PROJECT ON ADVANCED SYSTEMS AND CONCEPTS FOR COUNTERING WEAPONS OF MASS DESTRUCTION

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PASCC

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NAVAL POSTGRADUATE SCHOOL

For Unlimited Distribution

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Executive Summary

For the past five years, the Naval Postgraduate School (NPS) has hosted the Project on Advanced Systems and Concepts for Countering WMD (PASCC) for the Defense Threat Reduction Agency. PASCC has been managed by a small team of NPS faculty and staff researchers based in the School of International Graduate Studies. During this time, PASCC personnel have supervised the yearly release of a Broad Agency Announcement and convened and managed a rigorous, peer-reviewed proposal evaluation process involving Ph.D.-level experts on WMD issues from various departments across the U.S. government to select the best projects for eventual funding. PASCC also tracks the projects in progress; works with performers to resolve any logistical problems; reviews and edits final reports; and facilitates the briefing of research findings, especially in the Washington, DC, area.

In FY16, PASCC supported 10 strategic dialogues with a variety of countries on relevant WMD issues as well as 14 research studies on topics ranging from the future of missile defense, to the role of clandestine nuclear capabilities, to proliferation risks posed by additive printing, to means of improving compliance with arms control agreements. PASCC personnel provided continuing oversight of the 27 projects funded in FY15, as well as deliverables from several projects still in progress from FY14. PASCC organized outreach events to publicize findings from selected research projects in March 2016 at the National Academy of Sciences and in September 2016 at the Carnegie Endowment for International Peace, both in Washington, DC. PASCC also initiated an electronic newsletter to promote the distribution of project findings and released four quarterly issues during FY16.

Early in FY16, however, the Office of the Assistant Secretary of the Navy (Financial Management and Comptroller) issued new regulations requiring that the Naval Postgraduate School could henceforth only accept research support for programs where at least fifty-one percent of the funding remained at NPS. This shift meant that grant-making programs could no longer be managed and operated by NPS for other agencies within the U.S. government. Given this change, DTRA elected to transition the PASCC program to the U.S. Air Force Academy's Institute for National Security Studies by the end of FY16.

For the past four years, PASCC has been directed by Professor Clay Moltz of the NPS Department of National Security Affairs, with the valued support of Executive Director Dr. Michael Malley. During FY16, PASCC's staff also included Ms. Diana Wueger, who conducted research and managed project reporting to DTRA, and Ms. Jumana Kawar, who facilitated PASCC's outreach efforts. Although PASCC grants for FY17 will be issued by the U.S. Air Force Academy, PASCC personnel at NPS will continue to support DTRA and the U.S. Air Force Academy in PASCC-related activities through the end of FY17.

Highlights and Accomplishments

- PASCC held two half-day workshops in 2016 at which PASCC performers briefed their findings from a wide range of projects to U.S. officials and non-government experts. The first, "Emerging Nuclear and CBW Challenges and Management Opportunities," was held on March 11, 2016, at the National Academy of Sciences (NAS). The second, "Countering WMD amidst Global Tensions,"was held September 16, 2016, at the Carnegie Endowment for International Peace (CEIP).
- Between October 2015 and August 2016, PASCC made 24 FY16 project awards to 18 different research organizations.
- Seven strategic dialogues were held with counterparts around the globe.
- PASCC implemented a new quarterly electronic newsletter to highlight new reports and program activities.
- PASCC released 29 new technical reports, which are available through the Homeland Security Digital Library (HSDL).
- PASCC began the transition from the Naval Postgraduate School to the United States Air Force Academy, which took over the operation of PASCC beginning in FY17.

Research Themes for FY16

PASCC's FY16 project awards marked the fruition of a multi-step process. Research projects were initially solicited through a PASCC Broad Agency Announcement (BAA) released on Grants.gov in the spring of 2015. The BAA for FY16 funding emphasized the PASCC research mission in five broad areas:

1. **Proliferation of weapons of mass destruction** (WMD, defined as nuclear, chemical, and biological) and **weapons of mass effect** (WME, defined as other high-casualty or high-disruption weapons that might have "strategic" effects). This area includes: dealing with existing global horizontal and vertical proliferation concerns and their causes; developing strategies for preventing or, if prevention is not possible, minimizing the consequences of WMD/WME use and facilitating resilience and recovery; and anticipating new and emerging threats (whether by state or non-state actors). PASCC is also interested in topics related to the safety and stability of existing WMD arsenals.

2. **Future technologies of mass effect**. PASCC especially seeks to identify strategic weapons of the future, including such topics as infectious diseases, synthetic biology, nanotechnology, additive manufacturing, and autonomous systems. PASCC is particularly interested in anticipating and preventing threats to strategic stability and understanding non-obvious linkages between civilian technologies and possible warfare. Strategies for improving U.S. resilience and/or recovery in the face of future WMD/WME threats/attacks are a related area of interest.

3. **WMD/WME delivery systems** (including missiles, aircraft, ships, submarines, and unconventional modes). PASCC is especially interested in research on preventing new modes of delivery (including for biological weapons) and new approaches to managing or combating the spread or transfer of existing modes to countries of concern or non-state actors.

4. **Management and prevention mechanisms/regimes**. PASCC's interests include improvements to and enhanced enforcement mechanisms for existing treaties, regimes, and international organizations responsible for controlling WMD/WME, developing proposals for new international mechanisms (including possible WMD/WME elimination and such efforts as the Global Health Security Agenda), and explaining differing perceptions of (and assumptions about) WMD/WME.

5. **Multi-domain threats to strategic stability and hybrid warfare**. PASCC is interested in the linkages between strategic stability and emerging dynamics in other domains (space, cyber, maritime, etc.). This area includes research on the prevention of attacks against critical national technical means, infrastructure, and other systems linked to strategic stability. Attribution, situational awareness, and verification in these domains are other areas of interest, as are tools for "measuring" the robustness (or fragility) of strategic stability as affected by activities in these domains.

Over 65 white papers were submitted by a total of 38 organizations for evaluation by the Proposal Review Committee in July 2015. Federally Funded Research and Development Centers (FFRDCs) and other organizations precluded in their charters from the non-government grant competition were able to submit project concepts that were evaluated separately on their individual merits.

Projects Awarded in FY16

Applying the evaluation criteria in the BAA and FY16 available funding, PASCC awarded 24 projects – 10 dialogues and 14 studies. The following projects were selected during the 2015 application and review process and received FY16 funding. Project descriptions are based on the original proposals. Some projects will have minor adjustments during execution.

U.S.-China Strategic Stability and Japan

Performer: Carnegie Endowment for International Peace
Principal Investigator: Li Bin
Cost: $149,502

Objective: Japan is a critical player in the context of U.S.-China strategic stability; however, there are very few discussions between Chinese and Japanese security experts on the issue, much less trilateral discussions involving all three countries. Moreover, there has been little scholarly attention to the role Japan plays in the U.S.-China relationship. This project aims to investigate challenges to strategic stability between China and the United States that derive from the triangular relationship between these two powers and Japan through the medium of a trilateral U.S.-China-Japan Track 2 dialogue to promote mutual understanding among experts from the three countries on the concept and definition of U.S.-China strategic stability, the purposes that U.S.-China strategic stability serves, and approaches to fostering strategic stability in the region.

Approach: The issue of strategic stability between China and the United States is relevant to scholars and students of international relations and security studies as well as to the broader community of research institutes, universities, and corporations concerned about trends in these relationships. This project will use a trilateral Track 2 dialogue to explore the concepts, flashpoints, and policies that bear on strategic stability in the region. The commissioned papers and the findings from this workshop will be made publicly available online. Research findings will also be presented at American universities and through social media tools.

Strengthening Strategic Stability in Central and Eastern Europe

Performer: Center for European Policy Analysis (CEPA)
Principal Investigator: A. Wess Mitchell
Cost: $194,918

Objective: The project investigates the interplay between new Russian warfare techniques and emerging counter-strategies of frontline Central and Eastern European (CEE) states in order to fulfill two objectives: (1) to organize and disseminate expert assessments of under-studied CEE security dynamics in the context of the emerging Russian threat in the region and

explain what it means for regional and global strategic security; and (2) to stimulate public awareness and understanding of the implications of the erosion of U.S. extended deterrence and how emerging CEE deterrence strategies could counter new threats and support extended deterrence.

Approach: This project has three primary research topics: the problem of limited war and Russian tactical nuclear doctrine in CEE; the role of conventional deterrence in responding to the Russian nuclear threat, in operating in a limited war scenario, and in achieving nuclear strategic stability; and the future role of NATO-level tools, including tactical nuclear weapons and ballistic missile defense in Europe. Through two strategic dialogues, one in Washington, DC, and one in Warsaw, Poland, this project will collect findings on these topics and generate a comprehensive report that will be publicly distributed. CEPA will hold public events in Washington and Warsaw to present research findings.

The Role of Clandestine Capabilities in Deterrence: Theory and Practice

Performer: Columbia University
Principal Investigator: Austin Long
Cost: $ 152,722

Objective: Clandestine capabilities are an increasingly relevant part of nuclear strength, and will likely be a key determinant of deterrence success and strategic stability in future world politics. While the challenge of managing the balance between political benefit and the need to maintain the secrecy of these capabilities is not new, trends in technology are increasing the salience and importance of this issue across several different military domains. This project will investigate how states might use their clandestine capabilities for political benefit without permitting countermeasures to be implemented that would neutralize those capabilities. The project lead will then develop theoretical frameworks that can be used to analyze the impact of clandestine military capabilities on international politics.

Approach: This research anticipates developing hypotheses and analytical tools that can guide further scholarly research into the problem of clandestine capabilities. The extant security studies literature on coercion and intelligence lacks a theoretical framework to guide scholarly analysis. This project will fill this critical academic need through the process of theory building. Also, this research will advance the state of scholarly understanding on a number of important issues central to international relations. This research will therefore break new ground in the discipline of security studies, as clandestine capabilities have received little direct attention in the academic literature. Moreover, because of its roots in the bargaining model of war and other literatures on coercion, this research makes connections to several other classic security studies topics and has the potential to shed new light on them. Reports will be made publicly available along with presentation slides and the casebook developed as a supplement to this research.

European Trilateral Track 2 Nuclear Dialogue

Performer: Center for Strategic and International Studies (CSIS)
Principal Investigator: Rebecca Hersman
Cost: $160,804

Objective: This strategic dialogue seeks to promote insights and policy recommendations that contribute to P-3 unity on nuclear issues ranging from defining the future of disarmament to arms control, verification and nonproliferation. Moreover, it will address the role nuclear weapons play in the evolving security environment, advance NATO's nuclear policy, and enhance material security. This effort is increasingly important as new obstacles to P-3 unity on nuclear issues emerge from both external challenges and internal barriers to consensus policy positions.

Approach: The European Trilateral Track 2 Nuclear Dialogue will feature two meetings: one in London in May 2016 and the other in Washington, DC, in November 2016. The meetings will result in at least one "consensus statement" signed by the dialogue's Track 2 participants, followed by submission of an analytic report summarizing the results of the strategic dialogue—namely the qualitative differences and concurrences among the P-3 partners (United States, United Kingdom, and France).

U.S.-China Strategic Nuclear Dialogue

Performer: Pacific Forum CSIS
Principal Investigator: Ralph Cossa
Cost: $212,009

Objective: This research is anticipated to lead to greater understanding of strategic nuclear issues between the United States and China. The project will build a stronger relationship among scholars and experts in the United States and China. The dialogue discussions will provide academics and other security analysts with an opportunity to explore the differences between academic theory and the thinking of practitioners who have to implement and stand behind policy decisions. This is a follow-on project that will help build greater understanding between U.S. and Chinese experts on strategic nuclear issues by testing assumptions, correcting misperceptions, and stimulating new thinking and research in the arms control and nonproliferation community.

Approach: For this project, the Pacific Forum will host a strategic dialogue in Beijing in November 2016. Substantive topics are expected to include nuclear posture, deterrence policy, nonproliferation policy, no first use, strategic stability, mutual vulnerability, missile defense, long-range conventional weapons, confidence-building measures, and space security. Participants will be drawn from security specialists and up-and-coming experts in both countries. Additionally, participants will be asked to prepare and present research papers, which will be publicly available following the workshop. The findings will be distributed to academics, think tanks, and the general public along with the governments of the United States and China.

Trilateral Cooperation to Strengthen Extended Deterrence in Northeast Asia

Performer: Pacific Forum CSIS
Principal Investigator: Brad Glosserman
Cost: $216,323

Objective: This project will investigate opportunities and obstacles to U.S.-Japan-ROK trilateral cooperation to enhance the extended deterrence relationship between the United States and its two allies in Northeast Asia. This initiative will explore ways the three countries could work together to secure their national interests and reinforce the U.S. extended deterrent. The dialogue will build upon existing multilateral engagements to increase knowledge about current thinking in Japan and South Korea on topics such as the global disarmament movement, U.S.-Russian arms control measures, the U.S. nuclear weapons posture, China's nuclear modernization efforts, and the growing threat of proliferation in North Korea.

Approach: Pacific Forum CSIS will host a U.S.-Japan-ROK strategic dialogue in August 2016. This dialogue will focus on the three nations' perspectives on regional threats and challenges, identifying where they overlap and where they diverge in the face of increasingly sophisticated and capable (potential) adversaries and evolving capabilities among allies. In addition, it will assess how domestic politics facilitates or impedes cooperation, and it will also scrutinize bilateral dynamics in a rapidly changing domestic and regional environment. The findings from the meeting will be distributed to the governments of the United States, Japan, and the ROK, as well as to academics, think tanks, and the general public through the publication of a trilingual report, as well as private briefings and public panel sessions.

Landscape and Dynamics of a Multi-Polar Strategic BMD World

Performer: Federation of American Scientists (FAS)
Principal Investigator: Charles Ferguson
Cost: $134,598

Objective: Until recently, the United States has been the only state successfully pursuing ballistic missile defense (BMD) capabilities. However, Russia, China, and India have made strides toward their own strategic BMD systems, opening up a range of understudied questions. This research will improve scholarly and public understanding of the implications of a multi-polar strategic ballistic missile defense world. The project will investigate the strategic landscape and dynamics of a multi-polar strategic ballistic missile defense world in order to understand the potential impact of such a world on offense-defense dynamics, countermeasures, regional stability, cross-domain deterrence, alliance planning, and global arms control efforts

Approach: This project proposes to address this growing and challenging set of strategic and geopolitical issues through DC-based and in-country discussions and small group meetings with key experts and government officials from the United States, Russia, China, and India.

Furthermore, it will assign experts to write working papers on China, India, and Russia (two papers per country for a diverse set of views) and convene a small DC-based workshop devoted to the subject of a multi-polar missile defense strategic environment. The final publicly released report will be a substantial analytic work that will include detailed observations and findings to stimulate public debate on this important set of issues.

The Use of Chemical Weapons in Warfare: Insights from Archives and Battlefields

Performer: Georgia Tech Research Corporation
Principal Investigator: Lawrence Rubin
Cost: $72,002

Objective: There are no unclassified analyses of Iraqi decision making about chemical weapon use in the 1980s. Based on newly available documentation from Ba'athist Iraq, this project will produce the first publicly available study. The project will investigate Iraq's chemical weapons decision making in 1988 in order to produce a monograph that draws insights from the Iraq case study that are applicable to understanding Syria's recent chemical atrocities. The project will seek to answer three research questions: First, under what conditions do leaders decide to gas domestic groups? Second, how much leverage does the United States have to deter a country from employing chemical weapons? Third, if the United States chooses not to take strong action, will this embolden the aggressor state to engage in more undesirable behavior?

Approach: This study will use the qualitative research design of structured, focused comparisons to improve our understanding of the role that U.S. threats and assurances play, relative to other factors, in influencing decision making about chemical weapon use and non-use. To answer the research questions, this project will examine several sources: captured Iraqi records available at the Conflict Records Research Center, Hoover Institution archives, and University of Colorado Boulder archives; recently declassified interrogation reports of Iraqi principals, records, and testimony released in conjunction with the Iraqi war crimes trials; and documents in the Reagan Presidential Library, among other materials.

The Near-Miss Case of Taiwan's Historical Nuclear Proliferation: Countering Proliferation via Diplomacy, Intelligence, and Verification

Performer: Institute for Science and International Security (ISIS)
Project Lead: David Albright
Project Cost: $105,246

Objective: Taiwan's covert push during the 1990s toward developing nuclear weapons is an important, but relatively unknown, near-miss case of historical nuclear weapons proliferation that was thwarted by strong diplomacy, intelligence gathering, and international verification. The Taiwan case is relatively unknown and its lessons are unexplored except in a very few published

writings, none of which have had access to the collection of documents and materials that ISIS has. This project will contribute to scholarship on Taiwanese history and the dynamics of nuclear proliferation by making public a large body of significant, currently unpublished historical documents and data related to the Taiwan case. The project will investigate the historical case of Taiwan's efforts at producing nuclear weapons in order to utilize time-sensitive sources to build a thoroughly documented case history for future scholars, as well as to develop a more comprehensive understanding of the motivations and constraints affecting countries' pursuit of nuclear weapons.

Approach: This project will draw on ISIS's unrivaled set of documentation, news stories, declassified government cables and estimates, and unpublished manuscripts on the Taiwan proliferation case. This research will detail, review, and draw out lessons from the historical case of Taiwan's close call at producing nuclear weapons. The results of the study will assemble and make public information from U.S. and IAEA officials who were directly involved in this case. The PI will produce a substantial paper that draws lessons from this case and applies them to other potential cases of proliferation in the Middle East and East Asia.

Use of 3D Printing to Bypass Nuclear Export Controls

Performer: Kings College London
Project Lead: Grant Christopher
Project Cost: $104,486

Objective: This project will assess the likelihood of 3D printers being used to circumvent existing control regimes related to the nuclear fuel cycle. The project lead will investigate the impact of additive manufacturing on nuclear nonproliferation and the possibility of using off-the-shelf 3D printers to produce parts for centrifuges and other nuclear-fuel cycle relevant components. This research will provide important information for the global arms control community and academics concerned with nuclear proliferation pathways and will be valuable for academics and industry as they seek to understand the future uses for, and the potential need for restrictions on, 3D manufacturing.

Approach: The principle investigator (PI) will conduct a technical literature review of current 3D printer capabilities, focusing on their ability to print items for use in the nuclear fuel cycle, such as components of centrifuges, which are export controlled. This technical review will be supplemented by discussion and input from relevant fuel cycle and additive manufacturing experts. The project will use open sources to compile and publish data on the 3D printer-manufacturing base, the current location of 3D printers capable of printing sensitive items, and the availability of sensitive digital designs online, such as via ecommerce platforms and the dark web. Recent work by the PI has established that current off-the-shelf 3D printers claim to print steel at strengths that would be suitable for use in a centrifuge to enrich uranium. This development has not been discussed elsewhere in the open literature and the properties of 3D printed steel have not been explicitly examined in this context. Thus, this project will determine the possibility of using off-the-shelf 3D printers to produce steel parts for centrifuges and other nuclear fuel cycle-relevant components.

Evaluating WMD Proliferation Risks at the Nexus of Manufacturing Tools and Methods Used in DIY Communities

Performer: Middlebury Institute of International Studies (MIIS)
Project Lead: Ferenc Dalnoki-Veress
Project Cost: $102,253

Objective: This project will investigate how access to additive and subtractive manufacturing tools by do-it-yourself (DIY) communities decreases barriers for producing items on the Nuclear Suppliers Group (NSG)'s list of technologies controlled for export in order to determine if new manufacturing tools embraced by DIY communities may cause new proliferation risks. U.S. nonproliferation policy has principally relied on the notion that limiting access to nuclear technology can contain the proliferation of nuclear weapons and materials through export controls. Recently, however, additive and subtractive computer-aided manufacturing tools have become more widely accessible to DIY communities of entrepreneurs and hobbyists—a development that could increase the number of companies and individuals capable of fabricating export-controlled goods.

Approach: This research project will investigate how access to additive and subtractive manufacturing tools by DIY communities decreases barriers for producing items on the NSG's list of technologies controlled for export. Researchers will select a subset of these items, assess specific challenges in fabricating them, and determine if new manufacturing tools embraced by DIY communities may surmount those challenges and thereby cause new proliferation risks. Findings will be summarized in a final report that will inform strategies for outreach to DIY communities, raise awareness of potential proliferation risks, and suggest countermeasures such as new export control strategies.

A U.S.-Russian Academies of Science Security Dialogue

Performer: National Academy of Sciences (NAS)
Project Lead: Rita Guenther
Project Cost: $250,000

Objective: The NAS Committee on International Security and Arms Control (CISAC) maintains a scientific-technical dialogue with the Russian Academy of Sciences (RAS) in order to promote better understanding of each other's plans and actions and to seek opportunities for cooperation. These frank and open discussions and subsequent briefings foster trust and build confidence that aid further engagement and international security. Partnerships, ideas, and concepts developed through the project can be applied by policymakers and scholars of arms control and U.S.-Russian relations to promote future study and new pathways for WMD reductions.

Approach: CISAC will organize, conduct, and report on two bilateral meetings—one in the United States and one in Russia or a third country—on topics including (1) new conceptions of strategic stability in the context of military modernization (e.g., nuclear modernization in Russia and conventional precision weapons and ballistic missile defense in the United States); (2) monitoring of nuclear materials, including tracking and traceability; (3) scientific and technical methodologies for nuclear archaeology for fissile material production facilities; (4) the impact of dual-use biotechnology on biosafety and biosecurity; and (5) other topics agreed upon by NAS and RAS. Papers will also be drafted by participants and exchanged either prior to or following the meetings. The project lead will also conduct private briefings for officials concerned with these issues.

Assessing the Implications of Trends in Science and Technology Relevant to the Chemical Weapons Convention

Performer: National Academy of Sciences (NAS)
Project Lead: Teresa Fryberger
Project Cost: $181,292

Objective: This project will investigate trends in science and technology (S&T) relevant to the Chemical Weapons Convention (CWC) to assess their implications for the future operation of the Convention, including potential emerging threats and developments that could limit the effective implementation of the convention. The project will reach a broad international audience and will support a wider discussion between S&T and international security professionals about how to address the implications of the revolution in life sciences without unduly impeding continued scientific progress.

Approach: NAS will collaborate with several international scientific organizations to assess the implications of continuing rapid advances in S&T for the future operation of the CWC. The project lead will work with the International Union of Pure and Applied Chemistry (IUPAC) in the design and implementation of an international symposium that will bring together subject matter and policy experts from academia, industry, and government to consider recent advances in S&T and analyze their implications for the CWC. The resulting report, drafted and published by IUPAC, will summarize the scientific and technical discussions and provide an analysis of these topics to inform deliberations in advance of the 4th CWC Review Conference in 2018.

Joint Chinese-U.S. Activities on Biological Safety and Security

Performer: National Academy of Sciences (NAS)
Project Lead: Benjamin Rusek
Project Cost: $252,436

Objective: This project will build on previous collaborative activities between NAS's Committee on International Security and Arms Control and the Chinese Academy of Sciences on international global health security, biological safety, and biological security to build awareness of biosafety and biosecurity issues within the Chinese bioscience community. This project also aims to cultivate a set of Chinese leaders and champions in the biosecurity area and to equip Chinese scientists and institutions to better implement biosafety and biosecurity. Ultimately, it hopes improve the relationship between the U.S. and China on a range of biological security and biological safety issues.

Approach: NAS will collaborate with the Chinese Academy of Sciences and other Chinese institutions to organize two joint workshops, the first in China and the second in the United States, between Chinese and American experts on the challenges of emerging infections, laboratory safety, and global health security. The project's activities will increase both conceptual and technical understanding of Chinese thinking in these areas and through greater Chinese engagement outside of China, increase and improve the body of knowledge available to the international scientific community.

Global Security Engagement II: A Symposium to Update Cooperative Threat Reduction for 2016 and Beyond

Performer: National Academy of Sciences (NAS)
Project Lead: Benjamin Rusek
Project Cost: $126,715

Objective: This research seeks to improve understanding among non-governmental organizations and scholars of nonproliferation and international relations of existing Cooperative Threat Reduction (CTR) arrangements and the potential benefit to national and international security from increased or improved CTR efforts. The CTR program was created in 1991 to provide financial assistance and engineering expertise for securing or eliminating nuclear weapons delivery systems, warheads, materials, and technology from the Soviet nuclear weapons complex. These activities continued for many years, growing to encompass a broader scope and more donor countries. Since that time, CTR has undergone significant changes, most notably the cessation of cooperative work with Russia in 2014. This research will explore possible future directions for CTR work in 2016 and beyond.

Approach: NAS will convene a symposium to examine the state of CTR efforts today across the U.S. government to consider how they should be adapted and/or reframed for the current and evolving world. Symposium participants will be asked to identify actionable next steps, and NAS will explore the possibility of follow-on activities that might be carried out by NAS, other non-governmental organizations, and the U.S. government.

Securing Compliance with Arms Control Agreements

Performer: National Institute for Public Policy (NIPP)
Project Lead: Kurt Guthe
Project Cost: $145,565

Objective: This project will investigate four historical cases of arms control noncompliance to gain a better understanding of why noncompliance occurs and how it might be prevented or reversed. The problem of noncompliance with arms control agreements tends to receive less attention and analysis than that devoted to the agendas, proposals, negotiations, and verification for these agreements. Results from this study should be of interest to the community of government agencies, nongovernmental organizations, and academic scholars that deals with arms control issues, as well as to members of the general public, especially in light of media coverage of Russian, Syrian, and potentially Iranian cheating on WMD-related agreements.

Approach: This research project will employ a case-study approach to gain a better understanding of why noncompliance occurs and how it might be prevented or reversed. The proposed project will examine four historical cases in which a country violated an arms control agreement and then one or more other countries attempted to enforce its terms. The project lead will employ a common set of questions in order to derive generalizations, with supporting examples, that can be used in the design of deterrents and responses to arms control violations. The answers to these questions are expected to provide insights and supporting evidence regarding conditions that encourage or discourage cheating, measures that deter cheating, tactics of violators, other factors that impede enforcement actions, and ways to compel the compliance of violators.

U.S.-India Strategic Dialogue 2016

Performer: Naval Postgraduate School (NPS)
Project Lead: Paul S. Kapur
Project Cost: $204,608

Objective: This dialogue seeks to improve mutual understanding between the United States and India on a range of strategic and security-related issues. Although the U.S. and India have declared themselves strategic partners, there is considerable uncertainty in both countries as to what the partnership actually entails and how it can be operationalized. While vast

improvements have been made in the U.S.-Indian relationship since the Cold War, the areas of shared interests and values are not enough to minimize the nuclear and conventional dangers in the new environment.This project will address issues central to the U.S.-Indian partnership, thereby helping to inform each side of the others' views, identifying potential means of pursuing joint strategic interests and managing disagreements and enabling the participants to serve as resources for their respective security communities.

Approach: This project will bring together Indian and American strategic experts for a three-day discussion of issues central to the U.S.-India strategic relationship, paying special attention devoted to nuclear-related questions. Specific topics to be explored will include: an assessment of the general state of the U.S.-Indian relationship one year into the Modi administration; India's conventional and nuclear force posture, including the space and cyber domains; India's strategic partnerships in the Indian Ocean/Asia-Pacific region; India's regional threat perceptions; and the security of India's nuclear complex. By comparing the findings with conclusions from previous years, it will be possible to determine the extent of the evolution and current direction of the U.S.-Indian relationship.

Scoping Study and Model Development for South Asian Stability Workshop 3.0

Performer: Naval Postgraduate School (NPS)
Project Lead: Feroz Khan
Project Cost: $ 110,447

Objective: This research project will develop a new model and design a new scenario for conducting a third iteration of the South Asian Stability Workshop. This project will seek new game mechanisms that will allow for greater fidelity in depicting a nuclear-tinged future crisis in South Asia with the potential to draw in China and the United States. This project builds upon the foundations and feedback from previous TTXs conducted by the principle investigator. These previous exercises revealed several disconnects in each country's strategic rationale; limitations on their understandings of the intentions and capabilities of the other country; their assumptions about escalation control; and, most importantly, their assumptions and visualizations of the roles of international powers in South Asian crises. This crisis simulation exercise model will seek to incorporate best practices for conducting four-team war games and will incorporate regional force trajectories over the next ten years, as well as projected geopolitical trends.

Approach: This research project will develop a game design that will model the interplay of major powers in a South Asian crisis through a four-team TTX, as well as modifying in-cell dynamics to reflect more realistic civil-military relations in South Asia. This model will also allow for a deeper exploration of inter-service dynamics in a region where little attention has been paid to the air and maritime domains and where advanced nuclear capabilities are being developed and deployed. Finally, the project will consider questions related to deterrence and strategic restraint as well as future global restraint. The research will culminate with a detailed research report to be briefed in Washington, DC, to U.S. government officials and think tanks for feedback, which will be taken into consideration in the final report

Assessing the Benefits and Burdens of Nuclear Latency

Performer: National Strategic Research Institute (NSRI), University of Nebraska—Lincoln
Project Lead: Rupal Mehta
Project Cost: $95,682

Objective: This project seeks to understand the international causes and consequences of nuclear latency, defined as a state's possession of technical capabilities that enable—but fall short of—acquisition of nuclear weapons. A range of technological assets are needed to construct nuclear weapons, but two requirements stand out as having particular importance: (1) the materials and technical expertise required to fabricate an explosive device and (2) the capacity to produce fissile material (i.e., plutonium or enriched uranium). This project will also attempt to assess how nuclear latency affects both a state's security and bargaining power.

Approach: To achieve the project objectives, the investigation will utilize a mixed-methods research design employing statistical analysis and historical process-tracing on a series of case studies. The project will identify the conditions under which latency benefits or burdens states in international interactions. In addition, this project will illuminate the determinants of nuclear latency by examining what factors influence a state's decision to pursue fuel-cycle technology. It will also create an expanded dataset of latency measures.

U.S. Engagement in the Humanitarian Consequences of Nuclear Weapons Debate

Performer: Stanford University
Project Lead: Scott Sagan
Project Cost: $179,539

Objective: This research project seeks to encourage more extensive public understanding of and more effective U.S. engagement in debates about the humanitarian consequences of the use of nuclear weapons. There is a vibrant international debate about whether the use of a nuclear weapon could ever be legal under international humanitarian law as well as how to mitigate the environmental effects of nuclear weapons production and use. However, the U.S. public is largely unaware of this international debate. Thus, this project will investigate the humanitarian consequences of nuclear weapons in order to improve the engagement and interactions of the U.S. public and the government with international organizations and movements concerned with the humanitarian consequences of nuclear weapons.

Approach: This project will commission a set of papers addressing key understudied questions regarding the humanitarian consequences of the production and/or use of nuclear weapons. The papers' authors will research and analyze the linkages among the laws of armed conflict, nuclear postures by current nuclear weapons states, public opinion in the U.S. regarding nuclear weapons use, and the proliferation of nuclear weapons into the hands of current non-nuclear states. Several workshops and meetings will be held to discuss and refine research findings, and authors will be encouraged to publish their papers in leading journals or newspapers.

The Impact of Disruptive Technologies in Northeast Asia

Performer: Stimson Center
Project Lead: Yuki Tatsumi
Project Cost: $225,000

Objective: The project will investigate the development of disruptive technologies in Northeast Asia to assess the impact of these technologies on the United States' management of regional alliances and military strategy. The United States and China are both pursuing development of a full range of disruptive technologies, including hypersonic vehicles, cyber warfare capabilities, counterspace capabilities, and unmanned systems with state-of-the-art robotics technology. Simultaneously, emerging perceptions that the United States is losing its capacity as a security guarantor in the region have caused uncertainties in Japan and South Korea regarding the reliability of U.S. defense commitments. The increased risk of conflict makes it urgent that political and military leaders in these nations consider how disruptive technologies may affect the stability of Northeast Asia's security environment.

Approach: The proposed project will be executed in three phases. The first phase will be a detailed literature review of the U.S. strategic community's thinking on the emergence of disruptive technologies. In particular, it will review how such technologies may affect U.S. threat perceptions in various parts of the world, how they affect U.S. views on long-term trends in the security environment in the Asia-Pacific region, and how they may affect U.S. relations both with its allies and with China. The second phase will consist of small-group meetings with academics and researchers in Japan, South Korea, and China. Meetings with government officials in the three countries will be used to supplement and enhance understanding of the policy discourse in these countries. In the third phase of the project, the research team will convene both private and public meetings in Washington, DC, to discuss the findings from the research trip.

Estimating the Demand for Nuclear Weapons: The Agenda Ahead

Performer: University of California—Irvine
Project Lead: Etel Solingen
Project Cost: $100,054

Objective: The project will investigate the historical demand for nuclear weapons in order to better understand why states do or do not pursue them. In the last three decades, the study of nuclear proliferation has straddled the academic-policy divide, with a wave of systematic studies spanning different theoretical and methodological approaches. However, there has been little effort to integrate these various approaches to develop a comprehensive understanding of cases of nuclear proliferation or nonproliferation. This project seeks to understand which states have pursued nuclear weapons and why, as well as which have abstained from doing so despite incentives and capabilities and why.

Approach: The first stage of this project will take stock of substantive findings from recent waves of nonproliferation research. Beyond distilling findings from a comprehensive literature review, this stage will identify the utility and limits of different research designs. The second stage will introduce and develop certain methodological principles that may guide the identification of the relevant universe of cases that should be considered when evaluating theories of nuclear proliferation. This research will be of direct benefit to the scholarly community concerned with international relations, security, arms control, and nonproliferation. This research will also provide non-governmental organizations and foundations the ability to evaluate theories of proliferation and the policy prescriptions, such as sanctions, negotiations and bargaining, or declarations of war, that may flow from these theories.

U.S.-Singapore-Malaysia-Indonesia Multilateral Dialogue on Biosecurity: Year 2

Performer: University of Pennsylvania Medical Center (UPMC) Center for Health Security
Project Lead: Anita Cicero
Project Cost: $223,784

Objective: This follow-on project will comprise two biosecurity dialogues among the United States, Singapore, Malaysia, and Indonesia to address regional risks related to deliberate or accidental misuse of biological materials, biosecurity and biosafety vulnerabilities at high-containment laboratories, security issues posed by dual-use science, and infectious disease outbreaks that might pose security threats. Countries in Southeast Asia are particularly vulnerable to biosecurity threats due to the region's dense population, high volume of cross-border traffic, and frequent, close-quarter co-location of humans and animals. For these reasons, Southeast Asia is susceptible to emerging and re-emerging diseases (e.g., SARS, H5N1, Nipah virus). Bioscience labs are also becoming more common in the region, and "viral sovereignty" continues to be an issue. Moreover, there are known terrorist networks active in the area.

Approach: UPMC will convene two two-day meetings to address a range of issues relevant to biosecurity in Southeast Asia, including the prevention of biothreats, strategic weapons of the future and evolving biothreats, sharing pathogens and data during international public health emergencies, and preventing accidental misuse of biological materials. The first meeting will be held in Washington, DC, and the second meeting will be held in Jakarta, Indonesia. Prevention, detection, and response capabilities and challenges will be discussed in relation to biological weapons, laboratory accidents, and high-consequence infectious disease outbreaks. In addition, the group will consider emerging and future technologies in the biological sciences that could present security risks (as well as economic opportunities). Dual-use research of concern and possible insider threats will also be addressed. Following each meeting, the project lead will prepare a comprehensive report describing the meeting's findings and outcomes for public dissemination.

India-U.S. Strategic Dialogue on Biosecurity

Performer: University of Pennsylvania Medical Center (UPMC) Center for Health Security
Project Lead: Gigi Gronvall
Project Cost: $223,103

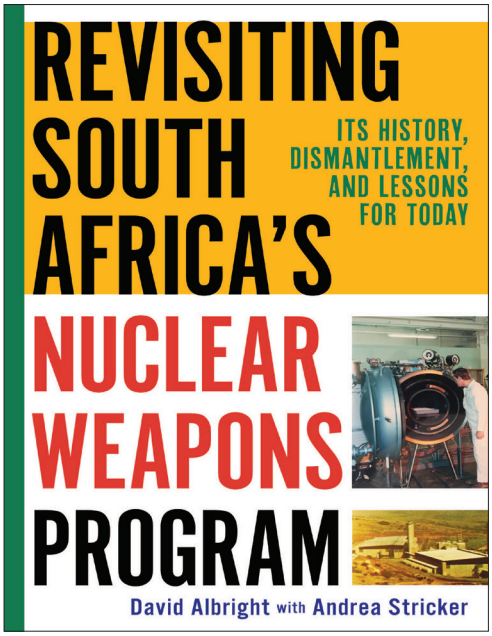
Objective: This project will investigate biosecurity threats to India and the United States through two strategic dialogues in order to create enduring, productive bilateral relationships and a deeper understanding of each state's biosecurity concerns and efforts to address them. The objective of this project is to initiate a sustainable, candid, and productive Track II dialogue between India and the U.S. on sensitive issues related to deliberate, accidental, and naturally occurring biological threats. By stimulating trust and habits of cooperation between dialogue participants, the project aims to reduce biosecurity threats and mitigate future crises that may emerge in the U.S. and India.

Approach: The UPMC Center for Health Security proposes to convene two two-day meetings, the first one hosted in Washington, DC, and the second in New Delhi, India. Each dialogue session will include influential policymakers, thought leaders, and scientists. Each dialogue will include a diversity of biosecurity issues based on the concerns and priorities of both the U.S. and India, including: prevention, detection, response and recovery capabilities, and challenges with respect to bioweapons; emerging and high-consequence pathogens; and laboratory biosafety. Following each meeting, the project lead will prepare a comprehensive report describing the meeting's findings and outcomes for public dissemination.

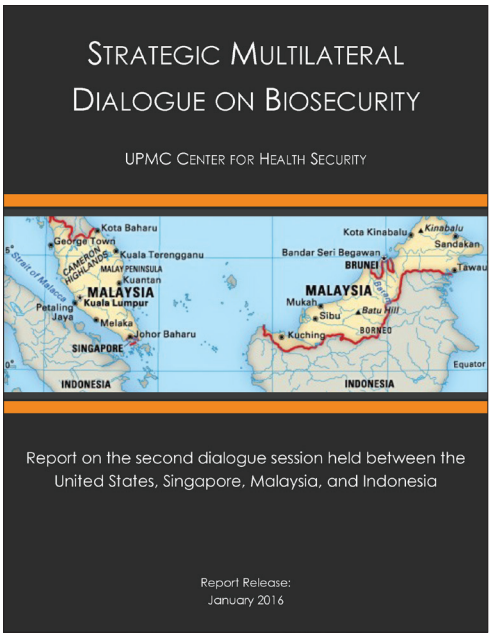
Reports Released in 2015

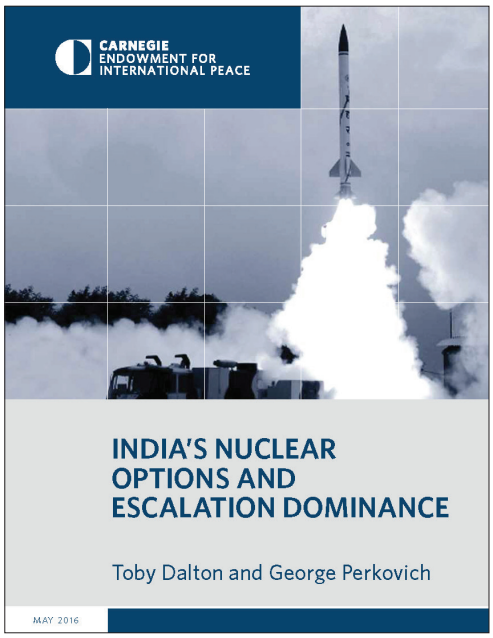
PASCC offers access to all publicly released PASCC-sponsored reports through the Homeland Security Digital Library (HSDL) at www.hsdl.org. Please click on "Refine by Publisher" and select PASCC to see the PASCC collection. HSDL is a public resource managed at NPS and leveraged by PASCC as a no-cost interface for PASCC reports. Some reports are also available through their authoring institutions.

Title	Author	Performer Institution	Distribution	Release Date
US-China Strategic Nuclear Relations: Time to Move to Track-1 Dialogue; The Seventh China-US Strategic Dialogue on Strategic Nuclear Dynamics	Ralph Cossa, Brad Glosserman, and David Santoro	Pacific Forum CSIS	Public	August 2015
Understanding the Dragon Shield: Likelihood and Implications of Chinese Strategic Ballistic Missile Defense	Bruce W. MacDonald and Charles D. Ferguson	FAS	Public	September 2015
The United States, India, and Iran: Managing a Delicate Balance	WPS Sidhu	NYU	Public	January 2016
CSIS Track-II Dialogue on Limiting Non-Strategic Nuclear Weapons	Sharon Squassoni	CSIS	Public	January 2016



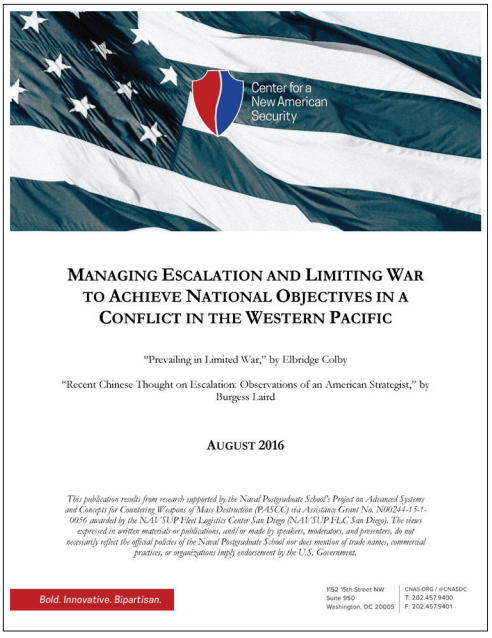
Title	Author	Performer Institution	Distribution	Release Date
Real-World Nuclear Decision Making: Using Behavioral Economics Insights to Adjust Nonproliferation and Deterrence Policies to Predictable Deviations from Rationality	Jeffrey W. Knopf, Anne Harrington, and Miles Pomper	MIIS	Public	January 2016
Public Opinion, Commitment Traps, and Nuclear Weapons Policy	Scott Sagan	Stanford	Public	January 2016
Strategic Multilateral Dialogue on Biosecurity	Anita Cicero, et al.	UPMC Center for Health Security	Public	January 2016
Scoping Future Nuclear Proliferation Risks: Leveraging Emerging Trends in Socio-Cultural Modeling and Analysis	Jeannie Johnson in cooperation with The Center for the Advanced Study of Language	Utah State University	Public	April 2016
Preventing Escalation During Conventional Wars	Keir Lieber and Daryl Press	Dartmouth College	Public	April 2016
India's Nuclear Options and Escalation Dominance	Toby Dalton and George Perkovitch	Carnegie Endowment	Public	May 2016

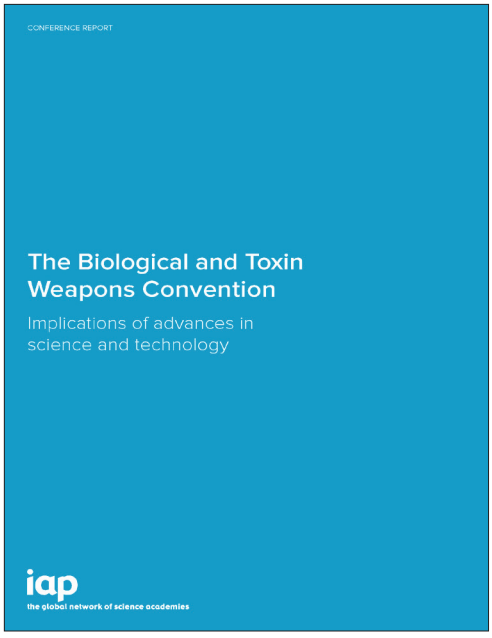




Title	Author	Performer Institution	Distribution	Release Date
Nuclear Command, Control, and Stability Framework	Jerome Conley	Virginia Tech Applied Research Corporation	Public	May 2016
The Growing Nonproliferation Challenges in Southeast Asia: Forecasting Emerging Capabilities and its Implications on the Control of Sensitive WMD-Related Technologies	Stephanie Lieggi, Catherine Dill, and Diane Lee	MIIS	Public	May 2016
Use of Attribution and Forensic Science in Addressing Biological Weapon Threats: A Multi-Faceted Study	Christopher Bidwell and Kishan Bhatt	NAS	Public	May 2016
Struggling with the Gray Zone: Trilateral Cooperation to Strengthen Deterrence in Northeast Asia	Brad Glosserman	Pacific Forum CSIS	Public	June 2016
Saudi Arabia's Nuclear Future	Matthew Moran, Wyn Bowen, and Dina Esfandiary	King's College London	Public	June 2016
Understanding Pathogenicity: A Workshop for the BWC Meeting of Experts	James Revill, Katherine Bowman, and Nancy Connell	NAS	Public	June 2016
U.S.-India Strategic Dialogue, 2016 Report	S. Paul Kapur	NPS	FOUO	June 2016
Scoping Study of a U.S.-Israel Security Dialogue	Chen Kane, Seth Carus, and Nima Gerami	MIIS	Public	June 2016
Revisiting South Africa's Nuclear Weapons Program: Its History, Dismantlement, and Lessons for Today	David Albright with Andrea Stricker	ISIS	Public	June 2016
Preparing for the Next WMD Elimination Mission - Lessons Learned from Past Experiences	Chen Kane and Phillip Bleek	MIIS	Public	July 2016
Predicting Proliferation: High Reliability Forecasting Models of Nuclear Proliferation as a Policy and Analytical Aid	Jeffrey M. Kaplow and Erik Gartzke	UCSD	Public	August 2016

Title	Author	Performer Institution	Distribution	Release Date
North Korea's Nuclear Futures: Implications for Peace and Security	Joel Wit, ed.	JHU-SAIS	Public	August 2016
Expanding Cooperative Threat Reduction in the Middle East & North Africa: Law-Related Tools for Maximizing Success	Orde F. Kittrie	Arizona State University	Public	August 2016
National Biosafety Systems: Case Studies to Analyse Current Biosafety Approaches and Regulations	Gigi Kwik Gronvall, et al.	UPMC Center for Health Security	Public	August 2016
Managing Escalation and Limiting War to Achieve National Objectives in a Conflict in the Western Pacific	Elbridge Colby and Burgess Laird	CNAS	Public	August 2016
American, Australian, and Japanese Perspectives on a Changing Security Environment	Thomas G. Mahnken, Ross Babbage, and Sugio Takahashi	JHU-SAIS	Public	October 2016
The Biological and Toxin Weapons Convention: Implications of Advances in Science and Technology	Katherine Bowman	NAS	Public	October 2016
Perspectives on Security and Strategic Stability: A Track 2 Dialogue with the Baltic States and Poland	Kathleen Hicks, et al.	CSIS	Public	October 2016
Missile Defense, Extended Deterrence, and Nonproliferation in the 21st Century	Catherine McArdle Kelleher, ed.	UMD	Public	October 2016





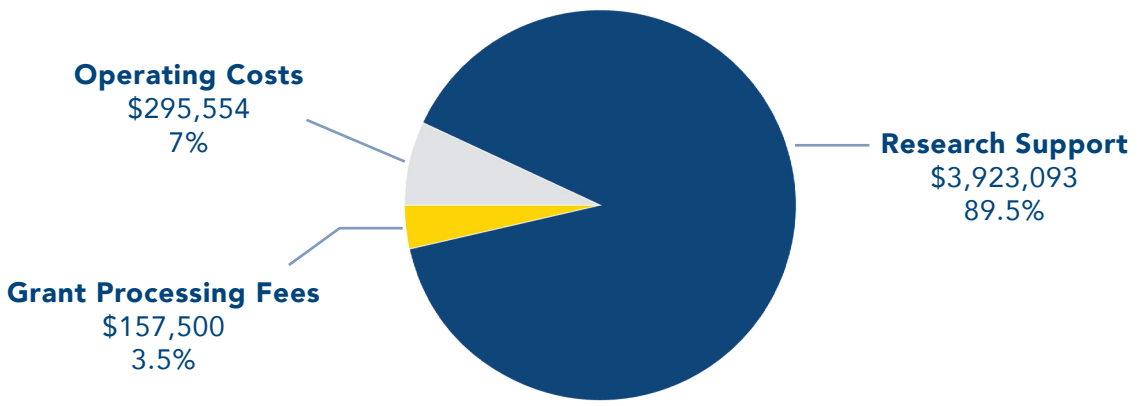
Budget

Due to changes in Navy regulations in late 2015, FY16 funding from DTRA for PASCC activities was delayed until late spring 2016. Funds then had to be sent directly to Naval Supply Systems Command's Fleet Logistics Center in San Diego. Eventually, PASCC was able to award $3,608,036 in new grants. In addition, $315,056 was awarded to NPS principal investigators, for a total of $3,923,093 in research support in FY16.

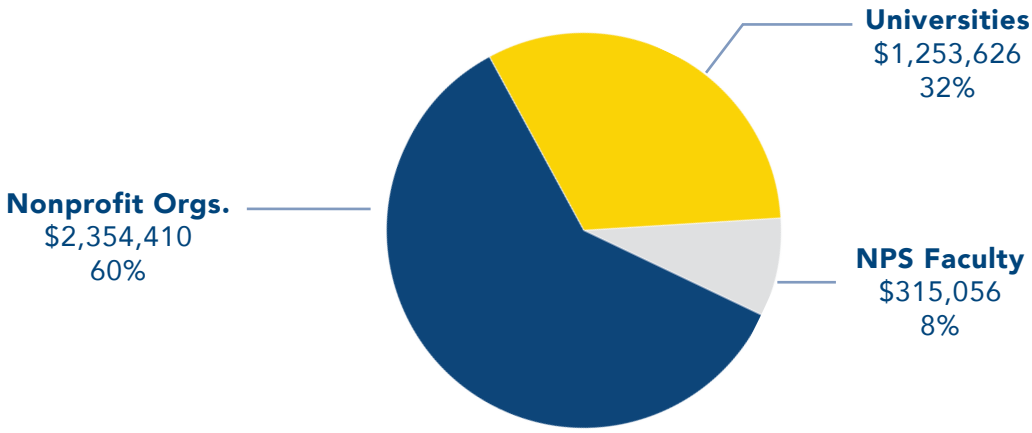
In FY16, PASCC spent $295,554 on management and operations including labor, mission-essential travel, and NPS indirect costs. Grant processing fees charged by the Navy amounted to $157,500.

The second chart shows the breakdown for research costs, grouping project awards into general categories based on the affiliation of the principal investigator—nonprofit think tanks, universities, and NPS faculty.

Fiscal Year 2016 Spending



Fiscal Year 2016 Project Award Recipients



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