The MITRE Corporation is a not-for-profit organization chartered to work in the public interest. MITRE manages federally funded research and development centers (FFRDCs). An FFRDC is a unique organization that assists the United States government with scientific research and analysis, development and acquisition, and systems engineering and integration. We also have an independent research and development program that explores new technologies and new uses of technologies to solve our sponsors’ problems in the near term and in the future.
Department of Defense Command, Control, Communications, and Intelligence FFRDC
Sponsored by the Department of Defense

Center for Advanced Aviation System Development FFRDC
Sponsored by the Federal Aviation Administration

Center for Enterprise Modernization FFRDC
Sponsored by the Internal Revenue Service and co-sponsored by the Department of Veterans Affairs

Homeland Security Systems Engineering and Development Institute FFRDC
Sponsored by the Department of Homeland Security

Judiciary Engineering and Modernization Center FFRDC
Sponsored by the Administrative Office of the U.S. Courts on behalf of the Federal Judiciary
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In 1958, when MITRE was formed, the articles of incorporation described the company’s business in terms that emphasized the application of scientific disciplines to advance research, development, and engineering with the explicit purpose of enhancing national security and furthering the public interest. These principles have served as our foundation for more than 50 years and remain at the heart of all our pursuits.

Today, we manage a company focused on the operation of federally funded research and development centers (FFRDCs). We do this because we believe the FFRDC model offers us the greatest opportunity to achieve the promise we made to the nation in that original charter.

FFRDCs are formed to address critical national problems of considerable complexity. To ensure the highest levels of objectivity, they are organized as independent entities with limitations and restrictions that prohibit them from manufacturing products, competing with industry, or working for commercial companies. These limitations eliminate traditional conflict-of-interest challenges, allowing industry and government to confidently entrust them with sensitive information. Working in this environment, FFRDCs support their sponsors across a full spectrum of planning and concept development, research and development, and systems acquisition.

As the federal government continues to wrestle with a number of difficult challenges—including terrorism, an ongoing presence in Iraq and Afghanistan, a slowly recovering economy, shrinking budgets, and an evolving healthcare system—we believe the role of the FFRDC has never been more important. At MITRE, we are helping to make substantive progress toward addressing these challenges.

We work closely with the Department of Defense and the Intelligence Community to improve the ability to detect, analyze, and respond to a variety of threats. Serving as lead systems engineer, we developed concepts for an airborne communications gateway for the Air Force that provides connectivity and situational awareness to air and ground forces. We architected the Army’s network infrastructure to transform the way information is collected and distributed. Working with the Navy and Marine Corps, we prototyped composable command and control solutions to improve expeditionary operations. On the domestic security front, we helped the Department of Homeland Security launch a secret-level communication-sharing network for state and regional intelligence Fusion Centers.

We continue to support the Federal Aviation Administration’s NextGen project to plan and implement the future National Airspace System. In 2010, we helped define the project’s critical path for the coming decade and prototyped key supporting technologies, including a tool that enables more flexible departure and landing routes. Working with the Internal Revenue Service on tax system transformation, we helped improve customer service and clamp down on fraud. We also worked with industry and government to expand the use of electronic health records, with the ultimate goal of lowering costs and improving patient care.

Because MITRE only manages FFRDCs, we are able to leverage the collective knowledge of the entire company and work across agencies on government-wide problems. One of these is the Advanced Persistent Threat—ongoing, malicious attacks on our nation’s computer infrastructures. In 2010, we collaborated with DHS and other organizations to release a crucial list of the main software programming errors that can introduce cybersecurity threats into computer networks. We are also working with partners in the DoD, DHS, and FAA to explore innovative ways to operate unmanned aviation systems for uses such as national emergencies and border patrol.
This year we were proud to be selected by the federal judiciary to operate its systems engineering and integration FFRDC—the Judiciary Engineering and Modernization Center. We will continue to leverage our experience in advanced technologies to help the Courts update their information systems.

We take great pride in our work and are gratified by recognition of our accomplishments. For the tenth consecutive year, we were selected for FORTUNE magazine’s 100 Best Companies to Work For list. We received similar recognition from the Boston Globe and Computerworld. R&D Magazine featured the MITRE-developed Universal Access Transceiver Beacon Radio on its list of the 100 most technologically significant products introduced into the marketplace over the past year, and our social network application was named a Gold winner of the international Intranet Innovation Awards.

Our Board of Trustees continues to provide strategic guidance and oversight to help navigate the complex challenges we face. This year we welcomed Nicholas Donofrio, a 44-year IBM veteran who led that company’s technology and innovation strategies for many years. We also want to acknowledge the retirement of Vic DeMarines, a board member since 1995. A 47-year company veteran and former president and chief executive officer, Vic contributed in many ways to MITRE’s vitality. We have been fortunate to benefit from both his leadership and friendship.

Looking to the future, we continue to place great emphasis on both the value and cost-effectiveness of our contributions. We are instituting processes to measure and manage product quality to the highest standards and will press forward with cost management activities to ensure the government’s investment is wisely managed. Our research program is addressing cybersecurity and privacy challenges, government acquisition process improvements, and large-scale data store management—problems all our sponsors face and areas where our systems engineering and advanced technology expertise can make a difference. We are also exploring emerging technologies that have the potential to dramatically improve mission performance. Our research investments combined with the collective knowledge of the five FFRDCs that we operate and the extensive collaboration with industry and academia position MITRE to continue to deliver solutions that make a difference.

Alfred Grasso
President and Chief Executive Officer

James Schlesinger
Chairman of the Board of Trustees
DEFENSE AND INTELLIGENCE

Information—its acquisition, dissemination, and strategic use—has never been more important for the protection of our nation. Getting better information into the hands of the men and women who serve our country in the military and in other capacities is not easy, however. At MITRE, the best solutions in some cases draw upon our traditional capabilities, like systems engineering, information assurance, and acquisition guidance. Other instances require new ways of thinking about a problem, such as incorporating mobile applications into the warfighters’ toolkit or analyzing the opinions of foreign nationals. During 2010, MITRE partnered with the defense and intelligence communities to achieve results in a range of programs, from improving cybersecurity and communications networks to developing an innovative approach to acquiring much-needed systems faster.

In 2010, network infiltrations such as the STUXNET worm demonstrated that targeted and sophisticated cyber attacks abound. The worst attacks spring from what’s known as the “advanced persistent threat,” or APT. Though APT attacks cannot be prevented outright, organizations can reduce their risk and mitigate damage. To combat the APT, MITRE helps our government sponsors incorporate agile cyber-defense strategies into their systems. One of the most promising is an evolving concept called resilient cyber architecture.

Resilient architectures can take severe blows to their systems, yet still carry out their critical missions. We work with agencies across the national security spectrum to identify...
critical functions and assets—their vulnerabilities, inter-dependencies, and alternative capabilities—and to integrate creative resiliency techniques. MITRE also promotes community building to advance innovative ideas and identify networks and systems that would benefit most from resiliency measures.

For example, we hosted the first Secure and Resilient Cyber Architectures Conference in October 2010. In his keynote address, Robert Butler—the Deputy Assistant Secretary of Defense for Cyber Policy—emphasized cybersecurity’s integral role in national defense and called on the participants to continue their work against APT and cyber threats of all kinds.

“\textit{I am writing this note as an expression of my complete satisfaction with the work provided by the MITRE employees supporting my initiatives. Their thought leadership, dedication to delivery and mission, and overall professionalism in supporting Intelligence Community, Department of Defense, and National Institute of Standards and Technology outreach and deliverables have been core to our teams' organizational success.}”

Roger L. Caslow, Chief, Risk Management/Information Security Programs Division, IC CIO/Intelligence Community Information Assurance, commending MITRE’s support to the program on Information Technology Systems Security Risk Management, Certification and Accreditation.
Bringing Technical Knowledge to the End Users

Working Up Close with Military Personnel to Find Solutions

Whenever possible, MITRE deploys staff to the field to study firsthand the special challenges warfighters face. For the Navy, for example, a group of MITRE “ship riders” lived aboard the USS PELELIU in mid-2010 to learn about the service’s unique command-and-control (C2) and communications issues. The team became immersed in the workflow and systems of entities such as Landing Force Operations Centers, gaining knowledge for future research and design efforts. For the Army, MITRE engineers frequently visit Afghanistan to contribute their technical expertise to intelligence, surveillance, and reconnaissance system challenges faced by U.S. and coalition troops.

And for the Air Force, a group of MITRE engineers developed a Mission Planning Warehouse (MPW) data management prototype to provide warfighters with greater situational awareness. The team traveled with personnel from the Air Force’s Electronic Systems Center (ESC) to a Combined Air and Space Operations Center that supports personnel in Iraq and Afghanistan. While there, they worked side by side with in-theater “combat coders” to install, test, and improve the MPW under battlefield conditions at a front-line command center. The first full release of the system, including the improved features, was delivered in early 2010. It has been called “a great example of quick-turn support to the warfighter,” by ESC Commander Lt Gen Ted Bowlds.

Addressing a Complex Challenge

A Plan to Unify the Army’s LandWarNet System

The Army is currently transitioning its LandWarNet from a loose array of networks and IT systems into a cohesive and integrated enterprise-wide system. The strategy governing the transition—the Global Network Enterprise Construct (GNEC)—is being phased in to accommodate priorities and resource constraints. MITRE, which has an in-depth understanding of the Army’s complex systems challenges, assists the effort in several key areas.

For example, we developed the concept of operations, functional requirements, and architecture for the Army’s Enterprise Service Desk. The service desk provides the single point of contact for technical and operational support throughout the Army. In 2010, the Army extended the service desk to nine locations and has begun the rollout to 70 more locations in 2011. For the Army’s Operating and Generating Forces, our GNEC team guided the Network Service Center Operational Validation. We developed the communications architecture, implemented the data replication, and led the data analysis and high-level evaluation for senior Army leaders. Building on this experience, MITRE is helping the Army prepare for Operation Guardian Enable, during which a Brigade Combat Team will use the evolving GNEC elements as part of its deployment in Afghanistan.

Aligning Technology with Social Science

A Different Kind of “Radar” to Support International Relations

Radar and other sensor technologies are key tools in support of U.S. missions around the globe. But in the 21st century, a new “radar” capability is equally important—detecting and understanding perceptions, attitudes, beliefs, and behaviors of foreign populations. Polls and surveys are expensive and time-consuming, while manually harvesting information from sources such as blogs, Twitter feeds, and social media is labor-intensive and unreliable. To meet this challenge, MITRE has developed the concept of “social radar” to communicate and guide technology development and implementation.
Social radar technologies have the potential to provide government teams with rapid situational awareness and decision-support tools. These, in turn, can augment human understanding and engagement techniques for enabling strategic communication, countering violent extremism, and building global partnerships. MITRE’s Smart Power initiative focuses on the research and implementation of tools and methods to enhance the ability of government agencies to achieve their missions. Through our work for the Office of the Secretary of Defense, Department of State, and Combatant Commander human-terrain analytic cells, we have seen support grow steadily for the use of social radar technologies to more effectively understand and engage foreign populations.

Bistatic Radar: A Maturing Concept

A drawback of traditional radar is the need for large-scale platforms (such as ground-based dishes or large surveillance aircraft). Using a bistatic radar approach, coupled with novel signal processing to eliminate “ghosting,” MITRE researchers found a practical alternative. A bistatic system can use different transmitters and receivers, so they can be placed on separate unmanned aircraft, saving weight and cost. The team’s prototype is being transitioned into operational use and promises to provide crucial reconnaissance information in a variety of challenging environments.

“Here in Colorado Springs we’ve been relying on you to keep us in the fight—first it was all about maintaining our air superiority, then it was about maintaining our space superiority, and now I would argue you are by our side as we try to figure out how to maintain cyber superiority. So this is an important relationship, and that’s why I am here today.”

### Innovation in the Public Interest

#### Using Smart Applications in Tough Situations

In the not-too-distant future, soldiers will routinely use smart phones with situation-specific mobile applications—ones that may save their lives. To bring that moment closer, MITRE has demonstrated how iPhones and similar cellular devices can be part of the warfighters’ standard gear.

Over the last year, a team of MITRE engineers developed a prototype app called “COIN Collector.” It helps soldiers access the unique data needed in a counterinsurgency (COIN) environment. Following rapid prototyping, MITRE offered COIN Collector to the U.S. State Department and leaders from several Provincial Reconstruction Teams (PRTs) for evaluation in Afghanistan. The PRTs quickly benefited from incorporating the app into their mission. In an unexpected enemy engagement, COIN Collector provided situational awareness to a team under fire, preventing loss of life. In addition, the Army used more than 200 COIN Collector-enabled phones for a large-scale field exercise in mid-2010, and the Marines have taken iPhones with the app on recent overseas deployments.

COIN Collector is only one example of the power of apps. We also created the Government Mobile Application Group to bring together commercial companies (including Apple, Google, and others) to discuss how industry can help the government. Dozens of representatives from government and industry meet quarterly to discuss user needs and how to lower barriers to fielding products quickly.

### Systems Engineering Expertise for an Urgent Need

#### A High-Flying Gateway for Communications Signals

The ability to relay communications signals among aircraft and ground personnel in geographic- and bandwidth-constrained locations stands as one of the military’s most urgent concerns of the last few years. An innovative solution that uses commercially available components—the Battlefield Airborne Communications Node (BACN)—now puts communications gateways in the air where warfighters need them. MITRE serves as the lead systems engineer on BACN for the Airborne Networking Division at the Air Force’s Electronic Systems Center.

These airborne gateways significantly shorten C2 response times by enabling machine-to-machine transactions, data-link translation, and voice bridging. By the end of 2010, the BACN team deployed five aircraft carrying the new node to the operations theater. The aircraft provide continuous, uninterrupted coverage over a wide area. For its achievements, the BACN team received three major awards: the DoD Top 5 Systems Engineering Program Award from the Office of the Secretary of Defense; the Weapons System Award and Col Franklin C. Wolfe Memorial Trophy from the Order of Daedalians, the national fraternity of military pilots; and the John J. Welch, Jr., Excellence in Acquisition Leadership award, the Air Force’s most prestigious acquisition award.

### An Outcomes-based Approach

#### Changing C2 Acquisition Practices, One Capability at a Time

As technology races ahead, the rigid acquisition processes for new defense systems cannot keep up with the evolving operational needs of today’s warfighters. This is particularly true for C2 systems, which often take years to design, build, and deploy. MITRE has set out to find ways to bring adaptive, responsive C2 systems to the field much faster and more cost-effectively through a wide-ranging research program called Composable Capability on Demand, or CCOD.”
CCOD follows principles similar to those in commercial information technology development. This means combining data and services to create “new” C2 capabilities, often in the form of Web or mobile applications. In 2010, the CCOD group created a technical platform that allows users to rapidly configure and adapt command center capabilities in response to mission needs. When we introduced the CCOD concept at a national conference, industry and government leaders welcomed it as a significant step forward in C2 systems acquisition.

For 2011, plans to bring CCOD to the field include showing staff at U.S. Africa Command headquarters in Vicenza, Italy, how CCOD methods can be used to help configure a contingency command post. (For more on CCOD, see page 27)

Collaboration for National Security

Incorporating Unmanned Systems into Civil Airspace

Unmanned aircraft systems (UAS) have proven invaluable overseas. Now, the DoD—along with the Federal Aviation Administration and Department of Homeland Security—seeks to integrate these aircraft into domestic airspace for uses such as national emergencies and border patrol. The plan is part of an aviation community need to integrate these new technologies into the National Airspace System.

One mutual concern revolves around UAS pilots’ current inability to “see and avoid” other traffic in shared airspace. A promising option is the Ground-based Sense and Avoid (GBSAA) concept. With GBSAA, a radar system provides the pilot with traffic information for the operating airspace, enabling the UAS to maintain safe separation from other aircraft.

In 2010, we outlined the GBSAA technical architecture for Cannon Air Force Base (AFB) and worked with Air Force Special Operations Command to help plan training missions. We also developed a proof of concept for Palmdale AFB that will serve as the foundation for the official program of record. MITRE’s support has been credited as a crucial factor in the establishment of the Air Force’s NextGen Joint Program Office, which will facilitate the UAS-civil airspace integration effort. (For more on this research, see page 27)
The words have become commonplace: “homeland security.” But few of the things the U.S. Department of Homeland Security oversees are ordinary or simple. DHS secures our borders and coastlines, guards our transportation infrastructure, and restores order following man-made and natural emergencies. MITRE provides enterprise-wide systems engineering expertise and impartial acquisition guidance to strengthen DHS's ability to carry out its crucial missions. In 2010, MITRE supported the department in myriad ways—from demonstrating how to detect underground tunnels along the border to developing a secret-level network for sharing information about criminals and terrorists.

Assuring Mission Success
Enabling a Stronger Homeland Security Enterprise

How do you unify processes, purchases, technology, and training across a matrix of agency infrastructures? For the Department of Homeland Security, this question lies at the center of some of its biggest challenges. As a trusted adviser to the DHS Office of the Chief Information Officer, we emphasize an enterprise portfolio approach. This is particularly true for the acquisition and deployment of new information technology systems—both “everyday” IT and classified networks.

Even before DHS selected MITRE to operate the department’s systems engineering FFRDC, we worked with leaders to strategize on the department’s ability to align DHS’s capabilities with its mission needs. This point of view extends to everything from the IT
budgeting process to the practicalities of system lifecycle planning. Because of our history of supporting other complex organizations, such as the DoD, MITRE provides innovative approaches based on real-world experience. We focus on workable solutions and avoid pitfalls that can accompany large-scale acquisitions. Using an enhanced acquisition process, DHS is positioned to more quickly and holistically review and approve the acquisitions of several billion dollars of IT systems yearly.

"I’d say MITRE is solving the problem of allowing UAS [unmanned aircraft systems] to effectively and safely operate in the United States. ...We’ll be able to see them ahead of time and keep everyone in the air safely, not just the unmanned vehicles."

Captain Joshua Finch, 3rd Special Operations Squadron, Predator Pilot, Air Force Special Operations Command; speaking about MITRE’s Ground-based Sense and Avoid research program, featured on pages 11 and 27. GBSAA facilitates collaboration among DHS, FAA, and the military.
Applying Technology for Public Safety

Underground Radar System Helps Fight Tunnels with Tunnels

The Border Patrol relies on ground-penetrating radar sensors placed on the surface along the border to detect smugglers’ underground tunnels. But smugglers have taken advantage of the limited ability of radar to peer through the surface clay and sand composition of terrain along the border. To provide the government with a reliable tool, MITRE researchers designed a prototype system to boost the ability of ground-penetrating radar to spot tunnels.

By running radar sensors through horizontal underground boreholes, border agents could get a much clearer view of clandestine activity. And thanks to the miles of fiber-optic cables telecommunication companies have placed underground, the technology for boring out horizontal, directionally drilled holes has become effective, affordable, and environmentally friendly. Inside the borehole, a robot crawler would carry a radar antenna that peers 360 degrees through the soil, searching for signals that might indicate a smuggler’s tunnel. Once proven and expanded, the system holds great promise for providing an effective, low-cost, and reliable solution to long-term border surveillance. Besides working along the U.S. border, the system could provide perimeter protection for military bases and assist in monitoring underground nuclear facilities and missile-testing sites. MITRE’s next step is to begin testing the system in the field.

Taking a Systems View

A Customized Data Network Enhances Public Safety

Following September 11, 2001, states and major urban centers designated 72 Fusion Centers to fight terrorism. Due to their success, the role of some Fusion Centers quickly expanded to include crime fighting. The mission of these centers focuses on the rapid exchange of information among state, local, and tribal partners. To support this mission, MITRE assisted DHS in deploying a secret-level network, the Homeland Secure Data Network (HSDN) to the Fusion Centers. MITRE used an end-to-end systems engineering process to assist in deploying the network to the Fusion Centers, and extending the “informational” reach of the centers. MITRE’s guidance ranged from requirements analysis, technical architecture, and technical deployment management to oversight of HSDN technology finances, acquisitions, delivery, and installation.

Since the work began, it has been transitioned to the Homeland Security Systems Engineering and Development Institute (HS SEDI™), operated by MITRE for DHS. Now, 52 Fusion Centers have operational HSDN connectivity—up from only 10 in 2007. Besides using the HSDN capabilities to connect the Fusion Centers with their law-enforcement and counter-terrorism partners, the network has also been used to support major national events such as the Republican and Democratic National Conventions, the Presidential Inauguration, and the Olympics.

Experimentation to Enhance Cross-Agency Cooperation

Using Simulations to Improve Recovery and Restoration Actions

DHS periodically examines emergency management tactics, plans, and procedures to improve its readiness strategies with existing, new, or emerging technologies. One useful approach for conducting this type of assessment is a simulation experiment, or SIMEX. Each SIMEX places participants in a realistic operating environment where they carry out scenarios that maximize data collection without disrupting daily operations. MITRE has extensive experience conducting such experiments with representatives from government, industry, and academia. In July 2010, the HS SEDI hosted a four-day SIMEX at MITRE’s Net-Centric Experimentation Laboratory for the Interagency Biological Restoration Demonstration (IBRD) program. IBRD—a collaborative
Collaboration for National Security

Strengthening Cybersecurity by Identifying Dangerous Programming Errors

Global public-private partnerships that strengthen our ability to thwart the cyber threat are integral to a healthy cyber ecosystem. In early 2010, MITRE cyber specialists from across the corporation collaborated with the SANS Institute and other top security experts throughout the United States and Europe to release the second list of the 25 most significant programming errors that can create serious software vulnerabilities. These errors, which can lead to security holes and enable online espionage and cyber crime, are common mistakes made in the process of developing software.

The main goal for the Top 25 list is to stop vulnerabilities at the source by educating programmers on how to eliminate all-too-common mistakes before software is shipped. Consumers can use the list to seek out more secure software. Software managers and CIOs can also use the list to measure progress in their efforts to secure their software. In the two years since the first list was released, it has influenced how commercial companies code software, how government agencies write contracts with security vendors, and how colleges develop courses for computer science students. The list leverages experiences from the SANS Top 20 attack vectors and MITRE’s Common Weakness Enumeration (CWE). MITRE maintains the CWE website with the support of the DHS’s National Cyber Security Division. The site includes descriptions of the critical programming errors along with guidance for mitigating and avoiding them.
FEDERAL SECTOR TRANSFORMATION

Our nation’s civil agencies must continually increase operational efficiency while enhancing mission effectiveness and meeting high public expectations for service and results. Many agencies have therefore undertaken large-scale transformation of their information technology and essential functions. Transformation means looking for fundamentally different ways of performing the mission and serving the public—to reduce risk, increase predictability, and ensure integrity in agency operations throughout the entire process. This is a long-term effort for civilian agencies, but in 2010, MITRE achieved results for our government partners in areas as diverse as financial oversight and healthcare information technology. We also marked a milestone in our collaboration with the federal judiciary with the award of its new FFRDC.

The Internal Revenue Service is in the midst of a long-standing evolution of systems and methods. Because the IRS collects most of the money that keeps government in business, this transformation must occur without disrupting operations. New responsibilities—including managing the tax consequences of the Patient Protection and Affordable Care Act—compound the challenge. MITRE focuses on several areas where we can have the most impact for the agency, from improving customer service and taxpayer compliance to identifying and combating tax avoidance schemes.

For example, we play a pivotal role in the Taxpayer Communications Task Group project, which has enhanced the clarity and effectiveness of IRS communications with taxpayers. In 2010, we worked with the IRS research community to deliver a prototype Correspondence Management Information System. The system will measure taxpayer response to the IRS’s changes in taxpayer communications and give staff the data to inform course corrections.
As part of an effort to strategically address factors that contribute to the national tax gap, the MITRE-designed Joint Operations Center for National Fuel Tax Compliance has enabled the IRS to make progress reducing multi-billion dollar deficits in the Federal Highway Trust Fund and its state counterparts. We also provide guidance on an even trickier challenge: international tax compliance. Multi-national companies and high-wealth individuals avoid, evade, or underpay an estimated $100 billion in taxes each year. With MITRE’s support, the IRS conceived of an International Data Lab (IDL), in which analysts capture, integrate, and standardize information about tax-avoidance methods and craft countermeasures. Following a successful test run, the IRS began to develop the IDL in a MITRE laboratory in 2010.

“I have said before, and will say again, VA would not have been successful in meeting this major challenge without MITRE. The MITRE/VA team has faced every challenge with poise, determination, and a can-do attitude. I will always be indebted to everyone involved. The team’s efforts have had a direct, tangible, and positive impact on the lives of hundreds of thousands of people.”

Keith Wilson, Director of VA’s Education Service, speaking about the successful launch of the Post-9/11 GI Bill, which received key systems engineering support from MITRE.
An Independent Stance

Supporting Government Efforts to Stabilize the Economy

The financial crisis of 2008 resulted in unprecedented challenges for the government. To stabilize the economy, Congress created new programs driven by urgent statutory deadlines. The government has called on MITRE to assess crucial technological, organizational, or cost aspects for several of these new programs. In 2010, for example, we helped the Recovery Accountability and Transparency Board evaluate the integrity of the data presented on its website Recovery.gov, which reports the use of stimulus funds.

We also examined the Troubled Asset Relief Program (better known as TARP) to develop the methodology to analyze whether contractors acting as federal financial agents charged reasonable and appropriate costs for their work. Following our work on a TARP foreclosure rescue program, a Treasury official stated, “What particularly impresses me is not only MITRE’s extraordinary effort, but more so the technical soundness (and creativity) of your approach.”

Innovation in the Public Interest

Accelerating Electronic Health Data Exchange

Health information technology makes it possible for healthcare providers to better manage patient care through secure use and sharing of information. A hallmark of health IT is the use of electronic health records (EHRs). With EHRs, providers can improve quality of care, empower patients through improved access to information, and deliver safer care with the expectation of lower costs. The Department of Health and Human Services created the Office of the National Coordinator for Health Information Technology (ONC) to advance the use of IT, including EHRs, across our nation’s healthcare system.

As a leader in developing health IT standards, MITRE has worked closely with ONC for the past five years. In 2010, ONC asked MITRE to support efforts to promote the “meaningful use” of health IT. One element of this effort is popHealth, a clinical quality-reporting system that uses data from EHRs to help providers identify opportunities to improve patient care.

An open-source tool, the MITRE-created popHealth is available to the entire healthcare community, including clinicians, EHR developers, and quality-monitoring organizations. We debuted the prototype at HIMSS10, the world’s largest health IT conference. The demonstration gave the healthcare community a hands-on opportunity to see how popHealth can enhance their efforts to lower costs and improve care by integrating the tool into EHRs.

Applying a Systems View

A New FFRDC for the Government’s Third Branch

On September 2, 2010, MITRE and the Administrative Office of the U.S. Courts finalized an agreement to create the Judiciary Engineering and Modernization Center, or JEMC. The new organization is the fifth FFRDC to be managed by MITRE, and the only one that exists on behalf of the federal judiciary.
The military’s challenge: Combine five medical training facilities into one as part of the 2005 Base Realignment and Closure process. When complete, the Medical Education and Training Campus (METC) at Fort Sam Houston, Texas, will rival the size of a large state university—with all the complexity that entails.

The military engaged MITRE as chief architect and systems engineer. Staff from our VA and DoD FFRDCs provided technical, analytical, program management, and enterprise systems engineering support for administrative and IT systems to serve more than 25,000 students yearly. Working with METC’s chief information officer, we co-developed a blueprint for the necessary technology infrastructure.

On June 30, 2010, officers from across the services cut the ribbon to open METC’s first phase. The ceremony marked what officials called the “birthplace for joint interoperability for corpsmen, medics, and technicians” and “a significant milestone in the ongoing story of military medicine.”
AVIATION SYSTEM DEVELOPMENT

The U.S. National Airspace System (NAS) is recognized globally as one of the safest and most technologically advanced aviation systems in the world. To maintain this record as passenger and cargo demand grows, the Federal Aviation Administration is developing and implementing the Next Generation Air Transportation System, or NextGen. NextGen will deliver continuous improvements to the NAS across all phases of flight to ultimately transform the aviation system. As operator of the FAA’s FFRDC, MITRE is a strategic partner with the agency. To deliver the best outcomes for increasingly complex technical and operational challenges, we use advanced simulation and modeling and human-in-the-loop techniques. We also maintain trusted relationships with stakeholders from industry, academia, and other government agencies to help understand and reach consensus on complex issues. And in cooperation with the FAA, we support global coordination activities through our international aviation work program.

A Trusted Partner  
Designing a Blueprint for NextGen Airspace

Call it “the plan within the plan.” Delivering NextGen’s safety, efficiency, and capacity goals in the near-, mid-, and far-term timeframes requires a system-level strategy. To help meet this need, MITRE developed and delivered the FAA’s National Airspace and Procedures Plan, or NAPP, in 2010. The NAPP compiles current and future airspace and procedures activities that support NextGen and outlines the plans and expected impact of each. It addresses recommendations from the RTCA NextGen Mid-Term Implementation Task Force 5, which reached community-wide consensus on improvements over the next eight years.
Also in 2010, MITRE began the “Optimization of Airspace and Procedures for Metroplexes” effort, in response to a related Task Force 5 recommendation. This initiative will improve procedures and address airspace problems in today’s busy metropolitan areas, including flow congestion, inefficient routing and altitudes, airports in close geographical proximity, and environmental constraints. Because resolving these issues is crucial to NextGen’s success, reporting on progress will be part of MITRE’s inputs to the FAA’s annual updates to the NAPP. Other updates will cover performance-based navigation improvements and the FAA’s NextGen facilities plans.

“The extensive work over the past year related to ‘Optimization of Airspace and Procedures for Metroplexes’ has truly been a partnership between MITRE and the FAA. The MITRE team provided critical expertise and input in every facet of the effort: concept and process development; analysis and operational assessments; findings and recommendations. This work builds on the long-standing, highly beneficial relationship developed between MITRE and the FAA over the years in airspace and procedures projects. We believe that continuing this relationship is key to our future success.”

Elizabeth Lynn Ray, Vice President, Mission Support Services, Federal Aviation Administration.
Technology for Broad-based Use

A Tool to Make Flight Procedures Easier to Validate

The demand for more efficient arrival and departure routes at airports (called flight procedures) is growing. Because the introduction of flight procedures is a significant element of NextGen, the FAA has authorized certain private firms to develop them. The FAA has instituted requirements that firms must meet when they develop procedures, including a final safety check called flight validation. MITRE developed the Flight Validation Capability using affordable consumer technology to accomplish the requirements efficiently.

The traditional method of validating flight procedures is both labor-intensive and time-consuming, involving paper-and-pencil computations and paper-based record keeping. The Flight Validation Capability enables independent real-time flight recording and post-flight playback, as well as electronic record keeping. The capability also allows procedure developers to assess ground-based obstacles (such as cell-phone towers) accurately and quickly enough to provide feedback into the design—eliminating the need for traditional survey methods. The high precision of these obstacle assessments enables more efficient airspace design.

The FAA and several flight procedure validation organizations have successfully used the Flight Validation Capability. In 2010, MITRE filed an application with the U.S. Patent & Trademark Office to patent the technology, and as the program evolves, we will continue to work with the FAA and others on further improvements.

A Systems View of Critical Networks

Enhancing Cybersecurity Within the National Airspace System

The NAS increasingly connects the FAA’s safety-critical infrastructure with external entities within and outside the United States. As with all information infrastructures, however, the benefits of greater connectivity bring an increased threat of cyber attacks. Critical security controls must work continuously to enable uninterrupted NAS operations. Because improved cybersecurity is a key element of NextGen, MITRE NAS experts teamed with cybersecurity specialists to develop the NAS Enterprise Information System Security (NEISS) architecture.

The NEISS architecture will guide the FAA’s design and execution of a set of enterprise-wide security controls, divided into five main areas. They range from external boundary protection (such as firewalls) to identity management, which verifies that people and other computers accessing the NAS have the proper authority to do so. Once the FAA fully implements the program, the result will be a stronger and more consistent level of security across the entire NAS. And as new cyber threats emerge, MITRE will continue to develop additional tools and security protocols for protecting the networks behind the NAS.

Building Relationships to Enhance Progress

Returning Control of Iraq’s Skies to Its Civil Authorities

In fall 2007, MITRE began to develop the Iraq Air Sovereignty Master Plan, which became the roadmap for the Iraqi Air Force to reestablish military air traffic control and national air sovereignty capabilities. As the situation in Iraq began to stabilize, however, coalition and Iraqi authorities decided the master plan should also include the country’s civil airspace system.
Taking advantage of the latest in situational-awareness technology for civil aviation can be challenging to small-aircraft owners. Equipment compatible with the FAA’s new Automatic Dependent Surveillance-Broadcast (ADS-B) system is larger and more expensive than many owners need or can afford. With MITRE’s Universal Access Transceiver (UAT) Beacon Radio, however, low-altitude aircraft can maintain air-traffic awareness using smaller and less-expensive equipment.

The product of collaboration between MITRE’s aviation and defense FFRDCs, the UAT Beacon Radio started as a research project in 2007. The portable, battery-powered system is about the size of two decks of cards and supports multiple broadcast data services. It also has potential applications for emergency management operations and search-and-rescue missions. Because it transmits messages compatible with ADS-B, it fits the blueprint for NextGen and will be valuable in the integration of unmanned systems into civil airspace. R&D Magazine named the radio a “2010 R&D 100” award winner as one of the 100 most technologically significant products introduced during the past year. MITRE successfully transferred the radio technology to commercial manufacturers, which are developing production systems based on our design.
How do you find a small platoon in a vast landscape? Or fight off large-scale attacks of influenza? Or overcome the patient privacy issues inherent in electronic health records? These are the kinds of big problems that the government faces—and that MITRE’s research program investigates. We focus on specific areas where our sponsors need us the most and where we can have significant impact. Because we don’t manufacture or sell the end products of our research, we have the freedom both to explore novel solutions and to find new uses for existing technology that help get prototypes to the field faster. And thanks to our innovative use of online collaboration, the MITRE Idea Market, researchers can benefit from the insights of their colleagues.

The search to find cures for ever-changing biological threats, such as new strains of influenza, never ceases. One promising method is a specialized therapy using human proteins called monoclonal antibodies. Antibodies are known to bind to and neutralize toxins, viruses, and bacteria. Human monoclonal antibodies can be used to not only protect against disease when administered prior to infection, they can also inhibit a pathogen’s ability to cause disease if administered soon after exposure.

Over the last four years, MITRE researchers, in collaboration with the Medical University of South Carolina (MUSC), developed a technology platform for producing antibodies against specific disease agents. The initial work focused on producing antibodies against influenza viruses, but the techniques can be used to develop antibodies against a range of diseases. This collaborative research effort has resulted in a cost-effective method for producing...
stable monoclonal antibodies that can be stockpiled to fight natural disease outbreaks or respond to a bio-terrorist attack—a capability critically important to the U.S. biosecurity community.

The work continues to expand and mature. MUSC has extended the research to target cancer cells. MITRE has established the capacity of producing limited quantities of custom antibodies for use by the U.S. government. We also have efforts underway to transfer the technology to appropriate government agencies. In addition, the technology has been licensed to a biotech company to continue development toward commercial production.

What Our Researchers Say

“MITRE gives us the opportunity to explore new ways of tackling big challenges. What’s really gratifying is seeing your research mature and have an impact on national security.”

Juan Arroyo, Ph.D., principal scientist and investigator on MITRE’s human monoclonal antibodies research.
Applying Systems Engineering Expertise

Advanced Signal Processing for Wireless Communication

What if your cell phone relied on other phones to work, rather than on an infrastructure of routers and base stations? Tactical military communications must work this way; they operate on mobile ad hoc networks (MANETs) where each radio routes traffic to and from other radios. These infrastructure-less networks present a range of challenges, including reliability and signal interference. To address the military’s specific needs, MITRE maintains a broad program in MANET research.

One area where MITRE has been contributing is in the development of Hybrid-Automatic Repeat reQuest (HARQ) protocols for specific tactical waveforms. These techniques allow the transmitter to send digital information in incremental chunks and effectively adapt the data rate to changing channel conditions instantaneously to avoid wasting capacity. Though such techniques have enabled 3G and 4G cellular systems to achieve data rates that were once thought to be impossible, these techniques have yet to find their way into fielded military waveforms. Our simulations of these techniques have demonstrated the promise of significant throughput gains for MANETs. We are now developing methods to implement HARQ with minimal changes to the existing waveforms to enable easy integration into future communication systems.

A Public-Interest Concern

Respecting Patient Privacy While Exchanging Medical Information

Government agencies and healthcare providers need to navigate a thicket of federal and state privacy rules to achieve health information exchange that respects patient privacy—a tall order that presents many technical challenges. Anticipating these challenges, MITRE’s research program took a multi-faceted but integrated approach.

First, patients need a way to express preferences about which parts of their health records they wish to share for treatment and other purposes. MITRE’s Data Reuse Agreements initiative prototyped mechanisms for individuals to authorize and set boundaries on release of their information, including sensitive topics like mental health records. Next, healthcare providers need ways to comply with patients’ wishes. The Enforceable Specification of Privacy initiative developed a decision engine that lets one provider automatically validate information requests from other providers against patients’ preferences and furnish only information patients authorized. Project hData, a proposed data standard, segments health records so sensitive portions can be reliably withheld.

Finally, researchers seek to mine huge databases of real records to find quality issues, compare treatment effectiveness, discover drug interactions, and ensure public safety. To protect patient identities, researchers created the MITRE Identity Scrubbing Toolkit (MIST) to prepare de-identified records for researchers.

A Mission Partner

Pinpointing Soldiers’ Locations with a Secure Device

The location of platoons on foot in remote settings has long posed a challenge to the military. Issues of security, portability, infrastructure, and cost combine to make it difficult to provide this critical situational-awareness information to commanders at operating bases. MITRE researchers developed a prototype, called the Wearable One-Way Transfer, or WOWT, that overcomes many of these hurdles.
Civilian first responders have information needs similar to troops on the front lines. In summer 2010, two teams of MITRE researchers—using concepts from our Composable Capability on Demand initiative (see page 10)—went to Los Angeles to show how research in data interoperability and composable systems, motivated by both our DoD and DHS sponsor needs, could be transitioned to first responders.

The teams took part in a DHS-sponsored exercise called Operation Golden Phoenix, which simulated the detonation of an improvised nuclear device at a subway station. One team deployed IC.NET, a MITRE-developed message router that makes use of a specialized data-exchange language for first responders. With IC.NET, agencies can share information using machine-to-machine communication, so updates and warnings move faster and more accurately to the field. Another MITRE team demonstrated new tools called Warfighter Widgets. These small, Web-based applications provide a simple way to visualize, integrate, and manage data; they were first designed for soldiers in theater.

Participants reacted enthusiastically to the increased data and the ease with which they could manage it. The teams will next develop systems, standards, and partnerships to deliver the tools to the agencies that need them.
For more than a decade, MITRE has worked to improve the ability of our employees to work anywhere they are needed—at our offices, at a sponsor’s location, on the road, or from home. We have invested in robust network connectivity, provided staff members with laptops, and increased the use of mobile devices.

The value of these investments has yielded significant results. During the “snowmageddon” storms of early 2010, the vast majority of our employees remained online and worked throughout the blizzard—even when bad weather forced the federal government itself to close.
The shortage of American students in the STEM (science, technology, engineering, and math) fields continues to be a matter of national concern—one that has gained consensus across the political spectrum. Though the sense of urgency has been growing recently, MITRE is no newcomer to providing technical opportunities for students. Our staff—many of them donating their time through our STEM Initiative—have long encouraged young people to pursue technical studies.

One example, our "Nanokids" Student Program, has for more than 20 years given hands-on research opportunities to hundreds of promising students. More than 98 percent of them move on to study science, math, or engineering in college. Many of them are now college professors or scientists responsible for breakthroughs in nanotechnology. The program’s success has inspired other organizations, such as the Air Force Research Laboratory, to start their own, similar initiatives.

Our partnership with a school in Lawrence, Mass., shows how companies can collaborate with local communities to improve educational opportunities for students from low-income families. Working through the Corporate Work-Study Program at Notre Dame High School, MITRE hires several students who otherwise could not afford a private college preparatory education. They work five days per month earning part of their high school tuition and gaining real-world experience. All of the students who have worked at MITRE have been accepted to college and many major in technology fields.

MITRE’s support to STEM education doesn’t stop on high school graduation day. Through college and beyond, minorities are traditionally underrepresented in the STEM fields. For nearly 30 years, MITRE has supported the National GEM Consortium—a nonprofit that partners with corporations and universities to help exemplary students attain graduate degrees through paid internships and full tuition assistance. During this time, more than 65 GEM fellows have interned at MITRE and 12 former fellows have been employed here. In October 2010, Al Grasso, MITRE’s president and CEO, became president of the GEM board of directors.

"One of the things I enjoy most about my job is that I get to talk directly to airmen, marines, soldiers, and sailors on a daily basis and provide them the best support MITRE has to offer. This commitment to serving in the public interest sets MITRE apart from many other corporations. You just feel a sense of pride in the work you do."

Lee Dang, senior defense space systems engineer and Air Force reservist.
In 2010, MITRE celebrated the 25th anniversary of registering the first top-level "org" domain name. Since July 1985, more than nine million other registrants have followed www.mitre.org in using the .org top-level domain.

NOTABLE NEWS IN 2010

“The MITRE Challenge,” a competition to encourage innovation in technologies of interest to the federal government, launches

Christopher J. Hegarty named IEEE Fellow

MITRE opens new sites in Baltimore and Aberdeen, Md., and Clarksburg, WVa., to support key DoD and civilian agency customers

Dr. Agam Sinha named chairman of the board of RTCA, which provides consensus-based advice to the FAA

MITRE researchers receive IEEE Best Paper Award for work on a single-particle detection system

Colorado Springs site celebrates 50th anniversary supporting the Air Force

Nicholas Donofrio appointed to MITRE’s Board of Trustees

INCOSE and MITRE sign agreement to grant INCOSE certifications to qualified MITRE systems engineers

Board of Trustees Chairman Dr. James Schlesinger receives Fubini Award for outstanding contributions to the DoD

President and CEO Alfred Grasso appointed to Defense Science Board and elected vice chair of the Armed Forces Communications and Electronics Association (AFCEA International)

Recent Corporate Recognition

FORTUNE
100 Best Companies to Work For—10th year in a row

R&D Magazine
R&D 100 Award for UAT Beacon Radio

Fast Company
World’s 50 Most Innovative Companies—number one in defense

Intranet Innovation Awards
Gold Award for the Handshake social networking tool

Boston Globe
Top 100 Places to Work

Computerworld
100 Best Places to Work in IT—6th year in a row

Glassdoor.com
50 Best Places to Work—3rd year in a row

A New Facility to Promote Collaborative Research

Designed with input from MITRE technical staff, a new energy-efficient laboratory building is rapidly taking shape on the Bedford campus. The 105,000 sq. ft. facility will include such features as a rooftop antenna field that connects via electrical conduits to the laboratories and an external service yard to support experiments on mobile units and robotics. It will also house open and reconfigurable lab space, host collaboration and demonstration areas, and serve as the new home of MITRE’s existing fabrication shop. Following the 2010 groundbreaking, the building is scheduled to open in late 2011.
The MITRE Corporation

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Seoul

TAIWAN
Taipei

UNITED KINGDOM
RAF Molesworth

FINANCIAL DATA

Total Revenue ($ in millions)

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Total Assets ($ in millions)

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MITRE’s revenue from operations increased 3.7% from $1,263 million in fiscal year 2009 to $1,310 million in fiscal year 2010. The year-over-year increase in revenue was primarily driven by the addition of work for the Department of Homeland Security FFRDC. Other growth areas included the Federal Aviation Administration contract, which grew 13% from fiscal year 2009. Increases in assets and staff from fiscal year 2009 were consistent with the overall revenue growth rate.
LEADERSHIP

Mr. Alfred Grasso
President and Chief Executive Officer

Dr. Lisa Bender
Vice President and Chief Human Resources Officer

Mr. Richard Byrne
Senior Vice President and General Manager, Command and Control Center, DoD C3I FFRDC

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Vice President and Director, Center for Enterprise Modernization, IRS/VA FFRDC

Mr. Gary Gagnon
Vice President and Corporate Director of Cyber Security, Center for Integrated Intelligence Systems, DoD C3I FFRDC

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Dr. Jason Providakes
Senior Vice President and General Manager, Center for Connected Government Director, HS SEDI FFRDC

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Dr. Agam Sinha
Director, Senior Vice President, and General Manager, Center for Advanced Aviation System Development, FAA FFRDC
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As a public interest company, MITRE works in partnership with the government applying systems engineering and advanced technology to address issues of critical national importance.