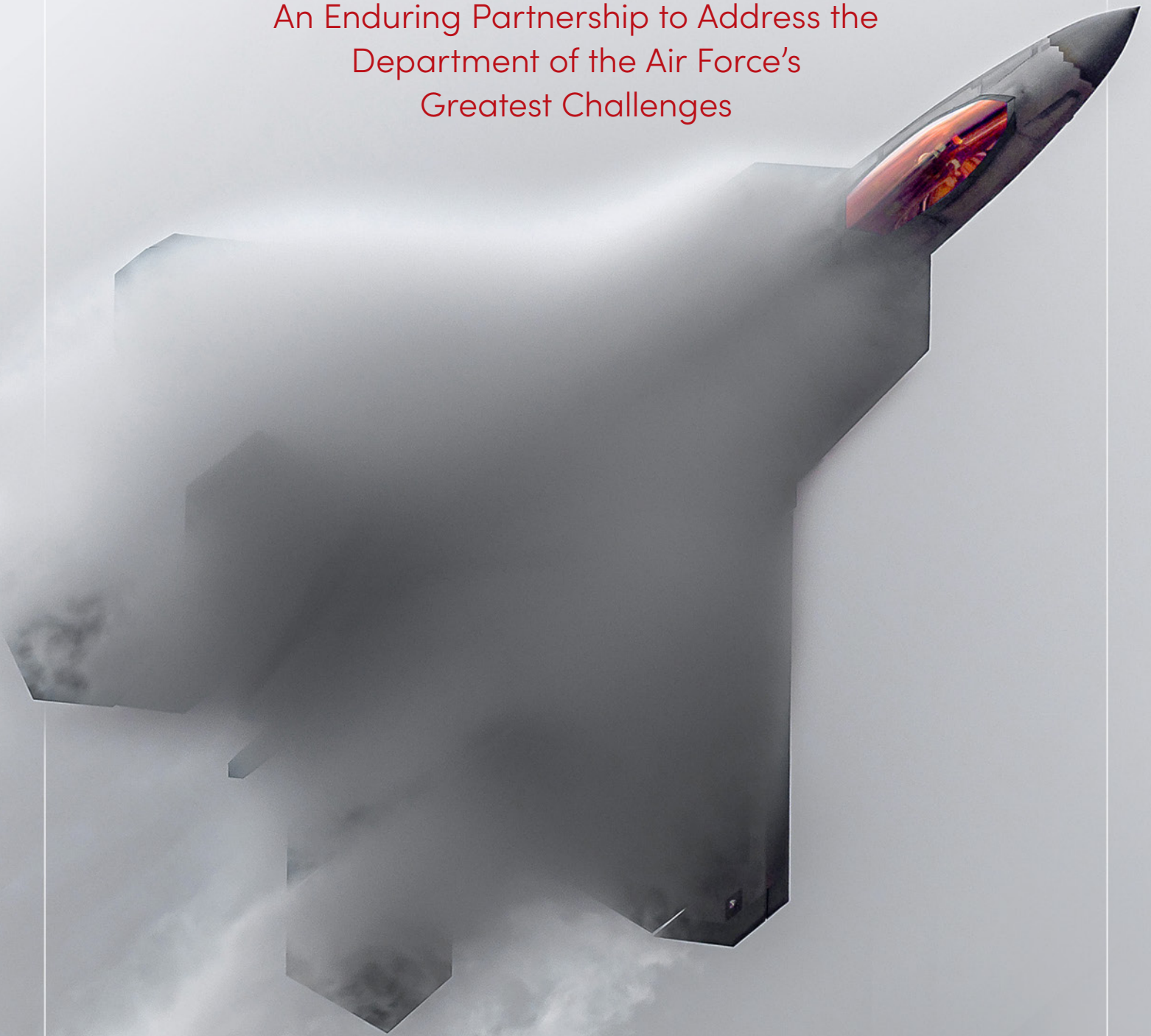



RAND PROJECT AIR FORCE

An Enduring Partnership to Address the
Department of the Air Force's
Greatest Challenges





The Department of the Air Force (DAF) confronts challenges on multiple fronts: the acceleration of threats from China and Russia; the need to integrate air, space, and cyber capabilities across warfighting domains and in concert with allies and partners; the imperative to stay ahead of the innovation curve; the organization of the department into two services with unique missions and requirements; the need to build and sustain a ready, talented, and diverse workforce; and many others—all within perennial budgetary constraints.

RAND Project AIR FORCE's (PAF's) mission is to help DAF leaders make informed, research-based decisions to meet those challenges. We provide objective analyses of complex problems and effective solutions for confronting those problems. We clarify issues that are often clouded by uncertainty or disagreement and develop solid courses of action for the U.S. Air Force (USAF), the U.S. Space Force (USSF), and the DAF as a whole. Our standard of success is very high: we must earn DAF leaders' trust in the quality and objectivity of our research; identify opportunities for positive action; and, ultimately, inform outcomes that benefit the DAF and the nation.

PAF was established in 1946 by General H. H. "Hap" Arnold as a way of retaining the benefits of civilian scientific thinking demonstrated during World War II. PAF remains the only DAF federally funded research and development center (FFRDC) concerned entirely with studies and analyses. The success of this partnership depends on having a close strategic relationship between PAF experts and senior DAF leaders and a balanced portfolio of independent research on areas of enduring concern.



PAF's INSTITUTIONAL VALUES

Objectivity and independence: PAF is part of RAND, a private, nonpartisan, nonprofit organization committed to serving the public interest and the needs of its sponsors. PAF provides a perspective that is informed by a close relationship with the DAF but is free from bias and conflicts of interest.

High-quality, fact-based research: PAF holds its research to the highest standards of scientific rigor to provide reliable findings and actionable recommendations. Superior access to DAF data and a record of methodological innovation have made PAF the gold standard for studies and analyses.

Integrated, interdisciplinary approach: The DAF and the nation face challenges that have wide-ranging implications for doctrine, organization, training, materiel, leadership, personnel, facilities, and policy. PAF researchers bring many types of expertise to bear on these problems, as illustrated in the following pages.

Long-term strategic perspective: While PAF helps the DAF address immediate challenges, it also examines the long-term implications of current problems and over-the-horizon challenges that require preparation today.

Transparency and broad dissemination of findings: To foster public confidence and ensure results stand up to scrutiny, PAF publishes its research as widely as possible, within the bounds of classification, proprietary information, controlled unclassified information, and other restrictions.

Research Areas

The DAF's need for analytic support from PAF has led to the establishment of four research programs representing core capabilities:

The **Strategy and Doctrine Program** seeks to increase knowledge and understanding of geopolitical and other problems in the national security environments that affect DAF operations. PAF maintains expertise in grand strategy; evolving security challenges; power projection; expeditionary operations; security cooperation; and the changing roles of air, space, and cyber power in current and future operations.

The **Force Modernization and Employment Program** identifies and assesses ways in which technological advances and new operational concepts can improve the DAF's ability to satisfy a variety of future operational demands. This research involves assessments of technology feasibility, performance, cost, and risk. PAF assesses major air, space, and cyber force components needed in the future and the systems and infrastructure supporting their operations. Areas of specialization include intelligence, surveillance, and reconnaissance; mobility; long-range strike; combat air forces; command and control; and space, cyber, and nuclear domains.

The **Resource Management Program** analyzes policies and practices in the areas of logistics and readiness; outsourcing, privatization, and contracting; the defense industrial base; planning, programming, and budgeting; infrastructure and its resilience; energy; and weapon-system cost estimating. The goal of this program is to maximize the efficiency and effectiveness of DAF operations in a resource-constrained environment.

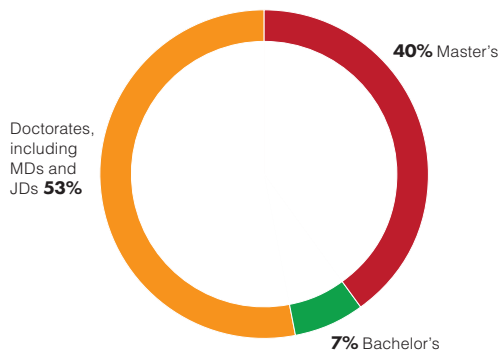
The **Workforce, Development, and Health Program** concentrates on questions about workforce size and composition and about the best ways to define, develop, sustain, renew, deliver, and coordinate critical workforces. PAF's research encompasses the total workforce: active-duty, guard, reserve, civilian, and contractor personnel.

PAF researchers also conduct research on topics that cut across all four programs, and they regularly respond to DAF requests for help with urgent problems.

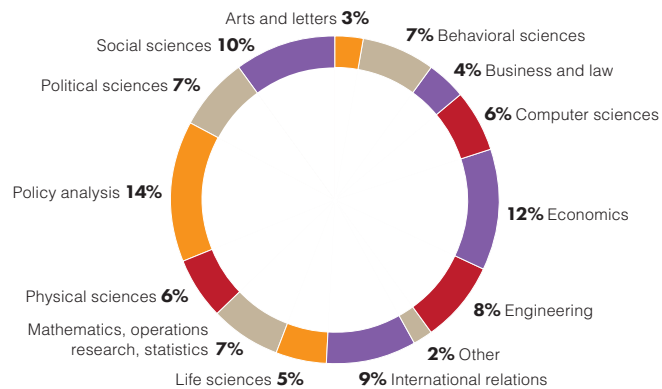
Expertise

Every PAF project involves a team of experts from multiple disciplines. PAF draws upon researchers from across the RAND Corporation, many of whom have backgrounds in academia, the military, industry, or government. Roughly 250 researchers are involved in PAF research at any given time.

Degrees (Research Staff)



Doctorates by Discipline (Research Staff)



Making a Difference for the Department

For more than 75 years, PAF's partnership with the DAF has been filled with success stories—instances of timely analysis and advice leading to good decisions and positive changes. Below are a few recent examples. Each example is the product of intense, sustained collaboration between DAF sponsors and PAF experts.

Strengthening Air Base Resilience |

The expansion of China's missile inventory has changed the United States' traditional approach to air operations in the Indo-Pacific theater. In 2011, PAF commenced building an analytic capability and a series of analyses designed to investigate the impact of China's missile strikes on U.S. and partner and allied air bases.¹ Researchers examined threats to base infrastructure; quantified the consequences for key metrics, such as sortie generation and damaged aircraft; and examined a wide variety of potential mitigation options, including active and passive defenses, agile combat employment, dispersed posture, and asset prepositioning strategy.² This line of work helped the DAF identify cost-effective approaches to this problem. PAF recommendations informed DAF plans for billions of dollars of investment in air base resilience measures.

Understanding the Costs and Benefits of Crewed-Uncrewed Teams |

The USAF is considering how large fleets of small, inexpensive, mostly autonomous uncrewed aircraft (called *collaborative combat aircraft* [CCAs]) could assist crewed aircraft in operations against highly capable adversaries. At ACC/A5/8/9's request, PAF performed the first integrated assessment of the types, numbers, and costs of CCA designs that would be most cost-effective across a range of missions; the crewed aircraft with which they should be teamed; operating concepts for using CCAs most effectively; and potential investment strategies and implementation challenges. The analysis directly informed deliberations by the DAF and the U.S. House and Senate Armed Services committees about CCAs and crewed-uncrewed teams in budget submissions for fiscal year 2024 and beyond. Consistent with PAF recommendations, the Secretary of the Air Force (SECAF) announced an initial plan to field 1,000 CCAs by the end of the decade.



ent of the Air Force

Managing Crisis Stability in Space | The proliferation of U.S. and adversary space capabilities could lead to unstable competition in space, raising the risk of rapid, and perhaps unintended, military escalation. Commissioned by USSF/S5/8, PAF assessed perspectives from the United States, China, and Russia on strategic stability in space and held an interagency workshop that examined the risks of escalation in a 2030 conflict scenario. Researchers provided a detailed analysis of how U.S. actions are likely to be perceived by adversaries and what actions are likely to be most helpful in preventing a crisis from escalating. The team made recommendations regarding space domain mission assurance, crisis communications, and the benefits and risks of revealing select space capabilities before and during a crisis short of conflict. PAF engagements throughout the USSF, the DAF, OSD, the U.S. Department of State, the National Space Council, and the National Security Council have informed decisions about long-term communications mechanisms and U.S. force structure development.

Leveraging Training Technology to Help Guardians Become Warfighters | The USSF must train, develop, and test new tactics for an increasingly contested space environment. Yet, it is difficult to train space crews in these capabilities. Advanced training technologies, such as virtual reality and common software architecture, may help, and there are many efforts in the USSF and across the U.S. Department of Defense that may be suitable to the USSF's needs. At the request of USSF/COO, PAF identified missions, tasks, training objectives, and training gaps across operational deltas; developed and applied a novel approach to quantify how well training technologies meet the range of USSF needs; and identified how training systems could best be implemented in curricula. This work directly informed CSO priorities, STARCOM, the USSF Strategic Requirements Document for operational test and training infrastructure, and the SECAF's Operational Imperative 7 working group.

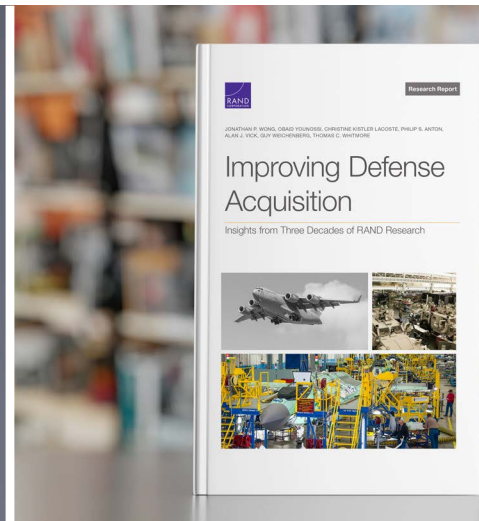
How to Access PAF Research

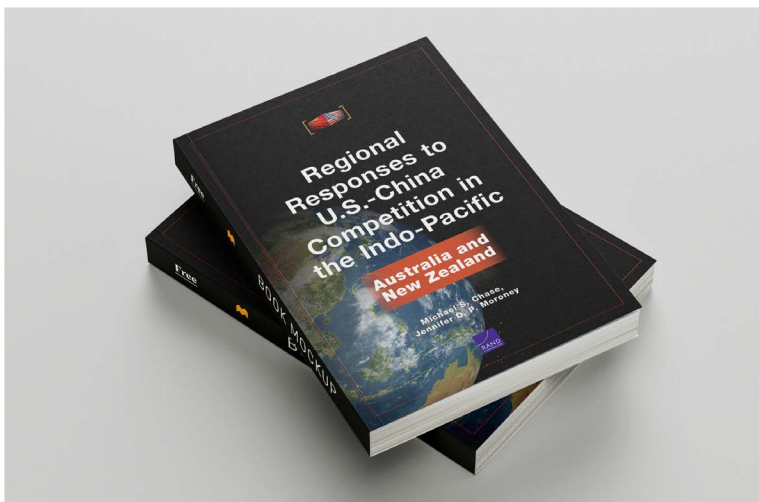
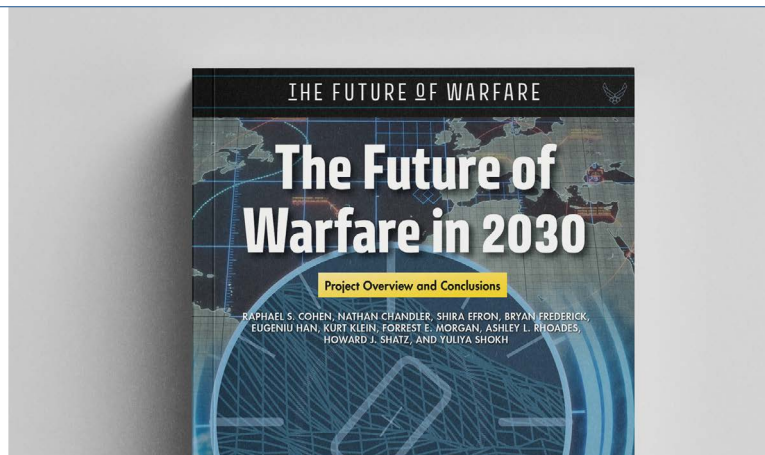
PAF engages with research sponsors and stakeholders with briefings and written documents throughout the research process. PAF also maintains a robust archive of completed research reports, which DAF personnel can access in several ways:

Public website: www.rand.org/paf is a searchable archive of unrestricted research reports spanning more than seven decades. The website is continually updated as new reports are released.

Intelshare: <https://intelshare.intelink.gov/sites/rand-corporation/> contains many PAF reports not available to the general public and is accessible to DAF users with a Common Access Card.

Engage with program directors: PAF program directors (listed on the back cover) can answer questions, connect DAF personnel to past research (including reports not available to the general public), and facilitate contact with research teams.





Research Report

BRIAN DOLAN, BONNIE L. TRIEZENBERG, EMMI YONEKURA, SANDRA KAY EVANS, MOON KIM, DWAYNE M. BUTLER, SARAH W. DENTON, SHREYAS BHARADWAJ

Understanding, Managing, and Reporting U.S. Space Force Readiness



How to Commission a PAF Project

DAF general officers or members of the Senior Executive Service can commission PAF research in two ways:

Core Research: A large portion of PAF's research agenda is funded from PAF's program element and is designed to address issues critical to the DAF and within PAF's core competencies. The core research agenda is determined annually by the DAF Steering Group, which is chaired by the Vice Chiefs of the USAF and the USSF, through a process led by the Secretary of the Air Force Office of Studies, Analyses, and Assessments (SAF/SA) starting each January.

Add-On Research: Add-on projects are funded by the sponsor and are approved by SAF/SA. DAF general officers or members of the Senior Executive Service can propose PAF add-on research at any time. As an FFRDC, PAF has an annual ceiling for how much research it can perform, so prospective sponsors should propose add-on research as early as possible in the fiscal year.

CORE RESEARCH

SAF/SA solicits proposed PAF project topics from across the DAF (January)

SAF/SA collects, vets, and prioritizes proposed topics

DAF Steering Group approves research plan (June)

Projects begin October 1

ADD-ON RESEARCH

Prospective sponsor contacts PAF

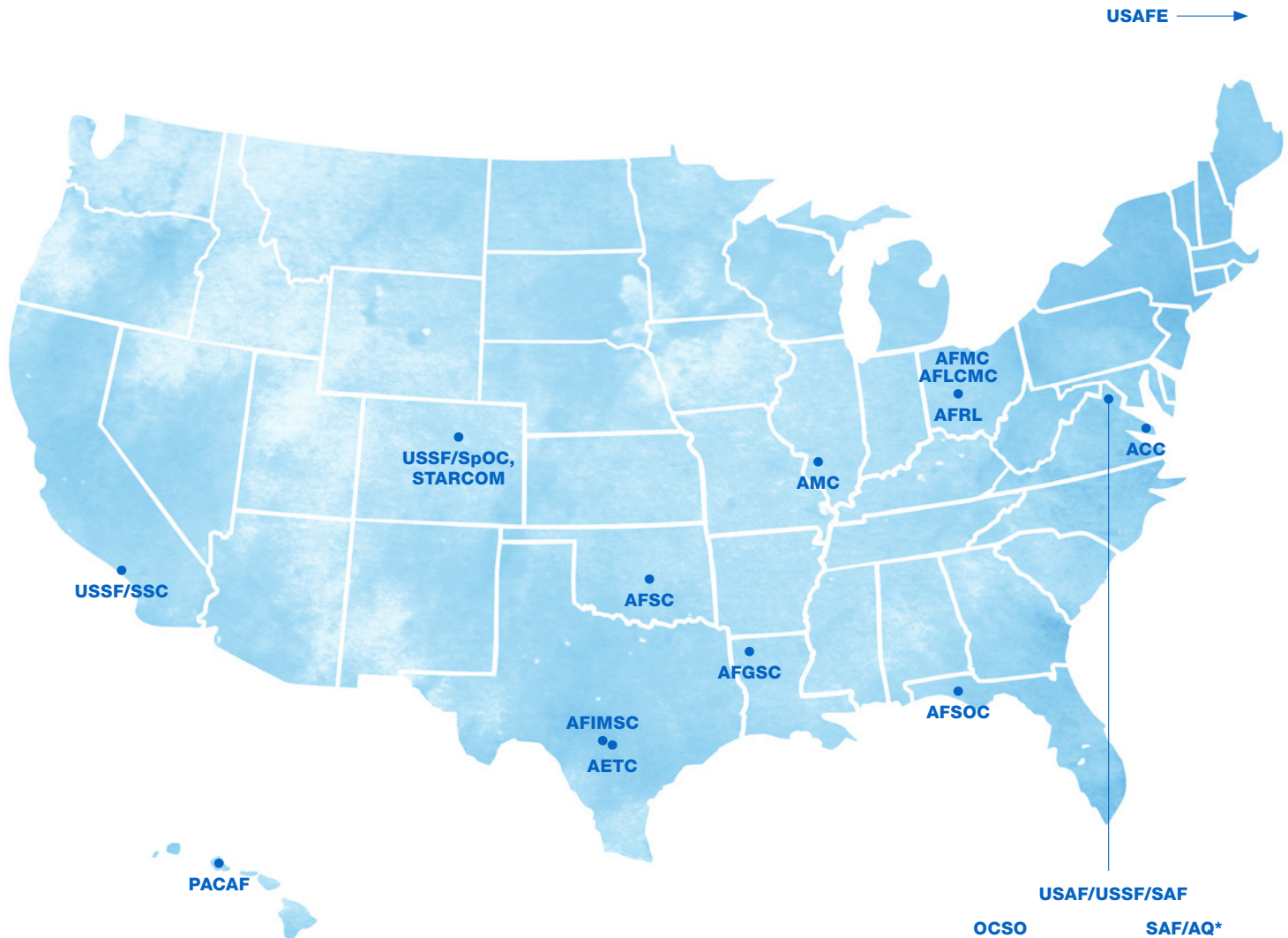
PAF and sponsor draft a project description

Sponsor approves a cost basis report generated by PAF

Sponsor submits a complete add-on package to SAF/SA

For more information or to get started proposing a research project, contact Anthony Rosello, Associate Director of PAF, at arosello@rand.org.

Engaging Sponsors Across the Department of the Air Force



USAF/USSF/SAF

OCSO	SAF/AQ*
AF/CV*, SF/CV*	SAF/MG
AF/A1*, SF/S1	SAF/CIO-A6
AF/A2/6*	SAF/IA*
AF/A3*	SAF/IE
AF/A4/7*	SAF/MR*
AF/A5*	SAF/GC
AF/A8*	SAF/FM
AF/A10*	SAF/SA*
AF/SG*	S1/4
AF/TFAM	S2/3/6/10
AFCAA	S5/8/9
	CTIO

* Member of the DAF Steering Group for PAF

Additional Steering Group members:

SAF/CN

ANG

AF/RE, AFRC/CC

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RESOURCE MANAGEMENT

WORKFORCE, DEVELOPMENT, AND HEALTH



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NOTES

¹Brent Thomas, Mahyar A. Amouzegar, Rachel Costello, Robert A. Guffey, Andrew Karode, Christopher Lynch, Kristin F. Lynch, Ken Munson, Chad J. R. Ohlandt, Daniel M. Romano, Ricardo Sanchez, Robert S. Tripp, and Joseph V. Vesely, *Project AIR FORCE Modeling Capabilities for Support of Combat Operations in Denied Environments*, RAND Corporation, RR-427-AF, 2015, www.rand.org/t/RR427.

²Christopher Lynch, Rachel Costello, Jacob L. Heim, Andrew Karode, Patrick Mills, Robert S. Tripp, and Alan J. Vick, *Operational Imperative: Investing Wisely to Bolster U.S. Air Bases Against Chinese and Russian Attacks*, RAND Corporation, PE-A1996-1, 2023, www.rand.org/t/PEA1996-1.

RAND Project AIR FORCE (PAF), a division of the RAND Corporation, is the Department of the Air Force's (DAF's) federally funded research and development center for studies and analyses, supporting both the United States Air Force and the United States Space Force. PAF provides the DAF with independent analyses of policy alternatives affecting the development, employment, combat readiness, and support of current and future air, space, and cyber forces. Research is conducted in four programs: Strategy and Doctrine; Force Modernization and Employment; Resource Management; and Workforce, Development, and Health.

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IMAGE CREDITS: cover, Trevor Cokley/USAF; pp. 2–3, Patrick Sullivan/USAF; p. 5, Philip Bryant/USAF; pp. 6–7, Alex Fox/USAF.

www.rand.org/t/CPA2710-2



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