Annual Report for FY 2021

Extramural Acquisition Innovation and Research Activities

Pursuant to section 2361(a) of title 10 U.S.C. Code

Director of
Extramural Acquisition Innovation and Research Activities

Office of the Under Secretary of Defense
for Acquisition and Sustainment

September 2021

The estimated cost of this report or study for the Department of Defense is approximately $3,730 in Fiscal Year 2021. This includes $0 in expenses and $3,730 in DoD labor.

Generated on 2021Sep29 RefID: A-5EE9061

Table of Contents

Summary

The Secretary of Defense created the Acquisition Innovation Research Center (AIRC) on September 30, 2020, in response to section 2361(a) of title 10 U.S. Code. AIRC has achieved its goals for its inaugural year, and a breadth of activities have been funded to engage AIRC on key challenges facing the Department of Defense (DoD).

AIRC is a 22-university collaboration within the DoD's Systems Engineering Research Center (SERC) University-Affiliated Research Center (UARC). This structure substantially accelerated its establishment and ensures broader engagement of academia on DoD challenges. Advisory boards were established, activated, and consulted to identify innovative ideas and ensure alignment with DoD priorities. Acquisition research focus areas were considered, discussed, and finalized through those boards and were approved by DoD acquisition leadership. An Interim Director was identified, and the DoD is pursuing a permanent director. Emphasis in AIRC is placed on applied experiments, prototypes, and demonstrations (beyond white papers and publications) to address and test solutions to enduring challenges in defense acquisition policies, practices, education, training, and decision making.

Innovative applied research includes topics and ideas from Congress, DoD leadership, and academia. Initiated research tasks seek improved decision making, workforce development, sustainment and supply chains, mission and portfolio management, requirements and budgetary processes for acquisition, and acquisition processes. A spring "incubator" cycle was conducted to identify innovative ideas from academia on selected DoD challenges. AIRC received 66 independent high-quality proposals from 30 universities after a joint DoD/academia workshop. Eight of these studies were funded by the Office of the Secretary of Defense (OSD) and another three by the Navy. Completion of these studies is expected in early Fiscal Year (FY) 2022, culminating in Phase II proposals for full research and application of successful concepts.

DoD believes that AIRC's first year has been well managed, successful, fast, and exceptionally effective. The Department is continuing to engage AIRC on its most challenging problems, seeking fresh ideas from all relevant academic disciplines to improve acquisition outcomes.

The Acquisition Innovation Research Center

The FY 2020 National Defense Authorization Act (NDAA) mandated in section 2361(a) of title 10 U.S. Code, the establishment of an extramural acquisition innovation research activity in academia. In response and on behalf of the Secretary of Defense, the Under Secretary of Defense (USD) for Acquisition and Sustainment (USD(A&S))—with active support and involvement from the USD for Research and Engineering (USD(R&E))—created the Acquisition Innovation Research Center (AIRC) as part of the Systems Engineering Research Center (SERC), a Department of Defense (DoD) University Affiliated Research Center (UARC). Initiated on September 30, 2020, AIRC involves 20 extramural U.S. universities in the SERC network plus collaboration with two military universities[1] to provide innovative academic research, analysis, experiments, prototypes, and demonstrations on enduring challenges in defense acquisition policies, practices, education, and training. The statutory activities of AIRC are: research to improve acquisition policies and practices; prototypes and demonstrations of new acquisition practices; data repositories and analytical capabilities; executive education; and ongoing reviews of the implementation of recommendations on acquisition policies and practices (see section 2361a(d) of title 10 U.S.C. for details).

This SERC/AIRC university collaborator network has been undergoing an assessment (to be conducted approximately every three years) since March 2021 to identify any universities to remove that have been inactive in SERC/AIRC UARC research, making room to add new universities with strong interests and relevant academic capabilities to the UARC's research. This assessment is particularly important for AIRC to expand capabilities and disciplines relevant to broader acquisition functions. When completed, the academic disciplines in the collaborator network will include stronger representation in artificial intelligence (AI), business, computer science, data science, economics, education, engineering, management, operations research, law, and public policy.

Beyond the UARC collaborator universities, AIRC has a limited ability to tap other expertise for DoD engagement through other mechanisms, including the advisory groups (described below), hiring faculty and researchers as part-time consultants at one of the SERC/AIRC partner universities, or as a select SERC/AIRC Fellow. Taken in total, these mechanisms provide the DoD

[1] The 20 extramural SERC/AIRC collaborator universities (before the ongoing reassessment is completed) are: Auburn University, Carnegie-Mellon University, Georgetown University, Georgia Institute of Technology (Georgia Tech), Massachusetts Institute of Technology, Missouri University of Science and Technology, North Carolina Agricultural and Technical State, Old Dominion University, Pennsylvania State University, Purdue University, Stevens Institute of Technology (*lead*), Texas A&M University, University of Alabama in Huntsville, University of Maryland, University of Massachusetts Amherst, University of Southern California (USC), University of South Florida, University of Virginia, Virginia Polytechnic Institute and State University (Virginia Tech), and Wayne State. Collaborating military universities include the Air Force Institute of Technology (AFIT) and the Naval Postgraduate School (NPS). AIRC also seeks participation with other Historically Black Colleges and Universities (HBCUs) and Other Minority-Serving Institutions (MSIs) besides North Carolina A&T State (official lists of HBCUs MSIs are at https://sites.ed.gov/whhbcu/one-hundred-and-five-historically-black-colleges-and-universities/ and https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst-list-tab.html).

with an extensive, stable outreach to leverage academia's top faculty and researchers to develop and apply new approaches for improving acquisition outcomes.

DoD Acquisition Innovation Advisory Groups

Strategic sponsorship and guidance for AIRC are provided by regular meetings with key senior executives and staff in the offices of the USD(R&E) and USD(A&S) to ensure active engagement, identification, adoption, and stewardship of innovation opportunities. These sponsors also meet regularly with professional staff members from the Senate and House Armed Services Committees, to ensure transparency and congressional awareness of acquisition innovation challenges and interim progress.

AIRC has four principal advisory and support groups that engage both the broader DoD and external communities:

- Acquisition Innovation Advisors (AIA), consisting of DoD stakeholders and functional leads
- AIRC Innovation Panel (AIP), consisting of external experts
- SERC Research Council (RC), consisting of academic intellectual leaders in acquisition-related disciplines—especially systems engineering
- SERC Executive Advisory Board (EAB), consisting of DoD and other governmental stakeholders and functional leads, especially in systems engineering. While this board focuses on overseeing the entire SERC, AIRC is part of the SERC and therefore falls within this larger governing board. It also provides connections to some non-DoD federal agencies, which may be useful in meeting AIRC's mission.

Acquisition Innovation Advisors (AIA)

USD(A&S) established this group of senior DoD officials and organizational representatives to assist AIRC by identifying thematic lanes of relevant research (such as Digital Transformation); identifying major systemic, policy, and functional problems hampering acquisition performance; and facilitating experimentation and piloting within DoD programs to test new approaches, solutions, and practices emanating from the research community. The AIA includes senior flag-level executives throughout DoD who are both stakeholders and sponsors of activities conducted by AIRC. The AIA meets quarterly to obtain updates and requests from AIRC and provide guidance for AIRC activities. Meetings this fiscal year were held quarterly on November 30, 2020, as well as January 15, March 3, and June 17 of 2021. Leaders on the AIA include senior representatives from the offices of the USD(A&S), USD(R&E), Assistant Secretary of the Air Force for Acquisition, Technology & Logistics (SAF-AQ), Assistant Secretary of the Army for Acquisition, Logistics, and Technology (ASA-ALT), Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN-RDA), Air Force Intelligence, Surveillance, Reconnaissance and Cyber Effects Operations (AF A2/A6), Joint Staff, Defense Acquisition University (DAU), Director of Operational Test and Evaluation (DOT&E), Director of Cost Assessment and Program Evaluation (CAPE), and USD(Comptroller).

AIRC Innovation Panel (AIP)

AIRC established a panel of experts from outside DoD (see Table 1) to help the center with strategy and guidance for the AIRC research program. The panel consists of select members of academia and industry executives—many with DoD backgrounds—to help identify thematic areas and research ideas for investigation. For example, the AIP was instrumental in brainstorming approximately 30 digital transformation concepts for AIRC research within the 2021 Incubate Cycle described below. The AIP meets approximately quarterly.

Table 1. AIRC Innovation Panel Members and Backgrounds

Name	Background				
	Academia	**R&D**	**Industry**	**DoD**	**Legislative**
Hon. John J. Young, Jr.		X	X	X	X
LtGen (ret.) Edward Cardon				X	
VAdm (ret.) Joseph W. Dyer			X	X	
LtGen (ret.) Wendy M. Masiello				X	
Dr. Trevor Brown	X	X			
COL (ret.) Andrew Carter		X	X	X	
Mr. Blaise Durante				X	
Mr. Kevin Gates		X	X		X
Ms. Stephanie Halcrow		X		X	X
Mr. Tim Richardson		X	X		
Mr. Matthew Rose	X	X	X	X	
Mr. Jeff Ryder		X	X		
Dr. Stoney Trent	X	X	X	X	
Mr. Christopher Zember		X	X	X	

SERC Research Council (RC)

The Research Council[2] consists of academic intellectual leaders, especially in DoD acquisition-related disciplines (e.g., policy, business, management, law, data science, economics, and systems engineering). These thought leaders meet approximately every month to provide expertise to ensure the quality of SERC/AIRC research as well as an additional source of faculty researchers for consultation.

[2] https://sercuarc.org/operations/#council

Table 2. SERC Research Council Members and Affiliations

Name	Title	Affiliation
Dr. Peter A. Beling	Professor, Hume Center for National Security and Technology, Grado Department of Industrial and Systems Engineering	Virginia Tech
Dr. Mark Blackburn	Senior Research Scientist	Stevens Institute of Technology
Dr. Barry W. Boehm	Research Council Chair and Chief Scientist Emeritus, Systems Engineering Research Center	University of Southern California
Dr. John M. Colombi	Professor and Program Chair, Systems Engineering	Air Force Institute of Technology
Dr. Daniel A. DeLaurentis	Professor, Director of i-GSDI, Chief Scientist, Systems Engineering Research Center	Purdue University
Dr. Darryl Farber	Assistant Professor of Engineering, College of Engineering and the School of International Affairs	Pennsylvania State University
Dr. Laura Freeman	Director, Hume Center's Intelligent Systems Lab, Research Associate Professor, Department of Statistics, Assistant Dean for Research at the National Capital Region	Virginia Tech
Dr. Azad M. Madni, NAE	Professor, Astronautical Engineering, Executive Director, System Architecting & Engineering Program, Director, Distributed Autonomy and Intelligent Systems Laboratory	University of Southern California
Dr. William B. Rouse, NAE	Senior Fellow, Office of Sr. Vice President for Research, McCourt School of Public Policy	Georgetown University
Dr. Valerie Sitterle	Chief Scientist, Systems Engineering Research Division, Electronic Systems Laboratory, Georgia Tech Research Institute (GTRI)Principal Research Engineer, Georgia Tech Research Institute (GTRI),	Georgia Institute of Technology
Dr. Eugene H. Spafford	Professor of Computer Science	Purdue University
Dr. Clifford Whitcomb	Professor, Systems Engineering, Graduate School of Engineering and Applied Sciences	Naval Postgraduate School

SERC Executive Advisory Board (EAB)

The EAB is the overarching governmental advisory and governance board for the SERC UARC. It consists of DoD and other governmental stakeholders and functional leads. The EAB is complementary to the AIA and includes oversight of the systems engineering research in the SERC outside of AIRC and thus includes extensive expertise in systems engineering. It also provides an avenue for insight from and outreach to other federal agencies beyond the DoD (e.g., NASA, DHS, NIST, FAA, and NNSA) to understand acquisition lessons learned and potentially serve as other experimental venues for innovative approaches and their effectiveness.

Innovation Activities

AIRC pursues new ways to improve acquisition outcomes through four types of activities illustrated in Figure 1. *Incubate* involves external idea generation around priority themes identified by the DoD. *Respond* are research tasks on specific topics and problems from DoD organizations. *Ideate* is a collaborative innovation process involving both DoD and AIRC organizations. Finally, *Connect* is a mechanism for identifying subject-matter experts in academia for consultation with a DoD organization.

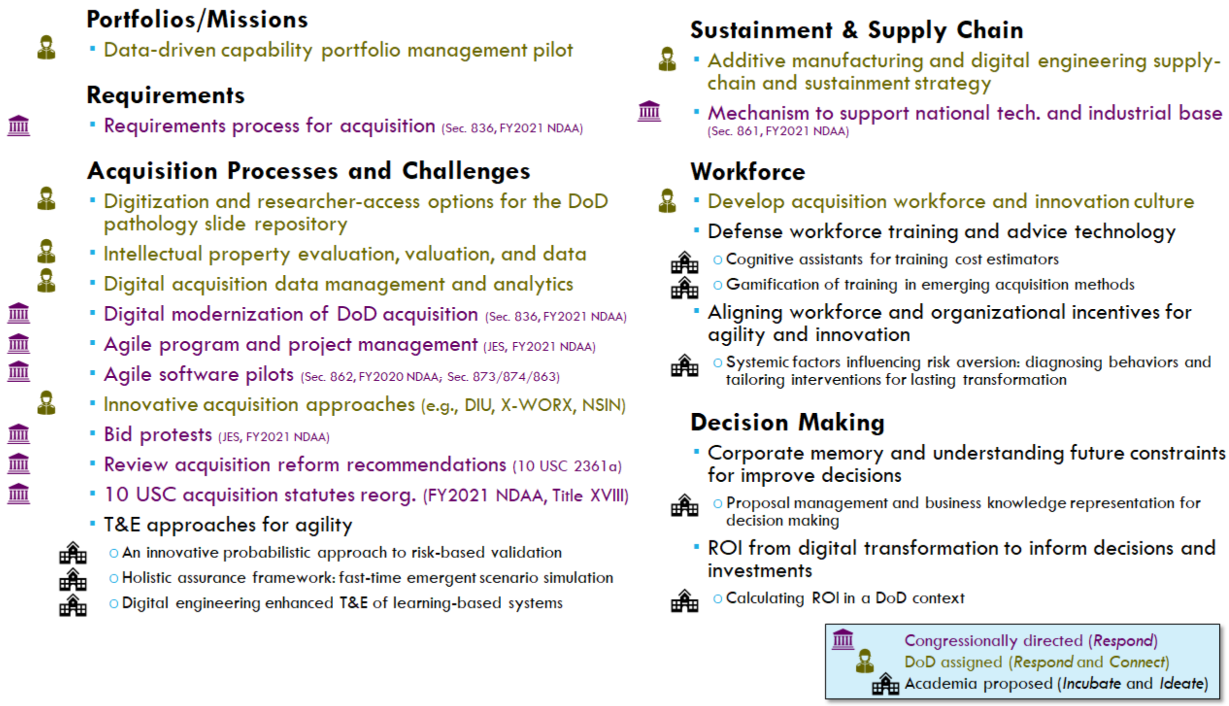
AIRC activities are not necessarily mutually exclusive. For example, as described below, the 2021 Incubate Process to generate new research ideas for DoD funding consideration involved both external idea *incubation* from experts outside the DoD as well as a joint *ideation* process in the Incubate Forum on April 6–7, 2021, wherein new ideas were jointly brainstormed and discussed by academic faculty and researchers, DoD sponsors, industry participants, and Federally Funded Research and Development Center (FFRDC) researchers. Also, a research task to *respond* to a specific request from the Joint Pathology Center was conducted by *connecting* to subject-matter experts and forming a rapid advisory panel to develop acquisition strategy options.

Figure 1. AIRC Processes for Developing and Applying Innovation to Defense Acquisition

Finally, a wide range of agile innovation activities is enabled by stable AIRC core funding that enables the synthesis and pursuit of new ideas with the objective of practical, long-term application to improve acquisition outcomes. These activities include outreach across academia, DoD, industry, and congressional staffers—both informally and through innovation panels, workshops, research incubators, and collaboration with government agencies. Funding on concepts selected for further exploration and development are provided in subsequent research tasks.

Figure 2 illustrates the distribution of research tasks begun in FY 2021 across AIRC processes shown in Figure 1, topical area, and tasking source. Here we see a balanced mix of congressionally directed efforts, tasks identified by the DoD based on strategic need, and proposals from academia. Congressional tasks align with the *respond* process while the DoD assigned tasks are a mix of *respond* and *connect* activities. The proposals from academia are a mix of *incubate* ideas created from innovative ideas from academia in response to collaborative *ideate* activities in the spring Incubate Forum described below. Most of these are described in the section below on New Research Tasks Funded in late FY 2021 (starting on p. 14).

Figure 2. AIRC Research Tasks in FY2021



Innovative Concepts and Phase I Seedling Studies: The 2021 *Incubate* Cycle

A major AIRC activity for FY 2021 was the Incubate process. AIRC advisors from OSD and the Military Services identified *Digital Transformation and Acquisition* as the theme within which to postulate new approaches and prototypes.

AIRC established an Innovation Panel of 14 external thought leaders from academia, industry, and former DoD and congressional stakeholders, who brainstormed over 30 novel application concepts within the theme. These concepts relate to three perspectives of the acquisition system:

1. Leader and Decision-Maker perspective;
2. Data and Infrastructure, Tools, and Techniques perspective; and a
3. Workforce and Incentives perspective.

Figure 3 illustrates the concepts in the leader and decision-maker perspective. Here AIRC envisions a range of approaches and use cases, including:

- ***Cognitive assistants*** to train and support decision-making throughout the acquisition chain of command, especially on new and agile acquisition approaches
- ***Intelligent search techniques*** to identify industry capabilities, relevant technologies and their maturity, and cost analogs to inform cost estimates
- ***Interaction and reporting aids*** to improve and speed coordination within and across acquisition functions, chains of command, and oversight structures
- ***Tools and approaches*** to integrate ***system-of-system (SoS) relationships*** to understand and engineer the net results from a military mission perspective.

Ideally, these would be applications ("apps") within an integrated working environment where DoD acquisition staff and leadership work and within which new applications can be added to incrementally provide new capabilities to streamline access and facilitate data and information sharing as well as analysis. While on a grander scale, this is somewhat analogous to how smart phone environments enabled incremental "apps" to be easily developed and applied as technology, needs, and innovative ideas arise.

Figure 3. Concepts in the Leader and Decision-Maker Perspective

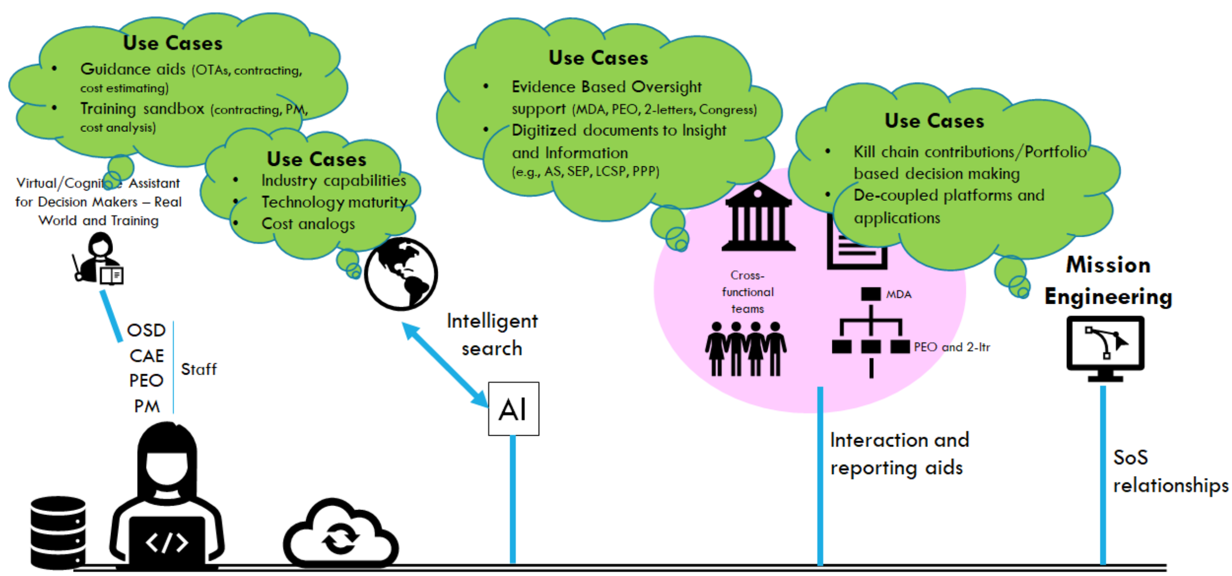


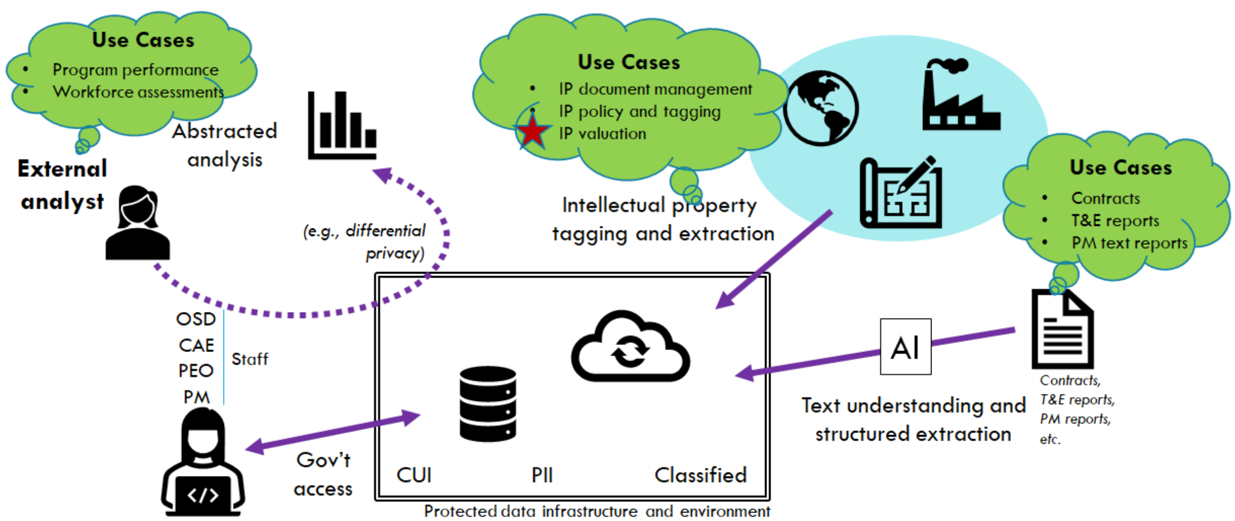
Figure 4 illustrates the concepts in the data and infrastructure, tools, and techniques perspective. Here AIRC envisions a range of approaches and use cases, including such as:

- A ***protected data infrastructure and environment*** to hold controlled and classified information (the box in the bottom-center of the figure)
- ***Direct government access*** within the DoD working environment (lower-left)

- ***Techniques (such as differential privacy and black-box analysis)*** for external analysts to conduct analysis on controlled and classified data without compromising their protections or divulging sensitive information (upper-left)
- ***Techniques to document, manage, tag, and value IP*** according to relevant policies (upper-right)
- ***AI techniques*** to extract information from unstructured documents and text (lower-right)

Together, these approaches leverage advances in technology, information processing, and protection to provide smart sharing and protection of information, applying the most recent advances from research and academia to accelerate and improve acquisition functions.

Figure 4. Concepts in the Data and Infrastructure, Tools, and Techniques Perspective

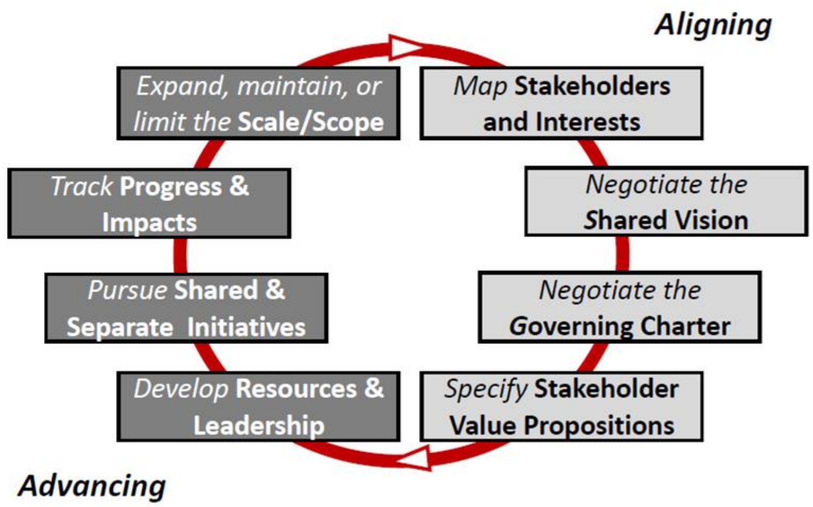


Finally, Figure 5 illustrates a structured approach for improving the workforce and its associated incentives and culture. These are, perhaps, even more important than technological and process improvement concepts because acquisition functions are executed by people, and the Department is well known for incentivizing conservation over agility and prudent risk taking. In one paradigm, workforce and culture are addressed through:

- Aligning incentives through mapping, negotiating, and specifying interests and value propositions
- Advancing workforce through development, pursuit, tracking, and scope control

This is but one of many potential approaches and bringing these “soft” approaches to bear on the underlying functional elements of the Department is, perhaps, the biggest challenge facing the DoD. As one of our AIP members stated: *Disruptive innovation is not an R&D problem—it’s an organizational problem*. In other words, itis less about being able to perform R&D and more about have an organization that is incentivized to innovate.

Figure 5. Concepts in the Workforce and Incentives Perspective



SOURCE: Cutcher-Gershenfeld, 2021, *Agile Institutions for the 21st Century*

AIRC's advisors focused on three of these concepts and added two more for collaborative development at the Spring Incubate Forum:

1. Workforce upskilling under continuous change.
2. Management and business knowledge representation for improved decisions.
3. Aligning workforce and organizational incentives for agility and innovation.
4. Innovative test approaches to enhance organizational agility.
5. Return-on-investment from digital transformation to inform decisions and investments.

The Incubate Forum engaged over 126 leaders, faculty, and researchers from 61 organizations—primarily from academia and the DoD but also including congressional staffers, industry, and FFRDCs.

AIRC issued a call for proposals from academia, receiving 66 proposals from 30 university faculty, researchers, and laboratories for 3-month Phase I studies for initial research and active engagement with DoD users and stakeholders ("champions") to deeply understand the department's challenges. Each proposal received at least three peer reviews within AIRC; the top half of those received an additional three peer reviews to prioritize the top proposals into tiers. These reviews focused on six general metrics (clarity of vision, intellectual merit, novelty, strategic impact, past performance, and multi-disciplinary) as well as whether the proposals were responsive to the identified topic in the call. The tiering also reflects diversity criteria to balance proposal across the five topic areas and to avoid funding large numbers of proposals from the same university. Table 3 lists the top tier of proposals—all of which were selected for funding by the DoD.

Table 3. Incubate Studies Selected for Funding in FY2021

<table>
<tr><th>Area</th><th>DoD Champions and Other Involvement</th><th>Study Titles (PIs)</th><th>Universities</th></tr>
<tr><td rowspan="2">Workforce Training/Advice Technology</td><td>DPC (J. Tenaglia)</td><td>1. Cognitive Assistants for Training Cost Estimators: Proof of Concept (Drs. Selva, Salado, and Chaspari)</td><td>Texas A&M and Arizona</td></tr>
<tr><td>CAPE (J. Bowles)
(Study 2 also involves game firms and may prototype at the enlisted technical school at Lackland AFB)</td><td>2. Gamification of Training in Emerging Acquisition Methods (Drs. Finkenstadt and Handfield)</td><td>NPS and NC State</td></tr>
<tr><td>Corporate Memory to Improve Decisions</td><td>R&E (S. Possehl), Acquisition (D. Cadman), Sustainment (V. Ramdass)</td><td>3. Proposal Management and Business Knowledge Representation for Decision Making (Dr. Mun)</td><td>NPS</td></tr>
<tr><td>Incentives for Agility</td><td>Acquisition (D. Cadman) with R&E (S. Possehl) and Sustainment (V. Ramdass).
(Study 4 also involves AFMC/AFICC)</td><td>4. Systemic Factors Influencing Risk Aversion: Diagnosing Behaviors and Tailoring Interventions for Lasting Transformation (Dr. Girth)</td><td>Ohio State</td></tr>
<tr><td rowspan="3">Agile T&E</td><td rowspan="3">DOT&E (R. O'Toole, S. Hobson, G. Zacharias)
(Study 7 also involves the Air Force Test Pilot School, NRO, Picatinny Arsenal, and potentially the Warfare Centers)</td><td>5. An Innovative Probabilistic Approach to Risk-Based Validation (Drs. Madni and Erwin)</td><td>USC</td></tr>
<tr><td>6. Holistic Assurance Framework: Fast Time Emergent Scenario Simulation (Dr. Sherry)</td><td>GMU</td></tr>
<tr><td>7. Digital Engineering Enhanced T&E of Learning-based Systems (Drs. Beling, Freeman, and Jitesh)</td><td>Virginia Tech and Purdue</td></tr>
<tr><td>Informing Decision with ROI</td><td>Navy RDT&E (Michael Doctor), TRMC (George Rumford), and DoD CIO (Tomasz Wojtaszek).
(Study 8 also involves IBM and Hewlett Packard Enterprise)</td><td>8. Calculating ROI in a DoD Context (Dr. Burger)</td><td>Georgetown</td></tr>
</table>

The eight selected proposals constitute an award rate of about 12 percent, reflecting a strongly competitive process given the high quality of the proposals received. These studies involve nine extramural universities and a military university (George Mason, Georgetown, North Carolina State, Ohio State, Purdue, Texas A&M, Virginia Tech, University of Arizona, USC, and NPS). There is at least one study for each topic area (Area 4 has three studies). These studies employ the following conceptual approaches, respectively:

1. Cognitive assistants (software applications) that help to train and advise cost estimators.
2. Gamification of training in emerging acquisition methods such as Agile development and DevSecOps.
3. Employ a transparent Decisions Options Register and integrated intelligent database system to capture historical decisions going forward, including their assumptions, data inputs, constraints, limitations, competing objectives, and decision rules.

4. Diagnose risk-averse behaviors then devise and evaluate interventions to incentivize system-wide innovative behavior while addressing disincentives to enable a culture of critical and creative thinking.
5. Use probabilistic success trees to design test and evaluation cases that maximize test coverage of operational conditions and measure remaining latent risks.
6. Use parallel Monte Carlo runs of an agent-based "digital-twin" of a system being tested to generate and identify rare events where complexity leads to "normal accidents" in which components function properly but the system fails.
7. Reduce the number of samples needed to test AI/ML models to an acceptable level by assessing underlying models, algorithms used to train the models, and the systems models, functional architectures, and other artifacts of the digital engineering process.
8. Adapt private-sector best practices and non-DoD public sector's ROI calculations to reflect the unique, non-monetary DoD benefits.

Research in Response to Specific DoD and Congressional Tasks

Digitization and Researcher Access Options for the DoD Pathology Slide Repository

The first full research AIRC task to be completed and reported by AIRC was a rapid response for the DoD's Joint Pathology Center (JPC) concerning acquisition approaches and strategies to make the existing physical pathology slide repository available in a digitized form to the broad health care/medical research community. AIRC connected the JPC to external subject-matter experts, forming a rapid advisory panel on acquisition strategy options to expand on recommendations from the Defense Innovation Board related to digitizing the pathology slide repository.

The panel met eight times over the span of two months to address (a) the major elements of the value chain of bringing the repository from its current state to a digital form that facilitates broader use that benefits both the public good and the warfighter; (b) critical acquisition cycle and value issues including sustainability, accessibility and ease of use, short- and long-term value and use, public perception and engagement, and data curation; (c) critical issues and constraints of the acquisition value chain including intellectual property (IP), privacy, security, and governance; and (d) possible acquisition pathways to achieve the aspirational goal, which include government-to-government collaborations, partnerships with private foundations, and deployment of challenges or contests to determine private sector interest, elicit creative solutions, and perhaps lead to public-private partnerships (PPPs). The panel identified five specific recommendations they assessed as instrumental in the success of the JPC's aspirational goal of leveraging these slides to advance military and public health. The JPC is currently reviewing the panel's recommendations.

Intellectual Property Evaluation, Valuation, and Repository

A second research task was initiated in late 2020 to explore improved IP mechanisms, tactics, techniques, and practices (MTTPs) to evaluate IP and to support an IP pilot program and process improvements. This effort seeks to fulfil FY 2020 NDAA (Sec. 801), section 2322 of title 10 U.S. Code, DoD Instruction 5010.44, and Defense Federal Acquisition Regulation Supplement (DFARS) 227. The objective is to identify MTTPs that are lean so that the DoD is proactive yet cost effective by acquiring only the necessary deliverables and license rights at the appropriate time needed to secure DoD's interests throughout the product life cycle. The goal is an evolving tool set that can be adapted to special circumstances with appropriate revisions as technologies and needs change.

In addition to IP evaluation and valuation, AIRC is developing an IP information repository concept and structure that could store numerous types of models and data associated with IP (e.g., contracts, solicitations, license/rights agreements, IP strategies).

A major part of this effort is an IP workshop to be conducted in September 2021 to bring together IP experts from academia, industry, and the DoD to explore approaches and options for IP evaluation, valuation, and information storage. These and other IP research activities are ongoing.

Acquisition Data Strategy

Finally, the initial AIRC core research funding provided for initial data strategy concept development for acquisition data in the DoD. These activities relate to the statutory responsibility to establish "data repositories and development of analytical capabilities, in coordination with the Chief Data Officer of the Department of Defense [DoD CDO], to enable researchers and acquisition professionals to access and analyze historical data sets to support research and new policy and practice development" (section 2361(a)(d)(3) of title 10 U.S. Code).

These research activities will be continued with ongoing funding provided in late FY 2021 and are anticipated to continue supporting the DoD's efforts to improve its data collection and analytic capabilities both within the Department and involving extramural researchers in academia and elsewhere.

Data Exposure for Extramural Research

Another near-term activity under section 2361a(d)(3) of title 10 U.S. Code has been the creation of *Data Sources for Analyzing Acquisition*—a list that AIRC created and will maintain on its website of public and restricted government data and information sources relevant to acquisition analysis. This list addresses a known challenge (both outside and within DoD) of finding the breadth of relevant data sources hosted by diverse organizations.

While many of these databases are restricted, some are public and can be readily used by extramural researchers to assess various aspects of the Defense Acquisition System. As for the restricted data sources, having a collective list of sources whose existence is in the public domain will facilitate sponsor discussions with faculty and researchers in academia on research approaches and the potential for granting selected data access as appropriate.

To structure the information, the list includes multiple groups of data sources according to acquisition system aspects and flows. For example, there is a list of data sources at various stages if one follows the funding flow as it works its way through various budgeting, requesting, approval, and spending processes. Other thematic flows list data sources related to following the acquisition programs, contracting, people, technology, etc. The list also includes general data sources and dictionaries. These thematic aspects interoperate in the acquisition system, so data sources may appear in multiple places, but these thematic structures help as analysts think through and assess various aspects or dimensions of the Defense Acquisition System.

New Research Tasks Funded in Late FY 2021

In addition to the eight Incubate studies discussed above, several new research tasks were funded in late FY 2021. These will largely be executed through the third quarter of FY 2022.

Portfolios/Missions

Data-driven capability portfolio management pilot. This effort will develop and pilot a prototype capability to enhance data-driven decision-making regarding acquisition and sustainment programs. It will explore the enablement of portfolio management from a mission engineering perspective. This includes exploring the transition from a paper-based (e.g., briefing slides) review of various portfolios (e.g., the electronic warfare portfolio) to a more model-based review (e.g., using models of the item to be acquired as used in model-based systems engineering).

Requirements

Assessments of the process for developing capability requirements for DoD acquisition programs. This study will assess processes for developing and approving capability requirements for the acquisition programs of the DoD and each Military Department. It will also develop recommendations for reforming such process to improve the agility and timeliness of that process in response to section 836 of the FY2021 NDAA.

Acquisition Processes and Challenges

Digital data management and analytic strategy to enable digital acquisition. This effort will focus on initial efforts in FY2021 to support the DoD's development of a Digital Data Management and Analytics Strategy for Acquisition. This strategy integrates several other efforts (e.g., digital engineering and its enablement of other functions: digital mission engineering, digital portfolio management, model-based cost estimating and program budgeting; flexible budgeting BA-8 for software;[3] intellectual property management and databases; performance metrics for Agile development) into an overall concept for Digital Acquisition. This effort will also develop and pilot at least two applied data storage and analysis techniques for acquisition. These activities continue AIRC's statutory role to establish "data repositories and development of analytical capabilities, in coordination with the DoD CDO, to enable researchers and acquisition

[3] Budget Activity 8 (BA-8) is a single funding account for the Software and Digital Technology Pilot Program. BA-8 funds can be used for any software development and fielding activity that would otherwise be appropriated into different accounts within Research, Development, Test, and Evaluation (RDT&E) or accounts for Procurement or Operations and Maintenance appropriations (see *Budget Activity (BA) "BA-08": Software and Digital Technology Pilot Program: Frequently Asked Questions*, Version 1.0, September 28, 2020. https://www.dau.edu/cop/fm/DAU%20Sponsored%20Documents/Budget%20Activity%20-%20BA-08.pdf?Web=1).

professionals to access and analyze historical data sets to support research and new policy and practice development" (section 2361a(d)(3) of title 10 U.S.C.).

Agile program and project management. This task will study and develop policy options and recommendations on how the DoD and the military services can use agile program and project management concepts in non-software acquisition programs in response to the joint explanatory statement (JES) accompanying the FY 2021 NDAA.

Agile software pilots. This effort will review ongoing pilots, the authorities they employ, any new authorities needed, and especially the execution of the BA-8 single-appropriation pilot for software and digital technology. This includes performance metrics to understand the benefits and issues associated with BA-8. It supports responses to and assessments of section 862 of FY 2020 NDAA, prior Agile directives and pilots, and the BA-8 pilot.

Assessments of bid protests. This study follows up on earlier bid-protest studies to collect additional data and assess various factors related to the effects of bid protests. It will also review existing law, the Federal Acquisition Regulation (FAR), and agency policies and procedures related to bid protests in response to the JES accompanying the FY2021 NDAA.

Review acquisition reform recommendations and implementations. In response to the AIRC charter in section 2361(a) of title 10 U.S. Code, this effort will review relevant DoD and private-sector studies on acquisition policies and practices, including the extent to which recommendations have been enacted into law by Congress, adopted through the issuance or revision of regulations, or adopted through issuance of an appropriate implementing DoD policy or guidance.

Title 10 U.S. Code reorganization of acquisition statutes. This effort supports the DoD's evaluation of the reorganization of Title 10, U.S. Code, by Title XVIII of the FY 2021 NDAA. This effort includes further recommended legislative textual changes and responses to any congressional staff members questions.

Approaches for accessing commercial innovation. This effort will critically assess the various DoD mechanisms for identifying and leveraging innovations in the commercial industry for its mission (e.g., DIU, X-WORX, NSIN). It will also establish a senior panel to review this assessment and make recommendations on how the realization of this strategic objective can be further enhanced.

Sustainment & Supply Chain

Additive manufacturing and digital engineering strategy development for mission engineering. This effort will help develop a DoD Additive Manufacturing Supply Chain and Sustainment Strategy and associated Digital Engineering (DE) strategy in support of mission engineering and readiness. The initial focus is on additive and adaptive manufacturing for sustainment.

Innovation Forums

To identify enduring challenges and identify innovative solutions, AIRC conducts a series of Innovation Forums on specific topics. These activities serve not only to clarify problems and past efforts but bring together academia faculty and researchers with DoD, congressional, industry, and laboratory specialists to brainstorm approaches to inform policy making or further faculty research.

Forums in FY 2021 include:

- The Spring Incubate Forum on April 6–7, 2021 (which informed the incubate proposals and studies discussed above)
- A strategy session on August 3, 2021, with thought leaders on grand challenges that impede acquisition performance, and
- An IP Valuation workshop on September 9, 2021, addressing the challenges of IP valuation and potential solutions and approaches.

Digital Data *Grand Prix*

The Defense Data *Grand Prix* is a three-stage ("heat"), 18-month prize competition[4] to encourage collaboration between government sponsors, academic teams, and corporate sponsors on mechanisms for data access and analysis to improve defense acquisition. Heats are aligned with the academic semester calendars. Heat 1 will focus on planning, Heat 2 on data access, and Heat 3 on data analytics to obtain new insights to inform acquisition decisions and processes.

The *Grand Prix* is designed to encourage and leverage innovation of faculty and students while engaging them on practical DoD acquisition problems. It is structured to maximize interaction between sponsors and competitors while rewarding innovation and shareable findings. Financial prizes will be awarded after each heat for the top performing teams, and submissions will be shared amongst all competitors to promulgate best practices and concepts. Strategic sponsors are the DoD CDO and the Office of the USD(A&S), with involvement by the Defense Logistics Agency (DLA). We are inviting and encouraging involvement from other DoD components, commands, and agencies.

Performance Metrics

As mentioned in the February 2021 DoD *Report on the Establishment of the Department of Defense Acquisition Innovation Research Center*, AIRC will seek long-term performance metrics to capture results from near-term engagements with academia as well as long-term outcomes from the results of AIRC research. That report identified potential metrics for consideration, but many of them are long-term and will be difficult to quantitatively measure or associate outcomes with changes from the implementation of AIRC prototypes, experiments, and research. Also, many of those metrics are input and process rather than outcome measures and thus demonstrate only

[4] For background information on prize competitions, see https://www.challenge.gov/ and https://www.xprize.org/.

activity rather than results. The DoD will continue to work with AIRC to seek and develop useful metrics for future reports to measure the progress made and the value of the endeavor.

Table 4 lists input and activity statistics that shed light on initial efforts to strengthen the academic acquisition research ecosystem, expand and sustain critical sponsor relationships, and begin conducting transformational and translational research. Because most of the currently available data reflect inputs or activities instead of outcomes (i.e., measurable improvements in acquisition functions or the system as a whole), the DoD will continue to evolve these metrics to obtain the most meaningful measures of performance as we manage and evolve AIRC over the coming years.

Table 4. AIRC Input and Process Metrics

Strategy	Performance Measure	FY 2021	FY 2022*
Strengthen Research Ecosystem *Create and strengthen vibrant relationships between AIRC and other organizations, between AIRC research projects and non-AIRC projects, and among AIRC researchers*	1 Connectivity and output of the academic research network: a. number of publications b. number of faculty engaged c. disciplinary diversity of research teams d. number of schools with a PI or co-PI	a. 1 (restricted) b. 55[5] c. High[6] d. 11	
Expand and Sustain Critical Sponsor Relationships *Strengthen relationships between AIRC and its current sponsors; develop a DoD sponsored strategy to expand the number of sponsors*	2. Connectivity and impact to the AIRC sponsor network: a. number of sponsors b. number of funding sources c. diversity of funding sources	a. 17 b. 4 c. OSD and Defense Agencies	
Conduct Transformational and Translational Research *Conduct longer-term research recognized by the community as potentially transformational and place it into practice in both DoDIIC and universities*	3. Number of AIRC collaborator ideas with early modest funding	8 Incubator Phase I studies	
	4. Number of longer-term projects with ongoing mid-to-large investments: a. annual research funding	a. $2,397,306.31 (funded in late FY2020)	a. $7,351,266 funded in late FY2021 ($1,657,490 + $5,693,776)

* Initial values, funded in late FY 2021 to be predominantly executed in FY 2022.

[5] Count from the 2021 Incubate Forum.

[6] Disciplines involved: Artificial Intelligence, Business, Computer Science, Data Science, Economics, Engineering, Information Science, Law, Management, Operations Research, Public Affairs, Public Policy, Statistics.