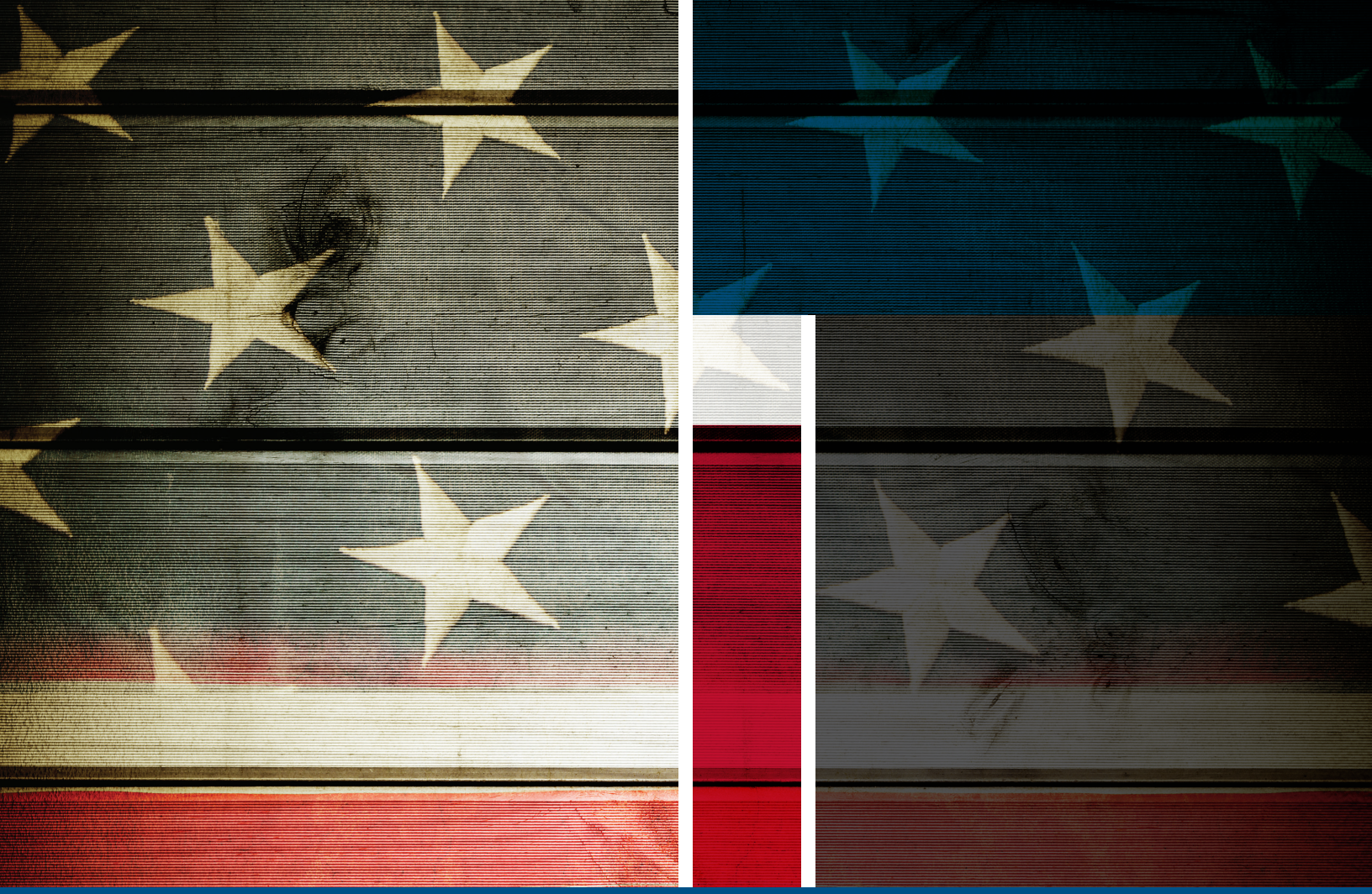

Integrated Product Teams for Department of Homeland Security R&D

FY17 Report

Homeland Security

World events in 2016 showed us how important technology can be to homeland security. With technology, we thwarted terror attacks and responded to disasters as we continued our mission to secure our homeland and our way of life. This has made it clear that the Department of Homeland Security (DHS) must continue to inject technological advancements into a constantly evolving security landscape—for our operators and for our communities.

At the direction of Secretary Johnson, the Science and Technology Directorate is charged with managing the DHS Component-led Integrated Product Teams (IPTs). These were re-established in 2015 to coordinate research and development (R&D) and collect valuable data about needed solutions for our operators on the front lines.

Part of the Unity of Effort initiative, IPTs leverage a network of technical and operational subject matter experts—both inside and outside of DHS—whose contributions identify needs, remove duplication of our R&D efforts, and help prioritize R&D projects. With the information provided by IPTs, DHS is empowered to make data-driven decisions that result in impactful solutions for homeland security challenges.

Due to the sensitive nature of the homeland security mission, this information must be protected from public release. As a result, this report does not include all the supporting information generated through the FY17 process but it does inform the public of the important work being done by the IPTs to coordinate DHS R&D activities to address priority homeland security needs.

We know there is still progress to be made. The Department is positioning the IPTs to collect increasingly better data from components and has created a gap lifecycle that will ensure continuous connectivity between operators and technical experts. Through this process, a roadmap is developed to turn a gap into a solution on the front lines.

By focusing investments in the highest priority areas, S&T uses the IPT information to bring technological and scientific solutions to our overall homeland security mission.

Sincerely,

Dr. Robert P. Griffin, Jr.

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ACKNOWLEDGEMENT

The Integrated Product Team (IPT) Process is the primary collaboration mechanism used to align R&D portfolios across the mission areas of the Department of Homeland Security. The process involves the active participation of the three DHS components appropriated for R&D (the Science and Technology Directorate, Domestic Nuclear Detection Office, and U.S. Coast Guard); other DHS operational and headquarters component organizations; the DHS Joint Requirements Council; other Federal departments and agencies; and State and local first responders. This report is presented with gratitude and appreciation to all participants in the FY16-17 IPT process, whose hard work and dedication enabled the development of this document and whose daily efforts advance the shared mission of identifying and delivering the best R&D solutions for the homeland security enterprise.

EXECUTIVE SUMMARY

Continuing its momentum from fiscal year 2015, the second cycle of the Department of Homeland Security's Integrated Product Teams (IPT) saw repeated success in gathering data across components while making marked improvements to the quality and breadth of data collected. By incorporating improved data and aligning funding information, the Fiscal Year 2016-2017 (FY16-17) IPT process will allow the Department to develop a coordinated research and development (R&D) plan that informs a wise investment strategy.

The IPTs align Departmental R&D to DHS mission areas and priorities. As part of the Unity of Effort Initiative, the IPTs play a critical role in identifying and prioritizing DHS-wide R&D technological capability gaps and informing DHS S&T's R&D portfolio management practices to provide complete, comprehensive and vetted information to support R&D investment decisions.

During the FY16-17 cycle, the IPTs were realigned to better reflect DHS core mission areas as reflected in the Quadrennial Homeland Security Review (QHSR)[1]. This realignment resulted in the following IPTs: Enhance Security; Prevent Terrorism; Prevent Terrorism: CB/RN; Secure Borders; Secure Cyberspace; and Strengthen National Preparedness and Resilience (Incident Management), which includes State, local, and tribal-level equities.

While the success of the first year was marked by the sheer volume of data collected, this second IPT cycle demonstrates its value through its Gap Lifecycle. IPTs bring components together to identify gaps and then leverage this established network to ensure an ongoing, year-round process with a designated component "champion" to shepherd each gap from the identification of needs to the transition of solutions to close the gap. This adds traceability for identified gaps to the operators who need the solution.

In FY16-17, the IPTs and the DHS Joint Requirements Council (JRC) forged new collaborative processes by issuing combined guidance and joint data collection and planning requirements. These efforts enabled S&T and the JRC to align the IPT core mission areas to the DHS Enterprise Architecture. JRC representatives participating at the sub-IPT level also continue to foster DHS-wide collaboration and information sharing. This level of cooperation between the IPTs and JRC will increase over time as the JRC processes for joint requirements assessment and operational capability gap prioritization continue to mature.[2]

Per the direction of the Deputies Management Action Group (DMAG), the FY16-17 IPT cycle incorporated process improvements focused on data quality and management, resulting in greater transparency and traceability, including the following supporting initiatives:

- **Data Quality:** Provided an increased level of detail for many of the funded R&D projects. This information is essential for improving alignment of DHS R&D investments to the high-priority technological capability gaps.
- **Standardized Prioritization Criteria:** Employed common criteria for prioritizing gaps at all levels of the process to ensure consistent results.

[1] *Quadrennial Homeland Security Review Report, U.S. Department of Homeland Security, 2014.*

[2] *Changes in non-R&D activities may also assist in closing IPT-identified gaps. S&T will work with the JRC and other business process owners to explore potential alternative approaches.*

- **Increased Decision Transparency:** Incorporated a ranking and prioritization system called Analytic Hierarchy Process (AHP), a methodology often used to evaluate alternatives in multi-criteria, decision-making situations.
- **Improved Alignment of R&D Efforts to Gaps:** Provided a data analytical process to transform data to useful characteristics and enable natural sorting into bins and categories.

The above initiatives contribute to a standardized approach for identifying and tracking DHS R&D efforts, thereby addressing the Government Accountability Office's recommendations[3] to: improve R&D coordination across the Department; establish a common mechanism and procedures for gathering and reporting priority gaps and corresponding R&D efforts to develop solutions; provide a technology review platform to identify and mitigate duplicative and overlapping R&D efforts within DHS; and help to fulfill longstanding statutory requirements for DHS and S&T to align Departmental R&D efforts.

The IPT process is designed to be a collaborative and cross-component endeavor. While S&T coordinates the overall effort, the individual IPTs are led by senior executives from DHS components, with representatives of the JRC and other DHS offices participating at various levels. In this way, the IPT process supports and strengthens the Department's Unity of Effort Initiative[4]. Table ES-1 shows the membership of the IPTs and sub-IPTs for fiscal year 2017 (FY17).

IPT Name	Component IPT Chairs/ Co-Chairs	IPT and Sub-IPT Membership
Enhance Security	TSA	CBP, FEMA, NPPD, TSA, USSS Non-DHS: DoD, DOJ/FBI, DOT, NCTC, USPIS, White House CVE Task Force
Prevent Terrorism: CB/RN	DNDO and OHA	CBP, DNDO, FEMA, OCHCO, OHA, TSA, USCG, USSS
Secure Borders	USCG	CBP, ICE, USCG
Prevent Terrorism	I&A	CBP, CRCL, DNDO, FEMA, I&A, ICE, NPPD, MGMT/OCIO, OGC, OPS, PLCY, TSA, USCG, USCIS
Secure Cyberspace	NPPD and MGMT/CISO	CBP, FEMA, ICE, MGMT/CISO, NPPD, PLCY, Privacy, TSA, USCG, USCIS Non-DHS: HHS, DOJ, NASA
Incident Management	FEMA	CBP, FEMA, ICE, NPPD, PLCY, TSA, USCG, USSS Non-DHS: FRRG

Table ES-1: *Membership of the IPTs and Sub-IPTs*

In response to the Secretary's request, S&T initiated a data call to all DHS components and offices requesting information on ongoing research and/or development activities and associated funding data. The information compiled through these efforts is presented in the ***Report of Coordinated DHS R&D*** delivered separately to the Secretary of Homeland Security (the Secretary).

[3] *GAO-12-837, "Department of Homeland Security: Oversight and Coordination of Research and Development Should Be Strengthened"; September 2012.*

[4] *Memorandum for DHS Leadership; "Strengthening Departmental Unity of Effort"; April 22, 2014.*

The IPTs then identified R&D efforts that address the high-priority gaps identified through the FY16-17 process. The S&T Research Council (SRC) recommended ongoing analysis of the technical solutions for high-priority gaps. The SRC also recommended that additional or new R&D be considered for gaps with insufficient or no associated R&D. The identified high-priority gaps and the R&D efforts that address those gaps are captured in the ***High-Priority Technology Solutions***, also submitted separately to the Secretary.

The results of this year's IPT process will inform a DHS R&D investment portfolio comprised of planned and ongoing S&T and component research efforts. A transparent R&D investment profile supports better decision making in the annual budget cycle and informs operational investments for planning purposes.

The IPT process continues to provide a strong foundation for future cycles through continuous process improvements and cross-Department collaboration. Executives from across DHS now have an established mechanism for coordinating and prioritizing R&D activities that supports decisions to address critical technological research for the most pressing mission needs.

The high-priority gaps resulting from the FY16-17 process[5] are presented in Table ES-2.

IPT	Technological Capability Gap
Enhance Security	Enhanced ability to quickly and accurately verify a passenger's identification and determine vetting status
	Reduced cost CT-like X-ray imaging system to improve the capability to electronically image for threats in bulk air cargo commodities. Per TSA, screening companies need cost-effective equipment
	Enhanced portable hand-held explosive trace detection (ETD) device capable of rapid detection and alarming on a wide range of explosive materials
	Enhanced capability to enable efficient and accurate detection of increasingly complex threat/threat concealment on passengers and property (carry-on)
	Improved ability to perform high-throughput air cargo screening
Prevent Terrorism	Improved detection of organic explosives compounds and homemade explosives
	Improved explosives/improvised explosive device (IED)-related anomaly detection
	Automated Machine Learning for analysts
Prevent Terrorism: CB/RN	Enhanced decision support
	Field Detection Equipment: Sufficient capability to detect disease and other biological threats at ports of entry

Table ES-2: *DHS High-Priority Technological Capability Gaps for FY17*

[5] *The Prevent Terrorism: RN gaps are not presented here.*

IPT	Technological Capability Gap
Secure Borders	Enhanced capabilities to detect cross-border tunnels and surveil infrastructure tunnels
	Enhanced capability to integrate disparate border security sensor and intelligence sources, perform data analytics, and share the resulting actionable intelligence with HSE partners
	Improved dark vessel detection, tracking and interdiction capabilities
	Enhanced utilization of biometric collection to expedite and improve people screening
Secure Cyberspace	Mobile security technologies integrated with continuous diagnostics and monitoring (CDM) to secure end-to-end voice & data in mobile network infrastructure
Incident Management	Autonomous Indoor Navigation and Tracking of First Responders [survivor-centric technology]

Table ES-2: *DHS High-Priority Technological Capability Gaps for FY17, Cont.*

In addition, the high-priority gaps resulting from the FY15-16 IPT process are presented in Table ES-3 below. DHS is already working to address these gaps by processing specific gaps through the IPT Gap Decision Framework, which is designed to inform the development and transition of solutions to close the gaps. DHS will apply this decision support process to the high-priority gaps for FY16-17 and to gaps resulting from future IPT cycles as well, building on relevant information gathered during previous cycles as part of the iterative, annual IPT process.

IPT	Technological Capability Gap
Aviation Security	Capability to accurately identify and screen checked baggage based on the owners Passenger Clearance Ranking
	Capability to verify a passenger's identification
	Enhanced ability to conduct primary screening of passengers in aviation security screening checkpoints (currently performed by advanced imaging technology and walk-through metal detectors) that provides the ability to distinguish threats from non-threats that are placed on the body
	Enhanced risk-based screening algorithms development for security technology to support operator and associated policy decisions
	Improved capability to allow operators to screen passengers' carry-on and checked bags for prohibited items to protect against sophisticated IED attacks (various explosive types)
	Improvement needed for screening methods against attacks using cargo IED, one or more, when in flight (various explosives types)
Biological Threat	Compact Personal Protective Equipment (PPE); Emergency/Escape Hood
	Decision Support for Operational Decision Making, including PPE use
	Means for field agents to detect, identify and classify the presence of biological agents
	Biological dispersion event modeling
	Data assimilation and predictive analysis to inform decision making in the field and operations centers
	Advances to allow for better timeliness to verify a biological attack
Border Security	Biometric Entry/Exit (counting and measuring)
	Improve performance of non-intrusive inspection (NII) detectors and/or sources
	Small Dark Aircraft Detection and Timely Interdiction
	Sensor and Intelligence Information Sharing and Data Analytics
	Land/In-Between Ports-of-Entry Situational Awareness
	Tunnel Detection, Surveillance, and Forensics
	Maritime Surveillance and Communications in Remote Environments
	Small Dark Vessel Detection
Cybersecurity	Distributed Cloud-Based Communications and Monitoring
	ICS Control Systems, Cyber Sensors, Analytics, and Prevention Capabilities
	Method for forensic examiners to capture user data from networked devices (the "Internet of Things")
	Lack of cybersecurity effectiveness, severity, and comparative metrics

Table ES-3: *Highest-Priority Gaps Resulting from the FY16 IPT Process*

INTEGRATED PRODUCT TEAMS FOR DEPARTMENT OF HOMELAND SECURITY R&D: FY17 REPORT

INTRODUCTION

The Department of Homeland Security (DHS) relies on innovative and effective technology solutions to provide the necessary capabilities to identify, mitigate, and resolve current and emerging threats to the homeland security enterprise (HSE). Title III of the Homeland Security Act of 2002, as amended, authorizes the Under Secretary for Science and Technology to identify priorities and coordinate research and development (R&D) activities to support the Department's mission.

Since the formation of DHS in 2002, the Department's R&D activities have been conducted largely within each component's portfolio rather than coordinating across the DHS enterprise. In 2012, the Government Accountability Office (GAO) recommended that DHS establish enterprise management practices for the whole of the DHS R&D investment portfolio. To address GAO's recommendations, the DHS Science and Technology Directorate (S&T) worked with other DHS components to improve R&D coordination through various means, including developing a DHS Directive and Instruction that define R&D and establish policies for identifying and reporting R&D activities.

In August 2015, the Secretary of DHS issued a memorandum establishing Integrated Product Teams (IPTs) to identify and coordinate the Department's R&D activities.[6] The memo charged S&T with coordinating the overall effort. In response, S&T developed an organizational framework and process that now serves as the mechanism for coordinating DHS-wide R&D to priority mission needs. The FY15-16 IPT process produced results and laid the groundwork for future iterations of an annual IPT cycle. The results of the inaugural IPT process were presented in the FY16 IPT report delivered to the Secretary in March 2015.[7]

This report presents the results of the second annual cycle of the IPTs, the FY16-17 IPT process. This year's IPTs are focused on the core DHS missions identified in the 2014 Quadrennial Homeland Security Review (QHSR), as follows: Enhance Security; Prevent Terrorism; Prevent Terrorism: Chemical & Biological/Radiological & Nuclear (CB/RN); Secure Borders; Secure Cyberspace; and Strengthen National Preparedness and Resilience (Incident Management).

Supporting the broader DHS Unity of Effort Initiative, the IPTs bring together cross-component teams to align the Department's R&D investments to priority technological capability gaps. While S&T leads the overall effort, the individual IPTs are led by senior representatives of the components. Subject matter experts from the DHS Joint Requirements Council (JRC) and other DHS offices also participate at various levels. Figure 1 illustrates the cross-component collaboration and unity of effort inherent in the IPT process.

[6] *Memorandum from Secretary of Homeland Security Jeh Charles Johnson to DHS Component Heads on Establishment of Integrated Product Teams, August 25, 2015.*

[7] *Integrated Product Teams for Department of Homeland Security R&D: FY16 Report, U.S. Department of Homeland Security, 2015.*

Figure 1: *Integrated Product Teams Unity of Effort*

In addition to the DHS IPTs, S&T continues to support the First Responder Resource Group (FRRG), a working group that helps to identify the priority needs of State and local responders in the field, as well as the Domestic Nuclear Detection Office (DNDO). Given the breadth and depth of DHS mission space and the associated R&D needs, the IPT process will continue to evolve in step with homeland security demands.

The results of the FY16-17 IPT process inform the following two products delivered separately to the Secretary:

- Report of Coordinated DHS R&D - captures ongoing and planned DHS R&D activities and associated funding.
- High-Priority Technology Solutions - captures high-priority capability gaps and corresponding R&D efforts to develop solutions.

The IPT process allows DHS components and S&T to gain a better understanding of existing and emerging needs; promotes greater transparency into budget and acquisition processes; serves as a roadmap for future internal investments; and informs industry partners who are key to bringing capabilities to the market.

I. GOALS AND OBJECTIVES

While many DHS components conduct research to address component-centric needs, previous efforts to coordinate DHS-wide R&D activities were limited to ad hoc arrangements that were not necessarily aligned to specific mission areas or component acquisitions. Within DHS, only DNDO, the United States Coast Guard (USCG), and S&T have R&D budget authority.[8] Other components may pursue and conduct their own R&D, as long as those activities are coordinated through S&T. As responsible stewards of taxpayer dollars, DHS is committed to identifying and coordinating R&D efforts across the Department to ensure mission alignment and the proper use of Federal Government appropriations.

OVERALL GOAL OF IPT EFFORT
Coordinate DHS-wide R&D to priority mission needs
OBJECTIVES FOR THE IPTS
Ensure that the Department is investing in non-duplicative technologies that address the highest priority gaps.
Refine the required mechanisms that result in the Department's High Priority Technology Solutions document – including metrics for transitioning technologies and improving mission capabilities.
Continue to develop and refine DHS acquisition and funding profiles and align them to the highest-priority gaps.
Work to standardize data collection and reporting procedures to capture all ongoing R&D activities that inform the DHS-wide R&D profile.

IPTs inform resource decisions that optimize the R&D investment budget profile, ensuring alignment to the highest-priority gaps, recorded and submitted in the President's Budget to Congress. Moreover, the IPT process opens new channels of collaboration across the Department, fostering corporate thinking among executives and their operational staff.

In an August 24, 2016 memorandum,[9] the Secretary outlined four objectives for the FY16-17 IPT cycle. These objectives are consistent with those outlined in the Secretary's 2015 memorandum and are intended to foster transparency and collaboration to validate technology gaps and coordinated R&D investments. The 2016 memorandum also specifically requests that components provide R&D funding information along with their identified R&D activities.

[8] *Beginning in FY2017, additional Components and Directorates will have R&D funding under the Common Appropriation Structure (CAS). These include the Transportation Security Administration, National Protection & Programs Directorate, United States Secret Service, and the Directorate for Management. Reforms under the CAS have resulted in greater transparency of R&D activities that are occurring within other Components as part of acquisition programs.*

[9] *Memorandum for Component Heads; "DHS Integrated Product Teams for FY 16-17"; From Jeh Charles Johnson; DHS Secretary; August 24, 2016*

II. IPT PROCESS

The FY17 IPTs followed the same basic process established for the initial FY16 cycle, as follows. The sub-IPTs identify priority gaps within their specific topic areas. The IPTs compile the gaps from their respective sub-IPTs and re-prioritize gaps across each IPT mission area. The resulting prioritized gaps are submitted by each IPT to the S&T Research Council (SRC). The SRC then reviews the priority gaps from all IPTs and votes to identify the highest-priority technological capability gaps across DHS. See Figure 2 below.

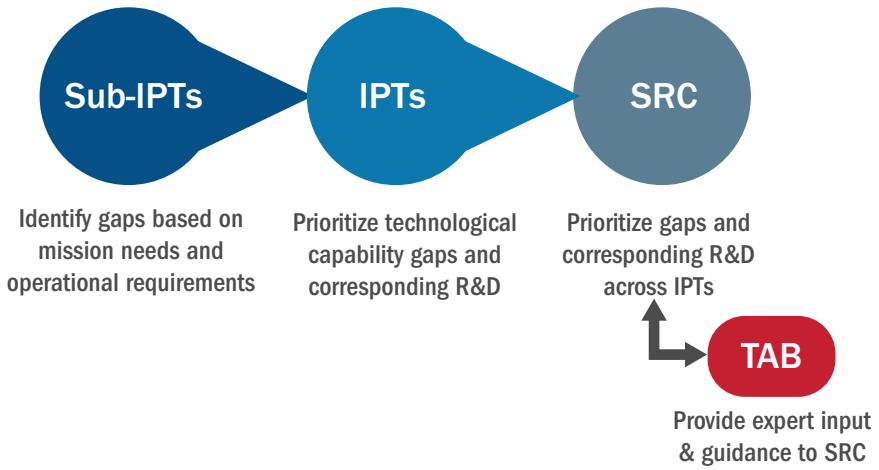


Figure 2: *IPT Process and Governance Structure*

Collaboration and Data Call Coordination with JRC

Representatives from the JRC participated in each sub-IPT to ensure alignment with JRC governance and consideration of the requirements identified through that process. The sub-IPTs use a Gap Tracking Tool to document pertinent information on identified gaps. S&T worked collaboratively with JRC staff in developing this tracking tool to support a joint IPT-JRC data call for technological and operational capability gaps, respectively. This coordinated data call eliminates duplication of effort and provides greater situational awareness across the Department's R&D and acquisition processes.[10]

[10] *Changes in non-R&D activities may also assist in closing IPT-identified gaps. S&T will work with the JRC and other business process owners to explore potential alternative approaches.*

III. RESULTS OF THE FY16-17 IPT PROCESS

High-Priority Technological Capability Gaps

This section summarizes information about the high-priority gaps identified through the FY16-17 IPT process, including a description of the relevant IPT mission area and the need(s) associated with each high-priority gap.

Enhance Security. Since the creation of DHS, enhancing aviation security has been a major priority. While DHS has made progress to move passengers, baggage, and cargo safely and quickly to their destinations, the Department consistently strives to create a positive passenger experience while prioritizing security in an evolving threat environment. The end goal is to provide non-invasive security screening at our nation's airports while preventing terrorist attacks and ensuring speedy and lawful trade and travel. The aviation security needs identified in the FY16-17 cycle focus around increasingly rapid and effective threat detection on passengers and in baggage and cargo, in addition to quickly authenticating the identity of passengers.

Technological Capability Gap
Enhanced ability to quickly and accurately verify a passenger's identification and determine vetting status
Reduced cost CT-like X-ray imaging system to improve the capability to electronically image for threats in bulk air cargo commodities. Per TSA, screening companies need cost-effective equipment
Enhanced portable hand-held explosive trace detection (ETD) device capable of rapid detection and alarming on a wide range of explosive materials
Enhanced capability to enable efficient and accurate detection of increasingly complex threat/threat concealment on passengers and property (carry-on)
Improved ability to perform high-throughput air cargo screening

Prevent Terrorism. A hallmark of homeland security, preventing terrorist attacks runs through the mission of every component. As noted in the QHSR, the threat of terrorism has become increasingly difficult to detect. Capabilities to better detect threats and conduct surveillance are priority needs, as well as the ability to use data more effectively to glean actionable information to combat terrorism.

Technological Capability Gap
Improved detection of organic explosives compounds and homemade explosives
Improved explosives/improvised explosive device (IED)-related anomaly detection
Automated Machine Learning for analysts

Prevent Terrorism: CB/RN. [11]A more specific area within the Prevent Terrorism mission area is addressing the threat of chemical, biological, radiological, and nuclear attacks, which require niche subject matter expertise to combat. Needed capabilities for this mission area include preventing releases and detecting and protecting against priority CB/RN threats and hazards known to pose particularly high risk. Operators in this mission space play a variety of roles and require detection and warning tools and modeling and predictive analytics capabilities.

Technological Capability Gap
Enhanced decision support
Field Detection Equipment: Sufficient capability to detect disease and other biological threats at ports of entry

Secure Borders. DHS is responsible for securing our borders while expediting lawful trade and travel. This includes the security of 7,000 miles of terrestrial border with Mexico and Canada, air domain awareness within the United States, the security of the maritime approaches of the United States, and security of the nation's air, land, and sea ports of entry. Border security presents complex challenges due to geographic locations, modes of transport, trade and travel volume, and transnational criminal organizations. Needs in this area include detection of small dark vessels, improving use of biometrics, and enhancing the use of sensors to gather, analyze, and share intelligence-related information.

Technological Capability Gap
Enhanced capabilities to detect cross-border tunnels and surveil infrastructure tunnels
Enhanced capability to integrate disparate border security sensor and intelligence sources, perform data analytics, and share the resulting actionable intelligence with HSE partners
Improved dark vessel detection, tracking, and interdiction capabilities
Enhanced utilization of biometric collection to expedite and improve people screening

Secure Cyberspace. Cyber-threats have resulted in detrimental impacts to the nation's economy and security. Integrated into our nation's critical infrastructure across the government and the private sector, cybersecurity is a top concern for DHS. The growth of the Internet of Things, cyber crime, and a growing dependence on digital devices and data add layers of complexity to cybersecurity that require integrated technology solutions. Of particular interest is mobile device security to ensure confidentiality, integrity, and availability for end-to-end mobile voice and data.

Technological Capability Gap
Mobile security technologies integrated with continuous diagnostics and monitoring (CDM) to secure end-to-end voice & data in mobile network infrastructure

[11] *The gaps associated with the RN threat were not prioritized by the SRC.*

Strengthen National Preparedness and Resilience (Incident Management): Encompassing incidents at the local, State, tribal, and Federal levels, incident management looks at events that can impact communities nationwide and how technology can assist those who respond. Homeland security affects all levels of government and all parts of a community. Key needs for incident management include technologies for the effective tracking of responders and law enforcement personnel in a variety of indoor settings.

Technological Capability Gap
Autonomous Indoor Navigation and Tracking of First Responders [Survivor-Centric Technology]

R&D Efforts to Develop Technology Solutions

The FY16-17 IPT process identified DHS R&D activities in two ways. First, S&T initiated a data call to all DHS components and offices (including DNDO and USCG) requesting information on ongoing or planned research and/or development activities. In addition, S&T compiled information on its own programs and projects through its internal Portfolio Analysis and Review (PAR) process. The information collected from these two sources informed the ***Report of Coordinated DHS R&D***.

The SRC met on November 17, 2016 to vote on the highest priority gaps from across the IPTs (see Table 1: High-Priority Gaps Resulting from the FY16-17 IPT Process). S&T then aligned identified R&D efforts to the high-priority gaps from the SRC, resulting in the ***High-Priority Technology Solutions*** document.

IV. IMPLEMENTATION: A DEPARTMENT-WIDE APPROACH

The IPT Process as an Annual Cycle

Consistent with the Secretary's guidance, the IPT process must provide a stable foundation for evolution and modification through subsequent cycles. Figure 3 illustrates the annual cycle culminating in an integrated IPT report.

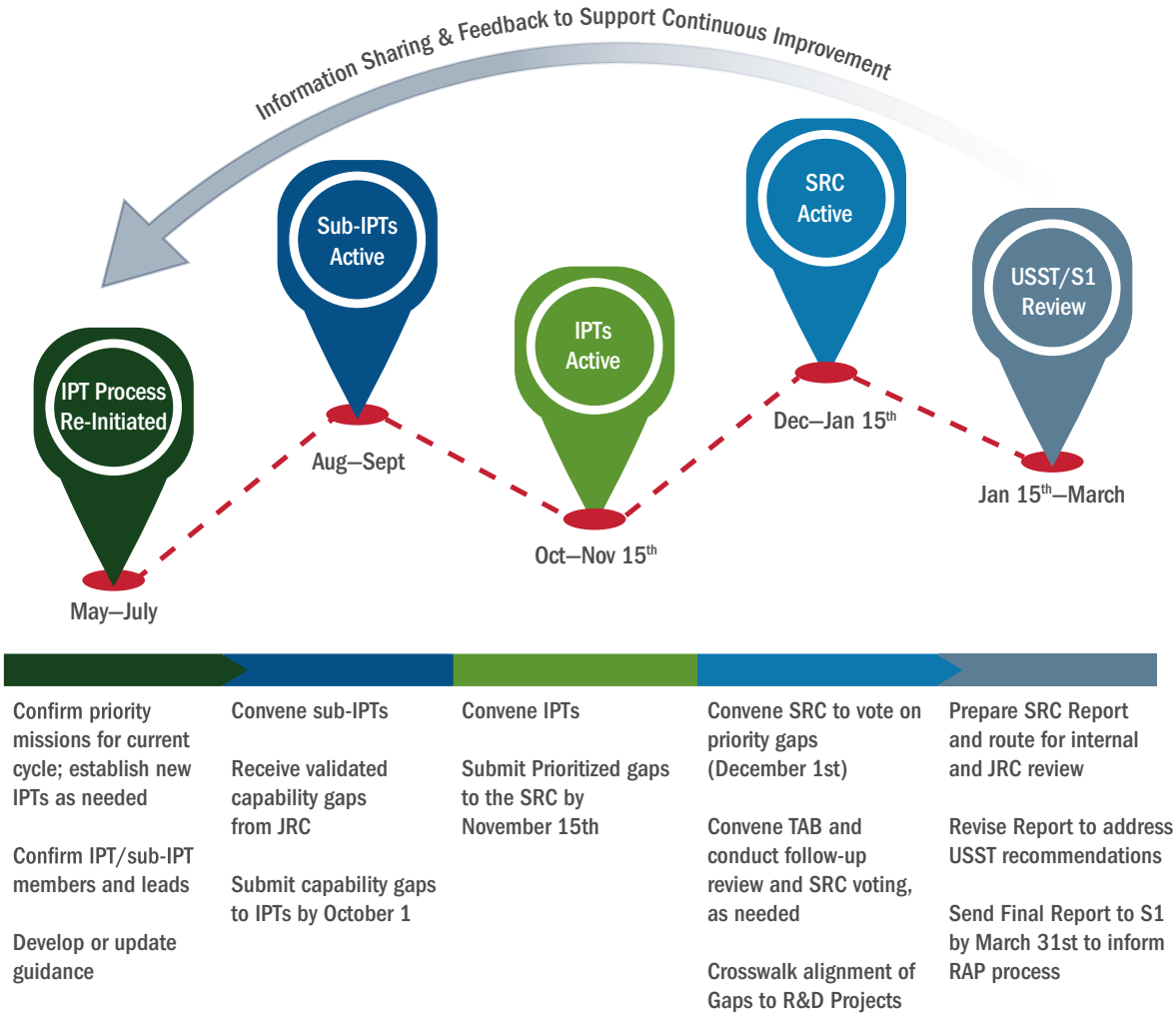


Figure 3: *IPT Annual Process*

It is important to note that the timeline depicted here reflects only the sub-IPT and IPT efforts that focus on developing final lists of high-priority gaps for consideration and ranking by the SRC for a given fiscal year. As described further below, the IPTs and sub-IPTs are free to meet throughout the year, as they deem necessary, to collaborate on identifying priority technological capability gaps within their mission areas.

Gap Lifecycle: From Needs Identification to Transition of Solutions

The IPT process is repeatable and flexible to support the ongoing maturation of DHS-wide R&D coordination. To realize the outcomes envisioned by the Secretary, the process must evolve into a year-round collaborative effort. Figure 4 illustrates the lifecycle of a technological capability gap. Some aspects of this lifecycle will take place during the initial year in which a gap is identified while other activities will occur in subsequent years. The following sections describe the four major phases of the gap lifecycle.

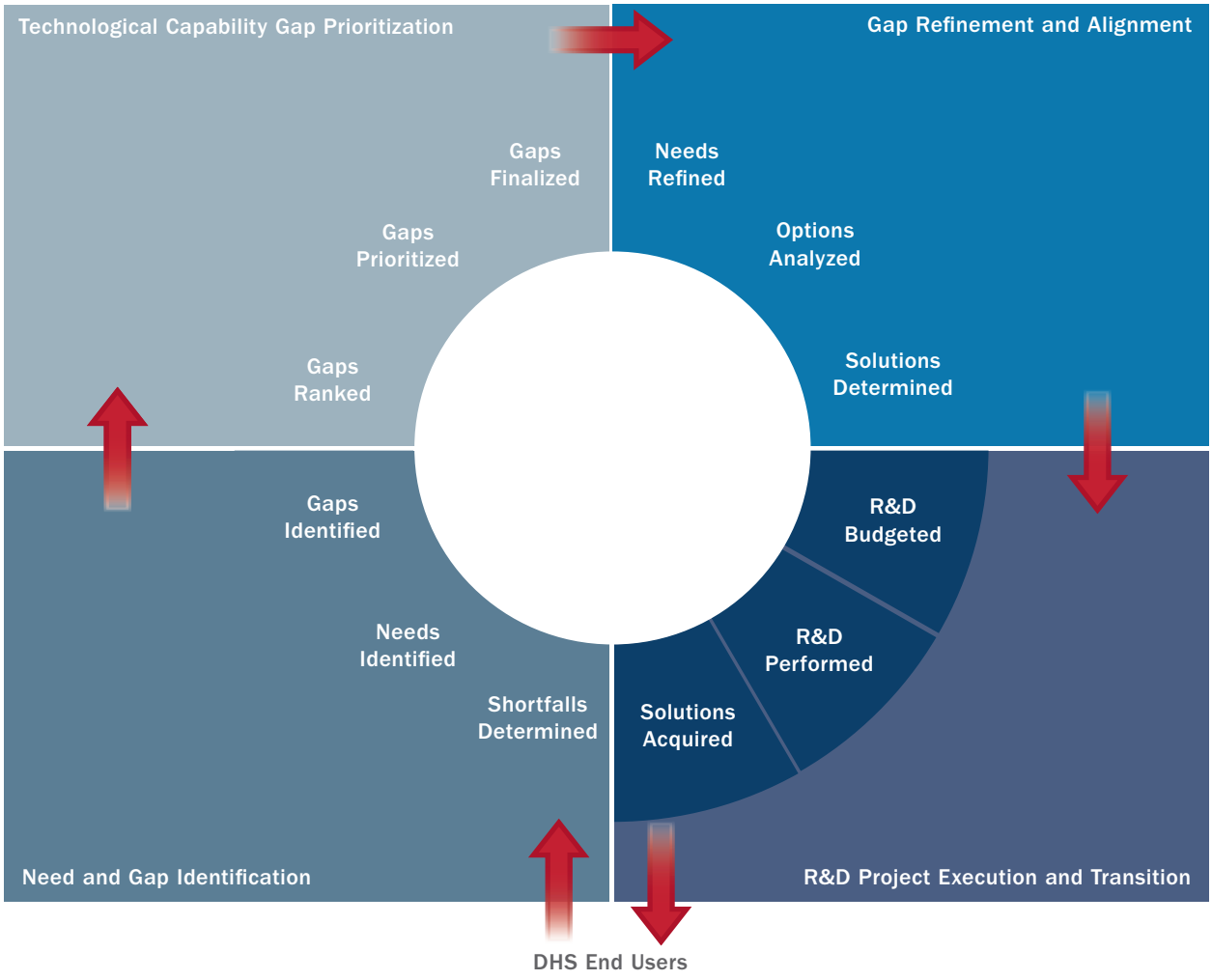
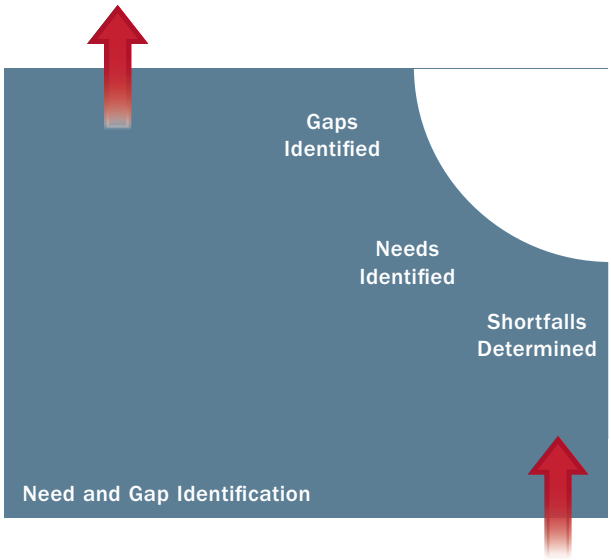


Figure 4: *Gap Lifecycle*

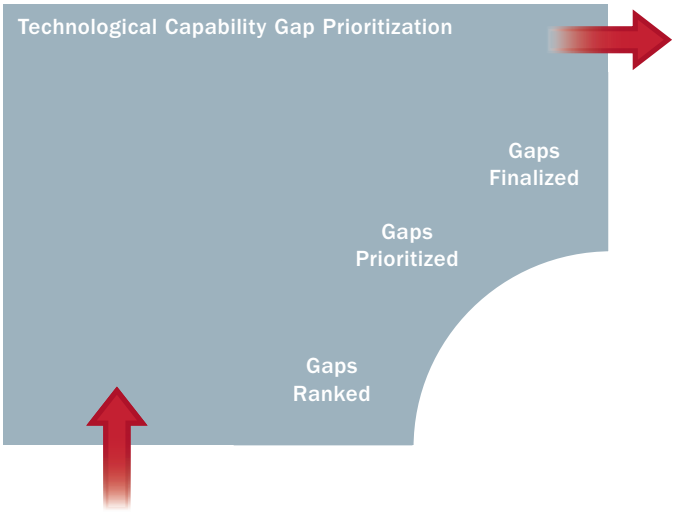
Need and Gap Identification

Prior to submitting a technological capability gap, the components conduct a review to verify that a capability shortfall exists (thereby identifying an operational capability gap). The components then evaluate the availability of a potential solution to close that gap. Component acquisition bodies attempt to acquire the desired solution and may determine that research and/or development is needed to fill the operational capability gap (thereby identifying a technological capability gap). It is through these internal processes that the operational components add gap data to the Gap Tracking Tool, which is subsequently presented to the sub-IPTs for consideration.



Technological Capability Gap Prioritization

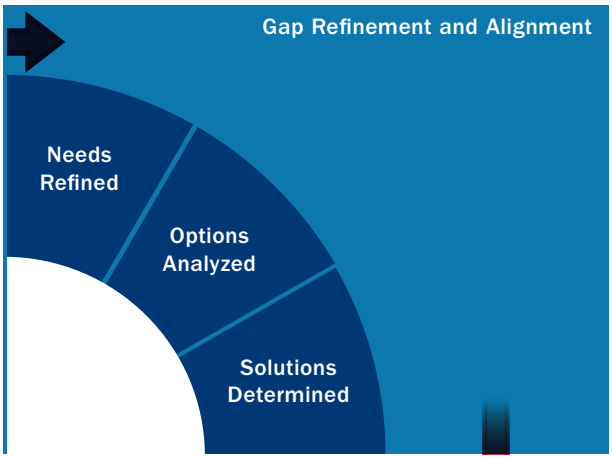
Sub-IPT and IPT Voting - Identification and Priority Ranking: IPTs are tasked with identifying technological capability gaps in need of research and/or development in their respective mission areas. The initial identification of gaps occurs at the sub-IPT level. To guide and structure the prioritization effort for the FY16-17 cycle, an Analytic Hierarchy Process (AHP) methodology was conducted through Decision Lens, an automated tool that provides a user-friendly application of AHP and the use of data analytics. The use of AHP for the prioritization of technological capability gaps at the sub-IPT, IPT, and SRC levels supports the comparison of gaps across the Department to determine the highest priority areas for R&D investment.



SRC Determination - Priority Ranking: The SRC performs the final priority ranking of gaps from all the IPTs. For the FY16-17 cycle, the SRC was able to leverage data cluster visualization and analysis to help support the "cut off" point for high-priority gaps. Specifically, the SRC reviewed data plots of clustered responses from the Decision Lens voting process described above. By identifying natural break points in these clusters, it is possible to define prioritization bins or cutoffs. Through this process, the SRC identified a total of 16 high-priority gaps in need of research and/or development across the FY16-17 IPTs.

Gap Refinement and Alignment

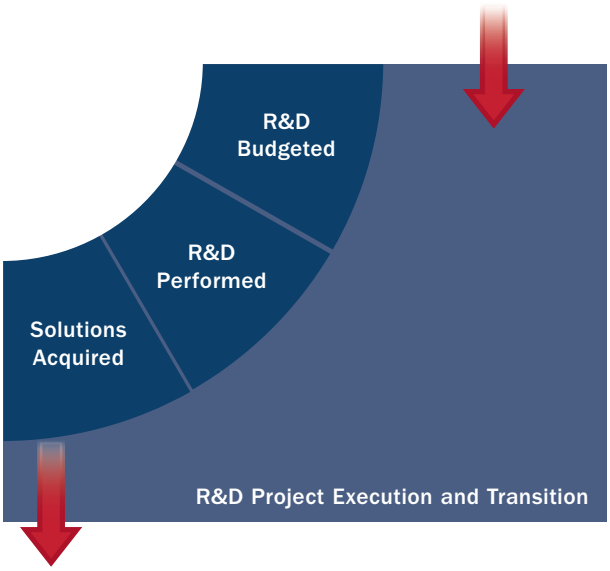
Refinement of Needs: When the SRC-prioritized gaps are approved by the Secretary, the IPTs will further refine the definition of the problem or need associated with their respective high-priority gaps to support technology scouting and market research to address the gaps.



Analysis of Options and Determination of Solutions: Once the needs associated with high-priority gaps are well defined, S&T conducts technology scouting to identify existing technology opportunities and market information that may support a gap. Analysts and gap SMEs then analyze the options for each gap and determine potential paths forward for addressing the gap.

R&D Project Execution and Transition

If the previous phase of the gap lifecycle reveals an existing solution to close a gap, that gap does not enter the final phase of the lifecycle. Conversely, gaps that require some level of solution development will be addressed by a new or ongoing R&D effort.



The desired outcome of the IPT process is to deliver a technology solution to the user community or back to the requesting component for deployment. This represents the final step in the Gap Lifecycle. There are several considerations that must be addressed for technology transition to occur successfully, including the following:

- The technology must reach a desired level of maturity;
- Proposed technical solutions must fill an existing technological capability gap; and
- Users must be able to deploy the technology.

Alignment of the IPT and JRC Processes

The IPT process and the JRC requirements generation process are distinct but mutually supportive processes. The IPT process provides a comprehensive profile of Department-wide R&D activities and tracks R&D investments

to improve the efficiency, effectiveness, and stewardship of R&D funds. The JRC process identifies emerging requirements to inform and oversee operational requirements across the Department. Both processes support component needs by identifying and prioritizing capability gaps to guide Department-wide investments. As such, the IPT and JRC teams work to establish appropriate linkages through operational engagement and process alignment. Typical juncture points include the following:

- JRC to IPT – The JRC may identify an operational capability gap that has potential technology solutions and an IPT will determine if the gap will be addressed through R&D efforts.
- IPT to JRC – An IPT may identify an operational capability gap in need of JRC review and validation.
- Technology Transition - If R&D results in a promising new capability, the technology may transition to industry for commercialization or to DHS acquisition for inclusion in its operational baseline.

Closing High-Priority Capability Gaps

The FY16 IPT Report described the DHS process for assessing high-priority gaps to inform the development and transition of solutions to close the gaps. This process leverages the gap decision framework shown in Figure 5. The framework requires extensive collaboration to ensure that all component equities are represented and that appropriate DHS programs are leveraged to support the longer-term objectives of the IPT process. Based on outputs from the decision framework, component and S&T representatives will coordinate with industry and other partners to review options and support an appropriate path forward to close priority gaps.

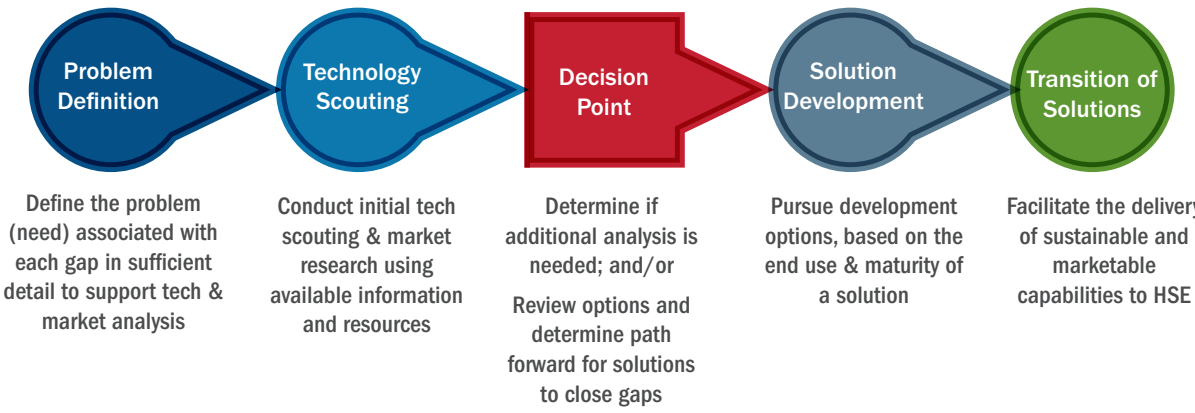


Figure 5: *IPT Gap Decision Framework*

As described earlier, to ensure continuity and progress in addressing the high-priority gaps identified from the FY16-17 cycle, the IPTs will evolve into standing, year-round entities charged with fully implementing the gap decision framework. In early 2017, the IPTs will define the mission needs associated with their respective high-priority gaps to support technology scouting and further analysis to address the gaps. An appropriate component representative will be designated as the "Gap Champion" responsible for tracking the progress and disposition of

each high-priority gap through the gap framework process (i.e., from needs definition to transition of solutions). The gap decision framework supports the last two phases of the Gap Lifecycle described on previous pages, i.e., Gap Refinement and Alignment, and R&D Project Execution and Transition.

The results of the technology scouting step will inform the development of a Gap Solution Profile, which will present options and support decisions on the best path forward for closing each capability gap. The IPTs will review the Gap Solution Profiles on a regular basis and recommend actions to assist in closing the gaps. S&T will compile quarterly status reports for SRC and JRC leadership to ensure ongoing progress in addressing high-priority gaps.

Technology Assessments and Acquisition Programs

In the 2015 memo establishing the IPTs, the Secretary directed S&T to conduct systems engineering reviews and technology assessments of the technical solutions in DHS major acquisition programs and provide a report to the Chief Acquisition Officer and Joint Requirements Council prior to the decision to enter the "obtain" phase of the Acquisition Life Cycle. The results of the IPT process can inform a DHS acquisition profile that aligns to the high-priority technological capability gaps across DHS mission areas. Technology assessments help to ensure the technical readiness and feasibility of solutions intended to address the high-priority gaps.

DHS S&T provides technical assessments on proposed and established Department R&D acquisition programs. A technical assessment is a combined system engineering review of an acquisition program and an assessment of the technologies that are necessary to realize the capability that the acquisition program intends to deliver. S&T has been conducting technical assessments of ongoing acquisition programs in FY16 and will conduct additional assessments in FY17 and beyond. In the future, where an assessment determines that major technical risk and/or overall program risk is high, follow-on technical assessments may be conducted during the acquisition cycle to monitor these risks.

Systems engineering technical assessments provide greater understanding of the technical maturity of solutions that DHS intends to acquire. The results of these assessments provide information on:

- The technical maturity of the planned technology(ies);
- Manufacturing capability;
- Technical risk;
- Potential opportunities to augment the program with new or additional capabilities; and
- Potential new gaps and/or R&D efforts.

Ensuring Continuous Improvement through Future Cycles

Through increased collaboration, IPTs will continue to focus on improving the identification and prioritization of technological capability gaps and identifying and reviewing R&D across DHS. IPTs will continue to advance the process by aligning with DHS priorities and synchronizing acquisition and budget considerations. The result of these actions will be a more transparent approach to R&D that includes engaging the private sector to develop technology solutions that address DHS priority needs.

In addition to the general improvements described above, the FY16-17 IPT process features the following specific improvements directed by the DMAG:

Comprehensive Gap Tracking Tool – By using the gap tracking tool to record information on gaps, the sub-IPTs and IPTs can meet acquisition, finance, and IPT requirements by aligning gaps to the DHS Enterprise as well as the core mission areas and JRC Portfolios.

Revised Prioritization Criteria – The standardized criteria developed by a cross-IPT working group ensure that a common prioritization approach is used at every level of the IPT process.

Expanded Component Representation – Senior officials from DNDO and USCG joined the leadership of the SRC.

Revised IPT Construct – The current construct aligns IPTs and sub-IPTs more closely to DHS core missions identified in the QHSR.

V. RESOURCE PLANNING

Mission-Driven Resource Planning

As components seek rationale and justification for their resource plans, the IPT Report can provide critical supporting information via the high-priority gaps (approved by the DHS Secretary) and their specific alignment to existing projects/programs and related funding requests. During the 'Planning' phase of the Planning, Programming, Budgeting, Execution (PPBE) process, the Office of Policy (PLCY) issues Resource Planning Guidance (RPG) to the Department. The Deputy Secretary also issues fiscal guidance (FG) to components with their top-line financial targets. These documents are used by components to guide the development of their respective Resource Allocation Plans during the Programming phase.

DHS components may complete Program Decision Options (PDO) to request funding for R&D projects based on transition data provided to the Secretary. These PDOs will comprise a portion of the RAP submission that the components submit in order to request funding. The IPT Report can be used in a similar capacity. Components can cite technological capability gaps listed in the IPT Report to strengthen operational justification for resource plans. Figure 6 illustrates how high-priority R&D gaps become integrated into the DHS PPBE system and inform the DHS budget request (known as the Office of Management and Budget Justification (OMBJ)), which ultimately provides a basis for the enacted budget from Congress.

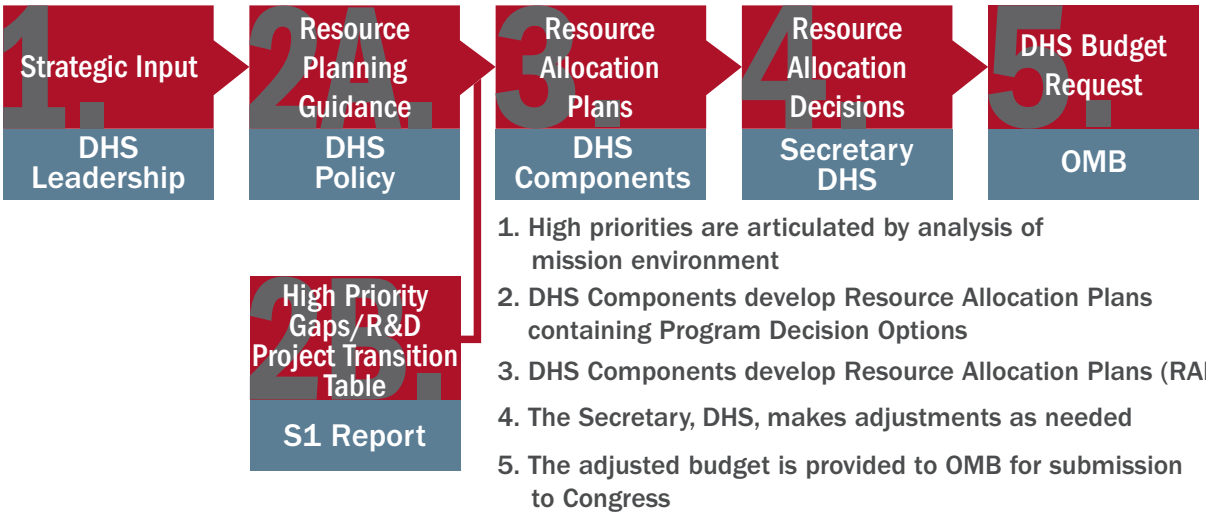


Figure 6: *Traceability of R&D Gaps to Resource Plans and Budgets*

Enhanced Identification and Classification of R&D for Budget Planning

This year's R&D data call resulted in more robust information from components. The Gap Tracking Tool included guidance that requested an explanation of each data field to facilitate more refined data collection. In addition to the general project data collected last year, the FY16-17 data call included fields for transition and funding metrics. Specific transition data included:

- Sponsor
- End User
- Transition Timeframe
- Transition Pathway

These data will eventually result in consolidated reports to summarize High-Priority Projects and the expected time frame for transition. These data categories helped to build a Department baseline for R&D projects that enable the DHS Chief Financial Officer (CFO) to make informed resourcing decisions . In addition to IPT efforts to better track and manage R&D, the IPT process will integrate with and complement the newly implemented Common Appropriations Structure (CAS).

When DHS was established, 22 agencies with over 70 different appropriations came together as a Department. The difference in accounting between components led to a lack of uniformity that impeded decision-making for the Department. In response to House Report 113-481 (2015)10, which stated that the "disparate legacy appropriation structure" hindered the "Department's ability to carry out mission planning, programming, budgeting, execution and performance in an integrated fashion," the DHS Office of the Chief Financial Officer (OCFO) developed the CAS.

The CAS is a budget framework that reduces the aforementioned 70+ different appropriations down to a common four appropriations and distinct fee appropriations. The four main appropriations are:

- Research and Development (R&D)
- Procurement, Construction, and Improvements (PC&I)
- Operations and Support (O&S)
- Federal Assistance (FA)

While the FY17 budget was submitted in both legacy and CAS structure, moving forward, the Department's R&D budget requests will be aligned to the R&D appropriation.

R&D Planning in the Future

As DHS continues to transition to and implement CAS, which is widely viewed as a complex multiyear effort , the IPT process will integrate and adapt to ensure that project descriptions provide the appropriate level of detail to properly categorize projects for resource planning. Eventually the IPTs will advance and mature their data enterprise approach to include data tagging within R&D project descriptions and categories. Such an effort will further clarify, streamline and automate reports across the DHS enterprise and will help to better align mission planning, programming, budgeting, execution, and performance measurement in an integrated fashion.

Mitigating Risk with the IPT Process

The IPT process is intended to guide Departmental R&D efforts, at the component level and across DHS, to ensure that needed capabilities are deployed; ongoing research across the government and private sector is shared and leveraged; and duplication of effort is minimized. The process seeks to ensure that the most critical priorities are addressed through R&D and to reduce the risk of DHS acquiring technology that does not meet mission needs. While not an exact science, the process enables the components and stakeholders to jointly determine current priorities across the Department and how they should be addressed with R&D dollars, regardless of existing technology solutions. The IPT process identifies R&D gaps and technologies to close those gaps and evaluates technology maturity throughout the acquisition lifecycle.

There are challenges inherent in this process, including the pressure between long-term R&D needs and the desire for quick solutions. R&D includes analysis of the potential of future solutions to meet mission gaps in the most effective and efficient manner in the long term. DHS components often seek to acquire technology that is well understood and available today, using R&D dollars, without being informed about the potential for future technology to provide a greater value in the long run. Components seek to spend R&D dollars on emerging needs, which may or may not be of the highest priority across the entire Department. In addition, the DHS budget cycles provide a challenge in that components must submit budget requests far in advance of R&D technology maturity, making it difficult to identify “current” R&D needs.

The IPT process addresses these complex issues. While labor-intensive, it results in reduced risk for DHS R&D investments. Activities include:

- **Resource-intensive identification and assessment of emerging technological gaps.** Participants from across DHS identify R&D priorities, determine solution spaces, and minimize duplication of effort. These efforts ensure that DHS R&D dollars are spent on the highest priority missions, as agreed to by the DHS components.
- **Development of a DHS risk landscape that accounts for all DHS stakeholder missions.** These efforts enable DHS to demonstrate that all R&D investments are made to address a homeland security challenge and reduce the risk that R&D dollars are used to purchase the latest “toy” to meet a tactical need rather than to address a long-term DHS mission.

- **Collaboration with the JRC** to ensure that resultant acquisition programs meet DHS requirements. These efforts ensure that multiple DHS stakeholders do not invest in the same or similar capabilities, thereby reducing the risk of duplicative R&D or acquisition programs within individual DHS components.
- **Situational awareness of all ongoing DHS R&D** to maintain persistent awareness of current and planned R&D, emerging trends, capabilities, and required R&D. These efforts ensure that duplicative investments are reduced or eliminated, while R&D dollars and programs are maximized, increasing the ability to reuse government dollars on critical R&D efforts.
- In the future, the IPT process will include **"Goal-based" portfolio optimization methods** to aid S&T and DHS leadership in making ongoing resource allocation decisions. This will further mitigate risk associated with R&D efforts by maintaining ongoing situational awareness that will provide early detection of failing R&D efforts. The IPT process will assist in reevaluating the R&D effort, come to agreement on corrective actions and timelines, and/or reexamine the likelihood of success, thereby increasing the ability to "fail early" and reducing the risk of long-term acquisition programs that do not deliver needed technology.

VI. THE IPTS IN SUMMARY: CURRENT AND NEXT GENERATION

Consistent with the Secretary's guidance, the DHS IPT process delivered results for the second consecutive year and provides a solid blueprint for future annual cycles. The IPT process will continue to evolve to incorporate needed improvements and to meet changing demands internal and external to DHS. Perhaps most important, the process supports Departmental unity of effort by facilitating cross-component collaboration, transparency, traceability, and accountability for DHS R&D activities.

VII. ACRONYM LIST

AHP	Analytic Hierarchy Process
CAS	Common Appropriations Structure
CBP	DHS Customs and Border Protection
CB/RN	Chemical, Biological, Radiological, Nuclear
CDM	Continuous Diagnostics and Monitoring
CRCL	DHS Office of Civil Rights and Civil Liberties
DMAG	DHS Deputies Management Action Group
DHS	U.S. Department of Homeland Security
S&T	DHS Science & Technology Directorate
DNDO	DHS Domestic Nuclear Detection Office
DoD	U.S. Department of Defense
DOJ	U.S. Department of Justice
DOT	U.S. Department of Transportation
ETD	Explosive Trace Detection
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
FG	Fiscal Guidance
FRRG	First Responder Resource Group
GAO	Government Accountability Office
HHS	U.S. Department of Health and Human Services
HSE	Homeland Security Enterprise
I&A	DHS Office of Intelligence and Analysis
I&A / ISSE Staff	Intelligence and Analysis / Information Sharing and Safeguarding Executive Staff
ICE	DHS Immigration and Customs Enforcement
IPT	Integrated Product Team
JRC	DHS Joint Requirements Council
MGMT/OCIO	DHS Directorate for Management / Office of the Chief Information Officer
NASA	National Aeronautics and Space Administration

NCTC	National Counterterrorism Center
NPPD	DHS National Protection and Programs Directorate
OCFO	Office of the Chief Financial Officer of DHS
OCHCO	Office of the Chief Human Capital Officer of DHS
OGC	DHS Office of General Counsel
OHA	DHS Office of Health Affairs
OMBJ	Office of Management and Budget Justification
OPS	DHS Office of Operations Coordination and Planning
PAR	Portfolio Analysis and Review
PC&I	Procurement, Construction and Improvements
PLCY	DHS Office of Policy
PPBE	Planning, Programming, Budgeting, and Execution
QHSR	Quadrennial Homeland Security Review
RPG	Resource Planning Guidance
SRC	Science and Technology Research Council
TAB	Technical Advisory Board
TATP	Triacetone Triperoxide
TSA	Transportation Security Administration
USCG	United States Coast Guard
USCIS	United States Citizenship and Immigration Services
USPIS	United States Postal Inspection Service
USSS	United States Secret Service
WHTF on CVE	White House Task Force on Countering Violent Extremism