Award contracts and project initiation for NII project activities.	FY 2022 Q1	FY 2022 Q4	5-7
Award contracts and project initiation for alternate R&D technologies.	FY 2022 Q1	FY 2022 Q4	5-7
Perform initial assessment of technology/techniques to improve performance of NII detectors, algorithms, and data collection.	FY 2021 Q1	FY 2022 Q4	5
	FY 2023		
Develop detection capabilities for CBP Ports of Entry (POE).	FY 2023 Q1	FY 2023 Q4	N/A
Evaluate detection performance and expand detectable threat ranges.	FY 2023 Q3	FY 2023 Q4	6-7

Tunnel Detection and Surveillance

- **Problem:** CBP and ICE have a limited capability to (1) reliably detect cross-border tunnels, (2) investigate discovered tunnels without putting an agent in the tunnel, and (3) perform forensic analysis of the discovered tunnel to support investigations and prosecutions.

- **Solution:** This program is conducting market research, modeling and simulations, and operational experiments (OpEx) to enhance USBP's knowledge of the state of technology modalities to detect, exploit, and seal cross-border dug tunnels. The program will conduct technology assessments to investigate the ability to detect tunnels under varying environmental conditions and collect and analyze samples from discovered tunnels to enable investigations/prosecutions.

- **Justification:** The FY 2023 Budget for this project will be used to expand and further develop CBP's subterranean threat detection capabilities.

- **Impact:** Impacts include: (1) technical risk reduction to future activities of CBP's Cross Border Tunnel Threat (CBTT) program of record, (2) increased ability to investigate/exploit discovered tunnels safely, (3) increased arrests and prosecution of individuals involved in the creation/use of tunnels, (4) reduction of hundreds of tons of drugs kept off U.S. streets, and (5) savings of thousands of CBP and ICE labor hours.

Type of Research
Developmental

Technical Readiness Level
TRL varies for portfolio projects between TRL-4 and TRL-7. This project's R&D efforts start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology is then further assessed and considered for evaluation in an OpEx in a relevant environment (TRL-6) or operational environment (TRL-7).

Transition Plans
Deliver to CBP a geophysical model that approximates seismic and acoustic wave attenuation for tunnel detection system performance analysis.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Develop and deliver a mathematical model that approximates the physics of seismic and acoustic wave attenuation in order to conduct tunnel detection system performance analysis.	FY 2020 Q4	FY 2021 Q4	N/A
Conduct threat emulator testing to inform development and delivery of a model that will simulate geology and threats in an operational environment.	FY 2021 Q2	FY 2021 Q4	N/A
	FY 2022		
Conduct validation and verification activities to refine a mathematical model that approximates the physics of seismic and acoustic wave attenuation.	FY 2021 Q4	FY 2022 Q4	6-7
	FY 2023		
Research and evaluate mobile detection technologies capable for deployment in an operational environment.	FY 2023 Q1	FY 2023 Q4	N/A
Conduct validation and verification activities to refine a mathematical model that approximates the physics of seismic and acoustic wave attenuation.	FY 2022 Q2	FY 2023 Q4	N/A

Biometrics and Identity Management Program – The Biometrics and Identity Management Program adheres to the DHS Biometrics Strategic Framework 2015 – 2025 vision for biometric transformation and supports the specific goals and objectives for achieving the vision. This program develops and evaluates more effective biometric and identity technologies to optimize existing identity validation and verification operations for people at POEs., transportation security checkpoints, secure facilities, and online systems. The program employs a complimentary system engineering based data-driven approach to identify and prioritize changes in existing operations based on anticipated improvements, consequences, and costs of new solutions. This will be accomplished as described below with the prioritization, initiation, and completion dependent on available funding and driven by component inputs.

Biometrics and Identity Screening

- **Problem:** Strategic plans from DHS Components include increasing the use of biometric screening of travelers at Air, Land, and Sea POEs. DHS must address security concerns but also handle increases in traveler volume and traveler inspections in order to strengthen traveler vetting and scale operations to facilitate lawful and legitimate travel. DHS Components require more effective biometric capabilities to improve identity validation and verification of people arriving or departing at POEs within the United States, applying for benefits such as trusted traveler or immigration programs, as well as accessing secure Federal facilities or protection of designated sites. These capabilities must balance security and protection concerns with ongoing needs to facilitate lawful trade, travel, and assembly, by improving accuracy, flexibility, and scalability of solutions.

- **Solution:** Employ a comprehensive system engineering approach to identify opportunities for changes to existing operations and present anticipated improvements, consequences, and costs of new solutions, process, and technology improvements. This is accomplished by conducting technology foraging, technology readiness evaluations, and operational readiness assessments to inform DHS acquisition planning for more capable/lower cost technologies, including biometric recognition capabilities, to strengthen traveler vetting and facilitate lawful and legitimate travel. For the activities listed below, the Program will apply proven systems engineering approach to identify opportunities for changes to existing operations and present anticipated improvements, consequences, costs of new solutions' processes, and impacts of technology improvements. The evaluation of the cost effectiveness of biometric capabilities and technologies are necessary to effectively adjust to evolving security and safety needs, appropriately scale operations, and optimally use available resources.

    - Incorporate Facial Recognition into Vetting Capabilities: Advise and provide technical assistance to measure and operationalize enhancements to CBP and TSA Face Recognition capabilities. Activities include: automated face recognition performance monitoring based on National Institute of Standards and Technology (NIST) recommendation; informing incremental performance enhancements; comparative evaluations of human performance and system performance; enhancing overall system performance through Officer and automated algorithm collaboration.

    - Biometrics for Vehicles at POEs: Apply RDT&E to determine how CBP can effectively use biometric technology to rapidly verify the identity of individuals in vehicles entering (and exiting) the United States at land POEs.

Objective 3.5 in the DHS Biometrics Strategic Framework requires DHS Components to "Implement Standard Solutions" as a mitigation for operational and programmatic gaps pertaining to undisciplined acquisition of biometric technology. As DHS considers enhancements to existing inspection and screening operations for travelers at its POEs, it is important to employ a comprehensive systems engineering approach to identify opportunities for changes to existing operations and present anticipated improvements, consequences, and costs of new solutions. Using a data-driven approach to assess identification and screening solutions will inform S&T in the prioritization of RDT&E activities. The solutions above both establish and leverage innovative and robust science-based capabilities to provide the DHS and ederal partners with data and knowledge products which inform requirements and acquisition decisions.

- **Justification:** The FY 2023 Budget for this project will be used to execute CBP/OFO gaps, namely to advise and provide technical assistance to measure and operationalize enhancements to CBP Face Recognition capabilities; and apply RDT&E to determine how CBP can effectively use biometric technology to rapidly verify the identity of individuals in vehicles entering (and exiting) the United States at land POEs.

- **Impact:** Impacts include (1) enhanced lawful identification and validation for trade and travel; (2) improved ability to detect terrorists, criminals, and dangerous individuals; (3) improving and streamlining DHS acquisitions by allowing components' to definitively determine best-value solutions for any mission by reducing technical risk during source selections; (4) enabling enhanced interoperability of secure, interoperable, enterprise solutions; (5) improved DHS staffing efficiency by enabling streamlined, scalable, and cost-effective security, screening and inspection operations; (6) improved traveler throughput and satisfaction; and (7) improving capability for retrieval of biometrics records to aid front line officers conducting investigations in the field.

Type of Research

Developmental

Technical Readiness Level

TRL varies for specific project activities between TRL-5 and TRL-7. This project's R&D efforts typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology is then adapted and validated in a relevant environment (TRL-5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition.

Transition Plans

All analyses, models, technology prototypes, and knowledge products will be transitioned to DHS Components. Select work products may also be shared with airlines, airports, and other travel industry stakeholders to facilitate adoption and integration into aviation operations in order to enable co-operative procurement through public-private partnerships. Component-specific products include all operational performance analyses, vulnerability and mitigation analyses, and engineering trade study documentation for follow-on acquisition and/or sustainment.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Generalize and tailor test and evaluation methods to measure performance in support of different DHS Components or missions.	FY 2021 Q1	FY 2021 Q4	7
Develop technical contributions for new standards for next-generation biometric collection and quality enhancement capabilities.	FY 2021 Q1	FY 2021 Q3	7
Demonstrate complimentary capabilities of multi-system technologies to improve real-time CBP identity verification operations.	FY 2021 Q2	FY 2021 Q4	6
Enable demonstration and evaluation of Counting and Measuring/Wayfinding technology in operationally relevant setting.	FY 2021 Q1	FY 2021 Q4	6
	FY 2022		
Establish testing and qualification process to facilitate acquisition of interoperable and enhanced biometric collection capabilities to address DHS Component mission needs.	FY 2022 Q1	FY 2022 Q4	6
Develop technical requirements and specifications for various biometric modality collection systems and data quality to address the mission and assist acquisition needs of Components.	FY 2022 Q1	FY 2022 Q4	6
Facilitate development and operational deployment of biometric analysis workflows and technologies to support the incorporation and integration of Component biometric-enabled missions with the OBIM HART system.	FY 2022 Q1	FY 2022 Q3	7
	FY 2023		
Evaluate current biometric collection technologies to identify COTS/GOTS solutions and assess further development, modification, integration requirements to incorporate into DHS Component operations.	FY 2023 Q2	FY 2023 Q4	N/A
Select COTS technologies to conduct Biometric T&E to support integration into component operational mission spaces.	FY 2023 Q1	FY 2023 Q3	7
Develop technical requirements and specifications for various biometric modality collection systems and data quality to address the mission and assist acquisition needs of Components to meet new Joint Requirements Council requirements and Biometric Enterprise Management Reform Act requirements.	FY 2023 Q1	FY 2023 Q3	7

Counter Unmanned Aircraft Systems Program – This program conducts research, tests, evaluates and transitions technical capabilities that strengthen the security of DHS covered assets and facilities by detecting, tracking, identifying and mitigating the threat posed by nefarious small Unmanned Aircraft Systems (sUAS).

Counter Unmanned Aircraft Systems (C-UAS)

- **Problem:** Recent technology advances have resulted in a flood of inexpensive and easily obtainable sUAS that are used for multiple legitimate and illegitimate uses. As a result of the Preventing Emerging Threats Act of 2018, DHS is responsible for the safety, security, and/or protection of personnel, facilities, or assets, from unmanned aircraft systems (UAS) that pose a risk to the safety or security of a covered facility or asset. DHS operational Components have limited capabilities to detect, track, identify and mitigate sUAS under Title VI, Section 124n when performing certain congressionally approved missions. Currently, DHS has four operational Components that have been authorized by the Secretary of DHS to field capabilities that mitigate the threat of nefarious sUAS use. Given the rapid proliferation of highly capable sUAS in the marketplace and their ever-increasing capabilities, S&T must work with industry, government and our international partners to develop and test new and innovative C-UAS capabilities that can detect, track, identify and mitigate these advanced threats. S&T is also responsible for conducting research, testing and evaluation on all C-UAS technologies being considered for operational use to satisfy congressional requirements that include but not limited to ensuring the equipment is safe to use, the equipment is effective and to coordinate with the Department of Transportation / Federal Aviation Administration (DoT/FAA) to ensure there is minimal or no impact to the National Air Space.

- **Solution:** The program will accomplish the following objectives:
  - Identify and document initial DHS Component operational requirements based on their specific mission sets;
  - Identify potential COTS or GOTS solutions that might meet Component operational requirements;
  - Modify/tailor/adapt COTS/GOTS and other mature technologies to address urgent needs;
  - Per congressionally mandated 124n process[1] to deploy C-UAS technologies, S&T will adhere to all requirements, draft appropriate documentation and coordinate with DoT/FAA to ensure there is minimal impact to the National Airspace;
  - Conduct rapid test and evaluation of these adaptation/modifications in support of Component acquisitions;
  - Determine the direction of sUAS technology advancement in the far term to inform RD&I efforts to counter these improvements;
  - Leverage industry and schools of higher education in the creation of novel technical methods to defeat sUAS using challenge events;
  - Pursue technologies that can exploit the nascent Unmanned Traffic Management system to help determine friend vs. foe UAS in the National Air Space; and
  - Perform research and development on capability gaps identified by the 2019 validated DHS Capability Assessment Report (CAR) and prioritized DHS component gaps identified and documented during the 2020 C-UAS issue team led by DHS Program Analysis and Evaluation.

[1] 6 U.S.C. § 124n Protection of certain facilities and assets from unmanned aircraft

Justification: The FY 2023 Budget for this project will enhance previously deployed technologies and to address DHS Components' C-UAS mission needs that have not been adequately addressed previously and documented via operational assessments performed during testing and evaluation. To this end, C-UAS technologies that address those needs will be sought, integrated, tested and deployed to DHS prioritized critical assets, facilities and special events. The 2019 validated DHS CAR priority capability gaps will also be addressed starting in FY 2022 and continue through FY 2026.

Per DHS C-UAS Policy, S&T is responsible for testing all C-UAS technologies before fielding by DHS Components. These tests include but are not limited to radio frequency spectrum emissions, cyber security, and system performance. Funds will address four R&D focus areas that encompass 24 different efforts in the C-UAS Capability Development Roadmap, which trace back to the 2019 Joint Requirements Council (JRC)-validated CAR and the 2019 & 2020 C-UAS issue team results that were approved by the DHS leadership to address these gaps. The four R&D focus areas are Defense Chain Effectiveness, Interoperability and Operational Coordination, Deployment, and New and Emerging CUAS Technologies and Threats.

Impact: Upon successful completion of the project, S&T will have supported the development of well-defined and validated DHS Component C-UAS requirements and the C-UAS Program Management Office in an effort to coordinate all C-UAS RDT&E activities across the department. DHS Component acquisition strategies will be supported based on S&T's knowledge products including market surveys, test results, requests for information (RFIs), cyber-testing reports, initial operational requirements report, initial functional requirements and other artifacts. Most suitable and mature C-UAS technologies are recommended for operational evaluation and/or extended user evaluation.

Type of Research

Developmental

Technical Readiness Level

TRL varies for specific portfolio projects between TRL-6 and TRL-7. Project identifies and documents the unique implementation requirements of each "covered" facility or asset. Prospective C-UAS system solutions are then evaluated at a test facility (TRL-6) for that particular implementation. The most promising C-UAS solution is then tested and evaluated in the operational environment (TRL-7) prior to transition. Some milestones do not have TRL's associated with them because they are knowledge products / artifacts.

Transition Plans

- S&T will transition C-UAS systems from prototype pilots into operational systems to be used by DHS Components for protection of high priority facilities or assets as designated by the Secretary of DHS.
- Incremental C-UAS improvements based on the capability gaps identified by the 2019 validated C-UAS Capability Assessment Report (CAR) will be folded into C-UAS pilot systems in preparation for transition.
  S&T will provide program knowledge product artifacts such as market research, test results, operational assessment reports, and draft operational requirements reports to DHS Components to assist with their C-UAS procurement or acquisition activities.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Investigate and document interoperability requirements to address capability gaps identified by the 2019 validated C-UAS Capability Assessment Report (CAR).	FY 2021 Q1	FY 2021 Q4	N/A
Transition to use of the prototype C-UAS capability to Federal Protective Services (FPS).	FY 2021 Q1	FY 2021 Q4	7
Transition to use C-UAS technologies to USCG for National Security mission.	FY 2021 Q1	FY 2021 Q4	7
Transition to use C-UAS prototype systems to CBP on the southern border.	FY 2021 Q1	FY 2021 Q4	7
Establish CBP C-UAS technology pilot and complete performance test event.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
Update UAS threat document .	FY 2021 Q3	FY 2022 Q4	6
Test first implementation of intra-agency interoperability between two or more DHS operational C-UAS technologies.	FY 2022 Q2	FY 2022 Q4	6
Test first version of departmental rapid response C-UAS capability with FPS.	FY 2022 Q2	FY 2022 Q4	6
Complete transition of CBP pilot C-UAS kit.	FY 2022 Q1	FY 2022 Q4	7
Complete a performance assessment of at least one pilot C-UAS technology in or from a maritime environment applicable to USCG, FPS and/or CBP.	FY 2022 Q1	FY 2022 Q4	7
Complete a technical assessment of C-UAS technologies to detect, track and identify at TSA UAS testbed #1 located in MIA.	FY 2022 Q1	FY 2022 Q4	6-7
Demonstrate integration of at least 2 disparate C-UAS sensors in a common tactical display.	FY 2022 Q1	FY 2022 Q4	7
Develop prototype web-based system to submit flight restrictions for critical infrastructure.	FY 2022 Q1	FY 2022 Q4	6
Integrate UCOP with existing user interface system for a common viewing platform.	FY 2022 Q1	FY 2022 Q2	7
Integrate and test new sensors into Urban C-UAS Operational Prototype system.	FY 2021 Q1	FY 2022 Q2	7
Develop and test portable capability for component partner.	FY 2021 Q1	FY 2022 Q2	7
Conduct flight tests to ensure transition readiness of Urban Prototype Fixed Site capability.	FY 2021 Q1	FY 2022 Q2	7
	FY 2023		
Initiate task to study passive radar to detect, track and identify capabilities and provide a report.	FY 2023 Q1	FY 2023 Q4	6

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Test and assess C-UAS detect, track, ID and mitigate capability against multiple sUAS simultaneously.	FY 2023 Q1	FY 2023 Q4	6
Modify and test existing DHS prototype systems for DHS interoperability with another partner agency.	FY 2023 Q1	FY 2023 Q4	6-7
Develop and test modular, rapid roll-on roll-off detect, track, identify, and mitigate capability for departmental response.	FY 2023 Q1	FY 2023 Q4	6
Develop a market survey report for C-UAS technologies that can detect and possibly exploit advanced command and control links (e.g., 5G).	FY 2023 Q1	FY 2023 Q4	N/A
Test detection and mitigation of non-emitting sUAS.	FY 2023 Q1	FY 2023 Q4	6
Conduct performance assessment at TSA UAS testbed #1, MIA.	FY 2023 Q1	FY 2023 Q4	N/A

Forensic and Criminal Investigations Program – This program researches and develops technologies, procedures, detection and intelligence capabilities to enable DHS Components to collect, analyze, share, and act on law enforcement data and information.

Digital Forensics

- **Problem:** Law enforcement officials need new forensic tools to combat child sexual abuse. Due to technologies offering greater anonymization for both sellers and buyers, darknet criminal marketplaces have become more popular. According to ICE HSI, there are over 350 million child exploitation images in the current HSI database. New child exploitation cases are growing exponentially with seized images often exceeding 900,000 each week."

- **Solution:** This program will design, develop, test and integrate new innovative technologies 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 crime scenes, identify and rescue victims, and identify their perpetrators much faster. This will be accomplished through the following activities with the prioritization, initiation, and completion dependent on available funding and component input:

  - Facilitation and Outcomes Analysis of the 5RD Workshop to Combat Child Exploitation: Convenes government agencies including law enforcement, policy personnel and research scientists from Australia (AU), Canada, New Zealand, the United Kingdom, and the United States to exchange information, identify common strategic priorities, and coordinate R&D efforts in countering child exploitation.

  - Face Recognition: Continue to update the graphical user interface (Horus) for the Intelligence Advanced Research Projects Activity (IARPA) Janus face recognition tools for use by Federal, State and local law enforcement on new use cases.

  - Camera ID Project: Designs, develops, tests, and integrates new algorithms that characterize pictures taken from the same camera, thereby allowing forensic analysts to match still and video images. This better enables law enforcement officers to identify and locate victims and perpetrators. This work will also allow forensic analysts to cluster images from the same camera which will drastically reduce the amount of time necessary to locate victims and perpetrators.

  - Language ID Tool: Develops, tests, and integrates language ID into current forensic tools. This new capability will allow forensic analysts to quickly determine what sections of video digital imagery contains voice and what language is spoken.

  - War Criminal Identification Project: Develops, tests, and integrates algorithms into the Human Rights Violators & War Criminal Unit forensic tools at ICE HSI. The goal of these tools is to assist agents in identifying war criminals and victims in images and videos where agents currently have little access to facial recognition technology.

- Livestream Project: Develop system architectures and prototypes that will find criminal behavior on livestream platforms and provide data exploitation. Conduct operational pilots with end users.

- **Justification:** The FY 2023 Budget for this project will be used to provide research & development of digital forensics tools to fill high priority gaps for DHS law enforcement operations. Specifically, S&T will focus research on digital analytic automation to provide tools that will drastically reduce the amount of time it takes and analyst to conclude a case. In addition, funds will be used to further develop, test and integrate innovative digital forensics tools for forensic law enforcement applications.

- **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, thereby increasing an agent's effectiveness while drastically limiting the amount of time an agent must subject themselves to traumatizing material. These forensic tools are standalone tools that are useful for Federal, State and local law enforcement. This program also includes new innovative technology for a new livestream capability. This will increase the number of children recognized and saved from a life of abuse. New capabilities will support more efficient and accurate analysis. All the digital forensics' tools developed by S&T for the child exploitation problem are also usable for any crime that has digital evidence.

Type of Research

Developmental

Technical Readiness Level

Varies per project between TRL-4 and TRL-6. This project's R&D efforts typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Research is conducted when needed and then adapted and validated in a relevant environment (TRL-5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6). Examples from the R&D milestones detailed below:

- Test and update the Camera ID algorithms as a disruptive technology to match digital imagery (TRL-5).
- Transition language determination tools capable of determining where language is spoken in a video sequence, what language is spoken and transcribing common languages to English text (TRL-6).

Transition Plans

- Language ID Project: S&T will transition the Language ID Project technology to ICE HSI. FY 2023 will focus on R&D; transitions will begin in FY 2024.
- Livestream Project: S&T will transition a livestream warrant data triage tool to ICE HSI and develop and transition an additional search and data analytics capability. FY 2023 will focus on R&D; transitions will begin in FY 2024.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Researched and integrated Camera ID capabilities into current user interface.	FY 2021 Q1	FY 2021 Q4	5
	FY 2022		
Transition Speech & Language determination tools capable of determining where language is spoken in a video sequence, what language is spoken and transcribing common languages to English text.	FY 2022 Q1	FY 2022 Q3	6
Provide research in Natural Language Processing/semantic analysis for a Livestream data analytics capability.	FY 2022 Q1	FY 2022 Q4	4-5
Research and integrate Camera ID capabilities into current user interface.	FY 2021 Q1	FY 2022 Q2	5
	FY 2023		
Research and develop livestream scraping capabilities.	FY 2023 Q1	FY 2023 Q4	4-6
Research the use of computer vision (Language ID) for livestream capabilities.	FY 2023 Q1	FY 2023 Q4	4-6

Illegal Immigration Investigations

- **Problem:** DHS and ICE's Enforcement and Removal Operations (ERO) are on pace to encounter more individuals on the Southwest border than in the last 20 years. DHS is securing the U.S. border, executing the Centers for Disease Control and Prevention's (CDC) public health authority to safeguard the American public and the people crossing the border themselves, and protecting children.

  ERO has experienced migration surges in 2019, 2014, and prior. Since April 2020, the number of encounters at the Southwest border has been steadily increasing. DHS is working around the clock to process the flow at the border. Currently, DHS is working with the Departments of Health and Human Services, Justice, and State in an all-of-government effort to not only address the current situation at our Southwest border, but to institute longer-term solutions to irregular migration from countries in our hemisphere that are suffering worsening conditions. Given this workload, there are areas within ERO's mission space that could benefit from system modernization and implementation of new technologies and/or methods.

  In a meeting between the DHS Secretary and Components Leadership on February 4, 2021, the ICE Director stated that one of ERO's biggest challenges is the need for technology solutions that can aid in preventing detention.

- **Solution:** ERO is currently studying their Alternatives to Detention (ATD) program, which uses technology and case management to ensure compliance with release conditions, court hearings, and final orders of removal while allowing those people to remain in their communities in the U.S. This study is expected to be completed in the first quarter of FY 2022. This request will support development and implementation of technology in response to the findings of that study.

- **Justification:** The FY 2023 Budget for this project will be used to continue development and implementation of technologies that were initiated in FY 2022.

- **Impact:** ERO is helping to keep U.S. borders secure, humanely applying and enforcing immigration laws. Upon successful completion of this project, S&T will have identified systems and/or methods to aid ERO in its implementation of immigration processes, and technology solutions that can further aid in preventing detention.

Type of Research

Developmental

Technical Readiness Level

We anticipate the TRL will vary between TRL-5 and TRL-7. Following a FY 2022 market survey of available COTS and GOTS technology that could be adapted for ICE's use, identified technologies will be adapted and validated in a relevant environment (TRL-5). Upon successful validation, the most promising solution(s) will then be prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition. Examples that support the R&D milestones detailed below:

- Perform a market survey of technologies that could be adapted for ICE use to be validated in a relevant environment (TRL-5).
- Perform technology demonstrations & evaluations of system prototypes in a relevant environment (TRL-6).
- Apply R&D to bring identified solution paths in line with ICE's specific requirements.

Transition Plans

S&T plans to transition to ICE the resultant analyses, models, technology prototypes, and knowledge products in order to enhance the ability of ERO to perform their mission.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Initiate gap analysis.	FY 2021 Q3	FY 2021 Q4	6-7
	FY 2022		
Perform analysis of alternatives.	FY 2022 Q1	FY 2022 Q4	6-7
Provide technology recommendations and initiate associated R&D activities.	FY 2022 Q3	FY 2022 Q4	6-7
	FY 2023		
Continue R&D activities on recommended technologies.	FY 2021 Q1	FY 2023 Q4	6
Develop and Deliver Modeling and Simulation Tool.	FY 2023 Q2	FY 2023 Q4	5

Transnational Organized Crime and Counter Networks

- **Problem:** Transnational Organized Crime (TOC) networks and actors inherently operate over wide geographic areas and are only effectively combated by a team approach that is equally diverse, agile and generally not co-located. DHS Components including I&A, ICE/HSI, CBP, and USCG require a fabric of connected purpose-built data systems and forensic tools which enables an enterprise-wide data sharing capability and centralized data analytics platform to facilitate and encourage collaboration across DHS. Current forensic tools are standalone tools and have not had the opportunity to benefit from artificial intelligence (AI) and machine learning (ML), which will drastically increase the performance of these tools for law enforcement applications.

- **Solution:** The S&T Transnational Organized Crime and Counter Networks project will partner with DHS operational stakeholders to develop forensic tools and a central unified framework that encourages collaboration and leverages artificial intelligence and machine learning, thereby providing digital media exploitation capabilities designed to automate and augment current manual processes. The initial target of this work will be crimes involving human trafficking, forced labor, child sexual exploitation. The TOC work will leverage digital forensic tools and apply AI and ML, which will drastically increase the performance of those tools and move from manual to automated processes for operational end users. In addition, S&T will leverage R&D work from the intelligence agencies including Intelligence Advanced Research Projects Activity, Defense Advanced Research Projects Agency, and National Security Agency, and apply AI/ML, which will increase tool performance. TOC work will bring the current standalone digital forensics tools to an enterprise level on collaboration platforms including ICE HSI's Repository for Analytics in a Virtualized Environment (RAVEn). New capabilities will include computer vision for object and activity detection, voice semantic analytics, natural language processing of unstructured text documents, information fusion for entity resolution, automate data schema generation and tagging to move into the classified environment and provide tools in a central platform for interagency tactical collaboration.

- **Justification:** The FY 2023 Budget will be used to provide subject matter expertise to further develop, test and integrate investigative sciences technologies including digital forensics, identity resolution, behavioral science, and DOMEX (document and media exploitation) and apply AI/ML to increase performance of these technologies for operational end users. This research work will be centered on developing tools that use artificial intelligence and machine learning to counter TOC, specifically targeting crimes of Human Trafficking, Forced Labor, Child Sexual Exploitation for the DHS enterprise. S&T SMEs will ground truth operational data and further develop novel forensics tools that will automate current manual processes, provide data link analysis, and apply analytics and media exploitation which will save countless hours of time and provide Agents with leads for TOC investigations that are impossible to otherwise obtain.

- **Impact:** The S&T Transnational Organized Crime and Counter Networks project will enable DHS and its Components to leverage new forensic tools that take advantage of and data sharing capabilities that will encourage a unified approach to combat global TOC. These new forensic tools and data sharing capabilities will close the operational gap using a central data hosting, analytics, and collaboration platform where agents can access new vital forensic tools that benefit from AI/ML and share discoveries, theories and analysis.

Type of Research
Developmental

Technical Readiness Level
This project's R&D efforts will start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology will then be adapted and validated in a relevant environment (TRL-5). Following successful validation, the most promising solution(s) will be prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition.

Transition Plans
- As a 5-year endeavor, this project will focus on R&D and then spiral development (iterative phased development process designed to build upon lessons learned and enhancements gleaned from previous iterations) in unison with DHS operational components will culminate in DHS operational components pilot testing and system integration of forensic tools and data sharing capabilities. All analyses and prototyped tools and capabilities will be transitioned to the appropriate DHS operational component(s).
- FY 2023 will focus on R&D; while transitions will begin in FY 2024.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
N/A	N/A	N/A	N/A
	FY 2022		
Conduct an operational gap analysis of the host data platform and associated analytic tools.	FY 2021 Q1	FY 2022 Q4	5-7
Develop a framework outlining technology gaps and a roadmap for research requirements.	FY 2021 Q1	FY 2022 Q4	5-7
Develop use cases and scenarios to understand the underlying system architecture and decision processes.	FY 2021 Q1	FY 2022 Q4	5-7
Identify and ground truth datasets in preparation to apply AI/ML to forensic algorithms.	FY 2021 Q1	FY 2022 Q4	5-6
	FY 2023		
Develop automated tools to aide in ground truthing data sets.	FY 2023 Q1	FY 2023 Q4	4-5

Immigration Services Program – This program develops technologies for U.S. Citizenship and Immigration Services (USCIS) to meet their goals to provide efficient adjudication of all applications and petitions for immigration benefits, enhance integrity of legal immigration IT systems, and provide trusted and timely immigration, employment, and identity information through a culture of efficiency and creativity.

Immigration-Based Technologies

- **Problem**: USCIS needs process and technology improvements to their adjudication of applications and petitions for immigration benefits to strengthen and streamline the vetting process, thereby reducing the lengthy applicant backlog.

- **Solution**: This program enhances USCIS's ability to efficiently adjudicate all applications and petitions for immigration benefits, take timely action on related ancillary applications and other assigned product lines, provide direct customer service, maintain the accuracy and integrity of immigration information, ensure the integrity of the immigration system and provide timely assistance to applicants, petitioners and beneficiaries. The program's goal is to provide technology to USCIS to enhance the efficiency and integrity of their immigration services and activities.

- **Justification:** The FY 2023 Budget for this project will be used to identify and develop methods to automate portions of the current immigration interview and documentation processes, which will enhance the efficiency and integrity of USCIS's execution of their statutory responsibilities.
- **Impact:** Automation of current immigration interview and documentation processes will: 1) enhance USCIS's ability to process immigration benefit applications/petitions, 2) enhance their ability to identify fraudulent immigration applications/petitions, 3) reduce applicant backlogs, 4) improve USCIS staffing efficiency, and 5) improve customer throughput and satisfaction.

Type of Research
Developmental

Technical Readiness Level
TRL varies for specific project activities between TRL-5 and TRL-7. This project's R&D efforts typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology is then adapted and validated in a relevant environment (TRL-5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition. Examples from the R&D milestones detailed below:
- Conducted market research to identify areas of R&D investment to enhance the efficiency and integrity of USCIS's execution of its statutory responsibilities (TRL-5).
- Perform system evaluations and test proposed solutions (TRL-6).

Transition Plans

S&T plans to transition to USCIS analyses, models, technology prototypes, and knowledge products in order to:

- Enhance the integrity of the immigration system;
- Support efficient adjudication of all applications and petitions for immigration benefits;
- Provide the ability to maintain the accuracy and integrity of immigration information; and,
- Ensure timely assistance to applicants, petitioners and beneficiaries.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Based on results of market research, select area for R&D investment and initiate R&D project.	FY 2021 Q1	FY 2021 Q4	5
	FY 2022		
Perform immigration-based system evaluations.	FY 2022 Q1	FY 2022 Q4	6
Perform an analysis of alternatives of identified potential R&D investments to enhance the efficiency and integrity of the immigration system and select area for R&D.	FY 2020 Q2	FY 2022 Q4	5
	FY 2023		
Continue and deliver system analysis and R&D Roadmap for USCIS.	FY 2023 Q1	FY 2023 Q4	5

Maritime Safety and Security Program – This program develops and transitions technical capabilities that enhances 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 and enhance safety and resilience of the maritime transportation system.

Integrated Multi-Domain Enterprise (IMDE)

- **Problem:** The *Joint Mission Need Statement (JMNS) for HSE Information Sharing*, Joint Requirements Council (JRC), sponsored by USCG and CBP, validated in 2018, documented the need for an enhanced operational-level capability. This enhanced capability helps the DHS enterprise evolve from a stove-piped, component-centric operational environment into a maritime Information Sharing Environment (ISE) that integrates elements of the Maritime Domain Awareness (MDA) Network enabling increased information sharing and interoperability across DHS and authorized Federal, State, local, tribal, international, public and private regional partners (FSLTIPP) to provide:
  - Broader access to common and federated data;
  - Synchronized domain and situational awareness for maritime and operational intersection with air and land;
  - Enhanced ability to share unclassified//For Official Use Only (FOUO)//Law Enforcement Sensitive (LES) data at a national/regional/tactical level and ensure the flow of information to the intelligence community to improve analysis and intelligence products; and
  - Improved ability to connect unclassified operational and intelligence systems, data sources and sensors, and applications-based functionality using common standards and repeatable integration patterns

- **Solution:** S&T developed and demonstrated an enterprise information sharing architecture and reference implementation to the IMDE HQ program established under the Office of Homeland Security Situational Awareness (OSA), formerly the Office of Operations Coordination (OPS) in FY 2021 and transitioned to the Office of Chief Information Officer (OCIO) Chief Data Officer (CDO) in FY 2023. This architecture fully transitioned in FY 2021, as included in that Operations & Support chapter. S&T shall support RDT&E of broad deployment of this capability under sponsor's direction. Specifically, S&T will support establishment and enhancements of core information sharing architecture to enable DHS and its components to meet mission critical information sharing, domain awareness, and multi-agency operational coordination needs across the HSE.

  As a materiel solution, IMDE provides the following:

  - The connection method and distribution point for Multi-Agency Information Sharing. It establishes an enterprise architecture to enable portability of data between various stakeholder information systems. The end result is that users get information in their system of choice.

  - Enables aggregation of sources from HSE stakeholders as well as providing for dissemination of this information in accordance with the owner's policy. In the long term, the creation of these data buckets enables analytics, visualization, and other decision aides to be developed and delivered to the enterprise.

- Shall leverage OCIO enterprise identity management, attribute management, and core information services such as the Geospatial Information Infrastructure (GII), DHS Common Operating Picture, and Homeland Security Information Network (HSIN). Once the core infrastructure is established, component and other stakeholder system owners can leverage enterprise user management and information sharing services within their own systems.

- **Justification:** The FY 2023 Budget for this project will be used to implement an integrated test environment for the IMDE Joint Program Office (JPO), enabling streamlined, repeatable, and high quality service and connector development and implementation, supporting user and data attribute-based information sharing for the HSE; develop test fixtures and test data for services and interfaces as prioritized by the JPO; and implement continuous integration and automated test principles where possible.

- **Impact:** IMDE will provide a true domain agnostic information sharing platform available to all within the HSE. With this investment, the HSE will have capabilities that directly: increase the sharing of targeting, intelligence and scheduling information to improve situational awareness; uncover gaps in planned and ongoing operations, and reduce duplication of effort between agencies; ensure the real-time awareness, evaluation of threats and deployment of resources to the right places through active collection of port activity information; and minimize the economic impact from disruptions to commerce.

Type of Research

Applied and Developmental, Test and Evaluation

Technical Readiness Level

TRL varies between TRL-4 and TRL-7 depending on activity. This project's R&D efforts typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology is then adapted and validated in a laboratory or relevant environment (TRL-4/5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition. Examples from the R&D milestones detailed below:

- Establish a test environment and conduct integration and test of authoritative data services and enterprise information sharing services. (TRL-5)
- Integrate, adapt, and/or mature candidate enterprise services as required by the IMDE program. (TRL 4-7).
- Support operational research as directed by the IMDE program.
- Transition enterprise services and authoritative data source interfaces to the IMDE program and / or OCIO (TRL-7).

Transition Plans

RDT&E in this program is directly aligned to the needs of the DHS IMDE program office, under the OCIO CDO and with CBP, USCG, and ICE as the program line of business owners.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
N/A	N/A	N/A	N/A
	FY 2022		
Develop a Test and Evaluation Strategy for IMDE Program.	FY 2021 Q3	FY 2022 Q2	N/A
	FY 2023		
Conduct technology scouting for operational enterprise services, as prioritized.	FY 2022 Q2	FY 2023 Q2	4-7
Develop test plan to support initial operational capability.	FY 2022 Q2	FY 2023 Q2	N/A
Implement IMDE Test Environment.	FY 2023 Q1	FY 2023 Q4	6-7
Develop first set of IMDE service test fixtures and test data (service TBD as prioritized).	FY 2023 Q2	FY 2023 Q4	6-7

Port and Coastal Surveillance

- **Problem:** USCG, ICE, and CBP require operational capabilities to improve MDA for compliant and non-compliant (dark or non-emitting) vessels; enhance their ability to detect, deter, interdict, and investigate illegal maritime activity; and coordinate across the HSE.

- **Solution:** S&T is partnering with USCG, CBP, and ICE to identify, develop, and transition technologies that can be leveraged to improve MDA by improving, developing or integrating sensors and platforms (including autonomous), information sharing technologies, mission support tools/techniques and decision support capabilities to benefit FSLTIPP.

- **Justification:** The FY 2023 Budget for this project will be used to complete documentation of results and support transition(s) resulting from FY 2020 - 2022 MDA sensor technologies integrations and assessments; assess MDA gaps or shortcomings in stakeholder planned and resourced information sharing integration roadmap.

- **Impact:** Impacts include: 1) enhanced MDA, 2) increased detections and tracking of illicit activity, 3) increased interdictions of illicit activity, 4) increased efficiency/effectiveness/safety of personnel and equipment, 5) enhanced presence in the maritime domain, 6) enhanced information sharing to support DHS maritime safety and security missions, 7) improvements to environmental monitoring and response, and 8) improved ability to protect fisheries and legitimate economic activity.

Type of Research
Developmental

Technical Readiness Level
TRL varies between TRL-5 and TRL-7 depending on activity. This project's R&D efforts typically start by performing a market survey of available COTS) and GOTS technology that could be adapted for DHS component use. Identified technology is then adapted and validated in a relevant environment (TRL-5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition. Examples from the R&D milestones detailed below:
- Currently evaluating capabilities to detect vessels (compliant and non-compliant/dark) in a relevant environment (TRL-6).
- Promising maritime surveillance sensors will be tested and evaluated in an operational environment (TRL-7) prior to transition.
- Currently cooperating with USCG in evaluating and modifying UMS for critical missions (TRL-6).

Transition Plans
- Deliver to operational Components dark vessel detection track information from commercial and/or Government owned sensor systems.
- Inform CBP and USCG acquisition strategies for deployment of MDA capabilities.
- Inform USCG acquisition and operations strategy for the operation of UMS.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Deliver to operational Components dark vessel detection track information from commercial and/or Government owned sensor systems.	FY 2021 Q1	FY 2021 Q3	7
Assess the use of dark vessel detection track data feeds into Operational Component's system.	FY 2021 Q1	FY 2021 Q4	6
Initiate dark vessel detection track data feed transition to Operational Components for operations and sustainment activities.	FY 2021 Q1	FY 2021 Q4	7
Maritime Unmanned Systems Technology (MUST) Milestone: Accept delivery of six Ocean Aero unmanned maritime platforms to S&T.	FY 2020 Q2	FY 2021 Q3	6
MUST Milestone: Execute MUST Activity Year 2 Award Contract.	FY 2020 Q2	FY 2021 Q2	N/A
MDA Sensors: Finalize and Deliver DHS Science and Technology Maritime Domain Awareness (MDA) Sensor Technology Survey Results Report to DHS and Interagency Stakeholders.	FY 2020 Q4	FY 2021 Q3	N/A
MDA Sensors: Award task order for MDA Sensor Integration Services.	FY 2021 Q2	FY 2021 Q4	N/A
	FY 2022		
MDA Sensors: Award contract for two technology sensor assessments in Southern California or Puget Sound areas.	FY 2021 Q4	FY 2022 Q2	N/A
MDA Sensors: Assess technology to support Maritime Domain Awareness in prioritized areas of interest.	FY 2021 Q1	FY 2022 Q4	5-7
Develop Plan of Action and Milestones (POA&M) - A written plan for a study, assessment, laboratory or field tests of technologies to benefit USCG.	FY 2022 Q1	FY 2022 Q4	5-6
Perform operationally relevant testing and assessment of select capabilities identified in the Maritime Domain Awareness analysis of alternatives against dark vessels in relevant areas of responsibilities.	FY 2020 Q1	FY 2022 Q3	6-7
MUST Milestone: Demonstrate one unmanned maritime vehicle sensor system capabilities.	FY 2021 Q1	FY 2022 Q4	6
Deliver assessments, and technical, test, and demonstration reports on selected technologies to USCG to benefit USCG operations.	FY 2022 Q1	FY 2022 Q4	6-7
	FY 2023		
MDA Sensors: Transition and/or disposal of MDA sensors.	FY 2023 Q1	FY 2023 Q4	6-7
Cross Component Information Sharing: Conduct study of impacts of DHS HQ MDA information sharing activities.	FY 2023 Q1	FY 2023 Q2	N/A
MUST Milestone: Inform acquisition strategy for USCG UMS.	FY 2023 Q1	FY 2023 Q4	5-7
MUST Milestone: Conduct UMS experimentation for novel mission applications.	FY 2023 Q3	FY 2023 Q4	5-7

Port and Waterway Resiliency

- **Problem:** The USCG has limited computer-based tools to efficiently and effectively conduct port or waterway health assessments, analyze the condition of ports or waterways after incidents or disasters, and develop risk-based approaches for mitigation, response and recovery. Furthermore, USCG lacks technologies to remotely monitor and inspect Aids to Navigation, or to gather status information to inform decisions on upgrading or replacing existing Aids to Navigation and other infrastructure used to maintain navigation in the Marine Transportation System (MTS).

- **Solution:** S&T is developing and transitioning port and waterway resiliency analytical visualization tools, data, and technologies to provide USCG waterway managers with more effective and user-friendly capabilities to prepare for, mitigate, respond to, and recover from an incident or disaster affecting the MTS, and investigating existing and emerging technologies to enable remote monitoring and inspection of waterway infrastructure.

- **Justification:** The FY 2023 Budget does not provide funding for this project. When determining funding levels for programs/projects, S&T considers customer priorities and requirements received. This project is not a priority for the customer at this time, and there are no impacts to performance anticipated. Future efforts to develop next-generation aids to navigation (ATON) may be re-visited as necessary.

- **Impact:** Impacts include: 1) enhanced safety and economic security of maritime ports and waterways, 2) improved situational awareness and understanding of waterway criticality, 3) enabled decision-making for more efficient/effective resource allocation to keep ports and waterways open, and 4) more timely response to significant storms enabling critical waterways to reopen more quickly.

Type of Research
Applied and Developmental

Technical Readiness Level
TRL varies between TRL-4 and TRL-7 depending on activity. This project's R&D efforts typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology is then adapted and validated in a laboratory or relevant environment (TRL-4/5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition. Examples from the R&D milestones detailed below:

- Currently developing WAMS software modules with sample datasets to demonstrate prototype capabilities to the customer (TRL-4).
- Currently delivering and integrating WAMS modules into a relevant software test environment (TRL-5).
- Successful modules will be tested and evaluated in the system of record relevant test environment (TRL-6).
- Successful modules will be deployed as beta versions in the system of record to assess in an operational environment (TRL-7).

Transition Plans

S&T plans to transition and integrate software and data upgrades into an existing program of record under the sponsorship of USCG Marine Transportation Systems Directorate (CG-5PW). These products will inform future USCG acquisition strategies. Further, the River Information System will also be developed for commercial use to navigate inland waterways. The Water Harmonization Project and Waterway Analysis and Management System (WAMS) Project will be transitioned into the USCG system of record, USAIMS.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Deliver WAMS modules to USCG.	FY 2019 Q3	FY 2021 Q1	5-6
	FY 2022		
Research waterways management solutions to streamline and modernize ATON servicing	FY 2022 Q1	FY 2022 Q4	5-6
	FY 2023		
N/A	N/A	N/A	N/A

Remote Maritime Technologies

- **Problem:** DHS lacks technologies in the Arctic and other remote maritime regions to enable effective and timely execution of its law enforcement, regulatory, security and safety missions; for example, the USCG must respond quickly to locate and rescue victims in remote maritime areas. The Arctic and other remote maritime regions pose unique challenges due to their difficulty to access, extreme environments, lack of communications and other infrastructure which limits maritime domain awareness and hampers communications to/from these areas. Both USCG and CBP require the ability to effectively detect, respond and maintain command and control for illicit maritime activities, hazards or emergencies in the Arctic and other remote maritime regions.

- **Solution:** S&T is performing R&D on solutions to operate in the Arctic and other remote maritime regions to detect and respond to illicit maritime activities or emergency situations in a timely manner. Research includes technologies such as space systems to enhance Intelligence, Surveillance and Reconnaissance (ISR) and communications capabilities; AI/ML based analytics to provide timely alerting to illicit behaviors or emergency situations; technologies to aid in effective prevention and response to hazards; and solutions to prevent loss of life.

- **Justification:** The FY 2023 Budget for this project will be used to develop and implement AI/ML-based analytics within the DataHub framework which could be developed to meet USCG and CBP needs to enhance and employ within the CBP Kestrel system; evaluate selected solution approaches for distress alerting in remote maritime regions; and develop capability and technology roadmaps, conduct in-depth requirements analysis to inform project plans, and assess communications capabilities to address underway cutter connectivity needs.

- **Impact:** Impacts include: 1) near real time detection of illicit activities or emergency situations in the Arctic and other remote maritime regions; 2) ability to perform real time AI/ML-based analytics at scale using all available data sources and conduct time dominant operations; and 3) improved ability to communicate and conduct and effect command and control for successful responses to illicit maritime activities, hazards, or emergencies in remote environments.

Type of Research
Applied and Developmental

Technical Readiness Level
TRL varies between TRL-4 and TRL-7 depending on activity. This project's R&D efforts typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology is then adapted and validated in a laboratory or relevant environment (TRL-4/5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition. Examples that support the R&D milestones detailed below:

- Currently reviewing proposals for mass rescue devices for Phase I tank testing (TRL-4).
- Currently leveraging, modifying, and integrating COTS and GOTS software tools to develop a "DataHub" analytics capability to automatically detect anomalous behaviors using relevant data streams (TRL-7).

- Will be assessing the ability of DataHub to detect anomalous maritime activities using operational data streams at scale (TRL-7).
- Will be assessing technologies against realistic use cases to address maritime safety concerns (TRL-5-7).
- Will be researching communications technologies to enhance underway cutter connectivity (TRL-4/5/6).
- Perform Alternatives Analysis to identify the best option to pursue for supporting detection of distress alerts (TRL-4).

Transition Plans

- Deliver to CBP and USCG recommendations to use COTS / GOTS capabilities in support of MDA to inform potential acquisition.
- Inform DHS acquisition strategies for the deployment of remote maritime / Arctic MDA capabilities to support safety and / or security operations.
- Transition new data sources and / or analytic capabilities into existing component(s) systems of record to support safety and security operations.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Assess use of space-based capabilities to enhance Maritime Domain Awareness.	FY 2018 Q4	FY 2021 Q2	6-7
Perform operational evaluation of Datahub analytics to detect and report dark vessels performing illicit activities to component systems of record.	FY 2021 Q1	FY 2021 Q3	7
Transition new data sources or analytic capabilities into existing component(s) systems to support safety and security operations.	FY 2021 Q1	FY 2021 Q4	6-7
	FY 2022		
Deliver near real time analytic results from DataHub into DHS production environment.	FY 2021 Q1	FY 2022 Q1	7
Assess technologies for maritime search and rescue.	FY 2021 Q1	FY 2022 Q4	4-7
	FY 2023		
Deliver AI/ML-based analytics and integrate into CBP's Kestrel System.	FY 2023 Q1	FY 2023 Q4	7
Develop and update capability and technology roadmaps for underway cutter connectivity needs.	FY 2022 Q1	FY 2023 Q2	N/A
Assess existing, emerging and newly discovered technologies to enhance cutter connectivity in remote maritime regions.	FY 2022 Q2	FY 2023 Q4	4-7

Chemical, Biological, and Explosive (CBE) Defense Thrust Area
Research and Development

Technology Readiness Level Exhibit

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
Chemical, Biological, and Explosive Defense Thrust Area	$32,015	$32,592	$21,510

R&D Thrust Area Description

CBE DEFENSE THRUST AREA: R&D investments support prevention and protective strategies as well as the coordinated surveillance and detection of CBE threats. S&T's R&D 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.

CHEMICAL, BIOLOGICAL, AND EXPLOSIVE DEFENSE THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
Total – CBE Defense Thrust		**$32,015**	**$32,592**	**$21,510**
Chem-Bio Detection and Defense		**$10,722**	**$16,932**	**$9,210**
	Chem-Bio Threat Surveillance & Detection (formerly Biosurveillance Systems)	$1,430	$10,479	$4,250
	First Responder Knowledge Database	$814	-	-
	Food, Agriculture and Veterinary Defense (FAV-D)	$3,080	$2,800	$2,800
	USCG/EPA Wide Area/Vessel Decontamination Project	$1,160	-	-
	Urban Security Initiative	$4,238	$3,653	$2,160
Detection Canine		**$15,300**	**$9,360**	**$8,300**
	Detection Canine Project	$15,300	$9,360	$8,300
Opioid/Fentanyl Detection		**$5,993**	**$6,300**	**$4,000**

CHEMICAL, BIOLOGICAL, AND EXPLOSIVE DEFENSE THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
	Opioid/Fentanyl Detection Project	$5,993	$6,300	$4,000

Chem-Bio Detection and Defense Program – This program conducts research to assess, prevent, detect, prepare for, respond to, and recover from incidents involving chemical and biological (CB) threats and hazards. This program supports DHS, its Components, and the HSE with risk-awareness, knowledge products, and technical solutions needed to protect the Nation from incidents involving CB hazards and executes and enhances a portfolio of capabilities and supporting activities to counter CB threats.

Chem-Bio Threat Surveillance and Detection (formerly Biosurveillance Systems)

- **Problem:** Rapid response to CB events of national concern (e.g., a biological/chemical attack or disease outbreak) is critical to save American lives, protect critical infrastructure, and safeguard the U.S. economy. In the event of a CB event, there is a system of systems of capabilities required for prompt detection, defense, coordination, and rapid response actions that must occur amongst Federal, State, local governments and the private sector. The timely detection of and protection and confident response to the release and/or exposure from CB events is a critical challenge to multiple DHS Components (CWMD, USSS, USGC, TSA, CISA, CBP) and other Federal, State, local, tribal, and territorial (FSLTT) customers, including the public health and first responder communities.

- **Solution:** S&T will develop cost-effective systems to rapidly detect, defend against coordinate, and to respond to CB events. This will tie end-user needs (e.g., first responders) to a broader system of systems that work together and complement each other in the event of CB incidents, and will vastly increase operational effectiveness of CB technologies coupled with significant cost savings. Moreover, focusing on the implementation, coordination and development (as needed) of interoperable systems instead of one-off solutions will better enable decision makers to more quickly receive information, make actionable decisions, and improve coordinated actions. This program is pursuing a cost-effective approach to an indoor biothreat system of systems using existing COTS or GOTS solutions. Objectives of this system of systems include: a) addressing timeliness to detect the release of a biological agent by developing novel sensor/trigger technologies, b) identifying data and data streams to provide early warning situational awareness, c) integrating analytical tools and applying advanced computational techniques to integrate and analyze real-time data, and d) enabling more real-time sharing of information across Federal agencies and SLTT officials. Additionally, this program is pursuing system architecture approaches to incorporate the above effort and other existing DHS efforts into integrated DHS-enterprise-wide chemical & biological detection & defense system architectures. These systems architectures a) bucket end-user needs (e.g., first responders) into functional capabilities, allowing fewer technologies to fulfill more end user needs, b) develop strategic traceability of end-user needs to national strategic objectives thus reducing redundancy of efforts across DHS, and c) integrate solutions into a system of system which increases effectiveness of DHS CB programs at a cost-savings. Funding is paired with ongoing CWMD investments, including detection capabilities such as the Biological Detection for the 21st Century program that can support rapid response to emerging biothreats, investments in the S&T Probabilistic Analysis of National Threats, Hazards and Risks (PANTHR) program for expanding and

prioritizing the list of existing biothreats to augment existing capabilities, and additional investments by CWMD in information sharing and analytics that provide value to the broader stakeholder community. These efforts are aligned and synchronized to the greatest extent possible to ensure individual efforts result in enduring chemical & biological defensive capabilities across the HSE.

- **Justification:** The FY 2023 Budget for this project will be used to select and test collective protection technologies and modify components to adapt to component operational spaces. S&T will continue testing and evaluation of solutions for the indoor biothreat system, as well as to continue the development and delivery of supporting studies, assessments, and architecture design based on real world threats and mission specific operational environments. The indoor biothreat system, along with continued functional analyses of a chemical detection system of systems architecture, will be integrated into a comprehensive solution. S&T will also develop a single-particle mass spectrometer to make it smaller, able to detect more biothreats of interest such as viruses, and more affordable for planned use cases in customer venues of interest. In addition, funds will be used to develop and conduct bench-scale and meso-scale testing that will be used to model a theoretical test bed designed for proving out technologies that detect, identify, and mitigate biological and chemical contaminant releases in indoor building spaces, associated building infrastructure (e.g.: heating, ventilation and air conditioning (HVAC), plumbing systems) and external water treatment systems. S&T will leverage existing/developmental technologies and new capabilities supporting the defense of outdoor venues and other emergent DHS Component requirements.

- **Impact:** Improved capabilities in indoor/outdoor biothreat technologies and systems, maximize fulfillment of end-user needs (e.g., first responders) by translating needs into functional capabilities, building critical capibilities into flexible integrated systems, reductions in redundancies of CB efforts across DHS by tracing end-user requirements through strategic level objectives, and improved effectiveness of DHS CB capabilities at a cost savings.

Type of Research

Applied and Developmental

Technical Readiness Level

The program began at TRL-3 and will end at TRL-7. Two types of projects are performed under this program: (1) development of knowledge products; and (2) technology development to improve chemical and biological threat preparedness and defense. For knowledge projects, first steps typically involve workshops or interviews with SMEs and applicable end users. Technology R&D projects typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology is then adapted and validated in a relevant environment (TRL-5). Following successful validation, the most promising solution(s) are prototyped and evaluated in a relevant environment (TRL-6), then in an operational environment (TRL-7) prior to transition. Examples:

- Developing and testing a single-particle, time-of-flight mass spectrometer (TRL-5) as a presumptive identifier to detect bioaerosol threats; this instrument will be further developed to achieve a maturity of TRL 7 so that it can be transitioned.
- Leverage findings from the National Environmental Biological Detection Architecture (NEBDA) project to support new requirements from CWMD in support of BD21 and additional requirements. (TRL-4-7)

- Leverage findings from the National Environmental Chemical Detection Architecture (NECDA) project to support new requirements from CWMD and additional requirements. (TRL-4-7)
- Provide follow-on support (targeted mission analysis & capability assessments) to relevant DHS Components in support of chemical and biological defense initiatives.

Transition Plans

Systems architectures, concepts of operation, technology functional capabilities analyses & metrics, and implementation protocols for CB events will be developed for relevant DHS Components and other key stakeholders. These products will include customized, 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 work in coordination with all DHS Components including CWMD, to maintain synchronization & interoperability of efforts while at an overall cost-savings to DHS.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Document the utility of data fusion analytical methods in layered security biodetection and biosurveillance applications (e.g., reduce false alarms, identify anomalous data indicators).	FY 2019 Q2	FY 2021 Q2	5
Complete test and evaluation of systems for collection and detection of aerosolized biothreats.	FY 2020 Q1	FY 2021 Q4	5
Deliver a national threat assessment taxonomy with a focus on DHS Components.	FY 2020 Q2	FY 2021 Q3	N/A
Complete developmental test and evaluation of prototype advanced detection system.	FY 2020 Q4	FY 2021 Q3	5
Initiate identification of requirements and gaps in multi-environment chemical detection for a relevant Component.	FY 2020 Q4	FY 2021 Q4	N/A
	FY 2022		
Map potential technology solutions to biodetection-biosurveillance architecture and metrics.	FY 2021 Q1	FY 2022 Q1	N/A
Deliver indoor aerosolized biological particle detection design, including sensors and field-based detection technologies, to test bed for test and evaluation in an operationally relevant environment.	FY 2021 Q3	FY 2022 Q2	6
Demonstrate advanced detection systems for key stakeholders at the Federal, State, and local level.	FY 2021 Q3	FY 2022 Q3	6

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Begin integration of biodetection-biosurveillance architecture into a chemical & biological architecture.	FY 2020 Q4	FY 2022 Q2	N/A
	FY 2023		
Conduct mission analysis in support of test and evaluation of CB protection technologies.	FY 2023 Q1	FY 2023 Q4	6
Conduct mission analysis and capability assessments in support of chemical defense architectures and defensive/detection technologies for relevant DHS Components.	FY 2022 Q2	FY 2023 Q4	N/A
Initiate evaluation of selected CBR Protected Spaces technologies to be targeted for development or modification.	FY 2022 Q2	FY 2023 Q4	N/A
Deliver indoor aerosolized biological particle detection instrument with expanded operational capabilities to test bed for test and evaluation in an operationally relevant environment.	FY 2022 Q3	FY 2023 Q4	7
Demonstrate advanced detection systems for key stakeholders at the Federal, State, and local level.	FY 2022 Q3	FY 2023 Q4	7
Conduct mission analysis and capability assessments in support of development of a field-based biological identifier.	FY 2022 Q2	FY 2023 Q4	N/A
Conduct standards development in support of developed field-based biological detection systems.	FY 2022 Q2	FY 2023 Q4	N/A
Conduct mission analysis and capability assessments to support development of threat agnostic biosurveillance.	FY 2022 Q2	FY 2023 Q4	N/A
Conduct mission analysis activities in support of developing a testing capacity to assess vulnerabilities and mitigate chemical/biological risks in building air and water handling systems, and wastewater systems.	FY 2022 Q2	FY 2023 Q4	N/A

First Responder Knowledge Database

- **Problem:** DHS and the U.S. Government lack a common platform for information integration for first responders. This database/information integration platform will aggregate equipment lists, standards, capabilities, grants and training information vital to first responders. The lack of this capability forces first responders to engage across DHS instead of having a common portal to access mission support capabilities.

- **Solution:** Three separate solutions were identified: (1) "Research" – Conduct an Alternatives Analysis (AA) of the existing online sites within the Government and private sector that support or inform CWMD, first responders, and other stakeholders regarding the best practices, market research, test results, and other functions, as requested by stakeholders. Knowledge areas should include the five POETE analysis areas (Planning, Organizing, Equipping, Training, and Exercising) of the responder's operational missions; (2) Modify an Existing Solution or Develop a Custom Solution; and (3) Develop Custom Solution.

- **Justification:** The FY 2023 Budget does not provide funding for this project, consistent with the FY 2022 President's Budget.

- **Impact:** Based on initial plans, the first responder community would have a single source access for up to date, verified information to most effectively perform their duties. However, after S&T conducted a gap decomposition and solution analysis resulting in a Comprehensive Solution Analysis Report, then presented findings to CWMD, this requirement was deemed no longer relevant and any work on this project ceased.

Type of Research
Basic and Developmental

Technical Readiness Level
N/A (Knowledge Product)

Transition Plans
S&T completes a technical analysis of capabilities and transition the results to DHS Components in an actionable final report.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Conduct requirements analysis gap decomposition.	FY 2021 Q1	FY 2021 Q2	N/A
Produce comprehensive solution analysis report.	FY 2021 Q2	FY 2021 Q2	N/A
	FY 2022		
N/A	N/A	N/A	N/A
	FY 2023		
N/A	N/A	N/A	N/A

Food, Agriculture and Veterinary Defense (FAV-D)

- **Problem:** The United States is at significant risk for outbreaks of high-consequence foreign animal diseases that would cause major economic disruption to the agriculture sector critical infrastructure resulting in billions of dollars of losses to U.S. livestock producers and the U.S. government. These diseases include Foot-and-Mouth Disease, Classical Swine Fever, and African Swine Fever which may be introduced to the United States through natural, accidental, or deliberate means.

- **Solution:** This project supports CWMD's programs and mission to prevent, protect, mitigate, respond and recover from catastrophic events affecting the Food and Agriculture industry and the health and economic security of the United States. The S&T FAV-D Project leverages the Plum Island Animal Disease Center (PIADC) to develop new, next-generation vaccines, diagnostics and other countermeasures for critical infrastructure, to include government and industry stakeholders, to ensure that the United States Department of Agriculture (USDA) and other first responders in the animal agriculture community, have the countermeasures needed to effectively identify, respond and recover from foreign animal disease outbreaks. In addition to investing in novel technologies for solution products to rapidly respond to and recover from these threats, this project works with commercial animal health industry partners to ensure completion of U.S. regulatory requirements (master-seed, pre-licensing serials, clinical trials) for high-priority countermeasures so that they are readily available in an outbreak situation. This program's funding is in addition to that requested by the DHS Chief Medical Officer in the CWMD R&D appropriation.

- **Justification:** The FY 2023 Budget will be used to develop new, next-generation vaccines and other countermeasures to effectively identify, respond and recover from foreign animal disease outbreaks. In addition, funds will be used to engage and collaborate with nucleic acid vaccine industry partners to accelerate the development of new, next-generation vaccines, field deployable rapid diagnostic tests, and other countermeasures in conjunction with DHS, USDA, and other government and industry scientists, which will enhance DHS mission capabilities to effectively identify, respond and recover from foreign animal disease outbreaks. No other USG agency, including USDA, is currently focused on early and late stage countermeasure development in direct collaboration with the animal health industry to protect against foreign animal diseases.

- **Impact:** This project strengthens the defense of the U.S. agricultural infrastructure, in support of the CWMD's mission to prevent, protect, mitigate, respond and recover from catastrophic events affecting the Food and Agriculture industry, by ensuring that USDA and other first responders in the animal agriculture community have effective countermeasures needed to respond to foreign animal disease outbreaks. The S&T FAV-D project's ongoing efforts to develop multi-pathogen countermeasures will provide faster and more comprehensive protection to limit the spread and size of an outbreak. Data from this project will support the regulatory licensing and/or availability of new countermeasures to the National Animal Vaccine and Veterinary Countermeasures Bank in the event of a high-consequence outbreak in the United States.

Type of Research

Applied and Developmental

Technical Readiness Level

This project funds the development of multiple vaccines, lab and field deployable diagnostic assays, molecular detection tools, and disinfection and disposal solutions for foreign animal disease countermeasures, the vast majority of which start at TRL-3 and end at TRL-7.

Transition Plans

- Foreign Animal Disease Countermeasures are targeted for transition to the National Animal Vaccine and Veterinary Countermeasures Bank.
- Approved regulatory development package toward approval of a rapid, pen-side, nucleic acid-based diagnostic to prevent, protect, mitigate, respond and recover from catastrophic events affecting the Food and Agriculture industry test for African Swine Fever (ASF) virus.
- Approved regulatory development package toward approval of an African Swine Fever (ASF) emergency use vaccine.
- Approved regulatory development package toward approval of a prototype next generation messenger RNA-based subunit vaccine for livestock.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Demonstrate the safety and efficacy of a live attenuated vaccine for African Swine Fever virus (ASFV) in pigs.	FY 2019 Q4	FY 2021 Q4	4
Demonstrate the efficacy of a multicomponent, single injection vaccine for Foot-and-Mouth Disease virus (FMDV) in pigs.	FY 2020 Q1	FY 2021 Q4	4
Demonstrate efficacy of commonly used disinfectants used by the swine industry to be effective against FMDV and ASFV.	FY 2020 Q1	FY 2021 Q4	6
	FY 2022		
Complete a Foot-and-Mouth Disease subunit vaccine efficacy study in either cattle or pigs that can be used in direct support of a USDA Center for Veterinary Biologics regulatory development package toward product licensure.	FY 2021 Q4	FY 2022 Q4	6
Complete an African Swine Fever vaccine efficacy study in pigs that can be used in direct support of an USDA CVB approved regulatory development package toward approval of an ASF emergency use vaccine.	FY 2022 Q1	FY 2022 Q4	6
	FY 2023		
Complete validation studies of a rapid, pen-side nucleic acid-based ASF diagnostic test in direct support of an USDA CVB approved regulatory development package toward approval of an ASF emergency use diagnostic test.	FY 2021 Q4	FY 2023 Q2	7
Complete development of rapid messenger RNA-based subunit vaccine manufacturing process and complete efficacy studies of the initial prototype vaccine in livestock in direct support of an USDA CVB approved regulatory development package toward approval of emergency use livestock vaccines.	FY 2022 Q4	FY 2023 Q4	6

USCG/EPA Wide Area/Vessel Decontamination Project

- **Problem:** A terrorist attack involving the release of an aerosolized biological agent, e.g., *Bacillus anthracis* (i.e., anthrax) spores, in a major metropolitan area, often located along a coastal region or inner waterway, will require field-tested methods to rapidly restore vital services and critical infrastructure necessary to serve and help protect the public. USCG operations, assets, and facilities would be adversely impacted by wide-area biological agent contamination. Methods and strategies for recovery, which include characterization, decontamination, waste management, and clearance, have to date only been proven effective and scalable for single building, indoor locations. Field-tested methods for recovery of outdoor areas and key DHS Component assets are needed to minimize the impact on DHS missions to serve and protect the public.

- **Solution:** Develop and field test methods for rapid characterization of a wide-area biological agent event, decontamination, waste management procedures and clearance to inform response and recovery decisions.

- **Justification:** The FY 2023 Budget does not provide funding for this project, consistent with the FY 2022 President's Budget.

- **Impact:** Effective and efficient methods for rapid recovery of large metropolitan regions, coastal areas, and critical government assets following a wide-area biological contamination event will have been demonstrated. The USCG will benefit by rapid return-to-service of vessels and port facilities to enable continuity of mission responsibilities to protect and defend the coastal regions and waterways of the homeland. More broadly, the field-tested methods will enable faster re-occupation by the public of populated areas and help to instill confidence in the safety of natural resources (e.g., drinking water).

Type of Research
Applied and Developmental

Technical Readiness Level
The program began at TRL-4 and ended at TRL-7. This project's R&D efforts began by performing a market survey of available COTS and GOTS technology that could be adapted for DHS Component (e.g., USCG) and EPA's use. A system concept utilizing the identified technologies was then developed and validated in a laboratory environment (TRL-4). Following successful validation, the most promising solution(s)will be prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition. Examples from the R&D milestones detailed below:

- Complete lab-based evaluation of wide-area sampling methods (TRL-4)
- Conduct field demonstration of sampling, decontamination and waste management methods and strategies for USCG small vessels (TRL-7)

Transition Plans
Technology solutions and knowledge products, developed in accord with component requirements, will be transitioned to USCG and the EPA for acquisition programs or preparedness planning in FY 2023.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Complete decontamination decision support tool for a wide area biological agent incident, incorporating field-tested methods for urban areas, vegetation, critical infrastructure and USCG assets.	FY 2020 Q1	FY 2021 Q4	6
Conduct field test to evaluate fate/transport of spores on real-world outdoor surfaces as a function of environmental conditions and time.	FY 2021 Q2	FY 2021 Q3	7
Conduct demonstration of commercial equipment and evaluate applicability for wide-area decontamination of biological agent contamination.	FY 2021 Q3	FY 2021 Q3	7
	FY 2022		
Conduct field test to evaluate fate/transport of spores on real-world outdoor surfaces as a function of environmental conditions and time.	FY 2021 Q2	FY 2022 Q3	7
Conduct demonstration of commercial equipment and evaluate applicability for wide-area decontamination of biological agent contamination.	FY 2021 Q3	FY 2022 Q3	7
	FY 2023		
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A

Urban Security Initiative

- **Problem:** The Urban Security Initiative (USI) supports CWMD, TSA's Intermodal testbed program and multiple stakeholders across the HSE, including the New York Metropolitan Transportation Authority, New York Police Department, Port Authority of New York and New Jersey, New York City (NYC) Department of Health and Mental Hygiene as well as urban centers with mass transit subway systems. Subway systems that serve large metropolitan areas are attractive targets for potential acts of bioterrorism, particularly with aerosolized biological threat agents. Real-time detection and identification of biological agents is currently not possible, and the underground environment of urban subway systems poses unique challenges for existing technologies. S&T's field test in the (NYC subway that simulated a biological agent release confirmed dispersion model predictions that contamination from an aerosolized biological agent would be rapid, widespread and lead to a major public health crisis, with indications contamination would not be confined to the underground. Computational and hardware tools to inform emergency preparedness planning for a wide-area biological agent event, to support response and recovery actions based on plume tracking, to optimize sensor placements in densely populated urban centers, and to perform field confirmatory identification of a biohazard for rapid situational awareness are needed as access to scientific information and technology becomes more accessible to and readily exploited by an adversary.

  Solution: A permanent test bed in a major subway system enables the evaluation of emerging chemical and bio-detection technologies, detection architectures, and mitigation strategies to limit agent transport and public exposure to an aerosolized threat. Such evaluation in the operational environment is critical to informing spiral development of technologies and delivering a robust detection capability that can save lives and improve situational awareness. The Metropolitan Transportation Authority New York City Transit (MTA NYCT) will partner with DHS on implementing a test bed in the Nation's largest subway system which moves millions of passengers each day. S&T will leverage a previous 2016 field test simulating a biological agent release in the NYC subway that indicated contamination of the above ground environment will also occur, complicating response and recovery actions and magnifying damage in the region's and the Nation's economy. S&T will build upon results of the prior test by conducting a large-scale simulated bioagent attack in FY 2022 to include the NYC subway, above-ground environment that includes Manhattan, the surrounding boroughs, critical infrastructure including airports. The outcomes of the FY 2022 field tests will provide a realistic test of sensors in the subway testbed, and more broadly will inform emergency preparedness, response planning and optimized sensor positioning. The testbed and dispersion activities in NYC will be leveraged by the CWMD BD21 program. The analysis of the FY 2022 experimental measurements will serve to validate and ultimately transition to CWMD integrated airflow and dispersion models under development by S&T and enable evaluation of their utility to estimate locations where the simulated attack had originated. In FY 2023, S&T will transition the testbed to NYC stakeholders. Outcomes from testbed operations and the simulated bio-aerosol attack are also anticipated to be transferrable to other urban centers with large mass transit systems, with appropriate modifications.

- **Justification:** The FY 2023 Budget for projects in the Urban Security Initiative program will be used to deliver a comprehensive technical report and data package for the simulated bio-aerosol releases in NYC to stakeholders and brief mass transit systems across the Nation on findings and recommendations to inform emergency preparedness for a wide-area biological agent event. USI will also complete and transition key capabilities of the integrated underground, outdoor and indoor airflow and dispersion models to the DHS customer that include rapid plume viewer for mid-town Manhattan, source inversion and reach back tool to support estimate locations of a biological agent release, and modeling

architecture to evaluate and optimize sensor placements in a biosurveillance architecture and integrated model for the Nation's capital. The integrated models will deliver to CWMD the dispersion modeling capability and sensor siting tools necessary to support the BD21 system-of-systems program. In addition, funds will be used to conduct operational test and evaluation of COTS/GOTS biological identifier systems that are identified through a comprehensive analysis of alternatives. R&D, including DT&E, will be undertaken with potential candidate biological identifier systems should key performance parameters (KPPs) fall outside DHS Component requirements that are deemed critical for mission objectives and success in support of the CWMD BD21 program. For the subway testbed project, the Concept of Operations is built on a system-of-systems approach in an operational setting that is fully representative of a functional biosurveillance system. The system-of-systems approach includes networked sensors and evidence-based mitigation measures to shrink the potential geographic footprint of contamination and reduce the zone of the public health crisis. Funds in this subway testbed project will be used to design, construct, install and test an electrostatic spray knockdown system and other mitigation systems in an operational subway tunnel in order to mitigate the movement of a bioaerosol through the transit system and decrease the scale of contamination, and to complete expansion to a fourth contiguous station in the NYC mid-town transit corridor.

- **Impact:** A test bed in the operational mass transit environment will enable an assessment of the readiness of commercial and emerging chemical and biodetection technologies to reliably and continuously operate in the most challenging critical infrastructure system of a large metropolitan region, including effectiveness of 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 rapid situational awareness. The outcomes will be transferrable to other subway systems. The FY 2022 simulated bioagent attack will provide a realistic test of emerging detection technologies and validate models that integrate the underground, above ground and indoor environments in order to deliver a more accurate analysis of aerosol plume movement and affected populations. The simulated bioagent attack will enable evaluations by CWMD of the BD21 technology platform in an operational environment.

Type of Research

Developmental

Technical Readiness Level

The Urban Security Initiative builds upon previous R&D efforts and will focus on performing simulated bioagent releases in a complex urban environment, validate integrated urban dispersion models against environmental sampling data from the release; and evaluate handheld and stationary sensor technologies, networked sensor architectures; and the design and testing of plume mitigation measures in underground transit hubs in order to enable faster detection, response to and situational awareness of a CBR event. Technology evaluations began at TRL-4 and will end at TRL-7.

Transition Plans

S&T will transition CBR data and technical reports to users across the HSE, including CWMD, TSA, local and State authorities and response organizations, and to appropriate commercial customers via the Hazard Knowledge Center (HKC). Integrated airflow and dispersion models will be transitioned to CWMD. CBR sensor architectures for mass transit applications will be transitioned to local and State authorities that serve major urban centers (e.g., Chicago, Atlanta, Boston, Los Angeles, San Francisco Bay area, Washington, D.C.)

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Underground Transport Biodetection Testbed: Install, operate and evaluate at least four chemical or biological sensors.	FY 2020 Q1	FY 2021 Q4	7
Underground Transport Biodetection Testbed: Expand test bed to a second subway station.	FY 2020 Q3	FY 2021 Q4	7
Complete preparations and simulant production for major simulated dispersion of biological agent in New York City.	FY 2021 Q3	FY 2021 Q4	7
	FY 2022		
Install, operate and evaluate at least four chemical or biological sensors in NYC subway testbed.	FY 2021 Q1	FY 2022 Q2	7
Execute large-scale simulated bioagent release in New York City.	FY 2022 Q1	FY 2022 Q2	7
Complete validation of integrated urban airflow and dispersion models.	FY 2022 Q2	FY 2022 Q4	7
	FY 2023		
Deliver technical report and complete data package on NYC simulated bio-aerosol attack to NYC stakeholders and other major urban centers having mass transit systems.	FY 2022 Q2	FY 2023 Q2	7
Complete expansion of CBR testbed in NYC subway to a fourth station.	FY 2023 Q1	FY 2023 Q4	7
Transition a field-tested technology for mitigation of biological agent aerosols spread in the NYC and other underground subway systems.	FY 2023 Q1	FY 2023 Q4	7
Transition biological City Planner Resource (bioCPR) tool to FEMA.	FY 2018 Q3	FY 2023 Q4	7
Complete and deliver Technology Transition Products to DHS Component.	FY 2023 Q1	FY 2023 Q4	7

Detection Canine Program – This program conducts research to provide the tools, techniques and knowledge to inform and improve operational proficiency of the domestic detection canine. The Program's scope spans the entirety of the HSE, including DHS Components, State, local, tribal and territorial agencies that utilize detection canines across all threats.

Detection Canine Project

- **Problem:** Nationwide, DHS and the HSE have over 16,000 detection canine teams that lack the benefit of having a specific Federal program focused on providing critical tools, techniques, and knowledge to improve operational proficiency as well as better understand, train, and utilize these detection canine teams. Detection canines are often called to respond to new and emerging threats be it intelligence driven explosive materials or to a global human pandemic, like COVID-19. The decentralized employment of this resource requires a Federal core capability to inform the community and decision makers on canine capabilities and concepts of operations for this biological detector. Over the last 20 years, the demand for elite detection canines has increased while domestic supply has not kept pace. This has resulted in an increased reliance on foreign sourcing of detection canines and a subsequent reduction in the quality of the canines being offered for sale. This program provides a critical Federal focal point of knowledge and expertise to identify/address performance gaps in basic canine operations and emerging threat detection, effective/efficient canine training, and supply, to improve DHS (TSA, CBP, USSS, FPS & USCG) and HSE (State, Local, Territorial and Tribal) canine teams' ability to better protect the Homeland.

- **Solution:** The Detection Canine program serves as a trusted Federal focal point for expertise and knowledge sharing, to address customer requirements by understanding emerging threat detection performance; analyzing how threat concealment effects detection; and providing scientifically rigorous/statistically significant R&D and test & evaluation (T&E). The COVID-19 pandemic forged new partnerships with CWMD to identify key markers that could lead to the use of canines (and other detectors, like Nano sensors) to identify asymptomatic individuals infected with COVID-19. Discovery made though this R&D investment will work to inform processes that will significantly shorten the timeline to solutions to future outbreaks. The program has partnered with DHS partners and industry stakeholders to bring focus to the domestic detection canine supply challenge through FY 2022. The program established a breeding roadmap, which was endorsed by DHS Components and validated by a Breeding Working Group to integrate the best scientific practices in genetics, genomics, breeding, olfaction, behavior, training, and physiology and metrology to improve the mobile canine sensing platform. In FY 2021, the program's Breeding Consortium produced two litters of canines; over 80 percent of which were selected for advanced explosive detection training (over double the industry standard). In FY 2022, the output of this breeding consortium will be up to 50 candidate canines. The program has established core capabilities including odor chemistry expertise, breakthrough laboratory analysis capabilities, specialized T&E experts, and canine operations and training expertise to improve operational proficiency of DHS Component and State, local, tribal, territorial canine teams throughout the HSE.

- **Justification:** The FY 2023 Budget for this project will be used to execute ongoing research efforts into development of training tools that will ensure effective and efficient training of detection canine teams. These tools include, but are not limited to, nonhazardous explosive training aids and training aids reflecting concealed devices. Ongoing research also includes conducting odor generalization studies to reduce training burdens, performing field assessments to validate operational strengths and limits of the mobile canine sensing platform, and continue a pilot breeding consortium effort to improve the supply of domestic working dogs. In addition, funds will be used to expand efforts to continue scientifically validated canine mobile sensing technology for explosives detection, to be developed in collaboration with academia, that integrates best scientific practices in genetics, breeding, olfaction, behavior, training, physiology, and metrology.

- **Impact:** The Nation relies on the performance of detection canine teams every day, and this program allows them to do their job more efficiently and effectively thereby improving mission performance. A dedicated R&D office supports the expansion of domestic detection canine supply, but also the improved efficiency of production, which will substantially reduce dependence on foreign sources over time. The program establishes a domestic RDT&E focal point for detection canines which otherwise would not exist. This provides DHS and the HSE with a resource to fill critical gaps in canine training and mission performance, improve detection canine proficiency to more efficiently/effectively train and perform in operational environments, respond to emerging threats, to include infectious diseases, and address the growing threat and operational concerns of securing soft target venues and large public crowd events.

Type of Research

Applied and Developmental

Technical Readiness Level

The program began at TRL-4 and will end at TRL-7. This program's R&D efforts span applied research to technology demonstration. The application of analytical chemistry research to develop novel non-hazardous explosive training aids begin with material development (TRL-4) through developmental test and evaluation (TRL-7) leading to technology transition and commercialization is one specific example. Understanding the need to tie phenotypical traits with genetic markers that improve detection canine breeding, early learning and selection (TRL-4) are the building blocks of research that will form the base of an expansion of the domestic supply of high-quality detection canines. The program maintains enduring capabilities to respond to emerging threats and assess proficiency of the operationally fielded detection canine teams against these challenges (TRL 6-7).

Transition Plans

- Training Aids and Tools:
  - Complete the enhanced capability of a government laboratory to deliver non-hazardous peroxide based explosive training aids for government use at significant volume increase and cost reduction.
  - Complete transfer of non-hazardous, conventional base odor canine training aids through rigorous quality assurance testing.
  - Complete transfer of electronic test tool to TSA, FPS and USSS.
  - Deliver study on anti-static training aid containers for USSS.
- Operational Test and Evaluation (OT&E):
  - Inform TSA Passenger Screening Canine (PSC) Concept of Operations (CONOPS) with odor generalization studies.
  - Deliver PSC test results and recommendations for more efficient and effective operational testing practices in conjunction with the checkpoint system, including best practices in deployment configurations and basic training effectiveness and efficiency for the TSA PSC program.
  - Conduct Regional Explosives Detection Dog Initiative events to inform the HSE with validation of capabilities and areas for further focus for both R&D and operational training.
- Detection Canine Domestic Breeding Consortium Project:
  - Deliver analysis of phenotype and genotype study in support of Domestic Breeding Consortium Project.
  - Expand domestic detection canine supply infrastructure for the HSE.
  - Transition framework for increasing expanded domestic supply of detection canines.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Operational Test and Evaluation: Results from the Regional Explosives Detection Dog Initiative inform the HSE with validation of capabilities and areas for further focus for both R&D and operational training.	FY 2019 Q3	FY 2021 Q2	N/A
Detection Canine Domestic Breeding Consortium Project: Publish findings of working group of private/public/academia partners to determine ways to support decentralized, non-Federal domestic canine breeding capacity to produce high-quality explosives detection canines and modernize canine training standards.	FY 2018 Q2	FY 2021 Q3	N/A
Initiate Generalization Study Phase 2 addressing base odors for emerging threats that will reduce maintenance training burden and improve operational proficiency, enhancing training effectiveness/efficiency.	FY 2019 Q4	FY 2021 Q4	6
Report initial findings of Canine Decontamination & volatile organic compound analysis of COVID-19 biomarkers to inform detection modalities.	FY 2020 Q3	FY 2021 Q2	4
	FY 2022		
Evaluate/develop/refine CBP and Urban Search and Rescue team training aids to provide the most effective and efficient training tools and techniques to improve overall mission effectiveness.	FY 2021 Q2	FY 2022 Q3	6
	FY 2023		
Conduct initial general effectiveness assessments of TSA National Explosives Detection Canine Team Program's detection canine teams outside the aviation checkpoint and in relevant surface transportation venues.	FY 2022 Q1	FY 2023 Q2	6
Design and implement an independent covert assessment protocol for TSA's Passenger Screening Canines in the operational airport checkpoint.	FY 2022 Q3	FY 2023 Q3	6
Expand the development and deployment of targeted automated tools to conduct randomized test events for detection canine performance during training and operational scenarios.	FY 2021 Q4	FY 2023 Q1	7
Deliver study establishing best cognitive/behavioral predictors and traits for selection of successful detection canines; study will define quantitative measures for ideal explosives detection canines.	FY 2020 Q1	FY 2023 Q2	4
Conduct Phase IV parametric study of Person Borne Improvised Explosive Device (PBIED) detection canine use parameters for soft target/crowded place threats.	FY 2019 Q2	FY 2023 Q4	7
Deliver study that validates training aid signatures, evaluates surrogate training aids to address current/emerging threats, and uses explosives generalization research to reduce operational costs.	FY 2020 Q1	FY 2023 Q2	5

Opioid/Fentanyl Detection Program – This program will provide DHS Components and law enforcement partners with advanced, operationally effective detection capabilities to enable confident discovery and interdiction of opioids, and other narcotics, being trafficked across U.S. borders without disrupting the flow of legitimate commerce, as well as advanced analytic capabilities that that aid in the collection and correlation of complex evidence to be used for the prosecution and dismantling of the criminal networks responsible for distribution of illicit drugs.

Opioid/Fentanyl Detection Project

- **Problem:** The final report of the Commission on Combating Drug Addiction and the Opioid Crisis recognized challenges that limit DHS's ability to disrupt the flow of synthetic opioids, like fentanyl, that cross U.S. land, sea, and air borders, including international mail. The top challenges faced by DHS Components supported by this work, include the physical detection and interdiction of opioids, which can be trafficked in very small or dilute quantities, and the discovery and disruption of Transnational Criminal Organizations (TCOs)/Drug Trafficking Organizations (DTOs), criminal networks, and individuals who support illicit manufacturing and trafficking. DHS Components, and law enforcement partners, have identified critical needs for advanced technologies to aid in their missions to target, investigate, and dismantle illicit opioid and other narcotic trafficking into the United States.

- **Solution:** In coordination with DHS Components, S&T will develop a layered set of solutions, including detection hardware, fusion of sensor data, and advanced analytics, which can be deployed rapidly within existing operational environments. To enable agile and responsive support to DHS drug detection missions, S&T will pursue an iterative, integrated developmental approach and operational assessments. S&T will first make use of technologies, and then, where technologies do not exist, employ rapid prototyping of capabilities to fill operational needs. S&T will support ICE through development of analytics, such as deep learning algorithms for decision support, data visualization, and pattern recognition, to exploit available data (e.g., dark web commerce, cryptocurrency transactions) and fuse sensor information with other investigative holdings to discover and disrupt criminal networks and the activities they conduct. This program will prioritize development of capabilities to support continuity of the entirety of DHS and HSE counterdrug missions, regardless of changes in trafficking behaviors.

- **Justification:** The FY 2023 Budget for this project will be used to continue the development of advanced analytic capabilities and software tools to aid investigators in collection and analysis of evidentiary data to identify, dismantle, and prosecute criminal drug distribution networks. This funding will also be used to support transition and implementation of developed capabilities into ICE operational environments to support their efforts to combat drug trafficking.

- **Impact:** The growing opioid problem in the United States has been well documented in recent years and presents a significant challenge to DHS and the Homeland Security Enterprise. With the capabilities provided by this project, DHS Components and law enforcement partners will be equipped with advanced, operationally effective detection and investigative capabilities to enable confident discovery and interdiction of opioids, and other narcotics, and maximize the impact on disrupting drug trafficking into the United States.

Type of Research

Basic, Applied and Developmental

Technical Readiness Level

TRL varies for specific project activities between TRL-2 and TRL-7. This project's R&D efforts typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology is then adapted and validated in a laboratory or relevant environment (TRL-4/5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition. Examples from the R&D milestones detailed below:

- Developed advanced analytical tools to increase probability of interdiction (TRL-4).
- Initiate development of opioid-related investigative and training analytical capabilities (TRL-5/6).

Transition Plans

Within the next three years, S&T will:

- Complete and transition technical report on emerging forensics and investigative methods to DHS Components and law enforcement partners.
- Validate and transition capabilities to DHS Components for implementation in operational environments in accordance with roles and responsibilities documented in the transition plan agreement
- Continue to transition test, evaluation, and assessment reports on identified advanced capabilities to support DHS Counter-drug missions.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Perform limited operational evaluation of selected technologies.	FY 2020 Q3	FY 2021 Q1	N/A
Develop process models to enable Alternatives Analysis and recommendations for integrated systems-of-systems.	FY 2020 Q2	FY 2021 Q2	N/A
Initiate development of opioid-related investigative and training analytical capabilities.	FY 2021 Q1	FY 2021 Q2	5-6
Develop narcotics anomaly detection algorithms for non-intrusive inspection systems.	FY 2020 Q4	FY 2021 Q3	7
Deliver report on emerging, next generation detection technologies and methods to meet anticipated future requirements and needs.	FY 2021 Q3	FY 2021 Q3	2
	FY 2022		
Deliver opioid-related investigative training for law enforcement professionals.	FY 2021 Q4	FY 2022 Q3	6-7
Develop data-handling methods (e.g., ingest, clean, scale, and normalize) to enable cross-cutting analysis of investigative holdings.	FY 2021 Q4	FY 2022 Q3	6-7
Develop Quality of Evidence prototype analytics application.	FY 2022 Q1	FY 2022 Q4	6-7
Complete data collection campaign for COTS instruments and assays to support upgraded fentanyl/fentanyl analogues reference libraries.	FY 2022 Q1	FY 2022 Q4	6-7
Complete technical analysis of capabilities and transition the results to DHS Components in an actionable final report.	FY 2021 Q3	FY 2022 Q2	N/A
	FY 2023		
Deliver technical report on emerging forensics and investigative methods.	FY 2023 Q2	FY 2023 Q2	N/A
Develop Value of Target (VoT) prototype analytics application.	FY 2022 Q4	FY 2023 Q3	5-6
Complete data engineering of investigative holdings to support forensic intelligence fusion proof of concept demonstration.	FY 2023 Q1	FY 2023 Q4	N/A
Deliver report on the performance assessment of COTS instruments and assays equipped with upgraded fentanyl/fentanyl analogues reference libraries.	FY 2023 Q4	FY 2023 Q4	7

Counter Terrorist Thrust Area
Research and Development

Technology Readiness Level Exhibit

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
Counter Terrorist Thrust Area	$56,542	$69,361	$60,983

R&D Thrust Area Description

COUNTER TERRORIST THRUST AREA: 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 and/or illicitly move weapons, dangerous goods, and contraband. It also includes providing threat assessments of high-consequence attack methods such as CBE that terrorists may use to attack the Nation.

COUNTER TERRORIST THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
Total – Counter Terrorist Thrust		**$56,542**	**$69,361**	**$60,983**
Emerging Technologies		**-**	**$750**	**$750**
	Emerging Technologies	-	$750	$750
Explosives Threat Assessment		**$19,243**	**$25,175**	**$20,440**
	Aircraft Vulnerability	$2,500	$3,000	$3,000
	HME Identification, Detection and Mitigation (HEID&M)	$7,292	$6,560	$6,560
	Technology Explosives Assessment	$9,451	$15,615	$10,880
Probabilistic Analysis of National Threats, Hazards and Risks (PANTHR)		**$37,298**	**$43,436**	**$39,793**
	Agricultural Threat Characterization (AgTC)	-	-	$500
	Biological Threat Characterization (BTC)	$18,650	$20,663	$18,650
	Chemical Threat Characterization (CTC)	$5,823	$6,523	$4,393

COUNTER TERRORIST THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
	Hazard Knowledge Center (formerly Biodefense Knowledge Center)	$165	$400	$400
	Tools for Integrated Evaluation of Risk (TIGER)	$12,660	$15,850	$15,850

Emerging Risks and Technologies Program – This program represents a partnership led by S&T, Policy and DHS Components to develop and sustain a risk assessment methodology that identifies emerging risks, including emerging technology, and incorporates CISA systemic risks and FEMA natural disaster risks, to homeland security missions in the next 3-5 years. The approach leverages internal subject matter assessments and engages interagency, academic, industry and foreign partners to conduct assessments, studies and analyses to identify and prioritize emerging risks and technologies relative to future mission, including determinations of adversarial use and representing opportunities to use and opportunities to mitigate the adverse impacts of emerging technologies to protect the Nation.

Emerging Risks and Technologies

- **Problem:** Staying ahead of emerging risks, including adversarial use of emerging technology, by providing with a process for identifying, contextualizing and prioritizing emerging risks and technical expertise that helps the Secretary, Components, and S&T identify mitigation, exploitation, and response. In order to position DHS to both leverage emerging technologies and defend against emerging risks, the trends, risks and opportunities must be identified as far in advance as possible through partnership with government, private sector and partners in the Defense and Intelligence communities. The HSE must proactively identify critical emerging risks and technologies in order to effectively leverage or defeat them in defense of the homeland.

- **Solution:** This program executes research in order to establish a comprehensive, repeatable process for identifying emerging risks (including emerging technologies), prioritizing which risks have the highest probability of impact to the Nation, and subsequently informing relevant strategies, policies, or investments. It will refine and deliver a process to identify emerging risks.

- **Justification:** The FY 2023 Budget for this project will be used to augment the emerging risk assessment methodology across the HSE to deliver and implement a process for horizon scanning of emerging risks to identify critical gaps with, and bring focus to, emerging initiatives.

- **Impact:** DHS will use this research activity as a driver for conducting emerging risk assessments. Products from this R&D activity will be used by DHS PLCY and the Components to drive prioritization of risk and response across critical missions of the Department. S&T will use the products of this activity, along with Department and Component priorities as a key demand signal for the development of focused research and development programs. Results from this activity will be used to communicate the posture of homeland security emerging risks with the interagency, academic, industry and international community to drive and focus key relationships that improve DHS leverage of external investments to mitigate risks and appropriately seize future mission opportunities to protect the homeland.

Type of Research
Developmental

Technical Readiness Level
This project produces a repeatable process for DHS to identify emerging risks.

Transition Plans
Deliver 1 risk assessment to inform DHS policy development in emerging technologies.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
N/A	N/A	N/A	N/A
	FY 2022		
Develop 1 risk assessment to inform DHS policy development in emerging technologies.	FY 2022 Q1	FY 2022 Q4	7
	FY 2023		
Develop an assessment of an emerging technology on the HSE.	FY 2023 Q1	FY 2023 Q4	7

Explosives Threat Assessment Program – 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:** When designing screening technologies for the detection of explosives, whether on passengers, in checked bags, or in air cargo, it is essential to first determine the effects that different explosive threats can cause to a variety of commercial aircraft. The vulnerability of commercial aircraft types to the broad range of conventional and emerging improvised explosive device threat configurations is not thoroughly understood or characterized. This includes the blast effects vulnerability of relatively new composite aircraft structures currently entering the civil transport fleet. The vulnerability assessment data will support TSA in the development and update of explosive detection standards.

- **Solution:** S&T is working to identify the minimum size of the explosives threat that would result in catastrophic aircraft loss. S&T is also developing blast effects measurement testing capability to measure and characterize explosive performance and blast effects and derive explosive equivalence factors relative to standard explosive. S&T continues to work to develop commercial aircraft blast mitigation technology that will provide protection to commercial aircraft. In addition to live fire explosive testing capability S&T is developing commercial aircraft blast responses modeling, simulation and analysis tools and capability. S&T is also developing emerging explosive threats rapid response and assessment capability for commercial aircraft.

- **Justification:** The FY 2023 Budget for this project will be used to further develop and report commercial composite aircraft explosive vulnerability refined assessment, validate high fidelity modeling, simulation and analysis capability of blast responses of commercial aluminum and composite aircraft and develop fast running empirical engineering analysis tool for blast responses of commercial aluminum and composite aircraft.

- **Impact:** Commercial aircraft vulnerability data collected under this project will be used by TSA to validate and refine explosives detection standards. TSA will ensure that explosive detection system threat mass detection thresholds are sufficient to prevent introduction of explosive threats on board the aircraft that would otherwise result in catastrophic aircraft loss if detonated. 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 timely and pertinent information on commercial aircraft vulnerability to emerging terrorist-based explosive threats and assist TSA in preparing responses to mitigate or counter the explosive threats.

Type of Research

Applied and Developmental

Technical Readiness Level

TRL varies for specific project activities. Project develops various knowledge and technology (software and hardware) products starting from TRL-3 – TRL-5 and ending in TRL-6 – TRL-7 before product transition.

Transition Plans

Primarily a knowledge-developing effort, the impact of the aircraft vulnerability project will be reliant on the project's capacity for transitioning knowledge products, analysis tools, models and database, technology products, and capabilities developed to primary customers, TSA RCA, S&T/OSE/TCD, stakeholders and end users.

- Completed sufficient conventional aluminum airframe vulnerability testing to update commercial aircraft vulnerability assessment and deliver updated vulnerability summary report to TSA by FY 2021 Q4.
- Delivered explosive vulnerability preliminary estimates for wide body composite commercial aircraft to TSA by FY 2021 Q3.
- Delivered recommendations on explosive equivalence (in reference to spherical C-4 baseline threat) approach for explosive damage and vulnerability of commercial aircraft to TSA by FY 2021 Q4.
- Complete the development and deliver to the TSA the pressure film sensors for blast overpressure measurement on aircraft fuselage structures by FY 2022 Q3.
- Develop modeling, simulation and analysis capability of blast responses of commercial composite aircraft and develop the capability for the TSA by FY 2022 Q4.
- Further validate high fidelity modeling, simulation and analysis capability of blast responses of commercial aluminum and composite aircraft by FY 2023 Q4.
- Deliver refined explosive vulnerability assessment for commercial wide body composite aircraft by FY 2023 Q4.
- Develop and deliver beta version of fast running empirical engineering analysis tool for blast responses of commercial aluminum and composite aircraft by FY 2023 Q4.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Complete conventional (e.g., aluminum structures) airframe vulnerability testing and deliver updated vulnerability report to TSA.	FY 2020 Q1	FY 2021 Q4	6
Develop and report preliminary explosive vulnerability estimates for wide body composite composition structures commercial aircraft.	FY 2021 Q1	FY 2021 Q3	6
Develop and report preliminary commercial aircraft structural Damage Explosive Equivalence (in reference to spherical C4 explosive baseline threat) recommendations.	FY 2021 Q1	FY 2021 Q4	6
	FY 2022		
Complete development of pressure film sensor for blast overpressure measurement and deliver to TSA.	FY 2019 Q1	FY 2022 Q3	6
Complete development of modeling and simulation capability of blast responses of composite aircraft panels and deliver to TSA.	FY 2019 Q4	FY 2022 Q4	6
	FY 2023		
Further validate high fidelity modeling, simulation, and analysis capability of blast responses of commercial aluminum and composite aircraft.	FY 2023 Q1	FY 2023 Q4	7
Deliver refined explosive vulnerability assessment for commercial wide body composite aircraft.	FY 2021 Q1	FY 2023 Q4	6
Develop and deliver beta version of fast running empirical engineering analysis tool for blast responses of commercial aluminum and composite aircraft.	FY 2020 Q2	FY 2023 Q4	6

HME Identification, Detection and Mitigation (HEID&M)

- **Problem**: The Homemade Explosives (HME) threat is persistent and continuously evolving for many DHS Components, especially TSA. Detonation of an HME device presents an ongoing threat to the public and the homeland, in transportation as well as public places. The results of the HEID&M program research will directly support TSA in providing a secure aviation.

- **Solution:** The HEID&M project's primary mission is to mitigate against the effects of HME/Improvised Explosive Device (IED)-borne terrorist attacks. HEID&M leverages capabilities to advance the mission throughout its lifecycle, including:
  - Coordinating technical input from across the domestic and international community to inform standards, rulemaking, and harmonization activities.
  - Coordinating and conducting applied research, development, integration, and certification testing for the detection and mitigation of HME threats, including the management and utilization of laboratory capabilities.
  - Defining the needs and requirements for homemade explosive characterization to inform risk response and posture.
  - Performing explosive vulnerability assessments and developing testing tools and methods to inform future needs.
  - Supporting training requirements.

  The project provides a path forward for HME threat solutions, concentrating on four focus areas: rulemaking and certification; testing and evaluation procedures for HME threat materials and devices in association with Transportation Security Laboratory (TSL) managed facilities; risk response and assessment; and training and the development of tools with the ability to preempt, detect, or mitigate HME threat impacts.

- **Justification:** The FY 2023 Budget for this project will be used to continue to conduct assessment of the HME threat including HME performance characterization, collecting HME characterization data for input to detection technologies, and disseminating that information to other government partners. In addition, funds will be used to complete the second iteration of the risk assessment tool bringing it to full operation, as well as develop a Threat Article tool for TSA operational and inspection units.

- **Impact:** The HEID&M project results have allowed TSA to develop and field more effective transportation security equipment, provide better training to front line personnel, and validate and monitor continuing and emerging threats. Additionally, the project provides and transitions products that are essential to the mission of several other key DHS Components including CISA, USSS, and CBP. The tools, modeling and risk mitigation projects undertaken by the HEID&M project are technologies and knowledge products that protect national security and resiliency.

Type of Research
Developmental

Technical Readiness Level
TRL varies for specific project activities between TRL-6 and TRL-7. This project's R&D efforts include the collection of data on adapted commercial technology for developmental test and evaluation as well as intelligence based assessments (TRL-6); piloting prototypical test articles, training, information databases, and procedures (starting at TRL-6 and ending at TRL-7); as well as the transitioning of program developed standards for evaluation of blast professionals (TRL-7).

Transition Plans
Deliver two series of multi-day customized HME Training courses to the TSA end-user. Deliver a final report to TSA Special Operations Division's Red Team in support of TSA's access control testing detailing the results of the indexing study. Transition 6 characterization reports from CONUS/OCONUS DSARM prioritized list to the TSA to improve security effectiveness and operational efficiency via selection and implementation against highest risk threats. Deliver a preliminary FOUO version of Homeland Explosive Consequence and Threat (HExCAT) consequence modeling tool to one DHS Component. Deliver a defensible prioritized list of threats to TSA's Office of Requirements and Capabilities Analysis for VBIED and soft target CONOPS.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Transition chemical Region of Responsibility (ROR) to TSA.	FY 2020 Q1	FY 2021 Q4	7
Delivered first index testing baseline to TSA.	FY 2020 Q1	FY 2021 Q1	7
Transition 10 RORs from Continental United States (CONUS) Detection Standards Analysis and Revision Methodology (DSARM) prioritized list to the TSA to improve security effectiveness and operational efficiency via selection and implementation against highest risk threats.	FY 2020 Q1	FY 2021 Q4	7
	FY 2022		
Deliver 10 characterization reports on explosives and chemicals of interest to TSA.	FY 2022 Q1	FY 2022 Q4	7
Develop a skeleton report and data repository for explosives programs.	FY 2022 Q2	FY 2022 Q4	7
Deliver characterization report of GFR precursors to TSA.	FY 2022 Q1	FY 2022 Q4	7
Provide two multi-day Homemade Explosive courses to TSA customer.	FY 2019 Q4	FY 2022 Q4	7
	FY 2023		
Deliver two series of multi-day customized HME training courses to the TSA end user.	FY 2022 Q3	FY 2023 Q2	6
Deliver a final report to TSA Special Operations Division's Red Team in support of TSA's access control testing detailing the results of the indexing study.	FY 2022 Q2	FY 2023 Q3	7
Deliver a preliminary FOUO version of Homeland Explosive Consequence and Threat (HExCAT) consequence modeling tool to one DHS Component.	FY 2022 Q2	FY 2023 Q4	6
Define the structure of an updated risk analysis tool for explosive threats to program stakeholders.	FY 2023 Q1	FY 2023 Q4	6
Transition a series of characterization reports from the prioritized list to the TSA and other components to improve security effectiveness and operational efficiency via selection and implementation against highest risk threats.	FY 2020 Q1	FY 2023 Q4	7
Deliver a defensible prioritized list of threats to TSA's Office of Requirements and Capabilities Analysis for VBIED and soft target CONOPS.	FY 2021 Q4	FY 2023 Q1	7

Technology Explosives Assessment

- **Problem**: The TSL conducts T&E of all explosives and threat detection equipment utilized by TSA and across the HSE, including systems installed at commercial airports. Explosive threats rapidly evolve, and emergent threats must be quickly and accurately characterized so that screening equipment can be upgraded to reliably detect these new threats. New more cost-effective screening equipment also must be validated against both conventional and emerging threats.

- **Solution:** A network of laboratory capabilities are required to quickly and accurately characterize emerging threats and to develop cost-effective tools and T&E methods appropriate to analyze threats with modern screening technologies. TSL coordinates this capability through the management of its core laboratories:
  - The TSL at the William J. Hughes Technical Center (WJHTC), Atlantic City, NJ characterizes explosive threats and develops test articles, test methodologies, and quality control.
  - The Tyndall Reactive Management Group facility on Tyndall AFB, Florida houses a collection of specialized data for HME.
  - At the FBI TEDAC Improvised Explosives Detection and Synthesis (TIEDS) Center at Redstone Arsenal, Alabama (AL), S&T integrates the latest explosive characterization to evaluate new threats on transportation security equipment (TSE).

- **Justification:** The FY 2023 Budget for this project will be used to develop simulant validation methods for machine learning algorithms; develop drug detection methods and test articles; expand scale up procedures for HME materials; develop new simulants for millimeter wave (MMW) and x-ray technologies; develop testing methodologies and test articles for cargo skid screening systems; and conduct test and evaluation activities in support of the HSE and provides for core laboratory capabilities in support of these applied research areas, as well as support to other functions within the TSL mission.

- **Impact:** These capabilities enable quick, cost-effective, and accurate T&E of TSE in order to validate conformance with TSA requirements for existing and emerging threats. These capabilities also allow TSL to perform RDT&E that drives innovation and fosters the development of new technologies for the detection of emerging threats and other contraband (e.g., opioids).

Type of Research
Applied

Technical Readiness Level
The Technology Explosives Assessment provides tools for testing and evaluation and can be considered steady state TRL-3.

Transition Plans

The Technology Explosives Assessment capabilities enables and facilitates the production of products through applied research activities, but do not, in general, produce products for external customers. The applied research customers within TSA, Developmental T&E and Independent T&E, work closely with staff to ensure the timely release of testing methods, standards, and quality control procedures necessary to support T&E.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Develop drug detection methods and test articles for trace detection and quality control.	FY 2021 Q1	FY 2021 Q4	3
Develop new HME simulants for MMW and X-ray technologies for each emerging threat added to requirements for testing.	FY 2021 Q1	FY 2021 Q4	3
Perform Region of Responsibility (ROR) measurements for new HME threats.	FY 2021 Q1	FY 2021 Q4	3
Develop testing methodologies and test articles for cargo skid screening systems.	FY 2021 Q1	FY 2021 Q4	3
Complete data collection activities for threat materials in support of test and evaluation.	FY 2021 Q1	FY 2021 Q4	3
	FY 2022		
Develop validation methods and test tools for machine learning algorithm used in MMW and X-ray technologies.	FY 2021 Q1	FY 2022 Q4	3
Develop texture measurement tools and simulants with appropriate texture properties for X-ray technologies.	FY 2022 Q1	FY 2022 Q4	3
Develop new HME simulants for MMW and X-ray technologies for each emerging threat added to requirements for testing.	FY 2022 Q1	FY 2022 Q4	3
Expand scale up procedures for new HMEs for test and evaluation.	FY 2022 Q1	FY 2022 Q4	3
	FY 2023		
Continue development of validation methods and test tools for machine learning algorithm used in MMW and X-ray technologies.	FY 2023 Q1	FY 2023 Q4	3
Continue development of texture measurement tools and simulants with appropriate texture properties for X-ray technologies.	FY 2023 Q1	FY 2023 Q4	3
Continue development of new HME simulants for MMW and X-ray technologies.	FY 2023 Q1	FY 2023 Q4	3
Expand scale up procedures for new HMEs for test and evaluation.	FY 2023 Q1	FY 2023 Q4	3
Complete data collection activities for threat materials in support of test and evaluation.	FY 2023 Q1	FY 2023 Q4	3

Probabilistic Analysis of National Threats, Hazards and Risks (PANTHR) Program – This program addresses biological, chemical and hazard knowledge gaps to inform defensive strategies that provide accurate, useful, and defensible knowledge and tools to stakeholders in time to enable risk-informed decision-making pertinent for defense against Weapons of Mass Destruction (WMD) threats to the Homeland. PANTHR supports a full spectrum of knowledge products (e.g., risk platforms, scientific reports/studies, etc.) that are programmatically housed within its Hazard Knowledge Management System which functions as both the internal information archive and single point source for disseminating chemical, biological, radiological, nuclear (CBRN) hazard information across the HSE. The program will execute CBRN risk analysis capabilities to support national assessments, characterize biological and chemical hazards, to support HSE biological and chemical defense, and coordinate hazard awareness and characterization activities across S&T, DHS Components, and the HSE. The PANTHR program is executed in close coordination with the Countering Weapons of Mass Destruction (CWMD) Office through a request memorandum for CBRN hazard characterization and risk assessment from CWMD to S&T, as well as Operating Principles to guide mission management. Such program capabilities are accomplished through executing PANTHR's projects, containing Hazard Knowledge Center (HKC), Biological Threat Characterization (BTC), Chemical Threat Characterization (CTC), Agricultural Threat Characterization (AgTC), and Tools for Integrated Evaluation of Risk (TIGER). These programmatic capabilities will deliver operationally relevant impacts by increasing awareness, improving understanding, and enabling more effective decision-making regarding current and future chemical, biological, and agricultural hazards through tailored products, tools, technologies, and information.

Agricultural Threat Characterization (AgTC)

- **Problem:** DHS Components and the agricultural defense community require a capability to identify, evaluate, and characterize biological and chemical threats and vulnerabilities to the United States agricultural sector. Enhanced characterization data and analysis provide decision-makers with the knowledge products necessary to make data-informed assessments of potential risks to U.S. agriculture. Those defending agriculture lack critical data on certain characteristics of many threat agents. Scientific analysis is required to better inform investments that prevent, prepare for, respond to, and recover from potential threat events.

- **Solution:** AgTC activities conduct foundational research on traditional, new, and emerging biological and chemical threat agents. The knowledge products (technical reports) will support the development and validation of required analytic methods on the fundamental properties of hazardous agents, materials, and related technologies to support hazard awareness and the development of strategies. This advanced laboratory and field research will provide critical empirical data and insight on the properties of the highest risk threats and the hazards they pose to the agricultural sector. Knowledge products will be made available to DHS Components and the U.S. Chem/Biodefense community and will support operational elements in planning for and responding to natural and/or intentional events or disease outbreaks to prevent, prepare for, respond to, and recover from incidents.

- **Justification:** The FY 2023 Budget for this project will be used to enable a critical capability by executing characterization research at Plum Island Animal Disease Center (PIADC), other National Laboratories, and/or with industry partners to fill critical knowledge gaps on agricultural hazards and support sector risk assessments. The scientific data generated from this program will be provided to various stakeholders across the HSE to inform an array of activities such as hazard modeling for operational planning, medical countermeasure development, and policy development. AgTC will improve the preparedness of the USG for agricultural defense by supporting efforts to characterize traditional, emerging, and advanced chemical and biological hazards to the Nation.

- **Impact:** AgTC activities establish and leverage robust science-based capabilities to provide DHS with data and knowledge products which improve pre-event planning, event-specific operational response, and strategic Chem/Biodefense preparedness decisions. The data, analysis, and information generated will improve decisions, policies, and activities designed to prevent, protect, prepare, mitigate, respond, and recover from chemical or biological events. AgTC transitioned knowledge products and capabilities are important for effective preparedness and response to current and future agricultural threats will inform national homeland defense recovery activities to mitigate the impact of an event on U.S. agriculture.

Type of Research

Applied

Technical Readiness Level

AgTC provides tools for testing and evaluation that are TRL-3. The AgTC project executes laboratory or field research on agricultural hazards to address critical knowledge gaps and to inform requirements, mission assessments and operational plans. Activities are initiated based on stakeholder (e.g., DHS Components, HHS, DOD) needs. This research requires appropriately accredited facilities to support agricultural hazard research.

Transition Plans

AgTC will regularly deliver/transition the knowledge and insight produced by laboratory studies through reports delivered to the S&T HKC. These reports are shared with the HSE, including the Intelligence Community and the DOD, through the HKC's Hazard Knowledge Management System (HKMS) and other information portals. AgTC 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. The AgTC reports and knowledge products enable decision makers to appropriately prioritize agricultural defense spending on CONOPS, training, and research and development acquisition programs impacting billions of dollars of government spending.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
N/A	N/A	N/A	N/A
	FY 2022		
N/A	N/A	N/A	N/A
	FY 2023		
Develop/execute research studies to fill critical knowledge gaps on agricultural hazards based on priorities identified in risk assessments, collaboration with DHS Components, and PANTHR working group.	FY 2023 Q1	FY 2023 Q4	3
Conduct AgTC Projects execution, next year planning, and Year Project (portfolio) Review.	FY 2023 Q1	FY 2023 Q4	3
Transition at least one knowledge product resulting from agricultural threat studies to DHS Components and the agricultural defense community.	FY 2023 Q1	FY 2023 Q4	3

Biological Threat Characterization (BTC)

- **Problem:** DHS Components and the biodefense community writ large lack critical data on certain characteristics of many biological threat agents, as well as the impact of technological advances on those characteristics. Improved data on these characteristics enables Components to confidently predict the consequences or risk of a biological attack involving a given agent on the United States. In turn, these analyses allow decision-makers to effectively prioritize biodefense investments in order to prevent, prepare for, respond to, and recover from such an event. Further, this data is needed to define performance requirements for defensive countermeasures (e.g., detectors, personal protective equipment, and operational protocols) in order to ensure that the developed solutions mitigate hazards posed by biological threat agents.

- **Solution:** BTC activities provide knowledge products (technical reports) that are generated through conducting foundational research on traditional, new, and emerging biological threat agents, including development and validation of required analytic methods on the fundamental properties of hazardous biological agents, materials, and related technologies in order to support hazard awareness and the development of strategies. These rigorous laboratory experimentations will provide critical empirical data and insight on the properties of highest risk biological threat agents and the hazards that they pose. Knowledge products are made available to DHS Components and the U.S. biodefense community in order to support operational elements for use in planning for and responding to natural and/or intentional disease outbreaks to prevent, prepare for, respond to, and recover from incidents involving their use. BTC activities are executed in coordination and collaboration with the Hazard Awareness and Characterization Technology Center (HAC-TC) and the National Biodefense Analysis and Countermeasure Center (NBACC).

- **Justification:** The FY 2023 Budget for this project will be used to enable a critical capability by executing characterization research at the NBACC, National Laboratories, and industry partners to fill critical knowledge gaps on biological hazards and support enduring biological risk assessments. This scientific data generated from this program is provided to various stakeholders across the HSE to inform an array of activities such as hazard modeling for operational planning, medical countermeasure development, policy development. BTC will greatly improve the USG biodefense preparedness by supporting efforts to characterize traditional, emerging, enhanced, and advanced biological hazards to the Nation.

- **Impact:** BTC activities establish and leverage innovative science-based capabilities to provide DHS with data and knowledge products which improve pre-event planning, event-specific operational response, and strategic biodefense preparedness decisions. The data, analysis, and information generated will improve decisions, policies, and activities designed to prevent, protect, prepare, mitigate, and respond, recover from to biological events. BTC transitioned knowledge products and capabilities required for effective preparedness and response to current and future biological threats will inform national homeland defense recovery activities to mitigate the impact of a biological attack on the Homeland. In FY 2021, BTC executed high impact research to directly address critical knowledge gaps related to SARS-CoV-2 to support the Homeland, such as virus stability on surfaces, transmissibility of virus in aerosols, and of simulated sunlight to inactivate the virus.

Type of Research
Applied

Technical Readiness Level
BTC provides tools for testing and evaluation that are TRL-3. The BTC project executes laboratory research on biological hazards in order to address critical knowledge gaps to inform requirements, mission assessments and operational plans. Activities are initiated based on stakeholder (DHS Components, HHS, DOD, etc.) needs. This research requires appropriately accredited facilities to support biological hazard research.

Transition Plans
BTC regularly delivers/transitions the knowledge and insight produced by laboratory studies through reports delivered to the S&T HKC. These reports are shared with the HSE through the HKC's Biodefense Knowledge Management System and other information portals. BTC 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. The BTC reports and knowledge products enable decision makers to appropriately prioritize biodefense spending on medical and non-medical countermeasure acquisition programs impacting billions of dollars of Government spending.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Conduct BTC Projects execution, next year planning, and Year Project (portfolio) Review.	FY 2021 Q1	FY 2021 Q4	3
Transition at least four (4) knowledge products resulting from biological threat agent studies to DHS Components and the biodefence community.	FY 2021 Q1	FY 2021 Q4	3
Contribute priorities to the NBACC Annual Plan and execute approved plan (*aligned with NBACC's contract performance year)*.	FY 2020 Q4	FY 2021 Q2	3
Develop research studies to fill critical knowledge gaps on biological threat agents based on prioritization of priorities received and/or identified from PANTHR-TIGER, DHS Components and/or BTC working group.	FY 2021 Q1	FY 2021 Q4	3
	FY 2022		
Develop/execute research studies to fill critical knowledge gaps on biological threat agents based on priorities identified in collaboration with DHS Components and PANTHR working group.	FY 2022 Q1	FY 2022 Q4	3
Transition at least four (4) knowledge products resulting from biological threat agent studies to DHS Components and the biodefence community.	FY 2022 Q1	FY 2022 Q4	3
Conduct BTC Projects execution, next year planning, and Year Project (portfolio) Review.	FY 2022 Q1	FY 2022 Q4	3
Contribute priorities to the NBACC Annual Plan and execute approved plan (*aligned with NBACC's contract performance year)*.	FY 2021 Q4	FY 2022 Q2	3
	FY 2023		
Develop/execute research studies to fill critical knowledge gaps on biological threat agents based on priorities identified in risk assessments, collaboration with DHS Components, and BTC working group.	FY 2023 Q1	FY 2023 Q4	3
Contribute priorities to the NBACC Annual Plan and execute approved plan (*aligned with NBACC's contract performance year)*.	FY 2022 Q4	FY 2023 Q2	3
Conduct BTC Project execution, next year planning, and Year Project (portfolio) review.	FY 2023 Q1	FY 2023 Q4	3
Transition at least four (4) knowledge products resulting from biological threat agent studies to DHS Components and the biodefence community.	FY 2023 Q1	FY 2023 Q4	3

Chemical Threat Characterization (CTC)

- **Problem:** DHS Components and the chemical defense community have a need for a capability to identify, assess, and characterize chemical threats and vulnerabilities in the United States. Analyses allow decision-makers to effectively prioritize chemical-defense investments in order to prevent, prepare for, respond to, and recover from such an event. The community lacks critical data on certain characteristics of many chemical threat agents, as well as the impact of technological advances on those characteristics, and it requires analysis capabilities to be able better inform decision makers to provide defensible recommendations on chemical defense investments to the HSE.

- **Solution:** CTC provides chemical hazard analysis and threat characterization as well as chemical surveillance, detection, modeling and simulation. Through the Chemical Security Analysis Center (CSAC), CTC develops and maintains science-and technology-based quality assured information capabilities for acquiring, storing, indexing, evaluating and making strategically available cheminformatic data, technical reports and other knowledge products. CTC in coordination with the HAC-TC and collaboration with CSAC provides knowledge products (technical reports) that are generated through conducting foundational research on traditional, new, and emerging chemical threat agents. This includes development and validation of required analytic methods on the fundamental properties of hazardous chemical agents, materials, and related technologies in order to support hazard awareness and the development of chemical defense strategies. Knowledge products are made available to DHS Components and the U.S. chemical defense community and support operational elements nationwide. CTC provides the critical science and information that decision-makers rely upon to best prevent, prepare for, respond to, and recover from intentional or accidental chemical incidents.

- **Justification:** The FY 2023 Budget for this project will be used to enable a critical capability by providing chemical hazard analysis and hazard characterization as well as chemical surveillance, detection, modeling, and simulation. CSAC provides 24/7 response and technical assistance to the HSE, including modeling and simulation, characterization of current and emerging chemical threats, bulletins, threat scenario planning support to Federal and State agencies, and chemical threat knowledge tools that support operational components as well as the HSE. CSAC also provides a standing capability to rapidly execute high-priority and surge requirements to quickly respond to national emergencies and incidents involving chemical threats. The scientific data generated by CTC is provided to various stakeholders across the HSE to inform an array of activities such as hazard modeling for operational planning, medical countermeasure development, chemical threat detection and interdiction, safety and security of the Nation's food supply, and policy development will greatly improve the USG's preparedness and chemical defense capabilities by researching and characterizing traditional, emerging, enhanced, and advanced chemical hazards to the Nation.

  CSAC develops and maintains chemical hazard characterization analysis capabilities which provides the HSE with information needed to make science-based, defensible decisions regarding Homeland defense and recovery. CSAC updates toxic syndromes, ensuring knowledge products are based on the results of the most recent science and technology advancements.

- **Impact:** CTC activities provide DHS with data and knowledge products which improve pre-event planning, event-specific operational response, and strategic chemical defense preparedness decisions. The data, analysis, and information generated will improve decisions, policies, and activities designed to prevent, protect, prepare for, mitigate, respond to, and recover from chemical events. Careful analyses based on quality data and reasoned assumptions will more efficiently focus homeland security investments. CSAC is the Nation's only Federal studies, analysis, and knowledge management center for assessing the threat or hazard associated with an accidental or intentional large-scale chemical event or chemical terrorism event in the United States. CSAC serves key customers such as CISA, USSS, CWMD, TSA, and I&A within DHS, as well as several interagency partners. CTC coordinates and collaborates with other entities within the USG, industry and academia to maximize its ability to generate and utilize fundamental studies and analyses. CTC transitioned knowledge products and capabilities required for effective preparedness and response to current and future chemical threats will inform national homeland defense recovery activities to mitigate the impact of a chemical attack on the Homeland.

Type of Research

Applied and Developmental

Technical Readiness Level

This project's activities span TRL-3 to TRL-7 and provide capabilities outside of technology development. The CTC project provides decision analytics support and executes laboratory research (TRL-3) on chemical hazards in order to address critical knowledge gaps to inform requirements, mission assessments and operational plans. Activities are initiated based on stakeholder (DHS Components, HHS, DOD, etc.) needs. CTC products and information tools (TRL-7) inform decision makers on chemical hazards.

Transition Plans

CTC knowledge products (e.g., chemical-related tailored assessments) and insights produced by laboratory studies will be delivered via reports, presentations and tools that are directly transitioned to DHS Components, HSE stakeholders and international partners through the established CSAC processes as well as through the PANTHR Hazard Knowledge Center and other information portals such as HSIN. CSAC knowledge products (e.g., chemical-related tailored assessments) will be developed in accordance with the requirements (scope, content, timeline) of the stakeholder requesting the product.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Complete and launch CARD v11.0	FY 2021 Q1	FY 2021 Q2	7
Complete and launch CARD v12.0	FY 2021 Q3	FY 2021 Q4	7

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Using the validated CSAC developed chemical source term tool, conduct studies to design and evaluate new vapor detection strategies.	FY 2021 Q1	FY 2021 Q4	3
Update Non-Traditional Agent (NTA) Library to include advanced technical data matrices pertaining to all classes of NTAs, for the following research areas: toxicology, medical countermeasures, physical properties, detection, decontamination, and personal protective equipment.	FY 2021 Q1	FY 2021 Q4	3
Add at least 20 technical documents to the NTA Library.	FY 2021 Q1	FY 2021 Q4	N/A
Complete Study: Solubility, median lethal dose (LD)50 and Organoleptic Properties of Chemicals in Beverages.	FY 2021 Q1	FY 2021 Q4	3
Complete Study: Acceptance, LD50 and Organoleptic Properties of Chemicals in Food Matrices.	FY 2021 Q1	FY 2021 Q4	3
Complete Study: Dermal Toxicity of a Chemical in Saline and another carrier solvent and Toxidromic Progression.	FY 2021 Q1	FY 2021 Q4	3
	FY 2022		
Deliver technical report summarizing the validated chemical source term tool addressing the key hazard prediction modeling gaps, and introduction of the complementary computational modeling and conceptual design and evaluation of new vapor detection strategies of area surveillance.	FY 2022 Q1	FY 2022 Q2	3
Develop an architecture and graphic user interface of the chemical threat characterization database for the Chemical Threat Knowledge Management Platform V1.0.	FY 2022 Q1	FY 2022 Q2	7
Launch the Chemical Threat Knowledge Management Platform V1.0 by adding data from selected projects within S&T CSAC to allow for the coordinated search, recovery, and report formation.	FY 2022 Q1	FY 2022 Q2	7
Complete and launch CARD v13.0 1. Include, based on Open Source and classified reporting new high threat chemicals, their structures, synthesis, and existing chemical informatics data. 2. Expand Taxonomy as necessary based on new classes of chemicals introduced or new projects areas to enhance search efficiency for project associated users.	FY 2022 Q1	FY 2022 Q2	7
Deliver technical report on Solubility, Acceptance, median LD50 and Organoleptic Properties of Chemicals in Beverages and Food Matrices.	FY 2022 Q1	FY 2022 Q1	3
Deliver final technical report on Dermal Toxicity of a Chemical in Saline and another carrier solvent and Toxidromic Progression.	FY 2022 Q1	FY 2022 Q1	3
Complete follow-on Study on Acceptance, LD50 and Organoleptic Properties of Chemicals in Food Matrices.	FY 2022 Q2	FY 2022 Q4	3
Deliver follow-on study technical report on Acceptance, LD50 and Organoleptic Properties of Chemicals in Food Matrices.	FY 2022 Q2	FY 2022 Q4	3
Provide a selection of three advanced concepts for advanced chemical detection as candidates for future investment.	FY 2022 Q1	FY 2022 Q3	3
Deliver final technical report on Solubility, Median Lethal Dose, and New Matrices.	FY 2022 Q2	FY 2022 Q4	3

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Acute Exposure Chronic Effects (AECE) Research: Determine potential long-term effects from acute exposures to toxic chemicals of interest.	FY 2022 Q2	FY 2022 Q4	3
Submit a review article of a significant chemical detection technology area to a peer reviewed journal for publication.	FY 2022 Q1	FY 2022 Q4	N/A
Advance the presumptive cyanide exposure detection innovation, to include determining stability of materials under simulated field conditions and developing a prototype instrument that could be used in field trail testing.	FY 2022 Q1	FY 2022 Q4	3
Update Non-Traditional Agent (NTA) Library by adding additional data points to advanced technical data matrices pertaining to all classes of NTAs, for the following research areas: toxicology, medical countermeasures, physical properties, detection, decontamination, and personal protective equipment.	FY 2022 Q1	FY 2022 Q4	3
Add 10 technical or programmatic documents to the NTA Library to keep up to date with the latest published information.	FY 2022 Q1	FY 2022 Q4	N/A
Complete and launch CARD v14.0. 1. Enhance search protocols to continue to increase efficiency of the user experience. Continue to Include, based on Open Source and classified reporting new high threat chemicals, their structures, synthesis, and existing chemical informatics data.	FY 2022 Q3	FY 2022 Q4	7
	FY 2023		
Complete and launch CARD v15.0. 1. Include, based on Open Source and classified reporting new high threat chemicals, their structures, synthesis, and existing chemical informatics data. 2. Expand Taxonomy as necessary based on new classes of chemicals introduced or new projects areas to enhance search efficiency for project associated users.	FY 2023 Q1	FY 2023 Q2	7
Complete and launch CARD v16.0. 1. Include, based on Open Source and classified reporting new high threat chemicals, their structures, synthesis, and existing chemical informatics data. 2. Expand Taxonomy as necessary based on new classes of chemicals introduced or new projects areas to enhance search efficiency for project associated users.	FY 2023 Q3	FY 2023 Q4	7
Launch the Chemical Threat Knowledge Management Platform V2.0 by adding data from selected projects within S&T CSAC to allow for the coordinated search, recovery, and report formation.	FY 2023 Q1	FY 2023 Q4	7
Update Non-Traditional Agent (NTA) Library by adding additional data points to advanced technical data matrices pertaining to all classes of NTAs, for the following research areas: toxicology, medical countermeasures, physical properties, detection, decontamination, and personal protective equipment.	FY 2023 Q1	FY 2023 Q4	3
Add 10 technical or programmatic documents to the NTA Library to keep up to date with the latest published information.	FY 2023 Q1	FY 2023 Q4	N/A
Advance the presumptive cyanide exposure detection innovation, to include performing laboratory testing and planning field trial testing using a prototype instrument.	FY 2023 Q1	FY 2023 Q4	4

Hazard Knowledge Center (HKC)

- **Problem:** Customers from across the HSE and the interagency need technical information, analysis, knowledge, and access to data, information and expertise to help them make decisions that involve CBRN sciences and threats. Customers' information and decision needs vary considerably across DHS Components and multiple Federal, State, and local agencies. DHS Component and community partners require the ability to find relevant and trusted data to better enable decisions related to CBRN research and development efforts and to prevent, protect, mitigate, respond, and recover from CBRN incidents.

- **Solution:** The HKC is developing a knowledge management system that houses a large variety of classified and unclassified data and analyses, and technical or analytical reports written by the PANTHR projects. The system will also host hazard data generated by both the CTC and BTC projects, and incorporate models, tools and algorithms generated by the TIGER project so it can support risk assessments generated by PANTHR program. HKC will transition current Biodefense Knowledge Management System (BKMS) capabilities from Lawrence Livermore National Lab (LLNL) to S&T and integrate BKMS data into the Hazard Knowledge Management System (HKMS). Leveraging current cloud capabilities provided by I&A for classified systems and S&T capabilities for its FOUO system, the HKC will develop hosting solutions for safe and secure storage of PANTHR data and information. In its architecture and design, the system will incorporate advancements in Artificial Intelligence and Machine Learning (AI/ML) technology to enable faster and more efficient extraction from the cloud-based database.

- **Justification:** The FY 2023 Budget for this project will be used to continue to build the HKMS cloud capability across FOUO and Top Secret classification levels; host the first risk applications from existing PANTHR projects; transition both Chem and Bio data from multiple community sources and LLNL BKMS databases; and provide funding to maintain the administrative costs to build and maintain the HKMS.

- **Impact:** The HKC provides a centralized repository of information that helps to increase the awareness and understanding of CBRN threats and risks across the HSE at multiple levels of classification, to inform policy, CONOPS, RDT&E, technology acquisitions, and development and acquisition of medical countermeasures. By integrating the HKC into a combined Knowledge Repository for CBRN hazards and leveraging cloud services developed elsewhere within DHS, the HSE will have access to the technical information and analysis through a single, cost-effective portal to enable customers to make informed decisions to prevent, prepare for, respond to, and recover from incidents involving these hazards.

Type of Research
Applied and Developmental

Technical Readiness Level
This project's activities span TRL-4 to TRL-7 and also provides capability outside of technology development. This project leverages technologies in the TRL-4 and above to develop a database structure that can be taken beyond TRL-7 into deployment for use and sharing of CBRN information within the HSE.

Transition Plans

HKC develops the Hazard Knowledge Management System (HKMS) as a cloud-based platform to host a series of databases and user interface tools. The HKC will provide access to PANTHR-developed reports and tools to the HSE, including the Intelligence Community, the DoD. The purpose of the HKC is to provide information to the HSE in order to enable better informed decisions related to CBRN topics. The HKC develops information sharing tools to allow for PANTHR developed knowledge products and tools, as well as other community assets, to be effectively shared to promote communication, scientific understanding and CBRN risk awareness.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Develop road map to expand the infrastructure developed for biological hazards to incorporate chemical hazards.	FY 2019 Q3	FY 2021 Q1	4
	FY 2022		
Establish unclassified//FOUO network hosting capability.	FY 2022 Q2	FY 2022 Q4	4-7
Host the Countermeasure Assessment and Planning Tool (CAPT).	FY 2021 Q1	FY 2022 Q2	7
	FY 2023		
Establish secure network Hosting Capability (Top Secret).	FY 2020 Q4	FY 2023 Q1	4-7
Maintain and update TS secure cloud data, tools, and applications.	FY 2023 Q1	FY 2023 Q4	4-7
Maintain unclassified//FOUO cloud data, tools, and applications.	FY 2023 Q1	FY 2023 Q4	4-7
Develop systems - Architecture design for classified cloud.	FY 2022 Q3	FY 2023 Q4	6

Tools for Integrated Evaluation of Risk (TIGER)

- **Problem:** DHS has the mission to prevent, protect, mitigate, respond and recover from CBRN events, pursuant to the Homeland Security Act of 2002, Project Bioshield Act of 2004, Homeland Security Presidential Directive 9 and the Securing of Agriculture and Food Act of 2007. To meet these missions, Homeland Security Presidential Directives (18 and 22) and the National Biodefense Strategy outline the need for the comprehensive risk analysis of our Nation's defenses to help inform investments for national strategic defense planning, while identifying key knowledge and capability gaps and evaluating critical vulnerability mitigation strategies. To fulfill this mission, decision-makers require guidance from risk-relevant data that characterizes WMD threats, to effectively manage resources and reduce likelihood and impacts of CBRN incidents. A critical part of providing timely relevant risk informed decisions, is having the ability to execute risk analysis.

- **Solution:** TIGER will leverage hazard data, threat information, and will develop and produce modeling and software tools that are required by HSE to conduct and improve these hazard/risk assessments. The PANTHR projects provide knowledge products (i.e., technical reports) generated through rigorous laboratory experimentation providing critical data and insight on the properties of threat agents and the hazards that they pose.

  Knowledge products (i.e., risk assessments and tailored analyses) are made available to DHS Components and the United States CBRN defense community to support strategic, operational, and tactical elements for use in planning for and responding to both natural and intentional CBRN incidents. Various mathematical models will be improved and developed to provide more informed analysis and decision support.

- **Justification:** The FY 2023 Budget for this project will be used to continue to enable execution of CBRN risk analysis and expanding capabilities to address emerging and evolving threats. The risk and tailored assessment capabilities generated from TIGER are required by and provided to various stakeholders (e.g., DHS Components, HHS, DOD) to better enable and inform and array of activities such as operational and response planning, medical countermeasure development and acquisition, research and development, policy.

- **Impact:** TIGER's capabilities provide HSE with tailored analysis that assess chemical and biological risks and enable strategic, operational, and tactical decisions to increase prevention, protection, preparation, mitigation, response, and recovery from CB hazard events. By improving the ability to assess threats and understand hazards, these data and models allow improvement of risk management and ability to understand and prepare for the greatest risks to Americans. This will allow for prioritization of resources based on the highest CBRN risks (National Security Strategy, priority action: "improve risk management"). In FY 2020, TIGER leveraged several computational models to provide rapid decision support to DHS Components on a range of topics (e.g., evaluation of potential material threat determination, impact HVAC mitigation options, etc.) related to SARS-CoV-2.

Type of Research
Applied

Technical Readiness Level

The project is TRL-3 and provides capability outside of technology development. TIGER generates a National Level CBRN Risk Assessment and various tailored assessments based on Stakeholder requests as final knowledge products to support decision makers across the HSE, leveraging varying computational models and risk methodology approaches.

Transition Plans

TIGER will regularly transition knowledge products (risk and tailored assessments, computational models, etc.) to the S&T Hazard Knowledge Center. These reports will be shared with the HSE, including the Intelligence Community and the DOD, through the Hazard Knowledge Center's Hazard Knowledge Management System and other information portals. TIGER reports and knowledge products will provide the essential national consequence and risk assessments, enabling policymakers to establish risk informed and sound policy. The TIGER reports and knowledge products will enable decision makers to appropriately prioritize CBRN defense spending on medical and non-medical countermeasure acquisition programs impacting Government spending.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Generate tailored assessments to address stakeholder needs.	FY 2021 Q1	FY 2021 Q4	N/A
Produce Updated CBRN National Risk Data image for national assessments and risk tools.	FY 2021 Q1	FY 2021 Q4	3
Execute development activities to improve and expand risk analysis capabilities.	FY 2021 Q1	FY 2021 Q4	3
Develop risk assessment framework to integrate agriculture and anti-material threats.	FY 2021 Q2	FY 2021 Q4	3
Identify modeling and risk analysis capability developmental priorities.	FY 2021 Q3	FY 2021 Q4	N/A
Identify priority techncial hazard data gaps for BTC and CTC.	FY 2021 Q3	FY 2021 Q4	N/A
Develop risk assessment framework to integrate biotechnology and bioeconomy threats.	FY 2021 Q2	FY 2021 Q4	3
	FY 2022		
Generate tailored assessments to address stakeholder needs.	FY 2022 Q1	FY 2022 Q4	N/A
Produce updated National CBRN Risk Data image for national assessments and risk tools.	FY 2022 Q1	FY 2022 Q4	3
Execute development activities to improve and expand risk analysis capabilities.	FY 2022 Q1	FY 2022 Q4	3
Execute developments to support the agriculture risk assessment framework.	FY 2022 Q1	FY 2022 Q4	3

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Execute developments to support the biotechnology risk assessment framework.	FY 2022 Q1	FY 2022 Q4	3
Execute developments to support the bioeconomy risk assessment framework.	FY 2022 Q1	FY 2022 Q4	3
Identify modeling and risk analysis capability developmental priorities.	FY 2022 Q3	FY 2022 Q4	N/A
Identify priority technical hazard data gaps for BTC and CTC.	FY 2022 Q3	FY 2022 Q4	N/A
	FY 2023		
Generate tailored assessments to address stakeholder needs.	FY 2023 Q1	FY 2023 Q4	N/A
Produce updated National CBRN Risk Data image for national assessments and risk tools.	FY 2023 Q1	FY 2023 Q4	3
Execute development activities to improve and expand risk analysis capabilities.	FY 2023 Q1	FY 2023 Q4	3
Execute development activities to support the agriculture risk assessment framework.	FY 2023 Q1	FY 2023 Q4	3
Execute development activities to support the risk assessment framework to integrate biotechnological threats.	FY 2023 Q1	FY 2023 Q4	3
Execute development activities to support the risk assessment framework for Bioeconomy.	FY 2023 Q1	FY 2023 Q4	3
Identify modeling and risk analysis capability developmental priorities.	FY 2023 Q3	FY 2023 Q4	N/A
Identify priority technical hazard data gaps for BTC, CTC, and AgTC.	FY 2023 Q3	FY 2023 Q4	N/A

Cyber Security/Information Analysis R&D Thrust Area
Research and Development

Technology Readiness Level Exhibit

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
Cyber Security / Information Analysis Thrust Area	$25,091	$53,600	$48,567

R&D Thrust Area Description

CYBER SECURITY / INFORMATION ANALYSIS R&D THRUST AREA: Conducts and supports RDT&E and transition of advanced cybersecurity and information assurance technologies which secure the Nation's current and future cyber and critical infrastructures. These solutions include user identity and data privacy technologies, end system security, law enforcement forensic capabilities, secure protocols, and software assurance.

CYBER SECURITY / INFORMATION ANALYSIS THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
Total – Cyber Security / Information Analysis Thrust		**$25,091**	**$53,600**	**$48,567**
Cybersecurity Program (formerly Information Analytics)		**$25,091**	**$53,600**	**$48,567**
	Cyber Data Analytics	$24,091	$53,600	$47,067
	Cybersecurity for Law Enforcement	$1,000	-	$1,500

Cybersecurity Program– This program researches, analyzes, and develops technologies to strengthen defensive cybersecurity capabilities in a spectrum of strategic technical areas to mitigate risk to the Nation's critical infrastructure, Federal departments and agencies, as well as State, local, tribal and territorial organizations. The increasing reliance on complex data, technology, communication, and interconnectivity has changed and expanded the potential vulnerabilities and increased potential risk to governmental, citizen services, and critical infrastructure continuity.

Cyber Data Analytics

- **Problem:** Currently there is not a centralized source and capability for CISA operational units to query and correlate information related to cyber risk analysis, physical and infrastructure risk, and blended cyber-physical risk/threat. In order to close operational gaps, this research area will enhance the ability of operational units to correlate threat intelligence and risk data. This includes analysis of elements, increasing automated tools, and providing situational awareness in risk factors. This research area develops applied AI and ML infrastructure, algorithms, and tools to enable security orchestration, automation, and response (SOAR); behavioral anomaly detection; data reduction; tipping and queuing of analyst workflows; and other user driven mission needs. CISA's Threat Hunting leads the Federal response by serving as its primary operational arm in the execution of the asset response mission. To support the execution of the asset response mission, operators must be able to stream-line the advanced analytics through usage of AI/ML.

- **Solution:** This research area supports the improvement of computational analytics and information sharing in order to improve homeland security cyber-physical security risk analysis across government, the sixteen Critical Infrastructure Sectors, and fifty-five National Critical Functions. This ML work is strategic in nature, with tactical capability milestones. The work is driven by a vision for next generation CISA architectures, computation, and decision-making capabilities, and establishes the foundation for future AI solutions. Activities will focus on maturing CISA data analytics efforts through the development of representative data sets, stand up of joint computational sandbox capabilities, assessment of emerging analytics tools, experimentation with a variety of analytics use cases, and establishment of strategic research capabilities for the development of secure multi-party computational capabilities. This will be accomplished through the following:

    - Cybersecurity Artificial Intelligence/Machine Learning and Cybersecurity Lab (CYLAB): Develop applied AI and ML infrastructure, algorithms, and tools to enable security orchestration, automation, and response (SOAR); behavioral anomaly detection; data reduction; tipping and queuing of analyst workflows; and other user driven mission needs. CISA's Threat Hunting leads the Federal response by serving as its primary operational arm in the execution of the asset response mission. To support the execution of the asset response mission, operators must be able to stream-line the advanced analytics through usage of AI/ML. Develop a secure data platform that correlates the data collected from all CISA programs into a common information architecture available to all CISA critical mission activities. Development of hybrid cloud infrastructure to support the full breadth of cyber defense operations. Explore encryption techniques and commercial solutions to enable additional sensitive but unclassified data sharing with critical infrastructure owners and operators while protecting privacy. Develop algorithms, models, and data access mechanisms to ensure that data is available within and across CISA and mission partners.

    - Cyber Analytics Platform Capabilities (CAPC): Develops and/or advances cyber analytic capabilities in three major areas: 1) automate, to the extent possible, what is currently a largely manual process of malware analysis; 2) leverage expertise across multiple partners to accelerate Cyber related R&D; 3) use data and analytics to gain information about adversaries to improve real-time network defense; and 4) address shortcomings in existing risk assessment methods that are needed to develop the National Critical Functions (NCF) risk architecture.

- Natural Language Processing (NLP) Capabilities: Explore various NLP algorithms, approaches, and technologies to better correlate CISA's heavily structured cyber data with its unstructured physical infrastructure security data. Develop NLP ML algorithms to ensure alignment with CISA's Enterprise Conceptual Data Model, populate required metadata, and improve the results of CISA's traditional security products (alerts, warnings, assessments).

- Software Assurance, Maturity, and Composition (SAMC): Develop and/or advance cybersecurity tools and analytic techniques around three major areas: 1) Software assurance of applications relating to the security and safety within government environments; 2) Software lifecycle maturity studies and software to determine which aspects of an organization's code base are least mature and need attention; and 3) Software composition of codes at the source, byte, and binary levels to track usage, origination, and identify extra features that are not needed. These efforts will enhance CISA ability to detect malicious and problematic software sooner in the lifecycle, potentially preventing our adversaries from gaining entry to critical systems.

- **Justification:** The FY 2023 Budget provides $47.1M for this program. This funding is required to keep pace with the rapidly increasing sophistication of threat actors and attack vectors. The investment in these research areas positions technology innovations for operational use. This program enables the exploration of new automation technologies that will accelerate the effective integration of efficient data machine learning infrastructure that will underpin the analytics architecture for CISA. This funding will be used to develop and deliver data analytics and machine learning technologies to enhance CISA Threat/Hunt and Vulnerability Management capabilities in defense of Federal networks and the Nation's critical infrastructure.

- **Impact:** The program and related projects will provide improved operational utilization of large and complex data with modern data analytics techniques and enhanced tools and procedures. Enhanced risk analysis, consequence analysis, and threat intelligence data capabilities will improve incident response times and threat and mitigation correlation across Federal, State, and local governments and the private sector.

Type of Research

Applied and Developmental

Technical Readiness Level

Project is identifying concepts currently at TRL-2+, and in partnership with the interagency, academia, industry and CISA, developing them into operational capability (TRL-7), to inform planning for full operational implementation.

Transition Plans

S&T will deliver targeted exploratory, developmental, and operational capabilities directly to CISA for operational use.

- S&T is co-developing a technology platform to accelerate data characterizations, discovery and innovation directly with CISA partners and to accelerate the assessments of technology and transition of S&T and CISA partner research innovations into operational use.
- S&T will transition architectural concepts to CISA for use in future planning through workshops, white papers, technical assessments, technical reports, data inventories and joint experiments.
- S&T will evaluate and assess emerging COTS/GOTS/Open Source capabilities to translate the impact of emerging architectures, algorithms and capabilities to critical mission opportunities and risks.
- Research and development activities refocused as needed to address relevant and critical strategic capability gaps identified by the ongoing technology assessments and results from emerging research to improve transition outcomes.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Deliver capability advances to CISA that combat sophisticated, covert, and targeted malware developed by advanced threat adversaries.	FY 2020 Q4	FY 2021 Q4	4-6
Deliver report to CISA's National Risk Management Center on (1) incorporating dependency information at scales useful to NRMC risk analysis approaches and (2) the value of information concepts for NRMC risk analyses.	FY 2020 Q4	FY 2021 Q4	6
Deliver report to CISA's Cyber Security Division, based on a use case, on the exploration of deception with Automated Content Generation as a service for the enterprise.	FY 2020 Q4	FY 2021 Q4	4-6
	FY 2022		
Generate computational analytics and methodologies for CISA to accelerate and exploit the understanding of tools and techniques that can significantly enhance threat intelligence.	FY 2022 Q1	FY 2022 Q4	4-6
Deliver report on supporting human analysts in novel and increasingly automated ways to support operational goals of classifying, characterizing, and mitigating threats.	FY 2022 Q1	FY 2022 Q4	7
Deliver updated transition and integration strategy to ensure a handoff of capabilities to DHS for deployment, analyst feedback, and refinement.	FY 2022 Q1	FY 2022 Q4	7
Complete initial build for multi-cloud environment for next generation CISA architecture.	FY 2022 Q1	FY 2022 Q4	5
Deliver initial analysis and report on NLP algorithmic use and approach to develop proof-of-concept.	FY 2022 Q1	FY 2022 Q3	3
Deliver initial supply chain approaches, novel mitigation techniques, addressing software assurance, maturity, and composition.	FY 2022 Q1	FY 2022 Q4	1-2

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Deliver study results and recommendations to CISA's National Risk Management Center on software assurance lifecycle maturity and mitigation techniques.	FY 2022 Q1	FY 2022 Q4	3
	FY 2023		
Expand the CISA advanced analytics environment to support additional infrastructure security use cases.	FY 2022 Q2	FY 2023 Q4	6-7
Design and architect a proof-of-concept of NLP with a subset of CISA structured and unstructured data sets.	FY 2023 Q2	FY 2023 Q4	3
Deliver capability advances on the use of emulation and active data collection/analysis to gain information about adversaries to improve real-time network defense.	FY 2022 Q1	FY 2023 Q4	4-6
Deliver new methodology and metrics that advances CISA's National Risk Management Center by enhancing existing risk assessment methods that are needed to develop the NCF risk architecture.	FY 2022 Q1	FY 2023 Q4	4-6
Deliver cybersecurity techniques to CISA that advance automated cyber threat prediction, recognition, identification, and mitigation.	FY 2023 Q1	FY 2023 Q4	4-6
Transition the Deception Orchestration Leveraging Open-Source-Intel (DOLOS) effort to CISA.	FY 2023 Q1	FY 2023 Q4	4-6
Deliver capability advances in risk analysis for assessing cyber risks to critical infrastructure and Federal networks.	FY 2023 Q1	FY 2023 Q4	4-6
Complete two technical evaluation reports that summarize evaluation results of advanced analytic technologies for CISA missions.	FY 2022 Q4	FY 2023 Q4	5-7
Deliver study results and recommendations for high performance, distributed, large-scale analytics for application to CISA use cases .	FY 2022 Q4	FY 2023 Q4	4-7
Initial establishment of a DHS and National Science Foundation (NSF) AI Institute, to leverage national efforts in AI to inform opportunities to enhance future cybersecurity missions.	FY 2023 Q3	FY 2023 Q4	1-4
Develop initial NLP use cases with CISA operational entities, data ontologies, and machine learning infrastructure and tool requirements to validate design and experimentation outcomes.	FY 2023 Q2	FY 2023 Q4	3
Deliver preliminary analysis of software supply chain techniques, software bill of material approaches, and operations software test and evaluation tools.	FY 2023 Q2	FY 2023 Q4	5
Deliver preliminary studies and initial prototype plans for software assurance and integrity approaches to machine learning capabilities and environments.	FY 2023 Q2	FY 2023 Q4	4

Cybersecurity for Law Enforcement

- **Problem:** A significant barrier for DHS Components with a law enforcement mission is keeping abreast of technology changes that are constantly evolving. 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.

  A significant barrier for law enforcement is keeping abreast of changes in criminal enterprise tactics and technologies and the tools being developed to counter or investigate those activities. New technologies, modalities and training are required to equip and enable law enforcement to counter these evolving threats. Some of the threats being encountered include anonymous networks and currencies, cyber security forensics tools, Internet of Things (IoT), cyber-attacks against critical infrastructure.

- **Solution:** This project supports the research, analysis and development of new technologies, capabilities, and standards to assist law enforcement in training, prevention against cyber-attacks, cyber-crime investigations and the forensic analysis of technologies used in criminal activity.

- **Justification:** The FY 2023 Budget for this project will be used to evaluate current technologies to be targeted for development, modification and integration to fit within the law enforcement operational mission space and develop low and no cost exportable cyber forensics tools and processes training.

- **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.

Type of Research
Applied and Developmental

Technical Readiness Level
TRL varies for specific project activities between TRL-3 and TRL-7. This project's R&D efforts typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology is then adapted and validated in a laboratory or relevant environment (TRL-4/5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition.

Transition Plans
End-users and customers, including 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.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Conduct initial needs assessment and gap analysis relating to local law enforcement and community cyber security needs.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
N/A	N/A	N/A	N/A
	FY 2023		
Evaluation of current technologies to identify COTS/GOTS solutions for further development/modification & integration.	FY 2023 Q1	FY 2023 Q3	N/A
Develop/modify select technologies for testing and evaluation within component operational mission spaces.	FY 2023 Q1	FY 2023 Q4	6
Conduct analysis and execute development of low and no cost exportable cyber forensics tools and processes for training of Federal, State, local, tribal and territorial law enforcement especially those in remote and rural locations.	FY 2023 Q1	FY 2023 Q4	6

First Responder/Disaster Resilience Thrust Area
Research and Development

Technology Readiness Level Exhibit

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
First Responder / Disaster Resilience Thrust Area	$43,473	$64,716	$55,950

R&D Thrust Area Description

FIRST RESPONDER / DISASTER RESILIENCE THRUST AREA: Work includes reducing vulnerability of critical infrastructure to terrorist attacks and other hazards; working with SLTT 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 SLTT partners, as well as nongovernmental organizations, the private sector, and the general public; advancing and improving disaster emergency and interoperable communications capabilities; and improving capabilities of DHS and its Components to lead in emergency management.

FIRST RESPONDER / DISASTER RESILIENCE THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
Total –First Responder / Disaster Resiliency Thrust		**$43,473**	**$64,716**	**$55,950**
Community and Infrastructure Resilience		**$11,384**	**$38,978**	**$40,550**
	Climate Adaptation and Resilience		$20,000	$20,000
	Community Resilience Testbeds	-	$3,650	$3,200
	Critical Infrastructure Resilience	-	-	$4,000
	Disaster Recovery	$4,455	$4,500	$4,200
	Flood	$6,929	$6,928	$6,000
	Next Generation Disaster Proofing	-	$3,900	$3,150
First Responder Capability		**$27,089**	**$25,738**	**$15,400**
	Explosives & Radiological/Nuclear Resiliency	$5,000	$4,500	$1,500

FIRST RESPONDER / DISASTER RESILIENCE THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
	First Responder Technologies	$10,127	$7,898	$5,000
	First Responder Technologies – System Assessment and Validation for Emergency Responders (SAVER)	$1,980	-	-
	Personal Protective Equipment (formerly Compact Personal Protective Equipment)	$1,089	$3,075	$1,500
	Public Safety Communications	$2,750	$1,500	$1,500
	Response and Defeat Operations Support (REDOPS)	$3,515	$3,515	$3,000
	Stakeholder Engagement and Requirements (First Responder Requirements Group & International)	$250	$1,500	$500
	Training and Optimization Performance	$2,378	$3,750	$2,400
Natural Disaster Resiliency		**$5,000**	**-**	**-**
	Cyber Physical Systems	$5,000	-	-

Community and Infrastructure Resilience Program – This program conducts research and develops innovative solutions, standards, and conducts operational experimentation required to adapt and transition climate science, and new technologies completed by S&T and other agencies on behalf of FEMA and CISA.

Climate Adaptation and Resilience

- **Problem:** Climate change directly impacts the homeland security mission of DHS. FEMA and CISA need access to the latest science and technology to address the risks and impacts of climate change. Climate change is driving sea level rise and changing weather patterns resulting in increased droughts, floods, hurricanes and wildfires, and changing weather patterns directly impact the Nation's agricultural sector. The Nation faces increased loss of lives, infrastructure damages and economic costs due to natural disasters driven by climate change. These increases impact the ability of the Federal government to financially support disaster recovery and develop and maintain a sound financial framework for FEMA's Federal Insurance and Mitigation Program and its programs. In addition, climate change is a global problem. Instability and displacement in one country caused by catastrophic disasters and food insecurity have ripple effects that are felt throughout regions and across the world. Meeting this challenge requires mobilizing science at an unprecedented scale. New technologies and science are needed to respond to climate change, and these new technologies will create the opportunity for good jobs, strong economies, and a more secure world.

- **Solution:** DHS will support State and local government to meet the Administration's climate change and resiliency goals through Departmental programs that set polices, guidelines and standards, and administer and issue grants. S&T performs the research, development, innovation, standards development, and operational experimentation required to adapt and transition climate science research performed by other agencies to operational use. S&T applies research on the longer-term changes in risk from multiple hazards, such as flooding and hurricanes. S&T will lead coordination and formulation of research needs and requirements to DOE for new insurance and economic risk sharing solutions and develop smart materials for more resilient buildings and infrastructure, use of alternative energy vehicles for disaster response, and carbon sequestration technologies for debris removal and risk reduction, such as forest undergrowth thinning. S&T will accomplish this by tapping into the imagination, talent, and grit of America's innovators, scientists, and workers. S&T will fund this collaborative research in climate adaptation and resilience with the new ARPA-C that will be located within DOE. The ARPA model of high-risk, accelerated research is uniquely meant to conduct R&D that, if successful, results in transformational technology advancements. ARPA-C will also have a strong role in government-wide coordination of research in climate adaptation and resilience to ensure that the investments support solutions that benefit the broader community, national, and potentially international needs.

- **Justification:** The FY 2023 Budget for this project will be used for R&D needs aligned to the DHS climate change action plan and mission-related requirements of DHS Components including FEMA, CISA and other partners in the climate, natural disaster, community, and infrastructure resilience and adaptation space.

- **Impact:** Foster affordable, game-changing technologies and identify self-healing materials[2] and innovations that can protect the American people from the impacts of climate change such as droughts and flooding, bigger wildfires, and stronger hurricanes and extreme weather conditions. With the help of S&T, components will be able to: 1) to reduce disruptions and mitigate risks to critical infrastructure; 2) ensure more social and environmental equity in climate resilience; 3) improve sustainability operations of DHS and critical infrastructure facilities; 4) improve the resilience and security of critical information and communication technology; and 5) promote eco-friendly solutions for strengthening climate resilience and reducing carbon emissions.

Type of Research

Applied and Developmental

[2] Artificial or synthetically created substances that have the built-in ability to autonomously repair damages to themselves without human intervention or external diagnosis. Ghosh SK (2008). Self-healing materials: fundamentals, design Strategies, and applications (1st ed.).

Technical Readiness Level

TRL varies for specific project activities between TRL-5 and TRL-7. This program's R&D efforts will begin by conducting a requirements analysis and gap analysis including performing a market survey of available COTS and GOTS technology that could be adapted for DHS Component use. Active research and development will be initiated to prove feasibility (TRL-3). A system concept utilizing the identified technologies is then developed and validated in a relevant environment (TRL-5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition and end user adoption.

Transition Plans

The intended pathway for the transition of the Climate Adaptation and Resilience technologies, materials, and knowledge products are to submit the final prototypes and findings to FEMA and CISA at the end of the period of performance for each activity. Success will be determined by FEMA's and CISA's ability to implement climate change mitigation practices and work with SLTT governments to enforce these practices in an effort to better protect their communities. The intended end users are community officials and individuals that can use novel materials to affordable and environmentally friendly solutions for strengthening climate resilience. A successful transition will be able to be implemented in communities that are the most impacted by climate change and will provide greater social and environmental equity and climate resilience.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
N/A	N/A	N/A	N/A
	FY 2022		
Initiate requirements analysis.	FY 2021 Q3	FY 2022 Q2	N/A
Conduct Climate Resilience Innovation Prize Competition for Novel Cooling Solutions to reduce morbidity and mortality from extreme heat emergencies.	FY 2022 Q1	FY 2022 Q4	3-7
Conduct research analysis on climate adaption and resilience efforts within local communities such as actions that integrate climate change and future risk into planning, zoning, and land use to identify best practices and success stories.	FY 2022 Q2	FY 2022 Q4	3-7
Conduct ideation sessions and solicit stakeholders' input to identify novel solutions, approaches, and technologies for addressing key DHS climate adaption and resilience goals.	FY 2022 Q1	FY 2022 Q4	N/A
Launch Climate Resilience Innovation Prize Competition for environmental and carbon-friendly debris removal and forest vegetation undergrowth thinning solutions.	FY 2022 Q3	FY 2022 Q4	3-7
	FY 2023		
Identify and enhance scientifically sound sources of data on social equity to better support homeland security climate adaptation and disaster resilience efforts across Federal, State, and local stakeholders to inform implementation and public action plans that enhance disaster resilience outcomes.	FY 2023 Q1	FY 2023 Q4	3-5
Research new insurance and economic sharing solutions to identify critical data and capability gaps to conduct policy incubation experiments to increase climate resilience.	FY 2023 Q1	FY 2023 Q3	3-5
Research and identify initial use cases for technologies to enable sensors with on-board analytics for automated alerting. Examples include surface and air detection (border), physical security sensor enhancement, infrastructure integrity monitoring, critical asset threat detection and automated alerting, and screening improvements.	FY 2023 Q1	FY 2023 Q3	3-7
Conduct demonstration of hydrogen fuel powered vehicle for disaster response and recovery to foster the use of alternative energy equipment.	FY 2023 Q1	FY 2023 Q2	3-7
Conduct Climate Resilience Innovation prize competition for protective structures that are eco-friendly to reduce fatalities from wildfires.	FY 2023 Q1	FY 2023 Q4	3-7
Establish climate adaption and resilience technology innovation and accelerators in geographically and socially vulnerable communities for research, testing, and evaluation.	FY 2023 Q2	FY 2023 Q4	N/A
Develop training to enhance climate literacy programs and develop the future homeland security climate resilience workforce.	FY 2023 Q2	FY 2023 Q4	N/A

Community Resilience Testbeds

- **Problem:** The costs of both manmade and natural disasters continue to rise on an annual basis in the United States. FEMA and State and local communities need access to new and emerging technologies and innovations to strengthen critical infrastructure lifelines, mitigate hazard vulnerabilities, and strengthen residential housing and commercial structures to reduce disaster risks, losses, and damages allowing communities to rebound more quickly.

- **Solution:** This R&D will pursue new/emerging technologies for streamlining/optimizing FEMA disaster resilience investments in insurance, mitigation, and recovery operations/assistance programs and enable State, local, and private sectors. This will include establishing testbeds with local communities and the private sector to assessment, evaluation, and innovate new approaches and technologies and serve as proving grounds for enhancing cooperation between Federal, State, local, and private sector to spur innovation and ensure new technologies and approaches work and are implementable.

- **Justification:** The FY 2023 Budget for this project will be used to experiment, evaluate, validate, and support the transition of future R&D outputs to FEMA and its external stakeholders including high risk areas and assisting FEMA with updating related policy, doctrine, operations, and training plans. In addition, funds will be used to support ready to implement R&D projects for Civic Innovation that address the needs of DHS, FEMA, and its stakeholders in building community resilience.

- **Impact:** With this support from S&T, FEMA will be able to evaluate and validate new solutions and make more informed technology investments toward keeping pace with the Nation's evolving disaster risks, expand State and local capacity, and reduce fatalities and property losses and prioritize and optimize its pre- and post- disaster grants programs.

Type of Research
Developmental

Technical Readiness Level
The project efforts will range between TRL-5 and TRL-7. This project's R&D efforts include: This project's R&D efforts began by performing a market survey of available COTS and GOTS technology that could be adapted for FEMA use. A system concept utilizing the identified technologies is then developed and validated in a relevant environment (TRL-5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition.

Transition Plans

The intended transition pathway is to transfer operational tools and knowledge products to FEMA at the end of the period of performance for each activity. Success will be determined by FEMA's ability to implement community resilient technologies and best practices in selected communities. The intended end users are State and local governments in those communities heavily impacted by natural disasters. The desired end state is to implement new solutions, grant programs, and investments in technology and disaster planning. Transition measures of success for this effort will be demonstrated by a reduction in the number of fatalities and property losses following a natural disaster.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Perform operational test & evaluation of IoT Flood Sensors with State/local stakeholders for commercialization at performer developed testing facilities.	FY 2021 Q1	FY 2021 Q3	7
Provide assistance to State and local stakeholders in the deployment of flood sensors; technical support, training, and user documentation and supporting materials.	FY 2021 Q1	FY 2021 Q4	7
Deliver to FEMA: Technical support, training, and user documentation and supporting materials on the deployment of flood sensors.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
Establish community resilience testbeds between local communities, research entities, and the private sector partners that serve as proving grounds for assess, evaluate, and innovate new approaches and technologies for resilience and risk reduction.	FY 2022 Q1	FY 2022 Q4	6
	FY 2023		
Conduct field-level testing and evaluation of FY 2022 natural disaster innovations from the community and infrastructure resilience R&D investments within S&T community resilience testbeds.	FY 2023 Q1	FY 2023 Q4	3-7
Launch a national resilience Civic Innovation Challenge that connects researchers, community partners, and industry to solve key resilience challenges through new approaches, solutions, and technologies.	FY 2023 Q2	FY 2023 Q4	3-7

Critical Infrastructure Resilience

- **Problem:** Critical infrastructure resilience is vital to the national economic security, and national public health and safety. The Nation's critical infrastructure is dependent on the physical and electronic-based systems for many applications to maintain operations, that are at risk to man-made and natural events. 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. Other electronic capabilities within critical infrastructure ecosystems are susceptible to intentional attack or natural occurrence of electromagnetic pulses (EMP) and geomagnetic disturbances (GMD). Currently, critical infrastructure owners and operators lack solid, data-driven information on the Position, Navigation, and Timing (PNT) and EMP threats and the impacts to their sectors, including up-to-date information on what actions and mitigations they should consider for risk management. This research fills that knowledge gap and provides CISA and infrastructure owners and operators with actionable information, based on validated research findings.

- **Solution:** The research from this effort will inform best practices and provide tools to critical infrastructure owner and operators on how best to prepare for and protect PNT capabilities and protect electronic systems against an EMP or GMD event. Activities focus on testing, evaluating, validating the impacts on select, prioritized critical infrastructure, including 5G infrastructure in order to provide industry with actionable, timely information on how to protect their systems before widespread buildouts of new infrastructure occur. This research will enhance security and resilience of both government and private sector critical infrastructure from disruption, corruption, and dysfunction of infrastructure systems by addressing sector risks, mitigation options, and opportunities for industry to innovate novel solutions. This will be accomplished through the following:

    - Position, Navigation, and Timing (PNT): This research supports the CISA mission to enhance security and resilience of both government and private sector PNT disruption, corruption, and dysfunction of critical infrastructure by addressing sector risks, mitigation options, and opportunities for industry to innovate and participate with S&T.

    - Electromagnetic Pulse Resiliency (EMP): This work builds knowledge and expands our understanding of the impacts and effects of EMP events on critical infrastructure. The objective is focused on providing useful information and products to inform strategy, policy, and most importantly critical infrastructure owners and operators (CI O&O). The research from this effort will inform best practices and provide tools to critical infrastructure owner and operators on how best to prepare for and protect against an EMP or GMD event.

- **Justification:** The FY 2023 Budget for this project will enable knowledge products and tools to critical infrastructure owner and operators to enhance our countries resiliency. The Nation's Critical Infrastructure and industry relies on systems, both physical and electronic based, for critical functions. These systems and capabilities are vulnerable to attack from adversaries, as well as natural terrestrial and space-based events.

- **Impact:** This research will improve risk strategies and provide mitigation solutions to address new threats to PNT systems, and the impacts of an EMP/GMD event. The results and solutions from this research will enhance risk analysis and mitigation approaches to the first order effects on critical infrastructure, and second and tertiary societal and economic impacts.

Type of Research

Applied and Developmental

Technical Readiness Level

Project is identifying concepts currently at TRL-2+, and in partnership with the interagency, academia, industry and CISA, developing them into operational transition (TRL5+), to inform planning for full operational implementation.

Transition Plans

The intended transition pathway is to transfer operational tools and knowledge products to FEMA at the end of the period of performance. Success will be determined by FEMA's ability to implement critical infrastructure technologies and best practices in selected communities. The intended end users are critical infrastructure owners and operators, of which the new technology would provide solutions that address threats against PNT. The desired end state is to provide risk analysis and mitigation approaches that would lessen or eliminate the impact of an EMP/GMD event. Transition measures of success for this effort can be measured by its societal and economic impacts of persistent and reliable PNT.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
N/A	N/A	N/A	N/A
	FY 2022		
N/A	N/A	N/A	N/A
	FY 2023		
Deliver to CISA reports of assessments of tools, techniques and procedures addressing impacts to critical infrastructure systems from PNT disruptions.	FY 2023 Q1	FY 2023 Q4	4
Develop planning and logistics for assessments, testing, and validation of EMP vulnerabilities related to 5G infrastructure. Deliver preliminary best practice recommendations to CISA.	FY 2023 Q2	FY 2023 Q4	4
Develop framework to enhance modeling capabilities tailored critical infrastructure owners and operator's business and technical roles, to enhance the ability to analyze the impact of employing EMP mitigations on their infrastructure.	FY 2023 Q2	FY 2023 Q4	5

Disaster Recovery

- **Problem:** Natural disasters of all kinds are a leading cause of fatalities and economic loss in the United States. Recovery is the costliest and time-consuming phase of disaster management. Local communities need access to new and emerging technologies and innovations in order to streamline and to optimize FEMA's disaster recovery operations and assistance programs. Communities need to speed up the process and reduce the time necessary to return to normal, to restore critical functions and community lifelines and for helping survivors get back to their daily lives.

- **Solution:** This project will develop new processes, products, and standards in order to improve operations and outcomes in FEMA, including promoting national preparedness and protective measures, preparing for catastrophic disasters, and reducing the complexity of FEMA. It will improve FEMA and State, local, and private sector capacities to recovery from disasters, return to normal, restore critical functions and community lifelines.

- **Justification:** The FY 2023 Budget for this project will be used to support R&D needs aligned to FEMA strategic plan objectives, including providing support for FEMA operational functions such as housing inspections, National Flood Insurance Program (NFIP) claims processing, and implementation of FEMA disaster programs, Disaster Recovery grant programs for Individual and Public assistance, and FEMA grant programs such as emergency management, firefighter assistance and safety, and hazard mitigation grants to reduce disaster recovery costs and losses.

- **Impact:** With support from S&T, FEMA will be able to: 1) speed up recovery aid to affected communities and assistance to survivors; 2) streamline individual and household assistance using new technology; 3) track and monitor rebuild and restoration functions through improved damage assessments for public assistance and mitigation programs; 4) reduce the complexity to communities and disaster survivors; 5) promote adaptive recovery; and 6) enable faster decision-making.

Type of Research
Applied and Developmental

Technical Readiness Level
The project efforts will range between TRL-3 and TRL-7. This project's R&D efforts include:
- Development of new science, technology, and methods for improving accuracy and performance of hazard modeling and analytics that would support key decision points (TRL-3).
- Publish a Broad Agency Announcement to select technologies that have a likelihood of meeting published requirements and fund development (TRL-4).
- Validate the technologies in a relevant environment (TRL-5).
- Evaluate prototype technologies in a relevant environment (TRL-6).
- Transition to FEMA at TRL-7.

Transition Plans

The intended pathway for transition of this knowledge product is to submit the final results to FEMA at the end of the period of performance, and to share the outputs of this foundational research and analysis with SLTT governments in an effort to identify actionable items and strategies with the goal of helping to improve individual and community preparedness. The desired end-state is to fully understand when Federal assistance helps or hinders the recovery processes or outcomes. This will be accomplished by systemically examining disaster recovery efforts in context when Federal disaster assistance is not requested or is denied. Transition measures of success for this program will be determined by the handoff to FEMA and the dissemination of the final study results to SLTT governments.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Develop new methods, proofs of concept, and prototypes for wildland fire detection and suppression technologies that can be deployed in-situ at high risk or vulnerable critical infrastructure locations.	FY 2021 Q2	FY 2021 Q4	4-6
	FY 2022		
Develop new science, technology, and methods for improving accuracy and performance of hazard modeling and analytics that would support key decision points.	FY 2021 Q4	FY 2022 Q4	3
Pilot new and emerging technologies to streamline disaster housing inspections across the Federal Government and FEMA's programs.	FY 2022 Q1	FY 2022 Q4	7
	FY 2023		
Conduct climate science research and enhance tools to ensure that results are incorporated into disaster recovery planning and community recovery efforts.	FY 2023 Q1	FY 2023 Q4	3-7
Enhance tools to provide access to information on useable, actionable guidance, that help communities and private institutions build resilience into disaster recovery (e.g. summer heat, wildfires).	FY 2023 Q1	FY 2023 Q4	3-7
Conduct research to define criteria leading successful disaster recovery in effort to increase the effectiveness of recovery programs and activities.	FY 2023 Q1	FY 2023 Q4	3-7

Flood

- **Problem:** Flooding of all kinds are a leading cause of fatalities and economic losses in the United States from natural disasters. Communities need new and emerging technologies to increase their resilience to flood disasters and provide flood predictive analytic tools to the FEMA and to State and local governments to reduce future flood fatalities and economic damages.

- **Solution:** This 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. S&T is developing low-cost, network-connected flood sensors to improve regional and local flood prediction; new ML algorithms to detect buildings and other structures in hi-resolution satellite imagery, which will in turn create a national structures inventory 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 groups in making planning, disaster response and recovery, and investment decisions related to floods. Specifically, S&T will develop the following:

    - 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 (e.g., aerial Laser Imaging Detection and Ranging (LiDAR), high-resolution satellite based synthetic aperture radar) and emerging technologies (e.g., UAS) 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 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 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 standard operating procedures, 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 and when they need it through developing a roadmap of the best available flood decision data for all data categories. As well as, 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.

- **Justification:** The FY 2023 Budget for this project will be used to support the continued research and development for the needs of FEMA and the flood risk management community for the national flood insurance program.

- **Impact:** With support from S&T, FEMA will be able to: 1) leverage existing data sources to create multi-dimensional representations of community functions using an integrated system-of-systems approach; 2) enhance whole community collaboration around disaster risk reduction; 3) identify indicators of community resilience and opportunities to introduce advanced technology solutions; 4) empower communities with decision support capabilities to enable both pre-event scenario-based risk planning and adaptive recovery in the post-event environment; and 5) enable faster decision-making.

Type of Research

Applied and Developmental

Technical Readiness Level

The project efforts will range between TRL-4 andTRL-7. This project's R&D efforts include:

- Perform market surveys and assessments of remote sensor technologies that could be suitable for use in multi-hazard, multi-environment operational missions. Initial studies also involve mission assessments, workshops, and interviews with end users and SMEs to determine system requirements. The outputs of these efforts will be used to define the system concept for subsequent development.
- Publish a Broad Agency Announcement to select technologies that have a likelihood of meeting published requirements and fund development (TRL-4).
- Validate technologies in a relevant environment (TRL-5).
- Evaluate prototype technologies in a relevant environment (TRL-6).
- Transition to FEMA at TRL-7.

Transition Plans

The intended transition pathway is to transfer operational tools and knowledge products to FEMA. Success will be determined by FEMA's ability to implement flood hazard modeling and impact assessment tools in selected communities initially. The intended end users are first responders and the communities where flood hazard modeling and impact assessment support processes would benefit most. The desired end state is to build a culture of preparedness across the United States therefore reducing flood related fatalities and property losses. Transition success for this effort will be measured by emergency managers' ability to leverage data sources and modeling programs to create pre- and post-event risk planning to enable faster decision making.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Facilitate, in coordination with the National Dam Safety Program, new guidelines for a national standard for dam assessment monitoring and reporting.	FY 2020 Q1	FY 2021 Q2	N/A
Develop transition agreement to transfer decision support tools to FEMA for deployment to Federal, State, local users and other stakeholders, including non-governmental agencies.	FY 2020 Q1	FY 2021 Q3	N/A
Develop enhancements to the Decision Support System for Water Infrastructure Security (DSS-WISE) web-enabled dam breach modeling and simulation service in coordination with the National Dam Safety Program.	FY 2019 Q1	FY 2021 Q4	4-7
Deliver to FEMA: New guidelines for a National standard for dam assessment monitoring and reporting.	FY 2021 Q2	FY 2021 Q1	N/A
Deliver to FEMA: Enhancements to the Decision Support System for Water Infrastructure Security (DSS-WISE) web-enabled dam breach modeling and simulation service.	FY 2019 Q1	FY 2021 Q2	7
	FY 2022		
Launch Flood Detection and Modeling Prize Challenge.	FY 2022 Q2	FY 2022 Q4	4-7
Research Compound Flood Events and Protective Action Guidance.	FY 2022 Q1	FY 2022 Q4	4-7
Launch Insurtech innovation pilot for remote flood claims validation.	FY 2022 Q2	FY 2022 Q4	4-7
	FY 2023		
Develop DSS-Wise next generation - enhancements in support of the National Levee and National Dam Safety Communities.	FY 2023 Q1	FY 2023 Q4	4-7
Conduct research, testing, and evaluation of Fiber Reinforced Polymers for concrete dams and water infrastructure.	FY 2023 Q1	FY 2023 Q4	4-7
Conduct research into new market innovations, incentives, and policy options related to parametric insurance services and micro-financing to improve risk reduction outcomes and advance social and environmental equity.	FY 2023 Q2	FY 2023 Q4	4-7

Next Generation Disaster Proofing

- **Problem:** The costs of both manmade and natural disasters continue to rise on an annual basis in the United States. FEMA and State and local communities need access to new and emerging technologies and innovations that reduce risk, improve protective measures, and optimize mitigation investments and lower the amount of damages, disruption, and ultimate costs of disasters.

- **Solution:** This research and development will pursue new/emerging technologies and standards for streamlining/optimizing FEMA disaster resilience investments in insurance, mitigation, and recovery operations/assistance programs and enable the States, local communities and the private sector. Other examples of targeted research and development outcomes are to develop new approaches to optimizing resilience investment to reduce disaster risk and losses, and measure community resilience and monitor effectiveness over time, and new technologies to reduce damages to residential structures, public assets, and critical infrastructure.

- **Justification:** The FY 2023 Budget for this project will be used to support R&D projects that pursue new/emerging technologies that reduce damages to structures, public assets, and infrastructure, and enhance FEMA mitigation program effectiveness.

- **Impact:** This program supports FEMA operations and pre- and post- disaster assistance programs, 20,000 communities participating in the NFIP and numerous State/local partners and critical infrastructure operators. These R&D investments allow FEMA to keep pace with the Nation's evolving flood risk, enable State and local capacity, and reduce fatalities and property losses. If not funded, FEMA would have diminishing capability to support disaster recovery operations and enable State and local capacity. Costs of disasters and losses would continue to rise. Disaster Recovery will remain costly and time consuming; assistance programs will remain overly complex and burdensome to disaster survivors.

Type of Research

Developmental

Technical Readiness Level

TRL varies for specific project activities between TRL-5 and TRL-7. This program's R&D efforts will begin by performing a market survey of available COTS and GOTS technology that could be adapted for FEMA use. A system concept utilizing the identified technologies is then developed and validated in a relevant environment (TRL-5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition.

Transition Plans

The intended transition pathway is to transfer disaster assistance programs to FEMA at the end of the period of performance for each activity. Success will be determined by FEMA's ability to implement new standards and best practices in selected communities. The intended end users are STLL government partners that manage community recovery operations following a natural disaster. The desired end state is to increase the number of people that benefit from disaster resilience research efforts in insurance and more rapid and efficient recovery operations. Successful transition for this effort will be measured by a reduction in lives lost following a natural disaster.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
N/A	N/A	N/A	N/A
	FY 2022		
Develop new categories and test protocols for new disaster proofing technologies intended to reduce damages to residential structures, public assets, and critical infrastructure.	FY 2022 Q1	FY 2022 Q4	5-6
Extend national standards for new disaster proofing technologies intended to reduce damages to residential structures, public assets, and critical infrastructure.	FY 2022 Q1	FY 2022 Q4	5-6
Collaborate with DHS partners to incorporate new categories for disaster proofing technologies into national mitigation, safety, and test and certification programs.	FY 2022 Q2	FY 2022 Q3	5-6
	FY 2023		
Launch Disaster Proofing Innovations Prize Competitions for natural disasters.	FY 2023 Q1	FY 2023 Q4	5-7
Develop training guides, best practices, and performance standards for Disaster Proofing Innovations.	FY 2023 Q3	FY 2023 Q4	5-7

First Responder Capability Program – This program develops and transitions technologies, information, procedures, and CONOPS to aid first responders, emergency managers, and incident commanders as they respond to hazardous situations. It assists emergency response communities through test and assessment of technologies for usability and seeks to transition viable solutions to the commercial marketplace to help make them available across all first responder communities.

Explosives & Radiological/Nuclear Resiliency

- **Problem:** A Radiological Dispersal Device Detonation or Nuclear Detonation are high consequence incidents and pose tremendous challenges to the first responder community and HSE in preparing for, responding to and recovering from.

- **Solution:** S&T utilizes the National Urban Security Technology Laboratory (NUSTL) to improve responder preparedness for the complexity of a radiological/nuclear incident response and recovery operations. By working with partner agencies, Federal interagency working groups, and first responders, S&T will identify impactful opportunities that address technology and research needs in the areas of radiological/nuclear response management, incident characterization, initial response capabilities, medical care/triage, casualty/evacuee care, impacted area stabilization/control, and site cleanup/decontamination.

- **Justification:** The FY 2023 Budget for this project will be used to continue research and development on advanced fast running urban dispersion modeling capabilities that will expand and improve the modeling products provided through the Interagency Modeling and Atmospheric Assessment Center (IMAAC) to FSLTT jurisdictions; build interactive tools to automate radiological data management and data validation and verification (V&V) processes; continue exploration of virtual reality (VR) solutions to expand responder access to immersive radiological/nuclear field response trainings; and conduct laboratory and field testing on radiological resuspension in representative urban environments.

- **Impact:** The project will result in improved radiological/nuclear response capabilities at the FSLTT levels through strategic investment in projects focused on increasing agency preparedness, improving government understanding of impacts and risks, and developing guidance, technology and other actionable solutions to radiological and nuclear capability gaps and mission needs.

Type of Research
Developmental

Technical Readiness Level

TRL varies for specific project activities between TRL-3/4 and TRL-7. This project's R&D efforts typically start by performing a market research of available COTS and GOTS technology as well as evaluation of existing research and interagency capabilities in modeling, analysis, and other expertise that can be leveraged for first responder capability needs. Identified solutions are adapted, enhanced, tested and piloted for planning, preparedness and response operations to meet first responders and SLTT needs (TRL-6/7). Examples that support the R&D milestones are below:

- Completing research to document future R&D needs based on lessons learned from the COVID-19 response. This research may result in a range of technologies, knowledge products, and R&D initiatives to explore at various levels of technical readiness levels (TRL 5-7).
- Expanding assessment calculations and analysis capabilities in an existing DOE tool, Turbo Federal Radiological Monitoring and Assessment Center (TurboFRMAC) for use by FSLTT organizations for monitoring and assessment for radiological/nuclear incidents (TRL-7).
- Enhancing modeling capabilities available through the FEMA-led IMAAC for radiological/nuclear incidents that support FSLTT decision-making on protective actions and response and recovery activities (TRL 5-7).

Transition Plans

- S&T will leverage existing radiological modeling, training, and preparedness organizations to include FEMA, DOE National Nuclear Security Administration (NNSA) and the Environmental Protection Agency (EPA) to assist in transitioning and transferring for distribution and integration of the developed technology and knowledge products into SLTT radiological and nuclear preparedness and response activities. Publications of knowledge products are typically shared through existing government websites or repositories of information. Technology investments are typically made into existing systems that are owned, operated, and maintained by the partners listed above.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Develop a FEMA National Training and Education Division (NTED) course and supporting material to train tribal, State, and local first responders and emergency managers in best practices for planning for RDD emergencies.	FY 2019 Q1	FY 2021 Q3	7
Develop simulation-file capability within the RadResponder Network that sufficiently provides increased options for users to conduct realistic training, drills, and exercises for radiation emergencies, including ones involving RDDs, Improvised Nuclear Devices (INDs), and Nuclear Power Plants (NPPs).	FY 2020 Q4	FY 2021 Q4	7
Complete development of the Radiological Recovery Logistics Tool (RRLT) and prepare for beta testing, validation and transition.	FY 2018 Q4	FY 2021 Q4	6
Develop and release an IMAAC Portal on the CBRN Responder network for use by FSLTT organizations for accessing IMAAC briefing and modeling products for real-world incidents, and	FY 2020 Q4	FY 2021 Q4	7

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
requesting and accessing products for exercise scenarios, that involve atmospheric release of materials.			
	FY 2022		
Complete development work for web-based and deployable application-based versions of the Nuclear Hazard Zone Tool, a tool that decision-makers can use to rapidly generate actionable protective action guidance and initial effects modeling following a suspected or confirmed nuclear detonation in the United States as part of the IMAAC suite of tools.	FY 2017 Q1	FY 2022 Q1	7
Complete the *72 Hour Planning Guidance for Response to a Nuclear Detonation*, which is validated science-based planning guidance for the first 72 hours of a nuclear detonation response, outlining specific missions and tactics for first responder operations consistent with the interagency update to the *2010 Planning Guidance for Responding to a Nuclear Detonation*.	FY 2019 Q1	FY 2022 Q4	7
Develop actionable recovery planning guidance based on sound scientific principles and existing research for conducting public health decision making, gross-decontamination, clean-up, waste management, and repopulation following an RDD detonation.	FY 2020 Q2	FY 2022 Q4	7
Develop additional Turbo FRMAC features to improve FSLTT ability to assess and understand radiation impacts following a radiological and nuclear emergency.	FY 2021 Q1	FY 2022 Q4	7
Finalize the RRLT to support the efficient use of public works and municipal equipment in a radiological response and recovery.	FY 2018 Q4	FY 2022 Q4	7
Complete a simplified interface with streamlined input fields that allows FSLTT users to independently and accurately self-request radiological and nuclear modeling products for exercise use.	FY 2021 Q2	FY 2022 Q4	7
Complete updates on key radiological response guidance documents used by SLTT planners.	FY 2021 Q4	FY 2022 Q4	7
Finalize Virtual Evaluation Scenario Training (VEST) materials for a nuclear detonation scenario to support ROSS cadre with fulfilling their Position Task Book (PTB) for expanded knowledge, cadre development and support to incident command and emergency operations.	FY 2019 Q4	FY 2022 Q4	7
Write and transition to the Federal Radiological Preparedness Coordinating Committee (FRPCC) a white paper that provides actionable recommendations for radiological/nuclear planning and future R&D based upon experiences seen during the COVID-19 pandemic and emergency response.	FY 2020 Q4	FY 2022 Q2	5-7
Complete technical support to the interagency, FEMA-led update to the 2010 Planning Guidance for Responding to Nuclear Detonation and supporting the interagency release of the updated Guidance for improved knowledge of the hazard and actions for planning by FSLTT emergency responders.	FY 2019 Q1	FY 2022 Q2	7
Document key findings and research in the form of actionable recommendations that can be integrated into first responder plans, procedures, and other materials that describe population screening and decontamination operations following a major radiological emergency.	FY 2020 Q4	FY 2022 Q1	7
Complete just-in-time training videos for radiological and nuclear briefings and modeling products in support of the Interagency Modeling and Atmospheric Assessment Center (IMAAC).	FY 2020 Q3	FY 2022 Q2	7

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Pilot a draft of the 72 Hour Planning Guidance for Response to a Nuclear Detonation with FSLTT jurisdictions to gain critical feedback before official publication.	FY 2020 Q1	FY 2022 Q1	7
Complete development of a new RFI form for FSLTT inquiries to the DOE Consequence Management Home Team for technical support during real-world incidents, trainings and exercises and apply RFI form to a major interagency exercise with FSLTT partners for validation.	FY 2020 Q1	FY 2022 Q3	7
	FY 2023		
Develop Data Quality Assessment (DQA) Toolkit for FSLTT organizations in conducting radiological data V&V following a radiological/nuclear incident.	FY 2021 Q4	FY 2023 Q1	7
Study strategies for improving fast running urban dispersion modeling capabilities for larger geographic areas and more complex scenarios.	FY 2021 Q4	FY 2023 Q2	4
Publish research on resuspension in the urban environment to support SLTT radiological/nuclear response and recovery planning.	FY 2021 Q4	FY 2023 Q2	3-4
Publish waste management case studies for various radiological/nuclear scenarios to support emergency preparedness and planning.	FY 2021 Q4	FY 2023 Q2	7
Complete immediate advancements to fast running urban dispersion modeling that aims to improve modeling capability available to FSLTT organizations.	FY 2021 Q4	FY 2023 Q3	7
Create a toolkit for SLTT jurisdictions to conduct scientific wide area environmental radiation background surveys for response and recovery.	FY 2021 Q4	FY 2023 Q3	7
Produce decision-support guide and checklists for stormwater runoff and subsequent contaminant movement during radiological/nuclear response and recovery for FSLTT organizations.	FY 2021 Q4	FY 2023 Q3	7
Write requirements document for interactive, automated DQA Tool.	FY 2021 Q4	FY 2023 Q4	3
Investigate and publish guidance on using VR for radiological field training.	FY 2021 Q4	FY 2023 Q4	6-7
Complete nuclear detonation visualizations on nuclear effects and response tactics to support planning, training and exercises.	FY 2021 Q4	FY 2023 Q4	7

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 FSLTT first responders is critical to ensure their safety, performance, and well-being.

- **Solution:** S&T will identify high priority needs, develop prototype solutions, and conduct operational field assessments and experimentation 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 80 percent or more of the operational requirement. Individual R&D activities pursued will vary in response to current operational demands, new and emergent threats and hazards, new environmental conditions, and recent technology advancements. S&T is focusing on solutions/technologies including but not limited to:

  - Data Collection, Management, and Analytics: Capabilities for rapid data capture, upload, management, and processing to enable data fusion, interpretation, and filtering to remove uninformative information and reduce data overload; improve timeliness to disseminate actionable intelligence; and increase situational awareness.

  - Geolocation of Responders and Resources: Capabilities for position tracking of personnel on the incident scene, including indoor and outdoor harsh environments, and resources, such as active emergency vehicles.

  - Information Sharing: Cost-effective capabilities for a large number of geographically dispersed First Responders to collaborate and train simultaneously, repeatedly, and frequently in an experiential and realistic manner.

  - Crowd Control Tools: Capabilities that assist law enforcement and response communities in safely dispersing large crowds and deterring violence, such as less lethal dispersal tools, quickly deployable physical barriers, and tracking to identify behaviors or individuals.

  - Improvised Explosive Devices (IED) Defeat: Technology solutions that allows bomb technicians to ascertain precise positioning information about IEDs inside of a suspicious container or barrier and to remotely render-safe IEDs.

- **Justification:** The FY 2023 Budget for this project will be used to identify high priority needs, develop prototype solutions, and conduct operational field assessments of next generation technologies to strengthen the response community's ability to protect the homeland, respond to disasters, and save lives.

- **Impact:** These technologies will strengthen the response community's ability to protect the homeland and critical infrastructure, respond to and minimize impact of disasters, and save lives through the increased availability and reliability of technology for first responders.

Type of Research

Applied and Developmental

Technical Readiness Level

Projects executed under the First Responder Technology Program begin at TRL-3, where a proof of concept has already been developed and demonstrated, and end when the technology is ready for transition and commercialization (TRL-7). R&D includes validating the technology in a laboratory environment (TRL-4), validating the technology in a relevant environment (TRL-5), producing prototypes that can be tested in a relevant environment (TRL-6), and developing harden prototypes that can be tested in an operational environment (TRL-7). Before a contract is awarded, a technology scouting initiative is executed to ensure the requirement driving the R&D is not readily available through an existing commercial offering. If it is, no R&D investment is made.

Transition Plans

The primary stakeholders for First Responder technology are SLTT first responders who historically do not make bulk purchases or enter into transition agreements due to the limited funds first responders receive at the State level. To ensure a smooth and successful transition occurs, S&T works with the performer from the onset of a project to develop a transition and commercialization plan that identifies the performer's manufacturing capabilities, partners who will assist with manufacturing, and potential domestic and global reach. The plan also looks at market size, sales projections for years 1 through 3 and target costing for low and high-volume production runs. The plan gets delivered to the S&T program manager and transition office liaison for review prior to the R&D effort coming to conclusion.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Begin design for six new technology development efforts.	FY 2021 Q3	FY 2021 Q3	3
Develop prototypes for six new first responder technology development efforts.	FY 2021 Q4	FY 2021 Q4	4-6
Transition four first responder technologies to the commercial marketplace.	FY 2021 Q1	FY 2021 Q4	7
	FY 2022		
Award contracts for three new first responder technology development efforts.	FY 2022 Q1	FY 2022 Q4	3
Begin design for five new technology development efforts.	FY 2022 Q1	FY 2022 Q4	3
Develop prototypes for four new first responder technology development efforts.	FY 2022 Q3	FY 2022 Q4	4-6
Transition two first responder technologies to the commercial marketplace.	FY 2022 Q1	FY 2022 Q4	7
	FY 2023		
Award contracts for two new first responder technology development efforts.	FY 2023 Q2	FY 2023 Q3	3
Develop prototypes for two new first responder technology development efforts.	FY 2023 Q2	FY 2023 Q4	4-5
Conduct OpEx or Operational Field Assessment (OFA) for two new first responder technology development efforts.	FY 2023 Q2	FY 2023 Q4	6
Transition two first responder technologies to the commercial marketplace.	FY 2023 Q1	FY 2023 Q4	7

First Responder Technologies-System Assessment and Validation for Emergency Responders (SAVER)

- **Problem:** Technology/equipment that first responder agencies need to purchase is increasingly complex and rapidly evolving. Additionally, these agencies frequently lack in-house specialized and technical expertise to make informed technology purchasing decisions.

- **Solution:** S&T utilizes the NUSTL SAVER knowledge products that serve as a valuable guide for informing first responder agencies' technology and equipment purchasing decisions by reporting what technologies are available in the marketplace, and how they perform in realistic conditions. This information can reduce agencies' risks of buying technology/equipment that does not meet their operational needs; enabling smart use of State and local, as well as DHS funds and grants. In particular, FEMA has provided billions of dollars in funding for emergency responder equipment though the Homeland Security Preparedness Grant Programs. FEMA Preparedness Grants totaled more than $1.9B in FY 2021. The SAVER program was designed to make sure that this funding is judiciously spent. The breadth of SAVER spans over 700 distinct types of technology and equipment that fall into the 20 FEMA Authorized Equipment List (AEL) categories associated with those preparedness grants. Without funding, NUSTL cannot conduct evaluations of commercially available first responder technologies nor provide knowledge products that support the responder equipment purchases across the Nation.

- **Justification:** The FY 2023 Budget for this project will be aligned under the Foundational Tools Program within the Innovative Research and Foundational Tools Thrust.

- **Impact:** First responder organizations rely on SAVER knowledge products to make sure their agencies have the right tools and technologies to effectively support their missions. If these tools do not perform as required, the lives of first responders and the people they protect are at risk. NUSTL's SAVER program recently looked at ballistic resistant body armor for women in law enforcement, recognizing that women-users have unique needs that must be met to ensure the effectiveness of their body armor. SAVER assessments are driven by first responders, focusing on the responders' experience with the equipment – the operational features, and how it works for the end-user in realistic operational conditions. These considerations are not captured in product spec sheets, or even known by the technology vendor in many instances. NUSTL utilizes its own expertise and partners with external SMEs, for example other labs and organizations that have expertise in explosive detection, tactical equipment, chemical detection, to evaluate these tools with responders. For these reasons, responder agencies rely on SAVER as their first stop for researching technology and equipment solutions before making a purchase. Over 1,000 SAVER knowledge products are available to the national first responder community - the nearly 18,000 police agencies and 30,000 fire departments in the United States.

Type of Research
Applied

Technical Readiness Level
TRL N/A: All tools and technologies under evaluation are COTS products that are available for purchase by first responder agencies.

Transition Plans

Publish assessment reports and other knowledge products on S&T's public facing website. FOUO products are provided directly to specific entities securely as needed.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
SAVER was aligned under the First Responder/Disaster Resilience Thrust in FY 2021.	N/A	N/A	N/A
	FY 2022		
SAVER will be aligned under the Innovative Research and Foundational Tools Thrust in FY 2022.	N/A	N/A	N/A
	FY 2023		
SAVER will be aligned under the Innovative Research and Foundational Tools Thrust in FY 2023.	N/A	N/A	N/A

Personal Protective Equipment (formerly Compact Personal Protective Equipment)

- **Problem:** First responders require Personal Protective Equipment (PPE) that provides protection and mitigates the health risk associated with exposure to chemical, radiological, physical, electrical, or biological elements within their operational environment. Additionally, with the most recent widespread civil unrest that occurred throughout the Nation in 2020, first responders also require protective gear in response to violent threats which may occur during demonstrations or riots. Without sustained PPE availability, first responders are vulnerable to serious injuries, illnesses or even death. Ultimately, the designation and proper use of PPE protects against these identified hazards. While no single combination of PPE offers protection against all hazards, the risk of potential harm to the first responder is significantly reduced when PPE is used.

- **Solution:** S&T engages with DHS Components and FSLTT first responders to ensure understanding of the end-user needs, identify actionable requirements to address those needs, and effectively deliver solutions addressing identified PPE capability gaps. S&T will identify Project Performers to develop technology that will strengthen the first responders' capabilities and enhance effective emergency responses during active shooter incidents and other potentially violent or hazardous situations. S&T will engage with the respective Project Performer to develop prototypes at the Technology Readiness Level (TRL) 6/7 and pursue pathways to commercialization to make solutions widely available for procurement.

- **Justification:** The FY 2023 Budget for this project will be used to develop critical PPE such as, riot protection helmets for law enforcement officers, base layer duty uniforms offering first responders abrasion resistance protection against punctures/slashings, flame/melt retardant properties, and resistance to the absorption of liquids, i.e. blood borne pathogens, saliva, and other liquid contaminants. First responders will participate in operational field assessments (OFAs) to evaluate the technology. System prototypes at TRL 6/7 will be assessed in simulated and/or operational environments. First responders will provide feedback, which the Project Performer will use to further enhance the prototype for transition into the commercial marketplace.
  PPE that will transition to the commercial market include: National Fire Protection Association (NFPA) 1984 approved respirators which offer respiratory protection to wildland firefighters or first responders who work in a wildland fire environment, i.e. traffic control officers assisting with an evacuation, National Institute of Justice (NIJ) Level IIIa, NFPA 1971:2018 firefighter helmets which integrate both ballistic protection along with thermal and impact protection for structural firefighters, an organic photovoltaic (OPV) wire technology integrated into first responder base garments offering sufficient energy to power radio devices and wearable chemical badges which detect and alert first responders to the presence of toxic industrial chemicals (TICS).

- **Impact:** S&T will work with contracted Project Performers to ensure the supported customer base is provided a viable PPE solution that provides protection and mitigates the risk of serious injuries, illnesses or even death, associated with the exposure to hazards or civil disturbances in the operational environment.

Type of Research
Applied and Developmental

Technical Readiness Level
TRL of delivered technology varies between an initial start of TRL-3 and a completion of TRL7. OFAs (as applicable) will be conducted to assess the completion TRL.

Transition Plans
S&T will transition developed technology to the first responder community to include: structural or wildland firefighters, emergency medical technicians, and law enforcement personnel.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Awarded SBIR Commercialization Readiness Pilot Program (CRPP) to TDA Research for continued development of the wearable chemical badge sensor.	FY 2021 Q3	FY 2021 Q4	6-7
Transitioned Lost Person Locator, FIND Mobile software application for use by search and rescue (SAR) personnel.	FY 2021 Q1	FY 2021 Q4	7
Established Cooperative Research and Development Agreement (CRADA) with first responders for receipt of prototype associated with the wearable chemical badge sensor developed by TDA Research.	FY 2021 Q2	FY 2021 Q3	6-7
Awarded contract for Next Generation Firefighter Helmet.	FY 2021 Q4	FY 2021 Q4	N/A
	FY 2022		
Conduct an Operational Field Assessment (OFA) of the respiratory protection system for wildland firefighters.	FY 2022 Q3	FY 2022 Q3	7
Assessment of the wearable chemical badge sensor for first on-scene responders.	FY 2022 Q3	FY 2022 Q4	7
Provide prototype technologies to first responder community, i.e. First Responders Resource Group.	FY 2022 Q3	FY 2022 Q4	6
	FY 2023		
Develop PPE for use by first responders when responding to civil disturbances, riots, or demonstrations. The PPE solution may include: clothing, accessories, or devices the first responder may wear or carry to protect themselves.	FY 2022 Q2	FY 2023 Q4	6-7
Develop PPE for use by law enforcement officers/first responders as a base duty uniform. The PPE solution offers resistance to abrasions, repels liquids, and prevents burn injuries.	FY 2022 Q2	FY 2023 Q4	6-7
Develop PPE for use by law enforcement officers/first responders when responding to civil disturbances, riots, or demonstrations. The PPE solution is a lightweight helmet offering protection against concussive and ballistic threats.	FY 2022 Q2	FY 2023 Q4	6-7
Conduct OpEx for critical PPE.	FY 2023 Q4	FY 2023 Q4	6-7

Public Safety Communications

- **Problem:** With the constant evolution of modern terrorism and other threats to the security of the homeland, it is critical that first responders have the technology to rapidly respond to emergent events. DHS Components need to have access to mission-critical communications solutions that are highly available and resilient. The introduction of broadband networks and new emerging standards has increased capability for the inclusion of voice, video and data resulting in a more complex environment where responders need to be ensured interoperability and compatibility across networks and maintain interoperability with legacy solutions (Project 25). In the past, stove-piped, proprietary systems have resulted in fractured, non-interoperable and expensive solutions. The evolution of new technologies and standards, such as the emergence of 5G/XG, Smart Cities, IoT, Next Generation 911 systems, AI, and advanced computing, has given rise to new opportunities for advanced capabilities that can be leveraged by DHS operational Components and first responders alike. However, these opportunities also result in numerous challenges for ensuring highly reliable, available, interoperable and secure communications.

- **Solution:** Through the RDT&E of technologies, S&T will develop, tailor, and pilot applications and services that leverage emerging communications and networking technologies and standards to address technology gaps to meet mission needs and user requirements. Solutions will focus on achieving efficiencies, interoperability, compatibility effective use of applications and services while addressing threats and challenges (spectrum, utilization, network resiliency, cyber and physical attacks). Additionally, S&T will conduct detailed assessments of commercial technologies to ensure that end-solutions are interoperable, compatible and standards-based ensuring the end solutions presented best value and minimal risk to users. S&T will also conduct targeted exercises to improve the resilience and minimize impacts to systems.

- **Justification:** The FY 2023 Budget for this project will be used to develop and deliver technology solutions, including knowledge products, to DHS Component as well as the broader first responder community to meet legislative requirements for interoperability and compatibility per 6 USC 195. This effort results in testing and analysis to ensure that all Land Mobile Radios developed with P25 Standards conform to standards and are interoperable. In the area of 5G/XG and advanced communications, S&T will work to support the DHS mission needs for advanced computing and communications needs. This effort will closely align to *National Strategy to Secure 5G Implementation Plan* leveraging efforts across the Federal enterprise (e.g., NIST, National Telecommunications and Information Administration (NTIA), DOD, NSF and Department of Commerce (FirstNet)). In FY 2021, during several demonstrations across various cities, first responder agencies reported interference on their radio systems. DHS has been working with a number of agencies including Federal Communications Commission and NTIA to develop technologies and techniques, tactics and procedures to address these jamming threats to public safety networks.

- **Impact:** This project supports highly available and resilient critical communications and information sharing capabilities for DHS Component including first responders using emerging technologies and communications networks. S&T will also conduct testing and evaluation of solutions to improve the resilience and availability of public safety networks in the presence of jamming (unintentional or intentional). This effort will also ensure that radio systems procured by Federal, State and local public safety users are interoperable and standards based.

Type of Research
Applied and Developmental

Technical Readiness Level
TRL varies for specific project efforts between TRL-3 and TRL-7. Project identifies and documents unique Federal, State, tribal, and local public safety requirements in voice, video, and data communications. First, technologies and capabilities are validated in a lab environment (TRL-4).

Following successful laboratory validation, technologies will be further tested in a relevant DHS Component customer environment (TRL-5). S&T will test COTS technologies in a technical demonstration environment (TRL-6). Subsequently, updates to the technology will be made, tested and evaluated in an operational environment (TRL-7) prior to transition. Finally, the project will also include conducting interoperability and compatibility testing of products for compliance with P25 standards (TR-7). Approved systems will be identified on P25 CAP website for transition and acquisition to DHS Components and responders nationwide.

Transition Plans
This effort will transition technology solutions to customers after rigorous laboratory, field, and operational testing. Solutions will be standards-based, non-proprietary in nature to allow plug-and-play adaptability for first responders. Forward-leaning first responder agencies will be identified to serve as early adopters and evangelists for the technology solutions. Knowledge product development (e.g., lessons learned, best practices, pilot reports, and test evaluations) will also be a key component of transition. Publicly available knowledge products can be disseminated more broadly and have great reach with end users. These knowledge products can also serve to promote best practices and help agencies learn from those who have come before them.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Transition technology solutions to customers after rigorous laboratory, field, and operational testing.	FY 2020 Q1	FY 2021 Q1	7
Conduct an analysis of interoperability and compatibility among tier 1,2, and 3 service providers and applications interoperability (including FirstNet).	FY 2021 Q1	FY 2021 Q1	7
	FY 2022		
Develop use cases for evaluation and assessment of next generation (e.g., 5G, XG, IoT) communications technologies in a real-world component environment to examine how current and emerging communications and network technologies can increase component effectiveness.	FY 2021 Q3	FY 2022 Q4	7
Develop strategy to address priority communications and network R&D gaps from FY 2021 analysis.	FY 2022 Q1	FY 2022 Q4	N/A
Conduct First Responder Jamming Exercise with Federal, State, and local public safety partners.	FY 2021 Q1	FY 2022 Q3	7
Conduct interoperability and compatibility testing in a multi-vendor environment for legacy and broadband systems (FirstNet).	FY 2021 Q1	FY 2022 Q2	7
	FY 2023		
Conduct performance, conformance and interoperability testing for P25 radios, consoles, and gateways systems as part of P25 CAP.	FY 2023 Q1	FY 2023 Q4	7
Develop testing scope to ensure interoperability between P25 and other communications networks (e.g., broadband, analog, and non-P25 systems).	FY 2023 Q1	FY 2023 Q4	5

Response and Defeat Operations Support (REDOPS)

- **Problem**: The response environment that our Nation's 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 particular, Public Safety Bomb Squads and Special Weapons and Tactics (SWAT) Teams are on the forefront of addressing emerging threats such as active shooter, complex coordinated attacks, and improvised explosive devices (IEDs). While significant investments are made on explosive detection, there are limited investments being made across government to ensure bomb technicians have the capabilities to preserve life and/or property once an IED has been discovered.

- **Solution**: S&T will support short, medium, and long-term focused efforts that ensure regular delivery of new capabilities to supported first responders. The Agency will identify user-developed innovations through direct and regular interaction with user community to identify user developed innovations that with additional development can be quickly transitioned. S&T will also identify high priority requirements and capability gaps, develop solutions, and conduct operational assessments of next generation technologies that address identified gaps, with a goal of rapidly developing and transitioning new capabilities. Furthermore, S&T will perform operational assessments of emerging technologies that assess new capabilities with immediate field applications and identify new research and development requirements. Finally, the Agency will develop IED disablement tools and/or techniques through a combination of rigorous scientific testing and cutting-edge engineering practices. Specifically, S&T is focusing on the following:

    - Micro Research and Development: Identify user developed innovations that can quickly transition to community-wide use. Validate performance of the innovation and develop required designs and specification for immediate to operational use. Validate knowledge products with State and local agencies. Developed capabilities are transitioned in less than 12 months.

    - Operational Assessments and Response Experimentation: Perform user-driven operational assessments of emerging technologies with immediate field applications in order to identify capabilities and limitations of equipment and systems, new technology development requirements, and lessons learned/best practices in high threat operational responses. Knowledge products are transitioned within 12-18 months.

    - RAPID: Research and Prototyping for IED Defeat (RAPID) develops cutting edge counter-IED defeat capabilities with focused R&D on emerging threat devices. RAPID uses a hard science approach, both in the lab and in the field, to find the best possible methods for safety disabling bombs. Developed capabilities are transitioned to operational use within 12-24 months. RAPID is performed in partnership with the FBI Critical Incident Response Group who transitions all REDOPS technologies to the State and local community.

    - RAPTOR: Research and Prototyping for Tactical Operations applies the REDOPS model to the tactical community with focused operational assessments, response experimentation, and micro-R&D in direct support the Federal, State, local, tribal, and territorial SWAT community.

- **Justification:** The FY 2023 Budget for this project will be used to assess C-IED technologies, develop new tools and/or tactics, techniques, and procedures to counter evolving threats, and transition work products to bomb technicians across the country. IEDs remain one of the most accessible weapons available to terrorists and criminals, and the tactics used in IED attacks continue to evolve as our adversaries seek to overcome countermeasures. This project will close associated capability gaps in order to preserve life and/or property.

- **Impact**: Developed solutions will strengthen the front-line public safety response capabilities to the highest priority threats and increase our Nation's ability to protect the homeland and respond to terrorist and criminal activities while saving lives and protecting property.

Type of Research

Applied and Developmental

Technical Readiness Level

TRL varies for specific project activities between TRL-4 and TRL-7. Some efforts begin as an idea identified by field users, which are then are designed and characterized in a lab environment prior to being published as a knowledge product (TRL-4). Some efforts assess existing technologies and tactics, techniques, and procedures which are validated and published as a knowledge product (TRL-6). The goal is to transition technology at TRL-7 or a knowledge product (TRL-6) within 12-24 months.

Transition Plans

The program partners with the National Bomb Squad Commanders Advisory Board, International Association of Bomb Technicians and Investigators, United States Bomb Technicians Association, National Tactical Officers Association, and DOD, who are directly involved with the activities associated with this project from initiation to transition. In addition, the program partners with the FBI who serves as the National Program Manager for Counter IED activities and is responsible for the Hazardous Device School which trains all Public Safety Bomb Technicians within the United States. Products are evaluated and/or characterized before being transitioned directly into the Hazardous Device School and/or through the FBI's Law Enforcement Enterprise Portal. This ensures that applicable work products reach the bomb technician community in its entirety.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Execute four test bed assessments.	FY 2021 Q1	FY 2021 Q4	6
Validate and produce REDOPS knowledge products for a minimum of four micro technologies.	FY 2021 Q1	FY 2021 Q4	6
Develop and test two REDOPS IED render safe technologies.	FY 2021 Q3	FY 2021 Q3	4-6
	FY 2022		
Execute four test bed assessments.	FY 2022 Q1	FY 2022 Q4	6
Validate and produce REDOPS knowledge products for four micro technologies.	FY 2022 Q1	FY 2022 Q4	6
Develop and test two REDOPS IED render safe technologies.	FY 2022 Q1	FY 2022 Q3	4-6
Deliver four Advanced Disablement Engineering and Transition Seminars.	FY 2022 Q1	FY 2022 Q4	7
	FY 2023		
Execute four test bed assessments.	FY 2023 Q1	FY 2023 Q4	6
Validate and produce REDOPS knowledge products for four micro technologies.	FY 2023 Q1	FY 2023 Q4	6
Develop and test two REDOPS IED render safe technologies.	FY 2023 Q1	FY 2023 Q3	4-6
Deliver four Advanced Disablement Engineering and Transition Seminars.	FY 2023 Q1	FY 2023 Q4	7

Stakeholder Engagement and Requirements (First Responders Resource Group and International)

- **Problem:** First responders have limited avenues to relay their highest priority requirements for R&D that can save their life and improve their safety, efficiency and effectiveness.

- **Solution:** S&T will provide our Nation's first responders and DHS Components, as well as international partners, with a forum to relay and pursue their highest priority capability needs and to provide critical input on the design and function of new technologies.

- **Justification:** The FY 2023 Budget for this project will be used to engage with FSLTT first responders (fire, law enforcement, emergency medical service) through the First Responder Resource Group meeting, which consists of 150 Federal, State, and local first responders from across the country, international cooperative activities, focused working groups, and operational field assessments and operational experimentation exercises in order to understand strategic direction and requirements for high priority technology development needs and to obtain user feedback to ensure usability and operability of new capabilities.

- **Impact:** The requirements identified and end-user feedback provided by the stakeholder engagement led to the development of life saving technologies that make our Nation's first responders safer, more efficient, and more effective. To date, the close coordination and execution of R&D projects through this stakeholder engagement has led to successful transition of more than 20 technologies to the commercial marketplace for first responders to purchase.

Type of Research
Applied and Developmental

Technical Readiness Level
The TRL values do not apply to stakeholder engagement activities (requirements gathering meetings). The operational field assessments are focused on TRL 5-6 technologies. The period of performance for activities varies from about 3-12 months.

Transition Plans
Identification of common global capability gaps informs transitions plans and encourages industry and other stakeholders to identify and develop solutions for first responders.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Hold one annual requirements gathering conference and identify 12 to 16 new technology requirements for DHS Components and our Nation's law enforcement, fire and emergency medical service first responder.	FY 2021 Q2	FY 2021 Q3	N/A
	FY 2022		
Complete two operational field assessments with First Responder participants.	FY 2022 Q1	FY 2022 Q4	5-6
	FY 2023		
Hold annual conference to identify 5 – 8 new technology requirements for DHS Components and our Nation's law enforcement, fire, and emergency medical service first responders.	FY 2023 Q1	FY 2023 Q3	N/A
Complete one operational field assessments with First Responder participants.	FY 2023 Q1	FY 2023 Q4	5-6

Training and Performance Optimization

- **Problem:** The efficiency and effectiveness of DHS's law enforcement, security officers, 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. DHS Components and law enforcement need enhanced modern training delivery tools, training infrastructure, and mission execution training capabilities that are research-based, maximize proficiency, effectiveness, efficiency, safety, and build officer confidence and to more capably support the DHS' missions and respond to local, national, or international disasters or emergencies.

- **Solution:** S&T works with DHS Components and the first responder community to identify common mission and operational capability gaps that can be addressed through improved training and performance optimization methods, tools, and technologies. DHS Component end-users and first responders require training that leverages the latest research-based, cutting-edge training methods and innovative technologies in order to deliver the skills and flexibility required to respond under a variety of conditions, thereby increasing capacity, task retention, improved mission performance outcomes, resilience, and safety. Improved training in areas such as the underlying components of critical decision-making (e.g., perceptual skills, critical thinking, alternate option weighing) are imperative when operating in uncertain, stressful, time-constrained, or hazardous environments. Improving the delivery and retention of training and performance optimization tools includes maximizing human performance, integration of human in the loop with the systems they use, and enabling informed decision making. The collective synergy of a research-based approach to training and performance optimization will improve operational efficiency, effectiveness, and overall national security.

- **Justification:** The FY 2023 Budget for this project will be used to develop, assess, and transition immersive training and operations methods and tools for the Federal Law Enforcement Training Centers (FLETC), DHS Training Academies, and Component Training Offices in support of personnel on the front line of homeland security. DHS Components need modern training and immersive technologies that maximize skill sustainment and operational performance. A recent JRC Strategic Review Risk Areas report identified training for both proficiency and expertise as a need that may be accomplished in an online or distributed environment. The environment in which Components work, learner needs, professional development opportunities, and major trends in workplace training are advancing at a rapid pace. The Covid-19 pandemic accelerated many of these changes outside of DHS. As the threat to the homeland changes so will the tools and the approach DHS takes. Modern training approaches, such as immersive technologies and game-based learning, developed with this funding, when deployed correctly and in a pedagogically consistent manner, have the potential to support and expand curriculum while enhancing learning outcomes in ways which have not been previously possible, affordable, or scalable. Funds will also support research and studies, in support of FLETC's Training Environment of the Future, on emerging homeland security threats, methods, and tools for law enforcement to safely, efficiently, and effectively perform their duties while building resilience across Components.

- **Impact:** Mission success and resilience of our homeland security workforce is never assured. Providing DHS and broader homeland security enterprise end users 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, safety, robustness, and capacity for rapid recovery and adaptability.

Type of Research

Applied and Developmental

Technical Readiness Level

This project's R&D efforts typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS use. Identified technology is then adapted and validated in a laboratory or relevant environment (TRL-4/5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7). Project efforts will transition at TRL-6 or TRL-7. The period of performance for most activities is 12-18 months.

Transition Plans

- A research-based systems engineering study, a university andragogy-based infrastructure study, and plans developed for FLETC to identify requirements for future R&D and guide future investments in their Training Environment of the Future.
- A study and assessment of a training delivery platform/method to improve the participation rate of State, local, tribal and territorial law enforcement especially and remote and rural locations.
  Transition a report on that describes technologies that could mitigate law enforcement distracted driving incidents and provides an overview of future technologies that may contribute to distracted driving.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Transition a process and research report to code and score video obtained from encounters between officers and the public that may be used to improve officer skills, methods, and departmental polices.	FY 2020 Q3	FY 2021 Q4	7
	FY 2022		
Transition a university program's infrastructure study with findings and recommendations to support and recommendations FLETC's Training Environment of the Future.	FY 2021 Q3	FY 2022 Q3	5
Transition research-based Training Evaluation Framework for immersive training content and delivery for skill improvement and task transfer to FLETC law enforcement students.	FY 2021 Q4	FY 2022 Q4	7
Transition a report on that describes technologies that could mitigate law enforcement distracted driving incidents and provides an overview of future technologies that may contribute to distracted driving.	FY 2020 Q1	FY 2022 Q4	7
Complete evaluation of an immersive analysis and training tool to assist law enforcement agencies with improving cognitive, visual and manual officer skills required for emergency vehicle operations and help reduce accidents resulting from distractions commonly found in a patrol vehicle.	FY 2022 Q1	FY 2022 Q4	6
Initiate applied research assessment of immersive technologies for experimentation and validation that these tools improve the delivery of law enforcement training.	FY 2022 Q3	FY 2022 Q4	5-7
	FY 2023		
Complete draft report of Criminal Investigator and Law Enforcement skills required for new officer success, including the processes used to identify required skills and to develop curriculum that ensures officer success.	FY 2023 Q1	FY 2023 Q4	5
Identification of updates that should be incorporated by OPM in officer skill job descriptions and classifications.	FY 2023 Q2	FY 2023 Q4	5
Conduct research on immersive training and operational tools and scenarios to the FLETC, USSS, and DHS Training Academies.	FY 2023 Q1	FY 2023 Q4	7
Initiate a research study, in support of FLETC's Training Environment of the Future, on emerging homeland security threats, methods, and tools required by law enforcement to safely, efficiently, and effectively perform their duties while building resilience across Components.	FY 2023 Q3	FY 2023 Q4	5

National Disaster Resiliency Program – After FY 2021, this program no longer exists. This program developed and provided advanced planning, CONOPS, disaster management tools, and training aids for responding to and recovering from a large-scale natural disaster. This included 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

- **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. Advances in networking, computing, sensing, and control systems have enabled a broad range of new applications. Operators are increasingly seeing the potential of adding computational power and network connectivity to a wide range of devices. 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.

- **Solution:** The project will provide solutions that enable systems and defense-in-depth computer components that are trusted, hardened, and able to recover from large-scale failures. Project solutions align with government missions with highest value and highest risk to safety and security. This effort works to provide gap solutions as the spectrum of Industrial Control Systems (ICS), Cyber-Physical Systems (CPS), and the IoT continue to proliferate and become networked and a more complex attack surface. This includes efforts for risk, threat, and mitigation analysis capabilities in blended cyber, physical, and all-hazards scenarios. For example:

  - CPS/ICS/IoT: Risk assessments and analysis within the critical infrastructure today are often separate processes for cyber security in information technology and operational technology than other processes for physical security and processes for all-hazards events. The CPS/ICS/IoT effort works to enhance consequence and holistic risk assessment capabilities in context of overall blended and linked real-world, with mitigations/counter-measures appropriate to a blended outcome.

  - Vehicle Cyber Security*:* DHS has the largest fleet of civilian vehicles, a majority supporting law enforcement and homeland security missions. Current and future vehicles will increasingly utilize connected features and autonomous capabilities. This effort identifies cyber vulnerabilities in telematics, fleet management, connected components, and autonomous features, with development of mitigations in DHS law enforcement use cases.

- **Justification:** The FY 2023 Budget does not provide funding for this project.

- **Impact:** This project will provide capabilities for enhanced security in CPS/ICS/IoT practices and designs; enhance capabilities to detect, defend, and mitigate threats related to CPS/ICS/IoT; enable the exploration of recovery and reconstitution areas; and support the development of countermeasures that will fundamentally change the way CPS/ICS/IoT risk and security is deployed.

Type of Research
Developmental

Technical Readiness Level
The program began at TRL-5 and will end at TRL-7. This project's R&D efforts typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology is then adapted and validated in a relevant environment (TRL-5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition.

Transition Plan
S&T will deliver targeted exploratory, developmental, and operational capabilities directly to sustained component operations.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Develop initial analysis of cyber security risks to DHS law enforcement/HSE fleet vehicles and emerging autonomous capabilities. Include applied research project concepts to mitigate gaps and risks.	FY 2021 Q1	FY 2021 Q3	N/A
Deliver targeted exploratory, developmental, and operational capabilities directly to Components (i.e., CISA) for sustained operations.	FY 2020 Q4	FY 2021 Q2	N/A
Demonstrate a prototype firmware-trojan detection system using the electromagnetic emissions (EME) technique with at least 75% accuracy.	FY 2021 Q1	FY 2021 Q4	5
Documentation of a design outlining the research, development, testing and piloting strategy for end-to-end security controls for a 5G device, RAN, core, and transport network architecture aligned with the network architecture nationwide wireless services providers will be implementing in their networks.	FY 2021 Q1	FY 2021 Q3	6
Deliver prototype of non-VOIP (Voice Over Internet Protocol) secure voice and messaging applications supporting the Government Sensitive But Unclassified (SBU) protection requirements.	FY 2021 Q1	FY 2021 Q3	6
Demonstrate prototype of virtual Trusted Internet Connection (vTIC) cloud implementation for traffic inspection and processing, and authentication to identify Internet traffic by individual users. The prototype will also implement protective Domain Name System (DNS) for mobile devices.	FY 2021 Q1	FY 2021 Q3	6
5G security study discussing vulnerabilities and risk mitigations for 5G network security, cybersecurity, and supply chain security.	FY 2021 Q1	FY 2021 Q4	5

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Documentation of an architecture to define, implement, test and document a secure voice network that can support landline-to-landline, landline-to-mobile and mobile-to-mobile secure communications.	FY 2021 Q1	FY 2021 Q4	5
Report detailing the testbed implementation of 4G LTE (Long Term Evolution) capable calling devices with a secure distance bounding protocol, fuzzing infrastructure optimized for core LTE protocols, device link location measurements, and encryption implementations.	FY 2021 Q1	FY 2021 Q2	5
Execute a pilot implementation and deliver targeted exploratory, developmental, and operational capabilities directly to Components (i.e., CISA) for sustained operations.	FY 2021 Q1	FY 2021 Q4	5
Deliver CAD-to-CAD Interoperability Specification (functional solution, technical solution) directly to Components (i.e., CISA) for publication and potential commercialization.	FY 2021 Q1	FY 2021 Q4	5
Complete development of 2 - 4 cyber-attack scenarios and deliver to CISA for use in Control Environment Laboratory Resource (CELR) testing skids.	FY 2020 Q4	FY 2021 Q4	7
	FY 2022		
Prototype embedded technology to defend against mobile network infrastructure firmware attacks such as buffer/heap overflow, rootkits or attack chains involving any embedded or IoTs device. A key feature of this project will be a new capability to modify firmware to add or remove functionality.	FY 2021 Q2	FY 2022 Q2	6
Deliver a focused 5G security study to inform the investment of DHS R&D funds that address risk mitigation for 5G network security, cybersecurity, and supply chain security. Topics may include priorities of the CISA Director, ECD, NRMC, CSD or strategic policy goals.	FY 2022 Q1	FY 2022 Q4	N/A
Deliver a knowledge product that uses stateful communication protocols SS7, Diameter and GTP Firewall with security-focused advanced analytics algorithms and a global threat intelligence service to ensure network borders are continually secured.	FY 2021 Q2	FY 2022 Q4	N/A
	FY 2023		
N/A	N/A	N/A	N/A

Innovative Research and Foundational Tools Thrust Area
Research and Development

Technology Readiness Level Exhibit

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
Innovation Research and Foundational Tools Thrust Area	$76,792	$79,793	$95,106

R&D Thrust Area Description

INNOVATIVE RESEARCH AND FOUNDATIONAL TOOLS THRUST AREA: S&T aims to understand the high-priority, homeland security capability needs and gaps, and identify optimal approaches for providing solutions and knowledge that address those needs. R&D investments enable gathering gaps through analysis and requirements prioritization with focus on identifying and analyzing potential solutions and working with customers to select the best approach to delivering solutions, including knowledge and advice.

INNOVATIVE RESEARCH AND FOUNDATIONAL TOOLS THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
Total –Innovative Research and Foundational Tools Thrust		**$76,792**	**$79,793**	**$95,105**
Foundational Tools		**$13,527**	**$16,006**	**$15,006**
	Aligning Departmental R&D to DHS Goals (Integrated Product Teams)	$2,001	$3,000	$3,000
	First Responder Technologies-System Assessment and Validation for Emergency Responders (SAVER)	-	$1,980	$1,980
	Technology Clearinghouse	$2,750	$1,250	$1,250
	Technology Scouting	$4,796	$4,796	$4,796
	Technology Transition	$3,980	$4,980	$3,980
Partnerships		**$26,274**	**$23,796**	**$18,675**
	Bi-National Cooperative	$2,000	$1,000	-
	Commercialization Accelerator Program	$5,185	$5,185	$3,000

INNOVATIVE RESEARCH AND FOUNDATIONAL TOOLS THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
	Coordination, Engagement, and Outreach	$3,089	$3,089	$2,000
	Partnership Intermediary Agreements (PIA)	$7,000	$4,000	-
	SBIR Management (formerly Partnership Mechanisms and Technology Transition)	-	$1,522	$2,175
	Silicon Valley Innovation Program (SVIP)	$9,000	$9,000	$9,000
	Technology Transfer and Commercialization	-	-	$2,500
Technology Centers		**$36,991**	**$39,991**	**$61,424**
	Advanced Computing Technology Centers	$11,126	$11,126	$17,557
	Enduring Sciences Technology Centers	$16,594	$19,594	$30,367
	Innovative Systems Technology Centers	$9,271	$9,271	$13,500

Foundational Tools Program – A critical part of S&T's mission as science advisor to the DHS Secretary is to ensure that R&D receives the proper requirements analysis and due diligence that will support homeland security operations. There are critical elements of the R&D lifecycle that are required for all programs and projects to undergo from the point of concept through the transition of a capability or knowledge product. S&T is responsible for collecting, identifying and prioritizing DHS-wide R&D capability gaps/needs, minimizing or eliminating the duplication of efforts, as well as identifying cost effective solutions for Component operations and process inefficiencies. S&T also utilizes its scientific, technical, and mission expertise to conduct technology scouting analysis and transfer the information to Components and stakeholders in order to support the identification, development, and transition of solutions to high priority capability needs and gaps. In support of these activities, S&T aims to expand the associated functions of OpEx events and the Technology Clearinghouse to serve as centralized demonstrations of potential technology options and a common knowledge management and communication portal for homeland security technology requirements and solutions.

Aligning Departmental R&D with DHS Goals

- **Problem:** S&T receives many requests each year from DHS Components for R&D work. With a limited budget, S&T needs to understand the relative priority of each of these requests and their significance to the Component's mission and DHS strategic goals. S&T also needs to ensure all R&D programs, projects, and activities are coordinated across the department to avoid duplication of efforts and to enable enterprise solutions.

- **Solution:** S&T implemented the Integrated Product Team (IPT) process as a mechanism to identify, collect, and prioritize Components' R&D needs and priorities throughout the fiscal year. The IPT process will continue to serve as S&T's primary mechanism for identifying and prioritizing Component R&D-related capability gaps as existing and emerging threats are identified, to support S&T decision-making on internal R&D activities and resource allocation. The IPTs are also used to report on the status of all ongoing S&T R&D programs, projects, and activities to ensure customer alignment throughout the R&D lifecycle.

  S&T also established the Department-wide R&D Coordination process as an enterprise-wide approach to achieving a more unified, coordinated approach for conducting R&D against DHS's needs. R&D Coordination will continue to deliver visibility, transparency, and traceability of the comprehensive set of DHS R&D investments, to inform resource decisions and ensure alignment to high priority mission needs. R&D Coordination is also used to report on DHS's overall R&D status. R&D Coordination is aligned with S&T's IPT process, ensuring that S&T's IPT activities are recognized as contributing to Department-wide coordination, while allowing S&T the flexibility to manage them according to its own internal business process.

- **Justification:** The FY 2023 Budget for this project will be used to further advance the use of portfolio management, risk management, and decision analytics. The combined implementation of IPT process and R&D Coordination process will provide unprecedented transparency and traceability of S&T and DHS R&D activities, respectively, from capability gap/need identification to solution delivery. The improved processes ensure direct alignment of R&D resources to Component/homeland security enterprise mission needs and DHS strategic priorities. S&T will also improve alignment of the IPT and R&D Coordination processes with DHS resource allocation planning cycle to improve prioritization and coordination of R&D with major acquisitions.

- **Impact:** Through the IPT process, S&T ensures that R&D efforts address validated and prioritized R&D needs of DHS operational and support Components. This will in turn enable S&T to successfully deliver effective and impactful solutions that meet Components needs to help them fulfill their missions. Through the R&D Coordination process, S&T ensures DHS R&D current activities and long-term strategies are coordinated and aligned to optimize the use of limited R&D resources.

Type of Research

Applied and Developmental

Technical Readiness Level

This is part of the R&D lifecycle development and deployment for all programs and projects to ensure customer component alignment, priority, and enterprise-wide collaboration. The majority of S&T R&D is between TRL-4 and TRL-7.

Transition Plans

N/A

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Integrated data analytics into the IPT Process to ascertain the technical feasibility of applying R&D to capability gaps.	FY 2021 Q1	FY 2021 Q3	N/A
Aligned the IPT and Joint Requirements Council (JRC) Portfolio Team Process to ensure better coordination of R&D and acquisition resources for long-term capabilities development.	FY 2021 Q1	FY 2021 Q4	N/A
Conducted the FY 2021-2022 IPT process to identify and prioritize R&D capability gaps.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
Conduct FY 2022 IPT process to identify and prioritize R&D capability gaps that will influence out year resourcing plans.	FY 2022 Q1	FY 2022 Q4	N/A
Integrate new standards and procedures to improve the quality, consistency, and efficiency of capturing and maintaining a comprehensive accounting of Department-wide R&D projects and activities. Improvements will be based on recommendations from the S&T Focus Group for R&D Standardized Reporting; S&T Leadership; and the R&D Coordination Steering Group.	FY 2022 Q1	FY 2022 Q3	N/A
	FY 2023		
Conduct the FY 2023 IPT process to identify and prioritize R&D capability gaps/needs.	FY 2023 Q1	FY 2023 Q4	N/A
Conduct the FY 2023-2024 R&D Coordination process to report on DHS's overall R&D status and strategic alignment.	FY 2023 Q2	FY 2023 Q4	N/A
Charter the new R&D Coordination Council to govern the R&D Coordination process.	FY 2023 Q1	FY 2023 Q4	N/A
Deliver R&D Coordination Implementation Guidance that defines alignment across DHS R&D, requirements, and acquisition processes, enabling an enterprise-wide approach for coordinated use of R&D and technology resources to address DHS's priority needs.	FY 2023 Q1	FY 2023 Q4	N/A

First Responder Technologies-System Assessment and Validation for Emergency Responders (SAVER)

- **Problem:** Technology/equipment that first responder agencies need to purchase is increasingly complex and rapidly evolving. Additionally, these agencies frequently lack in-house specialized and technical expertise to make informed technology purchasing decisions.

- **Solution:** S&T utilizes the NUSTL SAVER knowledge products that serve as a valuable guide for informing first responder agencies' technology and equipment purchasing decisions by reporting what technologies are available in the marketplace, and how they perform in realistic conditions. This information can reduce agencies' risks of buying technology/equipment that does not meet their operational needs; enabling smart use of State and local, as well as DHS funds and grants. In particular, FEMA has provided billions of dollars in funding for emergency responder equipment though the Homeland Security Preparedness Grant Programs. FEMA Preparedness Grants totaled more than $1.87B in FY 2021. The SAVER program was designed to make sure that this funding is judiciously spent. The breadth of SAVER spans over 700 distinct types of technology and equipment that fall into the 20 FEMA Authorized Equipment List (AEL) categories associated with those preparedness grants. Without funding, NUSTL cannot conduct evaluations of commercially available first responder technologies nor provide knowledge products that support the responder equipment purchases across the Nation.

- **Justification:** The FY 2023 Budget for this project will be used to plan and execute SAVER activities that will help first responders of all disciplines (Fire, EMS, Law Enforcement) to better select, procure, use and maintain emergency equipment. SAVER activities include the development of: Tech Notes, a two-page product summary that explains in basic terms what a technology does, what it is used for, and how it works; and market survey reports which provide a snapshot of the commercial market for a particular type of equipment. SAVER activities also include facilitating focus groups with first responders to gather and analyze technology requirements and evaluation criteria; and conducting comparative technology assessments with first responders using the equipment in real-world conditions.

- **Impact:** First responder organizations rely on SAVER knowledge products to make sure their agencies have the right tools and technologies to effectively support their missions. If these tools do not perform as required, the lives of first responders and the people they protect are at risk. NUSTL's SAVER program recently looked at physiological monitoring systems for first responders, recognizing the distinct operational needs and austere environmental conditions that these devices need to function in, to provide real time information on health of first responders. SAVER assessments are driven by first responders, focusing on the responders' experience with the equipment – the operational features, and how it works for the end-user in realistic operational conditions. These considerations are not captured in product spec sheets, or even known by the technology vendor in many instances. NUSTL utilizes its own expertise and partners with external SMEs, for example other labs and organizations that have expertise in explosive detection, tactical equipment, chemical detection, to evaluate these tools with responders. For these reasons, responder agencies rely on SAVER as their first stop for researching technology and equipment solutions before making a purchase. Since 2004, SAVER has produced more than 1,000 knowledge products, addressing equipment in 18 of the 21 AEL categories, covering 187 unique AEL numbers. Knowledge products are available to the national first responder community - the nearly 18,000 police agencies and 30,000 fire departments in the United States.

Type of Research
Applied

Technical Readiness Level
TRL N/A: All tools and technologies under evaluation are COTS products that are available for purchase by first responder agencies.

Transition Plans
The SAVER project transitions final knowledge products to the responder community by posting them on the DHS S&T SAVER document library website, in accordance with the S&T COD publication review and approval process. Links to the final knowledge products are emailed to stakeholders. FOUO reports are provided directly to specific entities securely as needed. Transition success is tracked through website analytics and responder feedback.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
SAVER was aligned under the First Responder/Disaster Resilience Thrust in FY 2021.	N/A	N/A	N/A
	FY 2022		
Publish Market Survey Report for Patient Triage Using Artificial Intelligence.	FY 2021 Q3	FY 2022 Q4	N/A
Publish Assessment Report for Crowd Counts and Analysis.	FY 2021 Q3	FY 2022 Q4	N/A
Publish Market Survey Report for Mobile and Portable Radiation Detector Systems.	FY 2021 Q1	FY 2022 Q2	N/A
Publish Market Survey Report for Laser Protection Eyewear.	FY 2021 Q2	FY 2022 Q2	N/A
Publish Market Survey Report for Respiratory Protection for Wildland Firefighting.	FY 2021 Q3	FY 2022 Q3	N/A
Publish Market Survey Report for Blast Resistant Trash Receptacles.	FY 2021 Q4	FY 2022 Q2	N/A
Publish TechNote for 3D Locator Technology.	FY 2021 Q4	FY 2022 Q4	N/A
Publish Assessment Report for Physiological Monitoring Devices.	FY 2020 Q1	FY 2022 Q4	N/A
Publish Assessment Report for Night Vision Technology.	FY 2020 Q2	FY 2022 Q3	N/A
Publish Assessment Report for Radio Repeaters.	FY 2020 Q3	FY 2022 Q2	N/A
Conduct survey, analysis, and planning for FY 2023 Assessments, Market Surveys and TechNotes.	FY 2022 Q3	FY 2022 Q4	N/A
	FY 2023		
Conduct survey, analysis, and planning for FY 2024 SAVER.	FY 2023 Q3	FY 2023 Q4	N/A

Technology Clearinghouse

- **Problem:** S&T must maintain a collaboration information sharing capability for DHS Components and the first responder and emergency preparedness and response communities. This is necessary in order to gather necessary information for its programs and to keep those communities informed about the technologies and knowledge products S&T is developing on their behalf. Additionally, DHS needs a single, intuitive knowledge sharing resource to find, collect, curate and disseminate relevant information to partners, stakeholders and the private sector regarding homeland security technologies, innovative solutions, resources, and capabilities.

- **Solution:** S&T's Technology Clearinghouse provides collaboration opportunities among homeland security personnel, industry, academia, and other stakeholders and aids in the development of innovative technology solutions for homeland security. The S&T Technology Clearinghouse shares curated information and general resources that assist the R&D, industry and manufacturer community in collaborating with DHS and the broader first responder community to protect the Homeland. This curated information defines authoritative homeland security requirements and gaps, research and development investment and business opportunities, licensing opportunities, operational testing and evaluation activities, standards development and other partnership initiatives. The Technology Clearinghouse was authorized in the Homeland Security Act of 2002.

- **Justification:** The FY 2023 Budget for this project will be used to: conduct ongoing user-driven assessments of the Technology Clearinghouse governance, technical implementation and content development to ensure that it continues to meet the requirements of the Homeland Security Act of 2002; enhance and add new functionality to the technical implementation to ensure that it meets user identified requirements; review, assess, and maintain content in the Technology Clearinghouse to ensure that the curated information in the Technology Clearinghouse is current and relevant to homeland security stakeholders; promote the Technology Clearinghouse through ongoing stakeholder engagements to expand the user community, content, and new and enhanced functionality; advance the current Technology Clearinghouse from an S&T-centric platform to a national homeland security capability; expand the Pathways to Innovation Learning Series to provide a collaborative environment for sharing homeland security challenges and potential solutions to assist in supporting ongoing R&D, acquisitions and deployment decisions.

- **Impact:** The S&T Technology Clearinghouse increases awareness of S&T's work, and it facilitates the flow of important information throughout DHS, the emergency response community, and the private sector innovation community. The Technology Clearinghouse facilitates the knowledge sharing of existing R&D expenditures and is a cost-effective communication tool that expands S&T's reach into stakeholder communities and enables DHS and the homeland security community to make better informed R&D, investment and purchasing decisions.

Type of Research
Applied and Developmental

Technical Readiness Level
This is part of the R&D life cycle development and deployment for all programs and projects to ensure customer component alignment, priority, and enterprise-wide collaboration. The majority of S&T R&D is between TRL-4 and TRL-7.

Transition Plans

N/A

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Hosted four or more Pathways to Innovation Learning Series (PILS) events.	FY 2021 Q1	FY 2021 Q4	N/A
Increased the number of Tech Clearinghouse knowledge products by 20%.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
Build out the Technology Clearinghouse to provide access to academia, Industry, R&D organizations and the Innovation Community.	FY 2022 Q1	FY 2022 Q4	N/A
Integrate the public and limited-access portals into a single science and technology repository.	FY 2022 Q2	FY 2022 Q4	N/A
Build out the Technology Clearinghouse to provide external access to State and local public safety/first responder agencies and organizations.	FY 2022 Q1	FY 2022 Q4	N/A
	FY 2023		
Develop integrations with two knowledge repositories to increase the amount of discoverable content by 25%.	FY 2023 Q1	FY 2023 Q4	N/A
Provide the ability for DHS components to access S&T Transition knowledge products.	FY 2023 Q1	FY 2023 Q4	N/A
Work with users to gather, document, and prioritize new technical requirements for future development sprints.	FY 2023 Q1	FY 2023 Q4	N/A

Technology Scouting

- **Problem:** S&T program operational mission needs. This is essential and is part of all program or project solution analysis in order to avoid unnecessary, duplicative R&D. Detailed research and analysis of viable solution alternatives improves program planning and R&D decision-making, and it informs a customer's decision on the most appropriate existing, adaptable or new R&D solution(s). A centralized source of information on existing commercial or R&D solutions needs to be available to users to most effectively and efficiently satisfy existing technology capability gaps and to rapidly enhance homeland security.

- **Solution:** By conducting research on existing technologies and solutions that are available commercially, through another Federal agency or supported research organization, technology scouting provides input to assist in the make versus buy decision; therefore, eliminating unnecessary R&D. Providing technology scouting services will support technology research, alternatives analysis, support and capability transition for inserting appropriate technology and knowledge products into DHS Components and the larger HSE.

- **Justification:** The FY 2023 Budget for this project will be used to provide technology scouting in support of the S&T Business Process Flow Program Manager and component customer needs. Conducting one market analysis and one horizon scanning report will be done to better inform S&T Program Managers with R&D spend and acquisition planning. Additionally, initiation of a study to create novel, composable technology scouting services will be aimed at assisting DHS Components in the acquisition process.

- **Impact:** Leveraging these existing capabilities allows faster development and increases partnership opportunities and resources to assist in the development of current or future homeland security systems and needs and eliminates unnecessary R&D expenditures.

Type of Research
Applied and Developmental

Technical Readiness Level
This is part of the R&D life cycle development and deployment for all programs and projects to gauge the state of the market and to ensure S&T leverages academia, industry, and other Federal entities before making R&D investments. The majority of S&T R&D is between TRL-4 and TRL-7.

Transition Plans
N/A

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Create knowledge distribution channels to share completed tech scouting reports and research to greater audiences within the HSE.	FY 2021 Q2	FY 2021 Q4	N/A
Provide tech scouting services to cover S&T business process flow high priority Program Manager and Component customer requests.	FY 2021 Q1	FY 2021 Q4	N/A
Initiate tech scouting-rapid technology assessment planning process, develop tools and methodology.	FY 2021 Q2	FY 2021 Q4	N/A
	FY 2022		
Conduct two pilot tech scouting – rapid tech assessment activities and 50 tech scouting engagements to provide customers information on the viability of potential solutions.	FY 2021 Q3	FY 2022 Q4	N/A
	FY 2023		
Continue to provide tech scouting services to cover S&T business process flow for high priority Program Manager and Component customer requests.	FY 2023 Q1	FY 2023 Q4	N/A
Initiate a study to create novel, composable tech scouting services aimed at assisting DHS Components in the acquisition process.	FY 2023 Q1	FY 2023 Q4	N/A

Technology Transition

- **Problem:** The transition of new technologies and capabilities to DHS Components and other end users is a challenge for all USG agencies. The purpose of Technology Transition is to ensure, to the maximum extent practicable, that S&T transition management and execution is integrated into S&T's R&D program management lifecycle process and then managed to ensure greater success in the adoption and tracking of solutions funded by DHS and developed for national homeland security purposes.

- **Solution:** S&T will provide transition management services and tools that will assist Program Managers (PMs) and S&T decision-makers in project planning and execution. As part of the R&D lifecycle, all programs and projects will require transitioning planning. These services focus on critical transition areas identified by S&T including selection and implementation of transition tools and strategies; identification, measurement, and mitigation of transition issues and risks; engagement and communication between the PM and the customer; and assurance that the user is ready and resourced to employ S&T-developed products. Enhancements to transition management services will be based on a formal independent evaluation, analysis and recommendations for the incremental build of a transition management service capability that can support the evolving needs of S&T and its customers.

- **Justification:** The FY 2023 Budget for this project will be used to provide R&D transition planning and management service capability to DHS PMs; offer tools and services to track S&T's and DHS's project transitions, collect and analyze post-transition data for the purpose of reporting on the impact of DHS sponsored R&D; share guidance to standardize collection and reporting of R&D indicators of success by S&T and DHS in support of *the FY 2017 National Defense Authorization Act (NDAA)* R&D annual report; and improve strategic communication channels to improve transition coordination, management and reporting.

- **Impact:** Providing S&T a transition management service capability for its R&D programs, projects, and activities will expedite the transition of technologies and knowledge to DHS and other government agencies; improve the probability of successful project outcomes; and provide a systematic approach to determine potential failure points associated with the transition of a solution so that resources can be quickly allocated to address issues or reallocated to priority projects. Separately, S&T will track and report on DHS R&D transitions and also focus on post-transition evaluations of R&D activities for three years in accordance with the FY 2017 NDAA.

Type of Research

Applied and Developmental

Technical Readiness Level

This is part of the R&D life cycle development and deployment for all programs and projects to ensure successful transition of R&D capabilities to component customers.

Transition Plans

N/A

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Provide transition planning services to cover S&T high priority PM and Component Customer requests.	FY 2021 Q2	FY 2021 Q4	N/A
Establish S&T R&D transition tracking and reporting capability in support of the 2017 NDAA and other data/information sharing requirements.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
Provide transition planning and management capability services for S&T's R&D efforts while enhancing foundational governance and procedural guidance documents to further mature S&T's transition management services capability for R&D programs, projects, and activities.	FY 2022 Q1	FY 2022 Q4	N/A
Develop a pilot program that uses customer feedback elicitation to collect information from customers to understand and quantify satisfaction levels with the R&D process and solution deployment on five (5) transitioned efforts.	FY 2022 Q1	FY 2022 Q4	N/A
Expand planning, training, and education activities to promulgate transition management matrix services and enhance the development of measurable transition-specific metrics.	FY 2022 Q1	FY 2022 Q4	N/A
	FY 2023		
Provide transition planning and management capability services for S&T's new sponsored R&D efforts.	FY 2023 Q1	FY 2023 Q4	N/A
Implement guidance to standardize the collection and reporting of R&D indicators of success by S&T and DHS Components in support of the 2017 NDAA and other data sharing requirements.	FY 2023 Q1	FY 2023 Q4	N/A
Enhance strategic communication channels to improve the coordination, management, and reporting for S&T's R&D transitions and resultant outcomes.	FY 2023 Q1	FY 2023 Q4	N/A

Partnerships Program – S&T Partnerships build and sustain relationships with industry to advance the development and delivery of innovative technology solutions to homeland security operators. Funding supports two primary focus areas of innovative technology development and solution delivery.

Bi-National Cooperative

- **Problem:** DHS shares many of the same technology requirements as its international partners and without collaboration to address these requirements efforts could be duplicative.

- **Solution:** The Bi-National Industrial Research and Development Homeland Security (BIRD HLS) project promotes collaboration between U.S. and Israeli technology companies for joint product development for the HSE.

- **Justification:** The FY 2023 Budget does not provide funding for this project. BIRD HLS already has several projects under development, as evidenced in the report detailing the grants awarded. S&T will use carryover funding, as appropriate, to maintain S&T's commitments to the BIRD HLS program.

- **Impact:** International research agreements leverage technical resources and expertise and share costs for technology research, development and assessment and contributes to building a global homeland security industrial base, and, most importantly, help generate cutting-edge technologies in support of first responders and the larger homeland security mission.

Type of Research
Developmental

Technical Readiness Level
The project identifies R&D efforts from TRL-5 to TRL-7 and facilitates the sharing or transition of the technologies between international partners.

Transition Plans
S&T will identify activities associated with these efforts based on input from U.S. and Israeli end-users. In addition, the vendors supporting the activities will be domestic and international partners and will leverage a broader customer base which results in manufacturers being able to produce the products more efficiently thus reducing the cost for the end user.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Transition or commercialize outcomes of previous BIRD HLS cohorts.	FY 2021 Q1	FY 2021 Q4	5-7
Release a new call for proposals addressing homeland security priority areas for technical development.	FY 2021 Q1	FY 2021 Q4	N/A
Complete commercialization planning with active BIRD performers to encourage homeland security market relevance.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
Transition or commercialize outcomes of previous BIRD HLS cohorts.	FY 2022 Q1	FY 2022 Q4	5-7
Release a new call for proposals addressing homeland security priority areas for technical development.	FY 2022 Q1	FY 2022 Q4	N/A
Complete commercialization planning with active BIRD performers to encourage homeland security market relevance.	FY 2022 Q1	FY 2022 Q4	N/A
	FY 2023		
Transition or commercialize outcomes of previous BIRD HLS cohorts.	FY 2023 Q1	FY 2023 Q4	5-7
Complete commercialization planning with active BIRD performers to encourage homeland security market relevance.	FY 2023 Q1	FY 2023 Q4	N/A

Commercialization Accelerator Program (CAP)

- **Problem:** Only a small fraction of the research performed using Federal funding reaches the marketplace where it can have an impact and ensure the most meaningful return on investment. This is due to limited resources to identify the right technology, mature it for transfer, ensure it meets operational needs, and create partnerships with communities in the private sector that can facilitate commercialization.

- **Solution:** CAP will support S&T in delivering innovative technology solutions to DHS Customers by focusing on accelerating the commercialization process and addressing roadblocks to transfer federally funded R&D. The program will increase market readiness of technologies and collaborate with operational users, start-up companies, small businesses, the R&D community, manufacturing and supply chain partners, and development partners to accelerate commercialization and HSE adoption of innovations through partnerships.

- **Justification:** The FY 2023 Budget for this project will be used to advance federally funded innovation projects to strengthen the HSE and transfer technology in areas such as cyber security, chemical/biological detection, and critical infrastructure resilience. These funds will also enable CAP to deliver internal and external commercialization assistance services to accelerate capability improvements of those innovations and support their utilization by the HSE.

- **Impact:** The program will enable S&T to leverage relevant existing technologies, including those funded and developed by others, to ensure a pipeline of ready to transition solutions for DHS Components at a fraction of the time and cost. Completion of existing CAP projects will provide the transfer of technology and knowledge to DHS and other government agencies and continuously improve future CAP project outcomes, reduce inefficiencies, and provide commercially available products and services to enhance public safety and improve homeland security.

Type of Research
Applied and Developmental

Technical Readiness Level
The CAP executes projects spanning TRLs 3-7. Primarily, laboratory innovations are expected to begin at a minimum TRL-3 and projects progress to TRL 4 to TRL-7 from validation in the lab environment to system prototypes tested in the field within 12-24 months. CAP identifies existing applied research and advances technologies through CAP's internal process to create more operationally ready and higher TRL level technologies. CAP utilizes various means to determine the start and end TRL of each assessed technology. Technologies that have been in development from laboratory partners (e.g., national laboratories, defense laboratories, federally funded research and development centers (FFRDCs), university affiliated research center (UARCs) utilize their own internal methodologies to assess the technology readiness level. Furthermore, CAP utilizes assessment tools and SMEs to analyze selected technologies from laboratories to verify or determine the TRL. While the technology goes through the CAP process, the technology is monitored closely and the TRL is reassessed at project completion.

Transition Plans

The program will plan for the transition of all relevant DHS technologies from each project applicable to DHS Components and transfer to potential startup and non-traditional companies, and other private sector commercialization partners as the TRL progresses through testing and evaluation. The laboratories supporting the activities will be partnering with the domestic industrial base and will leverage a broader customer market that will provide a greater return on the government R&D investment and allow more efficient product manufacturing and result in reduced cost for the end user. Through a collaborative partnership, the laboratories will be responsible for implementation and execution of the transfer of technologies to industry (startup and non-traditional companies) that will be utilized by DHS Components. The program processes are structured to prioritize technical and programmatic objectives with a main focus on transferring the research outcomes to industry, DHS Components, and other Government stakeholders to enhance the commercialization potential and enable acquisition that will provide full product lifecycle support DHS missions.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Kickoff for the 14 FY 2021 DHS CAP projects with laboratory scientists, engineers, academia and private sector cohort members.	FY 2021 Q1	FY 2021 Q2	N/A
Release a new call for proposals for late stage federally funded applied research addressing homeland security priority areas for technical development.	FY 2021 Q1	FY 2021 Q2	N/A
Conduct technology and innovation analysis for DHS's broad mission priority technological/capability requirements to inform commercial viability.	FY 2021 Q2	FY 2021 Q4	4-7
Award 4-6 Interagency Agreements to domestic laboratories including the DOE national labs, DOD labs, FFRDCs & UARCs to leverage federally funded innovations that will develop and strengthen homeland security enterprise technology capabilities and enable commercialization to the marketplace.	FY 2021 Q3	FY 2021 Q4	N/A
Execute the development of 14 DHS research projects in partnership with the CAP cohort of performing laboratories and focus on developing partnerships for commercialization.	FY 2021 Q1	FY 2021 Q4	4-7
Transition or commercialize outcomes of CAP cohorts by collaborating with non-profit and private sector partners to execute a robust commercialization assistance process in cooperation with federally funded laboratory scientist and engineers interested in performing impactful research projects that will advance homeland security related innovations into the marketplace for utilization across the government.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
Kickoff for the six FY 2022 DHS CAP projects with laboratory scientists, engineers, academia and private sector cohort members.	FY 2022 Q1	FY 2022 Q2	N/A

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Release a new call for proposals for late stage federally funded applied research addressing homeland security priority areas for technical development.	FY 2022 Q1	FY 2022 Q2	N/A
Conduct technology and innovation analysis for DHS's broad mission priority technological/capability requirements to inform commercial viability.	FY 2022 Q2	FY 2022 Q4	4-7
Award one to three Interagency Agreements to domestic laboratories including the DOE national labs, DOD labs, FFRDCs & UARCs to leverage federally funded innovations that will develop and strengthen homeland security enterprise technology capabilities and enable commercialization to the marketplace.	FY 2022 Q3	FY 2022 Q4	N/A
Execute the development of 4-6 DHS research projects in partnership with the CAP cohort of performing laboratories and focus on developing partnerships for commercialization.	FY 2022 Q1	FY 2022 Q4	4-7
Transition or commercialize outcomes of CAP cohorts by collaborating with non-profit and private sector partners to execute a robust commercialization assistance process in cooperation with federally funded laboratory scientist and engineers interested in performing impactful research projects that will advance homeland security related innovations into the marketplace for utilization across the government.	FY 2022 Q1	FY 2022 Q4	N/A
	FY 2023		
Release call for proposals covering broad DHS needs to leverage federally funded innovations that will develop and strengthen homeland security enterprise technology capabilities and enable commercialization to the marketplace.	FY 2023 Q1	FY 2023 Q4	N/A
Execute the development of DHS research projects in partnership with the CAP cohort of performing laboratories by collaborating with non-profit and private sector partners focused on transfer of technologies to the HSE.	FY 2023 Q1	FY 2023 Q4	3-7
Transfer outcomes of CAP cohorts by collaborating with non-profit and private sector partners to execute a robust commercialization assistance process in cooperation with federally funded lab performers interested in performing impactful research projects that will advance homeland security related innovations into the marketplace for utilization across the government.	FY 2023 Q1	FY 2023 Q4	N/A

Coordination, Engagement and Outreach

- **Problem:** Traditional methods of engaging and contracting require innovation to ensure that S&T is reaching the broader groups of industry who are poised to deliver significant solutions to DHS Components in an appropriate, condensed timeline. Focused engagement to new potential partners is necessary to develop and maintain mechanisms for engaging industry to meet Components' technology needs.

- **Solution:** S&T will utilize a series of expanded innovation programs and platforms designed to engage a range of community stakeholders on homeland security missions, technology, and innovative solutions.

- **Justification:** The FY 2023 Budget for this project will be used to reach an ever-broader industry audience with DHS mission-relevant capabilities by facilitating additional events to educate stakeholders on the activities and technology needs of DHS Components. In addition, funds will be used to coordinate engagement efforts with the private sector which will allow S&T to forge connections with technology developers and operational end users, enabling joint R&D and energizing a diverse group of research communities to address Homeland Security challenges.

- **Impact:** The program will ensure S&T is able to deliver the best technology solutions to DHS's end-users and operators building and sustaining relationships with industry and innovation communities.

Type of Research
Applied and Developmental

Technical Readiness Level
This is part of the R&D life cycle development and deployment for all programs and projects to gauge the state of the market and to ensure S&T leverages academia, industry, and other Federal entities before making R&D investments. The majority of S&T R&D is between TRL-6 and TRL-7.

Transition Plans
This will be determined at later date and developed based on event observations and feedback.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Facilitate 5 events to educate stakeholders on the activities of DHS Components, current technology capabilities, and technology needs.	FY 2021 Q1	FY 2021 Q2	6-7
Facilitate 5 events to educate stakeholders on the activities of DHS Components, current technology capabilities, and technology needs.	FY 2021 Q2	FY 2021 Q3	6-7
Facilitate 5 events to educate stakeholders on the activities of DHS Components, current technology capabilities, and technology needs.	FY 2021 Q3	FY 2021 Q4	6-7
	FY 2022		
Facilitate 8 events to educate stakeholders on the activities of DHS Components, current technology capabilities, and technology needs.	FY 2022 Q1	FY 2022 Q2	6-7
Facilitate 8 events to educate stakeholders on the activities of DHS Components, current technology capabilities, and technology needs.	FY 2022 Q2	FY 2022 Q3	6-7
Facilitate 8 events to educate stakeholders on the activities of DHS Components, current technology capabilities, and technology needs.	FY 2022 Q3	FY 2022 Q4	6-7
	FY 2023		
Facilitate 5 events to educate stakeholders on the activities of DHS Components, current technology capabilities, and technology needs.	FY 2023 Q1	FY 2023 Q2	6-7
Facilitate 5 events to educate stakeholders on the activities of DHS Components, current technology capabilities, and technology needs.	FY 2023 Q2	FY 2023 Q3	6-7
Facilitate 5 events to educate stakeholders on the activities of DHS Components, current technology capabilities, and technology needs.	FY 2023 Q3	FY 2023 Q4	6-7

Partnership Intermediary Agreements (PIA)

- **Problem:** The transfer and commercialization of federally funded technologies is frequently a time consuming and expensive undertaking especially when resources are constrained at Government agencies, including DHS.

- **Solution:** S&T will utilize its network of qualified Partnership Intermediary organizations to increase the maturity and market readiness of DHS funded technologies to prepare them for transfer and commercialization to meet DHS' operational needs and the needs of the wider HSE.

- **Justification:** The FY 2023 Budget for this project will be aligned under the Technology Transition Support program of the Acquisition and Operations Analysis PPA within the Operations and Support (O&S) appropriation. The FY 2023 Budget does not provide funding for this project within R&D.
- **Impact:** This program allows S&T Technology Transfer and Commercialization (T2C) to expand its reach to promote and market DHS technologies; gain increased partnerships with a variety of businesses and educational institutions; gain insight on industry perspectives on DHS technologies; and increase the likelihood of impact from research outcomes. Multiple PIAs are required to capitalize on State and local relationships across the United States to identify SMEs and benefit from local economic development resources; tap regional angel and venture capital networks; and leverage existing contacts with State and local first responder/law enforcement/mass transit communities.

Type of Research
Does not apply.

Technical Readiness Level
This is part of the R&D life cycle development and deployment for all programs and projects to gauge the state of the market and to ensure S&T leverages academia, industry, and other Federal entities. Project focuses on the transfer or commercialization of technologies at TRL-6 and TRL-7.

Transition Plans
The program will plan the transfer of all relevant DHS funded technologies to other government agencies, State, local, tribal, and territorial governments and the open market via commercialization.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Establish at least two (2) new PIAs focused on building out existing regional networks to promote DHS technologies and identify potential manufacturing and licensing partners. The new PIAs will focus on specific DHS research areas including First Responder Group, Critical Infrastructure, National Grip, CUAS/UAV to identify potential technologies for marketing, outreach and commercialization support.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
Establish roadmap to develop DHS innovation ecosystem to enable development and commercialization of DHS relevant technologies. Launch pilot DHS innovation hub to leverage and expand the network of potential DHS partners and performers.	FY 2022 Q1	FY 2022 Q4	6-7
Maintain and expand network of DHS PIAs to meet S&T technology transfer needs and leverage the S&T innovation ecosystem to drive the development and commercialization of DHS relevant technologies.	FY 2022 Q1	FY 2022 Q4	N/A
	FY 2023		
N/A	N/A	N/A	N/A

SBIR Management (formerly Partnership Mechanisms and Technology Transition)

- **Problem:** There are administrative costs to running the SBIR Program, most notably the program requires a portal for industry to understand and submit proposals for solicitations. The current portal, which was developed using technology from a previous SBIR, is now outdated technology. A new portal needs to be developed that can better produce required information for the congressionally mandated annual report submission to Small Business Administration (SBA) and to comply with current security standards.

  Additionally, the SBIR Policy Directive requires agencies to conduct targeted outreach to specific disadvantaged small businesses concerns. Conducting outreach that engages disadvantaged small business concerns and provides a beneficial impact to participation in the SBIR program requires research and addressing knowledge gaps in the DHS processes and missions.

- **Solution:** Funding is utilized to develop and maintain easy to navigate tools (portal) which, along with additional outreach, will improve industry response to solicitations. The tool also facilitates tracking, tasker response, and mandated SBIR reporting.

  Develop a strategic plan to ensure that outreach efforts are accessible and engaging for disadvantage small business concerns. The plan will incorporate existing programs and resources as well as developing elements to address additional knowledge gaps.

- **Justification:** The FY 2023 Budget for this project will be used to fund a portal to facilitate congressionally mandated data reporting for the SBIR program and facilitate proposal submission to reduce submission errors which lead to unresponsive proposals. This portal will be leveraged to support SVIP and Broad Agency Announcements (including the Long Range Broad Agency Announcement). In addition, funds will be used to ensure the outreach efforts are being done most effectively and can ultimately have a beneficial impact on the disadvantaged small business community.

- **Impact:** This funding will administer the IT, management, and overhead costs of the SBIR program to successfully interface with Small Businesses so that they can efficiently respond to solicitations. The IT will also be able to be leveraged for other S&T programs to facilitate their pursuit of technology innovation. The funding will also decrease the knowledge gap for disadvantaged Small Business concerns to increase successful participation in the SBIR program.

Type of Research

Applied and Developmental

Technical Readiness Level

This is part of the R&D life cycle to ensure S&T leverages academia, industry, and other Federal entities. Project focuses on the development and commercialization of technologies between TRL-4 and TRL-7.

Transition Plans

In FY 2023 Q1, the new portal will fully support SVIP and continue to support the SBIR program and BAAs.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
N/A	N/A	N/A	N/A
	FY 2022		
Deploy S&T's new SBIR program portal.	FY 2021 Q2	FY 2022 Q4	N/A
Conduct five engagement events to support SBIR program execution.	FY 2022 Q1	FY 2022 Q4	N/A
	FY 2023		
Continue refinement and security updates for SBIR Portal. Deploy expanded OIP portal capability to include support for Silicon Valley Innovation Program leveraging existing functionality.	FY 2021 Q4	FY 2023 Q1	N/A
Conduct five engagement events to support SBIR program execution with emphasis on underserved communities.	FY 2023 Q1	FY 2023 Q4	N/A

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 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, end users and HSE stakeholders throughout each project, thereby increasing the likelihood of successful transitions that meet operational needs.

- **Justification:** The FY 2023 Budget for this project will be used to complete phased funding of existing projects, including transitioning capabilities to DHS operational Components, such as digital immigration credentials and offline language translation. In addition, funds will also enable SVIP to generate approximately one to three new topics per year to address component innovation requirements. New topics supporting Component innovation interests include cybersecurity and operator performance and resilience.

- **Impact:** The SVIP provides accelerated and novel solutions for component and HSE requirements that can be used in operations in as little as 12-24 months. The program attracts new companies that may not have previously engaged with the Government. These new companies address long-standing issues as well as emerging needs, such as the COVID-19 pandemic, in a rapid fashion, increasing avenues by which DHS and its partners can obtain and leverage innovative technology and solutions. For a more detailed look at SVIP's inventive selection process and a list of current program performers, solving complex DHS problems sets through the power of the innovation community, please visit our website at https://www.dhs.gov/science-and-technology/svip. Highlights include innovations in supply chain and digital immigration credentials with blockchain and distributed ledger technologies, as well as adaptive algorithms for detecting common items in passenger bags.

Type of Research
Applied and Developmental

Technical Readiness Level
Specific company solutions are expected to begin Phase I at a minimum TRL-6, and solutions that successfully progress through Phase IV should finish at a TRL-7.

Transition Plans
The program will plan the transition of all relevant DHS technologies to applicable DHS Components and commercialization.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Transition completed projects into component operational acquisition cycles or commercial products (project/solution dependent).	FY 2021 Q1	FY 2021 Q4	6-7
	FY 2022		
Transition completed projects into component operational acquisition cycles or commercial products (project/solution dependent).	FY 2022 Q1	FY 2022 Q4	6-7
Release new solicitation calls in one to three specific areas covering broad DHS and critical infrastructure needs and requirements as identified through S&T requirement sourcing activities.	FY 2021 Q1	FY 2022 Q4	N/A
	FY 2023		
Generate new solicitation calls in one to three specific areas covering broad DHS and critical infrastructure needs and requirements as identified through S&T requirement sourcing activities.	FY 2023 Q1	FY 2023 Q4	N/A
Transition completed projects into component operational acquisition cycles or commercial products (project/solution dependent).	FY 2023 Q1	FY 2023 Q4	6-7
Conduct two to four SVIP Demo weeks showcasing SVIP funded performers, to broaden commercialization prospects of companies and highlight previously unknown solutions available to USG.	FY 2023 Q1	FY 2023 Q4	6-7

Technology Transfer and Commercialization (T2C)

- **Problem:** The transfer and commercialization of federally funded technologies is frequently a time consuming and expensive undertaking especially when resources are constrained at Government agencies, including DHS.

- **Solution:** S&T will support required staff needs and will allow the office to procure and maintain a technology transfer knowledge management system, support the continuation and expansion of the Homeland Security Startup Studio program, actively manage a DHS PIA network and associated PIA projects, and develop new programs to track intramural and extramural invention disclosures, monitor S&T program activities and engage with PMs throughout the BPF process, fund our Federal Laboratory Consortium dues and meaningfully participate in interagency Federal technology transfer programs and activities.

- **Justification:** The FY 2023 Budget for this project will be used to support required staff needs and will allow the office to procure and maintain a technology transfer knowledge management system, support the continuation and expansion of the Homeland Security Startup Studio program, actively manage a DHS PIA network and associated PIA projects, and develop new programs to track intramural and extramural invention disclosures, monitor S&T program activities and engage with PMs throughout the BPF process, fund our Federal Laboratory Consortium dues and meaningfully participate in interagency Federal technology transfer programs and activities.

- **Impact:** Technology transfer is a key metric for Federal research agencies as it documents the impact of the agency's research investments and ensures that the public benefits from new products and services. DHS, in particular, has an interest in ensuring that its technologies are commercialized and made available to its components and the HSE. Long term, this translates into local economic impact as measured by venture capital/angel investment, the creation of jobs, and increased tax revenue. DHS needs to adequately resource technology transfer and commercialize to realize its broader goals and support the DHS mission.

Type of Research
Developmental

Technical Readiness Level
This is part of the R&D life cycle development and deployment for all programs and projects to gauge the state of the market and to ensure S&T leverages academia, industry, and other Federal entities. Project focuses on the transfer or commercialization of technologies at TRL-6 and TRL-7.

Transition Plans
The program will plan the transfer of all relevant DHS funded technologies to other government agencies, State, local, tribal, and territorial governments and the open market via commercialization.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
N/A	N/A	N/A	N/A
	FY 2022		
N/A	N/A	N/A	N/A
	FY 2023		
Acquisition and implementation of the intellectual property, technology transfer, and commercialization system to manage all Technology Transfer and Commercialization (T2C) Branch workflows including intellectual property (IP) docketing and licensing, Cooperative Research and Development Agreements (CRADAs), Partnership Intermediary Agreements (PIAs), (Memoranda of Understanding) MOU/ Memoranda of Agreement (MOA) and royalty disbursement.	FY 2023 Q3	FY 2023 Q4	N/A
Development of a DHS web-based technology/SME locator which will incorporate all relevant (Office of National Labs) ONL information and Office of General Counsel IP/patent information for DHS inventions.	FY 2023 Q1	FY 2023 Q4	N/A
Expand the Homeland Security Startup Studio program to include a phase 0 module which will be codeveloped with ONL to provide entrepreneurship training and skills development for DHS researchers.	FY 2023 Q1	FY 2023 Q4	N/A

Technology Centers Program – The Technology Centers conduct enduring, foundational, basic, and applied research activities into cross-cutting scientific, engineering, and technological areas. This will ensure emerging technologies and advancements in science and technology are harnessed for cutting edge solutions for operational challenges and ensure technical SME capabilities are available to S&T and DHS for decision making. The Technology Centers are the source within S&T for scientific, engineering, and technology expertise and solutions to widespread challenges across DHS mission spaces. The funding for Technology Centers is applied towards broad outcomes that fundamentally change or provide a unique capability to address DHS's recognized gaps, needs, and emerging threats, to include:

- Maintaining S&T's technical baseline competency and awareness of the state-of-the-art/art-of-the-possible in key science, engineering, and technology areas.
- Advancing the state of science and technology where needed to address operational gap areas common to multiple missions/multiple portfolios.
- Exploring emerging technology areas and their potential threat and/or application to current and future DHS missions.
- Providing cross cutting solutions against challenging and persistent DHS mission needs and Component requirements.
- Delivering rapid-response expertise to urgent needs.

The Technology Centers are grouped under three primary focus areas, analogous to research projects from a budgetary perspective: Advanced Computing, Enduring Sciences, and Innovative Systems. S&T may establish or retire specific technology centers as the priorities and research needs of DHS evolve.

Advanced Computing Technology Centers

- **Problem**: DHS Components are generating and have access to more relevant data for decision-making than can be processed, assimilated, and used. DHS continues to face challenges with leveraging additional data sources to compute threats, impacts, risks, and to maintain situational awareness due to the exponential growth of data, particularly data associated with IoT, commercial, non-profit, open source, and publicly available information. Further, we face a rapidly evolving digital environment, one in which rapid advancements in distributed computing architectures, information storage, quantum computing, immersive and augmented reality, AI and ML are pushing the edge of innovation that enables us to explore new ways of training and protecting officers, detecting threats, and analyzing systems that were previously too complex or too dangerous to examine in the real world. However, this speed of innovation also makes it difficult to track and assess solution options for critical homeland security missions that are needed. In addition, our adversaries are exploiting these systems via weaknesses in our cybersecurity defenses in an attempt to thwart, deter, and/or slow down our progress and ability to execute our mission.

- **Solution**: This line of research brings together a full complement of capabilities as S&T's resource and expertise in data sciences, computational methods, and modeling and simulation techniques. These centers invest in emerging innovations to experiment with and apply the strengths of modeling and simulation, AI, ML, scalable data analytics, cybersecurity, and Quantum Information Science (QIS) to homeland security systems and operations. The centers also provide access to the ecosystem of experts, tools, and applications that can be leveraged for new applications, including training applications that augment human perception and comprehension. The Advanced Computing Technology Centers work across disciplines to illuminate next-generation problem sets, tools, techniques, technologies, and simulation environments to increase mission effectiveness. The centers conduct computationally and data-intensive research in support of DHS missions. S&T established the following:

    - Data Analytics Technology Center (DA-TC): An Enduring Center to enable analysts, operators, agents, and decision makers across DHS increase mission effectiveness by better leveraging data for decision-making. DA-TC keeps pace with the rapidly evolving and emerging digital environments by experimenting with growing data sets and next generation technologies, including publicly available information, real-time analytics, secure multi-party computation, high performance computing, edge computing, blockchain, and cloud environments to inform program planning, avoid technical obsolescence, accelerate transition, and prevent mission surprise. DA-TC provides DHS and S&T programs with coordinated research and subject matter expertise to improve program efficiency, share best practices, and improve security and privacy protection across DHS system investments.

    - Modeling and Simulation Technology Center (MS-TC): An Enduring Center leveraged across multiple S&T and DHS programs. MS-TC coordinates Modeling and Simulation (M&S) activities and requirements across DHS through a Community of Interest; serves as a body of SMEs on the subject to assist DHS operators, program managers, and analysts in leveraging M&S tools; and conducts research into advancements in AI, ML, and immersive simulations to enhance simulation environments for training homeland security operators. The MS-TC enhances S&T's collaboration with interagency partners (such as the DoD Modeling and Simulation Coordination Office and the Engineering Research and Development Center (ERDC)) in the M&S domain and leverages best practices and impactful emerging M&S capabilities from across the government to ensure a coordinated approach for DHS efforts using modeling and simulation tools.

- Quantum Information Science (QIS) Research Activity: QIS is a priority element of the Administration's "Industries of the Future" initiative. To accelerate the R&D in QIS technologies, the National Quantum Initiative Act was signed into law December 21, 2018 and calls for a federally coordinated effort in QIS. S&T is a member of the National Science and Technology Council (NSTC) Subcommittee on QIS and co-chairs the End User Working Group (EUWG) to lead these coordination activities. To support these activities, S&T has established a QIS community of interest within DHS that engages Components to promote an understanding of QIS technologies, identify potential mission areas where QIS technologies will provide significant impact, and develop a process, methodology and R&D roadmap to ensure Federal/industry/academic research communities are responsive to DHS and other agency technology needs. The EUWG activities also monitor, track, and examine the state of QIS technologies, including artificial intelligence applications, relative to the critical missions of the Department and identify potential areas where mature QIS technologies can be tested to demonstrate impact. To support these activities, S&T will partner with S&T Policy, NSTC, and other inter-agency partners (where feasible and appropriate) to support the national advancement of core QIS capabilities that meet needs of DHS. S&T established a QIS community of interest within DHS to that engages Components to promote an understanding the of QIS technologies, identify potential mission areas where QIS technologies will provide significant impact, and develop a process, methodology and R&D roadmap to ensure the Federal, industry, academic research communities is responsive to DHS and other agency technology needs.

- Artificial Intelligence and Machine Learning (AI/ML) Research Activity: A priority element of the Administration's "Industries of the Future" initiative. DHS's initial examination of emerging technology threats to homeland security has identified that AI/ML pose significant opportunities and threats to homeland security. This research activity will examine and characterize the state of AI research relative to future homeland security mission applications. Research activities will focus on the development of core capabilities that enable trustworthy AI to improve core automation capabilities that are secure, private, and trusted for critical homeland security applications.

- Cybersecurity Research Activity: Cybersecurity is a very fast-moving technical challenge for government agencies and critical infrastructure partners. The Cybersecurity Division of CISA partners with the Advanced Computing Technology Center to research and develop new cyber-threat hunting, information security, and software assurance capabilities for CISA as part of a technology pipeline for rapid deployment of effective cybersecurity against an ever-changing threat landscape. Work in this research activity will mature the methodology for operationalizing emerging research for use across the U.S. government and critical infrastructure partners.

- **Justification:** The FY 2023 Budget for this project will be used to continue research and development of analytics infrastructures to characterize multi-cloud and hybrid environments that will enable data sharing and collaboration across system owners, authorities, and policies and continue predictive threat modeling of DHS operational domains and continue to support CISA with cybersecurity subject matter expertise. Further research may be conducted on advanced analytics, M&S, and quantum information: The FY2023 Budget will also enable the formal stand up of AI/ML and Cybersecurity as two new S&T Technology Centers, as well as further research for advanced analytics, M&S and QIS.

- DA-TC: S&T will expand its research into human-machine teaming research that will characterize and develop solutions for more effective and timely decision-making, and develop applications for computer vision, deep learning, and other advanced AI/ML applications for DHS missions.

- MS-TC: S&T will expand M&S efforts to reflect augmented and virtual reality applications to additional missions including planning, wargaming, logistics and crisis management across DHS. MS-TC will also focus on innovative research to improve M&S development time concurrent with trustworthiness using advanced computing capabilities and shared knowledge, data, and resources within the HSE as well as external partnerships.

- QIS: Additional funds for basic and applied research into QIS will focus on understanding and developing mitigation measures of potential vulnerabilities as advances begin to be applied to DHS missions as well as leveraging advancements in QIS to strengthen DHS.

- Artificial Intelligence & Machine Learning Technology Center (AI-TC): S&T will establish a new Center to centralize AI/ML SME for DHS; serve to advise and guide policy and investments in AI/ML capabilities and technology solutions across the Department; advance integration of AI/ML capabilities across several capabilities and applications including virtual reality and augmented reality; and implement S&T's AI/ML strategy, created in FY 2021. The AI-TC will also conduct basic and applied research to understand how to harness AI/ML to advance the next-generation of DHS missions, understand vulnerabilities in AI-enabled systems, identify solutions to counter the misuse of AI, and address AI model trustworthiness that will engender trust with the public for implementation of AI at scale. The AI-TC will support experimentation and applications of advanced AI/ML applications to inform DHS about the opportunities but also challenges of implementing these solutions operationally, including studies in bias, model drift, and other concepts related to trustworthy systems and understanding the performance of models, humans, and machines in the decision-making process. Finally, the AI-TC will build a core enduring capability in AI/ML, including gold standard data sets, and large-scale learning applications with research on methods to protect privacy, incorporate security, and ensure trustworthy systems

- Cybersecurity Threats Technology Center (CT-TC): S&T will establish a new Center to conduct research into new and emerging cybersecurity threats to harness advanced capabilities and techniques that detect, identify, protect, respond to, potentially defeat and recover from these new cyber threats. The CT-TC will serve to advise and guide on emerging cybersecurity threats and future investments in cybersecurity related to information technology, operational technology, critical infrastructure, M&Ss for enhanced network characterization and vulnerability identification, mobile device cybersecurity, AI/ML augmentation of cybersecurity tools, and law-enforcement tools. Additional funding within the Advanced Computing Technology Centers will also allow S&T to maintain its technical subject matter expertise and to continue experimenting with cutting edge computing technologies for the purposes of identifying appropriate applications that will increase homeland security mission effectiveness. The CT-TC will engage in cutting edge research and development of zero-trust architectures as applicable to DHS and the Federal government; research and develop next-generation software assurance technologies, including Software Bill of Materials (SBOM) technologies, to enhance trust into our cybersecurity supply chain; build enhanced screening measures for cybersecurity tools to enhance the acquisition process in procurement of industrial and academic tools into DHS and Federal networks; research and advance technologies for law-enforcement purposes; and research and develop defensive technologies addressing the DHS critical infrastructure sectors, including chemical, communications security, critical manufacturing, dams, emergency services, IT, transportation, and water/wastewater systems.

- Advanced Computing Experimentation Lab: S&T needs to be able to experiment with new and emerging technologies in laboratory environments, as well as test and evaluate them in realistic operational settings in order to fulfill its role as science and engineering advisors to DHS Components. Funds will be used to expand and create a new computing laboratory environment that enables emerging and advanced computational, analytics, AI, cybersecurity, virtual reality, and quantum information capabilities experimentation. These capabilities will enable S&T to: 1) understand emerging and prototype technologies in light of DHS operational missions; 2) characterize and document technical requirements for DHS acquisitions; and 3) formulate strategies for R&D and Next-Gen mission capabilities.

- **Impact**: The Advanced Computing Technology Centers enables DHS to push beyond the state of the art and harness new technologies that both increase the productivity and effectiveness of the homeland security workforce and solve hard problems in more efficient ways. By investing in capabilities that empower data discovery, data curation, advanced cognition, and increased perception, homeland security end users and operators can spend more time looking at the right data and understanding the situation rather than looking for data and missing opportunities. In addition, these centers bring together communities of interest in relevant disciplines, which focuses a broad set of collaborative experts towards researching opportunities and solutions to homeland security challenges. This research ensures DHS remains ahead of emerging technology, informed of the impacts of such technology and avoids technology surprise. Research investments in advance computing will inform how to implement large-scale AI that engenders trust with the public, address vulnerabilities in protecting DHS assets given advances in quantum computing, build next generation cybersecurity capabilities for protecting networks and cyber-physical systems, and enable large-scale M&S to provide critical insights for addressing critical mission problems.

Type of Research

Basic, Applied and Developmental

Technical Readiness Level

DA-TC, MS-TC, QIS, Cybersecurity, and AI projects range from TRL-2 to TRL-7. The Technology Centers focus on fundamental research to inform science and policy. Therefore, we do not transition technologies directly to components as we do not directly develop technology. Activities are initiated based on stakeholder (DHS Components, HHS, DOD, State and local practitioners, DOJ, etc.) needs. The majority of deliverables are knowledge products and tools to inform decision makers. For this reason, the TRL level on many of its projects tend to be lower. Some examples from the milestones below:

- Leverage the National Institutes of R&D with Academic and Industry Partners to document options for the development and adoption of new Trustworthy AI concepts for homeland security (TRL-4).
- Develop technical research reports summarizing evaluation results of emerging computational technologies to guide acquisitions across DHS Components and the broader Government (TRL-5).

Transition Plans

- AI-TC S&T works directly with AI/ML communities of interest to share knowledge and understanding of the state-of-the-art. This research activity will develop a report and technology roadmap that characterizes artificial intelligence and machine learning opportunities and risks to homeland security that will be shared within the communities of interest, DHS operational Components, and HSE partners. This report will be posted in a government accessible knowledge repository for sharing across interagency partners.

- CT-TC S&T works directly with DHS Components and critical infrastructure communities of interest to share knowledge and understanding of the state-of-the-art. This research activity will develop a report and technology roadmap that characterizes cybersecurity research opportunities and risks to homeland security that will be shared within the communities of interest, DHS operational Components, and HSE partners. This report will be posted in a government accessible knowledge repository for sharing across interagency and critical infrastructure partners.

- DA-TC:
  - In emerging technology areas, DA-TC provides experimental results through technical reports and briefings that are relevant to homeland security missions. This transition of knowledge product provides inputs to S&T program planning as well as Component acquisition planning and ongoing operations.
  - DA-TC also works directly with industry partners to develop or improve capabilities and provide expertise and provides technical subject matter expertise and advice to Components as they acquire new analytics capabilities. This method of transition is direct to the Component through industry and can be completed using competitive procurement actions.
  - As a respected member of the data analytics research community, DA-TC regularly collaborates with industry, government and academic partners to ensure that the technical interests of homeland security are included in joint planning activities and external research efforts. This leverage improves the efficiency of DHS research investments and enables leverage of cross government efforts.

- MS-TC:
  - MS-TC continues to host DHS M&S community of interest (COI) to share relevant best practices and impactful emerging M&S capabilities and tools. Reports and knowledge are shared via this quarterly forum. These reports are posted in a government accessible knowledge repository for sharing across interagency partners.
  - In emerging technology areas, such as the use of machine learning and immersive visualization for simulation environments relevant to homeland security missions, MS-TC provides experimental results through technical reports and briefings directly to S&T and DHS programs. This transition of knowledge product provides inputs to S&T program planning as well as component acquisition planning and ongoing operations.

- QIS:
  - QIS activities will build and share knowledge among a DHS Community of Interest (COI) that promotes an understanding of QIS technologies and identifies potential mission areas where QIS technologies will provide significant impact.
  - The community of interest will develop a roadmap of QIS R&D activities that will be shared with the NSTC Subcommittee on QIS, EUWG.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
DA-TC: Develop two technical research reports summarizing evaluation results of emerging computational technologies to guide acquisitions across DHS Components and the broader Government.	FY 2020 Q3	FY 2021 Q4	5
MS-TC: Develop simulation prototype for FLETC future training initiative.	FY 2019 Q4	FY 2021 Q4	7
MS-TC: Develop government accessible knowledge repository to house the M&S Community of Interest Catalogue, as well as additional information and reports on best practices and impactful emerging M&S capabilities and tools.	FY 2020 Q2	FY 2021 Q4	7
QIS: Establish a DHS QIS community of interest that engages Components to promote an understanding of QIS technologies.	FY 2021 Q1	FY 2021 Q4	3
QIS: Conduct an assessment of emerging and commercially available QIS technologies, vendors, and mission applications within DHS.	FY 2021 Q1	FY 2021 Q4	3
QIS: Develop a roadmap of QIS R&D activities that communicates DHS QIS technology needs to Federal/industry/academic research communities.	FY 2021 Q1	FY 2021 Q4	3
QIS: Identify QIS threats and opportunities related to DHS mission space.	FY 2021 Q1	FY 2021 Q4	3
QIS: Solicit fellowships and scholarships related to QIS and AI within DHS and in partnership with other Federal agencies.	FY 2021 Q1	FY 2021 Q4	3

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
AI/ML: Collaborate with inter-agency partners in the development of a joint research and development activity targeting the development of trustworthy AI.	FY 2021 Q1	FY 2021 Q4	3-6
AI/ML: Develop a report and technology roadmap that characterizes artificial intelligence and machine learning opportunities and risks to homeland security.	FY 2021 Q1	FY 2021 Q4	4
	FY 2022		
DA-TC: Develop two knowledge products based on emerging technology evaluations that guide acquisitions across DHS Components and the broader Government.	FY 2021 Q4	FY 2022 Q4	3-6
DA-TC: Conduct two advanced data analytics demonstrations to inform component mission operations and expand DHS operational capabilities.	FY 2022 Q1	FY 2022 Q4	3-6
MS-TC: Develop immersive visualization of DHS operational environment on a selected area.	FY 2022 Q1	FY 2022 Q4	6
QS: Identify DHS Critical and essential investment needs in QIS.	FY 2022 Q1	FY 2022 Q4	5
QIS: Develop working partnerships to leverage other work within the Federal Government applicable to DHS QIS needs.	FY 2022 Q1	FY 2022 Q4	6
QIS: Develop a roadmap of QIS R&D activities that communicates DHS QIS technology needs to Federal/industry/academic research communities.	FY 2022 Q1	FY 2022 Q4	5
AI/ML: Leverage the National Institutes of R&D with Academic and Industry Partners to document options for the development and adoption of new AI concepts for homeland security.	FY 2022 Q1	FY 2022 Q4	4
Cybersecurity: Develop research partnerships to leverage interagency R&D to improve vulnerability analysis and threat hunting to meet next generation cybersecurity needs.	FY 2022 Q1	FY 2022 Q4	4
Cybersecurity: Develop a roadmap for Software Assurance R&D activities that communicates DHS Software Assurance technology needs to the Federal/industry/academic research communities.	FY 2022 Q1	FY 2022 Q4	4
Cybersecurity: Characterize software assistance opportunities and risks for DHS specific needs to identify critical and essential investment needs.	FY 2021 Q3	FY 2022 Q4	4
QIS: Develop at least two DHS specific QIS use cases. QIS technology will be investigated to align with solutions for these two use cases.	FY 2022 Q1	FY 2022 Q4	N/A
QIS: Host monthly meetings of the DHS QIS COI and bring in at least six guest speakers on relevant specialized topics to promote learning, capacity building, and info-sharing in support of DHS.	FY 2022 Q1	FY 2022 Q4	N/A
QIS: Develop a Landscape Assessment for QIS relative to DHS specific strategic and operational goals and update at least yearly.	FY 2022 Q1	FY 2022 Q4	N/A
	FY 2023		
AI/ML-TC: Establish a long-term research investment with government, academic, and industry partners focused on developing new AI concepts for homeland security.	FY 2022 Q1	FY 2023 Q3	N/A
AI/ML-TC: Develop two technical reports summarizing model performance and metrics for enabling and protecting next generation AI mission systems.	FY 2022 Q2	FY 2023 Q2	N/A

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
AI/ML-TC: Deliver two technical knowledge products identifying advanced AI developments to inform homeland security missions on emerging concepts and capabilities.	FY 2022 Q4	FY 2023 Q3	N/A
AI-TC: Conduct initial experiments with advanced AI/ML applications to inform operational implementation opportunities and challenges.	FY 2023 Q1	FY 2023 Q4	5
AI-TC: Initiate execution of the AI/ML strategy, establishing and resourcing subject matter experts for the AI/ML Center and working with DHS Components and Offices to communicate research activities for next generation AI/ML capabilities to ensure alignment with mission needs.	FY 2022 Q1	FY 2023 Q3	N/A
AI-TC: Create an approach, including identifying the impacts of authorities and policies that govern data retention, for developing enduring AI/ML data sets to validate performance of AI/ML approaches.	FY 2022 Q4	FY 2023 Q3	N/A
CT-TC: Develop a strength, weaknesses, opportunities, and threats report on software assurance, as it relates to government use cases and research areas to enhance government software security during the acquisition lifecycle.	FY 2023 Q1	FY 2023 Q4	N/A
CT-TC: Develop advances in software assurance in a selected area.	FY 2023 Q1	FY 2023 Q4	2-4
CT-TC: Develop roadmap for Zero Trust Architecture R&D activities that communicates DHS Zero Trust needs to the government/industry/academic research communities.	FY 2023 Q1	FY 2023 Q4	N/A
CT-TC: Develop roadmap for cybersecurity screening R&D activities that communicates DHS cybersecurity screening needs for the acquisition process to the government/industry/academic research communities.	FY 2023 Q1	FY 2023 Q4	N/A
CT-TC: Develop roadmap for cybersecurity law-enforcement tool R&D activities that communicates DHS cybersecurity/digital law-enforcement needs to the government/industry research communities.	FY 2023 Q1	FY 2023 Q4	N/A
CT-TC: Develop roadmap for critical infrastructure cybersecurity R&D activities that communicates DHS cybersecurity needs of critical infrastructure sectors for which it is a sector risk management agency, to the government/industry/academic research communities.	FY 2023 Q1	FY 2023 Q4	N/A
DA-TC: Develop two technical research reports summarizing evaluation results of emerging computational technologies to guide acquisitions across DHS Components and the broader Government.	FY 2022 Q4	FY 2023 Q4	N/A
DA-TC: Conduct one advanced data analytics proof-of-concept to inform component mission operations and expand DHS operational capabilities.	FY 2023 Q1	FY 2023 Q4	5
DA-TC: Build out multi-cloud infrastructure to support DHS missions and characterize architectures and different computational models to inform collaboration across multiple data owners, policies, and authorities.	FY 2022 Q4	FY 2023 Q4	5
MS-TC: Improve M&S knowledge repository beyond DHS-held assets through automated collection of curated sources.	FY 2022 Q2	FY 2023 Q4	7
MS-TC: Research HSE models with greatest potential to be generated with available data through machine learning in the training domain.	FY 2022 Q4	FY 2023 Q3	3

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
MS-TC: Research and evaluate applications of AR/VR for planning, wargaming, and operational crisis response.	FY 2022 Q1	FY 2023 Q3	4-5
MS-TC: Develop prototype architecture for rapid model development using advanced techniques and shared data and resources.	FY 2022 Q1	FY 2023 Q4	5
MS-TC: Expand M&S Community of Interest membership to include interagency partnerships.	FY 2022 Q2	FY 2023 Q1	N/A
QIS: Develop a detailed technical roadmap for a specific DHS quantum sensing use case.	FY 2021 Q4	FY 2023 Q4	N/A

Enduring Sciences Technology Centers

- **Problem:** DHS continues to observe that the threat (hazards and risks) landscape to the homeland is evolving and becoming more volatile, uncertain, complex, and ambiguous. Challenges and threats range from terrorism and emergency incidents such as chemical and biological attacks, global pandemics, active shooter and violent extremism, technological and cyber on networks and critical infrastructure, natural hazards such as fires, earthquakes, superstorms and floods to potential impacts from climate change. These evolving threat vectors stretch our operational and technical capabilities and result in immense economic and human costs. Despite the continuous efforts to address these threats, challenges persist in our ability to prevent, prepare for, respond to, and recover from the effects of such actions and events. Although DHS Components are best positioned to identify their immediate operational needs, they and our partner Federal, State, and local agencies and communities, particularly those communities focused on these risks and threat vectors, often lack critical data and expertise necessary to formulate appropriate policy, operational, and system-level requirements, knowledge of current and merging science and technologies related to interventions, counter measures and training. DHS does not fully understand the drivers behind various threat vectors including human trafficking, domestic violent extremism, mis/dis/mal-information campaigns, insider threats and terrorist actions, biological, chemical, and explosives attacks and the best methods of mitigating these risks. Components do not fully understand the ways in which new technologies will impact their ability to address such risks (threats and hazards), increasing the potential for failure when integrating solutions into operational use. DHS lacks an enduring capability to collect, analyze, publish, and disseminate information on topics critical to the homeland security mission space – including data on acts of terrorism, targeted violence, violent extremist movements, and more. We currently rely on research performers, think tanks, and universities to create these datasets (with DHS funding) and provide operations and maintenance of the datasets (at their cost). This leads performers to seek funding from other sources, diminishing the usefulness of the data to DHS and our stakeholders as new, non-DHS or non-USG funders have priorities that are not aligned to DHS' unique mission sets and needs. Data collected by outside entities can also result in lapses in data availability, lack of direct connection between DHS mission priorities and data collected, and variable quality.

- **Solution:** As homeland security threat vectors continue to evolve, the Enduring Sciences Technology Centers are S&T's resource for maintaining awareness of, mapping the causes and consequences of, and understanding the characteristics of current, emerging, and potential future threats. These centers provide a centralized function within S&T to coordinate critical expertise, provide access to knowledge products (i.e., technical reports) generated through rigorous technical analysis or laboratory experimentation, and identify and fill critical data gaps and insight on the properties of chemical, biological, and explosive threat agents and the hazards that they pose. These centers also form strategic insights into the motivations and actions behind human trafficking, violent extremism, mis/dis/mal-information campaigns, insider threats and terrorism to meet the policy, operational, and public needs to improve the effectiveness of interventions, counter and protective measures, and violence prevention efforts implemented by FSLTT and non-governmental stakeholders. Enduring Sciences Technology Centers directly inform DHS activities in preparing for, responding to, and mitigating the impacts of homeland security threat vectors. The ongoing research will continue as threats and our need to understand them evolve. The Enduring Sciences project is comprised of the following Technology Centers and activities:

- Hazard Awareness and Characterization Technology Center (HAC-TC): HAC-TC serves as an SME function supporting S&T programs, DHS, and our SLTT partners on topics involving current, emerging, and future chemical, biological, and explosives hazards. HAC-TC provides independent technical review of proposals, plans, and products developed for our partners; conducts evidence-based research to identify emerging technologies or developments that may impact future CBE threats and hazards to the homeland; and conducts evidence-based research to identify developed or emerging solutions that can be leveraged to mitigate current or emerging chemical, biological, and explosives CBE hazards; and HAC-TC directly coordinates activities with a variety of S&T programs and projects including: PANTHR, BTC, CTC, TIGER, HKC, HEID&M, NBACC, PIADC, and the CSAC.

- Social Science Technology Center (SS-TC): SS-TC encompasses the social, behavioral, and economic science expertise for the Department. SS-TC serves as a research support function for S&T programs, DHS, and our SLTT partners. SS-TC conducts evidence-based research on the transition of federally developed technologies, countering human trafficking, countering foreign influence, and targeted violence and terrorism prevention. The SS-TC conducts evaluation research, capability enhancement, and data development in each of these mission areas. SS-TC provides independent, objective evaluation to ensure that stakeholders who perform, fun, oversee, select and direct prevention and protection activities can understand and predict their effects and effectiveness in a variety of settings based on evidence. Through evaluation research, stakeholders will gain the ability to select prevention and protection activities with known effects, outcomes, and impacts. SS-TC enhances capability though of HSE operators through the development of new tools, tactics, or knowledge that will enhance their ability to operate effectively and efficiently. SS-TC supports the development of new scientific data on the nature of threats, crimes, organizations, and individuals to better understand where, when, and how to best intervene and prevent future public safety threats. SS-TC also provides technical expertise, support, and direction to all S&T programs and projects requiring expertise in these domains. As DHS implements the *Strategic Framework for Countering Terrorism and Targeted Violence* (September 2019) and the *Strategic Framework to Combat Human Trafficking, Forced Labor, and Child Exploitation* (January 2020), the SS-TC will provide foundational research to evaluate the impact of new programs and policies, enhance capability of our operational partners, and develop data that will help to continue to understand and characterize the threat. The SS-TC will also apply best practices in social science research to new and emergent DHS priorities, including countering online disinformation, where foundational research will improve our understanding and decision making. SS-TC supports the Office of Terrorism Prevention Partnerships, Offices of the Principal Deputy Counterterrorism Coordinator, Policy, DHS I&A, DHS Office for Partnerships and Engagement, Fusion Center, Civil Rights and Civil Liberties, Center for Countering Human Trafficking, and local terrorism prevention practitioners to provide subject matter expertise to assess the impacts of policies and programs developed to counter or prevent public safety threats. SS-TC research informs policy, strategy, tactics, techniques, and procedures at the Department and local level.

- Earth Systems Sciences Technology Center (ESS-TC): This new technology center for FY 2023 will support a more integrated response to threats from climate change, environmental pollution, global disease and other interactions between human and earth system that impact the Department's missions. This new area of research provides a transdisciplinary analysis of the structure and functioning of the Earth as an adaptive, integrated system by consider the interaction between all earth subsystems (hydrosphere, atmosphere, biosphere, etc.) with human systems (social economic, medical, etc.) to better inform the impacts of threats (climate, pandemic, man-made) and opportunities for increased resiliency.

- Statistical Collection and Reporting: Through Statistical Collection and Reporting research, the Enduring Sciences Technology Centers will begin to collect, store, maintain, analyze, and disseminate key terrorisms statistics that DHS Operations can act on and can be messaged to the public, and will look to a scalable solution that will enable DHS to systematically make evidence-based decisions on domestic violent extremism and terrorism prevention using objective, independent, quality-controlled data. This work will be closely coordinated with the Office of Immigration Statistics and the Office of the Chief Data Officer, for ensuring similar data standards are maintained, as appropriate, and for long-term benefits of this data and other Department-wide programs.

- **Justification:** The FY 2023 Budget for this project will be used to maintain SME and conduct long-term biodefense, chem-defense, explosives, and terrorism research that directly informs DHS Component risk assessment efforts. S&T will acquire additional SMEs through a variety of mechanisms, engage technical communities of interest, and exchange technical information with strategic interagency partners. Enduring Sciences Technology Centers will conduct the following ongoing research and development as threats and our need to understand them evolve:

  - SS-TC:
    - Disseminate data on acts of terrorism and targeted violence in the United States;
    - Expand analysis of extremist organizations in the United States to include a larger sample;
    - Map the Information Threat Landscape for DHS;
    - Evaluate the effectiveness of online diversion programs for violence prevention;
    - Conduct human trafficking research that will help inform DHS operations and policy; and
    - Develop and build fundamental research in labor trafficking, new and advanced methods to inform threat characterization.

  - HAC-TC: Evaluate chemical, biological, and explosive sciences and technology developments to understand what may impact the DHS mission three to five years; and exploration of new and advanced methods to inform threat characterization.

  In addition, funds will be used to focus on resilience research under the creation of a new technology center focused on Earth Systems Sciences allowing for expanded research and development in the following in new areas:

- ESS-TC: S&T will establish a new Center to conduct research focused on understanding the coming together of societal, technological, environmental, economic, political, and privacy and civil rights and civil liberties issues with science and technology innovations that can be catalyzed to address critical needs and capability gaps. These efforts will create solutions that build individual, community, and organizational resilience. The ESS-TC will identify and assess new advances in geophysical, materials, self-healing and regenerative sciences. The ESS-TC will expand partnerships with key agencies (DOE, NIST, U.S. Army Corps of Engineers (USACE), NSF) that will enable S&T to explore and assess the risks, vulnerabilities, and interoperability issues of next generation detection and observing systems, novel materials and self-healing technologies, and carbon sequestration solutions to strengthen infrastructure, ecological and institutional assets, and economic supply chains against current and emerging threats from climate change and natural disasters as well as unconventional shocks and stresses, ensure environmental and social equity and to inform policy formulation, optimize incentives and promote stakeholder adoption. These research efforts will fill critical knowledge gaps necessary to help understand the confluence of societal, technological, environmental, economic, political issues with science and technology innovations to inform what solutions or what type of solution options are most viable for building resiliency in communities as well as critical infrastructure and enable DHS to move into a proactive stance for threat situations that need rapid answers and response.

- Statistical Collection and Reporting: S&T will create a repeatable process to examine how the Department can best operate an enduring capability to collect, analyze, publish, and disseminate statistical information on targeted topics critical to the homeland security mission space. S&T currently relies on research performers, think tanks, and universities to collect, report, and disseminate scientific and statistical data that are vital to DHS interests (with DHS funding). These external research performers must then bear operations and maintenance costs of the datasets. This leads performers to seek funding from other sources, often outside the U.S. Government that do not share U.S. or DHS needs or interests, diminishing the applicability and usefulness of the data to DHS and our stakeholders. Data collected by outside entities has often resulted in lapses in data availability, lack of direct connection between DHS mission priorities and data collected, and variations in usefulness to DHS and public interest. DHS is an outlier among domestically focused Federal agencies in not having a statutory mandate for a primary statistics office. DOJ, DOL, DOE, CDC, and DOT all have authorities, obligatory legal requirements, and capabilities to collect and report on data that are relevant to their missions. FY 2023 funds for this effort will focus primarily on terrorism statistics and will be used to:

  - Identify key information on running statistical agencies, lessons learned, common pitfalls, and start-up challenges;
  - Obtain legal and privacy analysis to ensure all statistical data is collected in a way that protects individual privacy, civil rights, and civil liberties;
  - Identify standards for the collection of terrorism data to ensure quality, objectivity, and usability;
  - Gather information from key DHS, Interagency, Legislative, OMB, and SLTT partners to understand their terrorism data needs and how centralized statistics can improve their operations;
  - Work with partners to identify the best ways to disseminate data to stakeholders across DHS, interagency, academia, and SLTT partners; and
  - Deliver recommendations for the collection, reporting and dissemination of data in support of establishing a department level capability.

This statistical information can be used across the USG, DHS Components, the public, and SLTT partners for evidence-based decision making. This effort will also enable DHS to increase public transparency through the regular release of methods, data and analysis and the ability to systematically answer questions from operators, congress, auditors, and the public related to the nature of the threat from terrorism. Further, the availability of reliable data available for secondary analysis will organically increase and improve research on homeland security issues without additional USG investment.

- **Impact:** Enduring Sciences Technology Centers establish and leverage innovative science-based capabilities to provide DHS and our partners with the expertise, research, data, and knowledge necessary to implement best-practices and appropriate understanding of functional requirements for solutions to current and emerging chemical, biological, and explosive, climate change, and natural and technological hazards. Science-informed and evidence-based policy and practice also support more efficient and accurate analysis of the threats posed by violent extremists and evidence-based terrorism preventions policies, programs, and interventions. The application of expertise, enduring research, and knowledge coordinated through the centers increases the efficiency of DHS by enabling development of more effective solutions based on consistent and defensible recommendations, such as developing and fielding more effective transportation security equipment, providing better training to front line personnel, and validating and monitoring continuing and emerging threats.

Type of Research

Basic, Applied and Developmental

Technical Readiness Level

The Technology Centers focus on a combination of technical analysis and fundamental research to inform science and policy. Therefore, we do not transition technologies directly to components. Enduring Sciences Technology Centers execute basic & applied research on biological, chemical, explosive, organizational, and human hazards in order to address critical knowledge gaps to inform policy, strategy, requirements, mission assessments and operational plans. Activities are initiated based on stakeholder (DHS Components, HHS, DOD, State and local practitioners, DOJ, etc.) needs. At times, this research requires appropriately accredited facilities to support biological hazard research. The majority of deliverables areknowledge products and tools to inform decision makers. For this reason, the TRL level on many of our efforts is not applicable. When applicable, Enduring Sciences Technology Centers' TRL levels tend to be lower and may range from TRL1 to TRL 5. Some examples from the milestones below:

- Fundamental research to understand evolving threat space., creation of surveys, and characterization of threats. Results in the creation of knowledge products (TRL 3).
- Creation of datasets, evaluation plans, analysis that for decision makers that can be used by future RD&I efforts (TRL 5).

Transition Plans

- HAC-TC: HAC-TC regularly delivers/transitions the knowledge and insight produced through various products that are shared with DHS's components and the HSE, including the Intelligence Community and DOD through PANTHR's Knowledge Repository and other information portals, such as the S&T Technology Clearinghouse or publication on S&T's public website, as appropriate 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 spending on medical and non-medical countermeasure acquisition programs to mitigate chemical, biological, and explosive hazards impacting billions of dollars of Government spending.

- SS-TC: SS-TC regularly delivers/transitions the knowledge and insight produced through various technical reports that are shared with DHS Components and HSE partners.

- ESS-TC: ESS-TC will regularly deliver/transition the knowledge and insight produced through various technical reports that are shared with DHS Components and HSE partners.

- Statistical Collection and Reporting: Statistical Collection and Reporting will regularly deliver/transition the knowledge and insight produced through various technical reports that are shared with DHS Component and HSE partners, particularly with the DHS Office of Policy. For FY 2023, S&T will focus on terrorism statistics and deliver recommendations for the collection, reporting and dissemination of data

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
HAC-TC: Generate prioritization for basic research for the Biological Threat Characterization Project's FY 2022 Activities.	FY 2021 Q2	FY 2021 Q3	2
HAC-TC: Generate a prioritization for basic research activities for the Chemical Threat Characterization Project's FY 2022 Activities.	FY 2021 Q2	FY 2021 Q3	2
HAC-TC: Deliver one technical report on on an agent or technology that may impact future biological threats.	FY 2021 Q1	FY 2021 Q4	N/A
HAC-TC: Deliver one technical report on an agent or technology that may impact future chemical threats.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
HAC-TC Identify and validate method for populating explosive equivalency based on significant factor.	FY 2022 Q3	FY 2022 Q4	3

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
HAC-TC: Generate prioritization for basic research for the Biological Threat Characterization Project's FY 2023 Activities.	FY 2022 Q2	FY 2022 Q3	N/A
HAC-TC: Generate a prioritization for basic research activities for the Chemical Threat Characterization Project's FY 2023 Activities.	FY 2022 Q2	FY 2022 Q3	N/A
HAC-TC: Deliver one technical report on an agent or technology that may impact future biological threats.	FY 2022 Q1	FY 2022 Q4	N/A
HAC-TC: Deliver one technical report on an agent or technology that may impact future chemical threats.	FY 2022 Q1	FY 2022 Q4	N/A
SS-TC: Field a survey of the general public to better understand public perceptions of DHS use emerging technology – including AI/ML/FR.	FY 2020 Q4	FY 2022 Q4	3
SS-TC: Complete scientific assessment of insider threats facing domestic law enforcement agencies, with specific focus on identification and analysis of research, prevention efforts, and internal policies.	FY 2021 Q3	FY 2022 Q4	N/A
SS-TC: Conduct an outcome evaluation of the Digital Forums on Terrorism prevention in support of DHS CP3 initiative.	FY 2021 Q3	FY 2022 Q4	N/A
SS-TC: Disseminate a dataset and corresponding codebook examining acts of terrorism or extremist violence in the United States for use by research, DHS I&A fusion centers, DHS's Center for Prevention Programs and Partnerships, and other HSE partners.	FY 2020 Q4	FY 2022 Q3	5
SS-TC: Develop a briefing guide with practical steps for both understanding and responding to threats posed by the Incel movement.	FY 2020 Q4	FY 2022 Q3	N/A
SS-TC: Establish the collection and sharing of independent, objective data related to individuals, events, and organizations participating in targeted violence in the United States.	FY 2021 Q1	FY 2022 Q2	N/A
HAC-TC: Develop characterization approach for explosive hazards that will inform DHS's risk profile.	FY 2021 Q1	FY 2022 Q2	3
HAC-TC: Complete characterization research on one large scale explosive test that will inform DHS's risk profile.	FY 2020 Q4	FY 2022 Q1	3
HAC-TC: Facilitate international collaboration on current and emerging threats through development of an international forum for exchanging information.	FY 2020 Q4	FY 2022 Q4	3
SS-TC: Deliver a communications toolkit to first responders focused on how to manage risk perception and public acceptance of first responder use of Unmanned Aircraft Systems.	FY 2019 Q1	FY 2022 Q2	5
SS-TC: Deliver technical research results that provides insights into the psychology that drives extremist behavior	FY 2021 Q1	FY 2022 Q3	3
SS-TC: Complete technical assessment of the effectiveness of terrorism prevention programs funded by State, local, and international partner organizations.	FY 2021 Q1	FY 2022 Q4	5
SS-TC: Established formal, international information sharing for R&D supporting the prevention of Targeted Violence or Terrorism.	FY 2021 Q1	FY 2022 Q2	N/A
SS-TC: Develop the framework for the Blue Campaign evaluation and validate the Blue Campaign human trafficking indicators.	FY 2021 Q2	FY 2022 Q2	N/A

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
SS-TC: Deliver COVID-19 related research outputs targeted to first responder communities and other government relevant government agencies.	FY 2021 Q1	FY 2022 Q2	N/A
SS-TC: Deliver terrorism prevention and intervention Evaluation Plans for use across USG funded violence intervention programs.	FY 2021 Q1	FY 2022 Q3	5
	FY 2023		
HAC-TC: Deliver one technical report on an agent or technology that may impact future biological threats.	FY 2023 Q1	FY 2023 Q4	N/A
HAC-TC: Deliver one technical report on an agent or technology that may impact future chemical threats.	FY 2022 Q1	FY 2023 Q1	N/A
HAC-TC: Coordinate/facilitate a community of interest exchange of information event on explosives threats, research, or operations.	FY 2023 Q1	FY 2023 Q2	N/A
HAC-TC: Identify and adapt a cutting edge technology for use in characterization of explosives.	FY 2023 Q1	FY 2023 Q3	3
HAC-TC: Develop and implement method for characterization of explosives effects.	FY 2023 Q1	FY 2023 Q4	3
SS-TC: Disseminate data on acts of terrorism and targeted violence in the U.S. to DHS I&A fusion centers, DHS's Center for Prevention Programs and Partnerships, the research community, and other HSE partners.	FY 2023 Q1	FY 2023 Q4	N/A
SS-TC: Expand analysis of violent extremist organizations in the U.S. to include a larger sample.	FY 2023 Q1	FY 2023 Q4	N/A
SS-TC: Map the Information Threat Landscape for DHS that informs DHS Component partners of state of mis/dis/mal-information.	FY 2023 Q1	FY 2023 Q4	N/A
SS-TC: Evaluate the effectiveness of online diversion programs for violence prevention.	FY 2023 Q1	FY 2023 Q4	N/A
SS-TC: Conduct fundamental research into labor trafficking mitigation measures that enables decision makers, informs policy makers, and assists operational partners in their mission to mitigate labor trafficking crimes.	FY 2023 Q1	FY 2023 Q4	3
ESS-TC: Identify and assess new advances in geophysical, materials, self-healing, and regenerative sciences to inform Homeland Security missions and policy.	FY 2023 Q1	FY 2023 Q4	N/A
ESS-TC: expand partnerships with key agencies (DOE, NIST, USACE, NSF).	FY 2023 Q1	FY 2023 Q4	N/A
ESS-TC: Establish a Resilience sciences and Self-healing Technology research collaborative.	FY 2023 Q1	FY 2023 Q4	N/A
ESS-TC: Research the understanding of the coming together of societal, technological, environmental, economic, political, and privacy and civil rights and civil liberties issues with science and technology innovations that can be catalyzed to address critical needs and capability gaps.	FY 2023 Q1	FY 2023 Q4	N/A
ESS-TC: Explore and assess the risks, vulnerabilities, and interoperability issues of novel materials and self-healing technologies, solutions, and innovations to strengthen infrastructure, ecological and institutional assets, and economic supply chains against current and emerging threats from climate change and natural disasters as well as unconventional shocks and stresses,	FY 2023 Q1	FY 2023 Q4	N/A

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
ensure environmental and social equity and to inform policy formulation, optimize incentives and promote stakeholder adoption.			
ESS-TC: Explore and assess the risks, vulnerabilities, and interoperability issues of carbon sequestration technologies, solutions and innovations to strengthen infrastructure, ecological and institutional assets, and economic supply chains against current and emerging threats from climate change and natural disasters as well as unconventional shocks and stresses, ensure environmental and social equity and to inform policy formulation, optimize incentives and promote stakeholder adoption.	FY 2023 Q1	FY 2023 Q4	N/A
ESS-TC: Explore and assess the risks, vulnerabilities, and interoperability issues of resilience technologies, solutions and innovations to strengthen infrastructure, ecological and institutional assets, and economic supply chains against current and emerging threats from climate change and natural disasters as well as unconventional shocks and stresses, ensure environmental and social equity and to inform policy formulation, optimize incentives and promote stakeholder adoption.	FY 2023 Q1	FY 2023 Q4	N/A
ESS-TC: Conduct foundational research and develop an evaluation and equity resilience framework for assessing the interconnectedness of natural, technological, and human-made threats and hazards with strategic societal and technology drivers to inform fore sighting and evidence building activities across DHS.	FY 2023 Q1	FY 2023 Q4	N/A
Statistical Collection and Reporting: Collect recommendations from known experts on lessons learned for statistical offices and provide report to DHS PLCY.	FY 2023 Q1	FY 2023 Q2	N/A
Statistical Collection and Reporting: Receive legal and privacy analysis from DHS Headquarters on measures necessary to ensure all statistical data is collected in a way that protects individual privacy, civil rights, and civil liberties.	FY 2023 Q1	FY 2023 Q2	N/A
Statistical Collection and Reporting: Identify standards for the collection of terrorism data.	FY 2023 Q1	FY 2023 Q3	2
Statistical Collection and Reporting: Identify terrorism data needs of key DHS, Interagency, Legislative, OMB, and State, local, tribal, and territorial partners.	FY 2023 Q1	FY 2023 Q2	N/A
Statistical Collection and Reporting: Identify data dissemination methods.	FY 2023 Q2	FY 2023 Q4	N/A
Statistical Collection and Reporting: Deliver recommendations for the collection, reporting and dissemination of data in support of establishing a department level capability to DHS PLCY.	FY 2023 Q1	FY 2023 Q4	4

Innovative Systems Technology Centers

- **Problem:** Technology can be a tool for increasing the efficiency and effectiveness of homeland security operations; it can enhance capabilities and collaboration, provide better awareness and information, speed decision making, and deliver the ability to do things that were once not possible. Emerging technology and private sector innovations in the areas of communication, sensors, and identity technologies are playing an increasingly significant role in securing the Homeland against dynamic threats. However, S&T lacks a coordinated approach to research and analyze these next generation technologies through the lens of DHS and its unique mission needs and requirements, and inform DHS on technical maturity and potential risks of new technology. This includes potential vulnerabilities and/or malicious dual use of emerging technology.

- **Solution:** The Innovative Systems Technology Centers are S&T's resource for understanding and harnessing next-generation and emerging innovations for cross-cutting mission capabilities. These centers focus on understanding, exploring, researching, and analyzing these next generation technologies and capabilities to inform DHS on how to leverage these advancements to better meet mission needs and evolving requirements, while identifying and preventing potential vulnerabilities and/or malicious dual use. This is done, in part, by experimenting with and field-testing innovative systems to identify technological maturity, operational uses, and vulnerabilities of these systems. Focus areas include intelligent sensors and autonomous systems; resilient communications techniques, equipment, data, and networks; and enhanced biometrics and identity capabilities. The Innovative Systems project is comprised of the following Technology Centers:

    - Office for Interoperability and Compatibility Technology Center (OIC-TC): Provides subject matter expertise and conducts research into existing and next-generation communications; networks; and position, navigation, and timing capabilities. OIC-TC's research activities are rooted in its establishing legislation 6 USC 194 and 195. OIC-TC conducts R&D, including demonstrations, tests, and exercises, with component customers in the wireless communications and network ecosystem in order to assess the benefits and security risks of systems that deliver the interoperable, efficient, and resilient homeland security communication requirements. This research impacts DHS Components as well as State, tribal, and local public safety agencies' ability to communicate mission-critical information as they carry out their daily tasks of saving lives and protecting properties.

    - Sensors and Platforms Technology Center (SP-TC): Provides subject matter expertise and conducts research into next generation intelligent sensors, sensor platforms, and sensor integration architectures. SP-TC experiments with autonomous systems, innovative sensors that detect a broad spectrum of threats, and advanced emergency and security alert technologies to ensure operators have access to and can take advantage of emerging sensor capabilities.

- Biometrics and Identity Technology Center (BI-TC): Coordinates DHS technical biometric and identity competencies to provide world-class biometric and identity expertise, methods, tools, technologies, best practices, industry and international coordination, and operational insight to address the dynamic biometric, identity, and privacy needs of DHS and the HSE. DHS has a continued need for an enhanced set of identity technologies, and capabilities that Component customers and S&T program managers can incorporate into their R&D projects. BI-TC provides a sustainable, common platform for driving biometric and identity technology standards, best practices, and innovation across DHS and its Components. This enables DHS Components to quickly establish technical competence using more capable and cost effective biometric and identity technologies and facilitate operational excellence. BI-TC accelerates effective integration of biometric and identity technologies into DHS programs and Component operations and works in a cross-cutting fashion to mitigate potential inefficiencies, further driving down costs and increasing operational impact.

- **Justification:** The FY 2023 Budget for this project will be used to directly address the emerging opportunities and risks in biometrics and digital identity, such as *Face Morphing* and explore the next generation of intelligent sensors and systems for use across the HSE. S&T will acquire additional subject matter experts through a variety of mechanisms, engage technical communities of interest, and exchange technical information with strategic interagency partners to access supplementary expertise and leverage ongoing research for homeland security applications.

  In addition, funds will be used for:
  - Advanced Communications: S&T will renew its partnerships with CISA, DOT, NIST, and SLTT to secure public safety communication, ensure interoperability, and to securely move capabilities into the next generation of telecom equipment. Additionally, S&T will begin to study and address 6G advanced communication concerns—including the advanced technological capability, network security, and supply chain threats. With rapid advances in the telecom industry and the move to 5G, and potentially to 6G, it is critical that DHS ensures the security, integrity and interoperability of public safety communications while providing enhanced capabilities.

  - Biometrics & Identity: S&T will develop mitigations, solutions and countermeasures to evolving identity threats to emerging and evolving biometric threats.

  - Innovative Systems Operational Testbeds: S&T requires realistic operational testbed environments to understand the technical capabilities that next-generation systems offer that may increase mission success. New testbed environments will include: 1) an Operational Checkpoint Testbed that expands S&T's capabilities beyond the Maryland Test Facility to assess the application and performance of commercial technologies such as advanced biometrics and identity capabilities on DHS checkpoint operations; 2) an Advanced Communication Technology Testbed Network that develops partnerships with key agencies (DoD, NIST, NTIA, NSF) to establish a network of telecommunication testbeds that will enable S&T to assess the risks, security vulnerabilities, and interoperability issues of next-generation and advanced communication capabilities (e.g., 5G, 6G, XG); and 3) an In-Building Sensor Testbed that will create a capability to assess environmental, air quality, particulate, chemical, and biological sensors. These capabilities will enable operators to understand how these technologies will fundamentally shift the way they execute their missions.

- **Impact:** The Innovative Systems Technology Centers enable DHS Components as well as State, tribal, local government and industry partners, public safety to better take advantage of next generation and emerging innovations in communication, sensor, and identity technologies. These centers and testbeds ensure that operators can effectively identify, evaluate, and integrate technologies into use and that potential vulnerabilities are mitigated.

Type of Research

Basic, Applied and Developmental

Technical Readiness Level

OIC-TC, SP-TC, and BI-TC projects range from TRL-2 to TRL-7. The Tech Centers focus on fundamental research to inform science, policy, and our stakeholders on advancements and developments in various technical areas that may impact the Department. Within OIC-TC TRL levels tend to be generally higher (TRL 5-7) as S&T looks to research, adapt, integrate, test and shape existing capabilities into more mature applications to meet the needs for our stakeholder community. Within BI-TC and SP-TC TRL ranges vary depending on activity, from the lower end for activities such as researching and prototyping sensor detection capabilities and contributing to digital identity and biometric technology standards, to the higher end for activities such as commercializing sensors and evaluating commercial biometric and identity capabilities.

Transition Plans

Research, experimentation, and field-testing results are delivered in the form of knowledge products, including best practices, lessons learned, and technical reports. These products are used to inform policy, standards, operations and aid in decision making. They are typically provided directly to internal S&T programs, DHS Components and end users.

- OIC-TC:
  - Development of a R&D gap analysis for wireless communications (FY 2021 Q4) which will inform future S&T enduring research investments in this technology domain.
  - Development of use cases for DHS Components and First Responder applications of beyond-5G broadband capabilities for homeland security missions (FY 2021 Q4). These use cases will be the basis for future system prototype validation in relevant environments (TRL-7).
  - Development of technical reports detailing R&D results of advanced network communications technologies to facilitate interoperable communications capabilities for legacy and next generation systems (FY 2022 Q4). These knowledge products will be made available to DHS Component customers including First Responders.
  - OIC-TC has worked in collaboration with industry to develop a Resilient PNT Conformance Framework. This framework will be transitioned to a standards development organization for the development of voluntary industry standards for resilient PNT equipment and be a driver for building resilience in critical infrastructure against the growing risk of PNT disruptions.

- BI-TC:
  - BI-TC conducts evaluations of new and emerging technologies and provides experimental results through technical reports and briefings that are relevant to DHS Components. This transition of knowledge product provides inputs to Component acquisition planning and ongoing operations as well as S&T RDT&E planning.
  - BI-TC also works directly with industry and capability development partners to enhance and refine capabilities to better fit DHS Component needs and environments. This method allows S&T to broadly engage industry to increase the quality and quantity of new solutions and enables direct transition to the Component through industry.
  - To effectively use resources, BI-TC regularly collaborates with industry, government and academic partners to encourage a robust capability development pipeline from research to operational use. BI-TC ensures that the interests of homeland security are included in strategic planning activities and external research efforts and include technically robust evaluations.

- SP-TC:
  - SP-TC conducts evaluations of new and emerging sensor technologies and provides experimental results through technical reports and briefings that are relevant to DHS Components. This transition of knowledge product provides inputs to Component acquisition planning and ongoing operations as well as S&T RDT&E planning.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
BI-TC: Facilitated multi-agency test and evaluation activities at the Maryland Test Facility in collaboration with HSE stakeholders to assess innovative multi-biometric recognition on the move technologies.	FY 2021 Q1	FY 2021 Q3	5
BI-TC: Enabled joint CBP, TSA, ICE, or USCIS, or Critical Infrastructure Security Stakeholders to Operationally evaluate high-throughput biometric capabilities.	FY 2021 Q1	FY 2021 Q4	7
BI-TC: Developed a knowledge product and an initial capability to remotely verify the identity of DHS online service users with methods other than “knowledge-based Q&A,” which is made ineffective by data breaches.	FY 2021 Q1	FY 2021 Q3	6
BI-TC: Facilitated collaborative industry and Federal agency test and evaluation activities at the Maryland Test Facility to assess innovative cutting-edge identity and biometric capabilities.	FY 2021 Q1	FY 2021 Q3	5
BI-TC: Provided Technical Subject Matter Expertise and technical reports to inform DHS review of biometric technology acquisition programs.	FY 2021 Q1	FY 2021 Q4	7
BI-TC: Contributed to digital identity and biometric technology standards and best practices in coordination with relevant entities (e.g., NIST) to enable DHS and United States adoption and capabilities.	FY 2021 Q1	FY 2021 Q4	5

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
OIC-TC: Research hands-free, intelligent voice-based assistance to enable mobile users' intuitive access and sharing of information.	FY 2020 Q1	FY 2021 Q4	6
OIC-TC: Initial submission of Positioning, Navigation and Timing (PNT) conformance framework to a standards development organization.	FY 2021 Q2	FY 2021 Q4	N/A
OIC-TC: Development of a R&D gap analysis for wireless communications which will inform future S&T enduring research investments in this technology domain.	FY 2021 Q1	FY 2021 Q4	N/A
SP-TC: Expand IoT Flood Sensors into commercialization markets.	FY 2019 Q3	FY 2021 Q2	7
SP-TC: Deliver research, prototype and evaluation of wildland fire detection, alert and notification sensors and control systems.	FY 2019 Q3	FY 2021 Q4	5
SP-TC: Perform operational test & evaluation of IoT Flood Sensors with State/local stakeholders for commercialization.	FY 2019 Q1	FY 2021 Q4	7
SP-TC: Complete and transition to CBP & FPS an operational mobile/fixed, automated under vehicle inspection (UVI) system to detect modifications to manufacturer specifications to detect drugs & explosives.	FY 2020 Q2	FY 2021 Q4	7
SP-TC: Establish a 3D in-building testbed to evaluate sensors and platforms.	FY 2021 Q1	FY 2021 Q4	2
SP-TC: Design and develop a Virtual Room for strategic communications.	FY 2021 Q1	FY 2021 Q3	5
	FY 2022		
BI-TC: Provide Technical Subject Matter Expertise and technical reports to inform DHS review of biometric technology acquisition programs.	FY 2022 Q1	FY 2022 Q2	7
BI-TC: Assess innovative multi-biometric recognition-on-the-move technologies.	FY 2022 Q1	FY 2022 Q3	5
BI-TC: Contribute to digital identity and biometric technology standards and best practices in coordination with relevant entities (e.g., NIST) on topics including Quantifying biometric system performance variation across demographic groups and Mobile Driver's Licenses.	FY 2022 Q1	FY 2022 Q4	5
BI-TC: Facilitate collaboration among DHS Offices and Components in the review and potential adoption of novel digital identity capabilities within select DHS operations.	FY 2022 Q1	FY 2022 Q3	7
BI-TC: Identify and develop research initiatives to address technological or process weaknesses in DHS Biometric or Identity based operations.	FY 2022 Q1	FY 2022 Q4	4
OIC-TC: Conduct gap analysis of emerging PNT technologies to inform future requirements for PNT mitigations and research.	FY 2021 Q4	FY 2022 Q4	N/A
SP-TC: Provide technical Subject Matter Expertise and technical reports to inform DHS and the HSE about emerging sensor capabilities.	FY 2022 Q1	FY 2022 Q4	4-5
	FY 2023		
BI-TC: Facilitate multi-agency test and evaluation activities at the Maryland Test Facility in collaboration with external stakeholders to assess innovative multi-biometric recognition and/or digital identity technologies for secure and high-throughput applications.	FY 2023 Q1	FY 2023 Q4	6

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
BI_TC: Develop framework to review new and emerging digital identity capabilities and mitigations, and inform DHS consideration and potential use.	FY 2023 Q1	FY 2023 Q3	N/A
BI-TC: Develop risk characterization framework of online and close proximity digital identity capabilities to assist DHS Components assess the integrity, trustworthiness, and potential risks of digital identity approaches to inform potential issuance, acceptance, and use.	FY 2023 Q1	FY 2023 Q2	N/A
BI-TC: Provide technical Subject Matter Expertise and technical reports to inform DHS review of biometric technology acquisition programs.	FY 2023 Q1	FY 2023 Q4	N/A
BI-TC: Contribute to digital identity and biometric technology standards and best practices in coordination with relevant entities (e.g., NIST) on topics including Quantifying biometric system performance variation across demographic groups and Mobile Driver's Licenses.	FY 2023 Q1	FY 2023 Q4	6
BI-TC: Facilitate collaborative industry and Federal agency test and evaluation activities at the Maryland Test Facility to assess innovative cutting-edge identity and biometric capabilities.	FY 2023 Q1	FY 2023 Q3	5
OIC-TC: Conduct demonstrations of 5G DHS Component Use Cases to inform DHS Components of potential 5G solutions to address existing problems/gaps.	FY 2023 Q1	FY 2023 Q4	5
OIC-TC: Develop 5G/XG strategy for conducting R&D for DHS Components and First Responders.	FY 2023 Q2	FY 2023 Q4	N/A
OIC-TC: Conduct technology verification and validation in coordination with Standard Development Organization activities.	FY 2023 Q1	FY 2023 Q3	4
OIC-TC: Conduct updated PNT landscape threat assessment to identify new risks to use of PNT and inform HSE and critical infrastructure.	FY 2023 Q1	FY 2023 Q4	N/A
OIC-TC: Conduct technology experimentation for 5G/XG in support of operational DHS Components and first responder missions.	FY 2023 Q1	FY 2023 Q4	3-7
SP-TC: Add additional Testbed for 3D in-building sensor in commercial office complex or Port of Entry for airflow modeling and performance improvement.	FY 2023 Q1	FY 2023 Q4	5
SP-TC: Provide technical subject matter expertise and technical reports to inform DHS and the HSE about emerging sensor capabilities.	FY 2023 Q1	FY 2023 Q4	N/A
SP-TC: Identify enduring research questions in autonomous systems in maritime environments by collaborating with DHS Components through targeted workshops.	FY 2023 Q1	FY 2023 Q2	N/A

Physical Security and Critical Infrastructure Resilience Thrust Area
Research and Development

Technology Readiness Level Exhibit

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
Physical Security and Critical Infrastructure Resilience Thrust Area	$43,696	$41,058	$42,558

R&D Thrust Area Description

PHYSICAL SECURITY AND CRITICAL INFRASTRUCTURE RESILIENCE THRUST AREA: S&T invests in the R&D technologies, methods, and procedures to enhance the physical security of the Nation's critical infrastructure which includes the Nation's air travel system, mass transportation systems, and schools as well as soft targets such as mass public gatherings. S&T also conducts RDT&E to analyze the foreign influence spectrum; how it can impact critical functions such as the media and elections, and what can be done to prevent them. This research will enable policy makers and operational end-users to make informed decision to mitigate vulnerabilities and enhance community resilience in the face of various physical, social, and behavioral threats.

PHYSICAL SECURITY AND CRITICAL INFRASTRUCTURE RESILIENCE THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
Total –Physical Security and Critical Infrastructure Resilience Thrust		**$43,696**	**$41,058**	**$42,558**
Baggage / Cargo / People Screening		**$34,761**	**$34,080**	**$34,080**
	Air Cargo Screening	$4,432	$3,250	$3,250
	Checked Baggage Technology Development	$6,621	$7,750	$7,750
	Next Generation Explosives Trace Detection	$5,930	$6,080	$6,080
	Primary Screening for Carry-On Bags	$4,692	$5,500	$5,500
	Primary Screening for Passengers	$4,275	$4,000	$4,000
	Screening at Speed	$8,811	$7,500	$7,500
Countering Violent Extremism		**$5,478**	**$5,478**	**$6,478**

PHYSICAL SECURITY AND CRITICAL INFRASTRUCTURE RESILIENCE THRUST AREA *(Dollars in Thousands)*				
Program	**Project**	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
	Public Safety and Violence Prevention	$5,478	$5,478	$6,478
Physical Security		**$3,457**	**$1,500**	**$2,000**
	Soft Target Security (formerly Soft Targets, Vehicular, School Safety, Protective Sites)	$3,457	$1,500	$2,000

Baggage / Cargo / People Screening Program – This program develops prototype solutions for high priority technology capability gaps within the security screening processes for the Nation's air travel and other mass transportation systems.

Air Cargo Screening

- **Problem:** Air Cargo is one of three critical components of Aviation Security, along with Checked Baggage and Checkpoint Baggage. Public Law 110-53, mandates 100 percent screening of air cargo on passenger aircraft, to the same standards as checked baggage. Almost fifty percent of the contents in a passenger aircraft are cargo and almost all U.S. commercial carrier passenger flights carry air cargo. Per an upcoming July 2021 International Civil Aviation Organization (ICAO) requirement, all outgoing U.S. cargo must be screened to the same level as cargo on passenger planes. The range of air cargo commodity types is extraordinarily wide, and this poses challenges to developing screening systems for cargo. The current state of Air Cargo Screening deployment is critically behind that of checked baggage screening. Evolving threats pose a significant and continual threat to passenger safety through the Air Cargo conduit. Additionally, the increasing volume of air cargo (currently totaling over six trillion dollars of goods a year) makes it impossible to screen securely with current screening technologies. These three issues necessitate the need to develop next generation cargo screening systems.

- **Solution:** To handle the extremely high volume of cargo shipped by hundreds of shippers, TSA has decentralized the security screening of cargo to private cargo screening companies. The implementation of this decentralization is via the mechanism of the Certified Cargo Screening Facility (CCSF) program. In this program, TSA provides certification to private screening companies, that meet specific TSA standards, so that they can screen cargo using equipment that TSA lists on its ACSTL (Air Cargo Screening Technologies List). Since private screening companies are low-margin facilities, screening equipment must be affordable as well as effective. TSA and S&T work with private screening companies through the Aviation Security Advisory Council to determine appropriate solutions. The Air Cargo program supports TSA's CCSF program through a combination of short term, mid-term, and long-term strategies. These include (a) augmenting existing screening systems via advanced hardware and software to support increased security in the short term, (b) developing low cost Computed Tomography (CT) systems for 3D imaging of skids and automated threat detection algorithms in the midterm, and (c) in the long term, developing technologies to screen dense cargo. The program seeks to achieve these goals to meet TSA capability gaps identified by close collaboration between TSA, S&T, original equipment manufacturers (OEMs) and Screening Companies.

- **Justification:** The FY 2023 Budget for this project will be used to support the research and development for solutions in the areas of both cargo and passenger safety. The focus of the Air Cargo program is to identify technology for screening complex and dense cargo, develop operator assist and screener training tools, advance High Speed screening to support exponential growth of cargo and continue development of test and evaluation capability for cargo screening equipment at TSL. The technologies developed for screening air cargo for explosives can also be adapted and applied to other operational scenarios and component requirements, including the use of hardware for the screening of opioids and other contraband for CBP, as well as the use in high security areas and sites for USSS. In June 2021, new mandates were released requiring the screening of all air cargo in an effort to reduce significantly and address ongoing threats and the risk of catastrophic events occurring aboard commercial aircraft. Funds will also be used to accelerate development of new technology for effective screening of high-density air cargo pallets for threat items.

- **Impact:** This research is critical to TSA meeting its Congressionally mandated requirements for Air Cargo Screening, and for U.S. freight carriers to meet their ICAO obligations, continued with the exponential growth of e-commerce, Air Cargo security has a vital impact on both passenger safety and economic interests. Not funding this research will cause gaps in Air Cargo Screening and passenger safety will be compromised, an air accident will cause significant economic loss and contraband could be moved through the air cargo conduit if it is not properly screened. Funding this research will contribute to the strengthening of the Nation's air cargo security and aviation security infrastructure.

Type of Research

Applied and Developmental

Technical Readiness Level

- For low cost CT-like 3D imaging, the program began at TRL-3 and will end at TRL-7.
- For development of high penetration cargo skid size screening capability Preliminary Design Review (PDR), the program began at TRL-3 and will end at TRL-6.
- For development of generic threat detection software that can be used by cargo CT manufacturers, the program began at TRL-3 and will end at TRL-7.
- For development of the Opacity and Complexity Assessment Software Tool for single and dual view X-ray cargo screening systems, the program began at TRL-3 and will end at TRL7.

Transition Plans

- When the CT and high penetration air cargo skid scanners reach TRL-7 (successful developmental testing and evaluation at TSL), the products would be available to TSA for qualification testing. Upon successful qualification, TSA will place these products on the Air Cargo Screening Technology List (ACSTL). This will then allow the many Certified Cargo Screening Facilities around the country to procure and use these products for security screening of cargo. This will enhance passenger safety and national security and facilitate compliance with laws and international regulations. The latest ICAO requirements mandate that all outgoing cargo everywhere in the world be screened.

- Complete pre-production software and evaluate it at multiple TSA approved sites.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Complete development of simulator that generates simulated cargo and transfer simulator to TSL for test and evaluation.	FY 2019 Q3	FY 2021 Q1	6
Complete a technology research and evaluation program that investigates possible non-CT, non-Trace, approaches to screen high density cargo in a skid. The final goal is a report from Lawrence Livermore National Laboratory that details potential alternatives, if any, to X-Ray or Trace Systems for screening high density cargo.	FY 2019 Q4	FY 2021 Q1	N/A
Develop platform independent Advanced Automatic Threat Recognition and Anomaly Detection Algorithm for Air Cargo and submit report. This software is planned to be then hosted on the low-cost cargo skid computerized tomography scanners.	FY 2020 Q3	FY 2021 Q3	6
Complete field evaluation tests of Opacity and Complexity Assessment Software Tool (OCAST), an advanced image analysis software.	FY 2021 Q1	FY 2021 Q4	6
Upon successful demonstration of OCAST, transition OCAST software to TSA for deployment at Cargo Screening facilities on existing X-Ray systems to enhance their explosive detection capability and thus extend useful life.	FY 2021 Q1	FY 2021 Q4	7
	FY 2022		
Simulate X-Ray projection Measurements to support High Density Penetration System Analysis.	FY 2020 Q4	FY 2022 Q4	6
Complete ruggedization of Skid Screening System Air Cargo Using CT.	FY 2017 Q4	FY 2022 Q1	7
Complete ruggedization of Raytheon Nuclear Quadrupole Resonance Cargo Skid Screening.	FY 2019 Q4	FY 2022 Q1	6
Develop Common Automated Threat Recognition Software for Explosives Detection in Air Cargo Skids. Test ATR algorithms on a simulator using images obtained from CT scans of typical cargo at TSL.	FY 2020 Q3	FY 2022 Q3	7
Receive a system design package for integration of single and dual view X-ray scanners with a neutron scanner for improved explosives and contraband detection.	FY 2021 Q3	FY 2022 Q4	6
Complete data collection at a shipping facility and provide a final technical report discussing the performance of the RV during stream of commerce data collection at the test site.	FY 2022 Q1	FY 2022 Q2	7
Perform formal Test and Evaluation at TSL and generate a final technical report.	FY 2022 Q2	FY 2022 Q4	7
Test ATR algorithms on a simulator using images obtained from CT scans of typical cargo at TSL.	FY 2018 Q3	FY 2022 Q4	6

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Complete stream of commerce data collection at TSA approved cargo screening facilities. These will be the first low cost CT scanners capable of scanning skids measuring 48” W x 65” H x 48” L (or longer).	FY 2020 Q4	FY 2022 Q3	7
Conduct Field Evaluation Test of ruggedized Nuclear Quadruple Resonance (NQR) scanner for air cargo skids measuring 48" x 48" x 65". NQR, in which specific chemicals may be detected by the interactions of their nuclei with an electric field, may provide an alternate means of scanning high density cargo and determining if there are explosive threats.	FY 2020 Q4	FY 2022 Q3	6
	FY 2023		
Demonstrate a laboratory prototype neutron skid scanner.	FY 2021 Q4	FY 2023 Q3	6
Evaluate penetration performance of CT scanners at various X-Ray source voltages and filament currents at TSL using previously developed simulation tool.	FY 2022 Q2	FY 2023 Q3	7
Complete design review of high-density penetration CT system.	FY 2022 Q1	FY 2023 Q4	5
Complete Opacity and Complexity Analysis Software Tool development and associated documentation for deployment.	FY 2022 Q1	FY 2023 Q1	7

Checked Baggage Technology Development

- **Problem:** Explosive threats continue to expand due to improvised explosives. Detection of the full array of existing and emerging threats in checked baggage is limited due to the finite capabilities of currently deployed technologies.

- **Solution:** S&T and TSA are working jointly with industry and academia to research and develop interim technologies that enhance capabilities until the next generation explosive detection systems are developed and deployed. Acquired technologies will incorporate novel detection algorithms, enhanced software, more robust components and new innovative, scalable systems. The Checked Baggage Program has five specific focus areas:

  - Advanced X-ray Systems Development: Development and testing of systems of full up design models.

  - Algorithms: Development and maturation of threat detection and false alarm reduction algorithms, integration into operational/prototype systems, and demonstration.

  - Component Technology Development: Development and 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.

  - Baggage Movement Technology: Development of information-based methods to include new methods of baggage classification, screening, and transport in the checked baggage domain to enable multiple parallel screening tiers to adjudicate bag safety outside of X-ray technologies.

  - Screening Performance and Training Applications: Development of software integrated with currently deployed systems to facilitate data collection in support of performance management.

- **Justification:** The FY 2023 Budget for this project will be used to continue funding ongoing and new research and development activities through test and evaluation and ultimately through transition to TSA operations. Such activities would focus on the following three solution areas: Advanced X-Ray Systems Development, Algorithms, and Component Technology Development.

- **Impact:** These next generation explosive detection systems and subsystems will provide TSA with enhanced threat detection capabilities, lower false alarm rates, improved alarm resolution, and reduced lifecycle costs. This will allow TSA to be more efficient and effective in keeping pace with new threats as well as with the evolution of the traveling public. Future program goals include the following:
  - Expanded library of explosives and explosives signatures that can be effectively detected.
  - Improved automated explosives detection and false alarm performance.
  - Enhanced ability to detect priority non-explosive contraband materials.
  - Enhanced Threat Image Projection tools to improve screener performance.
  - Improved system reliability, screening speed (throughput) and reduced cost of ownership.
  - Improved baggage movement technologies that support changes to security parameters which will improve operations and allow for innovative infrastructure solutions.

Type of Research

Applied and Developmental

Technical Readiness Level

The Checked Baggage Technology Program will continue to initiate R&D through targeted TRL 2-6 projects that develop novel approaches and re-envision existing technologies to resolve current TSA capability gaps.

Transition Plans

- Perform independent testing to determine detection, identification, and false alarm performance characteristics of all prototype systems to assess transition worthiness and present data analysis and results to relevant stakeholders.
- Initiate transition of prototypes through knowledge products and acquisition alignment with TSA.
- Complete market landscape study and transition findings to TSA to help project future Electronic Baggage Screening Program needs and requirements.
- Coordinate development with TSA's recapitalization plans ensuring coordinated, timely technology insertion.
- Develop technology transition plans for qualifying software and data packages, ensuring these tools are provided to TSA with the data rights necessary for capability integration.
  Complete transition through coordination sessions supported by interagency agreements and Technology Transfer Agreements.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Award New Advanced X-ray Material Discrimination contracts for 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 2020 Q3	FY 2021 Q2	N/A
Conduct Preliminary and Critical design reviews of X-Ray diffraction-enabled explosive detection prototype system.	FY 2020 Q4	FY 2021 Q1	4-6
Award New Advanced Checked Baggage Systems contracts.	FY 2021 Q1	FY 2021 Q4	4-6
Demonstrate novel system and subsystem development efforts.	FY 2021 Q1	FY 2021 Q4	5-7
Complete market landscape study and transition findings to TSA to help project future Electronic Baggage Screening Program needs and requirements.	FY 2020 Q4	FY 2021 Q4	N/A
Develop technology transition plans for qualifying software and data packages, ensuring these tools are provided to TSA with the data rights necessary for capability integration.	FY 2021 Q2	FY 2021 Q4	N/A
	FY 2022		
Conduct preliminary design reviews for detection algorithm which identifies threat device components.	FY 2021 Q3	FY 2022 Q4	5-7
Conduct preliminary design reviews for cost-effective multi-energy CT detector components.	FY 2021 Q3	FY 2022 Q4	5-7
Transition knowledge products and software solutions for Automatic Threat Recognition algorithms.	FY 2021 Q1	FY 2022 Q1	4-6
Commission prototype hybrid CT-X-ray-diffraction baggage screening system.	FY 2022 Q1	FY 2022 Q3	5
Perform testing of prototype hybrid CT-X-ray-diffraction baggage screening system.	FY 2022 Q1	FY 2022 Q4	6
	FY 2023		
Award technology development contract(s) in accordance with TSA Electronic Baggage Screening Technology Roadmap Strategy, specifically in orthogonal screening and officer training and evaluation.	FY 2022 Q1	FY 2023 Q4	4-6
Demonstrate novel system and subsystem development efforts for next generation checked baggage X-ray detection systems.	FY 2023 Q1	FY 2023 Q4	5-7
Demonstrate a backwards compatible CT detector using the 4-side butt-able CT Module components in an existing system (OP)	FY 2022 Q1	FY 2023 Q3	5-7
Demonstrate and test an algorithm that assists an operator with alarm resolution by identifying threat device components in addition to the explosives alarm.	FY 2022 Q1	FY 2023 Q4	5-7

Next Generation Explosives Trace Detection (NGETD)

- **Problem:** As terrorists continue to evolve their tactics and threats, the variety of Homemade Explosives (HMEs) used in explosive devices has simultaneously increased. This leads to an enduring need for enhanced explosives screening and novel R&D solutions for employment at aviation checkpoints, border crossings, and large events. As part of understanding nature of emerging threats and associated scope of R&D, S&T must continue to assess the effectiveness of deployed technologies against emerging threats; identify capability gaps; develop novel capabilities to address these gaps; and test, evaluate, mature, and transition these capabilities to end-users. In addition to identifying and defeating emerging threats, the Program also explores and experiments with pathways to integrate Small-bulk Confirmatory Capabilities through Barriers with NextGen Trace and vapor detection for checkpoint applications. Looking beyond current needs, the Program spearheaded a ML effort to explore whether ML modules can learn features of new threats, shorten the development of detection algorithms, and, ultimately, increase accuracy of threat detection.

- **Solution:** As a result of collaborations with DHS Components, industry, academia, and FFRDC partners, S&T gained a comprehensive understanding of the nature of threats and operational requirements. This understanding provides the framework for the development of a three-pronged R&D plan:

  - Short Term Solution: enhancing detection capabilities of currently deployed systems. This includes: Retrofitting currently deployed Explosives Trace Detectors, training end-user on sampling efficiency, and expanding detection library to include emerging threats.

  - Mid-Term Solution: conducting R&D of Small-bulk Confirmatory Capabilities through Barriers and maturing Next Gen Mass Spectrometry ETDs;

  - Long Term Solution: further developing novel detection capabilities (ex: Small-bulk Confirmatory Capabilities through Barriers, Vapor Detection, and Machine Learning) to revolutionize Alarm Resolution (AR) capabilities.

  - With the expanded scope of AR, the Program has the knowledge, know-hows, and experiences needed to execute R&D and deliver solutions to the Components effectively.

- **Justification:** The FY 2023 Budget will be used to develop innovative solutions for Components while putting in place developmental milestones and framework needed for technical and capability breakthroughs in the future. There are multiple Component requests, collaborations, and joint R&D efforts spanning four different AR thrust areas (i.e. enhanced capabilities of deployed systems, Next Gen Mass Spectrometry ETDs, Small-bulk Confirmatory Capabilities through Barriers, and Vapor Detection).

- **Impact:** Working in collaboration with TSA Acquisition Program Management and Requirements Capabilities Analysis, the program demonstrated an excellent record of transitioning R&D solutions to Transportation Security Officers, CBP laboratories, Federal agents, and police officers. These solutions increased probability of detection of deployed systems, kept false alarm rates low, increased security effectiveness to meet evolving threats, and enhanced end-user satisfaction. In addition to TSA, capabilities developed under this program also contributed to detection enhancements for officers in the Secret Service and CBP. Active collaborations with both agencies are ongoing.

Type of Research

Applied and Developmental

Technical Readiness Level

Grounded in operational needs, the Program invests in selected technologies spanning all four thrust areas. As such, R&D efforts span a wide range of TRLs, from 4 – 7 for emerging capabilities to 7 – 8 for mature technologies. Whereas emerging capabilities are developed at the requests of DHS Components, matured technologies are developed with active participation and joint funding from DHS Components. In particular, the development and maturation of Next Gen Mass Spectrometry ETDs has been singled out for joint funding. This is a testament to S&T's R&D excellence and laser focus on turning requirements into capabilities.

Transition Plans

The Program embraced and embodied S&T Matrix Team to develop and deliver innovative R&D solutions to DHS Components. Transition plans are developed jointly at the beginning of projects and include R&D roadmaps and transition milestones. The Program then leverages all resources available within S&T and in some instances selected resources from the Components to achieve those transition milestones. To date, two transition plans have been jointly developed, one with TSA and the other with the Secret Service. On a smaller scale, another transition plan is being developed with CBP Laboratories and Scientific Services.

- The Matrix Team represents the best of DHS collaborative spirit and the Program embraces this concept for years to come.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Deliver feasibility study of Explosives Trace and Vapor Characterization methodologies.	FY 2020 Q4	FY 2021 Q4	N/A
Deliver assessment of non-contact sampling technologies.	FY 2020 Q4	FY 2021 Q3	N/A
Deliver assessment of optical trace detection technologies.	FY 2021 Q3	FY 2021 Q4	N/A
	FY 2022		
Validate Explosives Vapor Testbed using real-life scenarios.	FY 2021 Q4	FY 2022 Q1	7
	FY 2023		
Develop, test, and evaluate an Ambient Desorption Ionization (ADI) module retrofitted into a mass spectrometer trace explosives detection system.	FY 2022 Q1	FY 2023 Q3	5
Assess detection algorithms based on Machine Learning modules with conventional detection algorithms.	FY 2023 Q1	FY 2023 Q2	6
Complete design review(s) of Small-bulk Confirmatory Capabilities through Barriers prototype(s).	FY 2023 Q1	FY 2023 Q4	6
Test and evaluate Small-bulk Confirmatory Capabilities through Barriers prototypes.	FY 2023 Q2	FY 2023 Q4	N/A

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. As the number of travelers increases every year and, as 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 ATR for explosives and other prohibited items. Technologies under development include CT-based X-ray systems augmented with enhanced material discrimination capabilities, to screen more effectively while reducing the need for divestiture. New systems will be compatible with TSA standards and systems.

- **Justification:** The FY 2023 Budget for this project will develop primary and secondary X-ray screening systems and algorithms to meet TSA's most challenging detection requirements, reduce operator cognitive load, and improve passenger throughput. Funds will also be used to adapt current computed tomography, or other primary aviation screening systems, to meet requirements from other DHS Components to create dual use technologies.

- **Impact:** TSA will be provided with technology that allows for greater throughput and higher security measures, while reducing operator burden. Improved technologies and algorithms would provide TSA the capability to detect prohibited items in over 600 bags per hour, without divestiture of electronics, liquids, aerosols, powders, or gels.

Type of Research
Applied and Developmental

Technical Readiness Level
TRL varies for specific project efforts between TRL-3 and TRL-7. TRL-3 and TRL-4 projects are evaluated through technology demonstrations using simulated or representative data and processes to validate viability against TSA requirements. Projects that are TRL-5 or higher are evaluated at S&T's TSL (TRL-5/6), TSA's TSA System Integration Facility (TRL-6), and/or operational airport demonstrations (TRL-7) in coordination with TSA's Innovation Task Force.

Transition Plans

The Primary Screening for Carry-On Baggage project regularly transitions technology and knowledge products to TSA. The project's research and development (R&D) plan follows the Joint Consolidated Technology Roadmap, developed in partnership with TSA Requirements and Capability Analysis (RCA) and the TSA Capability Manager for Accessible Property Screening (APS). Aligning development to the roadmap ensures transitioned knowledge and capabilities meet TSA's technology development priorities. After the completion of DT&E at the TSL and R&D efforts conclude, critical knowledge products that define technology potential and capabilities, data collection and demonstration results about operational performance, and systems and algorithms for acquisition certification testing are delivered to TSA. Development spirals will be coordinated with TSA's recapitalization plans to ensure both a smooth and timely technology insertion. The Primary Screening for Carry-On Baggage project matures technologies to TRL 6, or as need per TSA guidance, and then transfers ownership of products to TSA for engineering development to move into their acquisition lifecycle. Not only do the transitioned products enable S&T and TSA to develop and refine acquisition requirements and continue to develop state-of-the-art capabilities to improve aviation security that meet TSA's priorities, but also offer other Government customers the opportunity to leverage the DT&E towards applications beyond the aviation environment.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Demonstrate a CT X-ray system capable of adapting its detection algorithms through risk-based screening.	FY 2020 Q1	FY 2021 Q4	5
Conduct a design and test plan review for a combined Computed Tomography and X-ray Diffraction system that is capable of meeting TSA's most stringent detection standards without removing liquids, aerosols, gels, powders, and electronics.	FY 2020 Q4	FY 2021 Q2	5
	FY 2022		
Demonstrate an X-ray diffraction-based system and deliver a test report showing the ability of the system to resolve alarms from an upstream X-ray transmission system, reducing accessible property false alarms at an airport checkpoint.	FY 2021 Q1	FY 2022 Q3	5
Demonstrate a CT X-ray system operating in a remote screening configuration using high speed network interconnects to demonstrate the efficacy and security of remote screening stations in an airport security checkpoint environment.	FY 2022 Q1	FY 2022 Q2	5
Conduct a technical design review of an orthogonal X-ray augmentation technology to improve detection and reduce secondary screenings.	FY 2022 Q1	FY 2022 Q4	5
	FY 2023		
Submit for developmental test and evaluation an augmenting X-ray detection system (e.g., phase contrast imaging or X-ray diffraction) more capable of distinguishing explosive, chemical, and 3-D printed threat items from benign passenger belongings than primary screening systems.	FY 2021 Q3	FY 2023 Q4	5
Demonstrate a reduced-form factor computed tomography (CT) X-ray system capable of meeting TSA's most challenging detection requirements while also meeting size, weight, and power requirements necessary to deploy CT systems at smaller airports.	FY 2021 Q2	FY 2023 Q4	5
Submit for developmental test and evaluation, a suite of ATR algorithms that can be selected dynamically based on an external risk score to increase sensitivity or reduce false alarms.	FY 2020 Q1	FY 2023 Q2	6

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 as 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 improving competition winning algorithms for next-generation Advanced Imaging Technology (AIT) systems. New capabilities are under development for AIT systems include the ability to screen passengers with improved imaging resolution to more efficiently detect challenging and emerging threats. New systems may also include the ability to screen passengers while they walk or while wearing bulky outerwear and shoes.

- **Justification:** The FY 2023 Budget for this project will be used to develop on-person screening systems, primarily millimeter-wave systems, and automated detection algorithms to meet TSA's most challenging detection standards and throughput requirements to improve the passenger experience, mitigate insider threat risks, and reduce pat-down rates.

- **Impact:** When integrated with other advanced checkpoint technologies, these systems will provide 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.

Type of Research

Applied and Developmental

Technical Readiness Level

TRL varies for specific project efforts between TRL-3 and TRL-7. TRL-3 and TRL-4 projects are evaluated through technology demonstrations using simulated or representative data and processes to validate viability against TSA requirements. Projects that are TRL-5 or higher are evaluated at S&T's TSL (TRL-5/6), TSA's TSA System Integration Facility (TRL-6), and/or operational airport demonstrations (TRL-7) in coordination with TSA's Innovation Task Force.

Transition Plans

The Primary Screening for Passengers project regularly transitions technology and knowledge products to TSA. The project's research and development (R&D) plan follows the Joint Consolidated Technology Roadmap, developed in partnership with TSA Requirements and Capability

Analysis (RCA) and the TSA Capability Manager for On-Person Screening (OPS). Aligning development to the roadmap ensures transitioned knowledge and capabilities meet TSA's technology development priorities. After the completion of DT&E at the TSL and R&D efforts conclude, critical knowledge products that define technology potential and capabilities, data collection and demonstration results about operational performance, and systems and algorithms for acquisition certification testing are delivered to TSA. Development spirals will be coordinated with TSA's recapitalization plans to ensure both a smooth and timely technology insertion. The Primary Screening for Passengers project matures technologies to TRL 6, or as need per TSA guidance, and then transfers ownership of products to TSA for engineering development to move into their acquisition lifecycle. Not only do the transitioned products enable S&T and TSA to develop and refine acquisition requirements and continue to develop state-of-the-art capabilities to improve aviation security that meet TSA's priorities, but they also offer other Government customers the opportunity to leverage the DT&E towards applications beyond the aviation environment.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Kickoff a high-definition advanced imaging technology (HD-AIT) system reference design that includes full schematics suitable for volume manufacturing, to create a system that can meet TSA's most challenging detection standards with an improved passenger and transportation safety officer experience that increases ease-of-use, safety, and relaxed requirements for divesting shoes and outerwear.	FY 2019 Q3	FY 2021 Q1	7
Submit for developmental test & evaluation a high-definition AIT portal for airport deployment that will be capable of automatically detecting threats at a higher TSA standard.	FY 2018 Q1	FY 2021 Q4	6
Demonstrate an AIT system with material discrimination technology to reduce divestiture.	FY 2019 Q1	FY 2021 Q4	5
Demonstrate a real-time AIT system capable of scanning a passenger at a walking pace.	FY 2020 Q4	FY 2021 Q4	5
	FY 2022		
Conduct a technical design review for an advanced real-time passenger imaging system.	FY 2020 Q4	FY 2022 Q3	5
Conduct a critical design review of prototype, handheld MMW screening devices in a wand form factor that will be used to resolve on-person screening alarms or as a primary on-person screening device in space constrained environments.	FY 2020 Q3	FY 2022 Q4	4
Demonstrate a video analytics capability to enable and support passenger screening automation.	FY 2022 Q1	FY 2022 Q4	4
	FY 2023		
Submit for development test & evaluation a shoe scanner with an automatic threat recognition algorithm capable of detecting weapons or organic threat items concealed in footwear without requiring passengers to remove their shoes.	FY 2021 Q3	FY 2023 Q4	6

Screening at Speed (SaS)

- **Problem:** Current DHS checkpoints use standalone sensors that do not speak to each other and are costly and time-consuming to upgrade in response to evolving threats. Current sensors are also prone to false alarms that require intrusive pat downs and manual searches to resolve and require that individuals being screened divest personal belongings to screen effectively. All these factors increase the per-person screening cost, operator fatigue, probability of missed threats, and the frustration of individuals being screened. The current screening process will become untenable as the number of people needing to be screened at TSA, USSS, and CBP permanent and temporary checkpoints continues to rise and new threats continue to emerge. DHS Components require detection technologies that effectively and efficiently screen for concealed threats using an integrated system-of-system that uses layered screening technologies.

- **Solution:** SaS is developing independent sensors that will be integrated to enable a seamless curb-to-gate security solution. It will reliably detect a wider range of prohibited items regardless of concealment, using technologies for passenger screening, property screening, video analytics, and infrastructure supporting technologies. Future systems that record and analyze a richer array of data will provide greater security while limiting the number of invasive, time-consuming false alarms. This could eliminate the need for today's cumbersome requirement to remove outwear, footwear, and personal belongings; reduce TSO manual searches and pat-downs; and enable future checkpoint automation.

- **Justification:** The FY 2023 Budget for this project will be used to develop an integrated system of sensors from curb-to-gate, which may include stand-off millimeter wave, trace explosives detection, and video analytics. Integrating these and other sensors into the same system will reduce technology stovepipes and enable rapid deployment of new capabilities and upgrades to the field at reduced acquisition costs. Funding to integrate sensors will also enable TSA's next generation concept of operations to dramatically increase passenger throughput while enhancing TSA security capabilities by increasing the amount of unstructured screening performed before the checkpoint, reducing the amount of screening necessary at the checkpoint, and meeting TSA's high detection standards.

- **Impact:** The SaS Program will integrate screening tools with real-time and walk-by sensing, wide-area surveillance, credential authentication, risk-based screening, and other technologies to further reduce overall risk throughout airports and in other operational areas including soft targets and national special security events. Improved detection probabilities and reduced false alarms will translate into fewer secondary inspections, lowering per-passenger costs for TSA, and reducing passenger inconvenience. A system-of-systems approach integrated using open architectures and capable of deploying a layered aviation security posture from curb-to-gate will reduce security risks and costs, and facilitate rapid, cost-effective system upgrades to continue countering evolving adversaries.

Type of Research

Applied and Developmental

Technical Readiness Level

TRL varies for specific project efforts between TRL-3 and TRL-7. The SaS program uses spiral development techniques to deliver intermediate capabilities that contribute to the system-of-systems approach. TRL-3 and TRL-4 projects are evaluated through technology demonstrations using simulated or representative data and processes to validate viability against TSA requirements. Projects that are TRL-5 or higher are evaluated at S&T's TSL (TRL-5/6), TSA's TSA System Integration Facility (TRL-6), and/or operational airport demonstrations (TRL-7) in coordination with TSA's Innovation Task Force.

Transition Plans

The Screening at Speed project regularly transitions technology and knowledge products to TSA. The project's research and development (R&D) plan follows the Joint Consolidated Technology Roadmap for Architecture, developed in partnership with TSA Requirements and Capability Analysis (RCA) and the TSA Capability Managers for Accessible Property Screening (APS) and On-Person Screening (OPS). Aligning development to the roadmap ensures transitioned knowledge and capabilities meet TSA's technology development priorities. After the completion of DT&E at the TSL and R&D efforts conclude, critical knowledge products that define technology potential and capabilities, data collection and demonstration results about operational performance, and systems and algorithms for acquisition certification testing are delivered to TSA. Development spirals will be coordinated with TSA's recapitalization plans to ensure both a smooth and timely technology insertion. The Screening at Speed project matures technologies to TRL 6, or as need per TSA guidance, and then transfers ownership of products to TSA for engineering development to move into their acquisition lifecycle. Not only do the transitioned products enable S&T and TSA to develop and refine acquisition requirements and continue to develop state-of-the-art capabilities to meet TSA's priorities, but they also offer other Government customers the opportunity to leverage the DT&E towards applications beyond the aviation environment.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Demonstrate automated tracking algorithms that associate passengers and their divested items at an aviation checkpoint, to enable screening of items according to passenger risk profiles.	FY 2019 Q1	FY 2021 Q4	5
Demonstrate the latency and throughput improvements achieved by integration of optical interconnections to enable walk-by passenger screening systems.	FY 2020 Q1	FY 2021 Q1	6
Submit for TSA evaluation an X-ray diffraction system capable of performing advanced alarm resolution and improving throughput at the TSA checkpoint.	FY 2020 Q1	FY 2021 Q3	6
	FY 2022		
Conduct a technical design review for an automated passenger screening solution concept to improve throughput and reduce secondary screening requirements.	FY 2021 Q3	FY 2022 Q3	4
Demonstrate an automatic threat recognition (ATR) algorithm on a high-definition advanced imaging technology (HD-AIT) system that integrates test & evaluation best practices, using artificial intelligence (AI), to improve the robustness of deployed detection systems.	FY 2021 Q3	FY 2022 Q4	5
Conduct kick-off for three new contracts for automated passenger screening solution concepts to improve throughput and reduce secondary screening requirements.	FY 2022 Q1	FY 2022 Q1	4
Conduct a design review for a small form-factor computed tomography (CT) X-ray system to enable a more compact, integrated screening solution.	FY 2022 Q1	FY 2022 Q4	4
Conduct a design review for next generation millimeter wave panel sensors to enable an automated passenger screening solution.	FY 2022 Q1	FY 2022 Q4	4
	FY 2023		
Demonstrate interconnected sensor systems that automatically fuse data from both sensors in order to improve overall detection performance while reducing false alarm rates.	FY 2022 Q1	FY 2023 Q4	5
Demonstrate a secure, integrated checkpoint computing environment that enables the use of more advanced algorithms and improves passenger throughput while reducing overall system costs.	FY 2022 Q1	FY 2023 Q3	5
Release an open architecture software development kit targeted for walk-by advanced imaging technology systems.	FY 2021 Q4	FY 2023 Q4	6

Countering Violent Extremism Program – Acts of violence can pose a significant impact to American lives and Federal, State, local, and tribal governments. This Program aims to conduct evidence-based research to meet the policy, operational, and public needs to improve effectiveness of public safety and violence prevention efforts implemented by FSLTT and non-governmental stakeholders. This research will enable policy makers and operational end-users to make informed decision to divert vulnerable individuals, prevent potential offenders, mitigate vulnerabilities, and enhance community resilience in the face of various social and behavioral threats.

Public Safety and Violence Prevention

- **Problem:** With a growing and evolving threat landscape, with changing motivations and actors, effective response requires a proactive, analytical, and qualitative approach to the prevention of, protection from, mitigation of, response to, and recovery from acts of violence that impact public safety. One of the Departments top priorities is to protect citizens from terrorism and other homeland security threats; however, the drivers behind these acts that impact public safety are not fully understood. Targeted violence and terrorism are not a single issue, but a complex host of problems, crimes and activities that are related to a number of threats. This program supports the *National Strategy for Countering Domestic Terrorism*, which highlights the need to better understand the full range of domestic terrorism threats in our country.

- **Solution:** S&T will conduct evidence-based research to identify high quality data to better understand the nature and threats in the United States while providing independent, objective assessment of activities to ensure that State and local stakeholders can continually improve and integrate new evidence and basic research in pursuit of the general welfare of our citizens. This program will utilize the application of fundamental research within social science disciplines to assist in the development of knowledge, tools, and techniques to support S/L/T/T efforts as we aim to mitigate and prevent acts that put an individual(s) or group(s) safety into question, with a specific focus on terrorism prevention, mis-dis-mal-information, and community resilience. Findings from this research aims to build evidence, data and knowledge products that shall strengthen public safety and violence prevention programming domestically.

- **Justification:** The FY 2023 Budget for this project will be used to deliver best practices, protocols, evaluation research to Federal, State, local stakeholders and the general public to enhance local prevention efforts by better understanding threats as it evolves.

- **Impact:** Provides the HSE with knowledge and findings to enable education and awareness to reinforce a whole-of-society prevention architecture. These efforts will equip and empower local efforts including peers, teachers, community leaders, and law enforcement – to minimize a threat as it evolves while enhancing emergency preparedness and response by better understanding how current prevention programming can improve while highlighting opportunities to improve and strengthen local prevention initiatives. Data and knowledge derived from the program shall increase understanding about what works, what doesn't, and what's promising in enhancing public safety and violence prevention efforts, while informing strategy, policy and operations for DHS Components and other key stakeholders.

Type of Research

Varies (basic and applied)

Technical Readiness Level

TRL varies for specific project activities between TRL-5 and TRL-7. This project's R&D efforts will start by performing a survey of tools and techniques that could be adapted for the purposes of this effort. Identified tools and techniques are then adapted or prototyped and then validated in a relevant environment (TRL-5/6). Following successful validation, the most promising solution(s) are evaluated in an operational environment (TRL-7) prior to transition.

Transition Plans

- Knowledge products in the form of best practices, protocols, and educational materials shall be developed for use by DHS and shared publicly. Evidence developed shall be shared within the HSE to help inform future policy and practice in terrorism prevention programming.
- Recommendations, best practices and techniques that are developed for local use are adopted, piloted, evaluated for impact and consequences, are transferred and applied to sector-specific training, guidance, and exercise services within the HSE.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Complete at least two Systematic Reviews of prior research and evaluation to build a global evidence base for terrorism prevention policy, strategy, and activity.	FY 2020 Q4	FY 2021 Q4	N/A
Develop protocols for conducting an impact evaluation of the Blue Campaign, a national public awareness campaign designed to educate the public in recognizing the indicators of human trafficking and how to respond to possible cases.	FY 2020 Q4	FY 2021 Q4	N/A
Develop guidelines explaining the "life cycle" of a CyberTip, a report outlining challenges and opportunities associated with the reporting and analysis of CyberTips.	FY 2020 Q4	FY 2021 Q4	N/A
	FY 2022		
Develop protocols for a text-enabled call center to handle potential cases of violent extremism in a local environment that will be shared for their operational use.	FY 2020 Q4	FY 2022 Q3	5
Conduct evaluation of locally based prevention programs in support of the Center for Prevention Programs and Partnerships (CP3) Grants Program.	FY 2021 Q1	FY 2022 Q4	N/A
Conduct and publish systematic reviews of prior research and evaluation to build a global evidence base for terrorism prevention policy, strategy, and activity.	FY 2020 Q4	FY 2022 Q4	N/A
Model and test countermeasures to determine efficacy of trainings utilized by front line practitioners.	FY 2021 Q4	FY 2022 Q4	N/A
Develop survey instruments to measure the impact of various domestic threats to population subgroups that shall help inform coherent and effective policies and operations within the HSE.	FY 2021 Q4	FY 2022 Q4	N/A

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
Assess the validity of current threat assessment and threat management approaches to inform DHS as to the needs, use, and efficacy of threat assessment tools and models.	FY 2021 Q4	FY 2022 Q4	N/A
Conduct an evaluation of current prevention programs to research best practices in intervention, reintegration and counter-recidivism to measure their efficacy.	FY 2021 Q4	FY 2022 Q4	N/A
	FY 2023		
Conduct impact/outcome evaluations of locally based prevention programs in support of the Center for Prevention Programs and Partnerships (CP3) Grants Program.	FY 2022 Q3	FY 2023 Q4	N/A
Publish at least two Systematic Reviews of prior research and evaluation to build a global evidence base for terrorism prevention policy, strategy, and activity.	FY 2022 Q1	FY 2023 Q4	N/A
Develop an analytical system that better understands threats, risk, and vulnerabilities across the country on a range of threats to include domestic violent extremism and terrorism, mis-dis-mal-information and other domestic threats.	FY 2022 Q4	FY 2023 Q4	6
Implement social-behavioral modeling exercises to examine human factor influence and countermeasures during a crisis situation.	FY 2021 Q4	FY 2023 Q4	N/A
Conduct an annual longitudinal survey to better understand the impact of messages on individuals' attitudes and actions around election security and foreign influence in order to drive new initiatives and programs.	FY 2021 Q4	FY 2023 Q4	N/A
Publish best practices on rehabilitation and reintegration programming that includes and expands on how the approach can be applied to different settings (I.e., school health and safety management teams).	FY 2021 Q4	FY 2023 Q4	N/A
Analyze political discourse to better understand how foreign influence operations impact the radicalization, particularly among domestic terror organizations.	FY 2022 Q4	FY 2023 Q4	N/A
Measure the effectiveness of messages and communication strategies countering mis-dis-mal-information initiatives.	FY 2022 Q4	FY 2023 Q4	N/A

Physical Security – Provides a layered and integrated capability to safely screen for potential threat items in unstructured crowds within soft-target venues and crowded spaces without impact to the speed of travel while maintaining individual privacy.

Soft Targets Security (formerly Soft Targets, Vehicular, School Safety, Protective Sites)

- **Problem:** Current security capabilities for screening people and their belongings in soft targets and crowded places (such as surface transportation environments) are extremely limited. The unique requirements of soft targets and crowded places (an open system with no fixed checkpoints, extremely high throughput, and an unalterable existing infrastructure within which technologies for various threats or anomalous behavior detection must fit) dictate the need for a dedicated program to address vulnerabilities.

- **Solution:** S&T will provide an orthogonal, layered, and integrated capability to safely screen for potential threat items in unstructured crowds within soft-target venues and crowded spaces without impact to the speed of travel while maintaining individual privacy.

- **Justification:** The FY 2023 Budget for this project will be used to continue spiral development of forensic video analytics technologies and permit transfer to industry partners for commercialization to the marketplace for procurement by the HSE. Funds will also be used to conduct OT&E of Person Borne Improvised Device (PBIED) integrated mmW Flat Panel Imaging Array. S&T will be able to develop capabilities, which can be commercialized to enhance security for Hostile Vehicle Mitigation (e.g., vehicle ramming, vehicle-borne improvised explosive device (VBIED) detection technology), with particular emphasis on special events and infrastructure protection.

- **Impact:** Leave-Behind detection with surrounding circumstance assessment will allow security personnel to clear 30-50 percent of suspicious packages without necessitating an emergency response ($600K/year manpower savings per Washington Metro Area Transit Authority (WMATA) and increase screening from three percent (current bag searches) to a goal of 95 percent of all passengers.

Type of Research
Developmental

Technical Readiness Level

TRL varies for specific project activities between TRL-5 and TRL-7. This project's R&D efforts typically start by performing a market survey of available COTS and GOTS technology that could be adapted for DHS component use. Identified technology is then adapted and validated in a relevant environment (TRL-5). Following successful validation, the most promising solution(s) are then prototyped and evaluated first in a relevant environment (TRL-6) then in an operational environment (TRL-7) prior to transition.

Transition Plans

- DT&E and OT&E will be conducted with surface transportation end-users within TSA Mass Transit Test Beds (MTTBs). When technologies reach appropriate maturity, they will be transitioned to an industry partner for commercialization. Once in the marketplace, the technology can be added to the approved equipment list (AEL) for purchase by surface transportation authorities.
- In coordination with TSA MPAC, conduct OT&E of Forensic Video Exploitation and Analysis (FOVEA) tool suite within TSA mass transit test bed in preparation for transition to industry partner for commercialization.
- Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL) has entered into a technology transition agreement with Liberty Defense Technologies (LDT). LDT has obtained the license to an MIT/LL patent (based on the mmW Flat Panel Imaging Array technology under development for S&T) to develop a portal-based millimeter wave system for detecting potential threat items entering large venues (i.e. stadiums) and schools.
- U.S. Army Engineer Research and Development Center (ERDC) is developing a protection portal containing Event Security Decision Support Tools for use by CISA and DHS Regional Protective Security Advisors (PSAs) to assist event coordinators with planning and assessment for effective physical security at events held at the State or local level which may require limited Federal support.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Conduct DT&E of Person Borne Improvised Device (PBIED) integrated mmW Flat Panel Imaging Array in TSA mass transit test bed or a simulated operational environment.	FY 2020 Q2	FY 2021 Q4	5-7
As part of the Event Security Decision Support Tools Project, develop the Barrier Damage Assessment Module (BDAM) by modifying the existing DoD tool for use in civilian soft targets and crowded places environments. The BDAM will assist event planners to estimate the effects of Vehicle Borne Improvised Explosive Devices (VBIEDs) on perimeter barriers.	FY 2021 Q2	FY 2021 Q4	5
	FY 2022		
As part of the Event Security Decision Support Tools Project, develop the Protection Planning, Visualization, and Assessment Tool (PPVAT).	FY 2021 Q4	FY 2022 Q4	5-7
As part of the Event Security Decision Support Tools Project, develop the Blast Stand-off App, the Serpentine App, and Vehicle Barrier Selection App.	FY 2022 Q1	FY 2022 Q4	5-7
	FY 2023		
Procure third party stand-off sensor (ThruVison TAC, SPO-NX, etc.) for inclusion in Layered Architecture and conduct in lab testing.	FY 2022 Q2	FY 2023 Q4	5-7
Integration of component technologies into layered system with automated threat detection for proof of principle.	FY 2022 Q4	FY 2023 Q4	5-7
Conduct DT&E of stand-off chemical detector for vehicle-borne IED detection in lab environment.	FY 2023 Q1	FY 2023 Q3	5-7
Conduct OT&E of Person Borne Improvised Device (PBIED) integrated mmW Flat Panel Imaging Array in TSA mass transit test bed or a simulated operational environment.	FY 2023 Q3	FY 2023 Q4	5-7
Conduct OT&E of FOVEA tool suite within TSA mass transit test bed with industry partners in preparation for transition.	FY 2019 Q2	FY 2023 Q1	5-7

University Programs – PPA

Budget Comparison and Adjustments

Comparison of Budget Authority and Request

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
Centers of Excellence	$39,354	$45,880	$45,880	-
Minority Serving Institutions (MSI)	$5,157	$5,157	$5,157	-
Total	**$44,511**	**$51,037**	**$51,037**	**-**
Subtotal Discretionary - Appropriation	$44,511	$51,037	$51,037	-

PPA Level I Description

University Programs (UP) 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. This PPA includes programs that bring 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.

UP includes the following programs:

Centers of Excellence (COE): The COE program focuses on building homeland security expertise in the academic community, creating strategic partnerships among universities, commercial interests, and public agencies, and developing a new science and engineering workforce dedicated to homeland security. COE program priorities are developed by DHS Components, based on their long-term mission needs.

MSI: This program enhances the capabilities of MSIs to develop homeland security-related science, technology, engineering, and mathematics research and curricula, and prepare MSI students for successful homeland security careers.

University Programs – PPA
Budget Authority and Obligations
(Dollars in Thousands)

	FY 2021	FY 2022	FY 2023
Enacted/Request	**$44,511**	**$51,037**	**$51,037**
Carryover - Start of Year	$24,419	$30,214	$11,847
Recoveries	-	-	-
Rescissions to Current Year/Budget Year	-	-	-
Net Sequestered Resources	-	-	-
Reprogramming/Transfers	-	-	-
Supplementals	-	-	-
Total Budget Authority	**$68,930**	**$81,251**	**$62,884**
Collections - Reimbursable Resources	$500	$500	$500
Collections - Other Sources	-	-	-
Total Budget Resources	**$69,430**	**$81,751**	**$63,384**
Obligations (Actual/Estimates/Projections)	$39,216	$61,944	$47,251
Personnel: Positions and FTE			
Enacted/Request Positions	-	-	-
Enacted/Request FTE	-	-	-
Onboard and Actual FTE			
Onboard (Actual/Estimates/Projections)	-	-	-
FTE (Actual/Estimates/Projections)	-	-	-

University Programs – PPA
Summary of Budget Changes
(Dollars in Thousands)

	Positions	FTE	Amount
FY 2021 Enacted	**-**	**-**	**$44,511**
FY 2022 President's Budget	**-**	**-**	**$51,037**
FY 2023 Base Budget	**-**	**-**	**-**
Centers of Excellence	-	-	$45,880
Minority Serving Institutions (MSI)	-	-	$5,157
Total Research and Development Projects	**-**	**-**	**$51,037**
FY 2023 Request	**-**	**-**	**$51,037**
FY 2022 TO FY 2023 Change	**-**	**-**	**-**

University Programs – PPA
Non Pay Budget Exhibits

Non Pay by Object Class

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget	FY 2022 to FY 2023 Change
21.0 Travel and Transportation of Persons	$64	$73	$23	($50)
25.1 Advisory & Assistance Services	$1,691	$1,939	$669	($1,270)
25.3 Other Purchases of goods and services	-	-	$1,613	$1,613
25.5 Research & Development Contracts	$6,704	$7,687	$3,347	($4,340)
31.0 Equipment	-	-	$19	$19
41.0 Grants, Subsidies, and Contributions	$36,052	$41,338	$45,366	$4,028
Total - Non Pay Budget Object Class	**$44,511**	**$51,037**	**$51,037**	**-**

Research and Development
Research and Development Projects

Summary of Projects

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
Centers of Excellence	$39,354	$45,880	$45,880
Minority Serving Institutions (MSI)	$5,157	$5,157	$5,157

Centers of Excellence
Research and Development
Technology Readiness Level Exhibit

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
Centers of Excellence	$39,354	$45,880	$45,880

R&D Project Description

CENTERS OF EXCELLENCE: S&T's COEs develop multidisciplinary, customer-driven, homeland security science and technology solutions and help train the next generation of homeland security experts. The COE network is an extended consortium of hundreds of universities conducting groundbreaking research to address homeland security challenges. COEs work closely with the homeland security community to develop customer-driven, innovative tools and technologies to solve real-world challenges. COE partners include academic institutions; industry; national laboratories; DHS Components; S&T divisions; other Federal agencies; State, local, tribal, and territorial homeland security agencies; and first responders. These partners work in concert to develop critical technologies and analyses to secure the Nation. In support of Administration priorities, the FY 2023 Budget maintains additional funding across the COEs to strengthen the Nation's investments in foundational, early-stage R&D at universities, to further secure our future.

CENTERS OF EXCELLENCE *(Dollars in Thousands)*			
Project	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
Arctic Domain Awareness Center (ADAC)[1]	$4,151	-	-
Borders, Trade, and Immigration (BTI) Institute[2]	$4,150	-	-
Center for Accelerating Operational Efficiency (CAOE)	$4,150	$4,875	$4,875
Coastal Resilience Center of Excellence (CRC)	$4,150	$4,875	$4,875
Criminal Investigations and Network Analysis (CINA)	$4,151	$4,876	$4,876
Critical Infrastructure Resilience Institute (CIRI)	$4,151	$4,876	$4,876
Cross Border Threat Screening and Supply Chain Defense (CBTS)	$4,151	$4,876	$4,876
Soft-target Engineering to Neutralize the Threat RealitY (SENTRY)[3]	$4,150	$4,876	$4,876

CENTERS OF EXCELLENCE *(Dollars in Thousands)*			
Project	**FY 2021 Enacted**	**FY 2022 President's Budget**	**FY 2023 President's Budget**
Master of Business Administration/Security Technology Transition (MBA/STT)	$2,000	$2,000	$2,000
National Counterterrorism Innovation, Technology and Education Center of Excellence (NCITE)	$4,150	$4,875	$4,875
Procurement Sensitive New COE Topic #1[4]	-	$4,875	$4,875
Procurement Sensitive New COE Topic #2[5]	-	$4,876	$4,876
Total – Centers of Excellence Thrust Area	**$39,354**	**$45,880**	**$45,880**

[1]ADAC is reaching the end of its period of performance and a New COE Topic (Procurement Sensitive) is in the planning stages. FY 2021 funding for ADAC is being applied to this new COE Topic; FY 2022 and FY 2023 funding for ADAC would be applied as well.
[2]BTI is reaching the end of its period of performance and a new COE Topic (Procurement Sensitive) is in the planning stages. FY 2021 funding for BTI is being applied to this new COE topic. FY 2022 and FY 2023 funding for BTI would be applied as well.
[3]This new SENTRY COE was awarded in FY22 Q1. Previously known as Engineering Secure Environments from Targeted Attacks COE.
[4]FY 2021 funding for ADAC is being applied to this new COE topic (Procurement Sensitive pending posting of the Notice of Funding Opportunity). FY 2022 and FY 2023 funding for ADAC would be applied as well.
[5]FY 2021 funding for BTI is being applied to this new COE topic (Procurement Sensitive pending posting of the Notice of Funding Opportunity). FY 2022 and FY 2023 funding for BTI would be applied as well.

Arctic Domain Awareness Center (ADAC)

ADAC 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, 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 emphasis on mission areas of high consequence: vessel intrusion, threats to navigation, search and rescue, humanitarian assistance, and disaster response. Results serve USCG and other DHS Arctic missions. The activities under this project include:

- Maritime Risk, Threat Analysis, and Resilience Research: DHS Components (e.g., USCG, CBP, FEMA, ICE) must define and assess threats, vulnerabilities and the consequences of terrorism, crime and natural disasters in the maritime domain to devise strategies to minimize these consequences. DHS must identify and select the most efficient and effective approaches to reduce risks to maritime environments, including ports, waterways, islands, the Arctic, coasts and coastal infrastructure. To do this, DHS needs to understand how to deter threats and crime, prepare for both human-caused and natural disasters, and develop effective approaches to increase U.S. resilience to maritime challenges. ADAC will focus on increasing USCG's knowledge of the impact of oil spills on the arctic environment and wildlife, including Arctic mussels and Arctic copepods, which will assist USCG first responders in determining when to use oil spill dispersants.

- Maritime Domain Awareness (MDA) Research: ADAC is working to expand MDA, which is the effective understanding of anything associated with the global maritime domain that could impact the United States' security, safety, economy, or environment. Growth of commercial activity in the maritime domain presents new security challenges, especially energy extraction-related growth. Increased and diversified utilization of maritime spaces will likely generate new security challenges and risks, and the potential for increased conflicts among maritime users, stakeholders, and interests. ADAC is currently providing USCG and mariners with information on ice conditions through an Arctic ice index and GIS platform to assist with operational decisions.

- Maritime Technology Research: Gaps in maritime security continue to evolve and maritime technology is one potential solution for addressing those gaps. ADAC supports innovative research and technologies to address maritime knowledge gaps that can be developed or adapted further to help, for example, first responders. ADAC is currently developing a specialized long-range autonomous underwater vehicle to provide the USCG a capability to detect oil spills in remote and austere environments and support oil spill first responders.

- Integration of Science and Engineering with Maritime Security Governance and Policy Research: Technological developments can enhance the effectiveness of maritime security, commerce, environmental management and disaster preparedness. However, technology must be understood in the context of maritime policy, laws, and international relationships. Understanding the long-term geopolitical drivers and improving cooperation among stakeholders that share common interests will be crucial to reducing risks. ADAC seeks to advance physical, biological, and social science research to improve understanding of how technological change will affect policy and governance, as well as research to determine what policy and governance regimes will foster the growth of beneficial technologies in the maritime domain, e.g., improved communication among state and non-state actors.

- **Justification:** ADAC is reaching the end of its period of performance. The FY 2023 Budget for this project will be used to fund the research required to develop the new COE topic designation package, the creation of the Notice for Funding Opportunity, and management of the competition to stand up a new COE.

- **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.

Type of Research
Basic, Applied, and Developmental

Technical Readiness Level
ADAC conducts a portfolio of projects that currently range from TRL-6 through TRL-7, but can range from TRL-2 through TRL-7, from initial concept development to system prototypes tested in the field. Each COE conducts multiple projects across its research and education theme areas. The range of TRL levels changes throughout a COE's life cycle, with a progression toward more TRL levels at the higher end of the scale; however, even a later-phase COE portfolio may include lower range TRLs in its portfolios to address emerging risks.

Transition Plans
S&T works with the ADAC to structure and position projects to align with customer needs, beginning from conception, through testing, and piloting in the field. 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. 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. S&T 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.

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. COEs work with their technology transfer offices to attract investments, address legal concerns, and leverage university infrastructures to execute the plans necessary to enable long-term sustainment of technologies.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Created and optimized a forecast numeric Arctic ice condition index for Arctic waters.	FY 2021 Q1	FY 2021 Q4	7
Began preparation for the completion of all research and education project activities for the final year of the COE.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
Complete the design and fabrication for an additional sensor capability to LRAUV to create a multi-mission capability and manufacture an additional (second) LRAUV based upon a reduced cost design.	FY 2021 Q1	FY 2022 Q1	6
	FY 2023		
N/A	N/A	N/A	N/A

Borders, Trade, and Immigration (BTI) Institute

- **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. 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 USCIS effectively enforce immigration and customs laws; promoting awareness and understanding of citizenship; and ensuring the integrity of the U.S. immigration system.

- **Justification:** BTI has reached the end of its period of performance. The FY 2023 Budget for this project will be used to fund the research required to develop the new COE topic designation package, the creation of the Notice for Funding Opportunity, and management of the competition to stand up a new COE.

- **Impact:** Improving the operational effectiveness of border management processes at ports of entry, identifying opportunities to counter weapons of mass destruction proliferation through export control enforcement, and improving biometric video and imagery capabilities that identify people in operational environments.

Type of Research
Basic, Applied, and Developmental

Technical Readiness Level
BTI conducts a portfolio of projects currently at TRL-7 , but can range from TRL-2 through TRL-7, from initial concept development to system prototypes tested in the field. Each COE conducts multiple projects across its research and education theme areas. The range of TRL levels changes throughout a COE's life cycle, with a progression toward more TRL levels at the higher end of the scale; however, even a later-phase COE portfolio may include lower range TRLs in its portfolios to address emerging risks.

Transition Plans

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 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.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Completed research examining migration from the Northern Triangle and what improvements could be made to regional immigration policies to better manage regional migration flows.	FY 2021 Q1	FY 2021 Q3	7
Completed all research and education project activities and prepared and submitted final report for COE.	FY 2021 Q1	FY 2021 Q4	N/A
	FY 2022		
N/A	N/A	N/A	N/A
	FY 2023		
N/A	N/A	N/A	N/A

Center for Accelerating Operational Efficiency (CAOE)

This Center conducts end user-focused research to enhance the application of analytic tools that support real-time decision making to address homeland security related threats and hazards. The Center also provides education and professional development to improve data management and analysis, to facilitate operations research and systems analysis, to identify the economic impact of security threats and hazards, and to critically assess future risks posed to DHS's mission.

- **Problem:** Our country's homeland security workforce faces complex challenges that require split-second decision making, wise allocation of scarce resources and accurately predicting consequences of natural and manmade disasters. In addition, constantly changing information requirements make it difficult to provide dynamic and adaptable tools and processes to address these challenges.

- **Solution:** The overarching goal of the Center is to develop tools and methods for all levels of the homeland security workforce (e.g., leaders, analysts and operators) to improve predictions in order to enhance preparation and response; to optimize screening and border operations for threat detection; and to inform prevention policy through risk and cost analysis. The activities under this project include:

    - Improving predictions to enhance preparation and response: CAOE's work in predictive analytics in advancing methodologies in terms of ability to provide analytic results faster and with more accuracy. Researchers are examining methods to analyze real-time streaming data to provide almost real-time solutions so that DHS operations can react quicker to changing situations. Research applies techniques to improve the accuracy of the predictions and build confidence in the results, whether it be in decision support tools or evaluation of the performance of artificial intelligence.

    - Optimizing screening and border operations for threat detection: CAOE simulation and modeling advances understanding of the characteristics of homeland security threats and homeland security operations. CAOE researchers are using analytics to identify where and what type of infrastructure should be in place to counter specific threats along with enabling increased apprehensions at ports of entry, improved threat detection, and/or reduction in operating costs.

    - Informing prevention policy through risk and cost analysis: CAOE's economic analysis and risk assessment capabilities are applied to DHS activities and mission areas, using "design science". Researchers are using both qualitative case-studies methods and quantitative psychometric/econometric approaches. The resulting design improvements touch areas across DHS, including acquisition and operations, cyber critical infrastructure, as well as the performance of TSOs.

- **Justification:** The FY 2023 Budget for this project will be used to advance research and test the utility of specific project developments. For example, funding will support applying developed metrics that assess the usefulness of artificial intelligence (AI) technologies when deploying processes that involve human AI teaming in the field. The Center will also develop training and education for the current and future homeland security workforce.

- **Impact:** Research outcomes will include analytical tools, technologies, and knowledge products for the homeland security workforce that may allow them to more accurately assess the analytical data they are collecting during operational duties. Outcomes may also improve threat detection, leading to increased identification of threats, at lower cost. The Center will produce new capabilities, test them in operational settings, and make validated solutions available and useful to homeland security professionals at all levels.

Type of Research

Basic, Applied, and Developmental

Technical Readiness Level

CAOE conducts a portfolio of projects currently at TRL-3, but can range from TRL-2 through TRL-7, from initial concept development to system prototypes tested in the field. Each COE conducts multiple projects across its research and education theme areas. The range of TRL levels changes throughout a COE's life cycle, with a progression toward more TRL levels at the higher end of the scale; however, even a later-phase COE portfolio may include lower range TRLs in its portfolios to address emerging risks.

Transition Plans

S&T works with the CAOE to structure and position projects to align with customer needs, beginning from conception, through testing, and piloting in the field. 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. 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. S&T 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.

Program managers work with the 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 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.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
With the future goal of efficient task-distribution and improved judgement in baggage screening, researchers completed an evaluation and demo of a working algorithmic tool that will be used in the first user study.	FY 2021 Q1	FY 2021 Q4	3
Researchers from Victoria University delivered a final report to OUP and CISA on the implications of COVID-19 for the U.S. agricultural sector and the broader U.S. economy. This analysis included a tailor-made computable general equilibrium (CGE) model with simulations run quarterly over the prior year.	FY 2021 Q1	FY 2021 Q3	3
In close coordination with TSA Sky Harbor, researchers completed a scalable and optimal (or near optimal) transportation security officer routing model and algorithm. Milestone was verified/achieved with delivery of report on routing policies to TSA stakeholders and included acceptable computational time and acceptable solution quality.	FY 2021 Q1	FY 2021 Q4	3
	FY 2022		
Develop the prototype for a software-based tool that will incorporate machine learning into human-dependent visual baggage screening to lead to more efficient and reliable baggage screening solutions at U.S. airports and other border entry points by reducing the rate of false positives and false negatives in screening tasks.	FY 2022 Q1	FY 2022 Q3	3
Host 10-20 undergraduate students for a STEM-based program that combines data analytics training and HSE problem sets.	FY 2022 Q3	FY 2022 Q4	N/A
Develop an early prototype for a deep learning model that will support DHS Components in better understanding migration data in order to better allocate resources.	FY 2022 Q1	FY 2022 Q3	3
	FY 2023		
Implement results of Biennial Review in order to ensure the research remains relevant to DHS missions.	FY 2023 Q1	FY 2023 Q4	N/A
Conduct at least one education and outreach initiative, such as the annual Hackathon, seminar series, and summer education program to engage 10-20 undergraduate students in homeland security science and engineering.	FY 2023 Q1	FY 2023 Q4	N/A
Develop at least one proof of concept for demonstration that uses AI technology to support HSE analysis tasks.	FY 2023 Q1	FY 2023 Q4	3

Coastal Resilience Center of Excellence (CRC)

- **Problem:** Damage caused by floods and hurricanes poses a near-constant threat to lives and property. A lack of resilience to natural hazards at the individual and community level is contributing to the increasing public share of disaster response and recovery costs. As of July 9, 2021, there have been eight weather/climate disaster events with losses exceeding $1.0B each to affect the United States. These events included one drought event, two flooding events, four severe storm events, and one winter storm event. Overall, these events resulted in the deaths of 331 people and had significant economic effects on the areas impacted. The 1980–2020 annual average is 7.1 events (CPI-adjusted); the annual average for the most recent five years (2016–2020) is 16.2 events (CPI-adjusted).[3]

- **Solution:** This Center conducts research and education to enhance the Nation's ability to safeguard people, infrastructure, and economies from natural hazards such as floods and hurricanes. It also considers the impact of future climate trends on coastal resilience. CRC's work directly addresses key challenges associated with growing coastal vulnerability and assists S&T, FEMA, USCG, CISA and local communities in coordination with public and private sector partners. Coastal Infrastructure Resilience examines new methods to assess vulnerability and assist practitioners. Building Resilient Communities conducts research and education to help communities mitigate, recover, and adapt to natural hazard risks. Disaster Dynamics advances coastal storm surge and flood forecasting capabilities and communicates the results to improve coastal resilience through flood risk maps and other mechanisms. Education formulates and delivers resilience-oriented undergraduate and graduate courses, concentrations, minors, certificates, and training, with strong emphasis on Minority Serving Institutions.

- **Justification:** The FY 2023 Budget for this project will be used to support expanding the understanding of coastal resilience through rigorous, integrated, interdisciplinary, and actionable research; developing new tools and methods to assess and enhance physical, social, economic, environmental, and institutional resilience; and transferring the resulting knowledge, tools, and methods into widespread practice. It will also support educating and training the next generation of scholars and practitioners.

- **Impact:** CRC's work produces tangible research and education results for use by DHS, other Federal agencies, State and local governments, and other relevant entities that help reduce the adverse impacts of coastal natural disasters on the Nation's citizens, infrastructure, and economy.

Type of Research

Basic, Applied, and Developmental

[3] NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2020). https://www.ncdc.noaa.gov/billions/, DOI: 10.25921/stkw-7w73

Technical Readiness Level

CRC conducts a portfolio of projects currently at TRL-7, but can range from TRL-2 through TRL-7, from initial concept development to system prototypes tested in the field. Each COE conducts multiple projects across its research and education theme areas. The range of TRL levels changes throughout a COE's life cycle, with a progression toward more TRL levels at the higher end of the scale; however, even a later-phase COE portfolio may include lower range TRLs in its portfolios to address emerging risks.

Transition Plans

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 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.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Transition and education institutionalization plans for FY 2020 portfolio were implemented.	FY 2021 Q1	FY 2021 Q4	N/A
Developed, in partnership with the American Planning Association, a professional training and certification program for the Plan Integration for Resilience Scorecard.	FY 2021 Q1	FY 2021 Q4	N/A
Identified marketable products for development from the ADCIRC Prediction System (APS) for operational end-users across government and private industry.	FY 2021 Q1	FY 2021 Q4	N/A
Disseminated results from MSI Summer Research Team projects.	FY 2021 Q1	FY 2021 Q1	N/A
	FY 2022		
Provide coastal flooding and storm surge guidance using the APS™ for hurricanes impacting the East and Gulf coasts to inform decision making for emergency management, hazard mitigation and post-storm damage estimations.	FY 2022 Q1	FY 2022 Q4	N/A
Complete implementation of technology transfer and transition plans for ADCIRC Prediction System (APS) TM.	FY 2022 Q1	FY 2022 Q4	7
Complete professional training and certification program for the Plan Integration for Resilience Scorecard TM.	FY 2022 Q1	FY 2022 Q4	7
	FY 2023		
Work with the States of Rhode Island and Louisiana to enable use of ADCIRC Prediction System (APS) ™ -coastal hazards modeling outputs for State emergency management agencies.	FY 2023 Q1	FY 2023 Q4	7
Provide coastal flooding and storm surge guidance using the APS™ for hurricanes impacting the East and Gulf coasts to inform decision making for emergency management, hazard mitigation and post-storm damage estimations.	FY 2023 Q1	FY 2023 Q4	7
Conduct research to inform equitable administration and application of FEMA's Building Resilient Infrastructure and Communities (BRIC) program to socially marginalized groups, neighborhoods, and communities.	FY 2023 Q1	FY 2023 Q4	N/A

Criminal Investigations and Network Analysis (CINA)

CINA conducts end user-focused research to enhance investigation strategies to address transnational criminal organizations activities and other homeland security-related crimes. This COE also provides education and professional development to improve the cost-effectiveness of criminal investigations, prosecution, prediction, and prevention.

- **Problem:** Transnational criminal organizations are committing heinous crimes in both physical and cyber space. This COE focuses on a major, cross-cutting DHS mission area, criminal law enforcement, that the COEs have not yet addressed. While technological innovations promise continuing improvements in the quality of life for individuals around the globe, criminal organizations are capitalizing on these transformative advances to become more agile and expand their illicit activities. Sophisticated criminal networks can easily appear, disappear and reorganize in response to opportunities and authority gaps. These networks function as complex social structures across the cyber and physical spaces, and operate at a variety of scales, ranging from local to international.

- **Solution:** The overarching goal of CINA is 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. The activities under this project include:

  - Criminal Network Analysis: Focusing on equipping HSE stakeholders with a thorough understanding and knowledge of criminal activity, its evolution, and convergence, CINA researches the structure of organized gangs, illicit supply networks, and cartels; furthering the development of tools to monitor and disrupt these activities.

  - Dynamic Patterns of Criminal Activity: This initiative seeks to improve prediction and forecasting for HSE stakeholders through the development of cutting-edge methods, agent-based models, and game theory to forecast criminal actions, gang activities, and threats to the United States. Studying the threats at the geographical, social, and cyber dimensions, can prevent, interdict, mitigate and deter homeland security threats or future losses.

  - Forensics: With the intent on developing and deploying state-of-the-art forensic methods, tools, and technologies within the HSE community, CINA leverages advancements in multimedia support, biometric characteristics and digital identifiers, allowing law enforcement officers to attribute malicious incidents with threat actors.

  - Criminal Investigative Processes: Intent on improving HSE end user investigative processes used to detect, pursue and solve transnational criminal activity, this COE is focusing on solving complex investigative processes associated with human trafficking, cybercrimes and money laundering.

- **Justification:** The FY 2023 Budget for this project will be used to continue academic research focused on thwarting criminal networks and transnational crime by advancing tools available to law enforcement officers within the HSE and providing analysts and policy officials with insights into the networked structure of these illicit actors.

- **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.

Type of Research

Basic, Applied and Developmental

Technical Readiness Level

CINA conducts a portfolio of projects that currently range from TRL-3 through TRL-6, but can range from TRL-2 through TRL-7, from initial concept development to system prototypes tested in the field. Each COE conducts multiple projects across its research and education theme areas. The range of TRL levels changes throughout a COE's life cycle, with a progression toward more TRL levels at the higher end of the scale; however, even a later-phase COE portfolio may include lower range TRLs in its portfolios to address emerging risks.

Transition Plans

S&T works with CINA to structure and position projects to align with customer needs, beginning from conception, through testing, and piloting in the field. 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. 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. S&T 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.

Program managers work with the 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. COEs work with their technology transfer offices to attract investments, address legal concerns, and leverage university infrastructures to execute the plans necessary to enable long-term sustainment of technologies.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Issued an annual request for proposals to obtain proposals and fund new performers not currently associated with the CINA program.	FY 2021 Q1	FY 2021 Q2	NA
	FY 2022		
Provided HSI Cyber Crimes Center with a prototype of the Criminal Predictive Analytical Platform for Opioid Abuse software for user feedback and preliminary testing.	FY 2020 Q4	FY 2022 Q1	3
Plan and host a CINA Futures Workshop that produces a workshop report capturing future challenges and potential solutions in CINA relevant scientific domains.	FY 2021 Q1	FY 2022 Q2	N/A
Launch at least one educational course that will support a certificate program or CINA minor in CINA relevant academic disciplines. .	FY 2021 Q1	FY 2022 Q2	N/A
Conduct six distinguished speaker series that bring in recognized authorities in CINA academic and operational topic areas.	FY 2021 Q1	FY 2022 Q2	N/A
	FY 2023		
Transition one CINA prototype through industry partnership.	FY 2023 Q1	FY 2023 Q4	5-6
Produce first video in planned CINA Video Training Catalog in support of FLETC, USSS, and/or HSI workforce development.	FY 2023 Q1	FY 2023 Q4	N/A
Host six Distinguished Speaker events that provide homeland security thought leadership and result in quality video resources for the HSE.	FY 2023 Q1	FY 2023 Q4	N/A

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. Infrastructure systems are increasingly reliant upon cyber physical systems. Those systems may become compromised as a result of cyber-attacks. Infrastructure owners and operators need to understand how organizational risk and operational readiness is affected by cyber risks.

- **Solution:** CIRI explores the organizational, policy, business, and technical dimensions of critical infrastructure's dependence on cyber assets. CIRI examines how computer hardware and software both contribute to and threaten resiliency and how industry makes decisions about cyber assets which contribute to resilience. The Center develops 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. The activities under this project include:

    - The Application of Critical Infrastructure Research in the Real-World: CIRI evaluates policy options and identifies, tests, and pilots technologies and non-material solutions to support effective decision-making in a collaborative risk management environment in real-world settings. Investigating areas from Cybersecurity Assurance for Critical Infrastructure to Electromagnetic Pulse (EMP) Risk Assessment and Mitigation Prioritization and Hybrid Quantum-Classical Reinforcement Learning, CIRI is leveraging existing publications, analyses, and verified and validated models to evaluate and select cross-sector issues that are amenable to real-world testing.

    - Understanding Resilient Critical Infrastructure Systems: Infrastructure systems are owned and operated by a variety of businesses and public entities, including municipal and other types of governments that vary in their knowledge of, and flexibility to manage catastrophic risk. To this end, CIRI is performing an Assessment and Measurement of Port Disruptions and will deliver a "proof-of-concept" framework that would allow port authorities to conduct contextually relevant threat-based assessments of port infrastructure.

    - The Business Case for Infrastructure Resiliency: Understanding how businesses that make up infrastructure systems make decisions before, during, and after a catastrophic event will assist in defining future policies, incentives, and programs. CIRI is analyzing government policies and regulations and the dynamics of risk insurance markets to determine their effects on the motivations and behavior of decision makers throughout the HSE. By assisting with cybersecurity framework implementation, modeling and planning dynamic resiliency, and leveraging AI for Disaster Response, researchers are developing future options for policies, regulations, and market conditions that will properly incentivize decision makers to make timely and appropriate investments in infrastructure security and resilience.

- The Future of Resilience: By researching cloud-based delivery of training related to cyber risk management processes, CIRI is improving risk-based cybersecurity postures within individual companies and government agencies.

- **Justification:** The FY 2023 Budget for this project will be used to develop and deliver educational and workforce development initiatives aimed at creating a workforce attuned to the requirements of infrastructure resilience and which is trained to implement resilience best practices and to pursue new avenues for improving critical infrastructure resilience. CIRI supports expanding the understanding of infrastructure resilience, integrated, interdisciplinary, and actionable research and developing new tools and methods to assess and support DHS initiatives to establish conditions for a more fundamentally secure and resilient cyber ecosystem. This will enable effective cyber risk management and transferring the resulting knowledge, tools, and methods into widespread practice.

- **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.

Type of Research

Basic, Applied and Developmental

Technical Readiness Level

CIRI conducts a portfolio of projects that currently range from TRL-3 through TRL-5, but can range from TRL-2 through TRL-7, from initial concept development to system prototypes tested in the field. Each COE conducts multiple projects across its research and education theme areas. The range of TRL levels changes throughout a COE's life cycle, with a progression toward more TRL levels at the higher end of the scale; however, even a later-phase COE portfolio may include lower range TRLs in its portfolios to address emerging risks.

Transition Plans

S&T program managers work with the CIRI to structure and position projects to align with customer needs from proof of concept through testing, and piloting in the field. 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. 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. S&T 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.

Program managers work with the 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. COEs work with their technology transfer offices to attract investments, address legal concerns, and leverage university infrastructures to execute the plans necessary to enable long-term sustainment of technologies.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Completed cyber vulnerability and gap assessment of current Public Safety Answering Point (PSAP) 911 architecture.	FY 2021 Q1	FY 2021 Q2	4
Developed, documented, and published proposed standards, procedures, and best practices to enhance the cybersecurity and resilience of next-generation mobile telecommunications networks (emphasis on 5G and emergency communications).	FY 2021 Q1	FY 2021 Q3	5
In close coordination with CISA, created the business model and implementation plan to establish a national scale cybersecurity education and workforce development network of academic institutions (including HBCUs, MSIs and two-year programs).	FY 2021 Q1	FY 2021 Q4	5
	FY 2022		
Enhance the assurance of resilient operational delivery of the 55 national critical functions by developing a cross-domain framework that industry and government can use to understand, implement, and maintain sound and standardized cyber risk management processes and industry best practices and to securely communicate their cybersecurity status to provide visibility within the organization and within and across entire supply chains delivered through DHS/CIRI-developed knowledge products, software, and technologies.	FY 2021 Q3	FY 2022 Q3	5
Facilitate development of a robust, competitive market for NG911 systems and enhance the assurance of resilient operational delivery of NG911 services by developing and implementing a sustainable, national-scale testing framework and capability to ensure interoperability, compatibility, and cybersecurity (in accordance with NIST standards) of NG911 components and systems and their supply chains.	FY 2021 Q4	FY 2022 Q4	5
	FY 2023		
Research and develop methods and tools for enhancing resilience of water distribution and other infrastructure through scalable AI-based planning.	FY 2022 Q1	FY 2023 Q4	3-4
In coordination with FEMA and State & local stakeholders, create and test resilience infrastructure prototype tools.	FY 2022 Q1	FY 2023 Q4	4-5
Identify and conduct transition related activities to further at least two ongoing research projects.	FY 2023 Q1	FY 2023 Q4	N/A
Plan and implement final Annual Meeting bringing together researchers, DHS Component stakeholders, and potential commercialization and transition partners to discuss all research and education activities.	FY 2023 Q4	FY 2023 Q4	N/A
Begin preparation for the completion of all research and education project activities for the final year of the COE.	FY 2023 Q1	FY 2023 Q4	N/A

Cross Border Threat Screening and Supply Chain Defense (CBTS)

CBTS focuses on researching and developing solutions, protocols, and capabilities to support the identification of potential biological threats and/or hazards within the DHS operational environment that could disrupt critical infrastructure supply chains and the supporting operational activities conducted at ports of entry, land borders, and other critical nodes within the supply chain.

- **Problem:** Certain technological fields such as biology, bioengineering, and supply chain analytics are rapidly evolving. New biological threats and hazards have the potential to significantly affect the health and well-being of people, animals, and plants, and to subsequently affect the Nation's economy and critical infrastructure. DHS needs the ability to better understand current and emerging biological threats that are faced at POEs and land borders and that may affect critical infrastructure supply chains.

- **Solution:** Potential approaches include the utilization of innovative technologies (e.g., screening physical cargo and passengers, and data analysis to identify potential conditions that warrant greater scrutiny), optimized operational procedures, and a skilled workforce trained in latest methods to identify and respond to biological threats and their corresponding impact on health and the economy. The activities under this project include:

  - Detecting Biological Threats and Disruption to People and Global Supply Chains: Develop simplified, cost effective, interoperable, and broad-spectrum approaches to screen for biological threats. CBTS is analyzing the feasibility of using blockchain and/or other IoT technologies to capture and securely transmit information throughout the supply chain. Additionally, CBTS is utilizing a hand-held device to develop a new assay that can identify infections in people before they develop symptoms, as well as differentiate between viral and bacterial pathogens in less than one hour.

  - Data Integration and Analytics: Improve decision analysis in the field by developing innovative tools, methodologies and processes to support DHS and its partners. Researchers are developing interoperable field-deployable software tools that integrate data from multiple data sources such as sensors, health records, import/exports, supply chains, private industry, and government partners to support decision makers.

  - Novel Operational Methods to Use Emerging Tools to Reduce Risk: Produce timely decision-making through meaningful data integration and representation from disparate sources via advanced Bayesian analysis applied to threat assessment outputs to inform future research, training and policy.

  - Time Critical Response Support: Research Early Warning and Workforce Protection against Highly Contagious Infectious Diseases will provide all levels of operators the guidance necessary to understand evolving global threats. This will help DHS respond to and support efforts to mitigate rapidly developing incidents.

- **Justification:** The FY 2023 Budget for this project will be used to aid DHS in reducing risks posed by biological threats and hazards encountered at borders, ports of entry, and within the global supply chain. By researching the countering biological threats in supply chains, CBTS will assist DHS operations that protect the global supply chain and reduce the risk of exposing people and infrastructures to new and evolving biological threats.

- **Impact:** CBTS will strengthen DHS operational workforce, protect people, animals, and agriculture, and help to defend against threats to the global supply chain that, if comprised, would cause harm to public health and U.S. economy.

Type of Research

Basic, Applied and Developmental

Technical Readiness Level

CBTS conducts a portfolio of projects that currently range from TRL-4 through TRL-7, but can range from TRL-2 through TRL-7, from initial concept development to system prototypes tested in the field. Each COE conducts multiple projects across its research and education theme areas. The range of TRL levels changes throughout a COE's life cycle, with a progression toward more TRL levels at the higher end of the scale; however, even a later-phase COE portfolio may include lower range TRLs in its portfolios to address emerging risks.

Transition Plans

S&T works with CBTS to structure and position projects to align with customer needs, beginning from conception, through testing, and piloting in the field. 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. 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. S&T 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.

Program managers work with the 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 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.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Finalized comprehensive curriculum gap analysis and epidemiology 101/102 courses.	FY 2021 Q1	FY 2021 Q4	N/A
Established a portfolio of research projects to address the thematic areas of the COEs, including: 1) detecting biological threats and disruption to people and global supply chains – technologies, tools, and methods; 2) data integration and analytics; 3) novel operational methods to use emerging tools to reduce risk; 4) workforce development; 5) time critical response support.	FY 2021 Q1	FY 2021 Q3	N/A
Collaborated with the CBTS Board of Directors and create a portfolio of projects that address the gaps and needs of the CBTS customers.	FY 2021 Q1	FY 2021 Q3	N/A
	FY 2022		
Develop a hand-held device that can identify pre-symptomatic infections in people.	FY 2020 Q4	FY 2022 Q4	4
Conducted a curriculum gap analysis and needs assessment of existing curriculum and developed course curriculum covering basic information about animal and plant infectious diseases and disease epidemiology.	FY 2020 Q3	FY 2022 Q1	7
Develop a Truck Border Crossing Delays and Disruptions Economic Impact Assessment Model to provide a practical and efficient tool to help conduct economic impact analyses on border crossing changes. The IMPLAN input/output model will be used to translate empirical data into regional and national economic impacts, using the model's multipliers, for wage, labor and production.	FY 2021 Q3	FY 2022 Q3	6
	FY 2023		
Develop research that addresses knowledge gaps related to detecting biological threats and its intersection with the global supply chains by developing simplified, cost effective, interoperable, and broad-spectrum novel approaches.	FY 2023 Q1	FY 2023 Q4	N/A
Conduct research that addresses known knowledge gaps related to border health, substandard, fraudulent, and counterfeit illegal medical supplies equipment, and how artificial intelligence (AI) can reduce biological risks.	FY 2023 Q1	FY 2023 Q4	N/A

Soft-target Engineering to Neutralize the Threat RealitY (SENTRY; formerly Engineering Secure Environments from Targeted Attacks)

- **Problem:** DHS faces a myriad of complex threats and challenges in the execution of its duty to safeguard America and its people. In order to address the evolution of threats over time, DHS needs resources it can leverage to pursue long term research focused on these grand challenges and strengthens the creation of a capable workforce to enhance the homeland security.

- **Solution:** COEs are university-led consortia that work with industry, DHS Components, other government and homeland security agencies (Federal, State, and local), and first responders to develop critical technologies and analyses to secure the homeland. COEs also develop homeland security-related curricula and training.

- **Justification:** The FY 2023 Budget for this project will be used to continue establishing this new COE that previously went through topic approval and was awarded in FY 2022. This Center is focused on detecting, deterring, and mitigating targeted violence by researching and developing innovative solutions to secure environments that are easily accessible to large numbers of people, such as crowded spaces, built environments, and transportation systems. Multiple DHS Components such as CISA, TSA, USSS among others need improved capability in this area.

- **Impact:** COEs are university-led consortia with multiple partners from academia as well as potentially industrial partners. They bring a wealth of innovative thinking across a broad spectrum of technical fields. These consortia can respond to requests from DHS Components to address needs and fill gaps in science and technology research needs.

Type of Research

Basic, Applied, and Developmental

Technical Readiness Level

SENTRY conducts a portfolio of projects currently at TRL-3, but can range from TRL-2 through TRL-7, from initial concept development to system prototypes tested in the field. Each COE conducts multiple projects across its research and education theme areas. The range of TRL levels changes throughout a COE's life cycle, with a progression toward more TRL levels at the higher end of the scale; however, even a later-phase COE portfolio may include lower range TRLs in its portfolios to address emerging risks.

Transition Plans

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 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.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Posted Notice of Funding Opportunity.	FY 2021 Q1	FY 2021 Q2	N/A
	FY 2022		
S&T facilitated work-plan development workshop with cooperative agreement recipient.	FY 2022 Q1	FY 2022 Q2	N/A
Recruit and appoint Federal advisors within DHS Components to serve on ESE Board of Directors.	FY 2022 Q1	FY 2022 Q2	N/A
Completed review and presented to USST.	FY 2021 Q2	FY 2022 Q1	N/A
	FY 2023		
Conduct a series of workshops attended by lead institution personnel, OUP officials, and engaged DHS Component personnel.	FY 2023 Q1	FY 2023 Q2	N/A
Identify at least two projects with transition potential and implement transition milestones with input from end users to be integrated into the work plan.	FY 2023 Q2	FY 2023 Q4	3
Conduct a series of educational seminars attended by OUP and DHS Components; industry and other academic institutions.	FY 2023 Q1	FY 2023 Q4	N/A
Develop integrated testbed approach/strategy to perform experimental research and evaluate new product technologies, products, platforms and systems.	FY 2023 Q1	FY 2023 Q3	N/A

Master of Business Administration/Security Technology Transition (MBA/STT)

- **Problem:** Technology development, transition, and procurement will always be a foundational element of DHS's strategy for keeping pace with current and emerging threats. The success of DHS's efforts is dependent not only on direct investments in research, development, and procurement, but is equally dependent upon a skilled workforce capable of moving the technologies into an operational setting.

- **Solution:** The MBA/STT program is a non-traditional COE that partners with an academic institution to develop an MBA with a concentration in STT. S&T investment in this space will be a "first of its kind" program aimed to build a cross-DHS Collaborative workforce with the capability and skillset needed to develop, acquire and implement operationally relevant technologies, understand and manage the process of technology transition, and reduce the barriers of technology transition that have historically derailed critical technological or operational improvements.

- **Justification:** The FY 2023 Budget for this project will be used to continue to fund the effort aimed to build a cross-DHS Collaborative workforce with the capability and skillset needed to develop, acquire and implement operationally relevant technologies, understand and manage the process of technology transition, and reduce the barriers of technology transition that have historically derailed critical technological or operational improvements.

- **Impact:** Through leadership development, the MBA/STT will advance the DHS workforce with the ability to successfully manage R&D projects, tools, and technologies will provide an impact across all other DHS missions.

Type of Research
Basic, Applied, and Developmental

Technical Readiness Level
TRL does not apply to MBA/STT program. MBA/STT does not develop new technologies. The program is doing case study research.

Transition Plans
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 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.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
First cohort to the MBA Program began.	FY 2021 Q2	FY 2021 Q2	N/A
Finalized MBA curriculum (specifically Security Technology Transition elective courses) tailored to support research and development technology transition.	FY 2021 Q1	FY 2021 Q3	N/A
Established Partnerships with Private Industry (e.g., defense/security firms + technology start-ups) to serve as mentors to students enrolled in the MBA STT programs.	FY 2021 Q1	FY 2021 Q2	N/A
	FY 2022		
Second cohort begins the MBA Program.	FY 2022 Q2	FY 2022 Q3	N/A
MBA STT students will participate in at least two program facilitated engagements that promote industry networking.	FY 2022 Q1	FY 2022 Q4	N/A
The MBA STT performer (George Washington University) will provide an Annual Review on MBA STT program progress to OUP, Industry Partners, and Board of Directors.	FY 2022 Q2	FY 2022 Q4	N/A
	FY 2023		
Select third cohort from qualified DHS candidates.	FY 2022 Q4	FY 2023 Q1	N/A
Develop Program Evaluation Study Plan.	FY 2022 Q4	FY 2023 Q1	N/A
Third cohort begins the MBA Program.	FY 2023 Q2	FY 2023 Q3	N/A
Cohort 1 graduates.	FY 2023 Q4	FY 2023 Q4	N/A

National Counterterrorism, Innovation, Technology and Education (NCITE)

NCITE (formerly Terrorism Prevention Counterterrorism Research (TPCR) Center) directly supports the HSE counterterrorism missions and professionals with user-inspired projects that are necessary to prevent terrorism and improve security. NCITE identifies, mentors, and evaluates products from the academic community and only conducts research that makes a difference to the HSE and can be applied to operations.

- **Problem:** In the past few years, the DHS Intelligence Enterprise (IE) has shifted their priorities and resources to focus on immediate counterterrorism operations. This has reduced DHS IE's capability to develop, test, and implement innovative strategic methods to counter terrorism. DHS needs new technologies, protocols, and capabilities to support the IE's long-term strategic thinking and develop new approaches to terrorism prevention.

- **Solution:** The new NCITE COE will harness the universities' domain expertise to provide the DHS IE with analytic tools and strategic thinking. NCITE will be designed to conduct a range of activities including basic and applied research, and education and training initiatives to support and enhance DHS analytic efforts to detect, deter, and prevent terrorism.

- **Justification:** The FY 2023 Budget for this project will be used to fund this Center's scope, which offers new technical expertise that complements the overall portfolio of COEs. The NCITE program will ensure that OUP can provide DHS operational components with the greatest range of scientific and technical domains not available through other means and programs.

- **Impact:** The NCITE COE has the potential to impact the entire DHS IE, SLTT, and private and public partners by coordinating with the Intelligence and Analysis Counterterrorism Mission Center. NCITE COE's involvement will include conducting a range of activities including basic and applied research, and education and training initiatives to support and enhance DHS analytic efforts that are not currently being done by other organizations in the space.

Type of Research
Basic, Applied, and Developmental

Technical Readiness Level

NCITE conducts a portfolio of projects currently at TRL-3, but can range from TRL-2 through TRL-7, from initial concept development to system prototypes tested in the field. Each COE conducts multiple projects across its research and education theme areas. The range of TRL levels changes throughout a COE's life cycle, with a progression toward more TRL levels at the higher end of the scale; however, even a later-phase COE portfolio may include lower range TRLs in its portfolios to address emerging risks.

Transition Plans

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 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.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Conducted a series of workshops attended by lead institution personnel, OUP officials, and the corresponding Board of Directors.	FY 2021 Q1	FY 2021 Q3	N/A
Conducted lab and field experiments with at least one prototype of a transition project to determine if its TRL can be increased.	FY 2021 Q2	FY 2021 Q4	3
	FY 2022		
Integrate findings across Suspicious Activity Reporting projects to inform operations of at least two DHS Components and/or partners.	FY 2022 Q1	FY 2022 Q1	3
Identify, place, and fund four Innovation graduate fellowships.	FY 2022 Q2	FY 2022 Q4	N/A
Conduct market assessment and determine market fit for at least two ongoing research projects.	FY 2022 Q2	FY 2022 Q4	N/A
Identify at least two projects with transition potential and implement transition milestones with input from end users to be integrated into the work plan.	FY 2021 Q2	FY 2022 Q2	3
	FY 2023		
Conduct Biennial Review on all research, education, and NCITE Management efforts. The biennial review evaluates the COE's long-term strategy, relevance of the research and education to DHS mission needs and technology gaps, level of stakeholder engagement, research quality, outreach efforts, and management of the activities funded under the cooperative agreement. At the conclusion of this review, DHS will provide actions and recommendations to be implemented in the next year's workplan.	FY 2023 Q2	FY 2023 Q2	N/A
Expose students to homeland security challenges by funding at least 15 within research, education, and core management activities at the Center.	FY 2023 Q1	FY 2023 Q4	N/A
Work with relevant DHS Components to create homeland security challenge areas, draft and release request for proposal for potential research projects.	FY 2023 Q3	FY 2023 Q4	N/A

New COE Topics #1 and #2 (Procurement Sensitive)

- **Problem:** DHS faces a myriad of complex threats and challenges in the execution of its duty to safeguard America and its people. In order to address the evolution of threats over time, DHS needs resources it can leverage to pursue long term research focused on these grand challenges and strengthens the creation of a capable workforce to enhance the homeland security.

- **Solution:** COEs are university-led consortia that work with industry, DHS Components, other government and homeland security agencies (Federal, State, and local), and first responders to develop critical technologies and analyses to secure the homeland. COEs also develop homeland security-related curricula and training.

- **Justification:** The FY 2023 Budget for this project will be used to plan for new Centers that align with DHS mission needs and priorities per the approved S&T COE Topic Designation Process. As part of the standard OUP planning and processes, S&T investigates new Center scopes and scientific areas to formulate potential COEs that will meet evolving DHS needs.

- **Impact:** COEs are university-led consortia with multiple partners from academia as well as potentially industrial partners. They bring a wealth of innovative thinking across a broad spectrum of technical fields. These consortia can respond to requests from DHS Components to address needs and fill gaps in science and technology research needs. The proposed increase in funding will strengthen the Nation's investments in foundational, early-stage R&D at universities, to further secure our future and expand the scientific and technical outputs that Components rely on. COEs have developed more than 200 targeted tools, technologies, and knowledge products through COEs for use across the homeland security enterprise.

Type of Research
Basic, Applied, and Developmental

Technical Readiness Level
N/A

Transition Plans

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 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.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
N/A	N/A	N/A	N/A
	FY 2022		
Complete the planning and initiation of new Center.	FY 2021 Q3	FY 2022 Q4	N/A
	FY 2023		
Complete review and present results to USST.	FY 2022 Q4	FY 2023 Q2	N/A
Facilitate S&T work-plan development workshop with cooperative agreement recipient.	FY 2023 Q4	FY 2023 Q4	N/A
Recruit and appoint Federal advisors within DHS Components to serve on COE Board of Directors.	FY 2023 Q4	FY 2023 Q4	N/A

Minority Serving Institutions (MSI)
Research and Development

Technology Readiness Level Exhibit

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 President's Budget	FY 2023 President's Budget
Minority Serving Institutions (MSI)	$5,157	$5,157	$5,157

Minority Serving Institutions

This program enhances the capabilities of MSI to develop homeland security-related science, technology, engineering, and mathematics research and curricula, and prepare MSI students for successful homeland security careers. Current MSI programs, include the Scientific Leadership Award (SLA) program, the Summer Research Team (SRT) program, and the Homeland Security Professional Opportunities for the Student Workforce to Experience Research (HS POWER). The programs provide research opportunities and experiential learning, as well as homeland security course content and training in areas critical to homeland security while building enduring partnerships with the COEs. With targeted investments, S&T expects significant returns in the development of a future, diverse workforce that is well postured to take RDT&E positions critical to the success of homeland security enterprise.

- **Problem:** Federal security agencies need diverse, well-qualified analysts and technologists to enter the homeland security science and engineering workforce. The identification, recruitment and retention of these individuals is necessary to secure a diversified workforce.

- **Solution:** MSIs which include Asian American and Native American Pacific Islander-Serving Institutions (AANAPISI), Hispanic Serving Institutions (HSI), Historically Black Colleges and Universities (HBCU), and Native American Serving Institutions will design innovative homeland security related science, technology, engineering, and math (STEM) curricula; support academic enhancements; provide student experiential learning opportunities; and support homeland security-relevant research projects or initiatives with significant involvement of early career faculty and in coordination with DHS COEs.

- **Justification:** The FY 2023 Budget for this project will be used to support continued homeland security related STEM research and experiential learning opportunities at MSIs across the United States, to include U.S. Territories and Tribal Nations. This aims to produce a diverse talent pool well postured to take RDT&E positions critical to the success of homeland security. Funds will also be used to facilitate engagements with the Nation's MSIs, which include HBCUs, HSIs, Asian American, Native American, and Pacific Islander-Serving Institutions, and Tribal Colleges and Universities, and provide student experiential learning opportunities through science and engineering teaching initiatives, curriculum development, and scholarships. Additionally, funding will support capacity building efforts to provide MSI R&D access and support to Homeland Security critical needs by ensuring diverse and multivariate points of view are applied while seeking capabilities for Homeland Security.

- **Impact:** MSI students will enter careers within the public and private Homeland Security Enterprise, thus increasing diversity and representation within the future homeland security RDT&E workforce. Additionally, funding provides MSIs faculty access and enhances capacity to support research opportunities to ensure that the HSE benefits from diverse research perspectives.

Type of Research

Basic, Applied, and Developmental

Technical Readiness Level

The MSIs conduct a portfolio of projects currently at TRL-2, but can range from TRL-2 through TRL-7, from initial concept development to system prototypes tested in the field. Each portfolio conducts multiple projects across its research and education theme areas. The range of TRL levels changes throughout a portfolio's life cycle, with a progression towards more TRL levels at the higher end of the scale; however, even a later-phase portfolio may include lower range TRLs in its portfolios to address emerging risks.

Transition Plans

S&T works with the MSIs to structure and position projects to align with customer needs, beginning from conception, through testing, and piloting in the field. 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. 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. S&T 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.

Program managers work with the Office of General Counsel, the General Counsel of the performing institution(s), and MSI Technology Commercialization Offices to support legal, privacy, market, and technology transfer elements of each project. MSIs 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.

Project Schedule

Research & Development Description	Planned Start Date	Planned Completion	TRL Level(s)
	FY 2021		
Collaborated with a private-sector partner to establish a joint and robust internship program for undergraduate and graduate students interested in performing pioneering research projects for homeland security relatedfields.	FY 2020 Q2	FY 2021 Q1	N/A
Awarded three to four Scientific Leadership Award grants to MSIs to help develop and strengthen homeland security related STEM curriculum. Provide students with scholarship funding to increase number of graduates in homeland security STEM fields. Develop pathways and increase number of two-year college students entering four-year degree programs.	FY 2020 Q4	FY 2021 Q2	N/A
Kicked off FY 2021 SRT internship program for MSI students and faculty members.	FY 2021 Q1	FY 2021 Q3	N/A
Launch pilot public-private internship program for undergraduate and graduate students to conduct DHS mission-relevant research with private industry partners.	FY 2021 Q1	FY 2021 Q3	N/A
Partnered with one to two MSIs to launch DHS agency relevant research projects as an opportunity to draw innovative ideas from our diverse population and answer the challenges faced by DHS Counterparts, the MSI Research and Development Consortium.	FY 2021 Q2	FY 2021 Q3	N/A
	FY 2022		
Launch one to two DHS mission related RDTE research projects in partnership with the MSI Research and Development Consortium.	FY 2022 Q2	FY 2022 Q4	2
Launch internship programs for undergraduate and graduate students to conduct DHS mission-relevant research with private industry and government partners.	FY 2022 Q2	FY 2022 Q4	N/A
Expand summer research opportunities with DHS Centers of Excellence to MSIs to include Asian American serving institutions, Historically Black College and Universities, Hispanic Serving Institutions, and Tribal Colleges and Universities to support DHS mission relevant research projects by 20%.	FY 2022 Q2	FY 2022 Q4	N/A
	FY 2023		
Launch two to three high-level DHS research projects in partnership with the MSI Research and Development Consortium.	FY 2023 Q1	FY 2023 Q4	2
Kickoff FY 2023 SRT internship program for MSI students and faculty members.	FY 2023 Q2	FY 2023 Q3	N/A
Continue research and experiential learnings/internship programs partnering with the Federal National Labs in priority DHS focus areas, to include Cyber Security and AI.	FY 2023 Q3	FY 2023 Q4	N/A
Award five to six Scientific Leadership Award grants to MSIs to help develop and strengthen homeland security related STEM curriculum. Provide students with scholarship funding to increase number of graduates in homeland security STEM fields. Develop pathways and increase number of two-year college students entering four-year degree programs.	FY 2023 Q3	FY 2023 Q4	N/A