Funding Opportunity Announcement (FOA)

Overview Information

Federal Agency Name: Combat Capabilities Development Command-Army Research Laboratory (CCDC-ARL). Acquisition office through US Army Contracting Command-Aberdeen Proving Ground, Research Triangle Park (ACC-APG-RTP) Division.

Program Name: CCDC-ARL Manufacturing Technology

Funding Opportunity Announcement Title: FOA for CCDC-ARL Manufacturing Technology. This FOA seeks proposals from U.S. for-profit organizations and non-profit organizations as allowed in accordance with 32 Code of Federal Regulations (CFR) Part 37 and entities eligible for award in accordance with 10 USC 2371b.

Funding Opportunity Announcement Type: This is the initial funding announcement.

Funding Opportunity Announcement Number: W911NF-20-S-0011

Catalog of Federal Domestic Assistance (CFDA) Number(s): 12.630 (applicable to TIAs)

Application Process:

The application process under this FOA consists of preparation of a proposal consistent with the requirements herein. In addition concept papers may be submitted for consideration to reduce potential unnecessary bid and proposal efforts for those concepts a potential applicant may wish to first discuss with the Government to ensure relevancy prior to a proposal submission.

Dates for Proposal: This FOA will remain open from the date of publish through 30 September 2023. Individual topics included herein may include specific proposal submission dates.

FOA Request: This notice of funding availability constitutes a competitive mechanism by which to evaluate and select proposals for award, including a merit-based competition, as described in the Department of Defense Grants and Agreements Regulations (DoDGARS), 32 Code of Federal Regulations (CFR) §22.315 for the selection of proposals to be awarded a TIA and for the competitive process for the award of OTs. A formal Request for Proposals (RFP) or any other type of solicitation regarding this program will not be issued.

ACC-APG RTP Division is soliciting concept papers and proposals, on the endeavor described herein.

The Government encourages businesses of all size, as well as institutions of higher education, to participate through teaming arrangements with the lead organization. Applicants must reflect the appropriate teaming structure and eligibility requirements as identified in this announcement. Applicants are responsible for reviewing and addressing, as necessary, any amendment to this FOA, to include but not limited to any adjustment on submission dates or times or other submission requirements.

Type of Contract/Instrument and Eligibility Criteria: The Government may award Department of Defense Grant and Agreement Regulations (DoDGARS)-based Technology Investment Agreements (TIA) (32 CFR Part 37) or Prototype Other Transactions (10 USC 2371b) as a result of this FOA. The Agreements Officer will make the determination as to which type of agreement will be utilized under this FOA.

A. As defined by the DoDGARS, a TIA is a special class of assistance instrument used to increase involvement of commercial firms in defense research programs and for other purposes related to integrating the commercial and defense sectors of the nation's technology and industrial base.

TIA's are used to stimulate or support research and are designed to: (a) Reduce barriers to commercial firms' participation in defense research, to give the Department of Defense (DoD) access to the broadest possible technology and industrial base; (b) Promote new relationships among performers in both the defense and commercial sectors of that technology and industrial base; and (c) Stimulate performers to develop, use, and disseminate improved practices.

Per 32 CFR Part 37, several determining factors must be addressed by the Government Agreements Officer in order to award a TIA. The following factors should be evident in the proposal submission and serve as eligibility criteria for potential award of a TIA:

1. The principal purpose of the project is the stimulation or support of research, rather than acquiring goods or services for the benefit of the Government. The basic, applied, or advanced research must also be relevant to the policy objective of civil-military integration as defined by 32 CFR Part 37 Appendix A. (Reference 32 CFR 37.205)
2. A TIA may only be awarded when one or more for-profit firms are to be involved in either the performance of the research project or the commercial application of the research results. (Reference 32 CFR 37.210)
3. The recipient must show a strong commitment to, and self-interest in, the success of the project. The Government is required to seek cost sharing to ensure the recipient incurs real risk that gives it a vested interest in the project's success. To the maximum extent practicable, the non-Federal parties carrying out the research project under a TIA are to provide at least half of the costs of the project. In the event that a lesser amount of cost sharing is impracticable, the proposal should provide justification for why that is the case and also demonstrate the potential recipient's self-interest in the success of the project. Cost sharing may include, among other things, in-kind monetary contributions, labor contributions, facilities/equipment contributions, contributions from third parties investing in the research project. (Reference 32 CFR 37.215)

B. Prototype Other Transaction (OT)

As specified in the DoD "Other Transactions Guide", Prototype OTs (November 2018) provide the Government with access to state-of-the-art technology solutions from traditional and non-traditional defense contractors (NDCs). OTs can help: (a) foster new

relationships and practices involving traditional and NDCs, especially those that may not be interested in entering into FAR-based contracts with the Government; (b) broaden the industrial base available to Government; (c) support dual-use projects; (d) leverage commercial industry investment in technology development and partner with industry to ensure DoD requirements are incorporated into future technologies and products; and (f) collaborate in innovative arrangements.

In order to be compliant with 10 USC 2371b, awards made as a Prototype OT must meet at least one of the following eligibility conditions:

1. There is at least one NDC or non-profit research institution participating to a significant extent in the prototype project.
2. All significant participants in the transaction other than the Federal Government are small businesses [including those participating in the Small Business Innovation Research (SBIR) or Small Business Technology Transfer (STTR) programs].
3. At least one-third of the total cost of the prototype project is to be paid out of funds provided by parties other than the Federal Government. OR
4. The senior procurement executive (SPE) for the agency determines in writing that the exceptional circumstances justify the use of a transaction that provides for innovative business arrangements or structures that would not be feasible or appropriate under a contract, or would provide an opportunity to expand the defense supply base in a manner that would not be practical or feasible under a contract.

Estimated Program Funding: The estimated amount of funding available for projects under this FOA is currently unknown. The Government will review and evaluate proposals in accordance with this FOA in order to make decisions on awards. Proposals are subject to available funding and a technical evaluation resulting in award. There are no limits on either the dollar amount or period of performance for agreements made as a result of this FOA.

Anticipated Number of Awards and Award Period: CCDC-ARL and ACC-APG RTP Division intend to make multiple awards (i.e., to enter into multiple TIAs/OTs with industrial and academic institutions and teams) but reserve the right to make no award under this FOA. The anticipated award period of a TIA/OT between the Government and an awardee will be based on the proposal and its research goals.

Brief Program Summary: The topics in Section I.A are intended to help ARL execute manufacturing technology (ManTech) programs to address the highest priority needs of the US Army. The goal of these programs is to demonstrate and ultimately transition improved and cost-effective manufacturing solutions for Army platforms and Warfighter systems. Strong transition planning is essential to program success and requires a clear path to implementation. Program stakeholders typically include proponents from the acquisition community, technology managers, manufacturing facilities, and industry. Program investment areas are aligned with Department of Defense (DoD) directives, and currently include technologies oriented towards: 1) future platforms, 2) legacy platforms, and 3) the organic industrial base. Alignment to the Army Modernization Priorities is also required, and these priorities are: 1) Long-Range Precision Fires,

2) Next Generation Combat Vehicle, 3) Future Vertical Lift, 4) Army Network, 5) Air and Missile Defense, and 6) Soldier Lethality.

CCDC ARL seeks proposals to develop and demonstrate manufacturing and/ or repair improvements for Army materiel, which includes items and materials associated with combat vehicles, armaments, vehicle and personal protection systems, etc. These manufacturing and repair improvements should provide cost, schedule, and risk reduction benefits compared to current baseline processes. Detailed descriptions of topics of interest are included below.

Full Text Announcement

I. PROGRAM DESCRIPTION

The U.S. ACC-APG (RTP Division), is soliciting concept papers and proposals consisting of Volume I, Technical and Volume II, Cost on the research efforts described below:**A. TOPICS**:

Topic 1: INTELLIGENT, MOBILE, ADAPTIVE MANUFACTURING CELL (IMAC) FORMING MT

Background:

The DOD is seeking proposals to develop and demonstrate improvements for the manufacture of combat vehicle hulls/structures, to reduce labor-intensive practices and processes on the production floor that exist today to produce vehicle structures. The fabrication of ground combat vehicles poses a set of unique challenges, which are naturally distinct from those of the automotive and aerospace industries. While both automotive and aerospace primarily utilize sheet or thin plate or extrusion product forms, ground combat vehicles are manufactured from welded thick armor plate to form the base hull/ structure, which makes automation much more challenging as compared to thin plate manufacturing processes. Inherent to thick-plate welding are not only the potential for weld defects, but the increased possibility for the workpiece to become distorted. As more plates and subsections are welded together, the likelihood of weld defects and distortions rise, and the end product (i.e. vehicle hull) can contain defects and deviations from its as-designed tolerances (where everything should fit together perfectly) that result in costly and inefficient rework. Each vehicle, particularly legacy platforms, is thus unique to some extent. This environment is different than the commercial automotive or aerospace platforms where more advanced forming techniques, precision and automation have been the norm. Hence, forming techniques that unify components to minimize joining have rapidly progressed and automation within these industries can be “hard-programmed” because the production environment is high volume, low mix, and high precision. In contrast, the production environment for combat vehicles is relatively low volume, high mix, and lower precision where more intelligence is required to adjust or compensate.

Recent advances in materials and forming technologies have allowed the automotive industry to consolidate multi-part, complex assemblies into one formed component. Through the utilization of high strength steels and hot stamping (press hardening), along with shape optimization algorithms, have enabled automotive designers to not only lighten automotive structural weights (in excess of 10%), but offer the flexibility of producing components with optimal gradient properties. While utilization of these processes for the automotive industry has dramatically increased over the past five years, this technology has lagged in application to defense products. Forming of high hardness armor steel alloy components has seen some maturation and inclusion in armored vehicles in Europe (and the civilian armored automobile market), the armor thicknesses for ground combat vehicles has limited its application to these systems. However, recent advances in armor steel, aluminum and titanium alloys and forming technologies has shown that application of these manufacturing technologies is possible, along with synergetic coupling of formed components with metal additive manufacturing processes. Maturation of the processes to consolidate armor vehicle component parts and minimize welds are enablers to advance the fabrication of combat vehicles and maintain program cost and schedule.

Up to this point in time, the most effective way to address workpiece deviations inherent to thick-plate combat vehicles has been to use a person-in-the-loop. As an experienced worker on the factory floor, the operator has knowledge to make decisions to compensate and still maintain performance requirements. However, there are drawbacks to this approach, first of which is the fact that individuals make individual decisions, which may or may not be consistent with other workers operating in-parallel on the production line. Part deviations resulting from individual decision-making can compound and cause greater, unforeseen assembly issues downstream, potentially leading to part non-conformance and expensive and time-consuming rework. Second, many manual assembly tasks are repetitive and time-consuming, and are often regarded as choke points in the production process requiring multiple workstations in multiple locations to maintain throughput.

Production of Army combat vehicles will benefit from the maturation and use of advanced manufacturing technologies to consolidate parts and decrease the number of welded components, along with robotics and automation to reduce the number of direct man-hours required to manufacture a combat vehicle in order to reduce production time, rework, and increase capacity. The robots must be configured for this environment by being intelligent and flexible. The required intelligence will be based on artificial intelligence and machine learning technology applied to the manufacturing environment. Intelligent robotics will know the operations to be performed, identify any dimensional differences, compensate where possible, notify an operator as necessary, perform the required operations, and inspect the results.

Requirements:

The objective for the maturation of advanced manufacturing technologies will be first to identify multi-part combat vehicle components and then develop the appropriate process or combination of manufacturing processes to consolidate the multi-part component into one part, thereby eliminating the need for welding, reducing cost and increasing performance. The manufacturing processes that can be considered include 1) hot forming (press hardening), 2) hot forming

followed by a separate quench and age or temper, 3) machining of thick armor plate, 4) a combination of hot forming, machining and metal additive manufacturing as separate discrete processes and 5) hybrid manufacturing whereby these are combined in one machine. Materials to be considered include roll homogeneous armor (RHA) steel, high hardness (HH) armor steel, ultra-high hardness (UHH) armor steel, armor aluminum and titanium alloys.

The objective for automating combat vehicle fabrication will be to develop technology for an intelligent mobile adaptive manufacturing cell (IMAC) with up to five stations for automating combat vehicle process and assembly operations. The basic operating premise for each station will be: 1) to move the workpiece/subassembly/assembly into the cell, 2) orient the workpiece, 3) scan the workpiece, 4) identify the task to be performed, 5) adjust the path planning and process parameters to compensate for any deviations detected, 6) perform the operation, 7) post-inspect and/ or scan the workpiece to determine GO/NO-GO on further part processing or set-aside.

Manufacturing operations can include:
1) Inspection/Metrology Operations: laser, x-ray, white light
2) Machining Operations: drilling, tapping, milling, grinding
3) Joining Operations: inserts, bosses, tack and light-duty welding
4) Other: cleaning, surface preparation

The foundation of the approach is the use of artificial intelligence and machine learning to enable intelligent robotics to position sub-assemblies and to perform a multitude of tasks during production and upgrade operations for ground combat vehicle platforms. Tasks targeted for initial development are ones that are currently performed manually and that prove particularly inefficient, tedious, quality-challenged, and time consuming.

An example of a tedious and quality-challenged manual operation facing many vehicle platforms is the drill-tap-insert (DTI) process. The DTI process is necessary for preparing attachment points for applique armor and other add-ons to vehicle hulls. Depending on the platform, these attachment points can number into the thousands, and each must be positioned in a precise location and pattern. Because uncertainty associated with welding the hull sections, these holes cannot be predrilled with the required precision.

The robotic technology will automate several combat vehicle assembly operations to reduce manufacturing costs and improve production throughput. The multi-station cell will also incorporate new in-line inspection capabilities to identify, eliminate, or mitigate minor part non-conformances early on in the manufacturing process before they become a future problem. This inspection feature not only lowers manufacturing costs but also enables higher quality and consistent products coming off the line. Additionally, by virtue of its design, the technologies are inherently platform-agnostic and can address the manufacturing needs of numerous vehicles in various lifecycle stages, new production, reset, ECP, etc. Capabilities targeted for initial demonstration are scanning of hulls/ subassemblies, delivery and manipulation of work pieces, drill-tap-insert (DTI) operations, and inspection.

Robots can be tailored to perform broad classes of functions, ie. workpiece delivery, manipulation, and positioning; and process workers. The ability of a material handling robot to

act as a fixture when positioning vehicle subassemblies, and the artificial intelligence required within the work cell, are desired aspects of IMAC.
Workpieces/subassemblies/assemblies/structures can differ from their as-intended designed tolerances. As such, robots performing autonomous operations on said workpieces must be able to recognize this, orient itself, and adjust its actions accordingly to compensate as required. Workpiece deviations occur in the ground combat vehicle manufacturing environment, particularly working with legacy structures. As such, robots cannot be simply hard-programmed for their tasks the way that robots in the automotive industry are. Some artificial intelligence/ machine learning is required.

The current DTI process referenced above involves manual operations for each hole. The procedure is as follows: 1) determine the correct location for each hole template on the side of a vehicle and attach them, 2) drill a hole into the vehicle's hull, 3) thread the hole with a tap, and 4) insert a wear-resistant insert (for accepting fasteners from applique armor and other add-ons). The templates are custom tooling pieces, and are not transferrable between vehicle platforms. To use the templates, an operator uses a hoist to position each individually for the particular hole pattern being worked. This positioning must be precise relative to key features such as datum locations and other hole patterns, such that no "ballistic windows" are created by gaps between improperly positioned armor panels. However, small adjustments to positioning are frequently needed to eliminate such gaps, as as-manufactured parts inherently deviate from their as-designed Computer-Aided Design (CAD) models, especially in the case of thick-plate welded structures. Some development will be necessary to automate the insert function since it is easy to misalign the insert with the receiving hole, resulting in cross treading or jamming of the insert which would require rework.

Robots must recognize and orient themselves based on prescribed part features (such as datums) and adjust functions/actions according to real time measurements taken from a workpiece. They must recognize workpiece deviations and adjust actions accordingly, consistently, and within allowable tolerances.

Due to the flexibility sought for the cell, there are several intended tasks that must be performed in each substation. Each task requires a specialized end effector; specialized not for its application to a particular workpiece or platform, but specialized for its function such as drilling holes, cutting threads, welding, machining, inspection, etc. Another challenge is the need to maximize the efficiency of the tasks to be performed in low-bay shop floor space, which restricts the way the hulls and subassemblies can be manipulated into favorable orientations for the tasks to be performed.

To initiate any activity assigned to a substation, the robots must be able to recognize the assembly, subassembly, or components that they will be working on. The material handling robot must then orient the structure into the proper position for a worker robot to perform the assigned functions or place it into an appropriate fixture. The worker robot will already have the necessary manufacturing data in memory to validate the workpiece is ready and to perform the assigned functions. The worker robot will be equipped with image recognition and sensors such

as lasers to be able to measure critical parameters on the workpiece, identify datums, and to adjust as necessary any path planning to perform the assigned functions.

Post-process inspections are important to overcome quality issues. It is important to identify the issues and take corrective action as soon as possible to prevent them from becoming problems. Inspections can include visual, laser, low dose X-ray to validate dimensional tolerances, and material integrity. Thorough inspection in the cell can enable repairs to be performed within the cell rather than cause disruptions and delays downstream with increased delay and cost.

Each sub-station may contain its own independent material handling system for positioning a workpiece or hull into the best, pre-programmed orientation(s) for tasks to be performed. "Worker robots" will then be used to actually perform the work at hand. These worker robots will be capable of travelling between sub-stations to perform the operations listed above (i.e. inspection, machining, and joining). A set of worker robots and a common repository for end effectors, combined with independent material handling in each sub-station, means that different vehicle platforms and workpieces in various stages of fabrication can be handled at once. It is not intended to be a station-by-station, iterative march-along for the workpieces that go through it. Rather, for ultimate flexibility, any sub-station that is open can accept any workpiece at any time for any programmed operation.

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Topic 2: DEVELOPMENT OF MANUFACTURE TECHNOLOGIES AND PROCESSES FOR VERSITALE TACTICAL POWER AND PROPULSION

ARL advances new concepts and technologies for the Army's future force, and provides the means to exploit scientific breakthroughs and avoid technological surprise. These concepts and technologies impact the development of new power and propulsion systems for current and future unmanned aircraft systems (UASs) and unmanned ground vehicles (UGVs) in support of the Future Vertical Lift and Next Generation Combat Vehicle Modernization Priorities. UAS currently suffer from inadequate performance, suboptimal reliability and increased life-cycle costs because they use propulsion systems that have been designed for civilian ground applications and single fuels rather than the harsh conditions associated with military operating environments. To address the needs of the Army Modernization Priorities and create new tactical unit independence capabilities, ARL seeks to improve and expand the domestic industrial knowledge and manufacturing base to meet the energy, power and propulsion system requirements (power density, range, reliability) unique to next generation Army air and ground operational environment. ARL also addresses capability gaps and supply chain risks characterizing the current generation of unmanned aircraft systems (UAS) and seek to avoid them for future systems and platforms. Research is needed into the underlying science and methodologies that improve manufacturing technologies and processes in support of engine and powertrain technologies to improve the performance, operational capabilities, and sustainment of Army vehicles. Further, process prototyping and pilot demonstration are needed to develop or modify manufacturing technologies for the Army's use. Efforts support the VICTOR ARL

Essential Research Program and include manufacturing capability and processes that support ignition and control with multiple fuels, robustness and reliability of materials and mechanical components with multiple fuels and harsh combustion conditions, hybrid-electrification and turbocharging for specialized Army configurations, and power storage and distribution in a multi-agent teaming environment.

Subtopics:

a. Ignition and Control.

Manufacturing technologies are needed that will enable the development of novel lightweight, high power density, and multi-fuel capable propulsion systems for next generation UAS. Current propulsion systems for these UAS are unable to operate on a wide range of fuel properties and extreme conditions, resulting in low performance and reliability, and high cost. In the future battlefield, UAS will require robust, reliable power generation with improved performance and tolerance to fuel variability. To address fundamental research gaps in multi-fuel ignition control strategies and other multi-fuel tolerant propulsion technologies, efforts will seek to expand knowledge and understanding to support the development of unique sensing, control, and design of small system power generation. In order to improve robustness of Army power sources, novel compact on-board sensors are required to measure specific fuel properties, and adaptive ignition strategies that adjust based on sensor output are needed. Areas of interest include, but are not limited to, new methods and technologies required to produce: miniaturized rugged reliable sensors for fuel chemistry; technologies to improve engine fuel tolerance; variable ignition modeling and fuel sensing; and ignition assistance technologies and controls, especially those that couple simulation and system response.

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b. Propulsion Materials.

Current UAS engines have exhibited serious component and system failures, resulting in wasted operations, maintenance, and acquisition costs, as well as reduced Army Readiness and mission effectiveness. Furthermore, ground-based engines are manufactured by foreign sources at high-cost, injecting risk into the UAS and ground vehicle component supply chain during an era of increased global trade uncertainty and military competition. To incentivize the US industrial base to domestically manufacture next generation propulsion systems, the Army must develop propulsion systems that can use multiple fuels – those found in theater and transported in – to accomplish diverse missions, while improving other performance attributes such as efficiency, power density, and resilience. ARL is seeking advances in the manufacture of robust materials and components to address the harsh operational conditions unique to Army vehicle propulsion such as high temperature combustion, lightweight needs, high pressure fuel

systems, and extreme lubrication conditions in mechanical components. Projects of interest may address challenges such as material development and design, manufacturing methodology, and the integration of these through computational tools and frameworks.

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c. Electrification and Hybrid Propulsion.

In UASs utilizing compression-ignition engines, turbomachinery is necessary to pressurize the engine intake and achieve the required power output. Current UASs use automotive-derived turbochargers, which are not designed to operate in flight and exhibit problems related to insufficient boost, over-speeding, and vibration. To address these problems and increase performance and reliability, efforts are focusing on enabling technologies for electric turbo compound systems, oil-free bearings, and modeling and experimental measurement of turbomachinery fluid–structure interaction. ARL is seeking materials and manufacturing processes which can be developed, applied to, and/or prototyped to enable turbomachinery components and sensors capable of withstanding high pressures, temperatures, and rotational speeds.

Further, hybrid propulsion systems are currently lacking, with fossil fuel engines outperforming them in almost all aspects. In order for hybrid-electric propulsion systems to become more widely used, new technologies need to be developed that improve energy storage and the overall performance of the electric machines, as well as simulation tools that allow for the performance evaluation of the propulsion system as a whole. ARL is seeking the integration of advanced materials and new manufacturing processes to the development, design, and manufacture of electric machines (e.g. electric motor) and energy storage devices (e.g. battery) that will improve the overall energy densities and power densities of those components. Additionally, ARL is seeking the development of simulation models which can be applied to increase predictability of their performance in a virtual framework to aid in system design and production.

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d. Fast Efficient Power Distribution

Solutions for powering missions over long durations without resupply rely on recharging of batteries for small robotic autonomous systems (SRAS), sensors, and Soldiers, however the process of sharing energy is limited by four key factors: (1) use of power sources or photovoltaics that limit recharge opportunities; (2) multiple charger interfaces and wiring; (3) recovery of SRAS; and (3) long battery charging times. As a result, there is a need to share energy in a more seamless manner that will increase the pace of operations, extend missions, and enable smaller, lighter weight power sources for high power devices. ARL is seeking

solutions to the battery charging gaps that will enable energy sharing between platforms powering future RAS platforms. In particular, ARL needs the knowledge and understanding that can promote manufacture processes and technologies for materials, designs, algorithms, and limitations of four key technologies and solutions that bridge the gap for these technologies from invention to development and industrial applications: (1) rapid recharge batteries to enable more operational time; (2) close proximity wireless power transfer to eliminate wires and connectors; (3) quiet multi fuel portable power generation to allow close-in charging capability; and (4) autonomy for seamlessly battery recharging and managing the usage and distribution of energy as a team.

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Topic 3: HIGH DEPOSITION RATE ADDITIVE MANUFACTURING

Background:

This topic seeks proposals to help the DOD develop and implement High Deposition Rate Additive Manufacturing (HDR-AM) and Repair (HDR-R) technologies through research and development of materials, processes, equipment, and applications that benefit the Army, the DOD more broadly, and the US Manufacturing base as a whole.

Several advanced manufacturing processes which deposit materials onto existing parts or build platforms through solid state processing or melt solidification processing have great potential for manufacturing and repair of new parts or fielded parts respectively. The US Army, and DOD more broadly, has need for life extension of service parts to reduce the logistics train and increase force readiness. This is achieved by reducing the time to repair or replace components in the field and by improving the quality of the parts in the field to reduce mean time between overhaul.

Recent work in deposition of advanced refractory alloys, cermets (ceramic-metallic composites), aluminum alloys, and maraging steels or instance have led to surface modification, part repair and new part additive manufacturing advances for armaments, aerospace hardware, ground vehicles, and ships that otherwise could not be achieved. Materials development, modeling and simulation, and experimental work have played a critical role in these advancements and will be critical going forward to benefit the widest range of applications and application needs. Work to develop the manufacturing techniques for repair of critical DOD hardware has been highly successful in certain applications, but the need for further materials development, production hardened equipment, adaptive processes like Machine Learning for process control, and more advanced application development such as structural repairs still exists.

High Deposition Rate Additive Manufacturing is a broad category which describes processes that can deposit 10's of pounds of material per hour making large part AM and AM of lower cost commodity materials cost effective and possible. HDR-AM also has the promise of adding features or rebuilding entire sections of existing components which closely aligns this technology to repair. The primary differentiation between HDR-AM and HDR-R is that it is common and often expected that HDR-AM processes will require some

level of heat treatment after the deposition or build process. This technology is in an earlier stage of development than part repair, but has many of the same needs with respect to feedstock development, equipment development, machine learning, and applications development across the DOD.

The Government intends for this FOA to support the development and establishment of new feedstock materials and processing techniques, models that can predict quality and defects in the deposited feedstock materials, new methods of incorporating machine learning into manufacturing processes, methods of robotic manipulation and control, sensors for tracking the build process of the materials, Non-Destructive Testing techniques for verification of part quality, equipment to better control the process, and applications for the Army and the DOD more broadly which can benefit from the technologies developed. The motivation for the HDR-AM-R program is to increase U.S. knowledge base in the technologies, solve real problems for the DOD today, and increase the competitiveness of U.S. entities in these manufacturing techniques.

The Government envisions this effort to bring together entities across industry and academia to solve the problems associated with implementation of structural repair using HDR processes with multiple material systems and to develop broader capabilities in whole part and partial part builds and in part repair using HDR processes. This collaboration will likely have several entities whose roles and expertise should be explained in the proposal. It is also the intent that this collaboration will work closely with CCDC-ARL to leverage the work already performed in this area, and to better understand the challenges to be addressed.

To be successful, the results of a proposal should result in new materials developed, new processes, new and improved control processes for the deposition system and robotics, and successful DOD applications developed and transitioned to the field. Sustaining any development effort of this sort requires the industrial base capacity for materials, equipment, and processing, and a sufficiently trained workforce which can apply the technologies developed. A successful effort will include a development of or a path toward this goal. This should be considered as a thread through the entire effort with emphasis placed on materials, equipment, and processes that further this goal.

Topic Description:

Cold spray is a HDR technology which has been demonstrated to dramatically extend the life of legacy weapon systems, with its unique ability to apply materials to substrates that no other technology can. Cold Spray can create high performance coatings and materials for advanced weapons capabilities and is therefore essential for our country's national defense. Cold spray can add new metal onto worn surfaces so that critical features can be re-machined back to tolerance, allowing parts that previously had to be scrapped to be reused. This provides an incredibly powerful tool for our military to quickly refurbish an existing damaged or out of tolerance part and simply reuse it, rather than waiting weeks, months, or up to 2 years in some cases, for a replacement part. The value this brings to our military cannot be overstated. Mission capability is the number one indicator of the strength of our fleets. When weapon systems are waiting months in depots for replacement parts, or extensive repairs must be undertaken because there is no in-situ high strength repair

capability available, then our fighting power is reduced. Cold spray can repair damaged areas with new material, fully restoring the functionality and confidence of the original part, and in many cases, this can be done, on-ship, on-aircraft, or on-vehicle in hours rather than weeks or months. Cold spray is also producing coatings and Additive Manufactured (AM) near-net parts that have applications in both legacy and future weapons systems addressing needs in the restoration and reclamation of worn/corroded parts for munitions, aircraft, ships, subs and vehicles eliminating the need to purchase new expensive parts with long lead times making those future fighting capabilities possible, now.

The use on Cold Spray as an additive manufacturing process has been demonstrated, but not fully developed. The high deposition rate of the process lends it to making large parts of features very rapidly. When using Cold Spray in this way other options exist including thermal and thermos-mechanical processing to reduce potential defects or produce unique composites and alloys. AM techniques including nozzle manipulation to freeform parts, and to use mandrel techniques to form more complicated parts have been considered and partially developed.

Other HDR processes include wire based melt solidification processes such as Wire Arc Additive Manufacturing. These processes have demonstrated similar deposition rates to those achievable with Cold Spray, but through fusion welding. A significant amount of the R&D work performed with this technology has been for producing large high quality parts although limited efforts have also focused on component repair and feature addition. The DOD in interested in furthering these HDR fusion based processes as well as the HDR solid state processes to provide a broader range of repair, and AM options for the DOD community. The Army specifically is invested in both HDR solid state and fusion based processes to achieve the improved performance and reduced downtime needed by the warfighter and has plans to further develop them through development in feedstock, process development, process modeling, process control, path planning, in-situ monitoring, and NDT.

A program in HDR-AM-R includes the following, with a proposal addressing some or all of these aspects as supported by an Applicant's approach and cost:

1. Process Modeling – Process modeling is critical to developing a broad understanding of the manufacturing processes themselves and to make predictions about potential defects and properties. Process models of interest include both physics based and semi-empirical models. Physics based models specifically have the potential of reducing the level of effort dedicated to the Edisonion trial and error approach to process and materials development. Semi-empirical models generally require some experimental data, but provide a mechanism to take that data, quantify it and make expressions to make further predictions in areas that have not been fully explored.

2. Feedstock Development – Feedstock is at the heart of any AM process as this if the material used to create the part, coating, or feature desired. Depending on the AM process used the specific critical aspects of the feedstock can change but include, surface oxide/hydroxide, microstructure including phase presence and segregation, heat treatment, and size. Process modeling can play an important role especially when

physics based models can provide details about the effects of particle flow stress on deformation under impact conditions or wire diameter on the depth of HAZ or solidification rate.

3. Process Development – Process development as a task will draw heavily from the process models and will be closely tied to the feedstock. Other important features of this effort would include equipment needed to achieve high quality deposition, the process settings (pressure, temperature, voltage, current, frequency, standoff, angle, etc.), the gaseous environment around the part. It will be incumbent as part of this task to develop robust designs for the equipment needed to achieve the highest quality materials that are highly flexible, but while also being robust for field use. This includes the added features and consumables that may be material specific, the sensors to monitor the process, and the motion systems needed for proper control.

4. Process Control – Process control can take on several forms and is of course closely tied to the other tasks described. At its core, this task would consider the sensor data from the process and use that data to control various aspects of the process ensuring consistent performance. Most high quality HDR processes have some level of process control through PLC, computer, or other type of digital controller. This task may consist of not only improving on the consistency of process control incorporating new sensors as needed from the Process Development task, but also incorporating machine learning into the control process of the system. Machine learning (ML) is a tool which can be used to monitor and update process conditions using algorithms which take advantage of data collected over time on high and low quality deposits of material. Two critical aspects of ML include being able to properly capture the process characteristics and having the data to support system learning. These would be critical aspects of any ML process control effort.

5. Motion Path Planning – Once a process is developed and can be controlled, robotic path planning is the key to being able to get consistent properties out of a process. Real part geometries can play a key role in the resulting properties of the deposits due to defect formation that may not be present in the typical flat plate used for process development. Rules based path planning, Machine Learning, and human-robot teaming have the potential to produce improved and consistent results from part to part. In addition, rules based repair designs combined with a geometry-property database has the potential to reduce the complexity of the required path planning and optimize the deposit properties.

6. Non-Destructive Testing – Many NDT techniques have been developed for traditional manufacturing processes based on the likely defects and defect locations from these processes. Likewise HDR-AM-R requires a set of NDT techniques which can be used either in-situ or ex-situ to validate build quality. CT Scanning for instance is a known method for evaluation of parts ex-situ, but capturing fine defects requires high cost and complex equipment. Layer-by-layer analysis techniques hold a great deal of promise in AM generally as the parts can be evaluated for internal quality during the build cycle.

7. Applications Development and Testing – The final proof of any process development will be the applicability of this process to real world hardware. This portion of any effort

would include review of part requirements and build or repair strategies and would require careful coordination with Program Managers (PM's), depots, and design authorities. It is expected that the applicability of the process will be included in any program and be started early in the program to identify multiple application off-ramps at different decision points along the program timeline.

The benefits of the HDR-AM-R program include the profound advantages for the DOD in component repair and manufacturing as well as the expected transition to the commercial realm making the US manufacturing workforce more productive. To this end it is anticipated that efforts might include commercialization aspects for instance regarding equipment, software, feedstock, NDT techniques, etc.

TPOC: Aaron Nardi aaron.t.nardi.civ@mail.mil

B. SCHEDULE/PERIOD OF PERFORMANCE

The period of performance of agreements resulting from this FOA will be based on the proposal and its research goals.

C. REPORTING ITEMS

1. Annual Business Reports
    a) Funds Expenditure Report
    b) Inventions, patent applications and awards, publications, and conference presentations

2. Quarterly Technical Reports
    a) Technical Project Status broken down by task and TPOC

3. Program Reviews
    a) Annual reviews of all tasks associated with the project

4. Standard Form 425 (SF 425) "Federal Financial Report"

5. Final Report

6. Prototypes or other deliverables as proposed and/or negotiated.

D. OTHER REQUIREMENTS

1. Program security classification: Unclassified

2. Program Protection Plan. The government will address any critical program information (CPI) with a potential requirement for a program protection plan (PPP) generated as part of this effort as needed.

3. Export Control: It is not anticipated that Export Control (International Traffic In Arms Regulation (ITAR) 22 CFR 120-131, or Export Administration Regulations (EAR) 15 CFR 710-774) will apply to the HDR-AM-R with the exception of DOD part information. It is the recipient's responsibility to determine applicability with Export Control laws and regulations and ensure compliance. Export Control laws and regulations may apply to individual tasks depending on the nature of the research tasks.

E. GOVERNMENT FURNISHED PROPERTY (GFP) AVAILABILITY

The government does not anticipate making GFP available under resultant awards, but reserves the right do so.

F. RIGHTS IN TECHNICAL DATA AND COMPUTER SOFTWARE

"Data" means computer software, computer software documentation, and technical data (as defined in DFARS 252.227-7013 and DFARS 252.227-7014).

Government purpose rights" means the rights to (i) use, modify, reproduce, release, perform, display, or disclose Data within the Government without restriction; and (ii) release or disclose Data outside the Government and authorize persons to whom release or disclosure has been made to use, modify, reproduce, release, perform, display, or disclose that Data for United States Government purposes. Government Purpose Rights will allow the Government the right to practice, obtain, reproduce, publish, or otherwise use in any part of the world for purposes of the Government, and to authorize others to do so solely for Government purposes. Government purpose does not include commercial applications.

"Unlimited rights" means rights to use, modify, reproduce, perform, display, release, or disclose Data in whole or in part, in any manner, and for any purpose whatsoever, and to have or authorize others to do so.

"Technical data" means recorded information, regardless of the form or method of the recording, of a scientific or technical nature (including computer software documentation). The term does not include computer software or data incidental to contract administration, such as financial and/or management information.

"Form, fit, and function data" means technical data that describes the required overall physical, functional, and performance characteristics (along with the qualification requirements, if applicable) of an item, component, or process to the extent necessary to permit identification of physically and functionally interchangeable items.

"Computer software" means computer programs, source code, source code listings, object code listings, design details, algorithms, processes, flow charts, formulae and related material that would enable the software to be reproduced, recreated, or recompiled. Computer software does not include computer data bases or computer software documentation.

"Computer software documentation" means owner's manuals, user's manuals, installation instructions, operating instructions, and other similar items, regardless of storage medium, that explain the capabilities of the computer software or provide instructions for using the software.

Technical data, Non-Commercial Software (NCS) and NCS documentation developed with mixed funding under an award are expected to be delivered with Government Purpose Rights. Proposals that propose delivery of technical data, NCS, or NCS documentation with less than Government Purpose Rights, that is subject to Limited Rights, Restricted Rights, or Specifically Negotiated License Rights should fully explain what technical data, NCS, or NCS documentation developed with costs charged to indirect cost pools and/or costs not allocated to a Government contract will be incorporated as part of the award effort, how this incorporation will benefit the program, and address whether there are portions or processes which are segregable for rights determination. All Proprietary /Limited/Restricted Rights data will be clearly identified and marked in the Applicant's proposal.

Relative to patents, the allocation of rights pursuant to the Small Business Patent Procedures Act, commonly referred to as the Bayh-Dole Act, and associated standard patent rights clauses (37 CFR 401.14) provides a baseline to the rights the Government will expect to obtain, unless the proposal identifies and supports the need to negotiate different patent rights provisions.

II. AWARD INFORMATION

The Government intends to award TIAs and Prototype OTs under the authority of 10 USC §2371 and 10 USC §2371b, as implemented by the Department of Defense Grant and Agreement Regulations (DoDGARS) for TIAs, or the DoD Other Transactions Guide, for Prototype OTs, and defined in the Overview Section of this FOA. The complete version of the DoDGARS can be found online at the link below, including Part 37 "Technology Investment Agreements": https://www.gpo.gov/fdsys/pkg/CFR-2012-title32-vol1/pdf/CFR-2012-title32-vol1-subtitleA-chapI-subchapC.pdf. The complete version of the DoD Other Transactions Guide can be found at https://www.dau.edu/guidebooks/Shared%20Documents/Other%20Transactions%20(OT)%20Guide.pdf.

A. ANTICIPATED AWARD DATE

N/A; Awards may be made continuously throughout the life of the FOA.

B. ANTICIPATED FUNDING FOR THE PROGRAM

1) The estimated amount of funding available for projects under this FOA is currently unknown. The Government will review and evaluate proposals in accordance with this FOA in order to make decisions on awards. Proposals are subject to available funding and a technical evaluation resulting in award. There are no limits on either the dollar amount or period of performance for agreements made as a result of this FOA.

2) This FOA is issued subject to the availability of funds. Funding is anticipated to continue for the five-year period. However, Applicants are reminded that this request is subject to Presidential, Congressional, and Departmental approval.

C. NUMBER OF AWARDS ANTICIPATED

The Government may make multiple awards under this FOA, but reserves the right to make no awards.

III. ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

Eligibility to respond to this FOA is limited to U.S. for-profit organizations and non-profit organizations, to include NDCs, as previously defined in this FOA. In order to be eligible for award, proposals must meet either the criteria specified in 32 CFR Part 37 for award of a TIA or 10 USC 2371b for award of an OT. This criteria is also specified in the "Type of Contract/Instrument/Eligibility Criteria" paragraph on page 2 of this FOA.

The awardee is expected to lead this effort providing regular updates and program reviews with ARL Technical SME's as well as other funding organizations including MANTECH program offices, Program Managers, and other DOD organizations. Effective management of this effort will therefore require a blend of organizational, technical, and leadership qualities.

B. COST SHARING OR MATCHING

1. Requirement for Awarding TIA

The recipient must show a strong commitment to and self-interest in the success of the project. The Government is required to seek cost sharing to ensure the recipient incurs real risk that gives it a vested interest in the project's success. To the maximum extent practicable, the non-Federal parties carrying out the research project under a TIA are to provide at least half of the costs of the project. In the event that a lesser amount of cost sharing is impracticable, the proposal should provide justification for why that is the case and also demonstrate the potential recipient's self-interest in the success of the project. Cost sharing may include, among other things, in-kind monetary contributions, labor contributions, facilities/equipment contributions, contributions from third parties investing in the research project.

For more detailed information on cost sharing, refer to DoDGARS 32 CFR §37.215 and §§37.525-37.555.

2. Requirement for Awarding Prototype OT

Depending on the level of participation of NDCs, non-profit research institutions, and/or small business concerns in the proposed project, proposals awarded a Prototype OT may require at least one-third of the total cost of the prototype project to be paid out of funds provided by parties other than the Federal Government.

C. FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTERS

Federally Funded Research & Development Centers (FFRDCs) are not eligible to receive an award under this FOA or team with an Applicant.

D. FEDERAL GOVERNMENT ORGANIZATIONS

The DoD recognizes federal government organizations may have unique facilities, capabilities, and expertise that may provide benefit to the project. Federal government organizations may not, however, serve as technical project leads, be involved in the management or administration of the lead organization, or be involved with the concept paper or proposal development.

E. FOREIGN PARTICIPATION

The recipient of the award must be registered as a U.S. organization. U.S. incorporated companies that are wholly or majority owned subsidiaries of foreign companies or foreign sister universities may be eligible to be sub-awardees of federal support if they are able to demonstrate to the satisfaction of the lead organization and DoD that: 1) their participation is in the best interest of the program, U.S. industry, and U.S. economic development; 2) adequate Intellectual Property and data protection protocols exist between the U.S. subsidiary and its foreign parent organization; 3) the project work is conducted in the U.S.; 4) other conditions deemed necessary by the lead organization and the government to protect U.S. government interests are met; and 5) the lead organization and the sub-awardees are in compliance with 8 USC§ 1324a and 8 CFR §274a.2.

Projects may be subject to export control laws and regulations. Under no circumstances may any foreign entity (*i.e.,* organizations, companies or persons) receive access to export controlled information unless proper export procedures have been satisfied. The lead organization will address participation by a foreign entity (*i.e.,* organizations, companies or persons) on a case-by-case basis, and will ensure measures are implemented that properly protect Export Controlled information.

IV. APPLICATION AND SUBMISSION INFORMATION

OVERVIEW

The application process consists of a Concept Paper or Proposal that will be reviewed for potential funding. The purpose of a Concept Paper would be to minimize the effort associated with the production of a detailed Proposal for an Applicant that is unsure of the applicability of their solution to the problem statement. Concept Papers are not required prior to the submission of a Proposal. The Government's decision to select a Proposal will be based upon the evaluation results of a timely and compliant submission.

Concept Papers and Proposals must be submitted in accordance with this FOA. The Proposal must be valid for at least 180 days from submission. Applicants should be alert for any amendment to this FOA that may adjust submission dates, times or other submission requirements. All submissions must be unclassified. The Government will not reimburse any cost associated with participation in the Proposal process. The cost of preparing Concept Papers and

Proposals in response to this FOA is not an allowable direct charge to any resulting award (or any other federal award/contract).

The Government reminds Applicants that only warranted Agreements Officers can contractually bind or otherwise commit the government.

A. ADDRESS TO REQUEST APPLICATION PACKAGE

This FOA may be accessed at Grants.gov (www.grants.gov) and in the Contract Opportunities at beta.SAM.gov (https://beta.sam.gov).

B. CONTENT AND FORM OF APPLICATION SUBMISSION

1. General Format

All Applicants should note that these submission instructions require the use of Microsoft Office, version 2007 or newer, and/or Adobe Acrobat, version 8.1.3 or later – or their fully compatible equivalents. At this time, the government knows of no fully compatible equivalents. The file name for a concept paper must have the form W911NF-20-S-0011 Concept Paper <Topic Name>.doc (or .docx) or W911NF-20-S-0011 Concept Paper <Topic Name>.pdf

The format requirements for all documents are as follows:
• Page Size – 8.5 x 11 inch paper
• Margins – 1 inch
• Spacing – double spaced
• Font –Times New Roman in 12 point

These requirements are to ensure the readability of the document by the evaluation team. The Concept Paper and Proposal should not contain any hyperlink references to circumvent the page restrictions called out below.

Page Count Guidance

This FOA identifies strict limitations on page counts for the Concept Paper and Proposal. To assist Applicants in complying with the page limitations while providing adequate detail on each topic, a "notional page count" is provided for each section of the outline in the table below. The two volumes are NOT required to comply with the notional page counts *for each section*. Each volume *is required* to comply with the limitation for *total page count*.

The Government will check the Concept Paper and Proposal for conformance to the stated requirements. Any pages in excess of the stated page limitation after the format check will not be considered for evaluation.

2. Concept Paper Instructions:

The Applicant may submit an electronic Concept Paper to the Government TPOCs indicated in this FOA. If an applicant chooses to submit a Concept Paper, it must be emailed to the TPOC listed for the applicable topic and must include a subject line of "CONCEPT PAPER – W911NF-20-S-0011 <Topic Name>" in order for the Concept Paper to be properly received.

When sending electronic files, an Applicant is to account for potential delays in file transfer from the originator's computer server to the government website/computer server.

A Concept Paper sent by any other means (*e.g.,* submitted to other email addresses, hand-carried, postal service mail, commercial carrier or fax) will not be considered. An Applicant will receive an email confirmation that their Concept Paper has been received.

a. General: The Concept Paper will include a rough order of magnitude (ROM) cost. The Concept Paper must include a discussion of the nature and scope of the proposed technical approach. The Government will evaluate the Concept Paper to determine if a likely proposal would include sufficient aspects of technology development in the task areas laid out, and if the program costs appear reasonable for the project. It is recognized the Concept Paper will not be at the level of a Proposal, but will describe the vision and outline of the Applicant's proposed plan. An applicant will be notified regarding a submitted concept paper if the Government is requesting a full proposal. The cost of preparing a Concept Paper in response to this FOA is not considered an allowable direct charge to any resulting award.

b. Page Limitation: The Concept Paper is limited to **10** pages, prepared and submitted in Microsoft Word or Adobe format. Font must be standard 12-point business font Times New Roman. Character spacing must be "normal," not condensed in any manner. Pages must be double-spaced (must use standard double-space function in Microsoft Word), double-sided (each side counts as one page), 8.5 by 11 inches, with at least one-inch margins on both sides, top and bottom. All text, including text in tables and charts, must adhere to all font size and line spacing requirements listed herein. Font and line spacing requirements do not have to be followed for illustrations, flowcharts, drawings, and diagrams. These exceptions will not be used to circumvent formatting requirements and page count limitations by including lengthy narratives in such items. Pages must be numbered starting with the first page of the paper being Page 1, and the last page being no greater than Page 10. The page limitation covers all information excluding cover page, technical references, and biographies. The Government will not consider pages in excess of these limitations for evaluation.

c. Format: The Concept Paper will be formatted as set forth below.

i. Section 1: FOA Number, Title of Topic, Name of Company, Business Size, Company's Commercial and government Entity (CAGE) number, Dun & Bradstreet (D&B) Data Universal Numbering System (DUNS) number, Contracting POC and Technical POC with appropriate telephone numbers, and email addresses for the POCs.

ii. Section 2: Background about Proposed Technology

iii. Section 3: Proposed Technology Development

iv. Section 4: Program Outline or Plan of Execution

v. Section 5: Technical references.

vi. Section 6: Biographies of Key Personnel.

vii. Section 7: Cost (Rough Order of Magnitude (ROM)).

d. Technical Portion: The Concept Paper consists of a summary of the proposed technology with any relevant background data or experience generated by the proposer of proposed sub-recipients. The proposed technology development should include the new development expected under the proposed effort and the shortcomings they address. The program outline should address timeline of execution and sufficient details about software to be used, equipment to be created, etc. as part of the effort. The technical references section of the paper should include any references critical to the understanding of the technology or the methods of execution of the effort. Total numbers of external references is not an evaluation criteria and limiting to those which are critical to understanding the proposal is preferred. **The main text of the Concept Paper, contained in Sections 2 through 4, is limited to ten (10) pages in length, exclusive of cover page, references, and bios.** The organization and content requirements for the Concept Paper are summarized in Table 2 along with suggested section page limits. A proposed Statement of Work is not required at this point.

e. Cost Portion: The cost portion of the Concept Paper shall include a ROM cost estimate. No detailed price or cost support information should be forwarded; only a time-phased bottom line figure should be provided.

f. Concept Paper Summary: Reference Section VI for a Checklist of the requirements.

TABLE 1 – CONCEPT PAPER FORMAT
(Maximum = 10 Pages)
SECTION 1 – Cover Page, Table of Contents (Excluded from the Page Count)
SECTION 2 – Background about Proposed Technology (2 pages)
SECTION 3 – Proposed Technology Development (4 pages)
SECTION 4 – Program Outline or Plan of Execution (4 pages)
SECTION 5 – Technical References (Excluded from the Page Count)
SECTION 6 – Biographies of key personnel (one page each max, excluded from page count)
SECTION 7 – Rough order of magnitude cost (including method of achieving cost-sharing) (Excluded from the Page Count)

3. Proposal Instructions:

A Proposal MUST be submitted electronically through the www.grants.gov portal. A Proposal sent by fax or email will not be considered. An Applicant is responsible for submitting electronic Proposals so as to be received at the Government site indicated.

a. General:

i. For Applicants submitting a Proposal through the proper means, the Government will evaluate the proposal to determine if it includes sufficient technical rigor, addresses the goals of this FOA and addresses sufficient aspects of technology development in the task areas laid out. In addition, the proposal will be evaluated to determine if the technical rigor and tasks warrant the proposed program costs.

ii. Technical and cost volumes of the Proposal should be submitted in separate volumes, and must be valid for 180 calendar days from the submission date.

iii. A Proposal must reference the announcement number: **W911NF-20-S-0011.**

iv. Applicants MUST submit their proposal via Grants.gov.

v. Applicants are advised that only Agreements Officers are legally authorized to contractually bind or otherwise commit the government.

vi. The cost of preparing a Proposal in response to the FOA is not an allowable direct charge.

b. For Electronic Submission:

i. Advance Preparation – Electronic proposals must be submitted through Grants.gov. There are several one-time actions your organization must have completed. Verify that the persons authorized to submit proposals for your organization have completed these actions. If not, it may take them up to **21 days** to complete the actions before they will be able to submit proposals.

ii. Electronic Submission Process: The process your organization must complete includes obtaining a Dun and Bradstreet Data Universal Numbering System (DUNS) number, registering with SAM, registering with the credential provider, and registering with Grants.gov. Designating an E-Business Point of Contact (EBiz POC) and obtaining a special password called MPIN are important steps in the registration process. Go to http://www.grants.gov/web/grants/applicants/organization-registration.html.

iii. Should you have questions relating to the registration process, system requirements, how an application form works or the submittal process, call Grants.gov at 1-800-518-4726 or support@Grants.gov <mailto:support@Grants.gov> .

c. Award Opportunity: Go to http://Grants.Gov to find the award opportunity. The initial screen will provide the synopsis for that specific award opportunity. To view the entire opportunity open the "Full Announcement" link in the "Related Documents" tab. NOTE: http://Grants.Gov has tools and guiding documents under "Applicant Resources" to help register and apply for award opportunities.

d. Proposal Cover Page – SF 424 (R&R) Form and Certifications: All proposals for assistance must include an SF 424 (R&R) as the cover page and the requisite Certifications. The SF 424 (R&R) and Certifications should be downloaded as part of the Application process at www.grants.gov. To complete the Certifications you must check Block 21 of the SF 424 (R&R), and by signing it, you are certifying that you have read and agree to abide by the terms in the Certifications. You do not need to submit any additional documentation unless you have lobbying activities to disclose on an SF –LLL.

e. The applicant will receive a confirmation page upon completing the submission to Grants.gov.

Proposals

The attachments that make up the content of the technical portion of the proposal consist of the following parts, not to exceed 32 pages. The first page is the cover page as described above, and which is not included in the page limit. The second section is the Executive Summary identifying problem statement, technology or technologies being developed, what will be developed and how it will address DOD needs. Next is the background of the proposed technology. After that will be the core technical section regarding the technology development plan. The next section is effectively the SOW and should list in an enumerated fashion the technical objectives to be addressed in the effort. The technical references needed to understand the technical background and plan outlined in the proposal should be included. The last section will contain biographies for key personnel on the effort. Each bio should be limited to 1 page and should include work/research history, education, and papers, presentations and proposals pertinent to the research proposed. The organization and content requirements for the Proposal are summarized in Table 2. Page count limits are provided in Table 2 for those sections with maximum page counts. There is no page count limitation for Volume II, Cost.

TABLE 2 – PROPOSAL FORMAT
VOLUME I/TECHNICAL
SECTION 1 – Cover Page, Table of Contents
SECTION 2 – Executive Summary (max 2 pages)
SECTION 3 – Background of the Proposed Technology (max 10 pages)
SECTION 4 – Technology Development Plan (max 20 pages)
SECTION 5 – Enumerated Technical Objectives (No Page Restrictions)
SECTION 6 – Technical References (No Page Restrictions)
SECTION 7 – Biographies of key personnel (one page per bio)
VOLUME II/COST (No Page Count Limitation)
SECTION 1 – Cover Page, Table of Contents
SECTION 2 – Detailed Cost by Cost Element
SECTION 3 – Acronym Listing

4. Cost Proposal

This volume, including the Cost Proposal spreadsheet, has no page limits, and Applicants may include as appendices any other information they feel pertinent to this volume. In addition to a spreadsheet breaking down the costs by category (material, equipment, travel, labor, etc.) the applicant should also complete an ARO Form99 form. The following information must be included in Volume II:

a.) Cost share plan: In addition to the cost proposal spreadsheet above, the Applicant must also include, as part of the cost proposal and if required for the anticipated award type, detailed information on the sources (by organization), timing, and amount. This plan must include the

value, in dollars, for all in-kind cost sharing of the required cost sharing. This information must include a schedule of cost sharing that shows when the proposed cost share will be available and applied to the award so the Government can evaluate the proposed equity when sharing costs.

b.) An Applicant must state in this section whether its accounting/financial systems have previously been audited by a government agency or if the Applicant has a completed or in-process audit in accordance with the OMB Circular A-133, which is the Single Audit Act. If the Applicant has been audited by a government agency, the following information shall be provided: audit agency name; auditor name, telephone number, and email; type of audit: and audit report number and/or date of audit report (if known). If an audit in accordance with OMB Circular A-133 has been completed, provide the date of its completion and the fiscal year for which it was completed. Also, report any in-process A-133 audits and their expected completion date.

c.) The Cost Proposal must confirm that the Applicant's proposal is valid for 180 calendar days from the submission date.

d.) All equipment planned to be purchased using government funds must be identified, must have a quote, must have a plan for disposition and the end of the effort, and all of this should be included in a table format or in a spreadsheet.

5. Submission Instructions: Go to http://grants.gov. The initial screen will provide the synopsis for that specific opportunity. To view the entire opportunity, open the "full Announcement" box in the upper center of the synopsis page and select from the documents available under "Announcement Group." NOTE: Http://grants.gov has tools and guiding documents in the left margin under "Applicant Resources" to help you find and apply for grant opportunities. Grants.gov requires Adobe Reader version 8.13 to open, download and save and submit an application electronically. Adobe Reader version 8.13 is available for free from Grants.gov under "Applicant Resources," "Download Software." The applicant should also send an email notification to the POC listed for the topic under which the proposal was submitted to make them aware of the proposal submission.

C. UNIQUE ENTITY IDENTIFIER AND SYSTEM FOR AWARD MANAGEMENT (SAM)

Applicants are required to: (i) be registered in SAM before submitting an application; (ii) provide a valid unique entity identifier in the application; and (iii) continue to maintain an active SAM registration with current information at all times during which it has an active Federal award or an application or plan under consideration by a Federal awarding agency.

The Federal awarding agency may not make a Federal award to an applicant until the applicant has complied with all applicable unique entity identifier and SAM requirements and, if an applicant has not fully complied with the requirements by the time the Federal awarding agency is ready to make a Federal award, the Federal awarding agency may determine that the applicant is not qualified to receive a Federal award and use that determination as a basis for making a Federal award to another applicant.

D. SUBMISSION DATES AND TIMES

This FOA will remain open through 30 September 2023. Topics may be added or removed throughout the open period of the FOA. Individual topics may specify proposal submission time periods.

E. FUNDING RESTRICTIONS

Reference the funding profile in the Overview Information Section of this FOA for funding restrictions and cost share requirements.

V. APPLICATION REVIEW INFORMATION

The Government may make an award to an Applicant under this FOA, based on the evaluation criteria listed below as applied to their Proposal. The Government reserves the right to make no awards under this FOA if no proposals meet the needs of the Government.

A. EVALUATION CRITERIA

Concept papers are considered for informational purposes only and are not evaluated based on any specific criteria. Generally, concept papers should provide an outline of what a full proposal would include. The feedback can then be used by the potential Applicant to make a decision on whether or not to proceed with a full proposal.

The evaluation criteria for a proposal will include an evaluation of the technical portion of the proposal to ensure that it meets appropriate technical rigor, and the cost portion of the proposal to ensure that the costs are aligned with the technical objectives. The evaluators will be specifically focused on the level of knowledge displayed in the technologies being proposed for development and a detailed description of a clear and credible path forward. Specific attributes to be evaluated will be:

- Overall scientific and/or technical merit of the proposal.
- Qualifications, capabilities, and experience of key technical personnel and partners.
- A demonstrated knowledge of the technology or technologies to be further developed, where the current state-of-the-art is with respect to this technology, and what challenges there are to further use of this technology.
- An understanding of how the proposed technology development will specifically impact the ARL mission and Army performance, durability, and availability, and how these developments will also improve aspects of the US industrial base more broadly.

- Reasonableness of proposed costs to accomplish the technical approach, to include detailed justification for all cost elements.
- Cost Sharing (as applicable depending on award type): The amount and form of cost sharing, as well as the value added as a result of the proposed cost sharing, will be evaluated as necessary.

VI. FEDERAL AWARD ADMINISTRATION INFORMATION

A. Award Notice:

Should a proposal be selected for award, only a signed Agreement from a Government authorized Agreements Officer constitutes an official award. Any other notification or correspondence is not considered an official award and is not sufficient as authorization to proceed with performance. The Government is not required to provide a notice or feedback to those Applicants whose proposal submissions are not selected for award.

B. FAPIIS Requirement

In accordance with OMB guidance in parts 180 and 200 of Title 2, CFR, it is DoD policy that DoD Components must report and use integrity and performance information in the Federal

Awardee Performance and Integrity Information System (FAPIIS), or any successor system designated by OMB, concerning TIAs as follows:

A. If the total Federal share will be greater than the simplified acquisition threshold on any Federal award under a notice of funding opportunity (see §200.88 Simplified Acquisition Threshold):

i. The Federal awarding agency, prior to making a Federal award with a total amount of Federal share greater than the simplified acquisition threshold, will review and consider any information about the applicant that is in the designated integrity and performance system accessible through SAM (currently FAPIIS) (see 41 U.S.C. 2313);

ii. An applicant, at its option, may review information in the designated integrity and performance systems accessible through SAM and comment on any information about itself that a Federal awarding agency previously entered and is currently in the designated integrity and performance system accessible through SAM;

iii. The Federal awarding agency will consider any comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under Federal awards when completing the review of risk posed by applicants as described in §200.205 Federal awarding agency review of risk posed by applicants.

A. If the total Federal share exceeds $500,000 on any Federal award under a notice of funding opportunity, the post-award reporting requirements reflected in Appendix XII to Part 200 of Title 2 CFR will be included in the award document. This requirement also applies to modifications of awards that: 1) increase the scope of the award, 2) are issued on or after January 1, 2016, and 3) increase the federal share of the award's total value to an amount that exceeds $500,000.

C. TAX AND FELONY CERTIFICATION

The Awardee will be required to submit the following representation as part of proposal submission:

Representations under DoD Assistance Agreements: Appropriations Provisions on Tax Delinquency and Felony Convictions

The applicant is ( ) is not ( ) a "Corporation" meaning any entity, including any institution of higher education, other nonprofit organization, or for-profit entity that has filed articles of incorporation.

If the applicant is a "Corporation" please complete the following representations:

(1) The applicant represents that it is ( ) is not ( ) a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

(2) The applicant represents that it is ( ) is not ( ) is not a corporation that was convicted of a criminal violation under any Federal law within the preceding 24 months.

NOTE: If an applicant responds in the affirmative to either of the above representations, the applicant is ineligible to receive an award unless the agency suspension and debarment official (SDO) has considered suspension or debarment and determined that further action is not required to protect the government's interests. The applicant therefore should provide information about its tax liability or conviction to the agency's SDO as soon as it can do so, to facilitate completion of the required considerations before award decisions are made. Applicant's authorized representative must sign and date form.

D. PROHIBITION ON CONTRACTING WITH ENTITIES THAT REQUIRED CERTAIN INTERNAL CONFIDENTIALITY AGREEMENTS – REPRESENTATION

Agreement with the representation below will be affirmed by checking the "I agree" box in block 17 of the SF424 (R&R) as part of the electronic proposal submitted via Grants.gov. The representation reads as follows:

By submission of its proposal or application, the applicant represents that it does not require any of its employees, contractors, or sub-recipients seeking to report fraud, waste, or abuse to sign or comply with internal confidentiality agreements or statements prohibiting or otherwise restricting

those employees, contractors, sub-recipients from lawfully reporting that waste, fraud, or abuse to a designated investigative or law enforcement representative of a Federal department or agency authorized to receive such information.

Note that: (1) the basis for this representation is a prohibition in section 743 of the Financial Services and General Government Appropriations Act, 2015, Pub. L. 113-235) on provision of funds through grants and cooperative agreements to entities with certain internal confidentiality agreements or statements; and 2) section 743 states that it does not contravene requirements applicable to Standard Form 312, Form 4414, or any other form issued by a Federal department or agency governing the nondisclosure of classified information.

VII. AGENCY CONTACTS

Contracting POC: ACC-APG RTP Division, Mr. Christopher Justice; Christopher.d.justice4.civ@mail.mil.