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Federal › Opportunity Details

AFRLRXC STRUCTURAL MATERIALS OPEN BAA PROGRAM

Opp ID:	104855
Buying Org:	AIR FORCE » AIR FORCE MATERIEL COMMAND » AIR FORCE RESEARCH LABORATORY » MATERIALS AND MANUFACTURING DIRECTORATE

At a Glance

Status	Umbrella Program
Solicitation Date	11/04/2013
Award Date	02/2019 (Deltek Estimate)
Value($K)	49,500
Competition Type	Full and Open / Unrestricted

Snapshot

Program Summary

The Department of the Air Force, Air Force Materiel Command,Air Force Research Laboratory, Materials & Manufacturing Directorate is soliciting white papers and potentially technical and cost proposals under this announcement that support the needs of its Structural Materials and Applications mission. Structural Materials technologies that range from materials and scientific discovery through technology development and transition are of interest. Descriptors of Materials and Manufacturing Directorate technology interests are in two contexts; that of structural materials science and engineering academic “competencies,” and that of Air Force application area needs.

Opportunity Summary

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Award Date	02/2019 (Deltek Estimate)
Solicitation Number	BAARQKM20140003
Value ($K)	49,500
Competition Type	Full and Open / Unrestricted
Type of Award	Other
Primary Requirement	Research & Development
Duration	Individual awards may range from 12 to 60 months in duration
Contract Type	Cost Plus Fixed Fee
No. of Expected Awards	Multiple - Number Unknown
Primary NAICS Code	541712 Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology) Size Standard: 500 Employees except 1500 Employees for Aircraft and 1000 Employees for Aircraft Parts, and Auxiliary Equipment, and Aircraft Engine Parts and space Vehicles and Guided Missiles, their Propulsion Units, their Propulsion Units

Place of Performance	• United States • Contractor's Facility • Wright-Patterson Air Force Base, Ohio, United States
Opportunity Website	https://www.fbo.gov/index?s=opportunity&mode= form&tab=core&id=b81aa55f48e1933baeba65df3a46 4aac&_cview=1
Last Update	10/03/2016

Funding / Contract Value

Total funding for this BAA is approximately $ 49.5M and the individual awards are anticipated to be in the range of $100K to $5M per contract. The anticipated funding to be obligated under this BAA is broken out by fiscal year as follows:

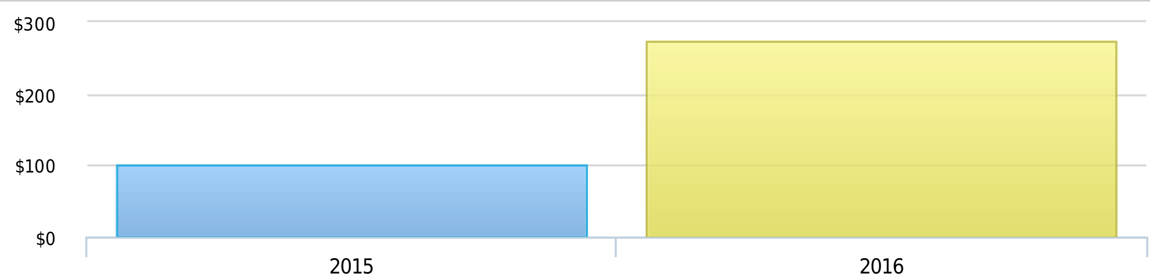
- FY14 - Approximately $5M
- FY15 - Approximately $11M
- FY16 - Approximately $11M
- FY17 - Approximately $11M
- FY18 - Approximately $11.5M

The value of the contract awarded to General Electric Company is $208,603.

The value of the contract awarded to Iowa State University of Science & Technology is $1,200,000.

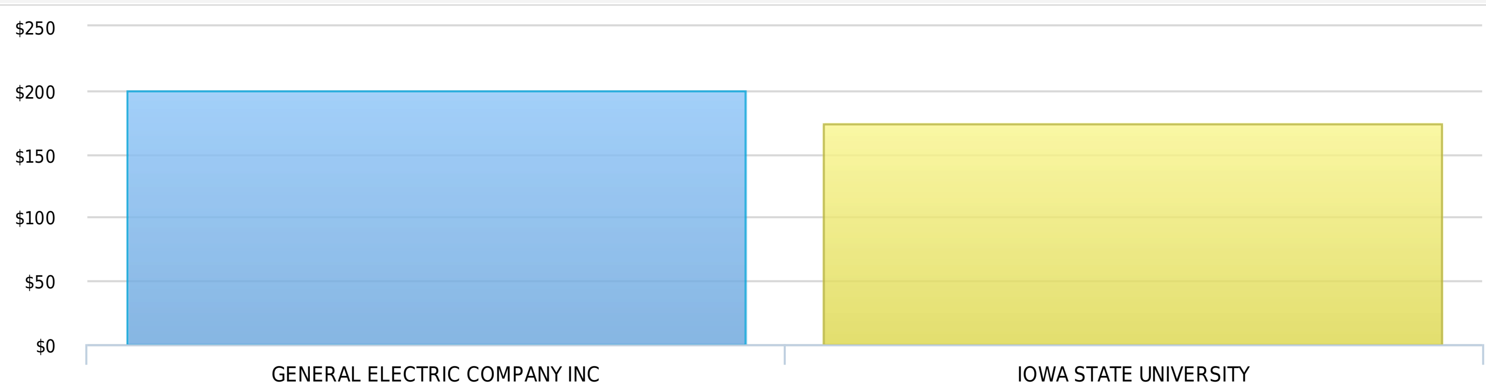
Reported Spending Highlights

Reported Spending by Year ($K)



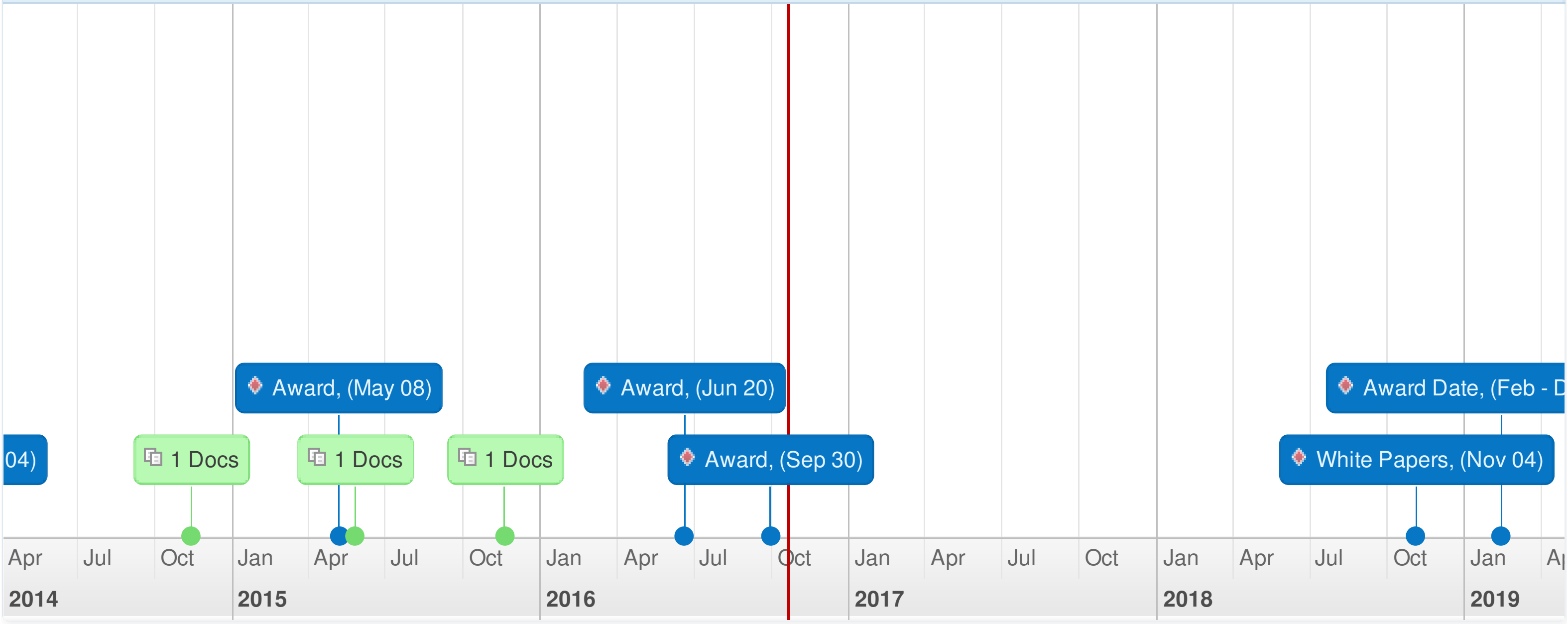
FY2015	100
FY2016	274

Reported Spending by Company ($K)



Timeline

Timeline of Major Milestones (2013 - 2019)



Procurement Milestones

Solicitation Release	11/04/2013
Award	06/20/2016
White Papers	11/04/2018
Award	05/08/2015
Award	09/30/2016
Award Date	02/2019 (Deltek Estimate)

Latest Analyst Updates

10/03/2016

An Award Notice was issued on September 30, 2016. A contract was awarded to The Boeing Company on September 30, 2016 for $390,717.

White Papers will be accepted until November 4, 2018.

09/16/2016

According to the BAA, White Papers will be accepted until November 4, 2018.

The government has not provided any additional information regarding this BAA to date.

06/20/2016

The Contracting Office issued an Award Notice on June 20, 2016. A contract was awarded to Iowa State University of Science & Technology on June 20, 2016 for $1,200,000.

White Papers for this BAA will be accepted until November 4, 2018.

04/28/2016

The government has not released any additional information regarding this BAA to date. As previously noted, White Papers will be accepted until November 4, 2018.

11/20/2015 The Contracting Office issued Amendment #3 on November 20, 2015. The purpose of the Amendment is to change the Point of Contacts and make administrative changes to the BAA. Dustin Bertrand is no longer associated with this effort and was replaced by Robert Marshall and Susan Southers was replaced by Catherine Stropki.

As previously noted, White Papers will be accepted until November 4, 2018.

11/03/2015 The Contracting Office issued an Award Notice on November 3, 2015. A contract was awarded to General Electric Company on May 8, 2015 for $208,603. As was previously stated, White Papers will still be accepted until November 4, 2018.

05/27/2015 The Contracting Office issued Amendment #2 on May 27, 2015. The purpose of the Amendment is to update the Points of Contact. Technical questions can now be submitted to Capt. Dustin Bertrand and Contracting questions can be submitted to Susan Southers. White Papers will still be accepted until November 4, 2018.

11/13/2014 The Contracting Office released Amendment #1 on November 13, 2014. The purpose of the Amendment is to provide updated contacts and administrative changes. White Papers will still be accepted until November 4, 2018. Carmen Carney and Mary Ann Sharits are the new points of contact for this effort.

04/22/2014 The Contracting Office confirmed that White Papers will still be accepted until November 4, 2018. Rebecca Novak has been identified as a point of contact for this effort.

11/07/2013 The Contracting Office stated that this is a New Requirement. White Papers are being accepted until November 4, 2018. This is an unrestricted solicitation. Small businesses are encouraged to propose on all or any part of this solicitation. Mary Ann Sharits is the Primary Point of Contact for this effort.

11/06/2013 The Contracting Office released a Broad Agency Announcement on November 4, 2013. The White Papers are due until November 4, 2018. This is an unrestricted solicitation. Small businesses are encouraged to propose on all or any part of this solicitation. Mary Ann Sharits is the Primary Point of Contact for this effort.

Description

Program Description

The Department of the Air Force, Air Force Materiel Command,Air Force Research Laboratory, Materials & Manufacturing Directorate is soliciting white papers and potentially technical and cost proposals under this announcement that support the needs of its Structural Materials and Applications mission. Structural Materials technologies that range from materials and scientific discovery through technology development and transition are of interest. Descriptors of Materials and Manufacturing Directorate technology interests are in two contexts; that of structural materials science and engineering academic “competencies,” and that of Air Force application area needs.

BACKGROUND

The Materials and Manufacturing Directorate, located at Wright-Patterson AFB and Tyndall AFB, develops materials, processes, and advanced manufacturing technologies for aerospace systems and their components to improve Air Force capabilities in these areas. The current Director is Dr. Katherine Stevens.

In 2003, the Directorate announced a new manufacturing method for use producing the turbine exhaust casing for the F119 jet engine used on the F-22 Raptor stealth fighter which will result in an estimated savings of 35% of the cost while also improving the durability.[51] In collaboration with Lockheed Martin Aeronautics, the Directorate helped develop a new laser-based ultrasonic scanner to inspect composite parts also for use on the F-22.[52] The Directorate also developed an advanced thermoplastic composite material for use in the landing gear doors on the F-22.[45] In 2008, the Air Force announced that the Directorate had developed a method of using fabric made of fiber optic material in a friend or foe identification system.

REQUIREMENTS

Air Force Research Laboratory, Materials & Manufacturing Directorate is soliciting white papers and potentially technical and cost proposals under this announcement that support the needs of its Structural Materials and Applications mission. Structural Materials technologies that range from materials and scientific discovery through technology development and transition are of interest. Descriptors of Materials and Manufacturing Directorate technology interests are presented below in two contexts; that of structural materials science and engineering academic “competencies,” and that of Air Force application area needs

Structural Materials Competency Needs:

Ceramics and Ceramic Matrix Composites Materials and Processes: The objective of Ceramic Materials and Processes research is the development of advanced high-temperature constituents for fiber-reinforced ceramic-matrix composites (CMCs) and an understanding of their behavior in relevant service environments. Specific research that is underway in advanced constituents involves development of next-generation fiber-reinforced structural ceramic materials and processing and process models for a range of air and space applications including turbine engine and scramjet engine hot-section components and thermal protection systems for hypersonic vehicles. Advanced constituents under investigation include stoichiometric silicon carbide fibers for superior creep resistance over current commercially available fibers, oxide fiber coatings for enhanced environmental resistance over state-of-the-art boron nitride fiber coatings, and matrices that increase the temperature capability of CMCs beyond the limitation imposed by the use of Si as a matrix constituent. Understanding of CMC behavior in service environments begins with understanding the effects of environmental degradation at the constituent level. Our focus in this area is currently on exploring constituent-level response in simulated turbine engine combustion and hypersonic aerothermal environments. Our approach leverages the materials and processing competencies of ceramic development and characterization and CMC processing and constituent level-behavior, with the goal of maturing existing composite classes and their processes and discovering and validating new materials and process concepts. Concept and feasibility exploratory studies, early development of composition, microstructure, coatings and processes, characterization and property screening against temperature, environment, stress and time variables, and modeling and simulation are used to advance ceramic materials technology and understanding to enable increased energy efficiency, freedom of operations, and reduced life-cycle cost of AF systems. Integrated Computational Materials Science and Engineering (ICMSE) seeks to couple processing, microstructure, and performance via validated computational methods to accelerate materials development, transform the engineering design optimization process, and unify design and manufacturing. To reduce insertion risks and to be cost-effective alternatives to other lower-performing high-temperature materials, the development cycle time for CMCs must be reduced significantly. Modeling and simulation driven optimization of design and fabrication processes and manufacturing methods reduces the cost and cycle time to implement CMCs in a variety of aerospace applications. This approach also reduces the manufacturing trials required to optimize the process for producing specific components. Identification of key CMC processing steps and development of computational tools to accelerate material and component development are also being conducted

Organic Matrix Composites Materials and Processes:

Organic Matrix Composite Materials and Processing (OMC M&P) research involves the conceptualization, development, manufacturing and sustainment of organic matrix composites in propulsion and structural applications to give the Air Force more “reach” from lighter-weight and higher-temperature structural components; more ”affordability” from predictive, optimized, and agile processing methods; more ”sustainability” from rapid insertion of robust materials with better as-manufactured performance baselines; and more “survivability” from electromagnetic energy and laser threats through multi-scale functional materials. This research leverages the unique competencies of structure-processing-property modeling, high temperature polymer matrix composites, structural hardening, nanomaterials and composites fabrication, to achieve accelerated insertion of precisely tailored composites with controlled structure via predictable processing. This is approached through: 1) Development of computational tools to simulate and predict the processing and manufacturing of structural organic matrix composite materials, 2) Development of new, emerging, disruptive processing methods with improved precision and processing flexibility to reduce the “design-build-test” development cycle, and 3) Development of processing methods for integration of multifunctional materials to expand the design space and meet specific Air Force needs, such as structural directed energy hardening. Existing and new integrated computational materials science and engineering (ICMSE) tools are included in the research approach to accelerate and facilitate technology insertion by combining computation, simulation, and structure-processing-property-performance modeling with strategic experimentation and data mining techniques. Some examples of areas of interest include the following: 1) High temperature polyimide chemorheology including the prediction and evolution of viscosity, porosity, internal structure, and residual stress of fiber reinforced polymer composites as a function of curing, 2) Improving the reinforcement volume fraction, orientation, and processability of organic matrix composites assembled using automated and digital processing methods, and 3) Processing-structure-property relationships of hierarchical (nano to meso scale) functional materials in a structural polymer matrix composite for enhanced durability against sudden exposure to large amounts of thermal and electromagnetic energy (lightning) and protection for underlying functional components

Composite Performance Prediction:

Due to their complex morphologies and microstructures and multiple/interactive failure modes of composite materials, the prediction of their behavior in the often poorly characterized extreme environments of high performance Air Force aerospace systems is extremely challenging. The inherent material capabilities are not fully exploited due to lack of ability in predicting performance associated with low probability of critical mechanical and environmental loading events. Rationalization of material and design knockdown factors associated with these low probability critical events through the use of ICMSE modeling capabilities leads to optimized composite designs that fully exploit the material’s capabilities. Computational and empirical methods within a digital framework that link characteristic material scale models to experiments for parameterization and validation to specific aspects of composite materials are needed. It is anticipated that research investment in this area will lead to risk reduction in high-temperature nonmetallic composites structures performance and impact emerging Air Force systems. The purpose of this research is to explore and expand frontier methods enhancing the fidelity and the reducing empiricism associated with predicting and representing materials performanc. The scope of the advanced structural airframe materials, process, and lifing tools to support composites certification covers exploratory through developmental research in fundamental understanding and prediction of composite behavior in representative Air Force system environments. The development of predictive, physics-based simulation tools for the prediction of damage evolution and behaviors across multiple scales is envisioned as a necessary step towards this goal. Constitutive models and the ability to analyze highly tailored composites at appropriate fidelity are needed. The research advances state-of-the-art (SOA) capability by developing more accurate, efficient and comprehensive methods across simulation and experimental domains (the current performance prediction tools that reside at a TRL 6 or greater level may be taken as representative of SOA). Experimental method development in parallel is critical, and includes methods for constitutive and parameter measurement and modeling, advanced nondestructive and destructive characterization methods, as well as simulation validation. Realistic representations of the variability leads to probabilistic prediction of composite performance tied to material heterogeneity and its evolution. The simulation methods monitors needs for eventual deployment in an engineering environment

Metals Materials and Processes:

Metals innovations have been at the core of the vast majority of disruptive technologies since the start of the industrial revolution. The development of advanced metals and their incorporation into aerospace design enables Air Force to maintain significant competitive advantage. Today, the high temperature metals sub-Core Technology Competency’s (CTC) motivation for the development of advanced metals, novel processing and new life prediction tools are guided by current and future requirements of the Air Force. Several advanced propulsion technology development programs are underway; specifically Versatile Affordable Advanced Turbine Engine (VAATE), Integrated High Payoff Rocket Propulsion Technology (IHPRPT), High Efficient Embedded Turbine Engine (HEETE), and 10X Scramjet. These advanced propulsion concepts require metallic materials that withstand higher operating temperatures for longer times at higher stresses and in more aggressive environments relative to existing alloys. Further, many of the intended applications involve thin structural gauges and heat-exchanger configurations. This provides the stimulus for developing advanced blade, disk and actively-cooled combustor materials solutions, as well as the associated processing, joining, testing, simulation and life management capabilities for these applications. Future systems for access to space and hypersonic delivery are calling for the development of advanced metallic thermal protection systems (TPS) and high-temperature airframe structures. This demands processing of thin sheet/foil, fabrication of light-weight structures and life prediction methodologies for structure and environmental degradation. The high temperature metals sub-competency focuses on the Air Force's affordable mission & sustainment needs, leading critical-path development efforts needed to achieve "true" retirement for cause.

A basic tenet of Materials Science and Engineering is that properties are determined by structure and that performance is controlled by the balance of properties produced by that structure (taking into account extreme values or defects). The essential problem of alloy and process development is finding the best overall balance of properties using chemistry, thermodynamics, and processing to tailor the microstructure (chemistry, phases/morphology, crystallographic orientation, boundaries, residual stress, and defects). To achieve significant improvements in performance, designers want to move away from using a uniform property set over an entire component and toward utilization of point-specific, tailored properties. Microstructure must be tailored to produce the property set required at any specific location. Such microstructure-sensitive design is a revolutionary and enabling approach far beyond the engineering (design) solutions that have dominated development in turbine engine technology and structures over the last twenty years. For systems engineers to take advantage of property gradients in the design process, a translation of these requirements to standardized microstructural descriptions becomes a necessity.

Point-specific materials design requires improvement in fundamental and quantitative understanding of microstructure-processing-property relationships. This necessitates advances in the basic science of micron, millimeter, and meso-scale deformation, phase transformation kinetics, defect generation during processing, crystal plasticity finite element methods (FEM), local microstructure dependency of material life prediction and the mechanistic underpinnings of these models that have only recently been able to be attacked due to advances in computational capabilities. As a result the high temperature metals sub-CTC is following a path that emphasizes utilization of Integrated Computational Materials Science and Engineering (ICMSE). As a result the 1999 Accelerated Insertion of Materials (AIM) program, the possibility of utilizing an ICMSE approach as a new foundation for metallic alloy development, processing, and behavior science was successfully demonstrated, and industry has noticed. Small business infrastructure development, academic focus, and small-scale follow-on industry demonstrations indicate that momentum has grown and that ICMSE is truly the path forward toward solving the microstructure issue.

The high temperature metals sub-CTC relies on the development, integration, and application of advanced modeling capabilities. The capabilities include ab-initio models, dislocation dynamics, fundamental constitutive equations, Monte Carlo, phase-field, and cellular automata models of recrystallization, grain growth, and precipitation. Also included are models for the formation of deformation, recrystallization, and transformation texture during processing of single-and two-phase alloys, crystal plasticity, FEM, advanced fracture mechanics and crack growth analyses. State-of-the-art experimental facilities (micro-testing, pilot scale processing, 3D microstructural characterization and mechanical property testing) are the backbone for development and validation of the models required to accelerate materials development, insertion and life management. Among our long-range core goals is the application of integrated materials modeling and simulation tools with advanced experimentation to accelerate development and manage properties including uncertainty and variation inherent in component performance. These tools are applied to legacy, developmental, and future Air Force systems.

Characterization, Sensing, and Analytics:

The mission of Characterization, Sensing, and Analytics is to lead, discover, develop, and deliver material and damage characterization technologies that assure maximum reliability, availability and safety of Air Force systems. This includes research and development addressing needs in the areas of nondestructive evaluation/inspection (NDE/I) and characterization of materials of interest to the aircraft structures, turbine engine, and low observables communities within the Air Force. The characterization, sensing, and analytics (CSA) team develops next generation sensing technologies for materials and damage state characterization to enable future sustainment and maintenance strategies such as Condition-based Maintenance plus Prognosis (CBM+). Developments enable validation and augmentation of life prediction for multiple material classes (existing and new structural materials) by characterizing their structure, sensing pre-cursors to damage, and assessing damage evolution. Success and full implementation of these future strategies will only be successful if damage and material state can be quantified. The CSA vision – reliable, nondestructive, quantitative materials/damage characterization regardless of scale - builds off the NDE sub-CTC that transitions NDE research into the depot and field inspection infrastructure.

The objectives of the research effort in CSA includes developing sensing methodologies to detect, locate, and characterize damage (e.g. cracks, corrosion, delaminations) and/or deleterious changes in material properties (e.g. pre-cursors) present in Air Force relevant materials. Success ultimately involves integration of computational methods for modeling forward and inverse problems using physics-based and numerical models addressing the primary NDE sensing modalities of electromagnetic (e.g. eddy current, THz, microwave), mechanical waves (e.g. modal analysis, ultrasound), and thermal (e.g. thermography), plus innovative coupling of multiple sensing modalities to augment the detection of changing material states. Advanced signal processing techniques, such as multi-modal methods, are also being pursued. Computational models coupled with estimation theory are being investigated to solve the ill-posed inverse problem to tackle the challenges of a complex and cluttered sensing environment.

Enhanced sensing methods for damage characterization must address the significant variability in the sensing environments found in turbine engine propulsion, structures, and low-observable systems and materials. Macro-scale damage sensing efforts focus on these environments and include developments in sensors, interpretation and correlation of sensor outputs to damage states, and interrogation of complex structures and/or locations with limited access. All sensing capability has relevance to both locally coupled and permanently mounted sensors designed to assess the condition of the materials.

In addition, characterization of the structure and performance of materials is a cornerstone to the development/understanding of structural materials and included in CSA research efforts. The development of novel materials microstructure and properties characterization tools and research methodologies is necessary to advance the state of the art in materials science. Tools and techniques that support integrated computational materials science and engineering includes automated data acquisition, multi-scale structural performance characterization techniques and apparatus, microstructural (chemistry, orientation, shape, and residual stress) characterization techniques and apparatus (destructive and nondestructive), remote testing, and data analytics/management and are desired. Both research laboratory and/or industrial setting/application environments are of interest

Integrated Computational Materials Science and Engineering (ICMSE):

Continued Air Force dominance in aerospace warfare is predicated on the continuous advancement of warfighting platforms and the materials that make them possible. Incorporating new materials or even evolutionary changes in materials into critical, performance-limiting components is a high risk and expensive process. Integrated Computational Materials Science and Engineering is an emerging approach that digitally integrates the results of experiments and modeling methods in order to simultaneously optimize material and component design for optimum performance. The approach significantly reduces the cost and risk of incorporating evolutionary and revolutionary materials advances into propulsion, airframe and conventional structural applications. Advances to the approach require infrastructure improvements that include but are not limited to advancing finite element modeling methods and constitutive descriptions for macroscopic and microscopic deformation (static loading and processing), testing, modeling includes thermo-mechanical processing, thermo-kinetics, microstructural evolution, casting, elastic-viscoplastic deformation over a wide range of stress, strain rates and temperatures, and multi-scale (space and time) verification, validation and uncertainty quantification of simulated behavior. Methods should also address representation and simulation of microstructure and its evolution, damage accumulation, extreme and anomalous features, and life-time prediction

AIR FORCE Application Needs:

Propulsion:

Structural materials for turbine engine applications must withstand aggressive service environments including high, complex loads, extremely high temperatures, and corrosive/erosive environments. Turbine engine components must meet a range of strict performance requirements including stress rupture, creep, low and high cycle fatigue (LCF and HCF), and oxidation / hot corrosion resistance. Advanced materials technologies are sought that enable higher operating efficiencies, enhanced performance, increased range, affordable manufacturability, and sustainability. In order to achieve improved efficiency and performance, materials technologies are required to enable higher operating temperatures, resulting in higher thermodynamic efficiency. Additional enhancement in efficiency is achieved through materials solutions that reduce engine weight, without reducing thrust. Activities are therefore sought to develop novel materials technologies with higher temperature capability and/or reduced weight for applications such as ducts, rotors, blades and airfoils, integrated rotating structures, vanes, shrouds, nozzles, and combustor liners. Developmental technologies could target advancements in organic matrix composites (OMC), metals, ceramic and CMC, and coatings

Space:

Spaceframe concepts demand complex, lightweight, load-bearing three-dimensional structures that can withstand launch loads. Similarly, space vehicle propulsion systems seek to identify component (impellers, cryopumps, nozzles, bearings) materials that reduce weight while fully meeting operational needs. Often space structural components do more than carry load and are multifunctional, requiring the optimization and consideration of non-structural properties as part of materials invention and development. Activities to develop novel, lightweight materials and/or manufacturing processes that address such needs are sought. Solutions incorporating the following characteristics are of interest: material composition development, hybridization and location specific tailoring of the properties of parts to optimize function, new manufacturing processes, additive manufacturing processes (and manufacturing in space), and integrated computational materials science and engineering. Solutions with projected revolutionary capability increases are preferred over evolutionary concepts based upon existing technologies

Hypersonics and Thermal Protection:

Efficient, high performance, hypersonic systems require advanced materials, processes and performance to survive during hypersonic flight. Existing materials must be evaluated to validate performance in the extreme environment and new materials developed to fill technical gaps. The materials need to be robust, reproducible, and affordable. High temperatures ranging from 1100 degree F to over 2400 degree F, limit the material options that can be considered. The materials and process (M&P) technology options are needed to reduce the risks associated with M&P acquisition decisions for future hypersonic vehicles. Vehicle concepts span the spectrum from expendable to reusable, boost glide to air-breathing propulsion; all placing different demands on the materials selected. All material systems are of interest as well as hybrid concepts. Joining, attachments, integration, insulation and seals are also areas of interest. Innovative solutions to enhance the system performance in an anticipated advanced directed energy (DE) (High Power Microwave, High Altitude Electromagnetic Burst, High Energy Laser) environment are of interest. CMCs, for example, must be able to operate in DE denied environments and may require novel material constructions or coatings to enhance their performance; however, these solutions should not impact structural performance, manufacturability or supportability.Solutions to link processing data/models with property, performance and lifing models to enhance the M&P selection in an ICMSE framework are of interest

Munitions:

Advanced munitions require new materials, processes, and performance understanding to support structural design in both the conventional and hypersonic regimes. Structural component performance in the areas of penetrating capability, enhanced fragmentation, weight reduction (cases and control surfaces), and propulsion efficiency drive future munitions capability. Solutions incorporating the following are of interest: novel metals, ceramics, and organic matrix composite manufacturing process development, hybridization and location specific tailoring of the properties of parts to optimize for function, NDI methods for quality inspection after manufacture, and the development and validation (using novel test techniques) of predictive performance models/simulations for munitions' unique, high strain rate performance environments

Advanced Material Characterization:

Characterization of the structure and performance of materials is a cornerstone to the development/understanding of structural materials. As such, the development of novel materials microstructure and properties characterization tools and research methodologies is necessary to advance the state of the art in materials science. Tools and techniques that support integrated computational materials science and engineering such as automated data acquisition, multiscale structural performance characterization techniques and apparatus, microstructural (chemistry, orientation, shape, residual stress), characterization techniques and apparatus (destructive and nondestructive), remote testing, and data analytics/management are therefore sought. Both research laboratory and/or industrial setting/application environments are of interest

Sustainment:

In order to support the long term Air Force Aircraft Structural Integrity Program (ASIP) goals and to ensure the desired level of structural safety, performance, durability, and supportability with the least possible economic burden throughout the aircraft service life, Nondestructive Inspection/Evaluation (NDI/E) capabilities are needed to detect damage, such as fatigue cracks and corrosion. Development of new methods for these aging structures continues to be driven by a need to detect and locate damage such as fatigue cracks and corrosion in a wide variety of complex (geometry and material) structures. Emerging technologies and methods to inspect these diverse structures are of interest, as well as innovative sensor manipulation methods to place inspection probes on or within aircraft structures to aid inspectors in their inspection task. Tools and techniques that support airframe sustainment such as advanced sensor development, automated data acquisition/processing, inspection reliability, remote sensing/testing, and data analysis/management are of strong interest. Technology development and advancement shall be derived with the Air Force depot and field application environment in mind

Airframe:

Hardened and Multifunctional Structures:

Hardened Structures:

Current and future developments in composites provide limitless opportunities to enhance and expand the traditional aerospace material-structure design space and revolutionize materials-by-design for new generations of highly optimized aerospace structures. The design tailorability of composites to optimize the balance of manufacturability, cost, performance, sustainability and weight savings for structures are enabling for next generation military platforms. Compelling new capabilities such as hypersonic flight, extended mission range, combat superiority and improved access to space are envisioned to be directly enabled by new composite designs and architectures. The objective is to explore and develop organic and inorganic matrix composite materials and processes that meet current and future Air Force system needs. This includes research to develop new high performance matrix materials, fibers, preforms, and other reinforcement materials, interfaces, processes, and the supporting computational tools. The research would include structure-process-property relationship development, processing science development, concept and feasibility exploratory studies, anticipated weapons material vulnerability assessment, and development of modeling and simulation capability in these

areas.
Air Force needs have evolved beyond commercial aerospace material systems to highly engineered multidirectional and multidimensional reinforcements with highly cross-linked high performance, durable matrices. The integration of multiple constituent materials spanning organic and inorganic structural materials is expected to enable expanded use in more aggressive operating environments. Processing science that enables such tailoring of extremely dissimilar constituents is critical to development, design and structural integration. A reliance on current and new ICMSE tools to accelerate this effort is likely to include structure-processing-property-performance modeling with strategic experimentation, and data mining techniques.
Ceramics and ceramic fiber-matrix composites (CMCs) are gaining importance to Air Force systems. The higher turbine engine operating temperatures enabled by CMCs, together with the low density of these materials, leads to lower specific fuel consumption and lower NOx emissions. The low dielectric constants of some CMCs, particularly oxide-oxide CMCs, enable various low observable Air Force applications. Thermal protection systems, ducts, and nozzles for hypersonic and space vehicles are other areas of high Air Force interest. Ultra-High Temperature Ceramics (UHTCs), including their laminated, graded, and fiber reinforced forms, are usually considered to be those ceramic phases with melting points higher than those of SiC (>2750°C). These are typically nitrides, carbides, and borides that have the best oxidation resistance and highest thermal conductivity and are therefore usually of the greatest interest for applications such as leading edges of hypersonic and reusable space vehicles, or scramjet hot structures. Finally, functional ceramics are required for high energy fiber lasers, capacitors, etc. The objective is to advance the materials and processes state-of-the-art, including process modeling, for this important class of Air Force materials. This includes research to mature existing composite classes and their processes, as well as efforts to discover and validate entirely new materials and processes concepts. The research would include concept and feasibility exploratory studies, early development of composition, microstructure, coatings, processes, characterization and property screening against temperature, environment, stress, and time variables, and modeling and simulation of these. The approach must include consideration of all available and emerging ICMSE tools to accelerate the effort and facilitate insertion by combining computation and simulation (including process modeling), high-throughput and conventional experiments, data mining techniques and, as such, are included in the research approach

Multifunctional Structures:

The Air Force is continuously challenged with developing capabilities to better design, develop, fabricate, characterize, and assess the performance of new and emerging multifunctional materials. Due to their complex nature, these materials are not only challenging to design (to required specifications) but to achieve the desired (often competing) level of functionality and performance. Furthermore, parameters of interest to accurately assess material performance are inherently difficult to measure due the material’s intricate make-up, and anisotropic and inhomogenous characteristics. Therefore, the development of novel design tools; advanced sensing technologies; advanced data collection, fusion, processing and analysis techniques; advanced evaluation and validation methods; as well as the development of inspection protocols and procedures for these materials require further investment in research and development. The development of modeling and simulation tools to design, characterize and optimize sensor response to the materials of interest is also highly desirable

Advanced Electromagnetic and DE Structures:

Electromagnetic (EM) protection materials are required for aircraft, spacecraft, ground support systems, and personnel. Threats to systems and personnel include high power microwave (HPM) weapons, various electromagnetic pulse (EMP) sources, lightning strikes, and high voltage electrostatic discharges from space charge build-up (spacecraft).

Historically, systems utilize heavy aluminum structures and enclosures to produce faraday cages or conductive ground planes to protect sensitive electronics from natural and man-made EM events. Aluminum structures are replaced with lighter weight carbon fiber composites and higher temperature systems such as ceramics, and the level of EM protection is significantly reduced. This results in significantly deeper EM energy penetration to critical electronic systems

This requires development and system validation of electromagnetic shielding materials for aircraft, spacecraft, or ground support systems that include vehicle structures and electronics enclosures against electromagnetic pulse, nuclear burst products, and high power microwave sources. These materials typically need to be compatible with composite materials (organic or ceramic) and manufacturing processes and cooperative with other directed energy protection technologies. For Aeroshell shielding the intention is to develop materials which are directly incorporated into prepreg, and wet layup processes through a nano-modified resin system. Other acceptable approaches include, but are not limited to, the modification of the carbon fiber, chopped or continuous, to enhance its shielding effectiveness

Materials enabling passive agile filtering of high power microwave energy directed at antenna apertures are a second area of focus. These materials must enable continuous operation of the underlying sensor or receive/transmit module by only blocking narrow bands associated with high power RF events. The materials should respond intelligently to high RF field strengths and develop surfaces to block out only the undesired RF frequency. In addition, this ability to develop a surface should be over as broad a frequency range as possible, with a narrow notch width.

Finally, materials that enable intrinsically high power RF hardened electronics such as conformal antennas are desired.

Primary NAICS Code

541712

Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)

Size Standard

500 Employees except 1500 Employees for Aircraft and 1000 Employees for Aircraft Parts, and Auxiliary Equipment, and Aircraft Engine Parts and space Vehicles and Guided Missiles, their Propulsion Units, their Propulsion Units

Primary Requirement

Research & Development

Secondary Requirements

- Defense & Aerospace
- Engineering, Scientific and Technical Services
- Research & Development

Online Resources

Materials and Manufacturing Directorate

Other Program Information

INCUMBENT INFORMATION

- This is a new requirement
- No incumbent contracts exist for this requirement

Contracts

Contracts

Contract# / Task Order#	Contract Title	Vendor	Incumbent	Award Date	Expiration Date	Spend-to-date ($K)	Est. Value ($K)
FA865016C5238	Maturation of Vibrothermography Model	IOWA STATE UNIVERSITY OF SCIENCE & TECHNOLOGY	No	06/20/2016	09/15/2019	174	1,200
FA865015C5207	AFRLRXC STRUCTURAL MATERIALS OPEN BAA PROGRAM	GENERAL ELECTRIC COMPANY INC		05/08/2015	08/11/2017	200	209
FA865016C5236	Directed Energy Threat to a Hypersonic Cruise Missile	BOEING COMPANY	Yes	09/30/2016			391

Contacts

Government Contacts

Org Chart	Name	Title	Contact Type	Phone & Email	Location
	Stropki, Catherine (Cathie) A.	Contracting Officer (AFRL/RQKMC)	Contract/Procurement Office	937-713-9901 catherine.stropki.1@us.af.mil	Wright-Patterson AFB, OH
	Sharits, Mary Ann	Contracting Officer, AFRL/RQKMS	Contract/Procurement Office	937-713-9898 mary.sharits@us.af.mil	Wright-Patterson AFB, OH
	Novak, Rebecca S.	Contracting Officer	Contract/Procurement Office	937-713-9896 rebecca.novak@us.af.mil	Wright-Patterson AFB, OH
	Bartley, Robin D.	Contracting Officer	Contract/Procurement Office	937-713-9894 robin.bartley@us.af.mil	Wright-Patterson AFB, OH
	Perkins, Jackie	Contract Negotiator	Contract/Procurement Office	937-713-9889 jacqualyn.perkins@us.af.mil	Wright-Patterson AFB, OH
	Bullen, Candus "Candy" M.	Contracting Negotiator	Contract/Procurement Office	937-713-9888 candus.bullen@us.af.mil	
	Marshall, Robert	Technical POC	Contract/Procurement Office	937-255-9020 robert.marshall.21@us.af.mil	

Resources

Documents Related to this Opportunity

Document	Publication Date	Document Source	Document Size	File Type	Starter Compliance Matrix
Amendment #3	11/20/2015	Government	37 KB	Adobe PDF	
Amendment #2	05/27/2015	Government	17 KB	Adobe PDF	
Amendment #1	11/13/2014	Government	35 KB	Adobe PDF	
Broad Agency Announcement (BAA)	11/04/2013	Government	254 KB	Word	

FedBizOpps Notices

Article	Publish Date	Website
Award Notice	09/30/2016	Website

Article	Publish Date	Website
Award Notice	06/20/2016	Website
Amendment #3	11/20/2015	Website
Award Notice	11/03/2015	Website
Amendment #2	05/27/2015	Website
Amendment #1	11/13/2014	Website
Broad Agency Announcement (BAA)	11/04/2013	Website

Vendors & Teaming

Interested Vendors

Vendor	Contact	Position	Socioeconomic Status	Website	Advertise Date

There are no related records

Companies that Hold a Current Contract for this Opportunity

BOEING COMPANY TEAMING