PROGRAM TITLE: U.S. Army Research Laboratory (ARL) Historically Black College and University (HBCU)/Minority-Serving Institution (MI) Partnered Research Initiative (PRI). Under the ARL HBCU/MI PRI, funding will be provided for HBCU/MIs to participate in highly collaborative research opportunities with major ARL collaborative research Programs.

ELIGIBILITY: This opportunity is only open to HBCU/MIs as provided in 10 U.S.C. § 2362, eligibility for this competition is open only to "covered educational institutions," which are defined as:

a. institutions of higher education eligible for assistance under Title III or V of the Higher Education Act of 1965 (20 U.S.C. 1051 et seq.); or

b. accredited post-secondary minority institutions.

Enrollments, accreditation, and other factors may affect an institution's eligibility in any given year. With the exception of HBCUs and Tribal Colleges and Universities (TCUs), in order to meet the eligibility criterion noted above, an institution must apply to the Department of Education (DoEd) each year for Title III or Title V eligibility. A copy of the DoEd letter dated January 2016 or later certifying eligibility for Title III or Title V assistance must be included with each Whitepaper submitted under this program. The eligibility letter will not be included in the page limit.

If the DoEd eligibility letter is not submitted with the initial Whitepaper, the submission will be deemed ineligible and the submission may not be considered.

SUMMARY: This is a call for HBCU/MIs to submit whitepapers expressing their interest in participating in highly collaborative research opportunities with major ARL collaborative research Programs under the HBCU/MI PRI. There are six ARL collaborative research Programs identified as part this opportunity. These six ARL Programs are described below and some recommended research topics to be considered within each Program are described for each.

PROCESS: The following represents the process to be used to make awards for the HBCU/MI PRI:

1. Whitepapers are to be submitted to the ARL Cooperative Alliance Manager (CAM) identified for each of the six ARL collaborative research Programs. The format and content of the Whitepapers, as well as submission information, are described below. Whitepapers may be submitted to more than one of the six ARL Programs; however, each Program requires a separate submission. Further, while there is no limit on the number of Whitepapers submitted by each institution, each named Principal Investigator from an institution can submit only one Whitepaper to each of the six ARL Programs.

2. Whitepapers will be reviewed by the ARL CAM as well as the Consortium leadership for each of the six ARL Programs. The HBCU/MI may be contacted by the ARL CAM for further discussions of the Whitepaper, should there be any questions on the Whitepaper or should the ARL CAM like to discuss the proposed incorporation of the research effort into the ARL Program. The ARL CAM and the Consortium leadership will make the decision jointly as to which Whitepapers will be included in submissions to ARL leadership for consideration for award under the ARL HBCU/MI PRI. That decision will primarily be made on: 1) the scientific and technical merit of the proposed research; 2) the extent to which highly collaborative research efforts can be realized; and 3) how the proposed research project contributes to the overall success of the ARL Program.

3. ARL leadership will review the proposals submitted jointly by the ARL CAM and the Consortium leadership and make the decision on which proposals to award. The decision on which proposals to award will be made using the same considerations described in #2 above, as well as balancing those decisions across ARL's current mission needs. More than one award may be made to a single ARL Program and some ARL Programs may not receive an award. Once the selections have been made, modifications will be executed under the Cooperative Agreement awards for each of the ARL Programs to provide for the research project described in the proposal. The Consortium for that ARL Program will then provide a sub-award to the HBCU/MI to fund their research efforts.

FORMAT AND CONTENT OF WHITEPAPER SUBMISSION: Submissions should not exceed 5 pages. Included in the 5 page submission should be a 3-page Project Summary/Abstract that should provide a concise description of the research/collaboration to be conducted, the institution(s), and technical ARL collaborative research Program under which the submission should be considered. An additional page should identify the PI and other key personnel, summarizing research credentials. A final page should include a budget outline and justification. The budget outline should include costs for faculty and student support, proposed equipment purchases, training, travel, partner/sub-awards, and any other related costs.

The white paper should provide sufficient information on the research being proposed (e.g., hypothesis, theories, concepts, approaches, data measurements and analysis, etc.) to allow for an assessment by a technical expert(s). It is not necessary for white papers to carry official institutional signatures.

FUNDING: Funding for this program is anticipated to be approximately $2M/year, which will be enough to support approximately four or five research projects at up to $500K/year. Of the up to $500K per project per year, up to 30% may be used by existing members of the associated ARL Program to foster a collaborative research environment and enable connected, interdependent and solidly joint, highly collaborative research efforts. Therefore, submitters, if successful, can expect an award that is up to $350K per year, if 30% of the maximum total effort ($150K of $500K) supports collaborating efforts of existing members of the ARL Program. Awards are anticipated to be a three-year base period with one additional year possible as an option for a maximum duration of four years. Funding levels for the optional fourth year will be on par with annual costs associated with the base award and are contingent upon funds availability and having met technical goals.

VERY IMPORTANT: There is no guarantee that any of the whitepapers submitted will be recommended for funding. More than one whitepaper may be recommended for funding via a single collaborative research Program opportunity. On the other hand, it is possible that no whitepaper associated with a particular collaborative research Program opportunity may be recommended for funding. It is anticipated the awards will be made as modifications to existing cooperative agreements. All awards are contingent upon the availability of funds.

WHITEPAPER SUBMISSION INFORMATION: Whitepaper submissions must be received by 4:00 p.m. Eastern Standard Time, Wednesday, June 8, 2016. Whitepaper submissions are due with DoEd eligibility letter to the cognizant ARL collaborative research Program CAM and to Ms. Patricia Huff (patricia.a.huff.civ@mail.mil) – please email a copy of your submission to both parties before the deadline. VERY IMPORTANT: Applicants are responsible for submitting their whitepaper in sufficient time to avoid the possibility of late receipt (for any reason, including technical difficulties). Submissions received after the deadline will be deemed ineligible and no further consideration will be given to them.

The Government will acknowledge receipt of each Whitepaper submission via a return email to the submitter. As stated above, the submitter may be contacted to discuss the Whitepaper. Once the decision has been made as to which Whitepapers will be included in a proposal submission to ARL leadership, the submitter will be informed that either: 1) the Whitepaper is being included in a proposal submission to ARL leadership; or 2) the Whitepaper submission is not being considered further in connection with the ARL HBCU/MI PRI. Finally, submitters whose whitepapers become part of a proposal will be notified if the proposal is funded or not. No further feedback concerning Whitepaper submissions will be provided to submitters beyond what is described herein.

DESCRIPTION OF SIX ARL COLLABORATIVE RESEARCH PROGRAMS:

1. ROBOTICS COLLABORATIVE TECHNOLOGY ALLIANCE

a. Background

The Robotics Collaborative Technology Alliance (RCTA) is focused on fundamental research to enable effective teaming of soldiers and unmanned systems as part of a small unit. This vision foresees unmanned systems becoming integral members of the small unit, tasked as a subordinates through speech or gesture, having a common perception of the surrounding world and able to place it into context, composing appropriate behaviors from modular skill sets based upon an understanding of both “commander’s intent” and specific instructions, having the transparency and reliability to engender trust from human teammates. This is a long term goal that has spawned research activities focused upon contextual perception, teaming and behaviors, adaptive learning, and the ability to operate in complex three-dimensional environments. The research is focused upon creating the fundamental technology that will permit unmanned systems (cyber-physical systems) the ability to conduct operations in dynamic, unstructured environments that will contain adversaries that are actively trying to interfere with those operations. This research is also creating a number of potential near-term capabilities, ready for transition to programs focused on Force 2025.

b. Topic Area

To date, the RCTA has not actively considered ways in which the technology can fail, accidently or intentionally, be disabled, fooled, or used to the detriment of blue forces. This announcement seeks to identify research that will identify such potential failures, to include protections or design elements that can recover from failures. Potential failure modalities can include software, hardware, and operational failures. In particular, the RCTA must identify the appropriate to inform the user(s) about confidence and uncertainties of robot performance; ways for the robot to identify when it is not being used "appropriately," e.g., when are shared mental models being violated and to what purpose; how to recover [from] such failures or attacks. Research should identify and create defense mechanisms for robot, e.g., robot "trust" in the user. Additional complications may arise from the networking of multiple agents, both human and machine.

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2. COGNITION AND NEUROERGONOMICS COLLABORATIVE TECHNOLOGY ALLIANCE (CTA)

a. Background

The Cognition and Neuroergonomics Collaborative Technology Alliance (CaN CTA) is the Army's flagship basic science research and technology transition program in the neurosciences. The CaN CTA's research program is aimed at advancing and accelerating the maturation of neuroscience-based approaches to understanding Soldier performance in operational environments and to enhancing future Soldier-system development. In particular, the CaN CTA seeks to understand the brain mechanisms involved in, and the cognitive burdens associated with processing the increased volume and variety of information that come with advances in battlefield technology. By leveraging gains in this understanding, the CaN CTA strives to establish the fundamental translational principles of neuroscience-based research and theory into Army relevant domains. Toward these goals, the CaN CTA research is currently focused in three primary areas: 1) advanced computational methods for extracting and interpreting task-relevant patterns of neural activity from high-dimensional, complex, and noisy brain-imaging data; 2) brain-computer interaction technologies and applications; and 3) technologies and methods for non-invasive, holistic imaging of brain-body in real-world environments.

b. Topic Area

The CaN CTA is seeking to expand this application of neuroscience-based approaches into the context of human-autonomy integration. Human-autonomy integration is a growing, multi-disciplinary area of research that is relevant to a number current Army programs. As autonomy proliferates into increasingly complex application spaces, developers continually work to define methods that successfully and optimally leverage the capabilities and offset the limitations of multiple human and autonomous agents. A fundamental issue underlying the transition of autonomous or semi-autonomous technology from the laboratory into an operational environment is how well it will integrate with the humans in that environment to perform complex tasks. Humans can generally adapt to dynamic task and environmental complexities during decision making. However, humans are constantly undergoing state changes, and even skilled humans are sometimes flawed and make errors. These state changes and the likelihood of errors makes the problem of integrating autonomous technologies with humans extremely challenging. Unfortunately, autonomous systems often do not take this performance variability into account, and thus cannot adapt to it. As a result, the overall performance of the joint human-autonomy system fails to achieve its full potential. Thus, the CaN CTA seeks to complement research in human-autonomy integration from a neurophysiological perspective. Specifically, we are interested in research that utilizes biological and neurophysiological signals to reveal additional information about the state or intent of the human operator while engaged with autonomous or semi-autonomous systems. Likewise, we are interested in research to identify the fundamental neuroscientific principles for dynamic integration of operator state within both the design and utilization of future autonomous systems.

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3. NETWORK SCIENCE COLLABORATIVE TECHNOLOGY ALLIANCE (CTA)

a. Background

The Network Science Collaborative Technology Alliance (NS CTA) is a collaborative venture between ARL, CERDEC, Academia, and Industry to create fundamental knowledge about complex multi-genre networks. Alliance researchers perform foundational, cross-cutting research for a fundamental understanding of interactions, interdependencies, and common underlying science among social/cognitive, information, and communications networks. Prediction and control of the composite behavior of these complex interacting networks will ultimately enhance effectiveness in network-enabled warfare and counterinsurgency. The NS CTA research program is structured as four interdisciplinary technical thrusts: Co-evolution and Dynamics of Inter-genre Networks (Co-EDIN); Information Processing Across Networks for Decision-Making (IPAN); Quality of Information for Semantically-Adaptive Networks (QoI-SAN); and Trust, Influencing, Modeling & Enhancing Human Performance (TIME). The following gaps have been identified:

b. Topic Areas

i. Novel Machine Learning for Big Data

The speed and dynamics associated with multi-genre (communications, information, social-cognitive) networks limit our ability to learn and model the evolution of complex phenomena. As a consequence, modeling is a difficult problem, particularly when complex heterogeneous networks interact with different time scales and with variable spatio-temporal footprints. The number of variables that could be monitored at different layers of the communications network, within social networks, within collaborative teams, and across information networks can be very large and diverse. Moreover, a key challenge is discovering unusual features and patterns in spatially and temporally varying networks, from partially observed data. Automated learning of the low-dimensional "signal manifold" of the structure and behavior of multi-genre networks is critical. Recent developments in computational theory and data science (such as deep graph learning) have led to substantial improvements in computer-based cognition of massive and complex data. These new approaches have led to substantial advancements in many domains. However, gaps still remain: in automated learning without labeled data samples, in coping with very large dimensional data under storage and communication constraints, in exploiting user- and context-dependence in extracting the signal subspace, and in learning in the face of adversarial and environmental deception.

ii. Game Theory, Informed by Socio-cultural Patterns

This gap spans multi-genre network science and cyber science. The study of group-group interactions, particularly in the non-asymptotic regime, is relevant to modeling the actions of groups of cyber adversaries, as well as group behaviors such as collaborative problem-solving, influence propagation and network formation games in network science. Behavioral game-theoretic approaches are potentially useful in modeling adversary-defender interactions as well as cooperative behaviors under resource constraints. Absent from current analytical approaches are incorporation of socio-cultural factors. But socio-cultural factors are critical to modeling adversaries, particularly adversarial groups, and to understanding the motivation for information/influence spreading. Hence, socio-cultural factors should be explicitly incorporated in the modeling of (partially or inaccurately known) strategies in game theoretic approaches to cyber maneuver and to network formation games.

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4. CYBER SECURITY COLLABORATIVE RESEARCH ALLIANCE (CRA)

a. Background

The Cyber Security Collaborative Research Alliance (Cyber CRA) is a collaborative venture between ARL, CERDEC, Academia, and Industry to create fundamental knowledge about cyber security phenomena, especially the theories and models of how adversarial behavior characteristics such as features, evolution, observability and degree of success depend on the defensive mechanisms and characteristics of Army networks. The goal is to develop fundamental knowledge of the laws, theories, theoretically-grounded concepts, and empirically validated models1 to enable the rapid design of cyber defense tools and predictive analysis of malicious activities on Army networks. The Cyber CRA research program is structured as three research area in risk, detection, and agility and one cross-cutting research initiative in psychosocial effects. The following gaps have been identified:

b. Topic Areas

i. Model Learning

The Cyber CRA is investigating an "operational model" framework, as a formal structure for reasoning about cyber-maneuvers and security goals and strategies in the face of dynamics in the environment and adversarial actions. This framework provides a potential umbrella tying together detection, agility and risk assessment. Extending the model to multiple simultaneous processes (attacks, maneuvers) and to networked scenarios leads to a state explosion problem. Potential approaches include model reduction, predicate abstractions and recent developments in AI. A second issue is that manual construction of the model is impractical in the face of multiple threats spread in space and time. To cope with this, we need approaches for "model learning": automatically infer the model, and represent it in a solvable or simulation-ready structure (the latter may be specific to the analytical solution or simulation engine).

ii. Game Theory, Informed by Socio-cultural Patterns

This gap spans multi-genre network science and cyber science. The study of group-group interactions, particularly in the non-asymptotic regime, is relevant to modeling the actions of groups of cyber adversaries, as well as group behaviors such as collaborative problem-solving, influence propagation and network formation games in network science. Behavioral game-theoretic approaches are potentially useful in modeling adversary-defender interactions as well as cooperative behaviors under resource constraints. Absent from current analytical approaches are incorporation of socio-cultural factors. But socio-cultural factors are critical to modeling adversaries, particularly adversarial groups, and to understanding the motivation for information/influence spreading. Hence, socio-cultural factors should be explicitly incorporated in the modeling of (partially or inaccurately known) strategies in game theoretic approaches to cyber maneuver and to network formation games.

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5. MULTISCALE MULTIDISCIPLIANRY MODELING OF ELECTRONIC MATERIALS COLLABORATIVE RESEARCH ALLIANCE (CRA)

a. Background

The Multiscale Multidisciplinary Modeling of Electronic Materials (MSME) CRA focuses on establishing the scientific foundations to enable predictive design of electronic materials from the smallest to the largest relevant scales. To achieve this, the Alliance is working on advancing the fundamental science, understanding and state-of-the-art (SoA) for modeling capabilities relevant to: A) Electrochemical Energy Devices; B) Hybrid Photonic Devices; and C) Heterogeneous Electronics and D) Cross Cutting Themes. The aim of this effort is to develop validated multiscale models to control transport, interfaces & defects within semiconductor & energy conversion devices. These validated multiscale models will be used to optimize and develop growth, processing, and synthesis of heterogeneous materials. Materials challenges being addressed through these efforts include developing fundamental physics based models for describing transport at/across interfaces for electrons, phonons, energy and/or mass/ions. Models describing defects, surfaces and interfaces are also being developed to understand and design materials/devices with strain, heterogeneities, impurities, point defects, vacancies, etc. Computational models are being developed for bridging the scales as well uncertainty quantification and verification and validation to fully realize materials by design for Army applications.

The objective of the MSME CRA is to conduct fundamental research to create multiscale models to support development of future electronic materials and devices for the Army. The CRA is working three electronic materials research areas to include electrochemical energy materials, hybrid photonics and heterogeneous electronics. The five core elements of the program are: 1) Modeling and Simulation: validated multiscale modeling of electronic materials to design materials and predict performance by exploiting the hierarchy of scales in a multidisciplinary environment; 2) Bridging the Scales: analysis, theory and algorithms, conduct theoretical and analytical analyses to effectively define the interface physics across length scales; 3) Multiscale Modeling Metrics: utilize existing and novel experimental methodologies to validate computational approaches in order to bridge the characteristic length and time scales, and to identify the comprehensive set of material characteristics for each of the three electronic materials defined above to enable the enhancement or creation of new electronic devices; 4) Validation and Verification: comprehensive validated experimental capabilities bridging time and space for probing the physics and mechanisms of electronic materials for verification and validation of multiscale physics modeling; and 5) Processing and Synthesis: validated modeling and techniques for the synthesis and processing of electronic materials.

b. Topic Area

To date the CRA has been working on developing validated multiscale models at and across the relevant time and length scales in each of the three electronic materials research areas. Gaps exist in developing scale bridging techniques as well as the development of computational techniques for addressing large systems. There is a need for research and development of parallel algorithms that exploit strong scaling, are reliable, can operate on advanced architectures and can handle large-scale data analysis. Research approaches for addressing large scale computing challenges are sought for in any one of the following areas: scalable program research (i.e. load balancing, fault tolerance), techniques for mesh generation (automatic or adaptive), meshless methods and particle simulations, and/or standardized efficient parallel IO data management.

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6. MATERIALS IN EXTREME DYNAMIC ENVIRONMENTS COLLABORATIVE RESEARCH ALLIANCE (CRA)

a. Background

The objective of the Materials in Extreme Dynamic Environments (MEDE) CRA is to establish the capability to design materials for use in specific dynamic environments, especially high strain-rate applications. In order to accomplish this goal, the Army Research Laboratory (ARL) established a major basic research program for to address the requisite grand challenges required for more revolutionary advances. This CRA brings the best of advanced materials research and technology together to form a comprehensive external and parallel internal basic research program in the area of multi-scale Materials in Extreme Dynamic Environments.

The purpose of the MEDE CRA is to drive forward and expand the fundamental understanding in the area of multi-scale Materials in ultra-high loading rate environments. The CRA is working of four classes of materials that include ceramics, metals, polymers and composites. The five core elements of the program are 1) Modeling and Simulation: Two-way multiscale modeling (predicting performance and designing materials); 2) Bridging the Scales: Using analysis, theory and algorithms, conduct theoretical and analytical analyses to effectively define the interface physics across length scales; 3) Advanced Experimental Techniques and Computational Validation: Use comprehensive experimental capabilities to verify and validate the physics and mechanisms of materials subjected to extreme dynamic environments, considering the effects of time and space on such multi-scale physics problems; 4) Multiscale Material Metrics: Determine a comprehensive set of metrics that define high loading rate tolerant material systems and enable their processing and manufacture; and 5) Processing and Synthesis: Develop modeling and techniques for the synthesis and processing of high loading rate tolerant materials

b. Topic Area

To date the program has focused on developing the relationships between the structure (i.e. microstructure) at various scales and the dynamic properties and high rate energy dissipation mechanisms. Gaps still exist in our ability to measure the evolution of these structures at small scales and a high strain rates. Additionally, advanced process modeling of these materials has not yet been fully developed within the program. The CRA would like to pursue opportunities with institutions that can expand our efforts in high rate characterization at various scales, or contribute to process modeling studies. Identification of how a material's internal structure changes in situ when subjected to high rate deformation is critical to the program's long term success. New and novel methods to observe real-time microstructural changes in all four material classes are of great interest.

Process modeling, while somewhat mature for a few materials, is still in its infancy for many others. To execute a materials by design capability for protection materials, it will be necessary to have mature process models for the materials of interest, including metals, polymer, ceramics, and composites. Efforts directed toward the maturation of process models in these materials classes could be of great value to our ongoing efforts. Specifically process models adaptable to magnesium alloys, boron carbide, or ultrahigh molecular weight polyethylene are needed.

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