Homeland Security Operational Analysis Center

2019–2020 Annual Report

HSOAC | HOMELAND SECURITY OPERATIONAL ANALYSIS CENTER

An FFRDC operated by the RAND Corporation under contract with DHS

The Homeland Security Act of 2002 (Section 305 of Public Law 107-296, as codified at 6 U.S.C. § 185) authorizes the Secretary of Homeland Security, acting through the Under Secretary for Science and Technology, to establish one or more federally funded research and development centers (FFRDCs) to provide independent analysis of homeland security issues. The RAND Corporation operates the Homeland Security Operational Analysis Center (HSOAC) as an FFRDC for the U.S. Department of Homeland Security (DHS) under contract HSHQDC-16-D-00007.

The HSOAC FFRDC provides the government with independent and objective analyses and advice in core areas important to the department in support of policy development, decisionmaking, alternative approaches, and new ideas on issues of significance. The HSOAC FFRDC also works with and supports other federal, state, local, tribal, and public- and private-sector organizations that make up the homeland security enterprise. The HSOAC FFRDC's research is undertaken by mutual consent with DHS and is organized as a set of discrete tasks.

The information presented in this annual report does not necessarily reflect official DHS opinion or policy.

For more information on HSOAC, see www.rand.org/hsoac.

For more information on this publication, visit www.rand.org/t/CPA947-1.

Published in 2021

Letter from the Director

As one of the U.S. Department of Homeland Security's (DHS's) federally funded research and development centers (FFRDCs), the Homeland Security Operational Analysis Center's (HSOAC's) ultimate goal is to add value for its sponsors and positively affect DHS mission outcomes by ensuring that policymakers have the best possible information to make important decisions about the challenges they are facing. We succeed only when our sponsors succeed—when they improve mission outcomes as decisions and policies are strengthened through targeted research and objective, evidence-based analysis. The following pages show the depth and breadth of the analytical work that HSOAC research staff produced in support of key DHS missions in fiscal year 2020.

As an FFRDC, we are a strategic asset for the department, a role that allows components to trust us with some of their most challenging problems and issue task orders without going through a formal acquisition process each time. Being an FFRDC means that we are permitted to be privy to the department's inner workings, are charged with developing a deep familiarity and trusted relationships across DHS, and must operate in the public interest. We are tasked by the Federal Acquisition Regulation to use this familiarity with our sponsor's needs to maintain an expert workforce that can bring independent and objective research and analysis to inform data-driven decisionmaking across the department's varied mission sets. We take this responsibility seriously, and we strive to continuously make improvements.

We have recruited and developed a strong cadre of research staff who have helped the department and its components mature its acquisition and requirements processes and artifacts, develop and refine its strategic plans, enhance workforce planning and resilience, identify and refine performance measures, respond to congressional mandates, and improve disaster recovery processes.

In this fourth annual update since the inception of the FFRDC, I am pleased to provide examples of how HSOAC uses cutting-edge analytical methods and tools to make tangible contributions to DHS mission outcomes across the entire breadth of the department. The projects we present here illustrate how HSOAC is helping the department safeguard the U.S. economy and borders, increase the United States' ability to respond to and recover from natural disasters, enhance cybersecurity, and mature management and personnel processes.

I am proud of the work our researchers have done for the department, and I hope that you too will be impressed by their efforts to advance key DHS missions.

With best regards,

Terrence Kelly
Director

HSOAC Supports DHS's Mission

The Homeland Security Operational Analysis Center (HSOAC), a federally funded research and development center (FFRDC), helps the U.S. Department of Homeland Security (DHS) address complex policy challenges as it carries out its core missions. FFRDCs are independent entities that act as strategic partners to help the U.S. government meet specialized research needs. HSOAC is operated under contract by the RAND Corporation, a nonpartisan, not-for-profit entity that has been operating FFRDCs for the government for more than 70 years.

HSOAC: OUR MISSION

To help DHS make the United States safe, secure, and resilient

To support DHS across its missions, HSOAC provides the department and its components with independent and objective research, analyses, and advice in core areas important to DHS (see the functional areas listed below). HSOAC also works with and supports other federal; state, local, tribal, and territorial; and public- and private-sector organizations that make up the homeland security enterprise (HSE).

Unique Purpose and Operation

HSOAC's sponsoring agreement with DHS focuses on seven functional areas that cut across DHS's mission categories:

- *homeland security threat and opportunity studies* that use risk assessment and forecasting to track current threats and identify vulnerabilities and potential future risks
- *organizational studies* that use workforce analysis and performance measurement to help DHS improve unity of effort across management and planning
- *operational analysis* that uses evaluation and simulation methods to help DHS assess mission requirements, improve operational processes and procedures, and understand operations' effects on a variety of outcomes
- *regulatory, doctrine, and policy studies* that use regulatory and policy analysis to offer insight into the effect that changes in external regulations, policies, and doctrines could have on DHS missions and activities
- *acquisition studies* that use planning, program management, and test and evaluation expertise to assess DHS's acquisition needs and apply lessons from past experience
- *research and development (R&D) studies* that use portfolio and foresight analysis to help DHS plan for the mix of projects needed to accomplish its missions and transition R&D results into technology and practice
- *innovation and technology acceleration* that uses technical analysis to promote, and identify barriers to, integration and adoption of new technologies.

Forming tailored teams to ensure value for sponsors

HSOAC task-order leads can build research teams from more than 1,000 researchers . . .

- Behavioral and policy sciences
- Defense and political sciences
- Economics, sociology, and statistics
- Engineering and applied sciences

to ensure the right mix of technical experts . . .

and analytic tools and methods . . .

. . . to address a sponsor's needs

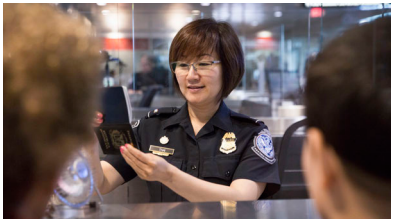
HSOAC's Expert Staff Add Value for DHS

HSOAC's principal value proposition for DHS is the ability to quickly access RAND's deep bench of experts through a staffing matrix—a diverse group of approximately 1,000 researchers who have demonstrated currency in every field of knowledge that might be required to address sponsor needs and affect mission outcomes—and focus them on addressing DHS's most pressing challenges. HSOAC researchers also bring extensive knowledge of DHS needs gained through professional experience.

HSOAC selects project leads with the right background and technical expertise to address any need a given sponsor might have. These project leads work closely with HSOAC management and the sponsor to identify the staffing requirements for a given project, including what mix of backgrounds, research methods, and analytical tools will be needed to meet the sponsor's needs. They then construct teams that are designed specifically to address whatever challenge a DHS sponsor is facing.

HSOAC Leaders and Staff Understand Sponsor Needs

HSOAC leadership and research staff are in regular contact with DHS personnel at virtually every level of the department across headquarters (HQ) offices and operational components to gain a better understanding of emerging and long-term priorities and challenges. Many have worked in DHS or other parts of the U.S. government as well. These "top-down and bottom-up" engagements include continuous dialogue between HSOAC management and DHS leadership on strategic issues and challenges; regular interactions through tactical and core research studies; workshops, conferences, and other events organized by HSOAC; and other opportunities to bring experts from inside and outside of government together with DHS staff.



HSOAC Supports DHS's Mission

HSOAC Research Adds Value for DHS Sponsors

HSOAC's ultimate goal is to add value for its sponsors and positively affect mission outcomes by ensuring that policymakers at DHS have the best possible information to make important decisions about the challenges they are facing. Often, there is a clear connection between HSOAC task orders and the benefits that sponsors derive from them—that is, when a sponsor has a pressing problem to address and the findings from HSOAC's analysis directly influence sponsor actions. Such actions can include informing policy decisions, developing new strategic planning documents, shaping acquisition strategies or requirement documents, understanding workforce staffing requirements, adopting policies that save billions of dollars, and informing or designing a new program or office to meet an identified need. DHS also turns to HSOAC to help fulfill congressional mandates and respond to recommendations made by oversight bodies.

In other cases, the main benefit that sponsors derive from HSOAC is the ability to make better-informed decisions about the key challenges that they are facing. HSOAC research can help policymakers at DHS better understand the ramifications of the decisions that they are considering and present actionable recommendations to help guide and inform their decisionmaking processes.

HSOAC Provides Opportunities for Innovation

HSOAC projects can take advantage of the many opportunities for innovation available at RAND. For example, experts in RAND's internal research program, Methods Centers, and Innovation Incubator develop and test new analytic methods and tools. In the Pardee RAND Graduate School's new Technology and Narrative Lab, policy analysts develop and pilot new applications as potential solutions to emerging policy problems. All of these capabilities, and more, can be leveraged to help solve the department's most important challenges.

How HSOAC adds value for DHS

HSOAC helps DHS	by adding program value by	by meeting DHS sponsor needs by	by operating the FFRDC by
• Counter terrorism and homeland security threats • Secure borders • Enhance cybersecurity • Strengthen disaster preparedness, resilience, and recovery • Safeguard the U.S. economy • Develop a more capable department and workforce	• Informing policy development on complex issues • Enabling data-driven decisionmaking • Generating innovative solutions to achieve mission objectives • Helping DHS respond to congressional mandates	• Designing and tailoring research plans that directly address needs • Developing and delivering – analysis – methods and tools – data sets • Making actionable recommendations • Disseminating results within the HSE	• Fostering familiarity with DHS needs • Maintaining the highest technical expertise and quality • Being flexible and responsive in the face of changing DHS requirements • Ensuring the objectivity and independence of our research staff and work • Delivering research products in a timely and cost-effective manner

How to Work with HSOAC

HSOAC's functional research areas are spread across four programs:

Acquisition and Development Program

- Acquisition studies
- R&D studies
- Innovation and technology acceleration

Personnel and Resources Program

- Organizational studies (i.e., workforce analyses, surveys, and organizational assessments)

Recovery Cost Analysis Program

- Acquisition studies related to recovery cost analysis

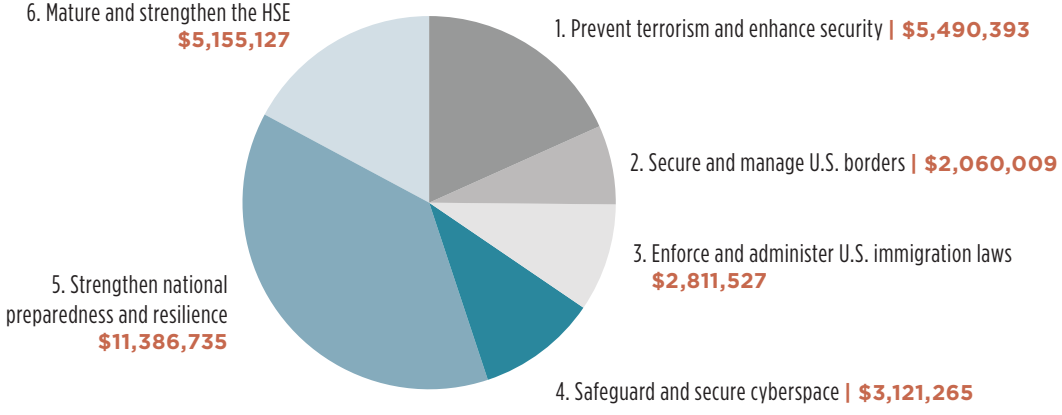
Strategy, Policy, and Operations Program

- Operational analysis
- Regulatory, doctrine, and policy studies
- Homeland security threat and opportunity studies

What We Do

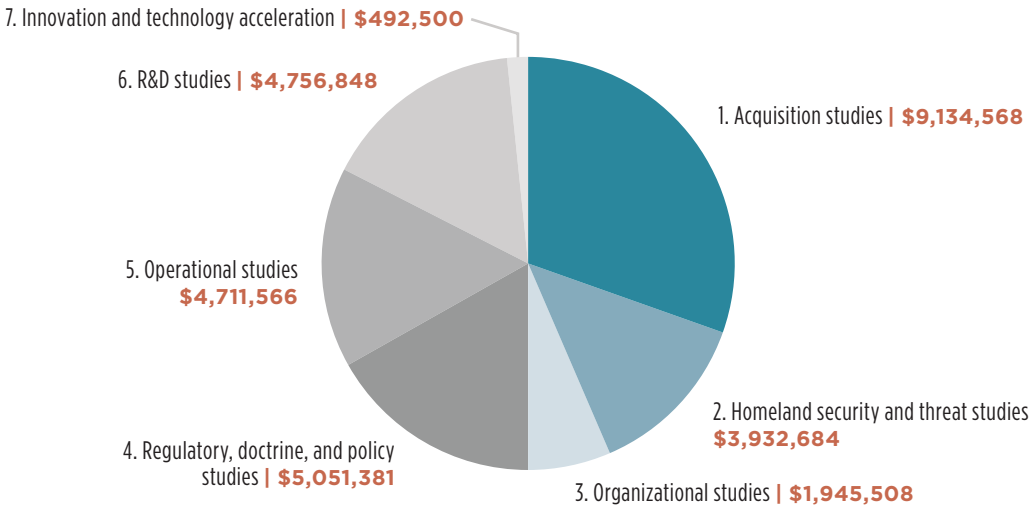
HSOAC works across DHS mission areas, components, and functional areas to improve operational effectiveness

Support provided, by DHS mission

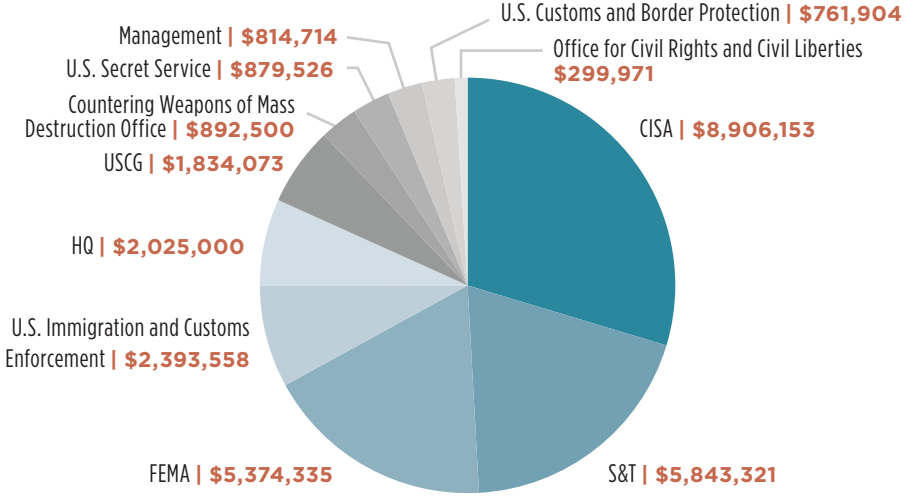


What We Do

Support provided, by HSOAC research focus area



Support provided, by DHS component



NOTE: CBP = U.S. Customs and Border Protection. CRCL = Office for Civil Rights and Civil Liberties. CISA = Cybersecurity and Infrastructure Security Agency. S&T = Science and Technology Directorate. FEMA = Federal Emergency Management Agency. ICE = U.S. Immigration and Customs Enforcement.

Enhancing the Resilience of Positioning, Navigation, and Timing Services

In response to an executive order, DHS was seeking to improve the resilience of positioning, navigation, and timing (PNT) services in critical infrastructure sectors. CISA asked HSOAC to help assess the resilience of different sectors, beginning with a pilot focused on enterprise information technology (IT) networks.

What was the challenge?

PNT systems are critical to many sectors of the economy but can be vulnerable to disruption and jamming. Executive Order 13905, signed in February 2020,[1] directs the development of what it calls "PNT profiles," which can be described as "responsible use of PNT services—aligned to standards, guidelines, and sector-specific requirements." These profiles will be used to inform contractual language across the federal government. A key challenge in developing the profiles is to define the *right* guidelines for each critical infrastructure sector. Pilot workshops are being used for this purpose. DHS asked HSOAC to focus the initial pilot on timing—in particular, on the use of timing within the IT networks used in most organizations for general enterprise support.

Supporting robust and secure PNT services

What did HSOAC do?

HSOAC experts designed a structured pilot workshop exercise using a variation of RAND's day-after methodology, which was originally developed to answer questions about nuclear proliferation. During the exercise, facilitators ask participants to imagine themselves facing a stressful situation in the future and to describe how they would cope, given current preparations—which is often quite poorly. Participants are then asked to refocus on the present and to describe how they could change preparations to avoid or lessen the problems they just imagined facing. The approach can expose a variety of challenges and provide new ideas for mitigation.

Impact

The pilot workshops will help sectors build awareness of risks and learn how to use PNT responsibly. The documentation of challenges and the mitigations will form the basis for improving relevant PNT profiles and ultimately will inform contracts for products, systems, and services that integrate or use PNT services. Findings are also expected to encourage the private sector to use additional PNT services and develop new robust and secure PNT services.

PROJECT LEADERS

Angela Putney • physical scientist

James Bonomo • senior physical scientist

Richard Mason • senior engineer

Helping DHS Field Systems and Capabilities to Better Support Operational Missions

Since 2017, Joint Requirements Council (JRC) staff have leveraged HSOAC's analysis and deep subject-matter expertise across the wide variety of efforts related to DHS capabilities and requirements. The familiarity that HSOAC personnel have with the ongoing nature of the JRC's work allows new issues to be addressed rapidly and effective solutions to be identified quickly.

What was the challenge?

The JRC governs requirements development across the department, including capability analyses, which can lead to acquisitions or procurements, as well as changes to training, organization, regulations, policies, and operational processes and procedures. The JRC reviews requirements across the entire DHS mission on short timelines with a small staff. The Joint Requirements Integration and Management System (JRIMS) process remains inconsistently implemented and misunderstood by some components—posing a significant challenge for DHS.

Informing data-driven decisionmaking on requirements

What did HSOAC do?

HSOAC experts analyzed major program requirements across DHS for the past three years and used this analysis to improve specific acquisition program requirements, improve the requirements and acquisition processes at DHS, and inform investment decisions across the department. The team recommended changes in policy and training procedures and provided analytic input to several high-visibility, DHS-wide working groups and policy initiatives (e.g., systems engineering life cycle, cybersecurity, transnational organized crime). The researchers also conducted technical capability gap analyses to improve the effectiveness and efficiency of components' requirements and developed assessments to improve workflows, personnel organization, and decisionmaking.

Impact

DHS is using HSOAC research to analyze capability gaps across DHS, inform future investments, update DHS instructions and training, and streamline the JRIMS process. Having HSOAC analysis directly improved the quality and consistency of dozens of requirements documents and high-priority DHS efforts (e.g., enterprise analytics, counter–unmanned aircraft systems [C-UASs], explosives detection). These contributions enhance the ability of DHS leadership to make data-driven strategic choices about issues that affect operations across the HSE and will ultimately help DHS field systems and capabilities to better support and execute operational missions.

PROJECT LEADERS

Laurinda L. Rohn • senior policy researcher

William Shelton • senior engineer

Building an Enterprisewide Approach to Cyber Supply Chain Risk Management

DHS wants to establish a coordinated, enterprisewide approach to cyber supply chain risk management (C-SCRM) within the department. HSOAC is providing analytic support to identify requirements and develop policies and procedures to assist DHS in providing governance, compliance, policy, and oversight of C-SCRM activities throughout DHS.

What was the challenge?

The cyber supply chain includes all the hardware, software, and services that support information and communication technology (ICT), as well as a wide variety of stakeholders and other entities, including vendors, suppliers, service providers, government, and users of technology. ICT is integral to the functioning of U.S. critical infrastructure and to the growing number of business operations and day-to-day activities that rely on technology. However, the interconnected nature of the cyber supply chain means that an attack on, or malfunction of, one part of the chain could have cascading effects on multiple critical sectors—potentially affecting DHS's ability to execute its missions. DHS needed to identify requirements, create a concept of operations, and develop policies and procedures to establish a centralized C-SCRM governance capability to ensure that it can execute its critical missions in the face of potential future ICT malfunctions or cyberattacks.

Building DHS resilience against cyberattacks

What did HSOAC do?

HSOAC researchers assessed DHS enterprise requirements; identified appropriate program metrics and measures of performance for C-SCRM; developed a concept of operations; provided organizational and strategic analysis to assist the Office of the Chief Information Officer; and developed candidate policies that provide governance, compliance, and oversight of C-SCRM activities and decisions within the department. HSOAC analysts also recommended materials, processes, and procedures to support a dedicated, centralized, departmentwide approach to C-SCRM.

Impact

HSOAC helped DHS establish the foundations for a centralized approach to cyber supply chain risk–based decisionmaking. HSOAC's contributions will ultimately better position DHS to manage risks, have visibility into its supply, conduct threat analysis, and ensure that its ICT systems resist vulnerability to increasingly sophisticated attacks or malfunctions that could cripple operations and degrade its ability to secure the homeland.

PROJECT LEADERS

Daniel Gonzales • senior physical scientist

Sarah Harting • senior defense analyst

Modernizing Data Management Across DHS

The Foundations for Evidence-Based Policymaking Act of 2018 mandates that every federal agency designate a chief data officer (CDO), a senior career official with the focused responsibility of managing agency data.[2] The DHS Office of the Chief Technology Officer asked HSOAC to assess governance options for the new Office of the CDO (OCDO) and identify a future state of organizational maturity for the office to achieve.

What was the challenge?

The Foundations for Evidence-Based Policymaking Act emphasizes the need to enhance federal agencies' ability to generate and use high-quality data to inform policy decisions and to improve public access to nonsensitive government data to increase transparency and individuals' ability to conduct meaningful research. DHS created a new organization in the department to focus on these key issues but confronted some key challenges related to integrating legacy entities and systems, adjudicating competing authorities and expectations, and putting in place a decisionmaking structure. DHS asked HSOAC to help it better understand these challenges and produce a plan that could be used to help stand up the CDO.

Enhancing DHS's ability to generate and use high-quality data

What did HSOAC do?

The HSOAC team reviewed relevant literature and conducted interviews and a workshop with stakeholders across DHS. The team developed a logic model to help identify the CDO's mission, vision, roles, responsibilities, and functions, and developed other models to assess OCDO's maturity. Researchers provided specific recommendations, including one for a path forward for the office.

Impact

The HSOAC team's findings are helping DHS create a more effective CDO. This research emphasized the importance of making the CDO position full time to better enable the CDO to fulfill the role's responsibilities, and DHS recently reconsidered its "dual-hatted" approach to the position, announcing an opening for a full-time CDO. The project also highlighted an important role for the CDO to play within the department: strategic thinker and problem solver. According to DHS, the study results will be used "to inform organizational development when the full-time CDO is hired."

PROJECT LEADERS

John Bordeaux • senior management scientist

Ryan Consaul • senior international and defense researcher

Supporting Disaster Recovery in the U.S. Virgin Islands

In September 2017, Hurricanes Irma and Maria devastated the U.S. Virgin Islands (USVI), making direct landfall on St. Croix and St. Thomas. Recovery activities began soon after. But more than three years later, the territory still has substantial recovery needs. FEMA asked HSOAC to develop analyses and strategies to enhance the USVI's capacity for managing recovery and to build the evidence base to support the implementation of the USVI's recovery plans.

What was the challenge?

The USVI government estimates that, to fully recover from the hurricane damage, it will need to execute $11.25 billion in recovery work—nearly three times its annual gross domestic product. The complexity, scale, and timing of the thousands of recovery projects that will need to be implemented add to the challenge. At the same time, the recovery process offers the USVI a chance to reenvision its future by leveraging recovery funding to create a more modern, resilient, and equitable territory.

What did HSOAC do?

HSOAC researchers identified the USVI's key recovery goals and accomplishments to date, assessed roadblocks and challenges, and suggested actionable recommendations to more efficiently implement recovery. The recommendations were developed through a bottom-up process involving more than 170 group discussions with stakeholders in the USVI government, its federal partners, the private sector, and nonprofit organizations. The research team provided a total of 76 key recommendations designed to enhance recovery efforts.

Enhancing the USVI's capacity to manage disaster recovery

Impact

The analysis helped stakeholders identify, validate, and set priorities for recovery in the USVI. The team's recommendations address multiple needs: crosscutting capacities required for progress in multiple sectors (management, fiscal, workforce, and supply chain), rebuilding of physical infrastructure (infrastructure services, energy, housing, and natural and cultural resources), and development of key aspects of the economy and public services (the tourism economy, education, and health). The USVI government and FEMA are using many of these recommendations to inform recovery implementation planning efforts, prioritize and phase projects to maximize efficiency and make the best use of funding, and develop metrics and indicators that can be used to measure and communicate recovery progress.

PROJECT LEADERS

Shelly Culbertson • senior policy researcher

Blas Nuñez-Neto • senior policy researcher

Understanding How Disasters Affect the Price of Construction

FEMA is increasingly interested in funding postdisaster Public Assistance (PA) projects using fixed-price contracts, which greatly reduce administrative burden on both FEMA and local governments while providing flexibility in how communities rebuild. However, fixed-price contracts require an accurate forecast of construction costs over the course of a project, including an understanding of whether aggregate prices in the area are likely to increase or decrease significantly while construction is underway. HSOAC researchers examined when and how construction prices can change after a natural disaster.

What was the challenge?

FEMA's PA program provides financial assistance to state and local governments that are undertaking large-scale, multiyear construction projects as part of recovery and rebuilding after a disaster. FEMA currently allows for a 10-percent increase in construction costs beyond what is already accounted for in its cost-estimating framework. Although using a fixed-price contract can help streamline the PA process, underestimating the price of future construction could leave a large burden on state and local governments, while overestimating the price could cost the federal government millions.

What did HSOAC do?

HSOAC researchers assessed how often natural disasters increase construction costs by more than 10 percent in the five years afterward. They also estimated, based on the characteristics of the disaster and the region, whether a given disaster would significantly increase construction wages. The team conducted expert workshops and developed a novel method to identify the effects that previous disasters have had and to explore the characteristics of disaster, county, and context that predict large effects.

Improving the accuracy of disaster recovery cost estimates

Impact

HSOAC research is providing the first evidence of when construction costs have changed as the result of a natural disaster. The researchers found that most counties had no change in prices due to a disaster; however, approximately one in 25 counties (4 percent) did experience disaster-related price increases of more than 10 percent. The team identified two key characteristics of these counties—property damage per capita and in-migration rates—that help explain why some disasters induce large price changes and others do not. These findings will support FEMA in deciding when a future price forecast is warranted.

PROJECT LEADERS

Priscillia Hunt • senior economist

Isaac M. Opper • full economist

Streamlining the FEMA Public Assistance Process to Respond to Coronavirus Disease 2019 and Other Types of Disasters

FEMA's PA program provides federal grant assistance after a disaster. In response to coronavirus disease 2019 (COVID-19), FEMA made federal PA grants available to pay for emergency protective measures related to the pandemic, such as personal protective equipment, medical care, food, medical shelters, and public health and safety communications. Given the widespread demands created by the pandemic and the need for physical distancing (sometimes called *social distancing*), FEMA asked HSOAC to help develop remote streamlined project applications (SPAs) for other PA categories.

What was the challenge?

The process of applying for PA typically involves many steps and forms, extensive documentation, and close, often in-person coordination with a FEMA point of contact, usually a program delivery manager. In addressing PA requests related to the COVID-19 emergency, FEMA sought to decrease the demands on its personnel and to move the entire process online. FEMA also wanted to reduce the number of steps and tailor questions and documentation requirements to specific activities while ensuring that requests were fully and accurately implemented in Grants Portal, FEMA's grant-processing system.

What did HSOAC do?

HSOAC analysts mapped the workflow of the PA process to identify areas that might be simplified or eliminated for the SPA and developed questions and surveys to tailor parts of the process to applicants' specific requests. The team also determined which questions required additional documentation and which required prior approval before work could be executed.

The team disseminated the updates broadly to FEMA personnel, developed reference guides and sample projects for implementation, and tested the implementation of the SPA in Grants Portal, providing live feedback to the development team.

Impact

FEMA has implemented the SPAs that the HSOAC team developed for emergency protective measures and debris removal, which are both live and active in the FEMA Grants Portal for the 2020 hurricane season. This supports FEMA strategic goals to improve customer service and to customize how information is collected from each applicant and project. The SPA approach can be applied, with modifications, to other categories of assistance and is on track to replace the traditional approach to PA.

Adapting FEMA's PA program for COVID-19

PROJECT LEADERS

Thao (Liz) Nguyen • physical scientist

Paul Brenner • senior management scientist

Meeting the U.S. Coast Guard's Airpower Needs

The USCG uses a fleet of fixed- and rotary-wing aircraft to conduct a variety of missions. As the air fleet ages and needs to be replaced, the USCG is reassessing its airpower needs for current missions and possible future operations. The USCG asked HSOAC to conduct a comprehensive examination of USCG airpower to answer this question: What mixes of airpower promise to help the USCG execute its variety of missions across the entire geographic domain for operations in the next 30 years?

What was the challenge?

Airpower assets are force multipliers, delivering effects with speed and flexibility unmatched by their surface counterparts. The USCG's current aviation assets consist of manned fixed- and rotary-wing aircraft. However, some aircraft are nearing the ends of their lives, while the emergence of unmanned aircraft systems (UASs) offers opportunities (these systems could be an additional viable solution to some airpower needs) and challenges, including how best to incorporate them into the current USCG air fleet.

What did HSOAC do?

HSOAC analysts developed a scenario based on recent demand for USCG missions, as well as a set of alternative demand scenarios in a wide variety of possible futures. The HSOAC team also modeled an exploratory set of alternative air fleet options—a mix of fixed- and rotary-wing aircraft, as well as UASs—to determine their effectiveness and cost in meeting the demands posed by each scenario.

Helping build the future USCG airpower fleet

Impact

The HSOAC team found that the current USCG airpower fleet—although aging—is well suited to respond to search-and-rescue cases; however, it does less well in scenarios that require increased detection and monitoring–type sorties. The team recommended that, to address this need, the USCG build a robust future fleet—with UASs as a major element of that fleet—to meet a variety of possible demand scenarios. The USCG has used the team's findings to help make decisions about the structure and size of its future rotary-wing fleet. The findings can also inform an analysis of alternatives or to make judgments about the validity of different recapitalization options, including the need for an expanded fleet of USCG UASs.

PROJECT LEADERS

Jeremy M. Eckhause • senior operations researcher

David T. Orletsky • senior engineer

Enhancing Security at U.S. Ports

The Transportation Worker Identification Credential (TWIC®) is designed to enhance security at U.S. ports by providing a standardized national credential and demonstrating that the holder has passed a federal security threat assessment. Legislation required a comprehensive assessment of the program to determine its value in mitigating security risks at ports. S&T asked HSOAC to conduct that assessment.

What was the challenge?

U.S. Government Accountability Office (GAO) reports had criticized DHS for failing to demonstrate that the TWIC program was effective at reducing risk and improving maritime security. At the time of this research, anyone with unescorted access to a secure area at a regulated maritime facility or vessel was required to possess a valid TWIC card. A pending regulation would require high-risk facilities to use TWIC in conjunction with an electronic biometric reader that matches the TWIC card to the holder. Assessing the program's risk-mitigation value is complicated by the fact that TWIC is only one component of facilities' access control programs. Furthermore, facilities face many threats, such as cyberattacks, that do not require physical access through entry points.

What did HSOAC do?

HSOAC researchers reviewed relevant documentation, including GAO and DHS Office of Inspector General studies, regulations relevant to TWIC, and USCG and Transportation Security Administration (TSA) policy documents. They also made an extensive study of the port environment, conducting 200 interviews with facility operators, security professionals, industry representatives, and labor representatives, covering 164 facilities in 45 port areas. HSOAC researchers also analyzed five years of known security breaches at facilities to determine where vulnerabilities might be the most pressing. The team also reconstructed the initial break-even analysis with improved data to validate the costs and benefits of TWIC electronic readers.

Developing effective, cost-efficient options for port security

Impact

The HSOAC team found that TWIC was stronger against attacks requiring persistent insider access than against those requiring one-time or no access. However, the costs of further enhancing TWIC requirements, such as by requiring widespread use of electronic biometric card readers, would likely exceed the benefits. The team recommended a systems approach to maritime security that allows flexible solutions specific to each facility's security needs. The team's report contributed to the USCG's decision to delay the effective date of TWIC reader requirements and to redo its cost–benefit analysis of the regulation.

PROJECT LEADER

Heather J. Williams • senior international and defense researcher

Protecting U.S. Elections from Cyberthreats

The diversity of U.S. election systems means that developing a national picture of cybersecurity risk is challenging, although each state and jurisdiction needs to evaluate and prioritize risk in the systems it oversees. CISA asked for HSOAC's analytic support in creating a national view of risk in election systems and developing a risk profile tool to aid in providing timely and targeted assistance to state and local election officials.

What was the challenge?

Concerns about cyberthreats to election systems in the United States have gained prominence in recent years, and cyberattacks are a potential threat to U.S. democracy. State and local election officials are trying to understand and prioritize cybersecurity risks in their systems while, at the national level, CISA is focused on providing cybersecurity services and products to improve election officials' cybersecurity postures. Ensuring the security of the United States' diverse election systems is challenging because the technology used to conduct elections and the governance of election systems vary by state, and even within states.

Helping election officials evaluate and mitigate risk

What did HSOAC do?

HSOAC researchers developed a methodology and risk profile tool to assist state and local election officials in understanding and prioritizing cybersecurity risk in election infrastructure. The tool covers the main components of election infrastructure (voter registration, pollbooks, voting machines, tabulation, and official websites), evaluating risk as a function of likelihood and consequence. The method provides relative risk rankings, which can assist election officials in understanding and prioritizing risk in their jurisdictions and in taking steps to mitigate the greatest risks.

Impact

The HSOAC team's approach to evaluating risk in election systems gives state and local election officials a way to understand where risk lies and highlights areas in which election officials could seek assistance from their vendors, CISA, or others. The risk profile tool that the team developed was released as a web-based tool by DHS and the U.S. Election Assistance Commission in September 2020. The national-level risk analysis informed development of a CISA infographic and assessment released in August 2020.

PROJECT LEADERS

Quentin E. Hodgson • senior international and defense researcher

Edward W. Chan • senior operations researcher

Core Research Program

The FFRDC Program Management Office coordinated an effort to identify and fund projects of broad applicability across DHS. Projects were identified through discussions with senior DHS officials from each of the 22 components.

The Core Research Program aimed to enhance the effectiveness of the entire HSE by

- **producing state-of-the-art solutions to complex problems**
- **developing game-changing improvements to enhance existing capabilities**
- **leveraging the work performed for individual components—including lessons learned and best practices—for the benefit of DHS more broadly.**

Completed Core Research Projects, 2019–2020

Site-Specific Counter–Unmanned Aircraft System Requirements Analysis

Robust advancements in UAS technologies have made drone platforms cheaper, more capable, and widely available. This trend has increased the potential for drone systems to become threats to DHS equities. Starting in fiscal year (FY) 2020, DHS needed to field counter-UAS (C-UAS) capabilities more broadly, thus requiring a larger and more comprehensive approach to analyzing C-UAS requirements. In past research, HSOAC analysts examined the impacts of UAS proliferation and documented DHS's requirements and capabilities to address those impacts.

This core study leveraged previous efforts and built on the work completed in the FY 2019 DHS capability analysis report (CAR) to define requirements across facilities, events, and covered assets. Researchers conducted analyses to inform the development of component-, facility-, event-, and asset-specific requirements as these facilities, events, and assets are prioritized and designated by the Secretary of Homeland Security as in need of C-UAS capabilities. The team also developed recommendations to address the solution approaches outlined in the CAR.

Site-specific C-UAS requirements will help guide and scope each component's long-term C-UAS acquisitions and R&D toward meeting the overall mission while reducing potential for duplicative capabilities. A joint perspective on needs and solutions will help ensure interoperability of DHS C-UASs and approaches to ease joint operations during an incident and to support data sharing before and after incidents.

PROJECT LEADERS

Brendan Toland • senior operations researcher

Christopher Scott Adams • policy analyst

Next-Generation Vertical Lift Requirements Analysis

Vertical lift is an enduring need across components. Existing fleets in the USCG and CBP's Air and Marine Operations are nearing the ends of their service lives and may soon be unable to meet the demand from their own and other components. As existing fleet capabilities near the ends of their service lives, the department needs to investigate approaches for transitioning to a next-generation vertical lift (NGVL) capability and begin the requirements development process before the capability gap manifests. The requirements development process should consider opportunities for joint or common capability requirements at multiple organizational and system levels. To support a unified approach, HSOAC researchers identified and analyzed capability gaps and requirements for vertical lift across the DHS enterprise and outlined implementation steps for transitioning DHS to next-generation lift capabilities.

This research provides a visible and practical way forward for NGVL capabilities that aligns component-level requirements analysis and enables innovation and joint development when appropriate. The research team assessed DHS's ability to achieve future missions associated with vertical lift, summarized analysis that demonstrates joint capacity and capability gaps, and identified the risks of not resolving those gaps. The findings provide the foundation for further development of acquisition requirements to support DHS needs for NGVL.

PROJECT LEADER

Jeffrey A. Drezner • senior policy researcher

HELPING DHS MONITOR RISK TO NATIONAL CRITICAL FUNCTIONS DURING A CRISIS

PROJECT LEADERS

Andrew Lauland • senior international and defense researcher

Benjamin Preston • senior policy researcher

When it became clear that COVID-19 had spread to the United States, it was apparent that the virus would affect public health and the economy, although its potential impact on other parts of the nation's critical infrastructure—including manufacturing, law enforcement, oil and gas production, education, and transportation—was less clear. As many regions of the United States began to shut down in March 2020, DHS sought to develop a system to actively monitor the ongoing risks from COVID-19 to 55 National Critical Functions (NCFs), which CISA defines as "the functions of government and the private sector that are so vital to the United States that their disruption, corruption, or dysfunction would have a debilitating effect on security, national economic security, national public health or safety."[3]

A Functional Approach to Assessing Risk

DHS asked HSOAC to operationalize a new approach to thinking about critical infrastructure, which shifted the focus from the infrastructure itself to also include the functions the infrastructure supports, such as transmitting electricity, providing education and training, and managing hazardous waste. To do this, DHS also asked HSOAC to apply and improve on a new risk framework developed by CISA's National Risk Management Center to conduct ongoing strategic assessments of the risk of significant or long-term disruption to the 55 NCFs from COVID-19.

HSOAC drew on its deep bench of RAND researchers to quickly assemble a team of more than 50 analysts with subject-matter expertise spanning all 55 NCFs. Team members were charged with assessing the risk—as high, medium, or low—that each of the 55 NCFs might be disrupted within the next 60 days by any of four drivers: (1) loss of a critical commodity the function requires, (2) a shortage of critical workers, (3) a surge in demand that exceeds the function's capacity to meet it, and (4) so little demand for a function that it ceases to be able to operate. HSOAC analysts identified bellwether indicators to track each driver for each function, assembling a total of more than 700 indicators across the 55 NCFs, along with data sources to track each indicator.

During the first six weeks of the project, researchers rapidly developed credible insights into the risk of COVID-19 to each of the 55 NCFs. They provided a picture of risk across the NCFs and characterized the geographic distribution of different types of risk across the country. Researchers created NCF dashboards, which provided an integrated visual display of risk ratings for the NCFs.

Leading into the second round of assessments, researchers made improvements—such as by standardizing assessment approaches, addressing gaps in the indicators, and enhancing data visualizations—and updated the analyses for all 55 NCFs. The updated assessments incorporated information about ongoing events that might affect risk associated with COVID-19, such as policy reactions to the pandemic, the closing and reopening of businesses, seasonal events (such as holidays that might lead people to gather), and major events (such as protests and hurricanes that bring people out of their homes).

Although some risk ratings remained stable over time, others displayed complex dynamics, which were reflected in the team's ongoing assessments. Researchers expanded the NCF dashboards to include more detail on the indicators, including the ability to drill down to understand the details of the risk ratings. These assessments have occurred on a rolling, weekly basis since the first days of the pandemic in March 2020 and continue to the present day.

This Risk Assessment Capability Can Be Used in Other Crises

The HSOAC team provided DHS with a rigorous and sustainable capability to assess risk to the NCFs, including metrics and data, as well as the capability to rapidly ramp up in an emergency. Although the initial use of the tool focused on COVID-19, the function-based approach can be used to monitor risk associated with other types of crises, including sudden shocks (e.g., cyberincidents, acts of terrorism) and long-term stressors (e.g., economic downturns, changes in technology). At DHS's request, the team applied the framework in August 2020 to assess risk from Hurricanes Marco and Laura.

U.S. Coast Guard and DHS Fellowships at RAND

Each year, RAND hosts DHS and USCG fellowships. These fellowships support the development of leaders at DHS with the strategic analysis and planning skills needed to meet the complex challenges of their respective organizations and missions. Working at RAND provides an opportunity for fellows to study with nationally known researchers and form effective partnerships outside of their organizations, as well as explore innovations needed to more effectively and efficiently manage resources. In return, fellows offer HSOAC an operational understanding of DHS elements and how to make our research more useful to the department.

The 2019–2020 Cohort

Eric Goldman was a 2019–2020 DHS fellow at RAND. Prior to the fellowship, Goldman was director of the Financial Operations Division, Mission Readiness Operations Directorate, at U.S. Border Patrol HQ in Washington, D.C. He joined DHS in 2010 as business financial manager of the U.S. Secret Service Information Integration and Technology Transformation Program and Information Resources Management Division. Prior to joining DHS, he oversaw personnel cost estimating for the U.S. Army. During his fellowship, Goldman was part of a team that evaluated the maturity and operations of the Office of the Chief Component Human Capital Officer. As part of this project, he participated in focus groups, coded and analyzed data, and helped the team formulate and apply a maturity model used to provide Mission Support leadership with an actionable plan for improving human capital processes at FEMA. Goldman also contributed to a North Atlantic Treaty Organization (NATO) Special Operations HQ construct project, working closely with another team member to conduct unclassified research on the history of NATO and the evolution of its protocols related to expanding the NATO command structure.

Brian Koski was a 2019–2020 DHS fellow at RAND. Koski is an experienced team leader who has successfully applied industrial engineering, operations research, systems analysis, project management, demand planning, capacity management, Six Sigma, and modeling and simulation tools to increase organizational efficiency, improve effectiveness, and enhance customer experience in the public and private sectors. He is currently a manager in the TSA Requirements and Capabilities Analysis Division and has been with TSA since October 2002. During his time at RAND, Koski provided subject-matter expertise and developed a sampling plan to support an HSOAC team in developing a robust design for covert testing of TSA passenger screening. He also contributed to the USVI recovery study by conducting literature reviews, analyzing grant data, and interviewing USVI officials. Koski also contributed to the NCF COVID-19 Risk Assessment project, providing the study team with analysis of COVID's effects on air transport cargo and passengers.

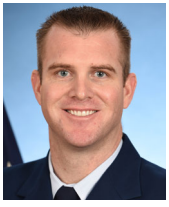
Rachel Liang was a 2019–2020 DHS fellow. She is the Nuclear Section chief for CISA. In that capacity, she leads the team responsible for developing and maintaining strong public–private partnerships and ensuring the ongoing execution of vital homeland security programs. She also serves as a technical subject-matter expert supporting the nuclear sector in executing the voluntary

critical infrastructure protection and resilience mission. Prior to leading the Nuclear Section, Liang served as deputy chief of the Office of Infrastructure Protection's Stakeholder Readiness and Exercise Section, where she coordinated, planned, and executed preparedness and response exercises with stakeholders across all 16 critical infrastructure sectors. During her time at RAND, Liang supported the USVI recovery project, helping the natural and cultural resource team understand the hurricanes' impact on the territory's resources. She also supported the Transport Materials by Pipeline infrastructure team on the NCF COVID-19 Risk Assessment project. Liang also contributed to studies related to the Army Installation and Community Partnership guide, air and maritime colocation study, and the USCG Evergreen study.

Captain Ben Maule served as 2019–2020 USCG fellow at RAND. Maule has served in the USCG for more than 21 years, spending the past three years serving as the executive assistant to the assistant commandant for response policy. In this capacity, he was responsible for advising a flag officer and senior executive in the development of strategic response doctrine and policy guidance for all USCG forces. These policies encompass seven of the 11 operational maritime missions in the areas of law enforcement, search and rescue, counterterrorism and defense operations, oil spill response, incident management and preparedness, and contingency exercise programs. During his time at RAND, Maule contributed to a study of USCG recruitment and retention of personnel from underrepresented demographic groups, which involved analyzing and modeling complex data sets. His knowledge of USCG data systems and operations helped researchers map USCG force packages to various activities, helping the service's leadership quantify the risks, trade-offs, and other implications of various force planning scenarios. Maule additionally supported broader DHS projects, including a study of requirements for air and maritime capability integration, which involved developing a combined infrastructure framework for the USCG and CBP.

The 2020–2021 Cohort

DHS Fellow: HSOAC welcomes Rephael Houston as 2020–2021 DHS fellow. Houston represents CISA, where he is the Chemical Security Assessment Tool IT program manager in the Office of Chemical Security.



USCG Fellow: HSOAC welcomes Commander Brian Whisler as 2020–2021 Coast Guard fellow. Before reporting to RAND, Whisler served as executive officer of the USCGC *Douglas Munro*, homeported in Kodiak, Alaska.

Abbreviations

CBP	U.S. Customs and Border Protection
CDO	chief data officer
CISA	Cybersecurity and Infrastructure Security Agency
C-SCRM	cyber supply chain risk management
C-UAS	counter–unmanned aircraft system
DHS	U.S. Department of Homeland Security
FEMA	Federal Emergency Management Agency
HQ	headquarters
HSE	homeland security enterprise
HSOAC	Homeland Security Operational Analysis Center
IT	information technology
JRC	Joint Requirements Council
JRIMS	Joint Requirements Integration and Management System
NATO	North Atlantic Treaty Organization
NGVL	next-generation vertical lift
PA	Public Assistance
PNT	positioning, navigation, and timing
R&D	research and development
SPA	streamlined project application
TSA	Transportation Security Administration
TWIC	Transportation Worker Identification Credential
UAS	unmanned aircraft system
USCG	U.S. Coast Guard
USVI	U.S. Virgin Islands

[1] Donald J. Trump, President of the United States, "Strengthening National Resilience Through Responsible Use of Positioning, Navigation, and Timing Services," *Federal Register*, Vol. 83, No. 32, February 18, 2020, pp. 9359–9361.
[2] Public Law 115-435, January 14, 2019.
[3] CISA, "National Critical Functions," undated.

Senior Leadership

Terrence Kelly, PhD: vice president and director, HSOAC;
director, Homeland Security Research Division, RAND Corporation
tkelly@rand.org, 412.683.2300 x4905

Henry Willis, PhD: director, Strategy, Policy and Operations Program, HSOAC
acting director, Personnel and Resources Program; senior policy researcher, RAND Corporation
hwillis@rand.org, 412.683.2300 x4650

Jessie Riposo, MS: director, Recovery Cost Analysis Program, HSOAC;
senior operations researcher, RAND Corporation
riposo@rand.org, 703.413.1100 x5162

Emma Westerman, MS: director, Acquisition and Development Program, HSOAC;
mathematician, RAND Corporation
emma@rand.org, 703.413.1100 x5660

PHOTO CREDITS

FRONT COVER
Top row: sherryvsmith/Adobe Stock; Dominick Del Vecchio/FEMA; Andrea Starr/Pacific Northwest National Laboratory; Journalist 2nd Class Mark O'Donald/U.S. Navy via Wikimedia
Bottom row: Gorodenkoff/Adobe Stock; TSgt Matt Hecht/U.S. Air National Guard; Eric D. Woodall/USCG; Charles Reed/ICE.

INTERIOR
Page 5, left to right: PO1 Luke Clayton/USCG; Eric D. Woodall/USCG.
Page 6, left to right, clockwise: Courtesy photo/U.S. Army Corps of Engineers; A1C Shannon Bowman/U.S. Air Force; Michael Traitov/Adobe Stock.
Page 22: metamorworks/Adobe Stock.
Page 23, left to right: Burlingham/Adobe Stock; yelantsevv/Adobe Stock; WavebreakMediaMicro/Adobe Stock.

HSOAC is an FFRDC operated by the RAND Corporation under contract with DHS. RAND is a research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest.

For more information, visit www.rand.org/hsrd/hsoac.

How can state and local officials protect elections from cyberattacks?

How can DHS address risk in the cyber supply chain?

Do disasters affect the price of construction?

What mix of airpower will the U.S. Coast Guard need to execute its future missions?

What risks does COVID-19 pose to National Critical Functions?