

**COOPERATIVE AGREEMENT**

**BETWEEN**

*(to be completed at award)*

**AND**

**U.S. Army Research Laboratory**

**CONCERNING**

**MULTISCALE MULTIDISCIPLINARY MODELING OF ELECTRONIC MATERIALS (MSME)  
COLLABORATIVE RESEARCH ALLIANCE (CRA)**

Agreement No.: W911NF-12-2-00xx

Total Estimated Funding of the Basic Period Agreement: \$ *(to be completed at award)*

Total Estimated Government Funding of the Basic Period Agreement: \$ *(to be completed at award)*

Total Estimated Recipient Cost Share of the Basic Period Agreement: \$ *(to be completed at award)*

Total Estimated Funding of the Option Period Agreement: \$ *(to be completed at award)\**

Total Estimated Government Funding of the Option Period Agreement: \$11,000,000.00\*

Total Estimated Recipient Cost Share of the Option Period Agreement: \$ *(to be completed at award)\**

\* While the Total Estimated Government Funding of the Option is listed above, the Recipient will be requested to provide a complete cost proposal for the optional five-year period of performance as part of the evaluation to be completed prior to making the decision concerning this optional period (See Article 5.1.2 and 5.1.3)

CLIN 0001 is hereby established in the amount of \$ *(to be completed at time of award)*. CLIN 0001 is funded as set forth below. Additional CLINs will be established, subject to the availability of funds, up to the Total Estimated Amount of the Agreement set forth above.

Government Funds Obligated: \$ *(to be completed at time of award)*

Authority: 10 U.S.C. 2358

Accounting and Appropriation Data:

<b>ACRN AA:</b>	
Appropriation No.:	
Requisition No.:	
Amount: \$	
Applicable CLIN:	0001
Applicable SubCLIN:	000101

This Agreement is entered into between the United States of America, hereinafter called the Government, represented by the **U.S. Army Research Laboratory (ARL)**, and *(to be completed at time of award)*, pursuant to and under U.S. Federal Law.

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## ARTICLE 1 – SCOPE OF THE AGREEMENT

### 1.1 Introduction

This Agreement is a “Cooperative Agreement” (31 USC 6305) and is awarded pursuant to 10 USC 2358 Research Projects. The Parties agree that the principal purpose of this Agreement is for (to be completed at time of award), hereinafter referred to as the “Recipient,” to provide its best research efforts in the support and stimulation of fundamental research and not the acquisition of property or provision of services for the direct benefit or use of the Government. FAR and DFARS apply only as specifically referenced herein. This Agreement is not intended to be, nor shall it be construed as, by implication or otherwise, a partnership, a corporation, or other business organization.

### 1.2 Background and Vision Statement

Today, the performance and effectiveness of many advanced Army materials are fundamentally influenced by finite scale effects. Whether a technology can suit the needs of the warfighter – by lightening the load, extracting selected information from the electromagnetic environment, or enabling greater lethality, survivability, or sustainability – may ultimately be decided by material constraints due to physical mechanisms at nanometer scales. Thus accurate understanding, influence, and eventual control over those mechanisms, in the broad contexts of synthesis, manufacturing, engineering, and operation of the system to which the materials belong, are the key outcomes sought over a long term. Such capabilities would enable both the discovery of new materials as well as the optimization of existing materials. Universally, however, are features such as defects, surfaces and interfaces, which can profoundly affect physical, chemical, electrical, optical, and mechanical behavior. Study of such material features is a pervasive theme in the global research community but their exploitation to enable control over behavior is the focus of the Army’s larger vision. Rigorous multiscale relationships – articulated through theory, validated by laboratory measurement, simulated via models – are therefore inherent to any approach. Research must plan accordingly to understand how to traverse length and time scales, and also how to exercise that understanding towards material control. The associated underpinning science has the potential to improve the Army’s capabilities in a transformative sense by categorically increasing functionality and mobility while simultaneously reducing vulnerability and power consumption.

The Army seeks a sustained research program, comprised jointly of extramural and intramural basic research efforts, which through collaborative research will methodically and systematically push towards this vision. To this end, the Army Research Laboratory will establish the Enterprise for Multiscale Research of Materials with three components: 1) a CRA for Materials in Extreme Dynamic Environments (MEDE), 2) CRA for MultiScale multidisciplinary Modeling of Electronic materials (MSME) and 3) an in-house Initiative for Multiscale Modeling of Materials (I3M).

As part of both CRAs, ARL Scientists will have substantial involvement in performance, with a cadre of ARL scientists engaged in deep and meaningful collaborative research with the other CRA team members. The MEDE CRA will develop the capability to design, create, synthesize, process and manufacture high strain rate tolerant materials and material systems. The MEDE CRA may consider a range of material classes such as metals, ceramics, polymers and composites. The MSME CRA will develop the capability, with modeling emphasis, to create electronic device applications to include sensors and electronics for enhanced battlespace effects and efficient power and energy devices. The MSME CRA will focus on advancing the fundamental science, understanding, and state-of-the-art (SoA) for Multiscale Multidisciplinary Models in each of the following Electronic Materials Research Areas: 1) Electrochemical Energy Devices, 2) Hybrid Photonic, Spintronic Devices, and 3) Heterogeneous Metamorphic Electronics.

As part of ARL’s vision for an Enterprise for Multiscale Research of Materials, the MSME and MEDE Alliances will work collaboratively with the I3M to identify areas for interdependent basic research projects that have definitive links to the current Army mission and long-term vision. Collaborations or transition links among the CRAs and I3M will also be pursued and defined through continuous collaboration, technical exchanges, site visits, staff rotations, and mutual participation in technical reviews during the period of performance. This will strengthen Army/ARL mission-relevance in the CRA research and enable the transition of developments from the Enterprise to further strengthen ARL’s efforts in multiscale multidisciplinary computational science, polymer & soft matter

science, and optoelectronic/electronic/power & energy science. Within these contexts, and through collaborations via the CRA, the outcomes will take the form of theoretical, modeling or experimental methods that improve mission flexibility and capabilities for ARL to pursue its core mission programs and business areas with the visionary arc towards materials by design. Contingent on the availability of funds, the program will also increasingly seek staff and subject matter expertise from the CRA to join the laboratory as jointly-advised students, post-doctoral associates and ultimately as candidates for permanent career civilian positions. These "personnel transitions" will expedite technical transitions while improving researcher collaborations.

The objective of the MSME CRA is to conduct fundamental research to create MSME to support development of future electronic materials and devices for the Army. To achieve this, the Alliance is expected to advance the fundamental science, understanding and state-of-the-art (SoA) for Multiscale Multidisciplinary Models in each of the following Electronic Materials Research Areas: 1) Electrochemical Energy Devices, 2) Hybrid Photonic, Spintronic Devices, and 3) Heterogeneous Metamorphic Electronics. The intent is for the Multiscale Models to be developed by the MSME Team. The experimentation for validation and verification for these models will be performed by ARL scientists in each of the three Electronic Materials Research Areas, which is expected to be part of a continual process to improve and create new models through collaboration between ARL and the MSME Team.

Programmatically, the CRA should initiate and execute a fundamental, cohesive, multidisciplinary collaborative research program that links MSME across length and time scales with validated modeling. Responses to the PA are expected to provide a plan to perform materials by design by addressing the following Multiscale Modeling Research Core Elements for each of the Electronic Materials Research Areas above: 1) Modeling and Simulation, 2) Bridging the Scales, 3) Multiscale Modeling Metrics, 4) Validation and Verification, and 5) Processing and Synthesis. Innovative crosscutting themes across both the Electronic Materials Research Areas and Multiscale Modeling Research Core Elements are envisioned to advance the SoA as part of this initiative.

To accomplish the objectives of this CRA, the Army envisions the PA will establish an environment for the Alliance to advance technology by conducting a number of individual, coordinated and collaborative research tasks based upon a series of consistent, yet flexible annual research plans that will be highly responsive to the needs of the Army and Department of Defense (DoD). These plans will include the interchange of scientists and engineers from among the Alliance participants, as well as educational opportunities that will serve to strengthen the ability of the Alliance and the larger research community to create new understanding and improved electronic device applications to include sensors and electronics for enhanced battlespace effects and efficient power and energy devices.

### 1.3 CRA Programmatic Strategy

The programmatic and research strategy outlined below provides the structure for the desired comprehensive and cohesive outcome of the CRA. The core basic research program will be funded under Budget Activity 1 (6.1 basic research) as defined and discussed below. However, the CRA will also allow participation from other government agencies (see discussion of Enhanced Program below) which may result in additional 6.1 (basic research) funding as well as Budget Activity 2 (6.2 applied research) funding. The research proposed and performed must comply with the definition for Budget Activity 1 or 2 funding (as appropriate) as outlined in the DoD Financial Management Regulation (FMR), Volume 2B, Chapter 5 (July 2008) as follows:

**Budget Activity 1, Basic Research.** Basic research is systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind. It includes all scientific study and experimentation directed toward increasing fundamental knowledge and understanding in those fields of the physical, engineering, environmental, and life sciences related to long-term national security needs. It is farsighted high payoff research that provides the basis for technological progress. Basic research may lead to: (a) subsequent applied research and advanced technology developments in Defense-related technologies, and (b) new and improved military functional capabilities in areas such as communications, detection, tracking, surveillance, propulsion, mobility, guidance and control, navigation, energy conversion, materials and structures, and personnel support. Program elements in this category involve pre-Milestone A efforts.

**Budget Activity 2, Applied Research.** Applied research is systematic study to understand the means to meet a recognized and specific need. It is a systematic expansion and application of knowledge to develop useful materials, devices, and systems or methods. It may be oriented, ultimately, toward the design, development, and improvement of prototypes and new processes to meet general mission area requirements. Applied research may translate promising basic research into solutions for broadly defined military needs, short of system development. This type of effort may vary from systematic mission-directed research beyond that in Budget Activity 1 to sophisticated breadboard hardware, study, programming and planning efforts that establish the initial feasibility and practicality of proposed solutions to technological challenges. It includes studies, investigations, and non-system specific technology efforts. The dominant characteristic is that applied research is directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters. Applied Research precedes system specific technology investigations or development. Program control of the Applied Research program element is normally exercised by general level of effort. Program elements in this category involve pre-Milestone B efforts, also known as Concept and Technology Development phase tasks, such as concept exploration efforts and paper studies of alternative concepts for meeting a mission need.

The program will develop the strategy for a focused effort to execute the Materials by Design Strategy for the three Electronic Materials Research Areas of interest: 1) Electrochemical Energy Devices; 2) Hybrid Photonic, Spintronic Devices; 3) Heterogeneous Metamorphic Electronics. The program and Materials by Design Strategy must contain the following five Multiscale Modeling Research Core Elements:

- **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
- **Bridging the Scales: Analysis, Theory and Algorithms:** Validated theoretical and analytical analyses to effectively define the interface physics across length scales,
- **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 Research Areas defined above to enable the enhancement or creation of new electronic devices
- **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.
- **Processing and Synthesis:** Validated modeling and techniques for the synthesis and processing of Electronic Materials.

#### 1.4 Multiscale Modeling of Electronic Materials CRA Vision

This Agreement will result in the establishment of the Collaborative Research Alliance (CRA) on Multiscale Multidisciplinary Modeling of Electronic Materials, for quantitative understanding of materials from the smallest to the largest relevant scales to create new and improved electronic device applications to include sensors for enhanced battlespace effects, sensing and processing, and efficient power and energy. The goal is to realize “Materials by Design” capability through the MSME CRA in each of the three Electronic Materials Research Areas: 1) Electrochemical Energy Devices, 2) Hybrid Photonic, Spintronic Devices, and 3) Heterogeneous Metamorphic Electronics.

##### 2-Year Goals:

Advance the fundamental understanding and implementation of Physics-Based Modeling of Electronic Materials across both time and space to develop a set of algorithms/theories for a broad range of electronic materials to create new and/or improved electronic devices, and advance the understanding of existing performance. Potential 2-year outcomes include:

- Multiscale models and algorithms that enable better understanding of material, electronic, optical and opto-electronic properties of Col IV, III-V, and II-VI semiconductor materials and devices for sensors and sources from 0-dimensional confinement up to 3-D
- Multiscale models and algorithms that predict the bulk and interfacial properties of fuel cells for development of novel low cost catalysts for fuel cells.

Benefit to the Soldier: Resulting models and algorithms will enable the advancement of sensors and power and energy devices on the battlefield.

#### **5-Year Goals:**

Integrate new multidisciplinary /multi-scale physics to enable multi-scale modeling and simulation capability that is validated experimentally in time and space to apriori design new or improved electronic materials that are uniquely characterized, synthesized and processed.

Potential examples of enhanced SoA resulting from the advancement or development of new theories and algorithms of MSME could include:

- Multiscale models that lead to the development of new generation high voltage rechargeable lithium ion batteries with improved energy and power density based on novel electrolyte formulations that are compatible with novel high voltage cathode materials.
- Develop algorithms and theory of dislocations, interfaces, and surfaces within semiconductor materials and devices for improved device efficiency.

Benefit to the Soldier: Resulting models and algorithms will enable the development of new sensors and power and energy devices on the battlefield.

#### **10-Year Goals:**

Advance the state of the art in multiscale modeling and electronic materials to create a capability for “Materials Optimization and Materials by Design”. Potential 10-year outcomes include:

- Deploy Multiscale Models for a variety of electronic materials that can be shared within the scientific community
- Higher performing (longer-lived) batteries by ~ 30% with more than double to treble the energy density
- Increase efficiency by 20%, with a fivefold increase in lifetime for UV solid state sources
- One order of magnitude reduction in dislocation density for IR detectors on Si → 10X reduction in FPA cost

Benefit to the Soldier: ARL will exercise “Materials by Design” capability to design new sensors and power and energy devices for the battlefield that are more efficient, have longer lifetimes at a lower cost.

### **1.5 Multiscale Modeling Research Core Elements**

The objective of this CRA is to conduct fundamental research to create MSME to support development of future electronic materials and devices for the Army. These models are needed to create new understanding and improved electronic device applications to include sensors and electronics for enhanced battlespace effects, and efficient power and energy devices. Offeror’s are expected to provide a plan to perform the following five Multiscale Modeling Research Core Elements for each of the three Electronic Materials Research Areas discussed below: 1) Modeling and Simulation, 2) Bridging the Scales, 3) Multiscale Modeling Metrics, 4) Validation and Verification, and 5) Processing and Synthesis. To achieve this, the Alliance is expected to advance the fundamental science and state-of-the-art (SoA) for Multiscale Multidisciplinary Models in each of the Electronic Materials Research Areas: 1) Electrochemical Energy Devices, 2) Hybrid Photonic, Spintronic Devices, and 3) Heterogeneous Metamorphic Electronics. Innovative crosscutting themes across both the Electronic Materials Research Areas and Multiscale

Modeling Research Core Elements are envisioned to advance the SoA as part of this initiative. The intent is for the Multiscale Models to be developed by the MSME Team, where validation and verification will be performed through collaboration with ARL scientists in each of the three Materials Research areas.

The following paragraphs discuss research issues in the five Multiscale Modeling Research Core Elements that the U.S. Army considers important for modeling the three Electronic Materials Research Areas discussed below.

**a. Modeling and Simulation:** multiscale modeling (predicting performance and designing materials) including multiscale information transfer between modeling and experimental results. The U.S. Army has the long-term strategy to advance the state of the art in computational electronics materials modeling across the scales both from a Multiscale and Multidisciplinary perspective. The strategy is to develop the material science and computational capability to exploit the scales from quantum through the continuum to provide a predictive capability. The result of the research should include a robust suite of recommended and validated models and codes at all of the length scales appropriate for use in the three major Electronic Materials Research Areas discussed below. The Recipient should consider the following as well as any and all other approaches to propose a modeling and simulation thrust consistent with the overall program strategy and is integrated across all of the Multiscale Modeling Research Core Elements.

- Modeling and simulation codes and algorithms from the atomic scale to the macro-scale (continuum).
- Validated mathematics, physics based algorithms and protocols for moving between all of the scales are required.
- Techniques for embedding models and algorithms into continuum codes.
- Analysis, approach and recommendations for using a multi-scale hierarchical or concurrent methodology
- Development of physics based models and algorithms for embedding into meso-scale and continuum codes.

**b. Bridging the Scales:** Theoretical and analytical analyses to effectively define the interface physics across length scales

The U.S. Army believes that a successful comprehensive program to enable a Multiscale Multidisciplinary Modeling of Electronic Materials requires a parallel and concurrent effort in analysis, theoretical mathematics and algorithms. This aspect of the program should work to (1) extract, evaluate and correlate experimental results either from collaborative efforts with ARL or through published results, (2) theoretically link materials micro, meso and macrostructure across scales and disciplines, (3) provide the foundation for new numerical modeling algorithms, and (4) provide physics insight into equations of state and continuative equations. The offeror should consider the following as well as any and all other ideas and theoretical/mathematical concepts.

- Novel mathematical theories/algorithms that link the fundamental governing equations across scales with the long-term goal to have a unified set of governing equations that are asymptotically valid across scales. Specifically across the interfaces between scales or materials.
- Novel mathematical theories/techniques linking the fundamental governing equations, equations of state and constitutive equations across scales and disciplines that can be used to optimize information transfer due to disparate length and time scales
- Novel deterministic and stochastic to data manipulation and correlation in both modeling and simulations as well as experimental analysis and code validation
- New and novel mathematical techniques that would be the basis for optimum numerical algorithms in a Multiscale/Multidisciplinary environment
- Novel mathematical methodology for enhanced computational techniques

- New mathematical techniques for manipulation and analysis of experimental data for validation and verification needed to understand the capabilities of modeling in a multiscale/multidisciplinary environment
- c. **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 Research Areas defined above to enable the enhancement or creation of new electronic devices.

It is important to be able to describe in detail deterministically and stochastically the characteristics of a material so it can be processed and/or synthesized. The current SoA of this aspect of material science is thoroughly founded for materials subjected to static or slowly varying conditions. The offeror is to consider developing advanced deterministic and stochastic metrics that define the desired properties, microstructure and characteristics for:

- Material properties in time and space
  - Material characteristics, defects and mechanisms allowed statically as well as in time and space
- d. **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.
- e. **Processing and Synthesis:** Validated modeling and techniques for synthesis and processing of Electronic Materials.

A number of the above Elements include experimentation. Experimentation is to be performed by SEDD/ARL scientists through continuous collaboration with MSME Team. Recipients should discuss a plan for what experimentation should be performed to validate their models. Again, SEDD/ARL capabilities are discussed in detail below, where more information can be found online at [www.arl.army.mil](http://www.arl.army.mil). Recipients should put forward a plan based on, but not limited by SEDD/ARL capabilities, that will provide a comprehensive validation and verification component for their planned work. However, Recipients should provide a rationale for using capabilities other than those currently available at SEDD/ARL.

## 1.6. Electronic Materials Research Areas

Material properties of principal interest are electromagnetic and optical, and properties of secondary interest include acoustic, chemical, and mechanical as they are necessary to evaluate the principle properties of interest or to develop rigorous models. Recipients must include Multiscale Multidisciplinary Modeling in each of the three Electronic Materials Research Areas below:

- **Electrochemical Energy Devices**—focus on interfacial physics and chemistry; solid-liquid interface—clear opportunities for batteries, capacitors, fuel cells, etc
- **Hybrid Photonic, Spintronic Devices**—interaction of photons, electrons, phonons—areas such as photonics, spintronics, plasmonics, and phonons
- **Heterogeneous Metamorphic Electronics**—mixed materials, with partial ordering—includes graphene, metamaterials, nanoelectronic structures, etc.

The specific electronic materials to be modeled for this CRA are up to the discretion of the offerors, but they must fall within the three Electronic Materials Research Areas above. Offerors should provide supporting arguments as to the significance, Army Relevance, and potential scientific and technological payoff of the electronic materials in

their proposal. Offerors should also provide a plan for validation and verification specific to the materials selected through collaboration with ARL researchers.

#### **a. Electrochemical Energy Devices**

ARL has identified a number of challenges in electrochemical energy storage and generation that can be effectively addressed through this CRA. Examples of materials and devices of particular interest to ARL in this Electronic Materials Research Areas are Lithium-ion Batteries; Alkaline Membrane Fuel Cells; and Solid Oxide Fuel Cells (offerors may suggest other areas for research, but need to provide supporting arguments for justification).

Lithium ion batteries. Modern batteries require storage of more energy per unit volume and weight, faster charge and discharge for many thousands of charge-discharge cycles. New electrolyte and electrode materials are needed for radical improvement in energy and power density of lithium ion batteries. Currently there is a general lack of understanding regarding the influence of electrolyte components (salts, solvents, additives) on molecular interactions and physical properties (ionic conductivity, viscosity, volatility) and how electrolyte properties influence device performance. Understanding these fundamental properties and interactions will enable design of new electrolytes that are tuned for specific electrode-electrolyte systems and diverse applications in regeneration and storage of energy. Thus, there is an increased need for reliable, transferable and validated multiscale simulation tools and methodologies that would effectively aid experimental efforts in obtaining fundamental understanding of the complex and interrelated electrochemical phenomena occurring in electrodes, electrolytes and at their interface.

Alkaline Membrane Fuel Cells. The Army is considering the AMFC as a low temperature fuel cell for operations with low to intermediate power requirements. The AMFC uses a polymeric alkaline anion exchange membrane (AAEM), which has alkaline-supporting functional groups to promote ionic transport. It is of interest because of the improved electrochemical kinetics offered by the alkaline conditions, including the use of a non-precious metal catalyst. However, there are challenges with the AAEM and electrochemical interfaces that are multiscale in nature and need to be addressed. Multiscale simulation can provide mechanistic details that are difficult to address experimentally regarding processes in the AMFC and can accelerate synthesis and development efforts.

Solid Oxide Fuel Cells. The SOFC is a technology of interest for a range of power requirements. The benefits offered by the SOFC include high efficiencies, availability of useful heat, and ability to use a variety of fuels including processed logistics fuel. However, there are several challenges with SOFC stability. These challenges include issues associated with the chemical, thermal, and mechanical stability of the cell and its constituent materials and structures. Multiscale simulations are well suited for these studies based upon their ability to provide advanced details regarding mechanisms and pathways of these processes, which are difficult to ascertain by experimental methods, providing insights into means to mitigate.

#### **b. Hybrid Photonic, Spintronic Devices**

Multiscale modeling initiatives are sought that address photonics, spintronics, and plasmonics by modeling the interaction of photons with electrons and phonons. Approaches may be multiscale in both space and time, and may span the wavelength range from millimeters to nanometers. Research is sought on the integration of first principle calculations of electronic band structure with continuum models that can predict macroscopic device performance by taking into account potential fluctuations and nanoscale compositional inhomogeneities in random and ordered alloys, as well as spontaneous and piezoelectric polarization as a function of crystal orientation, including anisotropy in optical and transport properties. Additional length scales created by the introduction of photonic cavities and periodic or aperiodic structures are also of interest. In a similar way, a

microscopic understanding of magnetic properties linked to a macroscopic description of spintronic devices is sought. In addition, an integrated approach is sought to model linear and nonlinear electronic and optical processes over multiple time scales that range from microscopic carrier-carrier, carrier-phonon and carrier-trap interactions on femtosecond to picosecond time scales to nonradiative and radiative recombination lifetimes on picosecond to nanosecond time scales, with correlation to device lifetimes that range from hours to years. Phonon-phonon interactions which lead to microscopic heat generation and their relation to macroscopic thermal management in devices is also important. Prediction of defects on the microscale (e.g., interface roughness, threading dislocations, stacking faults, point defects, traps) and their impact on device performance and noise on the macroscale are of particular interest, especially in materials on non-native substrates, as well as for optical and spin coherence in spintronic and quantum logic devices.

### **c. Heterogeneous Metamorphic Electronics**

Research in this Electronic Materials Research Area should yield multi-scale models necessary to describe and predict the interactions between the extrinsic factors of metamorphic materials (e.g. size, shape, adjacent materials, etc.) and their intrinsic properties. Metamorphic materials are traditionally defined as engineered materials (e.g. meta-materials and super-lattices) whose properties are primarily determined by extrinsic factors. However, in this PA the description shall be extended to describe other synthesized nanometer scale materials (e.g. graphene and nanotubes, -wires, and -rods) that also experience extrinsic factors that determine their intrinsic performance. Additionally, heterogeneous structures, where adjacent layers' intrinsic properties are so dissimilar as to substantially alter performance, are included in the general classification.

For material systems in this area, it is not possible to examine their intrinsic properties without consideration of their extrinsic environment. Additionally, the extrinsic-intrinsic interactions, which occur at one scale (either in space or time) can drastically affect performance at different scales. Accordingly, it is first necessary to understand and capture the physical phenomena governing interactions between extrinsic factors and intrinsic properties, and then to extend those relationship across scales.

In addition to extrinsic-intrinsic interactions, these material systems experience phenomena across extreme scales. For example, defect states at the atomistic, or even quantum, level can influence substantially the performance of a fully integrated electronic system. Some examples of materials and devices of particular interest to ARL in this Electronic Materials Research Area are meta-materials, graphene, and integrated heterogeneous electronic structures.

### **d. Innovative Crosscutting Themes**

Offerors should identify and provide a plan for crosscutting themes that will enable innovative research across the electronic materials and multiscale modeling research areas put forth in this CRA. Examples of crosscutting themes could include areas such as computational algorithms, computational mathematics, petascale computing and data analysis, surfaces, defects and interfaces; where advancements would crosscut and apply to more than one materials system. Proposals should include discussion as to how these crosscutting themes will drive technology advancements required to push the science forward.

### **e. Organic Hybrid Electronics (future years)**

For this topic area, ARL is only asking for a plan to incorporate multiscale modeling for "Organic Hybrid Electronics" in future years, to start at the beginning of FY16. The Army has made investments in the development of flexible electronics that include; organic, hybrid-organic and

inorganic electronics that are heterogeneously integrated with electro-optic devices for sensors, imaging, and displays. Flexible electronics has broad impact for rugged, light weight information displays, circuits, large area sensors, imaging devices, and energy harvesting. Some areas of interest for multiscale modeling are charge injection and transport, grain boundary effects, defects, crystallinity, maximal room temperature carrier mobility similar to that of inorganic semiconductors, cycling stress-effects, long time-scale relaxation effects, and operating lifetimes, carrier diffusivity, recombination, quenching, trapping and annihilation rates of excitons, transport models for disordered systems, improved light extraction in optoelectronic devices and applications, quantum efficiency, and quantum optics, charge generation; field effects on carrier transport, charge collection, solar spectrum match for organic photovoltaic cells and macromolecules, photo-conducting detectors; charge injection and transport through single molecules, photo-degradation and device lifetimes, device and systems-level reliability and feasibility of electrically pumped and micro-ring organic lasers, and conversion efficiencies and lifetimes for low-cost, energy-efficient lighting. New modeling and simulation approaches for bandwidth theories, band calculations, coupling constant determination, nano-scale effects, and polaron phenomena are of interest.

The Recipient shall participate in a program of coordinated research, development, and education with ARL in accordance with the Annual Program Plan, which sets forth the specific goals and objectives for the program for each program period. The Annual Program Plans will be provided as attachments to this Agreement. The Recipient shall also comply with the reporting requirements set forth in Attachment 4.

The Government will have continuous involvement with the Recipient. The Government will also obtain access to the research results and certain rights in data, computer codes developed, and patents pursuant to Article 10 and Attachment 1 to this agreement. The Government and the Recipient are bound to each other by a duty of good faith and best research effort in achieving the goals of the Program.

As a condition of this Agreement, it is herein understood and agreed that Federal funds are to be used only for costs that: (1) a reasonable and prudent person would incur, in carrying out the research project herein; and (2) are consistent with the purposes stated in governing Congressional authorizations and appropriations.

## ARTICLE 2 GENERAL DEFINITIONS

**2.1 Recipient** – An organization or other entity receiving a grant or cooperative agreement from a DoD Component. For purposes of this Agreement, the Recipient is *(to be completed at award)*

**2.2 Party** – For purposes of this Agreement, the parties are ARL and the Recipient.

**2.3 Collaborative Alliance Manager (CAM)**. The CA executed under the MSME CRA will be considered an extension and integral part of the ARL research program. As such, the program established under this PA will be planned, defended, executed, and reviewed as part of ARL's mission program. Overall, technical management and fiscal responsibility for the MSME CRA will reside with a senior ARL technical manager, who will be designated the CAM for the MSME CRA under the cooperative agreement. The ARL Grants Officer will receive recommendations from the CAM and will be the ultimate legal authority empowered to make formal adjustments in the MSME CRA, for the CA. The CAM is identified at Article 3.1.

**2.4 Grants Officer** – Is the Government's principal point of contact for all administrative, financial or other non-technical issues arising under the Agreement. The Grants Officer is identified at Article 8.1.

**2.5 Program Manager (PM)**. The MSME CRA PM is the LRO's scientific representative charged with the overall responsibility for management and guidance of the cooperative agreement. The MSME CRA is expected to be the primary responsibility of the individual assigned as PM, and a commitment of time commensurate with this responsibility is also expected. The PM is expected to be an eminent scientist in areas related to the MSME CRA. The PM will need to reduce any teaching schedule commitments commensurate with the duties required to manage

the CRA. It is also recognized that the PM may require staff support to manage and execute the cooperative agreement, and this should be included in the CRA proposal submission.

**2.6 Research Management Board (RMB)** will be established to identify and develop collaborative opportunities, advise and assist the CAM in setting research goals, and facilitate transition to ARL basic and applied research programs. The RMB will be chaired by the CAM and will include representatives from Army, other service organizations and other government agencies with interest and expertise in the technologies related to the CRA. The RMB will be informed about the Annual Program Plan approval process.

**2.7 Agreements Administrator**—The Agreements Administrator has the authority to administer Cooperative Agreements and, in coordination with the Grants Officer, make determination and findings related to delegated administration functions. The Agreements Administrator is identified at Article 8.2.

### ARTICLE 3 PROGRAM MANAGEMENT

**3.1 ARL Collaborative Alliance Manager (CAM).** The ARL Collaborative Alliance Manager (CAM) is:

*(to be completed at time of award)*

**3.2 Recipient Program Manager (RPM).** The Recipient Program Manager (RPM) is:

*(to be completed at time of award)*

**3.3. Management** - Management of the Agreement consists of parallel managers from the Government and the LRO who will provide day-to-day coordination and a consultative group of interested parties from the Government. Offerors may propose additional plans or mechanisms for management; however, offerors are cautioned to ensure that any such plans or mechanisms are: (1) not duplicative of the requirements, and (2) not overly burdensome to the Alliance.

**3.4 Lead Research Organization (LRO)** - The LRO is required to be an academic institution. The academic institution is expected to be an advanced degree-granting educational institution under the Higher Education Act of 1965 as amended. This institution is also expected to have doctoral level courses of study in scientific and research areas related to this CRA that can result in the granting of a doctoral degree. The LRO has primary responsibility for articulating and executing the vision for the basic research and maintaining cross-Alliance collaboration and integration. This Member is expected to articulate a vision for the CRA, promote collaboration among Partners and the Alliance, and coordinate crosscutting themes with the Alliance. The LRO is required to administer, integrate, and manage the Partners, participate in the research, and promote the transition of research and technologies resulting from the basic research program within the CRA. This includes distribution of Government funding to Partners in accordance with the approved IPP/APP under the agreement. Leadership from the LRO is expected to enhance the potential for transition of the resultant research into both the commercial sector and the DoD.

**3.5 Partners (Key Subawardees):** ARL envisions a CRA awarded to a Recipient with two Key Subawardees to meet the objectives for this program. However, the number of Key Subawardees is up to the discretion of the offerors. The Key Subawardees, also known as Partners, will fulfill the goals of this program through intimate involvement in the research program and provision of strategic input concerning the goals and direction of the CRA

**3.6 Subawardees:** The Alliance may be augmented with subawardees to conduct specific research projects as necessary and appropriate to meet the goals of the CRA, especially for the conduct of new and innovative research for which they are particularly suited. At least five percent (5%) of the annual research effort is expected to be devoted to novel and innovative research conducted by the subawardees.

**3.7 Covered Educational Institutions:** The FY10 Department of Defense (DoD) Authorization Act, Public Law 111-84, provides authority for the Secretary of each military department to carry out a program to provide assistance to "covered educational institutions" to assist DoD in defense-related research, development, testing, and

evaluation activities. The term “covered educational institution” is defined to mean an (1) an institution of higher education eligible for assistance under title III or IV of the Higher Education Act of 1965 (20 U.S.C. 1051 et seq.); or (2) an accredited postsecondary minority institution. As defined under title III or IV of the Higher Education Act, “covered educational institution” includes Historically Black Colleges and Universities/Minority-Serving Institutions (HBCU/MSIs).<sup>1</sup> Accordingly, it is required that covered educational institutions receive 5-10% of the annual funding under the CA. This may be accomplished through one of the following: (a) a covered educational institution submitting the proposal as LRO; (b) a covered educational institution being included as a Partner or other subawardee in a proposal; or (c) the proposal including a plan for how the academic institution receiving the award will work collaboratively with the Government to identify a covered educational institution for participation in the program.

### **3.8 Federally-Funded Research and Development Centers (FFRDCs) and National Laboratories:**

FFRDCs and National Laboratories may participate as Partners or other subawardees; however, their participation must be within the scope of their charter or sponsorship agreements. Further, FFRDC’s and National Laboratories must cost-share an amount at least equal to the funding to be provided to them under the CRA.

**3.9 Place of Performance:** There is no limitation on place of performance for any organization participating under the CRA.

### **3.10 Initial Program Plan (IPP) and Annual Program Plan (APP)**

Within 90 days after award, the LRO, Partners and the Government will jointly prepare an Initial Program Plan (IPP) to cover the first 9 months of performance. The IPP will be based substantially on the final proposal received from the Offeror. The IPP will be accompanied by a five-year roadmap that describes the overall plan to be accomplished by the MSME Team within the Alliance structure. This roadmap should provide the vision for grand challenges and crosscutting themes to be addressed during the first five years of the Alliance. The roadmap should provide a detailed description of a well-coordinated plan of technology development and application, balancing theoretical and experimental elements of the program in each of the three Electronic Materials Research Areas

Eight months after award, the LRO, Partners and the Government will jointly prepare a proposed Annual Program Plan (APP) for the next fiscal year. Through discussion among the Alliance, an APP will result that enables integration and execution of crosscutting themes that strive to achieve MSME CRA objectives. The CAM will approve the APP and formally submit the approved APP to the Grants Officer for incorporation into the CA. This process will continue through the life of the CA.

Each APP will cover a one-year timeframe, but may be altered, with the approval of the CAM and the Grants Officer, if research work requirements change. The APP will provide a detailed plan of research activities (including research goals, key personnel, educational opportunities, staff rotation, facilities, demonstrations and budget) that commits the MSME Team to use their best efforts to meet specific research objectives. The APP will also describe the collaborative efforts with the Government. During the course of performance, if it appears that research goals will not be met, the LRO will provide a proposed adjustment to the APP for approval by the CAM. In addition, the CAM may from time to time request that additional research be added to the APP within the scope of the CA.

During the course of performance, the Grants Officer, in coordination with the CAM, will have approval authority for certain specific changes to the IPP/APP including but not limited to:

- Changes in the scope or the objective of the program, IPP/APP, or research milestones;
- Change in the key personnel specified in the IPP/APP;
- The absence for more than three months, or a 25% reduction in time devoted to the project, by the approved PM;
- The need for additional Federal funding; and

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<sup>1</sup> See the definition of a “eligible institution” at 20 U.S.C. 1067q which includes historically Black colleges and universities and other minority-serving institutions.

- Any subaward, transfer, or contracting out of substantive program performance under an award, unless described in the IPP/APP.

The CAM, in coordination with the LRO and ARL management, will be responsible for integrating the IPP/APP into the overall respective research and technology programs.

## **ARTICLE 4 STAFF ROTATION AND ON-SITE COLLABORATION**

**4.1 Collaboration:** The MSME CRA continues the ARL concept of an Alliance to facilitate a close relationship between ARL and its partners so that collaborative research can leverage and enhance individual efforts. It is ARL's strong belief that work conducted under the MSME CRA cannot be successful either in whole or in part without collaboration. That is, collaboration between the MSME Team and the Government Members of the Alliance is integral to the execution of the CA. Creation of an environment that is conducive to collaboration is therefore a critical element in establishing the Alliance. This section describes potential means to establish a collaborative environment including outreach activities and an on-line presence wherein scientific ideas can be exchanged efficiently in an open environment amongst the Alliance.

**4.2 Collaborative Experimentation:** Experimentation is to be performed by ARL scientists in each of the three Materials Research Areas. These results will be shared within the Alliance and are expected to be part of a continual process to improve and create new models through collaboration between ARL and the MSME Team.

**4.3 ARL In-House Initiative for Multiscale Modeling of Materials (I3M) :** ARL is establishing an in-house Initiative for Multiscale Modeling of Materials (I3M) whose long term program goal is to develop new physics-based scientific multidisciplinary multiscale modeling methodologies and software that can interrogate design space in which material imperfections, surface and interfaces (ISI's) are prominent enablers or detractors for performance. The I3M will be a partner in collaboration with the CRAs. It is envisioned that this Enterprise effort will provide the Army and DoD fundamentally new cross-cutting capabilities (high level physics-based computational tools) that will help overcome obstacles for materials development relevant to energetics, sensors, electronics, power, modeling and simulation applications. This I3M will also provide access to advanced high performance computing capability, computing environments, validated codes and software, visualization suites, and data management techniques that can be leveraged by the CRAs.

**4.4 Lectures, Workshops, and Technical Reviews:** The Alliance may hold, from time to time throughout the period of performance of the MSME CRA Program, scientific lectures and workshops on mutually agreed upon topics. These lectures and workshops will serve as both educational and technical outreach opportunities and could involve participants outside the Alliance when appropriate. Additionally, the Alliance is expected to hold regular, periodic scientific reviews that will permit the free exchange of ideas and research results, especially those impacting crosscutting research themes, among the entire ARL Enterprise for Multiscale Research. The costs associated with the MSME Team efforts for these lectures, workshops and scientific reviews will be funded under the CA.

**4.5 Other Government Agencies (OGA's):** The Government will work with the LRO to leverage and/or integrate other interested OGA's into the CRA umbrella. These efforts and thrusts may be lead by the LRO, Partners or coordinated jointly. Other service elements such as the Air Force and Navy and U.S. Army Research and Development Centers such as the U.S. Army Research Development and Engineering Center, (ARDEC), the U.S. Army Aviation and Missile Research and Development Center (AMRDEC), the Natick Soldier Research Development and Engineering Center (NSRDEC) and the U.S. Army Communications Electronics Research Development and Engineering Center (CERDEC) also have requirements for electronic device applications to for enhanced battlespace effects, and efficient power and energy devices.

**4.6 Education:** As a means to foster the professional growth and scientific strength of ARL and to provide a source for training personnel in fields underlying the Alliance, the MSME Team will identify educational opportunities for Government scientists and engineers who perform research and development in fields related to the CA. These opportunities may include fellowship programs that lead to masters and doctoral degrees, and short courses (e.g., summer and intensive special topic courses in critical technology areas) that lead to the award of appropriate

academic credit. The MSME Team will further consider means to foster collaboration with ARL scientific staff through programs such as internships at ARL for graduate and undergraduate students, and sabbaticals and summer study for faculty. The costs associated with the MSME Team's efforts to identify, prepare for and execute such educational opportunities will be funded under the CA. The cost associated with salaries, travel, etc. for Government personnel will be the responsibility of the Government, and will not be funded under the CA.

**4.7 Opportunities for Research Collaboration and Staff Rotation:** A foundation of the CRA process is the rotation of scientific staff through short- and long-term temporary assignments among the Alliance. The scope of this collaboration may range from regular, periodic short term visits to sabbaticals lasting as long as a year. Staff rotations will be undertaken to foster and facilitate collaborative research where face-to-face interaction is advantageous, to enable a researcher to utilize unique facilities, to enable Alliance personnel to obtain specialized training or experience, to permit close, direct interaction between research partners, and to facilitate the exchange of research results. In addition, this exchange, or cross fertilization, of personnel will provide Alliance personnel with insight into Army unique requirements and will provide Government personnel with insight into commercial practices or the opportunity to pursue fundamental research with noted researchers. The success of these interactive and collaborative exchanges will be assessed by the quality of the collaboration as demonstrated by joint efforts such as archival journal papers, patents, and refereed presentations. All salary and travel costs associated with the rotation of Government personnel will be borne by the Government. All salary and travel costs associated with staff rotations of MSME Team will be funded under the CA. There should be a balance of staff rotations across CRA and across all the research areas. It is anticipated that some portion of the MSME Team's technical labor-years will be in staff rotations.

#### **4.8 Other Collaboration Opportunities:**

**High Performance Computing DoD Supercomputing Resource Center (HPC-DSRC):** ARL is a partner with the DoD High Performance Computing Modernization Program Office (HPCMPO) to manage and operate one of its three DoD Supercomputing Resource Centers (DSRCs). As one of the world's most powerful computing sites, the ARL DSRC delivers the latest in computational tools and innovative technology. Our computer simulations and models help technologists develop, test new and improved electronic device applications to include sensors and electronics for enhanced battlespace effects, and efficient power and energy devices. As one of the world's most powerful computing sites, the ARL DSRC uses world-class, high-performance computers (HPCs), cutting-edge applications, and expert staff scientists to help the United States maintain its technological and military supremacy. The Center offers a full spectrum of computational capabilities for the Department of Defense (DoD) Science and Technology and Test and Evaluation communities, including:

- \* Powerful parallel processors
- \* Reliable high-speed networks
- \* A wide range of software
- \* Comprehensive storage
- \* Scientific visualization
- \* Novel storage platforms
- \* Close ties with academic partners
- \* Advanced training
- \* Outstanding end-user care

The MSME Team can request access to the DSRC under the CRA umbrella to utilize the computational, and visualization resources.

**4.9 Salary and Travel Costs:** All salary and travel costs associated with the rotation of government personnel will be borne by the Government. All salary and travel costs associated with staff rotations of Recipient personnel will be funded under the Cooperative Agreement or may be provided by the Recipient as cost-share. There should be a balance of staff rotations across all the partners in the Consortium and across all the research areas. It is anticipated that some portion of the Recipient's scientific labor-years will be in staff rotations.

**4.10 Host Facility Regulations:** All personnel in rotational assignments or on-site collaboration are required to comply with the safety, environmental, security, and operational regulations or requirements of the host facility.

**4.11 Administrative Support:** The host facility will provide adequate office space, communications connections, administrative support, and office supplies, if available, for researchers in long-term rotational assignments. Should it become necessary to procure equipment to facilitate a rotational assignment, the APP should reflect the need for said equipment, and the costs will be borne under the Cooperative Agreement.

## ARTICLE 5 FISCAL MANAGEMENT

### 5.1 Allocation of Recipient Funds

#### 5.1.1 Restrictions on the Use of Government Funds

Government funds provided under this Agreement must be allocated by the Recipient exclusively for the execution and operation of the IPP/APP or Agreement Scope. Government funds shall not be utilized to support the Recipient's operations or administration unrelated to this Agreement.

#### 5.1.2. Cost Share *(will be included in the Cooperative Agreement only if there is Cost Share by the Recipient)*

The Government and Recipient estimate that the Scope of this agreement can only be accomplished with a total aggregate resource contribution of \$ (completed at time of award) for the Basic Agreement, and a total resource contribution of \$ (completed at time of award) \* for the Option. For the purposes of this Agreement, the cost share ratio for the Basic Agreement shall be \$ (completed at time of award) for the Government and \$ (completed at time of award) for the Recipient, and \$ 11,000,000.00\* for the Government and \$ (completed at time of award) \* for the Recipient for the Option. The Recipient intends, and by entering into this Agreement, undertakes the cause for which these funds are being provided. The Recipients contributions will be provided as detailed in the IPP and subsequent APPs under this Agreement. Failure of either Party to provide its contribution may result in termination of this agreement, or a proportional reduction in funding.

(\* While the Total Estimated Government Funding of the Option is listed above, the Recipient will be requested to provide a complete cost proposal for the optional five-year period of performance as part of the evaluation to be completed prior to making the decision concerning this optional period.)

#### 5.1.3 Obligation

In no case shall the Government's financial obligation exceed the amount obligated on this Agreement or by amendment to the Agreement. The total Government funding amount estimated for performance of the Basic Agreement is \$ (completed at time of award), subject to the availability of funds. Of this amount, the Government share is \$ (completed at time of award) and the Recipient share is \$ (completed at time of award). The total amount estimated for performance of the Option is \$ (completed at time of award) \*. Of this amount, the Government share is \$ 11,000,000.00 \* and the Recipient share is \$ (completed at time of award) \*. The amount of Government funds currently obligated and available for payment is \$ (completed at time of award). It is estimated that such funds shall be sufficient to cover performance from date of award through (completed at time of award) (completed at time of award) months. The Government is not obligated to reimburse the Recipient for expenditures in excess of the amount of obligated funds allotted by the Government.

(\* While the Total Estimated Government Funding of the Option is listed above, the Recipient will be requested to provide a complete cost proposal for the optional five-year period of performance as part of the evaluation to be completed prior to making the decision concerning this optional period.)

#### 5.1.4 Incremental Funding

The Government may obligate funds to this Agreement incrementally. In the event that this Agreement is funded incrementally, the Government anticipates that from time to time additional amounts will be allotted to this agreement by unilateral modification, until the total amount for performance of this Agreement has been funded. To minimize interruption of effort due to lack of funds, the Recipient shall notify the Grants Officer in writing whenever the amount of funds obligated under this agreement when added to anticipated costs in the next 60 calendar days will exceed 75% of the amount allotted. Obligated funds provided to the Consortium for any Governmental Fiscal Year (GFY), which are not expended in the same GFY, may be carried forward and expended in the next succeeding GFY until they are completely expended within the performance period of the IPP or APP.

### **5.1.5 Payments**

a. The Recipient shall submit to the Agreement Administrator an original and two (2) copies of all vouchers, SF 270 "Request for Advance or Reimbursement" or other form or format prescribed by the DoD component when it (component) determines that adequate information has been provided to meet Federal needs. One copy shall also be provided to the CAM for payment approval. The Recipient shall attach additional information as reasonably requested by the Agreement Administrator. After written verification of progress towards or achievement of the research milestones by the CAM and approval by the Agreement Administrator, the vouchers will be forwarded to the payment office within ten (10) calendars of receipt of the voucher. The Payment Office will make payments via EFT within 20 calendar days of receipt of transmittal.

b. Payments will be made no more frequently than monthly and will be based on reimbursement of actual expenditures as monitored against the Budget Plan contained in the IPP/APP. Once the CAM has verified that the Recipient has expended best efforts towards the successful achievement of the research goals, payment will be authorized.

### **5.1.6 Financial Reporting**

The Recipient shall submit Annual and Final Financial (SF425) reports as specified in Attachment 4.

## **ARTICLE 6 AGREEMENT ADMINISTRATION**

**6.1 Modifications to this Agreement.** Any Party who wishes to modify this Agreement will, upon reasonable notice of the proposed modification to the other Party, confer in good faith with the other Party to determine the desirability of the proposed modification. Modifications will not be effective until a written modification is signed by the Agreement signatories or their recognized successors. Administrative modifications may be unilaterally executed by the Grants Officer or by the Agreements Administrator.

**6.2 Requirements for Approval for Changes to the Program Budget and Program Plan.** This provision highlights Agency decisions on the terms and conditions of 32 CFR 32.25 and 32 CFR 34.15 as applicable. During the course of performance, the Grants Officer, in coordination with the CAM, will have approval authority for certain specific changes to the IPP/APP including but not limited to:

- Changes in the scope or the objective of the program, IPP/APP, or research milestones;
- Change in the key personnel specified in the IPP/APP;
- The absence for more than three months, or a 25% reduction in time devoted to the project, by the approved PM;
- The need for additional Federal funding; and
- Any subaward, transfer, or contracting out of substantive program performance under an award, unless described in the IPP/APP.

The CAM, in coordination with the LRO and ARL management, will be responsible for integrating the IPP/APP into the overall respective research and technology programs.

**6.3 No-Cost Period of Performance Extension.** In accordance with the DoD Grant and Agreement Regulations (DoD 3210.6-R), the Recipient may initiate a request for a one-time, no-cost extension to the period of performance. The request may not include additional Federal funds, nor change the approved objectives or scope of the program.

**6.3.1** Extension requests shall be directed to the Collaborative Alliance Manager for approval. Modifications will be completed by the Agreements Administrator listed in Article 8.1 with a courtesy copy to the Grants Officer listed in Article 8.1.

## **ARTICLE 7 TERM OF THE AGREEMENT**

The MSME CRA will be awarded for a five-year period beginning in FY12. There will be an option to extend the MSME CRA for an additional five years. At the end of the fourth year, a program review will be conducted as directed by ARL. This review will consider cumulative performance metrics, the LRO and Partners vision for the additional five-year period of performance (to be submitted by the LRO at the end of the fourth year), funding availability and the current fundamental research needs and goals of the US Army. Performance metrics are expected to include items that provide an indication of the MSME CRA's accomplishments such as the number of refereed journal articles, invited presentations, relevance of the work to ARL, collaboration, staff rotation, education, management, etc. The decision as to whether to exercise the option is expected to be based on the results of the review and evaluation described above.

## **ARTICLE 8 ADMINISTRATIVE RESPONSIBILITY**

### **8.1 THE AGREEMENTS OFFICE**

U.S. Army Contracting Command – Aberdeen Proving Ground (Soldier, Chemical, Research & Test)  
Research Triangle Park Contracting Division  
ATTN: CCRD-RT

For FedEx etc. use: 4300 S. Miami Blvd., Durham, NC 27703  
For USPS use: P.O. Box 12211, Research Triangle Park, NC 27709

Grants Officer: Patricia Fox	Agreement Specialist: Julia Wertley-Rotenberry
Phone: (919) 549-4272	Phone: (919) 549-4268
Fax: (919)549-4373	Fax: (919) 549-4373
Email: <a href="mailto:patricia.fox@us.army.mil">patricia.fox@us.army.mil</a>	Email: <a href="mailto:julia.wertleyrotenberry@us.army.mil">julia.wertleyrotenberry@us.army.mil</a>

### **8.2 AGREEMENTS ADMINISTRATOR**

#### **OFFICE OF NAVAL RESEARCH (ONRRO)**

*(to be completed at time of award)*

### **8.3 THE RECIPIENT ADDRESS AND POINT OF CONTACT**

*(to be completed at time of award)*

### **8.4 THE PAYMENT OFFICE**

*(to be completed at time of award)*

### **8.5 ADDRESS OF PAYEE – SEE ARTICLE 8.3**

## **ARTICLE 9 PUBLIC RELEASE OR DISSEMINATION OF INFORMATION**

**9.1 Open Publication Policy.** Notwithstanding the reporting requirements of this Agreement, parties to this Agreement favor an open-publication policy to promote the stimulation of fundamental research under this Agreement, but simultaneously recognize the necessity to protect proprietary information.

**9.2 Prior Review of Public Releases.** The Parties agree to confer and consult with each other prior to publication or other disclosure of the results of work under this Agreement to ensure that no classified or proprietary information is released. Prior to submitting a manuscript for publication or before any other public disclosure, each Party will offer the other Party ample opportunity (not to exceed 60 business days) to review such proposed publication or disclosure, to submit objections, and to file application letters for patents in a timely manner.

**9.3 Publication Legend.** It is herein agreed that except for the disclosure of basic information regarding this Agreement such as membership, purpose and a general description of the technical work, the Recipient will submit all proposed public releases to the ARL cooperative Agreement Manager for comment prior to release. Public releases include press releases, specific publicity or advertisement, and articles for proposed publication or presentation. In addition, articles for publication or presentation will contain an acknowledgement of support and a disclaimer. This should be included to read as follows. These statements may be placed either at the bottom of the first page or at the end of the paper. "Research was sponsored by the Army Research Laboratory and was accomplished under Cooperative Agreement Number **W911NF-12-2-XXXX**. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the Army Research Laboratory or the U.S. Government. The U.S. Government is authorized to reproduce and distribute reprints for Government purposes notwithstanding any copyright notation herein."

## **ARTICLE 10 INTELLECTUAL PROPERTY**

In addition to the Intellectual Property Rights contained in 32 CFR 32.36 or 32 CFR 34.25 as applicable, incorporated by reference into this Agreement, the participants recognize that this program may result in intellectual property that is generated by the Recipient or Sub-Recipient personnel and Government personnel. Should this occur, the Parties agree to use their best efforts to mutually agree to an equitable distribution of property rights and distribution of filing fees or other administrative costs. Should the parties reach an impasse in determining the distribution of property rights, the parties shall resort to the Disputes, Claims, and Appeals Process as set forth at 32 CFR 22.815.

## **ARTICLE 11 ENTIRE AGREEMENT**

This Agreement along with all Attachments constitutes the entire agreement between the Parties concerning the subject matter hereof and supersedes any prior understandings or written or oral agreement relative to said matter. In the event of a conflict between the terms of the Agreement and its attachments, the terms of the Agreement shall govern.

## **ARTICLE 12 GOVERNING LAW/ORDER OF PRECEDENCE**

The Agreement shall be enforced in accordance with applicable federal law and regulations, directives, circulars or other guidance as specified in this Agreement. When signed, this Agreement shall become binding on the Recipient and the Government to be administered in accordance with the DoD Grant and Agreement Regulations as they apply to the particular recipient or sub-recipient concerned. In the event a conflict exists between the provisions of this Agreement and the applicable law, regulations, directives, circulars or other guidance, the Agreement provisions are subordinate.

## **ARTICLE 13 WAIVER OF RIGHTS**

Any waiver of any requirement contained in this Agreement shall be by mutual agreement of the parties hereto. Any waiver shall be reduced to writing and a copy of the waiver shall be provided to each Party. Failure to insist upon strict performance of any of the terms and conditions hereof, or failure or delay to exercise any rights provided herein or by law, shall not be deemed a waiver of any rights of any Party hereto.

#### **ARTICLE 14 USE OF TECHNICAL FACILITIES**

To the maximum extent practical, the Recipient agrees to use the technical reference facilities of the Defense Technical Information Center, 8725 John J. Kingman Road, Suite 0944, Ft. Belvoir, VA 22060-6218 (Internet address: <http://www.dtic.mil>) and all other sources, whether United States Government or private, for purpose of surveying existing knowledge and avoiding needless duplication of scientific and engineering effort.

#### **ARTICLE 15 METRIC SYSTEM OF MEASUREMENT**

The Metric Conversion Act of 1975 as amended by the Omnibus Trade and Competitiveness Act of 1988 and implemented by Executive Order 12770 gives preference to the metric system. The Recipient shall ensure that the metric system is used to the maximum extent practicable in performance of this Agreement.

#### **ARTICLE 16 LIABILITY**

No Party to this Agreement shall be liable to any other Party for any property that the other Party consumed, damaged, or destroyed in the performance of this Agreement, unless it is due to the negligence or misconduct of the Party or an employee or agent of the Party.

#### **ARTICLE 17 NON-ASSIGNMENT**

This Agreement may not be assigned by any Party except by operation of law resulting from the merger of a party into or with another corporate entity.

#### **ARTICLE 18 SEVERABILITY**

If any clause, provision or section of this Agreement shall be held illegal or invalid by any court, the invalidity of such clause, provision or section shall not affect any of the remaining clauses, provisions or sections herein and this Agreement shall be construed and enforced as if such illegal or invalid clause, provision or section had not been contained herein.

#### **ARTICLE 19 FORCE MAJEURE**

Neither Party shall be in breach of this Agreement for any failure of performance caused by any event beyond its reasonable control and not caused by the fault or negligence of that Party. In the event such a force majeure event occurs, the Party unable to perform shall promptly notify the other Party and shall in good faith maintain such partial performance as is reasonably possible and shall resume full performance as soon as is reasonably possible.

#### **ARTICLE 20 NOTICES**

All notices and prior approvals required hereunder shall be in writing and shall be addressed to the parties identified on the Agreement cover page and Article 8. Notices shall be effective upon signature of the Grants Officer.

## ARTICLE 21 - ACCESS GUIDANCE.

Should a Recipient's performance require access to DoD facilities, the Recipient shall coordinate with their CAM or designated point of contact providing access in order to obtain the most current access guidance. Commencement of access coordination should occur at least 10 business days prior to the date of required access.

## ARTICLE 22 CENTRAL CONTRACTOR REGISTRATION AND DUNS

### *Central Contractor Registration and Universal Identifier Requirements.*

A. *Requirement for recipients.* Unless you are excepted from this requirement under 2 CFR 25.110, you as the recipient must maintain the currency of your information in the Central Contractor Registration (CCR) until you submit the final financial report required under this award or receive the final payment, whichever is later. This requires that you review and update the information at least annually after the initial registration, and more frequently if required by changes in your information or another award term.

B. *Requirement for subrecipients.* If you are authorized to make subawards under this award, you:

1. Must notify potential subrecipients that no entity (*see* definition in paragraph C of this award term) may receive a subaward from you unless the entity has provided its Data Universal Numbering System (DUNS) number to you and is registered in the CCR.
2. May not make a subaward to an entity unless the entity has provided its DUNS number to you and is registered in the Central Contractor Registration.

C. *Definitions.* For purposes of this award term:

1. *Central Contractor Registration (CCR)* means the Federal repository into which an entity must provide information required for the conduct of business as a recipient. Additional information about registration procedures may be found at the CCR Internet site (currently at <http://www.ccr.gov>).
2. *Data Universal Numbering System (DUNS) number* means the nine-digit number established and assigned by Dun and Bradstreet, Inc. (D&B) to uniquely identify business entities. A DUNS number may be obtained from D&B by telephone (currently 866-705-5711) or the Internet (currently at <http://fedgov.dnb.com/webform>).
3. *Entity*, as it is used in this award term, means all of the following, as defined at 2 CFR part 25, subpart C:
  - a. A Governmental organization, which is a State, local government, or Indian tribe;
  - b. A foreign public entity;
  - c. A domestic or foreign nonprofit organization;
  - d. A domestic or foreign for-profit organization; and
  - e. A Federal agency, but only as a subrecipient under an award or subaward to a non-Federal entity.
4. *Subaward*:
  - a. This term means a legal instrument to provide support for the performance of any portion of the substantive project or program for which you received this award and that you as the recipient award to an eligible subrecipient.
  - b. The term does not include your procurement of property and services needed to carry out the project or program (for further explanation, *see* Sec. \_\_.210 of the attachment to OMB Circular A-133, "Audits of States, Local Governments, and Non-Profit Organizations").
  - c. A subaward may be provided through any legal agreement, including an agreement that you consider a contract.
5. *Subrecipient* means an entity that:
  - a. Receives a subaward from you under this award; and
  - b. Is accountable to you for the use of the Federal funds provided by the subaward.

## ATTACHMENT 1

### **Standard Terms and Conditions for Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations Department of Defense Grant and Agreement Regulations (DoDGARS) (DoD 3210.6-R and 32 CFR Parts 21-37)**

Award, administration and performance under this agreement is subject to the requirements of the DoD Grant and Agreement Regulations (32CFR Parts 21-37). Narratives following a reference indicate the Agency's decision on specific issues.

- **32 CFR 22.815 Claims, Disputes and Appeal**  
The Agency and Recipient will employ Alternative Dispute Resolution to resolve issues which arise during the performance of the agreement. The procedures to be used will be mutually agreed to when and if issues arise (see section 815(c)(2)). The Grant Appeal Authority is the Director of ARL (see section 815(e)(i)).
- **32 CFR 32.21 Standards for Financial Management Systems**  
ARL does not guarantee or insure the repayment of money borrowed by the recipient. Further, ARL does not require the recipient to secure fidelity bond coverage to protect the Government's interests.
- **32 CFR 32.22 Payment**  
All payments made under this agreement will be of the reimbursement type. Recipients should refer to Article 5 Fiscal Management of this agreement for further information.
- **32 CFR 32.27 and 32.28 Allowable Costs**  
The Recipient shall comply with the appropriate cost principles.
- **32 CFR 32.23 Cost Share or Match**  
This provision is applicable only if cost share or match is included in the recipient's proposal and the subsequent award document. Should cost share or match be included, the parties to this agreement will mutually agree to its allowability, valuation and necessary documentation.
- **32 CFR 32.24 Program Income**  
Should this agreement result in generating program income, the recipient shall account for said funds, add them to the funds committed to the project, and they shall be used to further the program objectives. The recipient shall have no obligation to the Government for program income earned after the expiration of the program. Costs incident to the generation of program income may be deducted from gross income to determine program income, provided these costs have not been charged to the award document. The Patent and Trademark Amendments (35 U.S.C. Chapter 18) apply to inventions made under this award.
- **32 CFR 32.25 Revision of Budget/Program Plans**  
See Article 6 of this agreement.
- **32 CFR 32.26 Non-Federal Audits**  
Non-Profit entities shall submit a copy of the OMB Circular A-133 audit reports to the DoD Inspector General and to the Grants Officer.
- **32 CFR 32.40 through 32.49 Procurement**  
ARL reserves the right to review prior to award procurement documents such as request for proposals, or invitations for bids, independent cost estimates etc., during performance under this award.
- **32 CFR 32.5 Sub-awards**  
This subpart sets forth the requirement for flow down provisions or subsequent sub-agreements or sub-awards.
- **32 CFR 32.30 through 32.37 Property**

ARL waives the requirement for recordation of liens or other appropriate notices set forth at 32 CFR 32.37.

Recipients are subject to applicable regulations governing patents and inventions, including Government-wide regulations issued by the Department of Commerce at 37 CFR part 401 "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements."

ARL does not waive the right to obtain, reproduce, publish or otherwise use the data first produced under this award or to authorize others to receive, reproduce, publish, or otherwise use such data for government purposes.

- **32 CFR 32.51 and 32.52 Reports**

See Attachment 4 of this agreement.

- **32 CFR 32.53 Retention and Access Requirements for Records**

- **32 CFR 32.60 through 32.62 Termination and Enforcement**

In addition to the termination processes set forth in 32 CFR 32.61, this Agreement may also be terminated by the Grants Officer should available funds be insufficient to accomplish the goals or intent of the Agreement, or convenience of the Government.

- **32 CFR 32.71 through 32.73 After-the-Award Requirements**

## ATTACHMENT 2 National Policy Requirements

By signing this Agreement or accepting funds under this Agreement, the recipient assures that it will comply with applicable provisions of the national policies on the following topics:

### 1. NONDISCRIMINATION

- a. On the basis of race, color, or national origin, in Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d, et seq.), as implemented by DoD regulations at 32 CFR part 195.
- b. On the basis of sex or blindness, in Title IX of the Education Amendments of 1972 (20 U.S.C. 1681, et seq.). (Applicable to Educational Institutions only)
- c. On the basis of age, in the Age Discrimination Act of 1975 (42 U.S.C. 6101, et seq.), as implemented by Department of Health and Human Services regulations at 45 CFR part 90.
- d. On the basis of handicap, in Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794), as implemented by Department of Justice regulations at 28 CFR part 41 and DoD regulations at 32 CFR part 56.

### 2. Live Organisms.

(a) *For human subjects*, the Common Federal Policy for the Protection of Human Subjects, codified by the Department of Health and Human Services at 45 CFR part 46 and implemented by the Department of Defense at 32 CFR part 219.

(b) *For animals:*

a. (*Research, experimentation or testing involving the use of animals*) Rules on animal acquisition, transport, care, handling, and use in 9 CFR parts 1-4, Department of Agriculture rules implementing the Laboratory Animal Welfare Act of 1966 (7 U.S.C. 2141-2156), and guidelines in the National Academy of Sciences (NAS) "Guide for the Care and Use of Laboratory Animals" (1996), including the Public Health Service Policy and Government Principles Regarding the Care and Use of Animals in Appendix D to the guide.

b. (*DoD appropriations for training on treatment of wounds*) Prohibitions on the purchase or use of dogs or cats for certain medical training purposes, in Section 8019 (10 U.S.C 2241 note) of the Department of Defense Appropriations Act, 1991 (Pub. Law 101-511)

c. (*Activities that may involve or impact wildlife and plants*) Rules of the Departments of Interior (50 CFR parts 10-24) and Commerce (50 CFR parts 217-227) implementing the laws and conventions on the taking, possession, transport, purchase, sale, export, or import of wildlife and plants, including the: Endangered Species Act of 1973 (16 U.S.C. 1531-1543); Marine Mammal Protection Act (16 U.S.C. 1361-1384); Lacey Act (18 U.S.C. 42) and Convention on International Trade in Endangered Species of Wild Fauna and Flora.

**3. Debarment and Suspension:** The Recipient agrees to comply with the requirements regarding debarment and suspension in Subpart C of the OMB guidance in 2 CFR part 180, as implemented by the Department of Defense in 2 CFR part 1125. The Recipient also agrees to communicate the requirement to comply with Subpart C to the persons at the next lower tier with whom the recipient enters into transactions that are "covered transactions" under Subpart B of 2 CFR part 180 and the DoD implantation in 2 CFR part 1125.

### 4. Environmental Standards.

a. Comply with the applicable provisions of the Clean Air Act (42 U.S.C. 7401, et. Seq.) and Clean Water Act (33 U.S.C. 1251, et. seq.), as implemented by Executive Order 11783 [3 CFR, 1971-1075 Comp., p. 799] and Environmental Protection Agency (EPA) rules at Subpart J of 40 CFR part 32.

b. Identify to the awarding agency any impact this award may have on

1. The quality of the human environment, and provide help the agency may need to comply with the National Environmental Policy Act (NEPA, at 42 U.S.C. 4231, et. seq.) and to prepare Environmental Impact Statements or other required environmental documentation. In such cases, the recipient agrees to take no action that will have an adverse environmental impact (e.g., physical disturbance of a site such as breaking of ground) until the agency provides written notification of compliance with the environmental impact analysis process.

3. (*Awards that may affect the coastal zone*) Coastal zones, and provide help the agency may need to comply with the Coastal Zone Management Act of 1972 (16 U.S.C 1451, et. Seq.), concerning the protection of U.S. coastal resources.

4. (*Awards that may affect barriers along the Atlantic and Gulf coasts and Great Lakes shores*) Coastal barriers, and provide help the agency may need to comply with the Coastal Barriers Resource Act (16 U.S.C. 3501, et. Seq.), concerning preservation of barrier resources.

5. (*Awards that may affect existing or proposed elements of the National Wild and Scenic Rivers system*) Any existing or proposed component of the National Wild and Scenic Rivers system, and provide help the agency may need to comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271, et. Seq)

**5. Drug Free Workplace** – The recipient agrees to comply with the requirements regarding drug-free workplace requirements in Subpart B (or Subpart C, if the recipient is an individual) of 32 CFR part 26, which implements sec. 5151-5160 of the Drug-Free Workplace Act of 1988 (Pub Law 100-690, Title V, Subtitle D; 41 U.S.C. 701, et. Seq)

**6. Officials Not to Benefit.** No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this Agreement or to any benefit arising from it, in accordance with 41 U.S.C. 22.

**7. Preference for U.S. Flag Carriers.** Travel supported by U.S. Government funds under this Agreement shall use U.S. -flag air carriers (air carriers holding certificates under 49 USC 41102) for international air transportation of people and property to the extent that such service is available, in accordance with the International Air Transportation Fair Competitive Practices Act of 1974 (49 USC 40118) and the interpretative guidelines issued by the Comptroller General of the United States in the March 31, 1981, amendment to the Comptroller General Decision B138942.

**8. Cargo Preference.** The recipient agrees that it will comply with the Cargo Preference Act of 1954 (46 U.S.C. 1241), as implemented by Department of Transportation regulations at 46 CFR 381.7, which require that at least 50 percent of equipment, materials or commodities procured or otherwise obtained with U.S. Government funds under this agreement, and which may be transported by ocean vessel, shall be transported on privately owned U.S.-flag commercial vessels, if available.

**9. Military Recruiters.** As a condition for receipt of funds available to the Department of Defense (DoD) under this award, the recipient agrees that it is not an institution of higher education (as defined in 32 CFR part 216) that has a policy or practice that either prohibits, or in effect prevents:

(A) The Secretary of a Military Department from maintaining, establishing, or operating a unit of the Senior Reserve Officers Training Corps (in accordance with 10 U.S.C. 654 and other applicable Federal laws) at that institution (or any subelement of that institution);

(B) Any student at that institution (or any subelement of that institution) from enrolling in a unit of the Senior ROTC at another institution of higher education;

(C) The Secretary of a Military Department or Secretary of Homeland Security from gaining access to campuses, or access to students (who are 17 years of age or older) on campuses, for purposes of military recruiting in a manner that is at least equal in quality and scope to the access to campuses and to students that is provided to any other employer; or

(D) Access by military recruiters for purposes of military recruiting to the names of students (who are 17 years of age or older and enrolled at that institution or any subelement of that institution); their addresses, telephone listings, dates and places of birth, levels of education, academic majors, and degrees received; and the most recent educational institutions in which they were enrolled. If the recipient is determined, using the procedures in 32 CFR part 216, to be such an institution of higher education during the period of performance of this agreement, the Government will cease all payments of DoD funds under this agreement and all other DoD grants and cooperative agreements to the recipient, and it may suspend or terminate such grants and agreements unilaterally for material failure to comply with the terms and conditions of award.

**Incorporated by Reference:**

10. Trafficking Victims Protection Act of 2000 as amended (22 U.S.C. 7104)

**ATTACHMENT 3**  
**Other Certifications**

The following Certifications, which have been executed by the Recipient prior to award of this Agreement are on file with the issuing office, and are hereby incorporated herein by reference:

- a. Certification at Appendix A to 32 CFR Part 28 Regarding Lobbying

## **ATTACHMENT 4**

### **Reporting Requirements**

#### **A. QUARTERLY REPORT**

Throughout the term of the Agreement, the Recipient shall submit or otherwise provide a quarterly report (government fiscal quarter). Two (2) copies shall be submitted or otherwise provided to the CAM, and one (1) copy shall be submitted or otherwise provided to the Agreements Administration Office. A copy of the letter of transmittal shall be submitted or otherwise provided to the Agreements Office. The report shall contain two (2) major sections:

1. **Technical Status Report.** The technical status report will detail technical progress to date on research milestones, all problems, technical issues or major developments during the reporting period. The technical status report will include a report on the status of the collaborative activities during the reporting period. The technical status report will include the utilization of subject inventions by the Recipient.
2. **Business Status Report.** The business status report will provide summarized details of the resource status of this Agreement, including the status of contributions by the Recipient. This report should compare the resource status with any payment and expenditure schedules or plans provided in the original agreement. Any major deviations shall be explained along with discussion of adjustment actions proposed.

#### **B. JOINT PAPERS AND PRESENTATIONS:**

When determined necessary by the CAM periodic joint papers and presentations will be given.

#### **C. JOURNAL ARTICLES**

Journal articles in general and joint ARL/Recipient journal articles are strongly encouraged as a major reporting mechanism of this research effort.

#### **D. ANNUAL AND FINAL REPORTS**

1. The Recipient shall submit an Annual Report making full disclosure of all major technical developments and progress for the preceding 12 months of effort within sixty (60) calendar days of completion of the effort and for each additional 12 months of effort, through the life of this agreement. The report will also provide an accounting of all Federal funds expended during the term of the Agreement. With the approval of the Cooperative Agreement Manager, reprints of published articles may be attached to the Final Report.

The Recipient shall make distribution of the Final report as follows:

Cooperative Agreement Manager - 1 original plus 1 copy;  
Agreement Administration Office - 1 copy, and the  
Grants Officer - 1 copy of the letter of transmittal only.  
One (1) copy of the Final Report shall be provided to:

Defense Technical Information Center (DTIC)  
8725 John J. Kingman Road, Suite 0944  
Ft. Belvoir, VA 22060-6218.

#### **E. FINANCIAL REPORTING: Federal Financial Report (SF 425): Annual and Final Reports**

1. Reporting period end dates fall on the end of the calendar year for annual reports (12/31) and the end date of the grant project or period for the final report. Annual reports are due 30 business days after the reporting period end date, and the final report is due 90 business days after the end date of the grant.

All financial reports shall be submitted to the Grant Administration Office identified in Block 6 of the SF 26. Copies of the forms and instructions may be found on the Internet at <http://www.aro.army.mil/forms/forms2.htm>.

The Recipient shall make distribution of the Annual and Final (SF425) Reports as follows:

Cooperative Agreement Manager - 1 original plus 1 copy;  
Agreement Administration Office - 1 copy, and

Note: The SF 425 is a single form that consolidates and replaces the Federal Cash Transaction Report (FACTOR or SF 272/SF 272A) and the Financial Status Report (FSR or SF 269/SF 269A).

## F. FEDERAL FUNDING ACCOUNTABILITY AND TRANSPARENCY ACT (FFATA) REPORTING

Appendix A to Part 170 - Award Term

### I. Reporting Subawards and Executive Compensation.

#### A. Reporting of first-tier subawards.

1. Applicability. Unless you are exempt as provided in paragraph d. of this award term, you must report each action that obligates \$25,000 or more in Federal funds that does not include Recovery funds (as defined in section 1512(a)(2) of the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5) for a subaward to an entity (see definitions in paragraph e of this award term).

2. Where and when to report.

i. You must report each obligating action described in paragraph a.1. of this award term to [www.fsr.gov](http://www.fsr.gov).

ii. For subaward information, report no later than the end of the month following the month in which the obligation was made. (For example, if the obligation was made on November 7, 2010, the obligation must be reported by no later than December 31, 2010.)

3. What to report. You must report the information about each obligating action that the submission instructions posted at [www.fsr.gov](http://www.fsr.gov) specify.

#### B. Reporting Total Compensation of Recipient Executives.

1. Applicability and what to report. You must report total compensation for each of your five most highly compensated executives for the preceding completed fiscal year, if –

i. The total Federal funding authorized to date under this award is \$25,000 or more;

ii. In the preceding fiscal year, you received—

(a) 80 percent or more of your annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 CFR 170.320 (and subawards); and

(b) \$25,000,000 or more in annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 CFR 170.320 (and subawards); and

iii. The public does not have access to information about the compensation of the executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. (To determine if the public has access to the compensation information, see the U.S. Security and Exchange Commission total compensation filings at <http://www.sec.gov/answers/excomp.htm>.)

2. Where and when to report. You must report executive total compensation described in paragraph b.1. of this award term:

- i. As part of your registration profile at [www.ccr.gov](http://www.ccr.gov).
- ii. By the end of the month following the month in which this award is made, and annually thereafter.

C. Reporting of Total Compensation of Subrecipient Executives.

1. Applicability and what to report. Unless you are exempt as provided in paragraph D. of this award term, for each first-tier subrecipient under this award, you shall report the names and total compensation of each of the subrecipient's five most highly compensated executives for the subrecipient's preceding completed fiscal year, if -

i. In the subrecipient's preceding fiscal year, the subrecipient received –

(a) 80 percent or more of its annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 CFR 170.320 (and subawards); and

(b) \$25,000,000 or more in annual gross revenues from Federal procurement contracts (and subcontracts), and Federal financial assistance subject to the Transparency Act (and subawards); and

ii. The public does not have access to information about the compensation of the executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. (To determine if the public has access to the compensation information,

see the U.S. Security and Exchange Commission total compensation filings at <http://www.sec.gov/answers/execomp.htm>.)

2. Where and when to report. You must report subrecipient executive total compensation described in paragraph C.1. of this award term:

i. To the recipient.

ii. By the end of the month following the month during which you make the subaward. For example, if a subaward is obligated on any date during the month of October of a given year (i.e., between October 1 and 31), you must report any required compensation information of the subrecipient by November 30 of that year.

D. Exemptions.

1. If, in the previous tax year, you had gross income, from all sources, under \$300,000, you are exempt from the requirements to report:

i. subawards, and

ii. The total compensation of the five most highly compensated executives of any subrecipient.

E. Definitions. For purposes of this award term:

1. Entity means all of the following, as defined in 2 CFR part 25:

i. A Governmental organization, which is a State, local government, or Indian tribe;

ii. A foreign public entity;

iii. A domestic or foreign nonprofit organization;

iv. A domestic or foreign for-profit organization;

- v. A Federal agency, but only as a subrecipient under an award or subaward to a non-Federal entity.
2. Executive means officers, managing partners, or any other employees in management positions.
  3. Subaward:
    - i. This term means a legal instrument to provide support for the performance of any portion of the substantive project or program for which you received this award and that you as the recipient award to an eligible subrecipient.
    - ii. The term does not include your procurement of property and services needed to carry out the project or program (for further explanation, see Sec. --.210 of the attachment to OMB Circular A-133, "Audits of States, Local Governments, and Non-Profit Organizations").
    - iii. A subaward may be provided through any legal agreement, including an agreement that you or a subrecipient considers a contract.
  4. Subrecipient means an entity that:
    - i. Receives a subaward from you (the recipient) under this award; and
    - ii. Is accountable to you for the use of the Federal funds provided by the subaward.
  5. Total compensation means the cash and noncash dollar value earned by the executive during the recipient's or subrecipient's preceding fiscal year and includes the following (for more information see 17 CFR 229.402(c)(2)):
    - i. Salary and bonus.
    - ii. Awards of stock, stock options, and stock appreciation rights. Use the dollar amount recognized for financial statement reporting purposes with respect to the fiscal year in accordance with the Statement of Financial Accounting Standards No. 123 (Revised 2004) (FAS 123R), Shared Based Payments.
    - iii. Earnings for services under nonequity incentive plans. This does not include group life, health, hospitalization or medical reimbursement plans that do not discriminate in favor of executives, and are available generally to all salaried employees.

**ATTACHMENT 5**  
**Annual Program Plan and Budget**

(To be completed in accordance with Article 3.5.)