

**2021 PHASE I
CALL FOR RESEARCH PROPOSALS
ACQUISITION INNOVATION RESEARCH CENTER (AIRC), SERC**

The following is an open call to all faculty, fellows, and research staff at SERC/AIRC universities for 2-page research proposals related to the topics included in this solicitation. Our intent is to also consider proposals from faculty at non-SERC/AIRC universities within the United States.

RESEARCH TOPIC CATEGORIES

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This is not a formal government solicitation but rather a mechanism to reach out to existing and potential colleagues within academia to participate with us in this endeavor. Your research proposals will be assessed for funding from the SERC/AIRC sponsor funding sources as incubator research projects for the Summer of 2021. **Proposals are due May 14, 2021 by 11:59pm EDT.**

It would be greatly appreciated if you would also forward this Call for New Research Proposals to your faculty colleagues who may have an interest in these topics.

Proposers Meeting: The SERC/AIRC will hold a virtual meeting to help explain this research funding opportunity, clarify the simple process involved, and answer any questions.

The meeting will be held on **April 28, 2021 at 3:00 pm EDT (12:00 PDT)** on ZoomGov.

ZoomGov Meeting Information:

<https://www.zoomgov.com/j/1603160844?pwd=V2xuSTVWYjZsS0FvMkZuMzBacXhRdz09>

Meeting ID: 160 316 0844

Passcode: 983190

+16692545252,,1603160844# US (San Jose)

+16468287666,,1603160844# US (New York)

Background: The need for new concept incubation is an integral part of the AIRC strategy for creating innovative improvements in defense acquisition. AIRC is seeking proposals for summer studies in academia to design and propose demonstrations and pilot programs of innovative acquisition policies and practices for the specific application areas outlined below. Proposed approaches should have a strong potential for breakthrough results in improving the defense acquisition mission through applied piloting and experimentation, while also resulting in seminal/journal quality publications.

Opportunity: Phase I Seedlings. Subject to available funding, several high-quality proposals will receive initial seed funding, not to exceed \$100,000 per award. Selection will be made by the AIRC sponsors in the May–June 2021 timeframe, with awards targeted for June 14, 2021.

Topics. The proposed research topics must address one of the research challenge areas discussed in Attachment 1. Please identify the area you are responding to in your proposal.

Expected Outcomes. Expected activity and outcomes of the Phase I studies include the development of novel ideas and concepts; active engagement with relevant Department of Defense (DoD) and Industry experts during the study; the possible inclusion of preliminary proof-of-concept exploration/experiment (as time and resources allow); and the development of a proposal for a Phase II application pilot, prototype, or experiment for consideration by government champion(s). Out briefs of Phase II proposals for successful Phase I studies will be held in mid-September 2021.

Preferences. Preference will be given to proposals that leverage novel and interdisciplinary approaches, to include business, policy, education, economics, law, engineering, and science. Accordingly, teaming across multiple universities and academic disciplines is encouraged to bring novel approaches to bear on the identified challenges and needs.

Phase II Projects. In the second phase of this incubator program, a small number of research proposals will be selected from successful Phase I seedlings. Selection will be based on significance and uniqueness of the research approach, along with relevance to the targeted DoD acquisition field and its challenges. These Phase II research projects can have a significantly higher level of funding for up to two years as a function of research scope (e.g., ranging from \$200K to more than \$1M, depending on the proposal’s scope, challenging nature, and potential benefits to the DoD). Number and scope of Phase II awards will depend on the relevant value to the DoD user community, novelty of the approach, and available funding.

Depending on the nature of the approach and the maturity of the concepts involved, Phase II plans may discuss the need for non-academic organizations to be funded by the DoD apart from (i.e., in parallel to and coordinated with) the proposed Phase II AIRC project. Such inclusions should discuss how, when, and why such external partners should be involved. Remember that the focus of AIRC is to engage the best minds in academia (including collaborating UARCs) on the most challenging problems facing defense acquisition systems; consideration of transition and institutionalization approaches as well as potentially leveraging innovative technologies from industry can strengthen the proposals if they do not defer to business consulting or pre-existing solutions.

Expected Phase II Outcomes. Expected outcomes of the Phase II studies include demonstrated utility to the DoD users (Champion metrics), leave-behind capabilities (when possible) and scaling and institutionalization by 2022–2024, along with multiple journal publications.

Submission Instructions: To apply for Phase I incubator funding, submit a short description of your proposed research concept, addressing the first six Heilmeier Catechism criteria¹ used to “help Agency officials think through and evaluate proposed research programs,” namely:

1. What are you trying to do? Articulate your objectives using absolutely no jargon.
2. How is it done today, and what are the limits of current practice?
3. What is new in your approach and why do you think it will be successful?
4. Who cares? If you are successful, what difference will it make?
5. What are the risks?
6. How much will it cost? [i.e., How much are you requesting for Phase I?]²

Proposals and all supporting material must be concise; **proposals must be no longer than two (2) pages in length**. An additional page can be included to contain endnote references, graphics, and URL links to faculty/researcher bios or CVs. Include the names of the research team, lead university, partner universities (if any), and research challenge area with the title of your proposed research task. Format should be text-extractable PDFs or Microsoft Word files.

The overall value of the submissions will be judged based on several criteria, including: intellectual merit, clarity of the vision, novelty, past performance of the investigators, the potential strategic impact on and importance for the DoD, and the degree of taking full advantage of academia’s multi-disciplinary research capabilities. For past performance, please include references to previous research reports and published papers. If there are other sponsors within the DoD who may be interested in your proposed research and might provide matching funds or project guidance, please include this information as well.

Submissions should be made through the AIRC website submission form at <https://acqirc.org/call-for-research-proposals/>. **Research proposal responses are due by May 14, 2021 by 11:59 pm EDT.**

Please contact Ms. Kara Pepe at kpepe@stevens.edu if you have any questions about this research opportunity or the proposal response format.

Sincerely,

Dinesh Verma

Dr. Dinesh Verma
Executive Director, Systems Engineering Research Center (Stevens Institute of Technology)

cc: Mr. Thomas McDermott, AIRC Chief Technology Officer (Stevens Institute of Technology)
Ms. Kara Pepe, AIRC Chief of Staff (Stevens Institute of Technology)
Dr. Philip S. Anton, AIRC Chief Scientist (Stevens Institute of Technology)

¹ <https://www.darpa.mil/work-with-us/heilmeier-catechism>

² Note: If your Phase I summer seedling is successful, the Phase II proposal generated during Phase I will need to address all criteria in the *Heilmeier Catechism*, including the last two:

7. *How long will it take?*
8. *What are the mid-term and final “exams” to check for success?*

Attachment 1: AIRC Research Challenges

Below are described the five challenge categories, concepts, and application uses for the Phase I summer call for proposals within AIRC. Each category has one or more proposal areas along with a brief description of the DoD challenges and needs, potential research and piloting approaches, and practical considerations.

Overarching Context for the Five Research Proposal Categories

The DoD Acquisition System has evolved over decades to facilitate the acquisition of capabilities, often focusing on processes for major hardware systems (e.g., ships, ground vehicles, and aircraft) with long design and production timelines. While this will continue to be an activity for the Department, acquisition must contend increasingly with a faster pace set by rapidly evolving threats, accelerating technology advancement, and rapid developmental methodologies (e.g., driven by ubiquitous software, autonomy, AI/ML, DevOps, DevSecOps) as well as the need to leverage commercial innovations in both technology and business models. This is within a broader context where the mission and needs are evolving rapidly and there is a need for innovation from both technological and business perspectives. To address this need for agility and innovation, organizations within the Defense Acquisition System have a range of legal and regulatory options plus the ability to tailor processes. Often, these flexible approaches are not leveraged by a risk-averse workforce for a number of reasons, including a lack of understanding of these flexible options; weak incentives and even disincentives to explore more unique and flexible approaches; insufficient methods and tools to support decision making and engineering; and a need for better guidance and training. Decisions must be better informed and reflect needs across time and across multiple communities and their functional siloes.

These five categories reflect samples in this challenge space that would benefit from your fresh ideas and approaches, especially as they tap into academic disciplines that have had little application to the DoD in the past. We look forward to your ideas. Your involvement will provide interesting intellectual challenges to expand your field through research, application, and publication.

Practical Considerations

As applied research, the Phase I studies and associated Phase II proposals will need to consider the available data, inputs, transition conditions, user engagement, and success criteria. Engagement with government users and functional experts will be important to understand the DoD's problems and efforts. Successful pilots will be those that can be institutionalized and scaled to apply broadly across the DoD. Demonstrated performance improvements (e.g., reduced errors, faster training, broader skills, better information for decisions) will be assessed by our sponsors to determine the value of continuing and transitioning the research for broader use.

1. Workforce Upskilling under Continuous Change

Defense Workforce Training. Assist in rapid workforce training and assistance—including for new authorities and approaches—through advanced training tools, technologies, and methodologies.

Defense Acquisition Challenges and Needs

Area 1.1. Technology and educational approaches for training contracting officers on challenging approaches. Many DoD contracting professionals lack the skills to effectively leverage non-standard contracting options or to tailor contracts to meet the needs of new approaches such as Agile Development or DevSecOps.

Area 1.2. Technology and educational approaches for training new cost estimators. The Training cost estimators on the specific data and approaches used in DoD acquisition remains a challenge. Needs include moving cost estimator training from time-consuming live classrooms to online settings with interactive training tools, exposing new cost estimators to cost model that deal with uncertainties, and growing critical thinking skills.

Desirable Features. Models that reflect the effects of contract designs and acquisition strategies on technical and cost modeling. Predictive models that trade (and train) strategy versus system characteristics. Training approaches not only for new staff but for their existing managers and supervisors that are not knowledgeable about new approaches or are risk averse. Training environments that easily introduce, leverage, and process uncertainty and new data-driven parametrics. Technical solutions that both train and provide operational support and guidance during cost estimating.

Potential Research and Pilot Approaches

Here are some ideas suggested by our faculty colleagues; these are just ideas for your consideration.

- Workforce competency models and cross-functional training opportunities.
- Simulation-based experiential learning, adaptive learning courseware, and best-practices knowledge graphs for both within-function and cross-functional training.
- Cognitive assistants.

2. Management and Business Knowledge Representation for Decision-Making

Corporate Memory and Future Constraints from Decisions. Enable better actions and decisions by capturing, developing, sharing, and effectively using organizational knowledge.

Defense Acquisition Challenges and Needs

Area 2.1. Corporate Memory. The DoD lacks an ability to fully capture historical decisions and their associated assumptions and constraints. It also lacks the ability to “test drive” decision options to explore their likely effects on metrics of interests in the future. Gaps result from incomplete representations of decisions, assumptions, and the surrounding context and methods that enable exploration of alternate futures resulting from decisions. Furthermore, the ethical dimensions of decisions (e.g., privacy; the balance between public and government equities) need to be evaluated prior to implementation, but incomplete context and insights impedes the consideration of these equities. As a result, decisions are based on partial knowledge of the past and educated guesses about the future, affecting the quality of the decisions and the potential that better mission outcomes could have been obtained.

Desirable Features. At a minimum, the pilot needs to address how communication difficulties across organizational lines can be overcome using digital engineering with corporate memory.

Potential Research and Pilot Approaches

Here are some ideas suggested by our faculty colleagues; these are just ideas for your consideration.

- Modeling approaches such as AI-enabled episodic memory.
- Model-based storytelling to contextualize decisions, assumptions, and constraints.

3. Aligning Workforce and Organizational Incentives for Agility and Innovation

Aligning Incentives for Agility and Innovation. Motivate innovation and acquisition agility by aligning workforce and organizational incentives and minimizing disincentives.

Defense Acquisition Challenges and Needs

Area 3.1. DoD Organizational Incentives for Agility and Innovation. Approaches are needed to both strengthening incentives and reducing disincentives. Possible types of incentives include: Incentives for acquisition workforce development; Cultural disincentives – lack of candor, avoiding risk, discouraging learning; Disincentives rewarding implementation, not experimentation; Stakeholder situational awareness – gaps in what is known of stakeholder interests; Next-generation workforce incentives – new risk/reward motivations; or structural disincentives, such as the restrictions on what money can be spent on because of budget accounts.

Area 3.2. Contactor Innovation and Performance Incentives. What structural incentives can be used to drive contractor innovation, agility, and performance? For example, how can we increase supplier competition for longer (i.e., can we shift-right the final acquisition decision)? For example, provide common test and lab facilities (such as NIST’s “Manufacturing USA” institutes) so competitors do not need to all bid and build their own, reducing their capital investment, enabling them to sustain for longer before contract award.

Desirable Features. Approaches that reveal and align not just incentives but also removed or nullify disincentives across the enterprise. Provides: a built-in “check and adjust” capability; an ability to keep options open as long as possible. Empowers “lateral alignment” and innovation across acquisition functions and domains. Addresses how incentives add up from an integrated enterprise perspective.

Potential Research and Pilot Approaches

Here are some ideas suggested by our faculty colleagues; these are just ideas for your consideration.

- Organizational design/mapping
- Workforce incentives, such as promotion criteria, performance evaluations, and career experimentation credit
- Scenario-based learning approaches
- Economic incentives for corporations

4. Innovative Test Approaches to Enhance Organizational Agility

Agile Test and Evaluation Across the Acquisition Lifecycle. Efficient and effective test and evaluation (T&E) in operationally relevant multi-domain/complex environments at speeds relevant to changing threats and operational needs.

Defense Acquisition Challenges and Needs

- Area 4.1. Insights from T&E into Requirements, Operational Concepts, and Design.** T&E to inform other functions and aspects: requirements, systems engineering, concepts of operation, etc. Research should include how to balance objectives, assess the value of the information captured, and how to engage across communities with T&E information.
- Area 4.2. Integrated T&E and VV&A.** More integrated T&E and validation, verification, and accreditation (VV&A) approaches, combining data, information, and insights from modeling and simulation, prior testing, sequential test programs, and integrated information throughout the lifecycle (from development to sustainment).
- Area 4.3. Testing DE and AI Artifacts.** Approaches for testing Digital Engineering and AI.
- Area 4.4. T&E of Cybersecurity.** A “Science of Cybersecurity,” including metrics, test coverage, replicable results, translation to operational impacts, policies/approaches for dealing with the DoD’s new Cybersecurity Maturity Model Certification approach or the DoD’s Risk Management Framework process.

Desirable Features. Testing independence. Engaging new generation of researchers to seek novel/innovative ideas. Identify what digital transformation means for T&E.

Potential Research and Pilot Approaches

Here are some ideas suggested by our faculty colleagues; these are just ideas for your consideration.

- Holistic Assurance Frameworks: AI assurance (T&E of AI systems), decision assurance, system assurance, and digital twins of the algorithms and environment.
- Validation Frameworks: Updated models, models fit for purpose, model-induced design errors, and designed experiments for exploring model choices. Validate the models in addition to the actual systems being developed.
- Testing and M&S approaches that reflect the full operational system of systems, the adversary’s systems, and the effects of the humans in-the-loop, including digital twins of both the system and the environment.

5. Return-on-Investment from Digital Transformation

Assessing ROI of Digital Transformation for Decision Making. Inform decision-making, budgeting, and tradeoffs by enabling assessments of return-on-investment (ROI) for acquisition.

Defense Acquisition Challenges and Needs

Area 5.1. The Nature of Benefits and Returns in a Government Context. What are the fundamental concepts of ROI for the DoD (versus a commercial business), and how can they be structured and applied in practical situations? For example: how to define benefits (e.g., lower spending versus lower risk versus improved fielded capabilities); risk-reduction sufficiency; defining ROI for novel technologies.

Area 5.2. Measuring Returns. What approaches can be used to quantify (or even qualify) returns and benefits? For example, are there best practices in the private sector that facilitate calculating potential gains from the application of digital transformation and data science investments?

Area 5.3. ROI in the Context of Organizational Business Models. In the DoD, the costs are not always aligned with those that see the benefits. Investment models are institutional based (e.g., the DoD pays as an institution, but capabilities are “free” to operators), working capital (programs pay fully burdened cost), hybrid (DoD pays overhead, programs pay-per-use). How can we assess costs and benefits together in these institutional business models, or can we align/select institutional models that better align costs and benefits to improve ROI and investment decisions?

Area 5.4. Mission and Portfolio Decision Models. How can we better understand ROI from a mission and portfolio management perspective?

Desirable Features. Approaches that provide insights in to where to invest, how long to test, etc. Mechanisms that reflect ROI to the entire enterprise rather than local equities. ROI approaches that establish trust so decision-makers can focus on the implications of the data rather than arguing that the data are wrong.

Potential Research and Pilot Approaches

Here is an idea suggested by our faculty colleagues; these are just ideas for your consideration.

- Best ROI Practices from Industry. Map ROI and justifications for investments in data tooling from non-DoD environments to the DoD environment; develop law, policy, and regulatory changes based on findings.