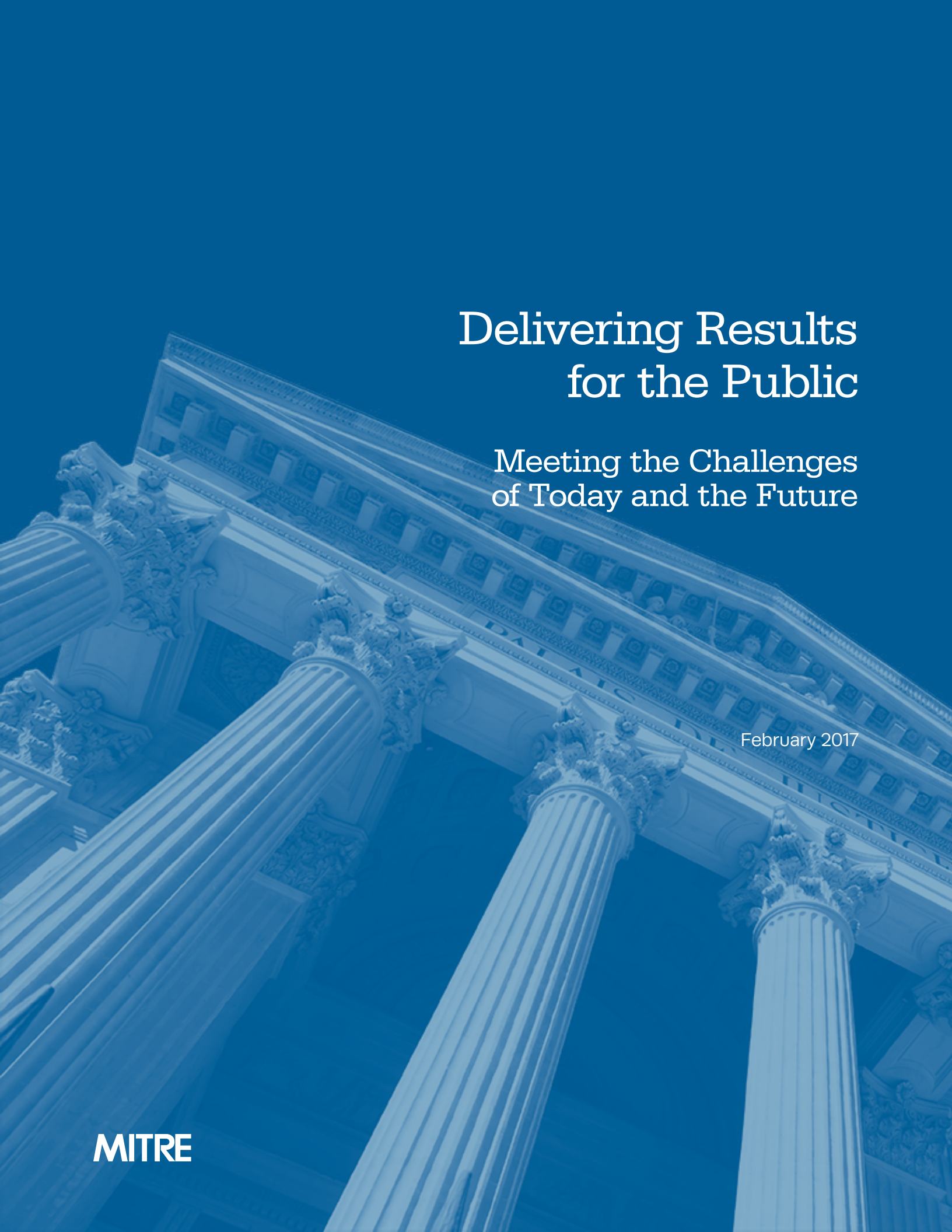

Delivering Results for the Public

Meeting the Challenges of Today and the Future

February 2017

MITRE

The peaceful transfer of power from one administration to the next has long been cited as a hallmark of our democratic system of government.

Transitions present challenges and uncertainties for the incoming leadership team, civil service employees, the public, and other organizations both here and abroad. But transitions also present tremendous opportunities—new ideas and perspectives can create breakthroughs that solve long-standing problems or deliver new levels of benefit. Incoming leaders eagerly look to drive change and deliver meaningful results that promote the priorities of the new administration. Career civil service employees are focused on responding to new directions by providing the benefit of their knowledge and experience to enable agency success.

Each incoming administration has a set of policy priorities and actions designed to deliver on campaign promises. Our experience shows that success depends on the speed with which new leadership can:

1. Understand the current state
2. Understand the range of possibilities
3. Assess what's possible
4. Develop informed roadmaps to rapid, effective implementation

The papers in this collection were selected for their relevance to major issues facing our government. They reflect our insights, practical experiences, and independent research on options for addressing key challenges and opportunities that our government leaders will encounter. A few papers relate directly to specific policy priorities. Most describe enablers that, if applied properly, can accelerate progress and deliver better results for the public. All these papers provide ideas and information that can be used to expedite impact.

At this period in our history, the public's sense of urgency and its level of expectations is significant—its demand for results and its lack of tolerance for bureaucracy is palpable. At the same time, the challenges and barriers to success are significant. We believe that the insights and ideas we share herein will be useful to the administration and Congress as they consider the range of possibilities and the "art of the possible" for delivering results for the public. As a company chartered to operate in the public interest, The MITRE Corporation offers this collection in that spirit. We are honored to continue to have the opportunity to assist administration and agency leadership to move forward with speed and agility.

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Today's complex and turbulent environment presents many profound challenges to our government and the public that it serves. With the world changing rapidly, it's clear that providing for the safety, security, and prosperity of the American people calls for new ways of thinking and new ways of operating. Creating public–private partnerships, investing in innovation, streamlining processes, and building networks are popular approaches that have gained widespread adoption. The MITRE Corporation sees five management priorities that require attention and will likely determine the success of our government now and into the future. These management priorities are *(a) Creating the Future, (b) Accelerating Acquisition of New Capabilities, (c) Protecting Our Information Assets, (d) Defending the Nation,* and *(e) Delivering Mission Results.*

Each of these priorities is represented by a section in this collection, and each section contains a set of papers that address key issues, new ideas, and opportunities for change. Note that all these papers provide information derived from more detailed analysis and experience. Our intent is to present an overview of the challenge and the key aspects of our recommended strategies and solutions. More detail can and will be provided upon request.

After a brief introduction, each paper consists of three parts. The first part is a case for action—a description that highlights the urgency of confronting a particular issue and of pursuing a solution during the early years of the new administration. The second part assists with understanding the problem that the issue causes by placing it in context—how the problem affects the mission, the extent to which it may be amenable to technological versus organizational change, efforts that have already been made or are currently being made to address it, or the perception of the state of the problem by oversight bodies. The third part suggests opportunities to address the issue effectively in the form of recommendations that, taken singly or in combination, can constitute a path toward remediation or change that can show positive results in a reasonable timeframe.

Creating breakthroughs requires new ideas or novel approaches, and new ideas and novel approaches require new thinking. In ***Creating the Future,*** we present a series of papers that focus on how to foster and harness innovation and technology to drive breakthrough results. This includes rebuilding the nation's investment in research and development, fostered by flexibility, agility, and vision more common in the private sector but hindered by the government appropriations process. We also address the need for more technology transfer to take greater advantage of the federal investment in research.

Of course, getting access to available solutions quickly, both to prepare for future needs and to respond to immediate issues and challenges, is the purview of the acquisition process. In ***Accelerating Acquisition of New Capabilities,*** we present several papers that address new models for acquisition that apply techniques to streamline the process, create speed and agility, and reduce overhead while meeting the intent behind federal acquisition laws.

Increasingly, new capabilities acquired to drive breakthrough change rely on technology and sensitive data about individuals and organizations. But while our digital world creates many new benefits, it also exposes us to new threats. In ***Protecting Our Information Assets,*** we present papers that focus on cybersecurity. These papers tackle ideas on prevention of attacks and resilience of the mission to mitigate the adverse impact of attacks. This is a critical issue on which public and private entities must work together to rapidly improve our posture.

While cyberspace may be the new battlefield, our physical borders also face new threats and challenges. In fact, they now extend into space. In ***Defending the Nation,*** we present a set of papers that address a new look at nuclear deterrence, countering the threat to our space systems, and, closer to home, transforming our ability to rapidly identify persons of interest from across a diverse set of systems and identity records.

Finally, the fundamental services that our government provides face challenges as well. Concerns about healthcare and benefits for veterans demand attention. Limitations on the government's ability to consistently deliver financial benefits to those who deserve them, and to successfully prevent fraud, waste, and abuse, have affected the public confidence and created a financial hardship for individuals and the government as well. In ***Delivering Mission Results,*** we present a select set of papers that address approaches to make significant progress on the ability to perform mission responsibilities and deliver a better result for the public.

We could have addressed many more specific issues, challenges, and opportunities in each of these priority areas. We selected the ones we did for their relevance and importance, and because we believe that addressing them with the ideas we have raised will provide a firm footing for those engaged in implementation efforts.

Creating the Future

Innovative thinking drives effective change, and innovative technology helps give that change shape. This section highlights key opportunities within the nation's science and technology ecosystem that can help incoming appointees succeed in creating desired results. The papers cover enabling change, leveraging and shaping innovation within the private sector, meeting priority goals through collaboration among government agencies, developing and justifying budgets for federal research programs, managing the execution and readiness of innovative technology projects, developing and using acquisition modalities that promote innovation, and using technology transfer to maximize the benefits of federal research.

A Change-Enabler and Foundation for America's Future

Each incoming administration faces a plethora of campaign promises and still-unknown challenges in national and homeland security, law enforcement, healthcare, and benefits management. While refocusing and executive action will address some challenges, most will require a more sustained effort that mixes new policies, capabilities, and cultural changes. Stimulating and coordinating the nation's technological innovation community is likely a critical component of the Trump administration's plan. The papers in this section highlight key science and technology (S&T) ecosystem opportunities that will help incoming appointees succeed.

A Case for Action

The United States is an innovative nation. American ingenuity birthed airplanes, the assembly line, mobile phones, microwave ovens, air conditioning—even masking tape. Thousands of innovations such as these are the foundation for our nation's economic growth, provide safety and security to our citizens, and help address our global priorities.

The federal government is the primary sponsor of basic research, which provides the groundwork for future innovation. Over the past fifty years, every U.S. president has invested considerable time and effort shepherding our complex yet incredibly fruitful "innovation nation." Vannevar Bush's seminal 1945 report to President Truman, *Science: The Endless Frontier,* identifies principles that the federal government must advance and respect for our S&T communities to meet the nation's future needs. These principles include the stability of long-term funding, research grants to independent institutions, and pursuit of projects consistent with agency missions.

Now, the United States' dominance in innovation is at risk as other countries recognize innovation's role in creating and maintaining our global preeminence. China and Japan have aggressively raised their standing through investments and pro-innovation policies, and are now innovating at roughly the same order of magnitude as the United States. And America's narrowing pipeline of science, technology, engineering, and math students is constricting our future innovation.

> **"More than four dozen countries have now created national innovation strategies and/or launched national innovation foundations."**
>
> –INFORMATION TECHNOLOGY & INNOVATION FOUNDATION, NOVEMBER 2016

Understanding the Problem

Given the importance of technological innovation to the nation's future, and its role in meeting President-elect Trump's priorities, the incoming administration will need its own S&T innovation strategy. The strategy must balance multiple aspects, such as:

- Encouraging current innovation while also strengthening the foundation for future innovation

- Addressing big-picture issues while also focusing on specific strategically important opportunities
- Accelerating innovation as much as possible while also enacting policies that protect and encourage implementation of concepts that haven't yet been imagined

The federal S&T budget is sizeable and generates many positive advancements. More can be done to maximize national benefits from these investments, however, and the incoming administration will also be able to refocus these activities to support their priorities. At the same time, federal S&T investments are but a small percentage of the overall national innovation ecosystem. The Trump administration may want to better leverage and shape the investments that address these issues and more rapidly integrate their successful outcomes into federal applications.

Areas of Opportunity for the New Administration and Agency Leaders

A presidential administration has a variety of means to support technological innovation. These include allocating funds, developing policies and/or challenge competitions that drive private-sector activities in a strategic direction, representing U.S. interests on the world stage, and serving as a champion for critically important functional areas and S&T topics. Following are additional papers within this technology innovation series:

- **Leveraging and Shaping Private Sector Innovation:** Given that federal S&T investments are a small part of the national "innovation ecosystem," how can the government better leverage what it doesn't control?
- **Interagency S&T Collaboration:** Interagency collaboration is the Trump administration's best chance of meeting its technological innovation goals, even though such collaboration is not the normal practice of the federal government.
- **Defensible Research Development Test & Evaluation Programs:** The federal process for developing programs and budgets doesn't guarantee that the programs will be successful. By instituting a "defensible" culture, the Trump administration can achieve more from its investments.
- **Managing Research Efforts:** Moving beyond cost and schedule to a multi-dimensional framework can help ensure both innovation and transition.
- **Planning Challenge-Based Acquisitions:** Even well-executed acquisition programs can produce a single product that doesn't meet mission needs. An alternative approach exists to better incentivize innovation and deliver successful outcomes rather than polished proposals.
- **Technology Transfer:** The U.S. government invests a significant amount of funding toward innovation, too much of which ends up sitting on the shelf. An increased emphasis on technology transfer can rapidly stimulate innovation throughout the nation, thus supporting a number of administration priorities.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Leveraging and Shaping Private Sector Innovation

The federal science and technology (S&T) budget is sizeable, but the majority of the national investment is by the private sector. This is both a challenge and an opportunity for the incoming Trump administration: How can the federal government gently influence the direction of private investments to support national needs? How can federal agencies better leverage private-sector innovations to meet current and future goals?

Current Investment Picture

Throughout its history, the United States has relied on innovation to solve its toughest problems and set up future successes. While most innovation occurs in the private sector, government plays a significant role in fostering innovation as an acquirer, user, and regulator of new technology. The next presidential administration will need a broad understanding of the innovation ecosystem outside of government and the support of the new federal agency leadership to enact plans that enable our nation to both cultivate and tap into private-sector innovation, so that we continue to enjoy our predominant economic and strategic position on the competitive world stage.

R&D Magazine forecasts that U.S. innovation investment will reach $514 billion in 2016. Industry remains the leading investor (66 percent) and performer (72 percent) of overall U.S. R&D, with the federal government a distant second at 25 percent and 13 percent respectively (when including federally funded research and development centers).

Internationally, the United States is the top country in R&D spending, representing 26.4 percent of the global investment. However, China plans to increase its R&D investment and could replace the United States as the top R&D spender and world innovator by 2022. Other major nations, such as Japan, Germany, the U.K., and Russia, are also ramping up their innovation investment.

> **"From the advances that put a computer on every desk to the discoveries that led to lifesaving vaccines, major innovations are the result of both government investments in basic research and the private-sector creativity and investments that turn them into transformative products... The public sector's investments unlock the private sector's ingenuity."**
>
> –BILL GATES, "ACCELERATING INNOVATION WITH LEADERSHIP," OCTOBER 2016

Understanding the Problem

Federal R&D investments are an increasingly critical component in seeding and growing the nation's innovation ecosystem. That's because the private sector is focusing its R&D spending on later stage development and return on investment, while significantly decreasing its investments in early-stage applied research. According to the Information Technology & Innovation Foundation, private-sector firms "don't fund basic research because it is high risk—it doesn't readily translate into products in the short term. Firms are simply financially unable to

address foundational research problems; research addressing basic and broad research questions lies outside the scope of most private investment."

Without federal investment in these critical research categories, the pipeline of new discoveries that enable later stage development would dry up, and American innovation would suffer. Fifty-six percent of our early-stage research takes place at America's research universities—and the majority of that is federally funded. Universities perform another important role in the national innovation ecosystem by training the nation's future innovators.

The federal government has traditionally influenced external innovation through its acquisitions and by highlighting for industry its continuing needs. However, these are slow-moving activities, with benefits realized months or even years after initial actions. Accordingly, federal agencies are taking new initiatives to quicken the pace of innovation adoption. For example, some agencies are sponsoring challenges and prize competitions. In another example, DoD and DHS have established offices in Silicon Valley to develop deep public-private partnerships, particularly in the field of cybersecurity.

Areas of Opportunity for the New Administration and Agency Leaders

To increase engagement of federal agencies with private-sector innovators and to influence innovation coming out of that sector, the incoming administration could consider the following ideas as priorities for action within the first year:

- Direct the National Science Foundation to lead an effort by government, industry, and academia to measure the effectiveness of early-stage research strategies. This is an inherently difficult task, as basic, early-stage research doesn't often lead to measurable impacts, and sometimes research "failures" can result in important discoveries. Nonetheless, a better understanding of the impacts of the nation's research strategies and investments will lead to better strategies in the future.
- The Office of Science and Technology Policy could lead a public-private effort to fully understand the national innovation landscapes for our most strategically important activities and publish this information so that the affected communities can benefit from it.
- Implement stable and effective policies, practices, and funding in support of basic research performed by universities and of graduate education, as recommended by the National Academies of Science.
- Work with OMB not only to roll back limitations on federal employee participation in conferences, but also to encourage employees to participate in conferences that increase their awareness and understanding of external innovation activities. OMB Memorandum M-12-12 has reduced federal knowledge of external activities and limited opportunities for private-public partnerships that could have resulted in new capabilities and cost savings.
- Encourage agencies and their staffs to implement a culture change that moves them away from focusing almost entirely on managing in-house innovation activities in isolation. Agencies instead should devote more effort to understanding and leveraging external innovations so that they can focus their own R&D efforts on closing remaining gaps.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

A Must to Meet Priority Goals

GPS. The Internet. Port screening devices. Breakthrough innovation often occurs when one federal agency builds on the work of another. Yet chances for these types of breakthroughs are frequently missed because the importance of developing and leading interagency science and technology (S&T) teams is often overlooked. By promoting information sharing and broader adoption while minimizing duplication of effort, these groups can be the Trump administration's best chance of successfully meeting its technological innovation goals.

A Case for Action

Even though "all science is interdisciplinary" (Paul Lauterbur's 2003 Nobel Lecture), federal S&T efforts are often planned and managed in isolated stovepipes. This isolation is further magnified within oversight bodies in the White House and Congress, which also focus on an agency-specific basis. While a relatively small number of high-priority cases are coordinated by the National Science and Technology Council (NSTC), the vast majority of federal research managers aren't expected, or even encouraged, to work with their peers in other agencies.

This stovepiped approach may be understandable for most federal activities. However, it runs contrary to typical scientific evolution, where current discoveries serve as the foundation for future research. For example, it is generally known that today's ubiquitous GPS was originally created by the DoD. Early attempts failed because the individual satellites could not keep accurate time, a problem solved by switching to NIST-developed atomic clocks. Today's Internet similarly originated within the DoD as an internal network. It did not truly take off until the NSF used the concepts to connect five university-based supercomputer centers, which quickly grew to nearly a hundred within a year. Finally, the technology behind the TSA's screening devices at airports would not have been possible without a DoD-Treasury partnership to develop a means to screen incoming shipping containers for smuggled drugs.

> **"The most impactful interagency S&T groups are those where its individual members view the success of the group as a critical step for their own agency's success. That level of buy-in creates significant opportunities, and should be a fundamental goal for anyone leading interagency initiatives."**
>
> –DUANE BLACKBURN, FORMER OSTP ASSISTANT DIRECTOR

The majority of the S&T spectrum is either application-agnostic or would benefit from cross-domain (i.e., cross-agency) collaboration. This is easily understood for basic and applied research, but applies to advanced development and standards more often than most realize. For example, a decade ago multiple federal agencies were independently developing fingerprint sensor requirements for

their operational systems. They shifted gears and developed a single specification that met everyone's needs. This resulted in industry being able to provide devices with greater functionality at less cost. Today, the military and intelligence communities are developing intelligence, surveillance, and reconnaissance capabilities that could also benefit a wide range of other activities, such as climate change analysis, crop maximization, and rural planning.

Understanding the Problem

Each federal agency has its own statutory authority, work culture, reporting chain, and oversight bodies within the White House and Congress, and no single directive or reorganization can overcome these silos. An interagency team, however, can create connections and spark collaboration between the silos, thus achieving the desired end state. Formal coordination through the NSTC is absolutely required for the federal research community to be able to meet President-elect Trump's priority innovation needs. Informal coordination is simply a good business practice that the administration should encourage because the resultant benefits will outweigh the cost of the investments—both for individual agencies and for the federal government as a whole.

Interagency leaders must grasp that their true hammer is their influence rather than their authority. Even in the rare cases when the President establishes an interagency group and tasks someone to lead it, the other members of the team still report to their agencies and not to the interagency lead. They have supervisors who are expecting them to represent their agency and its interests, not to be a conduit for interagency demands. Interagency leaders must convince these individuals that the interagency-developed path is the best approach for their agencies as well, and should use their influence over the group's meetings and deliberations to reach this goal.

Areas of Opportunity for the New Administration and Agency Leaders

In recognizing that science and technology innovation often requires interagency collaboration, the incoming administration should consider the following ideas:

- **Strategically prioritize interagency leadership.** Identify areas where technological innovation is critical and foster collaborative efforts. For the past three administrations, this has been managed by the NSTC with varying degrees of success. To achieve its primary objectives, the Trump administration should continue using the NSTC or establish an alternative NSTC-like function.
- **Encourage interagency collaboration at all levels within the Executive Branch.** Many innovation topics don't rise to a sufficient level of priority to warrant NSTC attention, but would still benefit from interagency collaboration. Incoming agency leadership should establish an expectation that their staff will exchange information and collaborate with their peers in other agencies on a regular basis.
- **Celebrate interagency advancements.** Individuals and research programs that break through their silos and achieve success should be identified and celebrated as exemplars for the remainder of the federal research community to follow.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Building a Defensible RDT&E Program

Individual federal research programs often get lost "in the weeds" of agency summaries and budget requests, and thus don't receive attention from agency and department management or oversight from the Executive Office of the President. As a result, there is little systematic pressure to ensure that programs support broader goals or maximize the results of their research. The Trump administration can shake up this culture by encouraging managers to take a broader perspective on strategic alignment, external coordination, and knowledge dissemination—making their programs more "defensible." Doing so will not only provide greater benefits to the nation, but will also expand the impact of each individual program.

A Case for Action

Developing and justifying research budgets within the federal government is vastly different than in the private sector. There is no profit motive, no shareholders comparing returns on investments in research groups with returns on investments in advertising. Instead, there is a massively complex budget development process in which research allocations are discussed at levels well above individual programs, and oversight and management are often disconnected from the budget process. Individual agencies (and even subcomponents within these agencies) may have their own expectations of the extent to which their programs need to be defensible. Individual program managers have widely divergent viewpoints, ranging from "it's good practice to do it anyway" to "it's not a valuable use of my time."

The Trump administration can direct its incoming agency leadership to encourage solid strategic planning and management of its research programs by ensuring that each program is defensible. Doing so will maximize the benefits of federal research investments, minimize duplication, and accelerate advancement while requiring only modest additions to program management budget lines.

A defensible federal research, development, test, and evaluation (RDT&E) program is one that is closely aligned with national-level policies and agency priorities, has solid technical and project management plans, and strategically leverages external activities as much as possible.

> **"One of our Committee's most important responsibilities is to ensure that federal science agencies spend taxpayer dollars as effectively and efficiently as possible. Every dollar wasted on mismanagement is a dollar that could be spent on groundbreaking basic research or training future scientists."**
>
> –BARBARA COMSTOCK, HOUSE RESEARCH & TECHNOLOGY SUBCOMMITTEE CHAIRWOMAN, FEBRUARY 2016

Understanding the Problem

Development of the federal science and technology budget is a complex process spanning many years and two branches of government. Any federal leader must understand the primary steps and influences affecting budget decisions to be able to plan strategically and direct an agency's internal activities and external interactions.

No federal RDT&E program exists in isolation. Each provides a service to someone, uses someone else's funds, and collaborates with external entities. Determining which entities have influence over a particular program and identifying the pressures they exert in decision making is critical to the RDT&E planning process. These entities include:

- Stakeholders, such as parent departments, the White House, and Congress, who provide direction, resources, and oversight
- Customers, such as members of the scientific community and field users, who adopt and build on the results of the RDT&E program activities
- Partners, such as other federal agencies, academia, and the private sector, whose research and know-how should be leveraged (rather than duplicated)

In the private sector, the roles of stakeholder and customer are clearly defined. Stakeholders are company investors, shareholders, and board members. Customers are the people who purchase and use the product or service. There is no such demarcation in the federal government, where stakeholders and customers are often one and the same. For example, an operational unit may use the RDT&E program's technologies, which makes it a customer. But it may also play a role in developing the RDT&E agency's strategy and budget, which also makes it a stakeholder.

In most RDT&E strategic planning activities, there is no clear beginning or end to the process. Since the pace of innovation is much faster than the three-year federal budget cycle, program managers must strike the right balance between embracing new discoveries and managing federal accountability. They must conduct ongoing assessments of capability gaps and future activities and adjust accordingly.

Areas of Opportunity for the New Administration and Agency Leaders

Incoming agency technology innovation leaders will likely find themselves knee-deep in budget planning and justification upon taking office. (As the government is still operating under a Continuing Resolution, FY17 budgets aren't final. The FY18 budget request will be submitted in February 2017, and some agencies are already developing budgets for FY19.) They'll need to quickly master the macro-level processes at work in the development of the President's budget request and establish relationships with their stakeholders. They'll need to understand their agency's existing priorities and plans, as well as the processes used to develop them—including gaps in the defensible process described above. These immediate, time-critical tasks are opportunities to set expectations for future budget cycles and to understand the agency's current culture—both of which are key steps in ensuring a defensible planning process. In the longer term, the Office of Science and Technology Policy and OMB can further reinforce a defensible RDT&E culture by analyzing some of the individual research programs in the budget development process (to push agencies toward compliance) and by highlighting individual program successes (to encourage individual action).

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Beyond Cost and Schedule

Federal management of research, development, test, and evaluation (RDT&E) projects predominantly focuses on tracking budget and timelines. While important, these two measures are insufficient for ensuring the successful completion and transition of research gains into follow-on operational usage. A multi-dimensional framework that manages the execution and technical readiness of a project, as well as customer commitment, is required to ensure a project's ultimate success.

A Case for Action

Providing management oversight on RDT&E projects is difficult, especially within the federal government. Project activity is usually cutting-edge and executed by individuals with deep and specialized technical knowledge. Federal program managers, while technically gifted, are often generalists in nature and have to understand a variety of different technology issues at a moderate depth. This reality, combined with the complex federal budget process, often leads these managers to focus on budget and timeline advancement as the primary metrics when tracking the progress of their projects. Absent a systematic approach to easily track technical progress and customer engagement, projects can often be considered "successful" even if they don't actually meet development and/or transition targets.

Understanding the Problem

The concept of "Technology Readiness Levels" (TRLs), which provide a common language for describing and quantifying a technology's maturity and its readiness for integration into larger systems, has been gaining popularity within the DoD, numerous other federal agencies, and the private sector. Even the GAO's August 2016 *Technology Readiness Assessment Guide* relies heavily on the TRL concept.

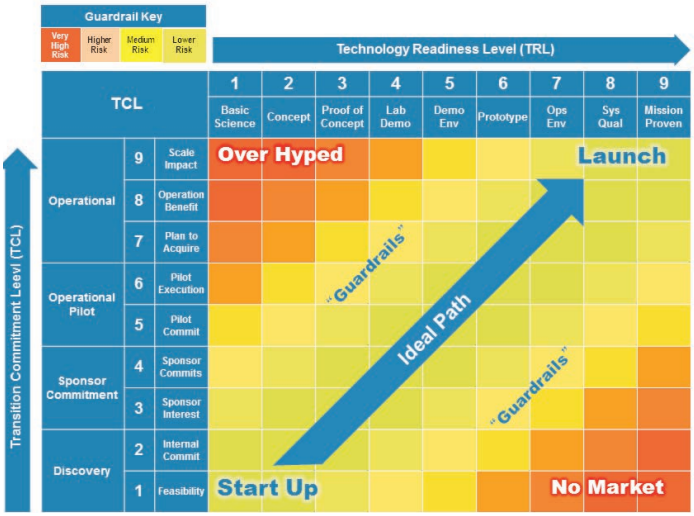
While definitely beneficial, TRLs don't account for the other half of the necessary framework: customer commitment. Without actively managing this aspect of research, even projects that are strong technical successes will often do little more than take up space on a shelf. To overcome this gap, MITRE has been developing a new concept, "Transition Commitment Levels" (TCLs), to help measure a customer's commitment maturity and risk, in much the same way that TRLs measure technology maturity and risk.

Comparing TRL and TCL levels within an individual project can provide a quick and easily understood assessment of a project's standing; plotting multiple TRL-TCL assessments will provide the same type of insight for multiple-project programs.

Stage	TCL Descriptions	TCL
Internal Discovery and Enterprise Commitment	Internal program/R&D commitment	1
	Internal portfolio commitment	2
External Sponsor/ Customer Commitment	Sponsor/customer interaction and awareness	3
	Sponsor/customer commitment and active support	4
Operational Pilot	Sponsor/customer commitment to pilot	5
	Sponsor/customer execution of operational pilot	6
Operational	Sponsor/customer commitment to acquisition	7
	Mission impact realized	8
	Impact scaled out	9

This framework also introduces the concept of "guardrails" that can be applied to projects or programs to help management balance investment in maturing the technology against the effort required to develop commitment through sponsor engagement. Projects within the guardrails are at higher risk of failure, and their future plans will need to be assessed and likely adjusted.

The TRL/TCL framework integrates both the technical and transitional aspects of a project, drawing attention to all the components needed for successful transformational innovation and providing a well-defined, optimal path to completion. Projects that deviate substantially from this path may require further scrutiny and evaluation.



The use of this framework has already been instrumental in a project to develop low-cost surface awareness for small-to-medium U.S. airports, where existing solutions for larger airports were cost-prohibitive. The FAA and MITRE undertook an R&D effort to develop a new concept that described airport runways as a series of connected blocks and used sensors and analytics to provide situational awareness of airplane traffic on the ground. What originated as an initial lab idea (TRL 1 and TCL 1) evolved into an operational assessment at Teterboro airport in N.J. that led to a plan to transition into regular operations (TRL 7 and TCL 7). Throughout the project, TRLs and TCLs were regularly measured to ensure that proper progression was being achieved.

The 2008 concept of Google Health was to centralize personal health information. Such a collection could have enabled improved health outcomes for individuals and the general population, but it was retired in 2011. The key reasons cited for its retirement were unclear customer value, little engagement with healthcare practitioners, and policy disconnects with insurance providers.

Areas of Opportunity for the New Administration and Agency Leaders

While the concept of TCLs, and the TCL–TRL matrix, are still in their infancy, they have already proven beneficial for a number of projects. Federal agencies can begin to use the concept as a part of their management approach for individual projects and multi-project programs, as well as contribute to the concept's maturation in a manner similar to the prior evolution of TRLs. The Office of Science and Technology Policy and OMB, in their oversight roles, can quickly look at a program's TCL–TRL matrix to understand its status (and multi-year evolution), utilizing a powerful new tool to accompany their existing fiscal and temporal assessments.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Prizes and Challenges-Based Acquisition

Federal acquisition traditionally follows a lengthy, serial process that generates megabytes of documentation in response to gigabytes of regulations, policies, and directives. Mission needs are translated into technical requirements, then into system specifications and contract deliverables. The end result is often a single performer being funded to develop a solution that meets the minimum specifications. Broader innovation is stifled, and private sector competition focuses on writing the best proposal rather than developing the best solution. Many times, prizes and challenge-based acquisition (ChBA) are a better approach.

A Case for Action

Despite the best efforts of federal programs to mitigate risk through verification and validation using the systems engineering process, even a perfectly executed research project can still produce a result that is "late to the fight," operationally ineffective, or unsuitable, even if it addresses the RFP's stated requirements. When this happens, agencies are back at square one, as only a single contractor was selected to perform and fulfill the government's requirements.

Furthermore, most contracts are awarded using government source selection evaluations based on industry paper proposals rather than "actual" product performance. This creates an incentive for industry to produce flawless documents with highly optimistic cost, schedule, and performance projections that meet RFP requirements. As a result, performance during program execution often falls short of the government's expectations, and cost and schedule overruns become nearly inevitable.

Challenges and prize contests differ from traditional development activities that fund participants for their time and materials. Federal resources are instead devoted to developing an infrastructure and/or awards that incentivize external parties to devote their own resources to overcoming the stated problem or addressing the capability sought. Challenge and prize competitions, when developed and managed properly, can induce significantly more innovation than would otherwise be possible through the implementation of traditional acquisition strategies and approaches. The concept is not new, but its usage within innovation programs and as part of the federal acquisition process has rapidly increased over the past several years.

Merging the prize and challenge concept directly with the federal acquisition process is also feasible and has already proven successful in a limited number of case studies. The incoming Trump administration can further refine and embrace ChBA as a better way to incentivize and leverage the private sector to solve national problems for both defense and civilian agencies while simultaneously enhancing the effectiveness of federal research programs.

Understanding the Problem

Governments and private organizations have used incentive prize and challenge competitions for centuries to encourage radical innovation in technology and solutions to particularly difficult problems. Implementing an incentive prize or challenge competition requires: 1) a description of a problem set; 2) clearly defined assessment criteria for evaluating proposed solutions; and 3) an incentive for participation based upon predefined evaluation criteria. Incentives may be monetary in nature, such as

a cash prize or contract award, or non-monetary, such as public recognition for the prize or challenge winner. What is not required is the current norm for federal acquisitions: a predefined solution or development process, both of which can unnecessarily constrain the solution space.

The America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (COMPETES) Act of 2007 provides additional authority for government agencies to engage in high-risk, high-reward research in areas of critical national need. In pursuit of this work, the COMPETES Act specifically calls for the increased use of incentive prize and challenge competitions as one means of encouraging the development of cutting-edge solutions.

> **"How can the DoD acquire capabilities both faster and better? The answer includes expressing requirements in terms of general capabilities rather than firm specifications and encouraging industry to respond with applicable product development and innovation that demonstrates best-of-breed solutions."**
>
> –THE PARTNERSHIP FOR PUBLIC SERVICE, INNOVATION IS A CONTRACT SPORT, FEBRUARY 2016

After executing an incentive prize or challenge competition under the COMPETES Act or other authority, the government often wants to purchase and field the winning solution(s) but may not have the ability to do so expeditiously. Reasons for the inefficient transition from prizes to procurements include differing interpretations of the current Federal Acquisition Regulations (FAR), Agency-Specific Regulations, and/or Other Transaction Authority by program managers and contracting officers, as well as the overall methods by which incentive prize and challenge competitions are structured, executed, evaluated, and documented. When these two factors are combined, transitioning an incentive prize or challenge competition result to a government procurement becomes inefficient and arduous.

Areas of Opportunity for the New Administration and Agency Leaders

ChBA takes the government-endorsed prize challenge concept a step further by designing it to be a part of the procurement process from the beginning. When properly managed, the strategic use of a challenge competition as an input to a follow-on acquisition satisfies federal acquisition competition and evaluation requirements simultaneously, allows the government to pay vendors for participation, and enables focus on successfully demonstrated outcomes rather than unproven proposals. The Trump administration can further expand federal use of the ChBA approach by:

- Encouraging federal agencies to assess the ChBA approach as a potential alternative to standard acquisition approaches
- Providing updated guidance and training to federal contracting officers on how ChBA is supported within the FAR
- Further encouraging a federal community of interest to share lessons learned and to offer support to participants in establishing future ChBAs

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Maximizing the Benefits of Federal Research

The U.S. government invests approximately $135B in public funds each year to advance science and technology (S&T) that improves security, creates jobs and higher standards of living, and unlocks new discoveries that will serve as the foundation for future innovations. Despite an abundant array of success stories, more can be done to reap the benefits of this investment. Research performed within a federal agency all too often stays within that agency. The knowledge gained and intellectual property (IP) developed are often brought to bear on that agency's mission, but less emphasis is given to how they could be leveraged by other agencies or the private sector. The incoming Trump administration has the opportunity to achieve a greater return on the taxpayer's investment by creating an environment in which federal research managers are expected to maximize technology transfer opportunities.

A Case for Action

Federally funded research is a national investment whose benefits need to be maximized. While there are many legitimate cases where IP should remain with the funded originator, there are also many cases where everyone would benefit if that IP were shared with other parties via technology transfer (either by making it freely available as open source or by entering into a formal licensing agreement). Doing so would allow the knowledge and/or capability gained through the federal investment to be leveraged in other applications and combined with other new discoveries in a future generation of innovation. This is a hallmark of scientific progress—and also helps entrepreneurs grow their businesses, thus creating new jobs and a boost to the U.S. economy.

An illustrative example comes from the Federal Aviation Administration (FAA), which, through its federally funded research and development center at MITRE, sponsored the development of a prototype system that provided small aircraft with the same level of situational awareness in the air that larger planes with costly and sophisticated systems enjoyed. MITRE developed a Universal Access Transceiver Beacon Radio (UBR) that affordably incorporates the community's standard Automatic Dependent Surveillance–Broadcast Technology, thus meeting the needs of the FAA and small aircraft operators. It has since licensed the technology to 14 companies, which are now commercially offering a variety of UBRs. Transferring results from this federally funded research has created a new market, revolutionized private aviation, and increased safety in the skies.

> **"We use open source releases to move technology from the lab to the marketplace, making state-of-the-art technology more widely available and aiming to accelerate U.S. economic growth."**
>
> –LINDA L. BURGER, DIRECTOR OF NSA'S TECHNOLOGY TRANSFER PROGRAM

In practice, technology transfer is not typically a high priority within federal research programs. Many federal employees have a limited understanding of technology transfer, it's not required by most agency leadership, and there hasn't been a sustained push by prior administrations.

This doesn't have to be the case. The incoming Trump administration can unlock these discoveries and make them available to our nation's innovators with a relatively small investment in training and by communicating the benefits publicly in order to attract greater private industry demand. Doing so can result in measurably improved returns on taxpayer investments within the President's first term.

Understanding the Problem

Perhaps the single biggest challenge is that most federal R&D program managers haven't been trained in technology transfer, so they don't understand their opportunities to maximize the benefits of the research they manage. Instead, they focus on the more traditional aspects of their role, such as ensuring that their inventions serve the needs of their agency and that their funding and contractual obligations are in order. The end result is that innovations that could be impactful in a variety of contexts remain, in effect, sitting on the shelf.

Assessment of technology transfer is rarely, if ever, a major factor in agency oversight or budget development processes. As a result, there is little incentive for agency managers, who are very focused on their agency's core missions, to focus attention on technology transfer.

Areas of Opportunity for the New Administration and Agency Leaders

An enhanced focus on technology transfer would be an opportunity for the incoming Trump administration to provide significant benefits to the nation within its first term at modest additional cost. A successful approach would combine top-down instructions and oversight attention that would drive agencies to focus on this priority, with training and incentives at the individual program manager level that would compel managers to take individual action. Recommended high-level actions include:

Tasking the Office of Science and Technology Policy and the Office of Management and Budget to:

- Ensure that technology transfer is a priority within federal research programs.
- Initiate an interagency process to identify and publicly highlight successful technology transfer activities throughout the federal government.

Instructing the Office of Personnel Management to:

- Develop and deliver training programs on technology transfer approaches and management, using the Federal Laboratory Consortium for Technology Transfer's *Green Book* as a starting point.
- Work with other entities within the executive and legislative branches to create personal incentives for federal program managers to successfully transition research advancements beyond their agency (inside and outside government).

Providing training and highlighting success stories within and across agencies

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Accelerating Acquisition of New Capabilties

Acquisition that fails to produce useful results cost-effectively and within an appropriate timeframe threatens U.S. technological superiority, wastes billions of dollars, degrades capability, and inhibits the delivery of critical mission capabilities. Acquisition that is speedy, agile, and responsive to challenges arising from regulatory complexity and the realities of the workforce can enable new leaders to save time, money, and—potentially—lives. The papers in this section suggest simplifying and digitizing as vehicles for speed and agility, developing acquisition pathways tailored to common categories of acquisitions, and identifying and managing acquisition lead times.

Transforming Federal Acquisition for Speed and Agility

The Trump administration has the opportunity to transform the federal acquisition enterprise into a system that promotes speed and agility, while also leveraging new tools, platforms, and strategies to drive innovation and deliver results. Such a modernized enterprise could provide new capabilities to address security threats (both foreign and domestic) and retain U.S. technological superiority.

Current Challenges to the Federal Acquisition Enterprise

From 2001–2010, the DoD alone spent $59 billion on acquisition programs that were ultimately cancelled without delivering new capabilities. Other programs have become mired in cost and schedule overruns while failing to meet performance requirements. These problems are largely due to the failure of federal acquisitions to keep pace with rapid changes in missions, threats, technologies, and budgets. Three issues pose particular challenges to the delivery of effective capabilities on schedule and within budget:

- **Complexity:** The growing number of laws, policies, and regulations, combined with constantly evolving requirements, technologies, and mission priorities, greatly increases the difficulty of achieving timely results.
- **Time:** While speed-to-market is a highly valued metric in the commercial sector, federal programs often sacrifice schedule in favor of other factors. The acquisition enterprise does not offer incentives to shorten delivery times and reap the associated cost savings.
- **Workforce:** Half of the acquisition workforce is within 10 years of retirement, while 40–50 percent have fewer than five years' experience. Moreover, 90 percent of the acquisition workforce is in civil service or contract services systems that struggle to recruit and retain knowledgeable professionals.

The First 100 Days

The Trump administration can focus on a set of "quick wins" to lay the foundation for longer term flagship initiatives that will transform the acquisition enterprise. Among these early steps are adopting an Agile approach to small, frequent deliveries; being responsive to operational and technology changes; and soliciting active user involvement across the lifecycle. Delegating key program decision authorities to the lowest possible level of oversight can promote agility and ensure that timely decisions are made by those closest to program execution. A strategic investment in data is critical to long-term success. This would include hiring data experts, investing in tools, and championing the White House's open data policy. Finally, new leadership by experts from industry could offer an infusion of fresh ideas, fix inefficiencies, and reshape agency culture to embrace a modern enterprise.

Two central themes should guide the long-term modernization of acquisitions:

- **Simplify:** Reduce the complexity of policies, processes, and initiatives to enable speed and agility.
- **Digitize:** Leverage the latest strategies and tools to redesign program and enterprise operations.

Simplify

An effective approach to navigating the complex acquisition environment would be to develop new models along the lines of "Google Maps." Acquisition executives could proactively tailor a series of acquisition models or pathways based on the type of product or service being acquired as well as the acquisition's size, complexity, and risk. Rather than relying on gate check reviews and cost thresholds for oversight, these new models would transition to in-process portfolio reviews and a risk-based approach that empowers mature acquisition organizations.

Executives and program managers could also establish an Agile framework for acquisition. This would require the development of new policies, roles, training, and processes to structure programs via small, iterative releases so that acquisition becomes more responsive to changing operations, technologies, threats, and budgets.

A third element in simplifying the acquisition enterprise would be to implement a "Should Schedule" initiative focused on streamlining program processes and structure to ensure the timely delivery of capabilities. This would build on the DoD's successful "should cost management" program, in which unnecessary costs are identified and eliminated. Finally, expanding budget reprogramming authorities would enable a more dynamic allocation of resources to capitalize on innovations and respond to shifting priorities without a lengthy coordination/approval process.

Digitize

Federal acquisitions require a digital transformation to be more agile, innovative, and collaborative. Creating a digital program office can leverage new enterprise platforms to improve and accelerate every role, process, and product in a program. A digital platform designed to capture meaningful program data opens up a wealth of analytic opportunities to identify program and enterprise trends and opportunities and to fuel algorithms that optimize investments and program execution.. Executives could charter a team with developing decision-support software that would provide a "Turbo Tax for Acquisitions" to enable the workforce to formulate complex acquisition strategies that comply with current laws, regulations, and guidance while replicating exemplary strategies. By digitizing policies and guidance, acquisition experts could rapidly share insights and provide the workforce with collective knowledge for creating effective programs.

Looking to the Future

Following these important steps in the first 100 days, executives will want to provide continued investment in rapid capability development, industry outreach, and innovation labs to enable acquisition enterprises that can swiftly exploit new technologies and experiment with new business models. Successful commercial companies incentivize bold ideas, risk taking, and iterative prototyping/development. The Trump administration can move assertively to simplify the heavily regulated federal acquisition environment. Leadership has an opportunity to go beyond simply fixing the entrenched system by designing new elements—from program office operations to executive oversight—for a modern, digital enterprise. The focus needs to be on initiatives that deliver capabilities faster and are agile enough to exploit the latest technology for decisive advantages.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

The "Google Maps" of Accelerated Acquisition

Inefficient acquisition practices contribute to billions of dollars in cost overruns, years of schedule delays, and degraded system performance, and pose a risk to the delivery of critical mission capabilities. Given the increasing complexity and challenges of the nation's acquisition system, new "tailored" acquisition pathways can produce more timely and effective purchases. Tailored acquisition pathways can be likened to Google Maps, providing an optimal route for common categories or types of acquisitions. With them, the Trump administration has an opportunity to save billions of dollars and achieve timely acquisitions—including those vital to national security.

A New Way of Thinking About Acquisitions

The federal acquisition system is a complex enterprise that requires professionals with many years of experience to expertly execute. While many in the acquisition workforce (including program managers, contracting officers, systems engineers, testers, and others) are encouraged to tailor the acquisition process to deliver capabilities efficiently, most do not have the experience, knowledge, or resources to facilitate tailoring. Furthermore, several institutional obstacles make tailoring acquisition processes and activities a challenging exercise.

Many policies and processes guide the execution of government acquisition practices. The Big "A" federal acquisition system is one that brings together requirements, budgeting, and processes to deliver systems, services, and capabilities. To successfully tailor the acquisition process, the workforce must consider program documentation, acquisition phases, decision reviews, and more. Knowing where to even start tailoring so many elements is frankly daunting.

Expecting acquisition professionals to tailor the acquisition processes on their own is like handing them a map and telling them to figure out the best way to drive from New York City to Los Angeles. If this is their first time making the trip, they will need a lot of time to study the map, plan the route, talk to others about shortcuts, and deal with traffic and detours along the way. Perhaps they will reach their final destination, but not without wasting significant time and fuel.

> **"Currently, DoD [acquisition] programs can spend up to two years meeting 49 information requirements and staffing them through up to 56 organizations for approval."**
>
> –GENERAL ACCOUNTABILITY OFFICE REPORT., 2015
> "DOD SHOULD STREAMLINE ITS DECISION-MAKING PROCESS FOR WEAPON SYSTEMS TO REDUCE INEFFICIENCIES."

But proactively tailored acquisition pathways present a new and different approach. Such pre-filtered pathways are Google Maps for acquisition. Routes are optimized for the type of product or service being acquired, with turn-by-turn guidance for each acquisition phase. Tailored acquisition pathways provide the acquisition workforce with a

pre-charted route that guides the workforce on a path for success. They provide the most relevant information, processes, and documentation for each type of acquisition, and give the workforce the flexibility to adapt the process based on the specific characteristics of a particular program. Proactively tailored acquisition encourages the workforce to think critically and to customize the acquisition the best way they see fit within the constraints of the regulations' intent and statutory requirements.

While each acquisition program has unique requirements and features, several categories or groupings within such programs could benefit from having their own tailored model. These pathways could be developed based on the type of system (e.g., aircraft, ships, business systems, information technology) or general categories of products and services (e.g., agile software development, commercial software licenses) while allowing further process tailoring as required.

The Challenge of Tailored Acquisitions

The current practice of using a generalized acquisition lifecycle framework that the workforce must figure out how to tailor for each acquisition is not effective. For instance, acquiring an IT system is significantly different from buying a jet fighter, yet most government organizations use a generic acquisition framework as the same starting point.

Furthermore, experienced acquisition professionals are in short supply. And those who do have the experience and vision to deviate from the traditional methods and tailor processes often face resistance from policy and process owners. While current acquisition policy guidance encourages tailoring, there is, in practice, no policy statement or guidance on when and how tailoring should be conducted—leading to sub-optimal acquisition strategies and inefficient program execution.

Making Tailored Acquisitions Easier

Proactively tailoring a suite of acquisition pathways will help programs focus on their core elements. As a result, the workforce will be able to navigate the lifecycle faster, leveraging the best practices and exemplary strategies of many previous programs. This will enable them to spend less time identifying the processes and documents required and more time designing innovative strategies to deliver mission-critical capabilities.

The following are key steps the Trump administration may want to consider in implementing such a practice:

- Advocate for a new approach to acquisition with an emphasis on streamlining processes and accelerating the workforce's learning curve.
- Mandate federal agencies to assemble multi-functional teams to develop a limited set of tailored acquisition pathways based on common types or categories of products and services.
- Promote education and training on acquisition tailoring for the workforce.
- Invest in digital tools to enable dynamic tailoring and the scaling of best practices.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Bottlenecks That Threaten Government Effectiveness

Until agencies speed up the process of fielding information technology products and services, they will be forced to continue relying on obsolete systems to carry out critical mission requirements. By implementing policies and procedures that reduce acquisition lead times, new agency leaders can save time, money, and—potentially—lives.

A Case for Action

Computers double their processing power about every 18 months. But right now, federal agencies take that long simply to identify program requirements and award a contract—and that's not counting the time required to actually design, develop, test, and implement the new system. By the time computers are finally delivered to agency customers, they may already be two generations out of date.

The consequences of long lead times in acquiring the latest information technology (IT) products and services are deadly serious for agencies that rely on them to protect citizens from terrorist threats, defend networks against cyber-attacks, and ensure that veterans, the sick, and the elderly receive their checks on time. And bottlenecks in IT acquisition have ripple effects for other types of acquisitions, from sensors to satellites.

That's why aggressive streamlining of acquisition lead time is a strategic imperative for all federal agencies. By reducing acquisition lead time, agencies will be able to:

- Keep pace with advancing technology and enhance operational effectiveness
- Become more adaptive to the needs of end users
- Become more innovative in a risk-averse environment
- Become more cost-conscious as budgets continue to shrink

As mission needs evolve and IT development cycles shrink, federal agencies cannot afford to wait for years to acquire critical mission capabilities. Actions to streamline lead times will not only decrease risks and costs, but will ensure that users and taxpayers alike benefit from significant savings.

> **"Effective processes that identify and manage acquisition lead times are of critical importance to maintaining cost-effective inventories, budgeting, and having materiel available when it is needed."**
>
> –WILLIAM SOLIS, DIRECTOR, DEFENSE CAPABILITIES AND MANAGEMENT, GENERAL ACCOUNTING OFFICE 2007

Understanding the Problem

Long lead times in federal acquisition have been the focus of increased attention in recent years:

- In 2012, the Defense Business Board warned that "cyber and IT modernization cannot succeed because the cycle times or spins within cyber and IT are far shorter than the time scale used by defense acquisition processes."
- In 2013, Federal Chief Information Officer Steven VanRoekel observed that "it is challenging to drive

innovation in the context of cycles that take six to nine months, a year or more … By the time you get the procurement done, the technology will change."

- The latest edition of *Better Buying Power,* the DoD's guide to best practices in procurement, emphasizes reduced cycle times as crucial to eliminating unproductive processes and bureaucracy.

While these and other efforts to call attention to the problem have certainly helped raise awareness, the underlying causes must be addressed if the problem is to be resolved:

- **Risk aversion** from fear of failing or disregarding established procedures
- **Fear of protest** leading to highly conservative strategies and over-documentation
- **Stovepiping** that discourages the "big-picture view" and collaboration with industry

Areas of Opportunity

There is no single, easy fix for long acquisition lead times. The solution requires acquisition leaders to tackle the challenge systematically through a coordinated, concerted, and cross-agency effort. Acquisition leaders could consider the following practical ideas as priorities for action within the first year of the new administration:

- **Foster a culture of risk-taking and innovation.** Agency leaders need to convey that fast, responsive acquisition lead time is part of the agency's DNA. One way to accomplish that is to establish a climate in which the workforce feels empowered to take a chance and experiment with innovative solutions.
- **Provide meaningful incentives.** To motivate the workforce to reduce acquisition lead time, agency leaders could establish specific goals and objectives and assess progress toward them in individual performance evaluations at all levels of the organization. Senior agency directors could publicly recognize accomplishments at ceremonies and in publications.
- **Anticipate and prevent problems.** Shifting the federal acquisition culture from reactive to proactive requires training the workforce to solve problems before they happen instead of waiting for them to happen. It also means overcoming the urge to discard innovative solutions out of fear of protests from industry, most of which end up being rejected anyway.
- **Measure and track progress.** Once specific goals and objectives for reducing lead time have been adopted, agencies could establish and track a set of metrics that show progress toward reaching them. These metrics could then be used to hold acquisition organizations accountable—from the contracting officer all the way up to senior leadership.
- **Partner with industry.** Industry is not an adversary in federal acquisition. An open dialogue with a bidder throughout the acquisition process minimizes the likelihood of a protest and improves the chance of shorter lead times. Plus, federal agencies can benefit from industry expertise in making sound acquisition decisions.
- **Employ alternative acquisition strategies.** Agencies could explore innovative contracting methods that promise to reduce the time required to conduct market research, develop RFPs, evaluate proposals, award contracts, and field solutions instead of relying on "by-the-book" methodologies that do not clarify how requirements contribute to the overall objective.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Protecting Our Information Assets

The increasing interconnectivity of our technologies enables government agencies to improve information and service delivery to each other and to the public. But cyber attacks that target the networks that underlie that interconnectivity threaten the services upon which agencies and the public depend. Cyber crime, moreover, costs the U.S. economy between $500 billion and $1 trillion a year. The first paper in this section discusses an approach to securing systems by actively preventing cybersecurity incidents. The second paper discusses the intertwining of mission execution and cyber risk, and proposes strategies for managing cyber risk in a mission context.

Prevention: An Enhanced Approach to Cybersecurity

Cyber crime costs the U.S. economy between $500 billion and $1 trillion a year. Cyber attacks on the country's critical infrastructure jeopardize our national and economic security, and incidents such as the recent cyber breaches at the Democratic National Committee, the Office of Personnel Management, and Sony erode the trust that Americans place in the institutions that support our way of life.

A Case for Action

Observable cybersecurity incidents have increased by more than 2000 percent since 2005.[1] They increased by 27 percent between 2013 and 2015.[2] Despite heightened awareness of cyber threats and growing expenditures for cybersecurity (which now account for as much as eight percent of the overall IT budgets at some companies), cyber attacks are likely to continue—if not increase—without a critical change in the current approach to cybersecurity.

> **"An ounce of prevention is worth a pound of cure."**
>
> –BENJAMIN FRANKLIN

Nationally and internationally, organizations largely fight cyber crime by focusing on overall baseline security. Defenders work to identify adversarial actions inside their networks, then launch counterattacks with their own targeted protections and network defense efforts. But today's determined adversaries are continually developing new ways to breach systems and establish footholds. Greatly helping them in this endeavor is the sheer volume of vulnerabilities and defects in any network that can serve as exploitable entry points. The defenders must constantly up their game to compensate for these insecure components.

Adopting a preventive strategy in the design and construction of cyber systems would represent a game-changing approach to cybersecurity. This means employing quality principles in the design and development of software and hardware in much the same way the U.S. auto industry in the 1980s applied quality principles to improve performance and lower total cost of ownership. In doing so, the government can help reduce successful attacks and conserve resources.

Instead of focusing all of our time, talent, and resources on defending subpar systems, what if we redirect a portion of investment to improve quality by design throughout the system, including foundational improvements that address quality issues at the component level?

Understanding the Problem

Many cybersecurity breaches occur through attackers exploiting software weaknesses. This quality crisis forces both software manufacturers and industry to devote costly resources to perpetually updating software to make it more secure.

Planning can begin with the use of NIST Secure Systems Engineering guidance (NIST 800-160) for improving engineering and design. It addresses the engineering-driven actions necessary to develop more defensible and survivable systems—including the components that compose and the services that

depend on those systems. But we need to do more to prevent losses and impact from poorly designed software-based components.

Areas of Opportunity for New Agency Leaders

Changing the process by which systems are designed and built is a huge undertaking, given how ubiquitous automation is in our lives. Right now our cyber language focuses on identifying and classifying vulnerabilities. Going forward, we need a language that specifies the level of quality assurance a software or networking product has achieved. As a major purchaser of information systems, the U.S. government can help standardize this language by specifying required quality assurance levels in the systems it buys. By doing so, the government will lay the foundation for the same approach to take hold in industry. To support a shift to a prevention-based strategy, the President should assign the following actions:

- Task the National Security Telecommunications Advisory Committee, a standing presidential advisory committee, to recommend approaches and policies to reinforce the use of prevention methods in critical infrastructures that support national security missions. This will provide a set of feasible recommendations for key industries.
- Require the U.S. General Services Administration and the Department of Defense, through public-private partnership efforts like ACT-IAC, to document effective contractual processes that use quality enumerations for software-intensive systems to ensure that the government is purchasing the highest quality software employing prevention concepts.
- Require the Office of Federal Procurement Policy to publish guidance ensuring that mission-critical programs in government leverage Common Quality Enumeration[3] in order to provide a more empirical set of data about the quality and security of software-intensive systems.
- The Office of Management and Budget should develop cost models that document the cost avoidance of improved prevention and higher quality capabilities.
- Require the U.S. Department of Homeland Security and the FBI to ensure that information sharing collaborations supported by government agencies leverage the enumerations of attacker actions documented in emerging standards such as PRE-ATT&CK™, which provides details on threat actor activities before they gain access to systems and data on networks.
- Advocate for national breach notification in order to reduce the ambiguity that currently exists across the United States with differing state-level requirements and increase the collaboration across sectors and with the relevant federal entities.
- The government should take action to accelerate the emerging cyber insurance marketplace, and evaluate its role to backstop catastrophic losses for key critical infrastructure entities.

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1 Fiscal Year 2007 Report to Congress on Implementation of The Federal Information Security Management Act of 2002, Office of Management and Budget.

2 Annual Report to Congress: Federal Information Security Modernization Act, Office of Management and Budget, March 18, 2016.

3 Software quality: A joint MITRE-SEI initiative developed a new Common Quality Enumeration (CQE) standard formally defining software quality measures which can help mitigate vulnerabilities. Already ten commercial vendors are building tools to perform automated CQE measurement and assessment.

For further ideas about applying the guidance in this paper to your agency's particular needs, email cyber@mitre.org

Cybersecurity: It's About the Mission

The digital age is a double-edged sword for federal civilian government organizations. The increasing interconnectivity of our technologies enables government agencies to improve information and service delivery to the public. At the same time, the dependence on networked technologies for mission fulfillment places those very missions at risk. A cyber attack on an agency's technology systems could prevent it from providing the services and protections its constituents depend upon.

Mission Execution and Cyber Risk Are Intertwined

"Mission breaches" have the potential for devastating consequences. They can expose confidential information, erode infrastructure reliability, damage public trust, endanger human safety, harm the economy, and even threaten our national security. The government must be able to sustain mission-essential services to the public despite cyber attacks and disruptions.

Securing data is not enough. Organizations must assure their missions by managing the risk inherent in the use of information systems.

To address the increasing risk that lies at this intersection, we recommend that agencies closely link their mission and cybersecurity strategies. This approach would call for agency leaders responsible for cybersecurity concerns to work with those responsible for mission operations, policy, and planning to address the perils—and promise—of networked technology. Through their collective insights and perspectives, cross-organizational teams can better outline a holistic picture of the agency's cybersecurity risks and identify what can be done to mitigate them at all levels of the organization.

Background: Blocks to Build On

Over the past years, Congress and the executive branch have passed laws and enacted government-wide policies and programs to improve cyber risk management. These include:

- The Federal Information Security Management Act
- The 2015 Cybersecurity Strategy and Implementation Plan for the Federal Civilian Government
- The 2016 Cybersecurity National Action Plan
- Threat information sharing policies and practices as codified in the Cybersecurity Information Sharing Act of 2015
- Boundary protection and monitoring measures such as EINSTEIN and the Trusted Internet Connections
- Cross-government cybersecurity services efforts such as the Continuous Diagnostics and Mitigation program

These and other government-wide and individual agency initiatives have created a foundation for future cybersecurity efforts. But they will be

incomplete without strengthening the connections between cybersecurity, mission execution, and enterprise risk management.

Discussion: Many Strategies, No Silver Bullet

No single action will bring mission execution and cybersecurity closer together. However, there are several elements of an overarching strategy that a new administration can promote. These include:

- **Adopting an Adaptive Defense:** Cyber defenders must anticipate and quickly adapt to threats in order to support ongoing mission performance. This requires greater focus on countering adversaries both before they enter networks and after they have breached them. It also necessitates using shared information to tailor defenses, and adopting resilience approaches that increase the likelihood of continued mission execution in the face of attack or disruption.
- **Addressing Holistic Risk:** Cybersecurity has often focused on risks to data confidentiality, availability, and integrity—such as theft of intellectual property. Changing technologies (e.g., Internet of Things, Cyber–Physical Systems) used in support of mission performance require cyber defenders to take a more holistic view of risk—one that also considers physical risks to human safety and infrastructure reliability.
- **Strengthening Trust in Technology and Users:** As networked devices play increasingly important roles in mission execution, the need for stronger trust in both the systems and the humans who use them increases. Organizations can increase the trustworthiness of their technologies by instituting strong security engineering at each stage of the system life cycle. Based on how a system will be used, agencies can assess the level of trust needed by a system or user and institute the appropriate protections.
- **Cultivating a Shared Mindset:** More than any technical issue, human attitudes are critical to address the risks that lie at the intersection of mission execution and cybersecurity. Cultivating a shared mindset requires greater focus on communicating the relationship between mission performance and cybersecurity. Agency leaders must send a clear message that cybersecurity is not just a static compliance exercise but requires ongoing evolution and continuous improvement in a collaborative manner.

Recommendation

The President direct the Office of Management and Budget (OMB), to work with federal departments and agencies to implement policies in support of adaptive defense, holistic risk, trust, and shared mindset. Further, direct the National Institute of Standards and Technology (NIST), working with the Department of Homeland Security (DHS), OMB, and industry, to review the Framework for Improving Critical Infrastructure Cybersecurity and Risk Management Framework to further encompass concepts of adaptive defense, holistic risk, trust, and shared mindset.

For further ideas about applying the guidance in this paper to your agency's particular needs, email cyber@mitre.org

Defending the Nation

The necessity of confronting profound technological and political change applies across the U.S. security and defense environment. The first paper in this section recommends that the government revisit its policy, strategy, capabilities, and force posture before spending $1 trillion over the next 30 years to modernize our nuclear enterprise. The second identifies opportunities for new leaders to ensure an affordable, resilient space architecture that can overcome emerging threats to our increasingly vulnerable GPS satellites. The third proposes person–centric identity management as a means of rapidly assimilating data in order to verify and confirm the identity of terrorists and to expand the identity–related intelligence required to prevent terrorist activity.

Deter, Assure, Strike

Building Nuclear Deterrence for the 21st Century

The threats to our nation have changed dramatically since our nuclear arsenal was first designed and fielded more than three decades ago. MITRE recommends that before the United States spends $1 trillion over the next 30 years to modernize its nuclear enterprise, it conduct a Nuclear Posture Review (NPR) to reassess and revise its policy, strategy, capabilities, and force posture. The NPR will help the administration re-focus the nation's nuclear enterprise to better respond to the world's current—and future—complex and turbulent environment.

A Case for Action

Our nuclear TRIAD has served America well. It has provided the cornerstone of our extended strategic deterrence policy of deter, assure, and strike. We *deter* potential adversaries with our overwhelming capability, *assure* our allies and partners that our arsenal is there to protect them, and serve notice of our resolve to *strike* with these weapons should deterrence fail and we or our allies/partners are threatened.

However, the TRIAD was designed over 30 years ago. Since then, the threats to our nation have changed markedly. Our near-peer competitors such as China and Russia have improved their offensive capabilities and their strategy of how and when to use them. They have also applied advanced technology to improve their defensive capabilities against our strategic weapon systems, strategic communications, and command and control infrastructure. Their progress jeopardizes our ability to sustain a credible nuclear deterrent.

In addition, there has been a marked increase in the number of nuclear-capable nation-states such as North Korea and Pakistan. While they do not currently pose an existential threat to the United States, we must establish well-conceived nuclear and non-nuclear, kinetic and non-kinetic response options to any potential aggression against us or our allies. Whereas in the past we could focus on just the one mission of survival against a first strike, we now need the tools (planning and execution applications, concepts of operation [CONOPS], and weapons) to execute across a continuum of options.

> **"Issues posed by regional proliferation, the emerging possibility of limited use in regional conflicts, and … concerns by many of our allies about our extended deterrence guarantee, all introduce complexities and challenges not seen since the early days of the Cold War."**
>
> –GENERAL JOHN E. HYTEN, USAF COMMANDER, UNITED STATES STRATEGIC COMMAND, SEPTEMBER 2016

Understanding the Problem

Three decades ago, when the United States completed developing and fielding its nuclear weapon systems, our nuclear world was "simpler."

In the era of "mutually assured destruction," we focused on surviving a massive, first-strike attack from the Soviet Union. Today, the new capabilities of our adversaries require that we have a much more flexible set of deterrence and response options. The ability to plan and execute this wide range of responses—from conventional to nuclear, from kinetic to non-kinetic, where conventional forces work in complete coordination with the nuclear forces—is our biggest challenge. The Services have recognized the need to modernize the nuclear enterprise and have embarked on an ambitious set of programs to field new weapon systems and the command, control, and communications infrastructure to enable them by 2030. Unfortunately, the current modernization plans underway are primarily based upon the same performance requirements and CONOPS that were used to address Cold War realities.

Consequently, if plans remain unchanged, the capability we will field in 2030 will be very similar to our legacy systems—just with new hardware. This will not address the realities of the threat environment in 2030.

Recommendations for the New Administration and Agency Leaders

Since its inception in 1958, The MITRE Corporation has been supporting the nation's strategic deterrent capability in the areas of CONOPS exploration; mission capability definition; requirements analysis; and individual systems design, development, procurement, and test. Based upon that experience and the environment summarized above, MITRE recommends the following:

- The Services should rapidly address gaps and shortfalls in our current strategic systems in order to be able to fight today's fight.
- The administration should request a Nuclear Posture Review to establish new U.S. nuclear policy, strategies, capabilities, and force posture in conjunction with other national power capabilities. The NPR can benefit from the current Defense Science Board Summer Study on "Nuclear Deterrence in the 21st Century's Multi-Polar, Multi-Threat Strategic Environment," which will address many of the technical challenges involved and inform the NPR on the art of the possible. The NPR should assess all aspects of our nuclear deterrent, including:
  - All elements of the TRIAD, including the communications and command and control infrastructure
  - Potential new delivery capabilities, in addition to ballistic missile, bomber, and air-launched cruise missile delivery vehicles
  - Closer "interoperability" between conventional forces and nuclear forces to provide to the President a wealth of conventional/nuclear, kinetic/non-kinetic options (e.g., cyber, info ops) to respond to a range of conventional and nuclear attacks.
- The resultant perspective will allow the DoD and DOE to re-focus the nuclear enterprise strategy and modernization plan—and help them determine the necessary budgets so they can engage with Congress for funding.
- The Departments of Defense and Energy should drive innovation and investments in the critical capabilities required for a revised strategic deterrent policy.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Overcoming the Threat to Space Systems

GPS satellites help target enemies while minimizing collateral damage. They help troops navigate and avoid fratricide. Their timing signal helps synchronize cellular networks, gas pumps, and cash machines, stabilizing our economy. Such a space-based capability is eyed by countries like China as an inviting—and highly vulnerable—target. Air Force Space Command (AFSPC) and the National Reconnaissance Office (NRO) have developed a Space Enterprise Vision that aims to ensure an affordable, resilient space architecture that can overcome threats and protect our edge in space-based capabilities.

A Case for Action

The United States and our allies remain far more dependent on space for military and economic success than our likely adversaries. We have yet to find alternatives to space that enable sufficient speed, accuracy, efficiency, and discretion in warfighting. Potential adversaries have noticed, and are developing capabilities intended to deny our use of space.

Almost 20 years ago, Chinese strategists began writing about targeting U.S. space assets as a "tempting and most irresistible choice." In 2007, China successfully tested an anti-satellite (ASAT) missile. Since then, their arsenals have been developing more quickly, deeply, and in a more diversified way than we anticipated.

Responding to this new strategic environment, the DoD and the Director of National Intelligence (DNI) released the first-ever National Security Space Strategy in 2011. But the strategy stopped short of detailing the means to address the threat. It took another Chinese ASAT test in 2012 for the DoD to work through the grieving process—denial, anger, bargaining, depression—to accept that our space systems are at risk and that funding plans must change.

But accepting that change is needed does not mean the DoD and DNI have reached consensus on how to respond. For instance, evolutionary changes in our procurements that may be easier to make than revolutionary changes are not sufficient to outpace the threat.

> **"The U.S. has a cohesive strategy to defeat the challenge from potential adversaries. It is essential that defense officials move faster to implement the strategy."**
>
> –GENERAL JOHN E. HYTEN, USAF COMMANDER, UNITED STATES STRATEGIC COMMAND, SEPTEMBER 2016

Understanding the Problem

Since 2015, the AFSPC and the NRO have been developing the "Space Enterprise Vision" (SEV). This shared vision provides the missing "means" to the National Security Space Strategy.

The vision no longer views space as a set of stove-piped activities. Instead, it treats space as an enterprise where high-value assets are defended as they are in other domains; where ground, space, and user segments must fight together; where we must proliferate and distribute space segments to attain resilience; and where military and intelligence space

forces integrate assets and operations. Leadership at the U.S. Strategic Command, AFSPC, NRO, and the Space Security and Defense Program support the SEV. They are committed to act with urgency.

Defeating the vast array of threats requires nearly every aspect of the enterprise to change within ten years. Satellite control systems, transport layers, transmit/receive antennas, satellites, and user equipment must be reconceived, redesigned, prototyped, and fielded affordably to enable a resilient enterprise. And this must be done on timelines and at cost that apply the tenets of the "should schedule" and "should cost" acquisition movements that the Pentagon has developed to address the speed and expense of its acquisition work.

Challenges to protecting our space-based capabilities can be overcome through changes to defense acquisitions approaches.

The first is determining the cost. Adding defenses will cost more and requirements discipline will be critical. However, initial cost estimates for adding resilience were unrealistically high. Air Force Space Command will develop more realistic estimates to support this year's budgeting and programming decision cycle.

The second will be gaining Joint acceptance for the SEV's approach to validating warfighter-essential requirements. SEV uses a novel approach to understanding and delivering those requirements based on identifying the needs of each Service's basic warfighting and sustainment elements and then determining how they will be employed during operations.

The third will be the Pentagon's holding acquisition program managers accountable for their actions, but not making decisions for them. Further, the Air Force Space and Missile Systems Center will need to realign processes and reorganize to agilely procure all the elements of this vision.

Areas of Opportunity for New Agency Leaders

While Pentagon staffs continue to study and debate implementation, our adversaries are developing, testing, and fielding highly capable ASAT systems. To ensure an affordable, resilient space architecture that can overcome emerging threats, new defense and intelligence leaders should consider such options as:

- Requesting briefings within the first 100 days on current Space National Intelligence Estimates and the AFSPC/NRO Shared Space Enterprise Vision and Strategy.
- Streamlining space authorities to ensure that requirements, resourcing, acquisition, and operational decisions can be made on a timeline that outpaces the growing threat.
- Guiding all future DoD and DNI space architectures, requirements, budgeting, prototyping, procurement, and planning decisions using a total enterprise perspective and the space resilience characteristics—protection, disaggregation, distribution, proliferation, diversification, and deception.
- Redirecting actions not already aligned with the future vision and strategy toward implementation of a resilient, affordable space enterprise that outpaces the threat.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Rapidly Assimilating Data About a Person of Interest

Recent terrorist attacks in the United States and around the world clearly illustrate the need for the rapid assimilation of data surrounding the perpetrators, both to verify and confirm the identities of perpetrators as well as potentially to expand the actionable identity-related intelligence required to prevent follow-on attacks or terrorist activity.

A Case for Action

The U.S. government screens millions of travelers, workers (who may be seeking employment with access to critical infrastructure, information, and transportation systems), refugees, and individuals visiting or immigrating to the United States and its territories. The vast majority of the data collected is stored in stand-alone and stovepiped systems with limited or no data sharing capabilities, no standard correlation capability to resolve and link identities, and no substantive capability to link additional peripheral encounter data (e.g., information gleaned from social media, checkpoint screening results, or other relevant agency records).

The U.S. government needs a robust Person-Centric Identity Management (PCIM) capability. PCIM enables the resolution and aggregation of multiple un-linked identity records (and associated data) to form a singular, comprehensive, and high-confidence view of an individual (subject to the appropriate security, privacy, and civil right/civil liberty legal protections).

Understanding the Problem

Currently, the U.S. government lacks an overarching PCIM capability, which results in:

- An inability to rapidly federate and share person-centric data, necessary to respond in near real time to acts of terrorism and law enforcement activities.
- Insufficient immigration data integration, necessary to allow officials to seamlessly track individuals through the enforcement and benefits systems.
- A diminished intelligence analytical capability, necessary to proactively resolve established identities (linked to encounter data) in order to provide actionable intelligence before and after events occur.

> **"There were so many mistakes made...I wouldn't pick out the [Commonwealth] Fusion Center but obviously we need to review this whole situation...How did he [Tamerlan Tsarnaev, one of the Boston Marathon bombers] get out of the country with only the DHS knowing? They didn't know when he came back. The FBI dropped him from the list, the whole lack of coordination and information ...clearly a lack of coordination among agencies"**
>
> –SENATOR JOHN MCCAIN,
> QUOTED IN "DATA-SHARING TROUBLES RAISE QUESTIONS IN MARATHON CASE," BOSTON GLOBE, APRIL 2013

- A limited ability to share "best of breed" screening and vetting solutions across federal agencies (and with state and local authorities), thus diminishing the quality of personnel vetting, checkpoint screening operations, and counterterrorism at all levels of government.

Areas of Opportunity

The Secretary for the Department of Homeland Security should consider establishing a department-level, cross-government initiative to create a PCIM capability. A robust PCIM capability will provide a federated view of all the identities that an individual has established across the federal landscape (and ultimately with state and local authorities) that will link all privileges, benefits, accesses, and credentials that the individual may possess. This overarching person-centric identity is linked to the biometric and biographical records, identity assurance levels, agency records, and encounter data that constitute a "complete" view of the individual's interaction with various government entities.

PCIM will provide an overarching, holistic view of an individual, improving:

- **Terrorism Response:** Accelerating to near real time a query capability across all data stores to enhance counterterrorism and law enforcement response times.
- **Refugee Vetting:** Strengthening the process by automating the flow of person-centric information and vetting results among DHS, DoD, DOJ, DOS, and the various intelligence community partners.
- **Immigration Enforcement:** Allowing DHS to link immigration data across the department to facilitate stakeholder access to real-time data in support of immigration processing (benefits and enforcement), trend analyses, and border security.
- **Border and Checkpoint Security:** Allowing federal, state, and local agencies to link person-centric data to critical infrastructure screening operations—airport checkpoints, entry/exit locations, and other critical infrastructure checkpoints/screening technologies.
- **Vetting Shared Services and a Common Approach to National Counterterrorism Center (NCTC) Vetting:** Strengthening identity resolution, shared vetting services, and a standard approach to NCTC vetting.
- **Person-Centric Analytics:** Laying the groundwork for actionable predictive and prescriptive analytics in order to provide advanced warnings and indicators to prevent acts of terrorism before they occur.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Delivering Mission Results

Effective government employs appropriate strategies, people, and practices to achieve desired, impactful results within and across federal agencies. The first paper in this section proposes focusing on prevention and on leveraging strategic, data-driven applications to stem the drain on programs caused by improper payments. The second shows how public-private partnerships can harness private-sector capabilities, efficiencies, and innovations for public good. The third presents a set of strategic approaches to building stakeholder engagement, key to mission achievement. The fourth shows how exploring organizational performance factors before undertaking a restructuring effort can increase the odds of achieving sought-after results. The final paper makes the case that successfully transforming the VA will require systems thinking and a systems-thinking culture.

Federal Improper Payments

A Trillion-Dollar Drain on Government Programs

Unless government decision-makers move urgently to address the problem of improper payments, agency budgets will continue to hemorrhage—restricting spending options, adding to the federal debt, enriching criminals, and undermining public confidence. New agency leaders can better confront the problem by intentionally focusing on prevention and by leveraging more strategic, data-driven approaches.

A Case for Action

Agencies have identified more than $1 trillion in improper payments they have made since 2002—payments that either should not have been made or were made in the wrong amount. The estimate for FY 2015 alone is nearly $137 billion—an increase of $12 billion over the previous year—and this estimate reflects improper payments associated with only 125 out of hundreds of federal programs! Moreover, this estimate likely understates losses due to fraud. For comparison, the federal government's FY 2015 R&D budget, in its entirety, was $135 billion—almost the same as that year's improper payments.

From where do improper payments arise?

- Errors that applicants make (e.g., when program beneficiaries submit claims, taxpayers file tax returns, or contractors submit invoices)
- Errors that agencies make in processing submissions
- Fraud that applicants commit

While the largest totals of improper payments come from such healthcare programs as Medicare and Medicaid, from Social Security, and from the IRS's Earned Income Tax Credit, they can be found in virtually every agency, increasing mandatory spending at the expense of discretionary programs and thereby limiting options for investment in solutions for critical problems. These needless expenditures contribute to federal trust fund crises, raise the federal debt, and increase spending on interest to finance that debt. Without question, improper payments siphon off funds that are direly needed to serve the interest of the American public and, ultimately, undermine public confidence in government.

> **"Billions of dollars... taken away from hardworking people and then squandered through improper oversight or plain old irresponsibility"**
>
> –SENATOR ORRIN HATCH, SENATE COMMITTEE ON FINANCE, HEARING ON IMPROPER PAYMENTS, 2015

Understanding the Problem

The problem has garnered considerable attention in recent years. Congress has enacted at least six statutes aimed at addressing aspects of the issue since 2002. Executive Orders, presidential memoranda, and Office of Management and Budget (OMB) guidance have been issued as well. Consequently, agencies have been making extensive efforts to estimate, report on, and mitigate improper payments in individual federal programs. Most recently, both the Fraud Reduction and Data Analytics Act of 2015 and the OMB July 2016 update

to Circular A–123 direct agencies to ensure that their overall internal control systems adhere, with due consideration for relevance and appropriateness, to leading practices identified in the Government Accountability Office's "Framework for Managing Fraud Risks in Federal Programs."

While these efforts have yielded some positive results, much more remains to be done. Absent further determined action, a number of trends indicate that the problem will continue to grow. These trends include the following:

- Technology, while helpful in preventing and detecting improper payments, also introduces new vulnerabilities, including cybersecurity concerns.
- Agencies face an ever more sophisticated onslaught from those committing acts of fraud—a problem compounded by the increasing globalization of fraud and related financial crime.

Other issues, too, impact the federal government's ability to reduce improper payments:

- Insufficient recognition by leaders of the importance of the problem and its impact on their budgets.
- Inadequate root cause analysis, and a focus on detection and reactive measures (like chasing improper payments after the fact) rather than on proactive preventive steps.
- Impediments to verifying applicants' identity and eligibility. For example, determining eligibility is often complicated by inconsistent statutory definitions, legislative requirements for prompt payment, and program design issues that cause some agencies to rely on self–reporting by applicants.
- Challenges to the ability to leverage data analytics—critical to the overall solution—by data access and quality issues and by a lack of skilled personnel.

Areas of Opportunity

The Director of OMB should consider the following practical ideas as priorities for action within the first year of the new administration:

- **Tackle the problem systematically as a coordinated, cross–government effort with top leadership focus.** Establish a cross–government senior leadership group to set a "tone at the top" that emphasizes prevention of errors and deterrence of fraud rather than the current "pay and chase" model, to develop a cross–government strategy regarding improper payments that better balances stewardship of funds with mission accomplishment, and to promulgate policies that facilitate interagency collaboration and leverage public–private partnerships to attack the problem.
- **Address identity and eligibility issues strategically.** Propose legislation to update the Computer Matching and Privacy Protection Act of 1988 (P.L. 100–53) in order to facilitate increased interagency data sharing, which will improve the efficiency and effectiveness of identity and eligibility verification. Initiate pilot tests of alternatives for making identity and eligibility determination processes more rigorous, data driven, and cost–effective.
- **Strengthen data analytics capabilities across government.** Establish a shared research and analytics capability, available government–wide, that would enhance prevention and detection of improper payments, facilitate evaluation of alternatives for predictive and prescriptive modeling of future trends, and serve as an early warning system to help inform planning and prevention activities.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Advancing Public Service in Partnership

Agency leaders can better perform their mission by building innovative, mutually beneficial solutions in partnership with commercial and nonprofit stakeholders. Public-Private Partnerships (PPPs) enable government to be smarter and faster in responding to change, provide better service to Americans, and grow the economy.

A Case for Action

The government is confronting a crisis in its ability to deliver its mission due to several converging issues that call for quick action:

- **Growing expectations:** Agencies are challenged to meet Americans' increasing expectations for responsive service, value, and the enhancement of existing services and systems.
- **Shrinking resources:** Agencies face an aging workforce and other obstacles to efficiency and program integrity, while discretionary funding has shrunk since fiscal year 2010.
- **Problems without boundaries:** Today's highly interconnected economic and political systems make it difficult for any government agency acting alone to make comprehensive, positive change.

Addressing these critical national issues and better serving the nation requires PPPs that apply entrepreneurial approaches, efficient capabilities, and innovations from industry, academia, and the nonprofit world.

PPPs make sense when an agency lacks funds or risk tolerance across the (long) lifecycle, when the problem is bigger than what a single entity can see or control, and when the solution is best addressed through collaboration among stakeholders.

Benefits of PPPs include improved performance, effectiveness, speed, and robustness, with reduced cost and risk to the government.

Public–Private Partnerships enable the government to harness private sector capabilities, efficiencies, and innovations for public good.

Understanding the Concept

PPPs have increasingly been used as a mechanism to deliver public good. Most PPPs are for public works—such as the partnership to operate the Chicago Skyway toll bridge—in which a long-term, performance-based government contract to provide a public good places the management and major share of risk on the private entity.

This concept can be applied to a much broader set of issues as well. A newer class of information-centric partnership serves as a focal point for public and private entities to exchange insights and data to address national issues such as:

- **Government Integrity and Efficiency:** Improved program and payment integrity; reduced financial fraud, waste, and abuse; and more efficient shared services via broad collaboration and partnership.
- **Health:** Improved care at lower cost, and better population health and patient safety via coordination with industry stakeholders.

- **Homeland Security:** Enhanced cybersecurity via information sharing and analysis centers and organizations, and improved resiliency.
- **Transportation:** Improved aviation and ground transportation safety via information sharing.

PPPs can also foster innovation via Cooperative Research and Development Agreements (CRADAs). See other examples by accessing the Partnership for Public Service and ACT-IAC.

The legal and policy support for PPPs is broad and well-established. Agencies can draw on existing authorities to collaborate and form partnerships under the Economy Act, Bayh-Dole Act, Federal Technology Transfer Act, and OMB guidance, as well as DARPA, NASA, HHS, and other agency policies and precedents.

Agencies can fund PPPs not only by contracts and grants but also by cooperative agreements (such as CRADAs) and Other Transaction Authority agreements. Additional best practices include setting up PPPs with:

- **Shared purpose** among partners who expect clear mutual and public benefit under a charter that aligns interests and expectations.
- **Trust** among the partners built through delivering as expected and communicating proactively.
- **Accountability** via data-driven decision making and performance-linked incentives.
- **Partner buy-in** based on the value and benefit to stakeholders exceeding cost and risk, as well as the empowerment of partners.
- **Value delivery** via responsive operation, where the partners employ the most effective governance and business models, technologies, and protocols.

Areas of Opportunity

Americans can benefit when agencies use PPPs to advance service delivery and mission success by:

- **Extending the proven model of PPPs** in public works to other government-provided services and critical national problems—for example, eliminating child abuse and neglect.
- **Emphasizing the use of PPPs** when acquiring solutions.
- **Embracing trusted third parties,** free from conflicts of interest, to facilitate or operate PPPs when appropriate.
- **Engaging with stakeholders** to design and execute PPPs to modernize government service delivery.

Congress and the Executive Branch can foster public good via PPPs by:

- **Providing safe harbor-style protections** for PPP members so that industry can more confidently participate and share proprietary data with less concern about liability or about competitors gaining advantage as a result of their participation.
- **Removing barriers** to PPP effectiveness and burdens on partners. For example, they can streamline the collection of PPP data under the Paperwork Reduction Act, or not count healthcare anti-fraud PPP efforts against industry's bottom line under the Medical Loss Ratio.
- **Encouraging the appropriate use of PPPs** by agencies to deliver innovative, widely beneficial solutions in the public interest.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Supporting What They Help Create

Stakeholders Hold the Key to Mission Achievement

Government programs lacking stakeholder engagement often fail. When making adjustments to existing programs or introducing new ones, agencies must coordinate with those affected and those who can influence the transformations. Not doing so can lead to failure to identify requirements, properly allocate resources, and account for resistance to change. Best practices in stakeholder engagement, on the other hand, bring the right expertise to bear and ensure the design, coordination, and implementation of effective solutions in a complex federal environment.

A Case for Action

Government agencies continually attempt to achieve and anchor change. Other aspects of the change process may attract more attention, but research published by the Project Management Institute indicates that stakeholder engagement accounts for 70 percent of an organization's effectiveness in change management.

In the private sector, the roles of stakeholder and customer are clearly defined. Stakeholders are company investors, shareholders, and board members. Customers are the people who purchase and use the product or service. There is no such demarcation in the federal government. Depending on the nature of the change, stakeholders can be a combination of customers, partners such as other government agencies and non-profit organizations, federal employees, or oversight entities.

Agencies that excel at building and sustaining strong relationships with stakeholders in change environments share key attributes. They see stakeholder involvement not as a "one and done" exercise but as an inclusive, continuous journey between the agency and those potentially impacted by change. They also recognize that engagement encompasses a range of activities and approaches and that it spans the entire life of a program, project, or initiative.

> **"Officials from federal agencies identified seven investments that ... best achieved their respective cost, schedule, scope, and performance goals. ... Officials from all seven investments cited active engagement with program stakeholders as a critical factor to the success of those investments."**
>
> –GAO, *CRITICAL FACTORS UNDERLYING SUCCESSFUL MAJOR ACQUISITIONS*, 2011

Understanding the Problem

Agencies reporting success avoid common stakeholder engagement pitfalls:

- **Failure to identify the right stakeholders.** Leaders can be too inclusive (everyone with an interest in the change) or value those stakeholders with the most influence rather than those who are most directly impacted (and who can be most disruptive to change in the long run). To make good decisions, leaders need to have the right people "at the table."

- **Failure to choose the right engagement activities.** When leaders focus on one-way communication of information that they select and control, stakeholders may feel they are being sold on purported benefits and deceived about risks and adverse impacts. Leaders relying on a sales pitch miss out on meaningful opportunities for input and two-way dialogue with stakeholders that could inform and improve their own decision making.
- **Lack of effective stakeholder involvement at early stages of exploration and project development.** People support what they help to create. Leaders must balance their desires for secrecy in early project stages with the risks posed by late engagement, which erodes good faith and trust.
- **Lack of a strategic approach to stakeholder engagement across the project life cycle.** Although stakeholder engagement supports an agency's broader work in setting strategic goals, implementing action plans, and assessing performance over time, many leaders view it as a one-time event that serves a specific purpose, such as a program launch. Even when leaders recognize the need for ongoing stakeholder participation, they sometimes neglect to implement, evaluate, and update engagement plans systematically.
- **Failure to recognize that stakeholder engagement is a complex activity requiring special skills very different from the technical skills needed to design, construct, and operate a project.** Leaders who do not provide enough support for stakeholder engagement—in time, resources, and positioning within their own organization—put stakeholder engagement at risk of being discounted and subordinated to short-term, more immediately tangible priorities.

Areas of Opportunity

Effective relationship building enables innovation and leads to enhanced performance that benefits an agency, its stakeholders, and the public at large. To increase the adoption of stakeholder engagement best practices, the Trump administration could consider the following ideas as priorities for action within the first year:

- Encourage new agency leaders to work with career staff to understand stakeholders and their influences. Career staff possess deep institutional knowledge and are an excellent source of information for new leaders seeking to better appreciate the challenges and opportunities for agency interactions with stakeholders.
- Direct OPM to lead an effort, in collaboration with external groups such as the Partnership for Public Service, to develop quick training on stakeholder engagement. This training could help agency leaders translate their private sector knowledge/experience into working with stakeholders in the federal environment.
- Establish a community of practice of federal employees who work with stakeholders in change contexts in order to provide an executive branch forum for refining approaches to stakeholder engagement and forging mentorship connections. The Federal Communicators Network, a professional community of more than 800 communications professionals from across government, could serve as a model for such a group while also generating synergies between the stakeholder engagement and strategic communication disciplines.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Thinking Outside the Box(es and Lines)

During the transition to a new administration, new agency leaders commonly look for ways to better deliver on mission. A new leader's first instinct may be to look critically at the organization's structure, believing that moving organizational "boxes and lines" will create improved results. But doing so won't necessarily resolve performance issues and may even obscure genuine problem areas, since structure is only one component of a complex organizational system. New leaders can increase their odds of achieving sought-after results by exploring a broad set of organizational performance elements before, and during, a restructuring effort.

A Case for Action

Research published by McKinsey & Company shows that fewer than 25 percent of organization restructuring efforts succeed, with nearly one-third failing to meet leadership objectives or enhance performance after implementation. Reorganizations are also distinctly unpleasant experiences for employees. Reorganization efforts, and the uncertainty they create, can cause higher levels of employee stress than downsizing. In fact, 60 percent of cases in a *Harvard Business Review* study experienced a resultant reduction in employee productivity.

By moving too quickly to restructure—or not considering the mix of interrelated factors influencing organizational success—an organization risks lowering employee engagement, losing critical employees, and interrupting key services. MITRE's work with numerous federal agencies shows that these risks are compounded by the unique challenges of the public sector. One such challenge is the sheer number and complex influence of stakeholders. A public sector leader must address the needs of a dizzying number of constituencies (e.g., the President, members of the Cabinet, and 535 members of Congress) while working to improve an agency's performance.

By conducting a rigorous organizational assessment before undertaking a restructuring effort, an organization can determine where true issues and opportunities for improvement lie and perhaps avoid the need for a reorganization altogether.

> **"Apart from the high costs and squandered opportunity, a failed reorganization can leave an enterprise even worse off than it was before..."**
>
> –BOSTON CONSULTING GROUP, *FLIPPING THE ODDS FOR SUCCESSFUL REORGANIZATION*, APRIL 2012

Understanding the Problem

GAO recommendations to improve effectiveness and efficiency within the federal government consistently underscore the need to reexamine the structure and operations of federal organizations. In its 2012 report *Government Efficiency and Effectiveness: Opportunities for Improvement and Considerations for Restructuring,* the GAO outlines the Reforming and Consolidating Government Act of 2012—the bill renewing presidential authority to reorganize

executive branch agencies—and points to federal programs where "unnecessary duplication, overlap, or fragmentation exists." In addition, the Government Performance and Results Act (GPRA) Modernization Act of 2010 established a revised, more rigorous, results-oriented framework to improve government performance. The Act requires OMB to work with agencies to define outcome-oriented goals, develop government-wide plans to achieve those goals, and establish performance indicators to measure progress. Agencies must report on performance annually.

The mandate for ongoing reporting and continuous oversight creates pressure for federal agencies to be transparent, accountable, and high-performing. To meet the expectations of oversight bodies and the public, new leaders need a way forward that will produce sound, visible performance results. Those leaders may avoid the potential operational drag and workforce stress of a formal restructuring by instead first addressing the alignment and health of other organizational components, such as strategy, culture, and management practice.

How to Proceed

Early on, new agency leaders should seek to understand their organization's strengths and areas for growth, along with the internal and external pressures it faces. MITRE has found success in employing a comprehensive analytical performance framework to help agency leaders understand how diverse organizational variables link to one another and how the "white space" between variables directly affects the organization's performance and success.

For example, an assessment may reveal problems stemming from the agency's integrating mechanisms—the informal networks that allow people to interact more freely and share knowledge across the organization. Strengthening those mechanisms alone may bring about the improved collaboration and decision making needed across the agency without formally revising the organization chart.

If structural change is necessary, agency leaders should be deliberate and systematic in reshaping the organization, while being mindful of the attributes that distinguish government agencies from private organizations. For example, leaders new to the public sector would be well served to ensure that changes are directly aligned to agency mission, as commitment to promote or protect the public good is paramount to most federal employees' performance in a way that is uncommon in industry. In addition, they must successfully balance the host of external stakeholders with the agency's careerists and internal influencers. With their vast operational knowledge and political insight, these internal stakeholders can be the key to a new leader's successful launch of improvement initiatives.

Finally, new leaders should allocate time and resources to implement the new organization design, while remaining cognizant that results can take longer to realize in vast, complex agencies whose policies were established more for public safety and protection than for innovation.

Before restructuring, new agency leaders should carefully assess the performance elements most likely to create meaningful change for their organization. If, after this assessment, they deem reorganization to be necessary, they should actively manage those elements—with consideration for public sector realities—to effect the best possible result.

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

Sucessful Transformation Requires Systems Thinking

VA has begun an ambitious transformation effort designed to enable the Department to become a "high-performing" organization that is the number one customer service organization in the federal government. Early efforts include developing leaders, establishing new capabilities, and making tactical improvements to increase Veteran access to services and improve the quality of their interactions with the Department.

In order to build on this momentum and help transformation take root, VA must now address systemic and "root cause" issues. Adopting a systems thinking approach to problem solving will help the Department address these issues by empowering employees, enabling holistic problem solving, and enhancing the implementation of solutions. These changes in capabilities will improve the delivery of consistently high-quality care and benefits to our Veterans.

Why Systems Thinking?

Systems thinking is the ability to see the big picture and examine its parts. Systems thinkers strive to solve problems by understanding the linkages and interactions among the elements of problems so that they can identify and address root causes instead of wasting valuable resources on solving the symptoms. A systems thinking organization is a learning organization in which individuals take time to plan before they act and then study the results to improve future planning.

The systems thinking approach fosters the integration of mindsets, behaviors, analyses, data, and resources. Its methods enable leaders and managers to positively engage the workforce because problems are reframed into opportunities for improvement and solving them is predicated on the universal recognition that components of the whole need to be working together.

Systems thinking approaches are well established in many industries, including healthcare. Without systems thinkers, an organization will constantly be challenged to solve problems and will not develop a culture of continuous improvement.

Systemic Issues Identified

The MITRE-led Independent Assessment of the Veterans Health Administration (VHA) in 2015, performed in accordance with the Choice Act, is an example of systems thinking in action. The assessment arrived at four systemic findings: 1) a disconnect in the alignment of demand for services, resources to meet that demand, and eligibility rules for benefits; 2) uneven bureaucratic operations and processes; 3) non-integrated variations in clinical and business data and tools for making decisions; and 4) leaders who are not fully empowered due to a lack of clear authority, priorities, and goals.

> **"The findings and recommendations from these assessments revealed interrelationships that demand a holistic understanding of VHA."**
>
> –VETERANS CHOICE ACT INDEPENDENT ASSESSMENT (SECTION 201)— INTEGRATED REPORT, SEPTEMBER 2015

These were labeled systemic findings because a solution aimed at addressing one of the findings would invariably impact the others. The findings point to complex, interwoven problems, and any solutions must take into account people, processes, and technology as well as the relationships among these elements. As noted earlier, VA has taken initial steps (through the "MyVA" initiative) to address these findings. Now is the time to apply systems thinking to enable holistic, integrated problem solving to further address these findings in the context of overall transformation that achieves successful healthcare outcomes for our Veterans.

Applying Systems Thinking to Realize Transformation

VA can best understand how to provide superior Veteran-centric integrated care only when its managers and employees understand the interdependencies of their offerings. Delivering on the vision of an integrated Veteran-centric, community-based healthcare and benefits delivery network calls for a systems thinking approach.

Systems thinking will enable the Department to understand the connections among its various "service offerings" (e.g., Healthcare, Benefits, and Memorials) and enablers such as research investments, human capital, information management, technology, and facilities management. Systems thinking will allow VA to model these interdependencies and formulate approaches that optimize organizational structure, authorities, and technology solutions as well as the operations of both headquarters and field offices. This approach will also provide VA management with a solid framework for evaluating competing priorities and making informed decisions. To enable transformation, VA should accelerate the development and adoption of linked analytical structures, frameworks, and methodologies to support decision making and effective governance throughout all levels of the organization. Ultimately, systems thinking can help VA employees to collectively streamline the delivery of healthcare and benefits to Veterans, improve the quality of these services, and cut costs.

Areas of Opportunity for VA Management

Over the next year, VA can take steps to proliferate a systems-thinking culture throughout the organization by:

- Establishing and empowering authoritative analysis and integration activities that will deliver the artifacts and data needed to enable employees to make sound decisions at all levels of the organization
- Investing in trained and experienced strategic planners, engineers, and architects able to embrace holistic views of problems, requirements, alternatives, and solutions
- Developing highly proficient program and project managers who are systems thinkers who can balance scope, schedule, cost, and complex vendor contracts to develop and deliver the large and complex systems and services required by our Veterans
- Promoting transparency across the organization by making it safe for leaders and managers to share data and results of their successes and failures in support of true collaboration and real problem solving throughout the organization

For further ideas about applying the guidance in this paper to your agency's particular needs, contact federaltransition@mitre.org.

APPENDIX A

Federally Funded Research and Development Centers

Federally Funded Research and Development Centers

A Valuable Partner for Safety, Security, and Prosperity

Federally funded research and development centers (FFRDCs) are established by government agencies when they have specific, long-term needs that in-house staff or traditional contractors can't meet. The most important thing to know about them is this: They're different by design.

FFRDCs work with their government partners—also called sponsors—to assist with systems engineering and integration; research and development; and study and analysis of complex problems. They help the government make data-driven decisions that drive change and advance their missions. FFRDCs are operated by non-profit, private organizations and are required to remain free from any commercial interest. As such, they represent resources available to government to explore options, assess impacts, and advise on actions to accelerate change and address critical challenges.

In accordance with the public-interest purpose behind FFRDCs, the FFRDC community offers a blend of non-partisan advice, deep organizational knowledge, and creative solutions.

Innovation with Impact

The first FFRDCs began with a straightforward idea: Maintain a pool of technical expertise to assist government, but one with an independent stance.

This is as true today as ever. You might be surprised to learn just a few of the ways the alliance between FFRDCs and their partners has delivered impact for the U.S. and the world. For example:

- Can you imagine using your smartphone without GPS today? Scientists and engineers at FFRDCs helped design the original global positioning system for the U.S. military.
- Do you fly on jets? If so, you can thank the FFRDC staff who developed the technology that keeps commercial airliners from colliding in mid-air.
- Were you impressed by the Mars Rover that sends back eye-popping images from the Red Planet? That mission is the work of an FFRDC.

We know the challenges government faces are not small, and the opportunities to help government work for the public are many. From defense, cybersecurity, and healthcare to economic stability, homeland security, and transportation infrastructure (to name a few), agencies need partners to accelerate change. FFRDCs are intended to accelerate that change—by fostering innovative solutions through research and collaboration with the private sector, and by helping the government to stay ahead of the issues.

We know the challenges government faces are not small, and the opportunities to help government work for the public are many.

And because they structurally have no commercial interests, FFRDCs help the government in ways that would be unsuitable or cost-prohibitive for

commercial companies—from performing basic scientific research to addressing a rapid-turnaround capability for users. This is part of what we mean when we say "different by design."

A Unique Public–Private Partnership

How does this work? FFRDCs are governed by a specific set of guidelines within the Federal Acquisition Regulation, or FAR. The FAR outlines the special role FFRDCs play. By law, FFRDCs don't compete with or work for industry. They don't manufacture or sell products. Even when FFRDCS (such as those operated by MITRE) develop technologies as part of their research, these innovations enter the marketplace through a technology transfer process that benefits government and industry alike.

FFRDCs partner with their government sponsors for the long term. They have no organizational conflicts of interest that could compromise objectivity, not even their working relationships with their sponsors. In fact, agencies rely on FFRDCs to "speak truth to power."

This special relationship also makes it possible for FFRDCs to have unique access to government and contractor data. They serve as trusted advisers during complex situations—for acquisitions, for big data analysis, for resolving disputes among multiple stakeholders. All sides know FFRDCs will keep proprietary information secure—never using it to gain a competitive advantage or to undermine another organization. FFRDCs act as true hubs for collaboration among government, industry, academia, and others.

Taken together, FFRDCs represent a tiny fraction of the federal budget. Yet they deliver a strong return on investment on behalf of the safety, security, and prosperity of our nation.

APPENDIX B

Federally Funded Research and Development Centers Operated by The MITRE Corporation

National Security Engineering Center | FFRDC

The National Security Engineering Center (NSEC), a federally funded research and development center (FFRDC), provides broad-based technical, scientific, analytic, and enterprise systems engineering support to the Department of Defense (DoD), Intelligence Community (IC), and their partners in the national security mission.

Helping to Shape the Nation's Changing Defense Landscape

For more than 50 years, MITRE has served the DoD and the IC as a strategic partner, delivering broad and deep technical expertise that is independent and free from conflict of interest. We have both the historical perspective and institutional memory to support mission-critical capabilities, promote enterprise-level solutions, and enhance system interoperability and cybersecurity.

As the worldwide defense landscape changes, the U.S. military is changing as well, evolving into a joint force that is smaller, leaner, more agile, and technically advanced. Our warfighters and intelligence professionals must have cutting-edge capabilities that provide a technological and networked advantage.

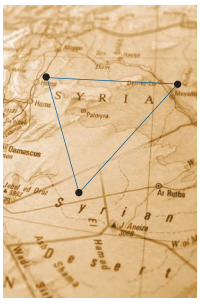
NSEC plays a vital role in this mission. We provide a disciplined approach to systems engineering and enterprise integration, and develop innovative technologies across a wide range of mission areas. We work closely with customers, commercial industry, other FFRDCs, academia, and the broader research community to apply the best expertise available to accelerate new capabilities. NSEC does this all while balancing capability improvement with cost containment. Three goals guide our work: dramatic performance improvement, reduced system costs, and accelerated delivery to the field.

Applying an Independent Perspective to Complex Challenges

MITRE's broad-based work program, independent perspective, and systems engineering expertise uniquely position us to address some of the DoD's and IC's most vexing challenges. For the DoD, we place special emphasis on creating joint systems to aid today's emerging missions. For the IC, we support U.S. intelligence agencies, military intelligence organizations, and combatant commands.

We aim for integrated solutions, in which systems work together seamlessly even if they are developed independently. We look for opportunities to work across our customer base to ensure that systems, services, and data can be shared within and across diverse missions.

At locations around the world, we provide our government sponsors with strong technical capabilities in systems engineering, modeling and simulation, acquisition strategy and management, enterprise engineering, and information technology. Decades of MITRE research and development on sensors, electronics, digital systems, and cybersecurity enable NSEC to address the evolving challenges of the 21st century.



Integrating data for better tactical vision

MITRE provided key command and control systems integration support for projects throughout the Middle East in support of U.S. Central Command and our coalition partners. MITRE integrated radar sensor data and tactical data link information, and developed the system interfaces needed for these partners to have input to U.S. military systems. The integrated data enables a common tactical picture, which U.S. military forces use to execute command and control of the airspace for friendly aircraft, adversary aircraft, and ballistic missile defense. Our work helped provide the coalition with radar coverage in areas previously not accessible due to host-nation sensitivities and allowed for efficient use of critical command and control resources.

Ensuring more accurate targeting

The Islamic State's tactic of embedding near hospitals, schools, and critical infrastructure makes military efforts by the United States and our coalition partners to target them a challenge. To help make the targeting and execution process more accurate, MITRE collaborated with U.S. Central Command, Air Forces Central Command, the ISR Task Force, and the Air Force Life Cycle Management Center to develop a capability to pull video from strike aircraft, which can be networked to decision makers at remote locations. A MITRE team also worked with operators to develop tactics, techniques, and procedures with the new capability.

Modernizing the nuclear enterprise

Since the end of the Cold War, the United States has maintained, but not vastly modernized, our nuclear enterprise. Now, numerous studies point to an aging infrastructure, outdated concepts of operations, inadequate architectures, and other systems in need of overhaul. MITRE is at the forefront of efforts to help the Pentagon design, develop, and acquire the future vision and architecture that can protect our country until 2030 and beyond.

Upgrading situational awareness in space

MITRE is working with the U.S. Air Force modernize its ground-based satellite control architecture and operations. This new, integrated Enterprise Ground System will replace existing stove-piped systems to provide space situational awareness with seamless command and control. MITRE will contribute expertise in acquisitions, systems engineering, advanced technology, and cybersecurity. MITRE's virtually connected systems integration lab to enables collaboration among government, FFRDCs, and industry. It allows the Air Force to develop, evaluate, and operationalize capabilities more quickly and adapt to dynamic mission needs.

Center for Advanced Aviation System Development | FFRDC

Progress in aviation is built on collaboration, innovation, and persistence. These qualities serve as the foundation of our work as we help the Federal Aviation Administration (FAA) and our other customers plan, develop, and field new capabilities that help modernize air traffic management systems and practices to improve the safety, security, capacity, and efficiency of the global air transportation system.

Resolving Global Aviation Issues through Research and Development

The MITRE Corporation is a not-for-profit organization that operates multiple federally funded research and development centers, including the Center for Advanced Aviation System Development (CAASD), sponsored by the FAA. By conducting an ongoing program of research, development, and engineering in collaboration with the aviation community, CAASD works to advance aviation in the United States and around the world.

MITRE has more than 55 years of experience partnering with the FAA and international civil aviation authorities to modernize air traffic management systems and operations. Our contributions include decision support systems for air traffic controllers and traffic flow managers; communications, navigation, and surveillance systems; procedure and airspace design; operational benefits and capacity analysis; and aviation safety analysis and improvements.

We understand the complex challenges that our customers face. Working in partnership with our customers and other stakeholders, we develop solutions for their most critical needs. We emphasize quality, integrity, and objectivity. This requires a long-term perspective focused on the public interest. We also seek ways to merge operational, technical, and program expertise for effectively deploying and transitioning new and enhanced capabilities.

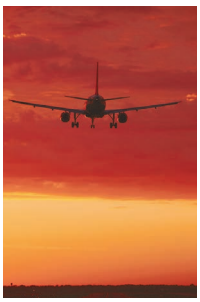
Dedicated to Improving Aviation Worldwide

In addition to our work for the FAA, CAASD performs work for international civil aviation authorities, airport operators, airlines, and other aviation organizations in more than 50 countries. We also conduct collaborative research with industry and academia. Finally, we help provide training—both in the United States and around the globe—on critically important aviation topics, including safety management system implementation and aviation system block upgrades.

Through our extensive modeling and simulation tools, significant data analytics capabilities, and world-class laboratories, we are able to provide the global aviation community with integrated solutions for new operational concepts and systems.

Defining the Future National Airspace System

CAASD is providing technical and operational analysis as well as complex concept evaluations to the FAA and the aviation community as part of planning for the Next-Generation Air Transportation System (NextGen). Developing and implementing NextGen is a huge undertaking with many challenges. We are working with the FAA to develop the vision, strategy, operational concepts, architecture, and implementation plans for NextGen.



Improving Aviation Safety

CAASD is developing and applying analytic capabilities to identify and address safety-related issues, with a focus on solving unanticipated problems before incidents and accidents can occur. We understand information system security and airspace operational security, and we are working to improve procedures and systems to mitigate threats and their potential operational impacts.

Improving Airspace Capacity, Performance, and Efficiency

CAASD is developing air traffic management (ATM) decision support concepts and capabilities; communications, navigation, and surveillance (CNS) concepts and capabilities; airport and airspace concepts and designs; and procedural improvements that will enable efficient operations. We understand the complexities and interactions of airspace users' objectives and operations, and we develop methods for measuring and predicting airspace performance. We also identify solutions to improve performance.

Increasing Airport System Capacity

Across the globe, CAASD is assessing empirical data and developing capabilities to identify the location, magnitude, and causes of current and projected future airport capacity shortfalls. We are also developing improvements to use existing airport capabilities and future airport investments more effectively.

Achieving Global Harmonization

CAASD collaborates with the FAA to provide global aviation leadership while ensuring that its evolving plans for ATM/CNS are compatible and aligned with international civil aviation authorities. A key focus involves developing integrated systems in harmony with international standards. As we continue to increase our knowledge of best practices—in areas such as airport safety, airspace design, airport and airspace capacity enhancement, equipage, and ATM—we apply them to the specific circumstances that characterize each country's civil aviation needs.

Center for Enterprise Modernization | FFRDC

The MITRE Corporation's Center for Enterprise Modernization (CEM) was established to focus on a specific challenge: how to successfully transform a large government enterprise to better serve the American people. Currently sponsored by the Department of Treasury and the Internal Revenue Service (IRS), and co-sponsored by the Department of Veterans Affairs, CEM has been a thought leader in this area since 1998. We enrich the public knowledge and contribute to major advances that have changed—and will continue to transform—tax administration, government financial management, the conduct of the U.S. Census, and caring for and providing benefits to our Veterans.

Thought Leadership for Modernizing the Federal Sector

Our vision for government enterprise transformation includes helping our sponsoring agencies develop and institutionalize new capabilities, preparing them to better plan, manage, and make critical decisions based on analysis and research-based exploration. The result is a greater frequency of success—with reduced risk and more predictable costs—while overcoming challenges in integration, scalability, security and privacy, and data sharing. MITRE's significant investment in research and innovation allows CEM to readily develop new ideas, evaluate new technologies, and transfer methods and technical capabilities to both government and industry

A Government-Wide Resource

In addition to our work with our sponsoring agencies, CEM engages with other government organizations to advise, inform, and partner with them to address a variety of modernization challenges. With the consent of the IRS, CEM also can work directly with other agencies, helping these organizations and their stakeholders effectively transform the way they do business with the American public.

CEM's work enables government enterprises to more efficiently acquire, integrate, manage, and operate business and information technology (IT) systems that are critical to the services they provide. We help our customers succeed by identifying opportunities to adopt new strategic and management capabilities, especially in the areas of information technology. Enabling our sponsoring agencies to serve as their own integrator has proven to reduce risk and improve the success rate of technology adoption. It also improves the government-industry relationship by creating greater shared responsibility in IT programs.

Improving the Well-Being of Veterans

MITRE conducted an in-depth study in collaboration with the Veterans Health Administration (VHA) that will contribute to improving the health, satisfaction, and well-being of Veterans, while also making services more cost-effective. The study resulted in nine recommendations for creating a system that more efficiently delivers better access and better outcomes. The resulting *VA Healthcare Modernization Report* includes steps for achieving efficiencies, such as standardized physical healthcare delivery structures and best practices for procuring equipment and pharmaceuticals as well as leveraging prime vendor contracts. MITRE and the VHA completed the study in spring 2014. MITRE also helped incorporate many of the study recommendations and findings into the VHA's *Blueprint for Excellence,* which the Secretary of Veterans Affairs published and provided on the VHA website.

Maximizing the Efficiency of the IRS's Filing Season Operations

Every year the tax filing environment grows more complex with an increasing number of new technologies, functions, and legislative changes. With MITRE's support, the IRS has introduced new efficiencies into its tax filing season planning and execution processes. One of the agency's principal goals is to deliver a successful tax filing season—one with minimal processing delays and system disruptions—to the more than 200 million taxpayers filing individual and business returns each year. MITRE is now working across the IRS to bring together and apply best practices.

Homeland Security Systems Engineering and Development Institute | FFRDC

The Homeland Security Systems Engineering and Development Institute (HSSEDI™) is a federally funded research and development center (FFRDC) providing systems engineering and acquisition expertise to the U.S. Department of Homeland Security (DHS). Sponsored by DHS and managed by The MITRE Corporation, HSSEDI works across DHS organizations and initiatives to protect the United States and keep it secure.

Safeguarding Domestic Security

MITRE has supported DHS since its inception in 2003 and, since 2009, has managed its systems engineering FFRDC. MITRE helps DHS apply a systems approach that supports mission outcomes and the organizational processes needed to operate a large, diverse organization in the rapidly changing homeland security environment that requires coordination among federal, state, local, tribal, and territorial agencies, as well as private sector and non-governmental organizations.

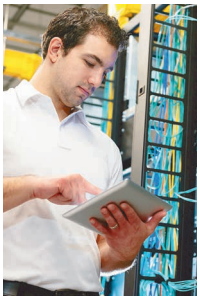
Providing Systems Engineering Expertise to Solve Complex Homeland Security Challenges

MITRE supports DHS in its mission to protect the nation from terrorist threats, enforce immigration laws, coordinate disaster responses, manage the nation's borders, and secure critical infrastructure and information systems to create a safer cyberspace..

HSSEDI supports DHS in four strategic focus areas:

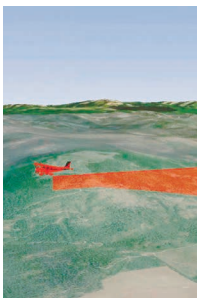
- Providing DHS scalable, cost-effective, enterprise services and infrastructure for mission effectiveness
- Deploying integrated security threat assessment to reduce the possibility of terrorism
- Increasing critical infrastructure protection
- Increasing cyber threat information sharing to improve mission resilience

MITRE delivers practical solutions and recommendations through a combination of direct project work, crosscutting HSSEDI core research, and corporate research, often drawing from MITRE's own work as well as best practices from industry, academia, and other FFRDCs. We provide independent and objective expertise in systems engineering, acquisition, risk management, and program management. Our systems engineering approach emphasizes the development of documented, disciplined, and agile practices and methods that balance the technical and non-technical aspects of systems, the homeland security environment, and the DHS organization.



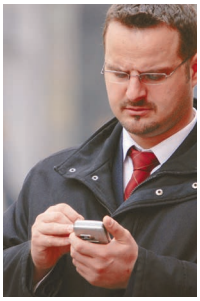
Cyber Threat Information Sharing

MITRE collaborated with DHS to develop standard approaches that allow organizations to communicate cyber threat information in a secure and automated manner. We recognized the need to address nontechnical areas—such as capability, liability, privacy, and culture—that often become obstacles to actionable threat information sharing. This strategy enables a faster and more relevant response to threats and enhances resiliency among critical infrastructure and public and private sector organizations.



Secure Mobile Communications

MITRE hosts the DHS Advanced Network Integration and Experimentation Lab (DANIEL) to investigate, develop, and deploy secure mobile solutions. One of its goals is to help DHS reduce the time and cost required to deploy sophisticated and secure mobile communications. MITRE engineers enabled smartphones to operate securely over an innovative and commercially available private cellular network, where data remains protected. By removing the device from the Internet, our engineers enhanced device and data security, simplified device management, cut overall risk, and reduced potential costs.



An Agile Approach for Immigration Challenges

MITRE's collaboration with the U.S. Citizenship and Immigration Services enabled the agency to deliver capabilities in half the time, allowing them to absorb increased workloads more efficiently and cost effectively. Based on agile methods, an approach that enables collaborative teams to build software incrementally in response to changing requirements, MITRE created a new enterprise operating model for developing technology solutions.

CMS Alliance to Modernize Healthcare | FFRDC

The Centers for Medicare & Medicaid Services (CMS) sponsors the CMS Alliance to Modernize Healthcare (CAMH), a federally funded research and development center (FFRDC). CAMH is one of seven FFRDCs operated by The MITRE Corporation, a not-for-profit organization chartered in the public interest. CAMH serves as an objective, independent adviser to CMS, the Department of Health and Human Services (HHS), and other government organizations with health-related missions.

Confronting the Nation's Toughest Health Transformation Challenges

Making healthcare more accessible and affordable is one of our nation's biggest challenges. Achieving large-scale connected integration—of transforming the health sector into a health system—is a systems engineering mission of enormous scale. CAMH objectively analyzes long-term health system problems, addresses complex technical questions, and generates creative and cost-effective solutions in strategic areas such as quality of care, new payment models, and business transformation.

Bringing the Best Experts from Nonprofits, Academia, and Industry

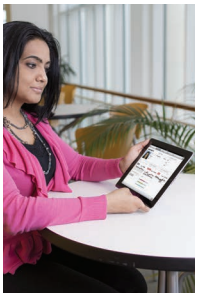
CAMH provides specialized expertise, health capabilities, and innovative solutions to transform delivery of the nation's healthcare services. With CAMH, government organizations and other entities have ready access to a collaborative alliance of partners from nonprofits, academia, and industry.

MITRE operates the CAMH FFRDC and brings experts to bear on subjects ranging from health policy and delivery system reform to federal acquisition, cloud computing, and complex systems engineering. CAMH also offers agencies access to experts from RAND Health, McKinsey & Company, and other leading healthcare organizations, as well as select qualified small and disadvantaged businesses.

In total, CAMH brings the expertise of more than 5,000 health transformation professionals to advance HHS's strategic goals of achieving better care, smarter spending, and healthier people.

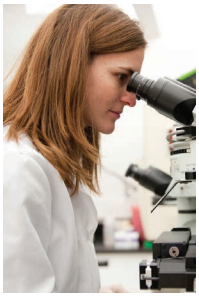
Better Care

CAMH works in close partnership with CMS, HHS, and other government sponsors to promote improvements in healthcare quality and access. CAMH convenes CMS Affinity Groups to facilitate collaboration across federal agencies on issues ranging from Alzheimer's and dementia to Value-Based Purchasing. To reduce the risk of falls or medication errors, CAMH is developing plans so CMS can ensure that electronic health records "follow the patient" from one post-acute-care facility to another. CAMH also offers CMS strategic guidance on policies related to structuring effective healthcare quality reporting programs. And in support of expanding healthcare coverage, CAMH is informing enhancements to the federal and state marketplaces to improve the consumer insurance purchasing experience.



Spending Smarter

CAMH manages multiple projects with CMS to advance reform of the $3 trillion healthcare delivery system to pay for quality care, not volume. For example, CAMH provides CMS strategic policy and payment model scoring guidance for the design of the new Merit-Based Incentive Payment System required under the Medicare Access and CHIP Reauthorization Act of 2015. CAMH also convenes the Health Care Payment Learning and Action Network, a partnership of health plans, providers, patients, employers, consumers, states, federal agencies, and other partners charged with advancing alignment of alternative payment approaches. And to prevent billions of dollars in fraud, waste, and abuse in healthcare spending, CAMH conducts advanced data analytics studies that enable CMS, insurers, and law enforcement to detect and combat improper payments.



Healthier People

CAMH partners with HHS and CMS to modernize health systems and unlock healthcare data to improve wellness and prevention for Americans. CAMH engages with the National Institutes of Health to shape biomedical research and advises the Centers for Disease Control and Prevention on their surveillance of disease, injury, and exposure to health threats. CAMH coordinates with CMS and the Office of the National Coordinator for Health IT to transition paper-based clinical quality measures into electronic measures to improve quality incentive and reporting programs. CAMH also advises the Food and Drug Administration on pathways to modernize their food and veterinary programs under the Food Safety and Modernization Act, and develops prototype technologies for the Federal Communications Commission to improve telecommunications options for the deaf, deaf/blind, hard of hearing, and speech disabled.

Judiciary Engineering and Modernization Center | FFRDC

Sponsored by the Administrative Office of the U.S. Courts on behalf of the federal judiciary, the Judiciary Engineering and Modernization Center (JEMC) provides objective assessments of the technical challenges facing the judiciary, including available and emerging technologies.

Working as a Trusted Partner to Modernize Judicial Systems

JEMC's founding in 2010 marks the latest step in the partnership between MITRE and the federal judiciary. Since May 2006, we have worked with judiciary stakeholders to develop enterprise-wide solutions for upgrading their wide-area network, voice, video, and Internet services. Through JEMC, our staff provides objective assessments of the technical challenges the judiciary faces, while analyzing the impact and risks of both available and emerging systems.

MITRE works as a respected and credible partner on the leading edge of change in legal and judicial systems, both domestically and internationally. We apply specialized technical and domain knowledge to support a global community that is changing the judicial reform landscape.

The Center for Judicial Informatics, Sciences, and Technology (CJIST) is an extension of JEMC. CJIST takes a global focus and works with the worldwide judicial community—including academia and international and nongovernmental agencies—involved in promoting the rule of law, access to justice, judicial reform, and modernization. These organizations face similar challenges as the federal judiciary.

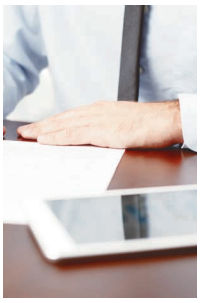
Advancing Judicial Systems Worldwide

The bedrocks of a stable society include access to justice and the rule of law. By working as trusted partners to focus on national and global judicial modernization, JEMC and CJIST are helping the judiciary community—both nationally and globally—through organizations such as the World Bank establish effective, efficient, and modern judicial systems.

For example, MITRE signed a Memorandum of Understanding in 2016 with the University of Montreal's Cyberjustice Laboratory. The agreement supports our entry into the Global Forum on Law, Justice, and Development, an organization of more than 100 members that discusses solutions to the world's problems related to law, justice, and equality in developing countries.

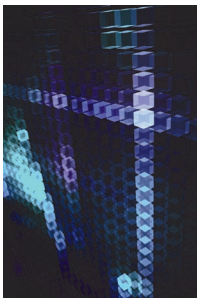
Computational Law

Computational law, or the automation of legal reasoning, has great promise to assist in lessening the burden of clogged courts and case backlogs. This emerging area combines science and the law and holds the potential to transform the judicial systems of tomorrow. MITRE is working with Stanford University Law School, the Michigan State University College of Law, the Illinois Institute of Technology Chicago-Kent College of Law, and others to study the potential use cases for computational law. As the Internet of Things continues to expand, the notion that some matters could be resolved by a "fairness engine" seems possible. This focus on emerging technologies, innovation, research, and development is a MITRE differentiator that helps our sponsors anticipate and plan for the future in this ever-changing environment.



Judicial Mapping

MITRE develops cutting-edge capabilities that help modernize judicial systems, promoting access to justice and enhancing judicial efficiency, including emerging technologies across judiciaries, judicial modernization and efficiency, and the court analytics and related technologies. Through JEMC and CJIST, MITRE is working in the United States and with the global judicial community, including the concept of judicial mapping, which involves geographical distribution of district courts and courts of appeal. One example is the Platform for the Computational Analysis of Public Systems, known as MITRE P-CAPS™. The Platform helps reforming and developing countries make data-backed decisions relative to judicial maps. It can also support mapping relative to healthcare and educational systems across MITRE sponsors.



National Cybersecurity FFRDC

The U.S. Commerce Department's National Institute of Standards and Technology (NIST) sponsors the National Cybersecurity Federally Funded Research and Development Center (FFRDC)—NCF—to operate its National Cybersecurity Center of Excellence (NCCoE). NCF is the nation's first and only cybersecurity FFRDC, established to advance the NCCoE mission by fostering collaborative innovation and promoting standards-based cybersecurity to protect businesses and the economy. NCF is one of seven federally funded research centers operated by The MITRE Corporation, a not-for-profit organization working in the public interest since 1958.

Real World Cybersecurity Solutions through Public-Private Partnership

As the national laboratory for cybersecurity, the NCF provides U.S. businesses with practical, standards-based solutions. This national hub enables the NCCoE to work with industry organizations, government agencies, and academic institutions to identify businesses' most pressing cybersecurity challenges and develop model solutions. Collaborating with technology providers, we create example solutions based on commercially available products. This approach transforms standards and best practices into practical solutions that meet real-world cybersecurity needs in identity and access management, secure email, mobile device security, attribute-based access control, and more.

With a culture of knowledge sharing, we apply lessons learned from MITRE's four decades of experience working with government to strengthen the nation's cyber defenses. Our work has enabled technology providers to identify functionality gaps and improve the interoperability of their products. Companies across multiple industrial sectors can now rapidly adopt cybersecurity technologies in practical ways that are modular, scalable, and standards-based.

Accelerating Innovation

NCF and NCCoE operate in a state-of-the-art facility that features 23 labs, ample public meeting space, and an overall environment that inspires public-private collaboration on current and future cybersecurity challenges. Engaging more than 100 technology vendors, NCF helps develop frameworks and implementation strategies, provides systems engineering and technology testing, and assists with technology transfer to bridge the need for cybersecurity innovation.

Cybersecurity is a multi-disciplinary challenge and requires the innovative thinking of our nation's most prominent academic institutions. MITRE partners with the University System of Maryland (USM) to accelerate innovation by identifying, supporting, and applying research from USM's nation-wide Academic Affiliates Council to technically complex, industry-driven challenges.

NCF supports NCCoE's efforts to accelerate businesses' adoption of secure technologies. This model is an example of what can be accomplished through government-industry partnership. Our work reflects the insight and passion of collaborators who share our vision of a secure cyber infrastructure that inspires innovation and fosters economic growth.

Providing Practical Cybersecurity: NIST Practice Guides

Working with communities of interest, NCF and NCCoE identify the most pressing and broadly-applicable cybersecurity challenges faced by businesses. The center then designs and demonstrates how to implement an example solution. The result: NIST Cybersecurity Practice Guides that encourage broad and early adoption of secure, standards-based technology across industry. These publicly available guides outline risks and potential business impacts for decision makers, and provide IT implementers and developers with comprehensive implementation information and instructions for mitigating cybersecurity risks. Sectors and security issues addressed so far include mobile device security for accessing medical health records, standards-based email security, and it asset management for electric utilities. NCCoE publications have been viewed more than 30,000 times.

Consumer Internet of Things Initiative (CITI)

Security is one of the top reasons cited by consumers for why they aren't using more IoT devices and enabling a smart home. CITI is a state-of-the-art living lab that enables researchers to assess consumer IoT devices and systems and to investigate proof-of-concept defensive techniques. CITI is the place to develop standardized IoT system evaluation procedures, and to capture, analyze, and catalog protocols used by these systems. Established by the NCF and located at NIST's NCCoE, CITI is open to MITRE sponsors, partners, and staff to collaborate and explore device capabilities, ecosystems, and emergent behavior of system-of-systems in a heterogeneous environment. This work has informed and enhanced the NCCoE's efforts to define new projects in identity and access management for IoT. NCF plans to expand the lab's capabilities to include integration with wireless network communications.

Continuous Diagnostics and Mitigation

NCF provides engineering support to NCCoE and the Department of Homeland Security (DHS) to improve Information Security Continuous Monitoring (ISCM)/CDM-centric standard practices and guidance for federal agencies under the Chief Financial Officers Act. NCF's work focuses on helping DHS improve its ability to assess and improve agencies' implementations of ISCM, thereby advancing the cybersecurity posture of the U.S. government.

NOTES: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