Industry Day:
University Affiliated Research Center (UARC): Tactical Autonomy

Agenda

Time	Activity
10:45 - 11:00 am	Sign-in
11:00 - 11:15 am	Introductions and Rules of Engagement
11:15 - 12:15 pm	Discuss requirement and BAA
12:15 - 12:30 pm	Break
12:30 - 1:30 pm	Questions and Answers

Overview

- Industry Day Purpose

- Agenda

- Background

- Requirements
  - Technical
  - Consortium
  - STEM

- Proposal Preparation

- Broad Agency Announcement (BAA)

- Awards

- Questions

Industry Day Purpose

Purpose:

Outline the Broad Agency Announcement (BAA), requirements, and selection process

- "BAA Preflight briefing"
- This discussion is <u>market research,</u> the BAA will contain final requirements and selection process. The BAA takes precedence over anything discussed.
- Questions are welcomed, we'll answer!
  - Q&As will be officially documented and distributed to registered attendees

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Background

For decades, Congress has recognized the need to develop a diverse national science, technology, engineering, and mathematics (STEM) workforce. While federal agencies provide significant opportunities for underrepresented racial and ethnic minorities in these fields, the national STEM workforce remains less racially and ethnically diverse than the U.S. general population. As the largest federal R&D funding agency and the largest employer of federal STEM professionals, the U.S. Department of Defense (DoD) plays an essential role in the U.S. science and technology ecosystem and can greatly expand opportunities to diversify the STEM workforce. To this end, the DoD operates under a department-wide STEM strategic plan, with the following :

Inspire community engagement in DoD STEM education programs and activities to provide meaningful STEM learning opportunities for students and educators.	Attract the Nations' and DoD's current and future STEM workforce through multiple pathways to educational and career opportunities.	Increase participation of underserved and underrepresented groups in STEM education and workforce development programs, activities, and outreach.	Advance the efficiency and effectiveness of STEM education and workforce development programs, activities, and outreach through evaluation and assessment

Background – Why Tactical Autonomy

Despite the autonomy advances in the last decade, several factors continue to impede the deployment and adoption of autonomous systems:

1. Trust in Mission Autonomy: Machine learning techniques widely used today are inherently unpredictable and lack the necessary mathematical framework to provide guarantees on correctness, while DoD applications that depend on safe and correct operation for mission success require predictable behavior and strong assurance. Additionally, if we assume autonomous systems are capable of moral agency, then the goal of machine ethics is to enable machines to reason ethically.

2. Collaboration between Platforms: Achieving higher levels of autonomy in uncertain, unstructured, and dynamic environments, increasingly involves data-driven machine learning techniques with many open systems science and systems engineering challenges.

3. Human-Machine Teaming: In the absence of an adequately high-level of autonomy that can be relied upon, substantial operator involvement is required, which not only severely limits operational gains, but creates significant new challenges in the areas of human-machine interactions and mixed initiative control.

Background

Identified program advocates (DAF and DoD)

SecAF approved plan on 25 Mar 2022

Developed team and began parallel efforts to build program and receive approval from USD(R&E)

Alignment:

- Program Sponsor – (AF/ST) Chief Scientist of the Air Force
- Contracting Activity – (AFRL) Air Force Research Laboratory
- Management Activity – (SAF/CDM) Air Force Concepts, Development, and Management Office

Advisors:

- Under Secretary of Defense for Research and Engineering (USD(R&E))
- Under Secretary of Defense for Acquisition and Sustainability (USD(A&S))
- Under Secretary of Defense for Personnel and Readiness (USD(P&R))

Background: UARCs

History

- The UARC program was established in 1996 via policy issued by the Director for Defense Research and Engineering.
- This action formalized DoD relationships with universities that in some cases dated back to WWII.

Current operations

- Each UARC must be *requested and sponsored by a DoD component*.
- UARCs provide and maintain advanced and sophisticated engineering, research & development capabilities that are essential to the DoD's mission and operations.
- UARCs operate as independent, trusted advisors and honest brokers, limiting their operations to be free from real or perceived conflicts of interest.

Current UARC Areas of Support

- Undersea/ocean environment technology R&D sensing
- Space situational awareness and sensing
- Nanotechnology, materials, and their applied use
- Biology and related fields, and their applied use
- Developing new and improved ways to train forces
- Human and behavioral sciences; human-machine systems
- Electronic Warfare, Missiles and Missile Defense
- Hypersonics, Cybersecurity, Spacecraft, AI, Robotics
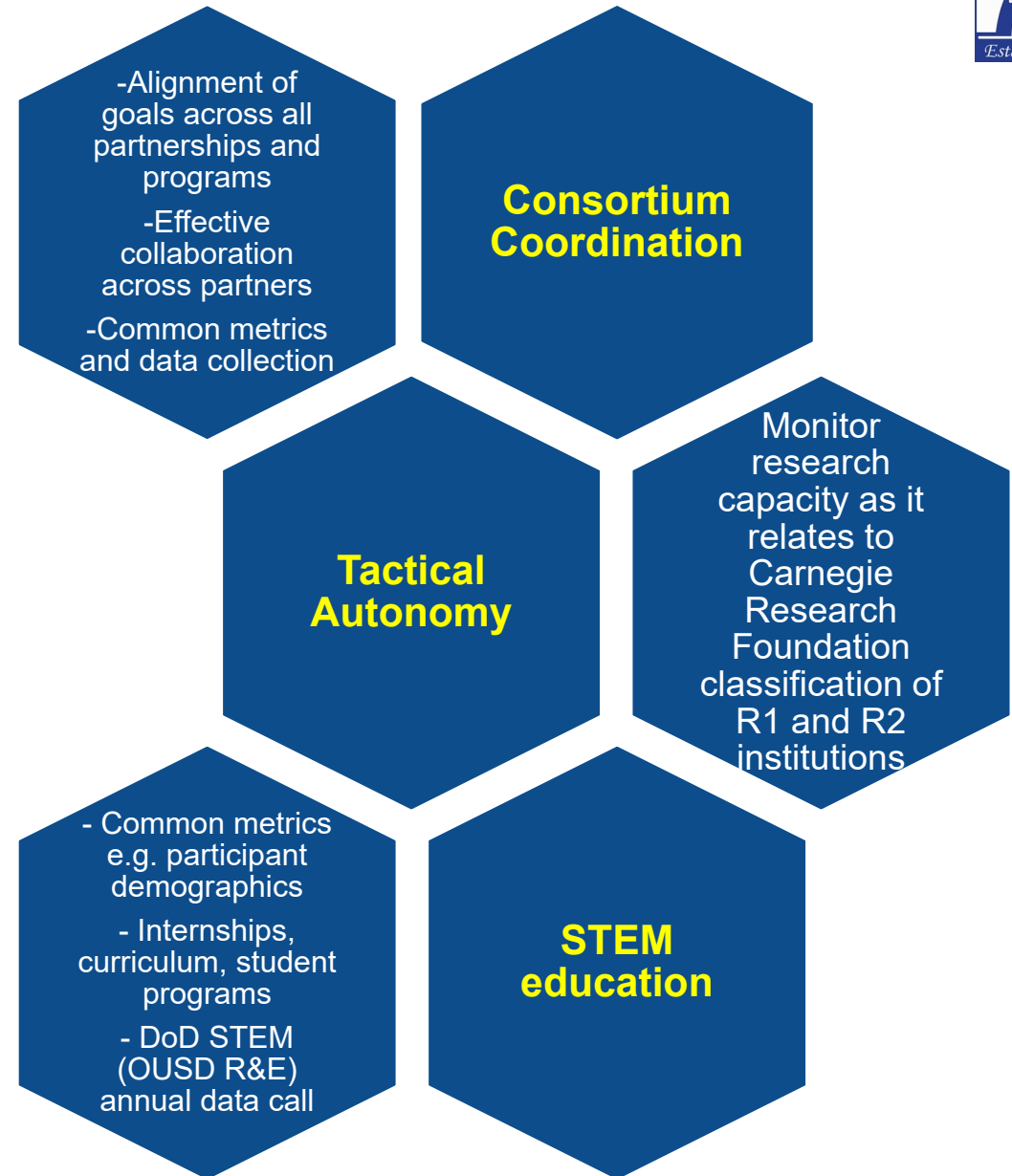- Nuclear Event Detection

Background

Program Description

Establish an Historically Black Colleges and Universities (HBCU) led University Affiliated Research Center (UARC) consortium to execute research focused in Tactical Autonomy (TA) that will aid in the transition of research into practical applications.

NATIONAL ACADEMIES — Sciences Engineering Medicine

"Develop Metrics to Evaluate, Track & Improve Institutional Growth and Competitiveness"

NASEM – DoD study
"Defense Research Capacity at Historically Black Colleges and Universities and Other Minority Institutions: Transitioning from Good Intentions to Measurable Outcomes", Spring, 2022

Consortium Coordination
- Alignment of goals across all partnerships and programs
- Effective collaboration across partners
- Common metrics and data collection

Monitor research capacity as it relates to Carnegie Research Foundation classification of R1 and R2 institutions

Tactical Autonomy

STEM education
- Common metrics e.g. participant demographics
- Internships, curriculum, student programs
- DoD STEM (OUSD R&E) annual data call

Objective

The program objective is to:

- Foster creative autonomy research in science and engineering; technologies to enable DAF / DoD mission sets; minimal supervision from humans; operations in complex and unpredictable environments; with applications in Air, Space, Cyberspace, Ground, and Sea.

- Enhance early career development of outstanding STEM professionals to ultimately increase and diversify the pool of STEM talent to fulfill the Department's missions; and

- Increase opportunities for HBCUs and students to engage with the Air Force, Space Force and DoD missions and related challenges in science and engineering.

Requirements

TECHNICAL

- Provide basic and applied research to advance the field of tactical autonomy and transition research into practical application in the below focus areas, while utilizing 10 initiatives, as referenced in the *DoD Better Buying Power 3.0: Achieving Dominant Capabilities Through Technical Excellence and Innovation*:
- Focus Areas:
  - Trust in Mission Autonomy
  - Collaboration between Platforms
  - Human-Machine Teaming

CONSORTIUM

- Create and lead a consortium of HBCUs to achieve the stated objectives to include increasing Carnegie Research Foundation Classification(s) from R2 (high research) to R1 (very-high research) for at least one of the consortium schools. As well as, develop an ecosystem in autonomy related disciplines, between academia, the DAF/DoD, small businesses, and the local/regional community.
- Establish a domestic, state of the art research facility(s) dedicated to tactical autonomy research,
- Assemble, foster, and support a world-leading team of autonomy faculty and researchers,
- Increase the quality and quantity of job candidates in this area of military need, and
- Support an ecosystem of business and government partnerships to transition autonomous technologies to the warfighter

STEM EDUCATION

- Develop STEM education research, development and related activities to support K-12 and postsecondary education programs and activities, including workforce training and career and technical education programs and activities, undergraduate, graduate, and postdoctoral education, and informal education programs and activities related to autonomy.

Requirements: Technical

Definition:

- <u>Tactical Autonomy</u> is defined as autonomous systems acting with **delegated and bounded authority** of humans in support of tactical, short-term actions associated with a longer-term strategic vision.

Requirements: Technical

Trust in Mission Autonomy

- Systems will behave as expected when exposure to the operators or "users" results in behavior expectations (a mental model of what the system will do) and users are willing to be vulnerable to the actions taken by the autonomous solution.
  - A major contributor to trust is proficiency of the solution. Estimating proficiency requires Test, Evaluation, Validation & Verification (TEV/V) which can be challenging in complex systems and particularly difficult in autonomy.
  - New approaches to TEV/V are required that envision more than a single authorization, but periodic validation / certification.
- A myriad of hardware/software (HW/SW) assessment technologies and technical approaches are sought to support fielding of Tactical Autonomy.
  - As an example, Artificial Intelligence (AI) or Machine Learning (ML) models may be needed to collect mission data to aid in establishing trust as models improve over time.
- After deployment of the models, consideration should be given to:
  - Gathering observations and incorporating updates to the AI models to enable Tactical Autonomy.
  - Regression testing of prior tests and the identification of issues from 're-training' users to account for new errors introduced by autonomy updates.
- Focus on tactical/real-time trust estimates to establish a 'pocket of trust' based on details of the current planned or ongoing use, versus aggregate measures of performance.

Requirements: Technical

Collaboration between Platforms

- Study interaction between various autonomous agents to determine feasibility. To achieve mosaic warfare requires disaggregation / distribution across manned and unmanned platforms. The composition of legacy solutions with new systems/platforms can create an adaptive kill web but should not be overly costly to develop.
- Three main technical challenges have to be addressed to achieve this goal:
  - Interoperability – should not lock down standards that limit technical innovation.
  - Composability – allow solution to combine together to accomplish tasks that could not have been accomplished independently.
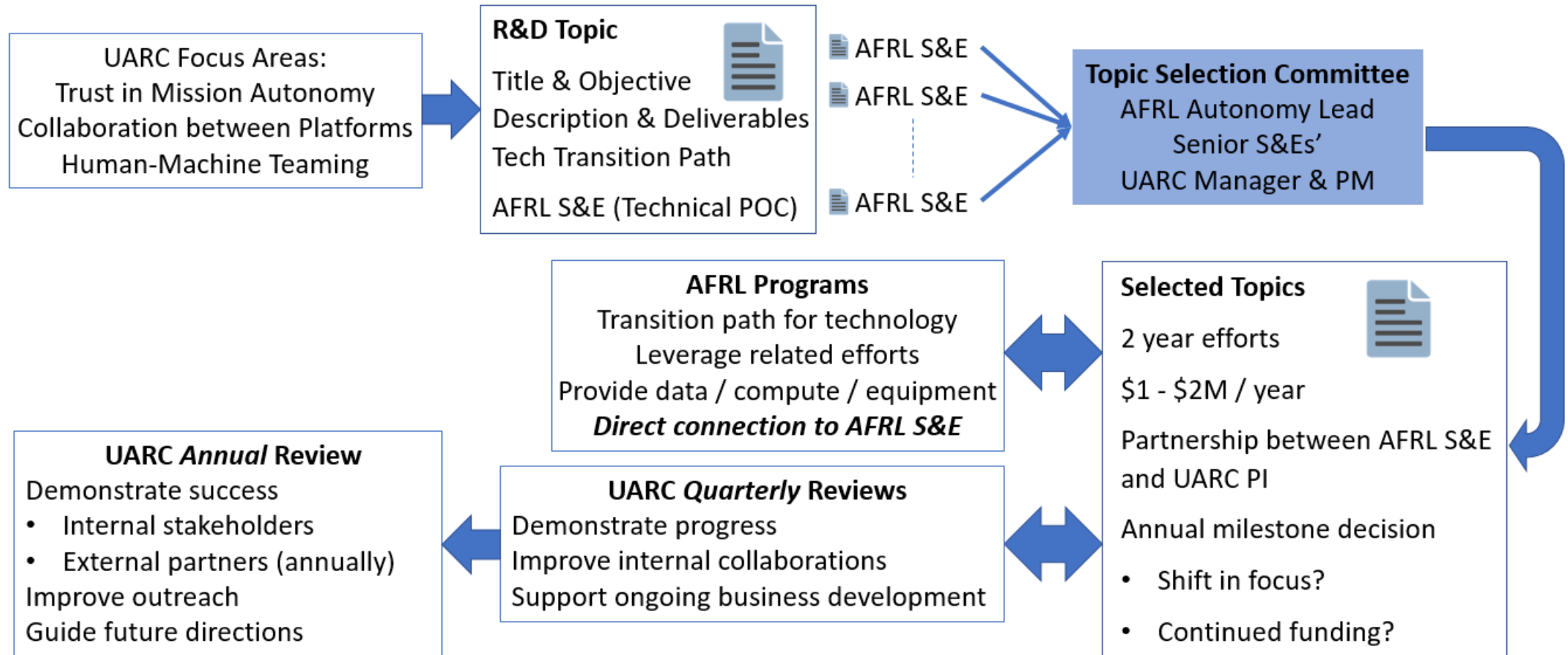 - Adaptability – broad, flexible solutions; functionality change.

Requirements Technical

Human-Machine Teaming

- Hybrid teaming where individuals have different roles. Roles need to be flexible – subordinate, peer, and supervising/tasking.
- Identify levels of acceptance, failure, etc., for approval. Describe and develop assessments to define levels of success.
- Requirements over time to achieve optimal performance.
- Research must answer the following questions
  - What is the system doing?
  - Why is it performing in this manner, and,
  - What happens if it's exposed to a different set of variables?
- Systems can use a representation with similar aspects of human cognition to facilitate the formation by the human teammates of a mental model of what the Tactical Autonomy is doing. Alternatively, in some instances joint training, co-creation between the human operators and the Tactical Autonomy developers.
- Research and development of systems must be inter-predictable. If systems must represent explainability, they are likely to suffer a loss in performance.
- Research and development of systems must focus on the dynamic between explainability and performance to avoid sacrifices in performance. It must be additive to the human-machine teaming relationship to spur development in Tactical Autonomy and be identified as an asset in real-time operations.
- Areas of particular interest are tactical autonomous systems that:
  - Enhance multi-domain situational awareness
  - Reduce Cognitive Workload
  - Enable Force Protection
  - Support Cyber Defense
  - Augment Logistics
  - Automate maneuver and mobility

Requirements Technical

Air Force Topic Selection

R&D Topic

Title & Objective
Description & Deliverables
Tech Transition Path

AFRL S&E (Technical POC)

AFRL S&E
AFRL S&E
AFRL S&E

Topic Selection Committee
AFRL Autonomy Lead
Senior S&Es'
UARC Manager & PM

UARC Focus Areas:
Trust in Mission Autonomy
Collaboration between Platforms
Human-Machine Teaming

AFRL Programs
Transition path for technology
Leverage related efforts
Provide data / compute / equipment
Direct connection to AFRL S&E

Selected Topics

2 year efforts

$1 - $2M / year

Partnership between AFRL S&E and UARC PI

Annual milestone decision

- Shift in focus?
- Continued funding?

UARC *Annual* Review
Demonstrate success
- Internal stakeholders
- External partners (annually)
Improve outreach
Guide future directions

UARC *Quarterly* Reviews
Demonstrate progress
Improve internal collaborations
Support ongoing business development

Requirements: Consortium

- The recipient shall create a Consortium Coordination Plan (CCP) agreement between the lead institution and consortium members clearly outlining the responsibilities of the consortium lead and those of the supporting HBCUs, or non-HBCU institutions of higher education (IHE) providing pro-bono or in-kind R&E support. Plans should identify additional faculty requirements in the research area of interest. Research staff, Contract Staff, and other personnel required to support the research and manage the program.

Lead the Consortium

- The recipient shall serve as the lead institution and shall plan Consortium Management Committee (CMC) Meetings, submit consolidated Consortium-wide deliverables, conduct program evaluations and overall outreach and communications efforts. The Recipient will also be responsible for the distribution of funding to all members of the Consortium. At a minimum the CCP shall include:
  - Prospective HBCUs
  - Definitions
  - Lead Institution Agreement
  - Responsibilities of Individual Members
  - Data Management
  - Confidentiality
  - Intellectual Property
  - Termination
  - Governing Law and Dispute Resolution
  - General Provisions

Structure and Operation of the Consortium

- Summarize the organization of your consortium, its governance structure, and how it will be managed. You should include details on the funding plan for the lead institution and what functions it will provide to the consortium members. Also include details on how member institutions will request-receive-execute funding, how their performance will be evaluated and how underperforming members can improve their performance or be removed from the consortium.
- Prepare the next generation. Provide a focus on education and training research, both in research on education and training, and in the actual education and training of researchers, graduate students, and practitioners.

STEM

- The recipient shall utilize the consortium to achieve the STEM objectives (see next slide). The CCP shall address (macro level) the plan to achieve this.

Requirements: STEM Education

Develop workforce training, career and technical education programs to support K-12 and postsecondary education programs and activities

Build an **autonomy pipeline** with training programs for undergraduate, graduate, and postdoctoral opportunities	Increase awareness of potential **ethical, social, safety, and security** risks of autonomous systems	Create **curriculum for teaching** topics autonomy-related topics to new and skilled workers	Support **equitable access to K-12** autonomy education for populations historically underrepresented in science & engineering	Promote widespread understanding of **autonomy principles and applications** to societal and economic needs

Proposal Preparation

Proposals must:

Demonstrate and articulate a **clear, unique and innovative** approach to achieve the Technical Requirements. New and creative solutions and/or advances in knowledge, understanding, technology, and the state-of-the art.

Demonstrate a **clear, complete, creative and achievable approach** for developing and leading a consortium of HBCUs to achieve the stated objectives to include increasing Carnegie Research Foundation Classification(s) from R2 (high research) to R1 (very-high research) for at least one of the consortium schools.

Depict a management structure that **supports the development of an ecosystem in autonomy** related disciplines, between academia, the DAF/DoD, small businesses, and the local/regional community with the express goals of:

- Establishing autonomy related infrastructure,
- Establishing autonomy related business partnerships, and;
- Establishing a long-term relationship with DAF/DoD for the essential engineering, research, and development capability in tactical autonomy.

Proposal Preparation

Proposals must (continued):

Identify STEM education research, development, and related activities to support K-12 and postsecondary education programs and activities, including workforce training and career and technical education programs and activities, undergraduate, graduate, and postdoctoral education, and informal education programs and activities that:

- Support the development of a diverse workforce pipeline for science and technology with respect to autonomous systems;
- Increase awareness of potential ethical, social, safety, and security risks of autonomous systems;
- Promote curriculum development for teaching topics related to autonomy, including in the field of autonomy ethics;
- Support efforts to achieve equitable access to K-12 autonomy education in diverse geographic areas and for populations historically underrepresented in science, engineering, and autonomy fields; and

Promote the widespread understanding of autonomy principles and methods to create an educated workforce and general public able to use products enabled by autonomous systems and adapt to future societal and economic changes caused by autonomous systems.

Broad Agency Announcement (BAA)

- BAA: FA9550-22-S-0001

- Will be posted to https://www.grants.gov/

- Anticipated Release: Aug 2022

- Anticipated Proposal Due Date: Oct 2022

- Anticipated Grant/Contract Award: 8 Dec 2022

- Anticipated Performance Start: 1 Feb 2023

- Questions can be sent to: afrl.hbcu.msi@us.af.mil

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Broad Agency Announcement (BAA)

Authority:

- 10 U.S.C. 3204(a)(3)(B) implemented by:
  - FAR 6.302-3 Industrial mobilization; engineering, developmental, or research capability; or expert services.
- 10 U.S.C. 3204(a)(5) implemented by:
  - FAR 6.302-5 Authorized or required by statute, specifically 10 U.S. Code 4144 The Secretary of Defense may establish procedures under which the Secretary may limit funding to Research and educational programs and activities to historically black colleges and universities under title III of the Higher Education of 1965

*• * Formerly 10 U.S.C. 2304(c)(3)(B)*

Broad Agency Announcement (BAA)

Anticipated Award:
- 1 Contract to 1 University
- Consortium managed by the 1 awarded University

5 Year Contract:
- Anticipated Period of Performance:
  - 1 Feb 2023 – 31 Jan 2028
- UARC re-certification occurs every 5 years to determine continuation

Estimated Value:
- $60,000,000 ($12M per year)
- Ceiling estimated at about $90M

Contract Type:
- Contract: Indefinite Delivery, Indefinite Quantity (IDIQ)
- Cost Plus Fixed-Fee

Broad Agency Announcement (BAA)

Eligibility:
- Historical Black Colleges and Universities <u>and</u>
- Carnegie Foundation Classification of R2 or higher
- Responsible based on FAR 9.1
  - At a minimum, we'll check FAPIIS and SAM

Fund Types:
- Predominantly 6.2 Applied Research
- May utilize 6.1 Basic Research

Selection Process:
- Proposal Merit
- Cost realism and reasonableness analysis

Broad Agency Announcement (BAA)

Principal evaluation and selection criteria:

- The <u>technical merits</u> of the proposed research and development. New and creative solutions and/or advances in knowledge, understanding, technology, and the state of the art; and,

- <u>Potential relationship of the proposed research and development to Department of Defense missions</u>. These efforts should be demonstrated through a Consortium Plan that is clear, complete, creative, and achievable to accomplish the objectives and demonstrate a structure to support an ecosystem in autonomy related disciplines, between academia, the DAF/DoD, small businesses, and the local/regional community with the express interest to increase opportunities for faculty, staff, and students to recognize the Air Force, Space Force, and Department of Defense mission and related challenges in science and engineering.

Principal selection criteria are of <u>equal importance </u>to each other.
The combined principal selection criteria are more important than the additional evaluation and selection criteria.

Broad Agency Announcement (BAA)

Additional evaluation and selection criteria:

- The likelihood of the proposed effort to <u>develop new research capabilities and broaden the research base</u> in support of U.S. national defense;
- Adequacy of current or planned <u>facilities and equipment</u> to accomplish research;
- Cost realism and reasonableness analysis

Principal selection criteria are of <u>equal importance</u> to each other.
The combined principal selection criteria are more important than the additional evaluation and selection criteria.

Awards: Contract

Purpose:

- Mutually binding legal relationship obligating the seller to furnish the supplies or services (research) and the buyer to pay for them.

Terms and Conditions:

- Federal Acquisition Regulation (FAR)
- https://www.acquisition.gov/browse/index/far

Indefinite Delivery/Indefinite Quantity (IDIQ):

- Provides for an indefinite quantity, within stated limits, of research during a fixed period. The Government places orders for individual requirements.
- Requires the Government to order and the contractor to furnish at least a stated minimum quantity of research. In addition, if ordered, the contractor must furnish any additional quantities, not to exceed the stated maximum.
- The base contract has no funding associated with it, and lays out the terms and conditions and pricing, applicable to any orders placed against the base contract.
- FAR 16.5

Questions

All Q&As will be documented for the record & future distribution

Verbal answers will be provided to the best of our knowledge

After the conference, the UARC Manager/Contracting Office will validate answers and revise, if needed

Official Q&As will be distributed to all registered parties via email in approximately 1 week

1. Does the Department of Defense currently have a UARC that is organized in a consortium fashion?

Yes, the Stevens Institute of Technology Systems Engineering Research Center (SERC) based in New Jersey

2. Does the recipient organization have to demonstrate financial administration of security requirements such as CUI or classified?

The primary recipient will be responsible for financial and security requirements. Those specific requirements will be covered in the BAA. Submitters will be responsible for writing to those requirements. Requirements could flow down to consortium members. For example, if a university requires access to classified information, they must obtain appropriate clearances.

3. Will people who work on projects in the UARC consortium have to have United States citizenship?

A: UARC principal investigators (PI), as well as, any non-lead consortium members PIs, must be U.S. citizens, or permanent residents at time of proposal submission; employed on a full-time basis and holds a permanent position. Any one working on classified work requires U.S. Citizenship.

4. Could the lead institution contract out financial and security requirements as long as they meet the National Industrial Security Program Operation Manual (NISPOM) and Defense Federal Acquisition Regulation (DFAR) requirements?

A: The awarded university is responsible for financial and security requirements. Ultimately, it is a business decision how to meet requirements.

5. Can non-HBCUs including MSIs and R1 institutions participate in the consortium?

A: Any funding from the DAF UARC must go directly to an HBCU. Non-HBCU institutions can be brought on by utilizing an already existing award or relationship with the University, however, DAF UARC funds cannot be used for it.

6. Given the focus on transition, will industry partners be accepted as well?

Yes, in fact, one of the things available for the consortium's utilization, although not directly tied to the UARC's BAA, is the Mentor Protégé Program (MPP). It is a DoD program sponsored by OUSD(A&S). It takes local or regional small businesses that may not have experience working with DoD, and partners them with a larger contractor within the defense industrial base, to ensure they have the right skill sets, and certifications to be better able to compete for DoD awards.

7. What is the expected relationship/collaboration between the DAF, AFRL, and the consortium?

A: The lead institution will interact with the Government Program Manager and his team. The DAF Chief Scientist will enlist a Board of Advisors that meet quarterly to provide valuable advice, expertise, and strategic insight. The program management team will facilitate two-way information flow between the consortium, the government board of advisors, the government S&E teams, and the PI Teams, as required.

8. After the award has been made, can institutions be later added to the consortium?

A: Yes, at any time, other institutions can be identified and recommended for inclusion by the consortium. Recommendations should be sent to the UARC's DAF management team who will then request Chief Scientist approval thru the Contracting Officer. Alternatively, the consortium coordination plan should include the process by which an institution can be removed for performance failures after completing a performance improvement plan.

9. Can the lead include and share funds with HBCUs that are not R2 classified?

A: Yes, as long as they are HBCUs, they may participate and receive funds.

10. Can R3 and lower HBCUs connect with multiple R2 institutions to be included in more than one proposal?

Yes, it is allowed and encouraged that institutions communicate what they have to offer to the R2 institutions.

11. Does the recipient institution have to include people who hold clearances?

It is not a requirement initially. The government will sponsor the awardees facility and personnel clearances to support classified research. There may be additional requirements in the future depending on the types of projects selected and the government will support the consortium in those efforts.

12. Will showing there are faculty who hold tickets (clearances) be helpful in the proposal?

It is helpful, but it won't preclude anyone from potentially being accepted.

13. Is the funding $12 million per year or $12 million plus $2 million from other agencies? The total is $12 million per year.

14. Will a Business Development Strategy need to be included in the Proposal?

The Consortium Coordination Plan (CCP) planning requires identification of Business Development.

15. In our rates can we include cost of money?

The cost of money cannot be included in the Facilities & Administrative (F&A) rates and exclusively putting it in to the proposal is **not allowed**. As a separate cost it **cannot** be included in the grant. The BAA will address this based on the contract type selected.

16. Are you considering a third agreement as a CRADA?

If the university determines they have a need for a CRADA it will be incumbent upon the university to coordinate with the government laboratory to establish the CRADA. There will not be substantial involvement by the government outside of guidance and program reviews. There will be extensive communication where the university provides information; however, the university will manage the research effort.

THE AIR FORCE RESEARCH LABORATORY

17. How will the operational (shared governance) directly linked to the mechanism of the contract/grant operate? Didn't understand the negotiation component of this award; assumed it would be an IDIQ w/TO. Grants require a different management mechanism, Management TO and Workforce Development TO. Grants will increase the management responsibilities of the university to build a budget and determine how much it will cost.

> The award will be a contract with the potential for grants or cooperative agreements in the future. The BAA will specifically address this issue.

18. The contract would allow other services to add funding. How will other services add funding if the funding vehicle is a grant? Too many degrees of freedom requiring various and sundry permutations and difficult for the universities to propose. The ability to grow and shape should have the maximum flexibility to grow. Is it harder for other agencies to MIPR funding via grant.

> The MIPR process is the same whether it's a grant or contract.

19. How do we relate the money to the consortium? There is concern tied back to the funding as it relates to fairness and equitability. Universities interested in hearing DAF thoughts regarding funding. How the money flows needs to be clear.

The DAF will declaratively state in the BAA which funding mechanism will be used.

20. Will the consortium drive the agenda around Tactical Autonomy? Can each university have their own research around this agenda or one agenda around the consortium or a central driver and each member completes a piece of the requirement?

The university recommends an answer to the identified problem set, which is the purpose of a BAA, unlike a Request For Proposal (RFP) solicitation (the BAA is seeking answers to a problem a Contract directs the development of a thing or research in support of a problem). As the university recommends a solution, the DAF will provide coordinated and approved research topics, likely during the contract kick-off.

21. In trying to align AF Science Strategy broadly and specifically the Autonomous Horizons V1 and V2 documents, the AF guidance seems to be focusing on Human Factors and Industrial Engineering. However, the broad conversation about the UARC seems to be more focused on engineering and things like sensing and control.

The short answer is both areas of research are within scope of the UARC. The intent of the findings in V2 go beyond the Human Factors and Industrial Engineering in the following way. They include knowledge as a fundamental concept, and in the AI world, knowledge comes from Human Factors, Industrial Engineering, Automated sensing and control. In addition, the 3 technical focus areas of the UARC can be loosely mapped to these areas as follows:

Human Factors and Industrial Engineering: Trust and Human-machine teaming Sensing and control: Collaboration between platforms

All of these areas are in play within the UARC. I would encourage you to think of the R&D space to include every mission aspect of an autonomous system. That includes traditional automation (think robotics) along with significant focus on the human aspect. The current AF strategy does not assume autonomous systems will operate open loop without a human in the system. The level of human oversight is very much a part of the R&D (trust and human-machine teaming being the keys). Given this rather large breadth, I believe a successful UARC will come from a combination of experience within the lead institution augmented by the partners of the consortium.

Points of Contact

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