

BROAD AGENCY ANNOUNCEMENT (BAA)

1. Agency Name

United States Air Force Academy (USAFA)
Colorado Springs, CO

2. Funding Opportunity Number

USAFA-BAA-2015

3. Funding Opportunity Title

Research Interests of the United States Air Force Academy

4. Types of Instruments Awarded

Research and development contracts, grants and cooperative agreements

5. Announcement Type

Amendment 0003 to Initial Announcement

6. Catalog of Federal Domestic Assistance (CFDA) Numbers

12.800

7. Opportunity Overview

USAFA's Research Center is announcing to business and academia the intent to solicit white papers/proposals for USAFA research efforts through this BAA. This strategy provides USAFA an acquisition tool with the flexibility to solicit proposals and make awards to develop technologies to meet present and future Air Force research needs as technology issues are identified. USAFA invites white papers and proposals for research in many broad areas. These areas are described in detail in Section I, Funding Opportunity Description. Additional information regarding USAFA Research Centers, Departments and Institutes may be found at www.usafa.edu.

USAFA is seeking unclassified research white papers and proposals that do not contain proprietary information. Requests for white papers/proposals are also transmitted via calls which may be published separately from the BAA at various times during the open period of the BAA.

It is anticipated awards will be made in the form of grants, cooperative agreements or contracts. USAFA reserves the right to select and fund for award all, some, or none of the white papers/proposals in response to this announcement. All awards are contingent upon funds availability for the program areas identified. Unless specifically indicated in a RFP or a call, cost sharing is permitted and encouraged, but not required.

Awards based on responses to this BAA are considered to be the result of full and open competition. Small businesses are encouraged to submit white papers against any Research Center's Areas of Interest described within this BAA. The North American Industry Classification System (NAICS) code, unless otherwise stated

in the BAA amendments shall be: 541714, Research and Development in Biotechnology (except Nanobiotechnology) and 541715, Research and Development in the Physical, Engineering and Life Sciences (except Nanotechnology and Biotechnology).

Interested offerors should be alert for any BAA amendments, calls, or other changes to the requirements of this BAA or its subsequent amendments. Amendments to and/or calls on this BAA will be posted to the FedBizOpps.gov and Grants.gov website and published when they occur. Interested parties are encouraged to periodically check these websites for updates and amendments. White papers and proposals submitted in response to this BAA shall be in accordance with the requirements of this BAA and its appropriate amendments.

USAFA will not issue paper copies of this announcement. The costs of white papers and/or complete proposals in response to this BAA are not considered an allowable direct charge to any award resulting from this BAA or any other award. Technical and cost proposals, or any other material, submitted in response to this BAA will not be returned.

This publication constitutes a BAA as contemplated in Federal Acquisition Regulation (FAR) 6.102(d)(2) and the DoD Grants and Agreements Regulation (DoDGARs) Subpart 22.315(a).

8. Response Dates

This announcement remains open until superseded. White papers are reviewed and evaluated as they are received and may be submitted at any time. The white paper/proposal submission process is discussed in sections IV and V of this BAA. Proposals will be due according to specific instructions contained in a separate Request for Proposal (RFP) notice resulting from favorable white paper evaluations or calls issued against this BAA. Calls may be placed against this BAA and specific information related to due dates will be provided in each call. Proposals or white papers submitted in response to calls should be submitted according to directions contained within each individual call and in accordance with this BAA. Late bid and proposal provisions (in accordance with (IAW) Federal Acquisition Regulations (FAR) 52.215-1(c) (3)) will apply to this BAA.

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I. Opportunity Description

The USAFA invests in an active research program for three main reasons. First and foremost, research significantly enhances the cadet learning experience. Our research is done by, for and with cadets who work alongside fellow cadets and faculty mentors. Research provides cadets with rich independent learning opportunities as they tackle ill-defined problems and are challenged to apply their knowledge and abilities.

Second, our research program provides opportunities essential for faculty development. Research broadens and deepens the experience base of the faculty. This infuses current, relevant, state-of-the-art and cutting-edge applications and examples into the curriculum. This also helps our faculty remain current in their respective fields.

Third, at USAFA we strive to conduct research to enhance the ability of the Air Force to perform its mission. There are ongoing research projects spanning topics as diverse as super hypersonics, cyber security, spatial disorientation, athletic performance and homeland defense. This BAA offers a vehicle for research to be performed to satisfy these three objectives, while also meeting research needs of industry counterparts/serve a public purpose. All awards issued against this BAA must serve to benefit the objectives identified above.

a. Research Centers

1. Aeronautics (Aeronautics Research Center)

The Aeronautics Research Center (ARC) performs a range of aeronautical research tasks in support of Air Force (AF), Department of Defense (DoD), National Aeronautics and Space Administration (NASA) and other government and commercial sponsors. Making use of the highly diverse and advanced experimental facilities housed in the USAFA Department of Aeronautics, the ARC pursues a range of aeronautic and propulsion research efforts. The research program in this center is geared toward providing all undergraduates with a rich, relevant research experience while answering critical research needs of our highly varied customer base. Researchers may expect extensive access to premier facilities, tremendous latitude of pursuits and single-minded focus on research tasks, but must seek to incorporate student participation in their projects, typically two to four students per semester. Substantial effort in this center is directed toward the solution of multi-disciplinary problems which may require skills beyond classical aeronautics disciplines, including plasma and laser physics, optics, automatic controls and applied mathematics. The ARC, in partnership with the USAFA Modeling and Simulation Center, is a leader in the complementary employment of experiment and simulation to solve complex fluid, aerodynamic and control problems.

Current research strengths include several complementary thrusts. Closed loop flow control efforts focus on aero-optic control and control of flexible structures under aerodynamic loading. There is extensive effort in the development of automatic control algorithms and techniques, experimental flow control methodologies, fluid-structure interactions and computational fluid dynamics (CFD) simulations. Well-developed and modern force and moment measurement capabilities in low speed ($M < 0.1$) and subsonic (up to Mach 0.6) wind tunnels are employed in the investigation of numerous

air vehicle modifications as well as development of new aircraft and Unmanned Aerial Systems (UAS) designs. Flight test of small air vehicles can be arranged using USAFA facilities. A Mach-6 Ludwig tube is now available, complementing an existing Mach 4.4 blow down facility for supersonic and hypersonic investigations, emphasizing shock wave-boundary layer interactions. Operating engines, including an F-109 turbo fan and several internal combustion engines, are used for fuels and flow quality investigations, with a current emphasis in ejectors, ducted fans, and propellers for small air vehicles. Researchers are encouraged to propose topics in these areas and other allied aeronautics subjects. USAFA is a pioneer in arranging for wind tunnel concepts to be field tested in flight vehicles, both “test mules” and small air vehicles designed and built in-house. Vehicles are then flown in USAFA-controlled airspace.

A list of current and available research facilities can be found at www.usafa.edu.

Thomas E. McLaughlin, Ph.D.
Director, Aeronautics Research Center
USAFA Department of Aeronautics
(719) 333-2613
Tom.Mclaughlin@usafa.edu

2. Aeronautics (High Performance Computing Research Center)

The High Performance Computing Research Center (HPCRC) is a multi-disciplinary center which shares a dual mission of providing high performance computing resources to USAFA cadets and research/teaching personnel, as well as conducting physics-based modeling and simulation research tasks in support of AF, DoD, NASA and other government and commercial sponsors. Making use of distributed/shared memory computing systems and a dedicated research network, the Center pursues a range of computational research efforts. The research program in this center is geared toward providing undergraduates with scientific computing experience supported by the DoD High Performance Computing Modernization Program and projects which answer critical research needs of our highly varied customer base. Researchers may expect extensive access to premier facilities, tremendous latitude of pursuits and single-minded focus on research tasks, but must seek to incorporate cadet participation in their projects, typically two to four cadets per semester.

The HPCRC, in partnership with the USAFA Aeronautics Research Center, is a leader in the complementary employment of experiment and simulation to solve complex fluid, aerodynamic and control problems. Current fluid/aerodynamic research interests include:

- Massively-separated flow aerodynamics, including turbulence modeling
- Chemical, oxygen, iodine laser operation optimization
- Reduced-order modeling for aircraft stability and control characterization
- Fluid-structure interaction as applied to aero-elasticity as well as other linear and non-linear problem sets
- Non-equilibrium gas dynamics typical of high-altitude, rarefied flows as well as hypersonic atmospheric re-entry
- Gas turbine propulsion devices (including inlets, compressors, turbines and nozzles), high-speed propulsion devices such as ramjets and scramjets
- Other topics of interest involving the use of high performance computing resources for the solution of complex scientific and engineering problems

The HPCRC also works in partnership with other USAFA academic departments and research centers to develop computational simulation capabilities using high performance computing (HPC) resources. Current research interests in this area include:

- Development of tools and techniques to ease the delivery of HPC services to users and researchers without a significant computational background (including undergraduate students)
- Development of software methods, processes, tools and utilities to solve complex science and engineering problems using HPC resources (including General Purpose Graphical Processing Units or GPGPUs)
- Development of parallel software processes and tools to improve maintainability, efficiency and scalability

Roger Greenwood, Lt Col
Director, High Performance Computing Research Center
USAFA Department of Aeronautics
(719) 333-4010
Roger.Greenwood@usafa.edu

3. Aeronautics (Hypersonic Vehicle Simulation Institute)

The Hypersonic Vehicle Simulation Institute (HVSI) funds and performs a range of hypersonic research tasks in support of the DoD High Performance Computing Modernization Program (HPCMP). HPCMP desires to improve computational simulations of hypersonic vehicles in support of Department of Defense goals by accelerating the successful development of HPC software and hardware. HVSI has the objectives to: facilitate the development and documentation of a national vision for hypersonic vehicle simulation; co-fund projects in the gaps of current DoD, DOE, NASA, and Industry research efforts critical to achieving DoD hypersonic vehicle simulation; facilitate transition of hypersonic research into production quality simulation software available to government, academic, and industry acquisition partners; create a national repository for hypersonic simulation verification and validation data; provide computational resources to provide a measurable leap forward in hypersonic system simulation capability for DoD hypersonic system acquisition. The HVSI will be looking to improve computational simulation approaches including numerical methods, modeling approaches, and simulation of a variety of aerothermodynamic and propulsion aspects of hypersonic flight. Specific science and technology areas include turbulence, boundary layer transition, fluid-structure-thermal interactions, non-equilibrium chemistry, ablation, and combustion.

Russell M. Cummings, Ph.D.
Director, Hypersonic Vehicle Simulation Institute
USAFA Academy Department of Aeronautics
(719) 333-9223
Russ.Cummings@usafa.edu

4. Astronautics (Space Systems Research Center)

The Space Systems Research Center performs a wide range of activities involving the design, assembly, integration, test, launch and flight of small satellites to conduct research for the AF and the DoD. This unique program blends science, technology and organizational skills like none other at the USAFA. The Center is currently operating FalconSAT-3 (launched 2007) preparing to operate

FalconSAT-6 (to launch 2018) and developing FalconSAT-8 (to launch in 2019), which host DoD Space Experiments Review Board-approved experiments. Other research areas are educational nanosatellites of the CubeSat form factor. Designing a satellite is a complex, multi-disciplinary undertaking requiring expertise across a number of technical disciplines. The goal of all SSRC research is to enable cadets to 'learn space by doing space' The Department of Astronautics, in partnership with the Space System Research Center, aims to extend this expertise through researching and applying design experiences and examples to support the AF and DoD.

Currently available facilities, instrumentation and research efforts can be found at www.usafa.edu.

Daniel Showalter, Major, Ph.D.
Director, Space Systems Research Center
USAFA Department of Astronautics
(719) 333-3315
Daniel.Showalter@usafa.edu

5. Biosystems and Extremophiles: Metabolic Regulation and Energy Transformation Mechanisms (Life Sciences Research Center)

The Life Sciences Research Center's (LSRC) primary mission is to support the Air Force's research programs at the Air Force Office of Scientific Research (AFOSR) and Air Force Research Laboratories (AFRL) through faculty and cadet research efforts. Within the Department of Biology at the U.S. Air Force Academy (USAFA), LSRC is seeking research partnerships to investigate changes in metabolism with regards to improving human performance. Insight into the nature of the cellular response of this process is of basic science importance and also relevant to recovery and adaptation from physical exertion, wound healing, tissue regeneration, and transplantation. Further, our center also wishes to uncover the unique protective properties of microbial photosynthetic extremophiles (algae or cyanobacteria that are thermophilic, acidophilic, desiccation tolerant, etc.) and to develop novel genetic engineering systems for these organisms.

Critical aspects of human performance and physiology are controlled by metabolic circuits that provide cellular ATP. These circuits are especially responsive to O₂ levels (influenced by exertion or altitude), reactive O₂ species (ROS), and the types/levels of dietary biochemical fuels. The Department of Defense (DOD) is interested in rapidly modulating human cell metabolic rates in response to a myriad of physiological and environmental cues. This can enable high-levels of ATP production in stressful conditions, even when energetic constraints exist because of sleep/caloric limitations (especially fatigue prevention). Despite extensive characterizations of the primary protein/enzyme machinery contributing to cellular ATP production, very little is known. Especially about how this machinery is controlled or how these pathways are dynamically regulated in response to signaling events and alterations in cellular redox status. There is growing interest in establishing fundamental mechanisms of metabolic regulation by redox sensors in model systems. One such approach could involve using bacterial, yeast and mammalian cell systems in parallel, to probe how cells respond to physiological changes brought about by varying levels of oxygen (the "Crabtree Effect") and nutrients. This would involve interrogating the control mechanisms cells use to regulate energy transformation when faced with dynamic redox conditions, e.g., fluctuating levels of energy carriers and/or O₂.

The LSRC is also interested in investigating the relevant properties of extremophilic, thermophilic, acidophilic, desert crust microbiota, etc., with a focus on discovering and understanding the basic natural mechanisms used by these organisms to survive harsh environments. Relatively little is

understood about energy transformation or enzymatic engineering within these biosystems (some of which capture solar energy, converting it to chemical energy). Further investigation of extremophiles and their mechanisms of metabolic regulation could lead to increasing energy production by these microorganisms, providing potential value in emerging technologies such as bioelectrochemical systems. Unraveling the complexities behind the aforementioned areas could perhaps lead to faster catalysis in materials identification or degradation, and could eventually lead to the ability for long term bio-sensing capability. Research efforts will focus on strain selection, cultivation and characterization, with a view to improving the overall metabolism of these robust microbial cultures for increased protective systems and energy capability.

Research activities in these areas could be carried out by a commercial or academic partner with experience in conducting and participating in R&D relating to the previously mentioned areas along with placing an exceptional research scientist at USAFA. Applications for on-site USAFA research are encouraged from individuals from a variety of backgrounds; phycology, microbiology, biochemistry, extremophile physiology, electrochemistry, genetic engineering, and microbial fuel cells (MFCs). We are especially centered on isolation and identification of desiccation tolerant photosynthetic microorganisms, and developing methods for making them tractable to genetic manipulation. These research thrusts have applications for the U.S. Air Force ranging from protein stability under harsh conditions to energy transfer across biotic/abiotic interfaces to the development of biosensors for threat detection and mitigation. Collaboration should include leadership and guidance on the proposed research areas for laboratory technicians/students, partner scientists, chemists and engineers on experimental work at the intersection of chemistry, biology, and biochemistry.

Because of the USAFA mission to prepare young men and women for leadership positions within the Air Force, cadet participation with researchers is expected as part of our independent study projects (499s) and cadet summer research program (visiting partner labs). Additionally, there is potential for cross disciplinary involvement from a number of academic departments other than Biology, such as Chemistry (biochemistry), Engineering (model production), and Management (project analysis). There are also potential collaboration opportunities with other academic institutions, private companies and other Air Force research agencies.

Donald V. Veverka, Ph.D.
Director, Life Sciences Research Center
USAFA Department of Biology
(719) 333-9670
Don.Veverka@usafa.edu

6. Chemistry (Chemistry Research Center)

The opportunity to participate in basic and applied research by faculty, staff, and cadets is important to the overall mission of the Air Force Academy. The Chemistry Research Center (CRC) provides for professional development of faculty members and resident researchers in addition to enhanced education of cadets through research programs in support of the Air Force as well as DoD R&D directives. In order to accomplish a portion of this, the CRC has had proven success by external partnering with academia, industry, and national laboratories in order to leverage an expanding technology base.

Current topics of interest in the CRC are renewable materials, light harvesting organic electronics, fluoropolymers, energetic composites, smart coatings, liquid crystalline elastomers, and high temperature composite resins and fibers. Research partnerships usually take place on-site using the laboratories and analytical instrumentation located in the Department of Chemistry at the US Air Force Academy (USAFA). Interested inquiries should contact the CRC POC before submission to ensure proposals are feasible for funding and of technical interest to the CRC.

A short description of the CRC research and capabilities is available at www.usafa.edu/research/research-centers/chemistry-research-center/

Scott T. Iacono, Ph. D.
Director, Chemistry Research Center
USAFA Department of Chemistry
(719) 333-6005
Scott.Iacono@usafa.edu

7. Computer Science (Academy Center for Cyberspace Research)

The Academy Center for Cyberspace Research (ACCR) conducts research in a wide range of areas within the fields of Computer and Cyber Science in support of the AF, DoD and other government and commercial sponsors. All cadets in the Computer Science and Cyber Science majors receive research experience through independent studies, course projects and summer research opportunities. ACCR has four primary research focus areas: system security analysis, immersive environments (augmented and virtual reality), artificial intelligence and autonomy, and big-data analytics. In addition to these four primary focus areas, ACCR can conduct research in any topics related to the field of Computer and Cyber Science provided there is sufficient faculty and cadet interest. State of the art facilities are available to students and researchers providing capabilities for network and platform vulnerability analysis; industrial control system/supervisory control and data acquisition security analysis and development; provably secure software development; network security stack analysis; virtual and augmented reality applications; high-performance computing; robotics and unmanned systems design, analysis, and operation; unmanned aerial swarms and multi-vehicle cooperation. ACCR is especially interested in research that incorporates proposed student projects. Current topics of research include operational network penetration testing techniques and tools, provably secure network applications, network security stack capability and shortfall analysis, virtual reality exposure therapy, augmented reality for distributed command and control, emergency response augmentation through virtual reality, counter-unmanned aerial systems swarm techniques, unmanned aerial swarm behaviors, and business process automation. Researchers are encouraged to propose topics in these areas as well as other cyberspace and computer science topics.

Currently available facilities, publications and research efforts can be found at www.usafa.edu.

Judson Dressler, Major
Director, Academy Center for Cyberspace Research
USAFA Department of Computer Science
(719) 333-8328
Judson.Dressler@usafa.edu

8. Engineering Mechanics (Center for Aircraft Structural Life Extension)

The Center for Aircraft Structural Life Extension (CAStLE) has a two-fold mission in support of the safe sustainment of aging structures and other material degradation related fields.

The first aspect of the CAStLE mission is to perform a wide range research and technology development projects focused on delivering science and technology (S&T) products to various government, academic and commercial sponsors. Making use of the extensive experimental and computational facilities housed in the USAFA Department of Engineering Mechanics and elsewhere, CAStLE pursues a range of research efforts in a wide variety of fields. These fields include engineering mechanics, mechanical engineering, aerospace engineering, corrosion engineering, and material science. CAStLE places more emphasis on applied research and that part of development not related to the development of a specific system or hardware procurement. CAStLE is a leader in the complementary employment of experiment and simulation to solve complex static stability, static strength and fracture mechanics problems. Current research strengths include advanced barrier coatings; static strength and static stability design; corrosion modeling, prevention and control; validation testing, analysis and methods development; computational structural and fracture mechanics; root-cause (failure) analysis; flight data acquisition system development, installation, maintenance and data analysis; educational curriculum research and development; structural risk analysis; forensic structural teardown analysis and research tied to the USAF Aircraft Structural Integrity Program (ASIP). The interaction between corrosion, cracking, and other material degradation/damage mechanisms and their effect on structural integrity has been a long-standing interest of CAStLE. There is DoD-level interest in material degradation in structures—to include corrosion, cracking and other service related damage mechanisms.

The second and no less important aspect of the CAStLE mission is produce individuals with education, training and experience, who will form the future core of the structures and material degradation technical community within the government and the general professional population. To this end CAStLE seeks to leverage research and S&T products to create educational experiences that will prepare and inspire future generations in relevant fields that support obtaining solutions to material degradation issues in structures. Past research programs have provided service academy cadets, college students, primary students, and faculty with rich, relevant research experiences while answering critical research needs of our highly varied customer base. New research projects must likewise seek to directly incorporate students or in some way educationally benefit students. Besides student participation elements in our S&T product development projects, CAStLE has education-based projects in distance learning, primary education curriculum and design research, science center education programs, and the creation of a wide variety of web-based video-delivered educational products. Producing individuals to form the material degradation technical core naturally requires those individuals to be prepared in the sciences, math and other technical areas related to engineering and technical topic areas which are appropriate to the age and background of the target audience. There is DoD-level interest in educationally preparing and inspiring future generations to pursue careers in material degradation of structures—to include corrosion, cracking and other service related damage mechanisms.

Gregory A. Shoales, Ph.D., P.E.,
Director, Center for Aircraft Structural Life Extension (CAStLE)
USAFA Department of Engineering Mechanics
(719) 333-6213
Gregory.Shoales.1@us.af.mil

9. Laser and Optical Physics (Laser & Optics Research Center)

The Laser and Optics Research Center (LORC) performs a range of research tasks in support of the AF, DoD, DOE, National Science Foundation and other government and commercial sponsors. Making use of the extensive experimental facilities housed in the USAFA Department of Physics, the Center pursues a range of research efforts. The research programs in this center are geared toward providing all undergraduates with a rich, relevant research experience while answering critical research needs of our highly varied customer base. Researchers may expect extensive access to premier facilities, tremendous latitude of pursuits and single-minded focus on research tasks, but must seek to incorporate student participation in their projects, typically two to four students per semester.

Current research areas of emphasis comprise five broad areas. In the atomic physics area, precision measurements of atomic properties are a primary focus of investigation. These include measurements of atomic state lifetimes and branching ratios in alkalis such as cesium, sodium, potassium and rubidium along with alkaline-earth elements such as strontium which have atomic clock applications. Also the interaction of alkali atoms with inert gases is being studied for their collisional excitation transfer properties which are important to the operation of alkali lasers. This area is closely related to our second area of emphasis: the study of diode-pumped alkali lasers (DPAL). Key objectives of the DPAL research program are investigating their potential for scaling to high average power, investigating various amplifier and resonator configurations and improving the spectral and spatial output characteristics of high power semiconductor diode pump sources. Applications such as second harmonic generation and sum frequency generation are also part of this effort. Other gas lasers such as carbon monoxide lasers operating infrared wavelengths are also investigated.

Fiber laser research involves novel fiber designs including photonic crystal fibers and acoustically-engineered fibers for the suppression of non-linear effects in high-power fiber lasers, fiber components necessary for coherent beam combining, fiber laser and amplifier characterization, novel fiber manufacturing and processing methods, high-brightness, efficient, wavelength-stabilized pump sources, modeling and simulation of fiber lasers and amplifiers and fiber laser applications including but not limited to remote sensing, tracking, directed energy weapons and communications.

High-performance imaging research is focused on novel wavefront measurement and manipulation techniques including holographic wavefront sensing and correction and photon sieve telescopes. Key objectives include developing and demonstrating imaging technology suitable for integration into rugged compact devices and aerospace platforms.

Nanomaterials research includes the application of novel materials structures for the manipulation of light including negative index materials, phonon-photon superlattices, tunable dielectrics, ferro-electric and ferro-magnetic oxides, surface plasmonics and black silicon for photo-detector and solar cell applications. Researchers are encouraged to propose topics in these areas and other related subjects.

Martin D. Johnson
Deputy Director, Laser & Optics Research Center
USAFA Department of Physics
(719) 333-2579
Martin.Johnson@usafa.edu

10. Physics (Space Physics & Atmospheric Research Center)

The Space Physics and Atmospheric Research Center (SPARC) studies the natural environment from the troposphere to the sun in support of AF, DoD, NASA, NSF and other government and commercial sponsors. Making use of the extensive experimental facilities housed in the USAFA Department of Physics, the SPARC pursues a range of efforts. The research program in this center is geared toward providing all undergraduates with a rich, relevant research experience while answering critical research needs of our highly varied customer base. Researchers may expect extensive access to premier facilities, tremendous latitude of pursuits and single-minded focus on research tasks, but must seek to incorporate student participation in their projects, typically two to four students per semester. Substantial effort in this center is directed toward the solution of multi-disciplinary problems which may require skills beyond classical physics disciplines, including plasma and laser physics, advanced miniaturization techniques, use of Micro-Electro-Mechanical-Systems, development of miniaturized automated satellite constellations and advanced data mining techniques for large data systems. The SPARC is a leader in the development of miniaturized payloads for small satellites, and the application of data provided by these payloads to relevant Department of Defense problems. SPARC research interests vary depending on the sponsoring agencies interests.

Current research strengths include several complementary thrusts. Space physics and space weather study the relationship of the space environment and the effects this environment have on mankind. Topics in space weather can range from experimental, such as developing new instrumentation to measure the space environment, to theoretical, such as developing assimilative models which can be used to predict the space environment into the future. Linked with space physics and space weather, the micro- and nano-satellite thrust develops aggressively miniaturized spacecraft for use in small inexpensive constellations devoted to exploiting the entire range of space activities of interest to sponsors. The applied physics thrust considers all applications of physics to the practical applications of technology of interest to sponsors. In the past has included studies of plasma actuators, high speed spectroscopy in support of brief duration phenomena in the troposphere, mesosphere and the ionosphere, studies of the aurora and applications of weather modeling to highly dynamic small scale areas such as the USAFA. Finally, the Department supports a wide range of basic research in astronomy and astrophysics in support of the USAFA observatory.

Matthew G. McHarg, Ph.D.
Director, Space Physics and Atmospheric Research Center
USAFA Department of Physics
(719) 333-2460 (Desk), Phone: (719) 333-3510 (Front Office)
Matthew.Mcharg@usafa.edu

11. Center for Physics Education Research (CPER)

The Center for Physics Education Research (CPER) was founded in 1994 to build a USAFA center of gravity providing impetus, opportunities and tools for physics faculty at USAFA and nationwide, as well as engage in and apply Scholarship of Teaching and Learning-like (SoTL) research activities within the Department of Physics. The CPER maintains extensive ties and collaborations with similar research programs nationwide.

The primary goals of the CPER are to:

- Engage in research initiatives that quantify gains in student understanding and appreciation of physics. Efforts in this category leverage the random assignment of students within Core Physics sections to categorize and assess gains in performance of students within a single semester and across multiple semesters. In addition to analyzing performance on standardized assessments, there is considerable interest in analyzing student response patterns, developing assessment rubrics and understanding prior student knowledge and correlating learning gains with other metrics such as instruction techniques and student engagement.
- Develop and share tools for enhancing teaching and student learning in physics. Of particular interest is the research and development related to pedagogical techniques and supporting tools for the Just-in-Time Teaching (JiTT) initiative, the signature CPER effort. This effort includes the extension of JiTT to develop student Self-Explanations under a Worked Example model of instruction. Additional efforts include development of tutorials (to include computer simulations) for both beginning and intermediate physics students.
- Maintain a connection between course and curriculum development (content, assessment methods, pedagogical approach) and physics education research. CPER is actively and intimately involved with several national level efforts to engage in collaborative education research and bring the research results into the classrooms, both nationally and at USAFA, as soon as warranted by the assessment results.

Current research in this area includes:

- Do-It-Yourself Modeling, examination of concept visualization techniques in eight disciplines ranging from Astronomy to Sociology, development of classroom lessons based on the group's prior work and developing and testing mobile technology techniques for monitoring student engagement. These topics (and supporting grants) are in the NSF IUES (Improving Undergraduate Education in Science) category.
- Proliferate lessons learned on a national level by disseminating research results through conference presentations, workshops and publications.
- In addition to disseminating results and lessons learned on CPER goals on a national level, CPER personnel are also developing research tutorials and annotating JiTT content for national distribution. The CPER is also interested in improving meteorology education. Evaluating the utility of textbooks on Physics of Space Weather and designing/testing an assessment of student learning gains in general meteorology courses are of particular interest.

Researchers are encouraged to propose research topics in these areas and other related subjects.

Lt Col Randy Carlson
 Director, Center for Physics Education Research
 USAFA Department of Physics
 (719) 333-9733
 Randall.Carlson@usafa.edu

12. Center for Unmanned Aircraft Systems Research (UAS)

The USAFA Center for UAS Research educates cadets as they prepare to become AF Officers, develops premiere UAS research capabilities and faculty and provides world-class UAS research facilities, supporting a real-world experience for our cadets and producing needed research solutions for our military partners and sponsors. The research in support of this Center focuses on providing

autonomous, decentralized solutions for systems of UAS that may also incorporate the use of land and water assets. Researchers may expect access to premier facilities, including lightweight UAS vehicles with supporting command and control infrastructure and test and development equipment. Current research areas support the Center's goals. These include control system algorithms to direct autonomous vehicles; robotic control and navigation; robust communication systems that meet the challenges of dynamic and unpredictable network topology changes; inexpensive sensor network designs that incorporate fusion techniques for target identification, localization and tracking; and event-driven, multithreaded software architectures. The center is also interested in research related to Sense and Avoid, GPS-denied navigation, and Counter-UAS. Researchers are encouraged to propose topics in these areas or in areas they feel will complement the Center's work.

George York, Ph.D.
USAFA Department of Electrical and Computer Engineering
(719) 333-4210
George.York@usafa.edu

13. Civil and Environmental Engineering Research

The Department of Civil and Environmental Engineering performs research to help cadets learn how to solve complex problems within the fields of civil and environmental engineering. Our interests include interdisciplinary topics, and reflect the interests of individual faculty members. White papers that demonstrate a link to DoD civil and environmental engineering needs will be considered. Cadet involvement is highly prioritized.

Current topics of faculty research interest are:

- Engineering education
- Subsurface contamination by a variety of contaminants with a focus on modeling
- (*e.g.*, chlorinated solvents, radionuclides, firefighting foam fluorosurfactants)
- Sustainable design and construction
- Design and construction in developing countries
- Building energy modeling
- Near-surface geothermal energy topics
- Soil classification techniques and refinements
- Laboratory pavement testing
- Critical infrastructure protection
- Static testing of structural components
- Dynamic testing of building and pedestrian structures
- Vibration serviceability

On-site research is desired. USAFA has a large field site with heavy construction equipment that may be used to construct experimental earth structures and test beds. At this field site, USAFA has an operational Energy Pile system, consisting of 8 energy piles with 3 of the piles heavily instrumented for observation of thermo-mechanical response of the foundations under both service and artificially high thermal loading. The facility also has instrumentation related to optimizing performance, including measurement of inlet/outlet temperatures, current to HVAC equipment, and temperature and moisture content of the soil surrounding the piles. USAFA also has a fully functional soils laboratory. The department has a 30-ft by 60-ft bay with a 19-ft clear height beneath a 5-ton crane and multiple universal testing machines, including one with a capacity up to 300 kips. A structural component static testing capability is provided by a 25-ft-long, 8-ft gage width, reaction

floor with an MTS hydraulic system and multiple 55-kip actuators. We have access to DoD's High-Performance Computing Center, which can be used to solve a computationally intensive problem in several civil and environmental engineering disciplines (e.g., discrete element modeling of airfield pavements, flow and transport modeling of contaminants in the subsurface, etc.).

Thomas J. Phelan, Ph.D., P.E., BCEE
USAFA Dept. of Civil and Environmental Engineering
(719) 333-2516
thomas.phelan@usafa.edu

14. Electrical and Computer Engineering Research

The Department of Electrical and Computer Engineering (DFEC) conducts research to produce needed solutions for our military partners and sponsors while providing real-world engineering experience for our cadets and aiding in the professional development of our faculty. Research in the areas of energy security and smart grid technology are sought to include concepts associated with effective demand management, integration of multiple generation sources and communication of energy events.

The DFEC research program currently includes investigations in the following areas:

- RF measurement and systems development
- Circuit development
- Robotics
- Renewable energy.

Examples of existing research include improvised explosive device (IED) detection, radar cross section (RCS) analysis, antenna design, portable wind power generation and autonomous robot algorithms. Researchers are encouraged to propose topics in these areas or in areas they feel will complement the department's work.

Derek C. Neal, Maj
USAFA Department of Electrical and Computer Engineering
(719) 333-4645
derek.neal@usafa.edu

15. Center for Space Situational Awareness Research (Department of Physics)

The Center for Space Situational Awareness Research (CSSAR) in the Department of Physics (DFP) conducts research across a variety of areas in support of the AF, DoD, NASA and other government and commercial sponsors. Making use of USAFA's extensive experimental facilities housed in several academic departments, DFP pursues a range of research efforts. The Space Situational Awareness (SSA) relevant research programs are geared toward providing all undergraduates with a rich, relevant research experience while answering critical research needs of our highly varied customer base. Researchers may expect extensive access to premier facilities, tremendous latitude of pursuits and single-minded focus on research tasks, but must seek to incorporate cadet participation in their projects, typically one to two cadets per semester.

With more nations building and launching satellites, space has become increasingly congested, contested and competitive. SSA is thus a vital component of U.S. national security due to the role

space and cyberspace play in our military operations. CSSAR is developing world-class SSA capabilities and facilities at USAFA to include a 2-meter Fast-Tracking Telescope (FTT), the Falcon Telescope Network (FTN), and the Cadet Space Operations Center (CSOC). The FTN is a global network of small aperture robotic optical telescopes focused on satellite characterization through simultaneous observations from multiple illumination geometries. It will also be used for testing handoff and cueing techniques as well as smart network and resource management. The CSOC will be the hub in which all of USAFA sensors are operated and controlled. The CSOC will be a test bed for new SSA algorithms that allow for improved capability in maintaining SSA leading to predictive analysis and assessment.

Current research areas of emphasis include space object characterization via resolvable and non-resolvable imaging using optical observations, improvements to satellite orbit determination and prediction, fusion of disparate data sources to maximize the situational awareness, and development of FTN and CSOC capability. Researchers are encouraged to propose topics in these areas and other related subjects.

Francis K. Chun, Ph.D.
USAFA Professor of Physics
(719) 333-2601 (Desk), (719) 333-3510 (Front Office)
Francis.Chun@usafa.edu

b. Research Institute

1. Institute for Information Technology Applications

The Institute for Information Technology Applications (IITA) is an Air Force research institute directed by General James P. McCarthy, USAF, Retired. According to General McCarthy, "the driving concept of the institute formed in 1998 was to provide opportunities for multidisciplinary research that would be of value to the Air Force and the Department of Defense." IITA's vision is to serve as a renowned Air Force research institute for operational and educational information technology application. The IITA team includes representatives from HQ U.S. Special Operations Command and Air Force Research Laboratory. IITA seeks research proposals that apply information technology to improve the missions at the USAF Academy, to the USAF, and the DoD. IITA has several ongoing programs that it is interested in advancing to include:

Warfighter's Edge (WEde) is a software innovation laboratory involved in creating or modifying GOTS and COTS software to meet the urgent or emerging needs of unit-level warfighters. Established in 2005, WEde has contributed numerous innovative software products used throughout the DoD. Translation of data formats and visualization in various geospatial display platforms make up a considerable share of WEde products, around which experience the lab is currently sponsoring a modernization of the DoD's core mission planning geospatial visualization tool. Details about WEde products are available from info@wedde.hpc.mil.

WEde is leading a multi-discipline applied research collaboration effort to net-enable legacy and emerging-technology sensor platforms across tactical IP-based radio networks, integrating with mission planning systems, ISR (Intelligence, Surveillance, & Reconnaissance) databases, and mobile OS platforms to provide distributed situational awareness (SA), machine-to-machine (M2M) cross-cueing, and remote management of unmanned sensors and platforms to operations centers, planners, and mission managers. Currently, this effort is focused on:

- Integrating sensor and mission management data feeds from small unmanned aerial vehicles (UAV's) with mission planning environments such as the Joint Mission Planning System (JMPS) and situational awareness platforms such as Android Tactical Assault Kit (ATAK) and Windows Tactical Assault Kit (WinTAK).
- Prototyping an open-architecture networked sensor data distribution service via software translators, integrating dissimilar and guarded sensor feeds over tactical IP-based radio networks.
- Integrating a standardized common user interface for networked mission management of multiple dissimilar sensor platforms.

Research goals for 2018 include:

- Net-extend artificial intelligence across radio networks to leverage organically semi-autonomous capable legacy platforms to extend a distributed, autonomous, command and control (C2) environment for manned-unmanned teaming (MUMT).
- Optimize distribution of high bandwidth data streams across constrained, disadvantaged mobile networks.

Research agreements with outside agencies are common. Researchers are encouraged to propose topics in these areas and other related subjects.

James P. McCarthy
 Director, Institute for Information Technology Applications
 (719) 333-2746
 Jim.McCarthy@usafa.edu

2. Institute for National Security Studies

The United States Air Force Institute for National Security Studies (INSS) is a strategic policy research institute located within the faculty at the US Air Force Academy. It is primarily sponsored by HQ USAF/A10 (Deputy Chief of Staff for Strategic Deterrence and Nuclear Integration), but it also partners with Air Force Space Command, the Defense Threat Reduction Agency (DTRA), and other members of the Department of Defense (DoD) strategic community. INSS serves as a locus for research related to strategic and air and space studies, emphasizing enduring and emerging strategic issues, global and regional strategic challenges, nuclear deterrence and arms control, strategic stability, space strategy and policy, and sustaining particularly the human infrastructure necessary to ensure long-term strategic and space security. In addition to its research efforts, the Institute conducts a broad range of other activities, including workshop planning and organization, curricula development and delivery, and scholarly publications.

This announcement specifically addresses additional research and analysis that INSS is conducting internally, through the USAFA and broader military academic communities, and externally as required to meet USAF and DoD needs. INSS research and analysis will be directed at discovering, disseminating, and applying new or expanded traditional and multi-disciplinary knowledge relevant to 21st century deterrence and 21st century space strategy and policy. INSS will focus its current efforts on the following areas:

Strategic Security:

- Regional/limited strategic conflicts involving at least one nuclear actor
- Escalation control, stability, and deterrence in regional/limited strategic conflicts involving at least one nuclear actor

- Extended deterrence and assurance today and into the future
- Adversary and ally perceptions of United States extended deterrence and assurance
- Arms control and cooperative security measures to advance stability today

Space Security and Policy:

- Integration of commercial and military space systems for more robust and resilient National Security Space architectures
- Varying measures of appropriate multi-domain response to attacks against space systems
- Deter, dissuade, assure, defeat applied to space operations
- Adversary and ally perception of U.S. actions in, and use of, space as it relates to policy for operations within the space domain
- Norms of behavior in the space domain - shaping policy for actions to, through and from the space domain

Research proposals are invited that address these areas. An overview of INSS research is available at <https://www.usafa.edu/research/research-centers/institute-national-security-studies/>.

James M. Smith, Ph.D.
 Director, USAF Institute for National Security Studies
 (719) 333-2717
james.smith@usafa.edu

3. Eisenhower Center for Space and Defense Studies

The Eisenhower Center for Space and Defense Studies is the research center of the Air Force Academy's Department of Political Science. The Eisenhower Center supports research and professional development programs for both cadets and faculty on national security and defense policy issues. In particular, the Eisenhower Center has established a reputation for innovative thinking on space security and deterrence. The Eisenhower Center's first project was the creation of its *Space and Defense Policy* textbook in 2009 used at the Academy and by Air Force Space Command's professional education programs. This project built upon the Department's tradition of applying the expertise of its faculty to the study of defense policy as evidenced by eight editions of its textbook, *American Defense Policy*. A ninth edition is currently being considered.

The Eisenhower Center publishes a new edition of its journal *Space and Defense* each year, and invites contributions from writers representing both the academic and policy communities. There is no standard length for articles, but 7,500 to 10,000 words, including notes and references, is a useful target for research articles. Viewpoint essays are normally in the range of 2,500 to 5,000 words. Past editions of the journal can be found in the EbscoHost database and on the web at http://www.usafa.edu/df/dfe/dfer/centers/ecsd/defense_journal.cfm.

The Eisenhower Center has also been asked from time to time to conduct studies in support the office of the Secretary of Defense and others on topics such as space deterrence, verification, and governance. The Eisenhower Center's Space Deterrence Study developed the "layered deterrence" model adopted in the 2011 National Security Space Strategy and is currently working on a cross-domain deterrence study.

Lt Col Ryan Guiberson
 Deputy Department Head

(719) 333-2435
Ryan.Guiberson@usafa.edu

c. Other

1. Department of Behavioral Sciences and Leadership Warfighter Effectiveness Research Center (WERC)

The Department of Behavioral Sciences and Leadership Warfighter Effectiveness Research Center (WERC) is involved in multiple research efforts that span the domains of human behavior. Specifically, the WERC has expertise in areas such as human factors, leadership, sociology, social psychology, clinical psychology, social work, general psychology, organizational psychology, biopsychology, and cognition. Research programs in the department are designed to build upon what is learned in the classroom and provide undergraduates with relevant, applied experience in research. Cadets may participate in capstone research, independent study projects, summer research programs, and/or ongoing faculty research projects, leveraging the expertise of our diverse faculty as well as numerous DoD agencies, academic institutions, and private business collaborators.

Current topics of interest range across the behavioral sciences and include:

- Human-Machine Teaming (HMT) has become a significant area of research emphasis within the DoD and USAFA. The goal of this line of research is to maximize team performance of humans working with autonomous systems in AF task environments. This includes studies in calibrated trust, team training, anthropomorphism, situational awareness, communication, and other related areas.
- Design of innovative systems that leverage a user-centered approach and can be assessed in ecologically-valid environments with cadets. Some application domains in command and control, intelligence, aviation, etc.
- The examination of leaders' decision making and performance in complex socio-cultural and technological contexts. The research goal is to enhance flexible and adaptive decision making and consequent behavior, which may include some or all of the following: civilian, military, interagency individuals and teams. Teams may cross the spectrum of civilian teams to current and potential military and civil-military (interagency and coalition) operations.
- Psychosocial resiliency. Research scenarios may range from civilians and first responders affected by 9/11 or the Boston Marathon bombing to soldiers who have deployed during Operation Iraqi Freedom and Operation Enduring Freedom.
- Research DoD policies, including changes therein, and their impact on civilian and military personnel (e.g.: Don't Ask, Don't Tell).
- Researching and accessing "Respect for human dignity."
- Reframing the discussion and researching and analyzing new methods or best practices surrounding suicide prevention in military, industry, civilian, and government environments.

Major Chad Tossell, Ph.D
Director, Warfighter Effectiveness Research Center
USAFA Department of Behavioral Sciences & Leadership
(719) 333-3132
chad.tossell@usafa.edu

2. Department of Foreign Languages and the Office of International Programs

Our ever-expanding global AF mission demands increasing foreign language capability and intercultural competence in our officer corps to support national security strategies. Foreign language programs at USAFA seek to expand the opportunities for USAFA cadets to enhance their foreign language skills and their understanding of world cultures in Arabic, Chinese, French, German, Japanese, Russian, Portuguese or Spanish. Beyond the classroom, language acquisition and cultural understanding is enhanced through study abroad opportunities for cadets such as the Cadet Summer Foreign Language Immersion Program, the Cadet Cultural Immersion Program, the Semester Exchange Abroad Program, the Semester Study Abroad Program and the Cadet International Academy Visits Program. Research and assessment tools within these programs and in-classroom curricula are essential to produce officers with some level of foreign language proficiency and intercultural competence. Research interests in foreign language and international programs include but are not limited to the following areas:

- Methods to assess foreign language proficiency of students in different levels,
- Methods to assess foreign language proficiency in various modalities,
- The impact of language and/or cultural immersions on language and intercultural competence development of students,
- The use and effectiveness of various technologies in teaching and assessing foreign languages.

Dr. Jean LeLoup

Associate Professor

USAFA Department of Foreign Languages and the Office of International Program

(719) 333-8698

jean.leloup.1@us.af.mil

3. Interdepartmental Program of Operations Research and Analytics

This interdepartmental program leverages the talents of faculty members across multiple departments in the disciplines of operations research, systems engineering, management and others. These individuals provide exceptional educational opportunities for cadets primarily supporting capstone projects in operations research. In addition, the program supports cadet projects such as new venture analyses, systems engineering process improvements, as well as a number of independent study projects and summer research programs. This is accomplished through numerous collaborations with other governmental and nonprofit agencies. The program supports local organizations as our students work with real clients in real agencies addressing real issues. While local organizations provide USAFA cadets an opportunity to experience organizational dynamics, the program also supports defense and homeland security agencies worldwide.

Each year cadets enrolled in Mathematical Sciences, Operations Research, Management and Systems Engineering Management Capstone courses develop projects that solve real world problems for client organizations with tools they have learned at the USAFA. Faculty and staff directly support these initiatives through both mentorship and research. While mathematics and management are well known fields, the operations research and analytics disciplines have developed within the advent of computer technology. Operations research and analytics methods focus on analyses that combine mathematical, econometric, computer systems and managerial concepts to improve operations and processes.

Current topics of interest range across operations research and the management sciences and include, but are not limited to:

- Scheduling, routing, assignment and resource allocation issues,
- Modeling and simulation of organizational operations and processes,
- Statistical analysis of organizational processes and business functions,
- Decision models supporting both strategic and tactical decisions.

Gregory M. Steeger, Lt Col
Operations Research
USAFA Department of Management
(719) 333-9712
gregory.steeger@usafa.edu

4. Air Force (AF) CyberWorx

AF CyberWorx:

AF CyberWorx engages with cadets, industry, academia, and government partners to apply human-centric design principles toward modeling and concepting solutions to hard AF problems. AF CyberWorx is dedicated toward creating solutions and delivering them to the warfighter quickly through a mix of RDT&E, tech transfer and direct industry development. The problems AF CyberWorx selects can be technical or process oriented and includes cyber operations related challenges and challenges that improve the effectiveness of the service and individual airmen across all warfighting domains. Additionally, AF CyberWorx investigates human-centered design methodologies and how they can be applied to governmental problem sets. AF CyberWorx is seeking solutions centered on advanced algorithmic applications, IoT, mobility, critical infrastructures and advancing user interfaces and experiences. AF CyberWorx conducts deep, longer term, basic and applied research through its local partners with the Department of Homeland Security (DHS) (Center of Innovation) and the Department of Computer Science (Academy Center for Cyber Space Research).

Center of Innovation (CIO)

The COI performs a wide range of research and innovation projects that immerse cadets and government employees into industry efforts that will shape the future marketplace. COI's efforts support the DHS Science and Technology, Office of the Secretary of Defense (OSD), DoD, and Intelligence Agencies by conducting horizon scanning of new emerging private sector capabilities and conducting proof of concepts of these areas of interest for Cyberworx, DHS, and USG. CoI's proof of concepts provide government insights and needs into industry R&D, as well as shaping government preparedness for emerging technologies. The COI develops partnerships with industry to help advance future commercial offerings that improve the security, reliability and flexibility of critical infrastructures, traditional IT networks, and OT systems.

The COI research program is geared toward providing all undergraduates with a rich, relevant research and innovation experience while answering critical needs of our highly varied customer base. Researchers may expect extensive access to premier facilities, tremendous latitude of pursuits

and single-minded focus on research and innovation tasks, but must incorporate student participation in their projects, typically two to four students per semester. Specifically, the COI is interested in championing innovations in the cyber and information technology (IT) realm with the state-of-the art networks, computational nodes, trusted enclaves, delayed tolerant networks, and disruptive software applications. Lastly, COI is interested in Accelerator Research, its processes and models that can accelerate USG innovations.

The COI's areas of interest include but are not limited to software defined networks, hardware based security protections, physical security, ICS, LiFi, advanced RF signaling, software defined radios, algorithmic security, advanced authentication, cloud computing and mobility. Researchers are encouraged to propose research topics in these areas and other allied COI subjects.

Academy Center for Cyber Space Research

The Academy Center for Cyberspace Research (ACCR) conducts research in a wide range of research areas within the field of Computer Science and Cyber Security in support of the AF, DoD and other government and commercial sponsors. The center seeks to develop cadets as cyber innovators by participation in and exposure to research projects in the domain of cyberspace. All cadets in the Computer Science and Computer and Network Security majors receive research experience through independent studies, course projects and summer research opportunities. Current research focus areas for ACCR include cyberspace education and training, cyber-warfare topics and information assurance. State of the art computing facilities are available to students and researchers for conducting studies in an isolated network environment running virtual machine (VM) software for rapid reconfiguration and testing. Parallel architectures are also available for studies using neural networks and parallel algorithms. ACCR is especially interested in research with proposed student projects. Current topics of interest include the application of concurrent coding theory to the development of jam resistant communications without requiring a shared secret, Supervisory Control and Data Acquisition (SCADA) systems, vulnerabilities and defenses, identifying and categorizing malware, finding application and web vulnerabilities and cyber situational awareness. Researchers are encouraged to propose topics in these areas as well as other cyberspace topics.

Cyber Contacts:

Col Jeffrey Collins, Ph.D.
Director, AF CyberWorx
(719) 333-3399
AFCyberWorx@usafa.edu

Terry Pierce, Ph.D.
Director, USAFA Center of Innovation
Special Advisor for Disruptive Innovation DHS S&T
(719) 333-3974
Terry.Pierce@usafa.edu

5. Scholarship of Teaching and Learning

The Scholarship of Teaching and Learning (SoTL) represents a growing national and international professional movement that advocates the scholarly approach to understanding factors that impact student learning. These factors include specific teaching techniques, incorporation of technology,

organization of materials, use of group work, etc. The International Journal for the Scholarship of Teaching and Learning explains why it is important for SoTL research to be performed. SoTL is “a key way to improve teaching effectiveness, student learning outcomes, and the continuous transformation of academic cultures and communities.”

The USAFA Program was established in June of 2009. Topics of interest have cut across disciplines, pedagogies and types of instructional technology. Projects may be limited to a single semester for a single instructor, or may include multiple semesters and instructors. Data include performance on course assessments, questionnaire inputs, focus group and interview responses, and behavioral observations. Some projects extend beyond the classroom to investigate other activities that might impact cadet learning.

Examples include:

- Metacognitive Reflection Related to Student Performance and Attitudes
- Impact of Learning Contracts on Student Commitment and Academic Performance
- Impact of Team-based Learning
- The Use of E-reader Annotations to Develop Critical Reading Skills
- Best Practices to Develop Critical Thinking Skills and Habits
- Dissemination and Application of the Science of Learning by Faculty and Cadets
- Impact of Video Tutorials on Cadet Learning.

Lauren Scharff, Ph.D.

Director, Scholarship of Teaching and Learning

Center for Educational Innovation

(719) 333-3277

Lauren.Scharff@usafa.edu

6. Digital Humanities Center

The USAFA Digital Humanities Center works to advance research, engage conversation, and develop courses to bridge the perceived gap between STEM disciplines and the humanities in order to champion a human-centric understanding of leadership, technology, and warfare. Interdisciplinary and cross-institutional in its orientation, the center leverages digital methods to explore and illuminate how people process and document the human experience. Even as the center grows its intellectual and system foundations to support research and coursework across the humanities (for example, in the fields of history, language, religion, and philosophy), faculty and cadets are conducting significant research and completing important projects that focus on better understanding and responding to the human experience as it expressed through literature and art.

Housed in the Air Force Academy’s Department of English and Fine Arts, the Digital Humanities Center:

- Nurtures efforts using technology to pursue traditional research and learning in the humanities.
- Encourages innovative use of technology in the creative arts.
- Helps understand how advances in technology influence what it means to be human.
- Offers opportunities to explore how the use of technology expands the potential for scholarship in the humanities.

A current venture is *The Red Badge of Courage* Project, a collaborative effort between computer scientists and scholars at MIT, Hofstra University, and Boise State, led by USAFA faculty with cadets included as significant project partners. This effort has involved the development and application of cutting-edge software to study, annotate, and analyze the original, handwritten drafts of Stephen Crane's canonical work, one of America's most important war novels and one of the nation's most culturally significant texts. During academic year 2017-2018, sixty-two cadets enrolled in the required core literature course and worked with the online software to perform essential primary editing tasks. These tasks included very close examination of the manuscript leaves and correlating them with previous research done by Fredson Bowers, a distinguished bibliographer and textual scholar. The work done by the cadets demanded intense attention to detail, and it began to lay the foundation for scholars who will follow them in coming years.

In addition to the *The Red Badge of Courage* project, the Digital Humanities Center also supported cadets engaged in studying cadet creative writing from the 1960s through 2017. The cadets focused their attention on the Academy's creative arts publication *Icarus*. Their idea for this project was sparked by attendance at the Digital Humanities Summer Workshop offered at the University of Victoria during June, 2017. There, under the supervision of English Department faculty members they attended hands-on classes learning how to preserve and examine text using digital research techniques and tools. Their project required them to locate and digitize all editions of *Icarus*. Their immediate goal was to ensure digital preservation of cadet creative writing, but their work went beyond initial preservation. They applied a range of digital tools to perform what digital scholars call a "distant reading" of text. The result of this reading allowed them to develop and test hypotheses about how cadet writing has changed over the years as the Academy itself has matured. Their research was selected for presentation at the Colorado Undergraduate Research Forum.

In addition to participating in original research, center-affiliated faculty work to engage broad conversations about the critical intersections between the humanities and science and technology and with other digital humanities centers and academic disciplines. During summer, 2017, two faculty members affiliated with the center traveled with three cadets enrolled in the Cadet Summer Research Program to the Digital Humanities Summer Institute in Victoria, British Columbia, attending seminars and courses with faculty and students from around the globe as they collaborate in the world's premier program for the digital advancement of the humanities. USAFA's Digital Humanities Center participated in the first digital humanities symposium for Front Range colleges and Universities.

Other ongoing and completed ventures can be viewed on the Center's website at <http://afaDigitalHumanities.com>.

William E. Newmiller
Deputy Director, USAFA Digital Humanities Center
William.Newmiller@usafa.edu

7. Military and Strategic Studies (Center for Airpower Studies)

The Center for Airpower Studies (CAPS) provides virtual and constructive environments for cadet and faculty research and education in air, space, and cyberspace power strategy and operations in support of multi-domain warfighting. The CAPS consists of two laboratories, the Cadet Battle Lab (CBL) which provides an environment similar to an Air Operations Center (AOC) for cadets to

explore joint warfighting concepts at the operational level of war. The Air Warfare Lab (AWL) houses a variety of educational instruments to include flight simulators and virtual reality learning devices to facilitate cadet education and research at the tactical level of war. The AWL provides these environments for the Department of Military and Strategic Studies, Department of Behavioral Sciences and Leadership, the Department of Aeronautics, and cadet clubs for a variety of education and training experiences. The CAPS' current research program, the Future of Airpower Strategy and Technology (FAST) provides a structured enterprise to conceptualize, test, and evaluate strategic concepts for contemporary and future warfighting at all levels of war, to include concepts of operations for emerging technologies. As a portion of the FAST effort, CAPS researchers are developing quantitative databases to enhance the Air Force Academy's capacity to conduct quantitative research in addition to on-going qualitative research in air, space, and cyberspace strategy.

Joel Higley, Lt Col
Director, Center for Airpower Studies
USAFA Department of Military and Strategic Studies
(719) 333-9421
Joel.Higley@us.af.mil

II. Award Information

The Government anticipates the award of grants, cooperative agreements and/or contracts under this BAA. Offerors should familiarize themselves with these instrument types and the applicable regulations before submitting a whitepaper/proposal. Please reference 2 Code of Federal Regulations (CFR) 200.22 Contract, 2 CFR 200.24 Cooperative agreement and 2 CFR 200.51 Grant agreement for descriptions of each.

It is anticipated that the cumulative amount for awards issued under this BAA will not exceed \$99 million dollars. This information is only an estimate and does not obligate the Government in any way. Estimated funding amounts may increase or decrease at any time based on current and future appropriations.

The amount of resources made available to this BAA will depend on the quality of the proposals received and the funds availability.

Awards may be proposed for up to five years. Awards may start any time during the fiscal year.

Awards written against this BAA will be governed by the guidance in 2 CFR part 200, "Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards," as modified and supplemented by the DoD's interim implementation found at 2 CFR 1103, "Interim Grants and Cooperative Agreements Implementation of Guidance in 2 CFR part 200", which also defers to the DoDGARs.

Historically, USAFA has supported a BAA process under the predecessor USAFA BAA 2009-01, awarding 127 grants, cooperative agreements and contracts to 79 different academic institutions, nonprofit organizations and industrial firms, totaling \$89 million (as of Nov 2014). The table below depicts the historical data in support of the previous research centers. This is provided for historical reference only and is not indicative of any future business plans for the USAFA.

USAFA-BAA-2001-9-1 AWARD STATISTICS AS OF Nov 14			
Section	Research Center, Institute, Department	Number of Awards	Average Award Value
I.a.1.	Aeronautics - Aeronautics Research	20	\$ 361,730.39
I.a.2.	Aeronautics - Modeling & Simulation Research	4	\$ 377,407.00
I.a.3.	Astronautics - Space Systems Research	7	\$ 475,081.05
I.a.4.	Bioenergy & Biomimetics	3	\$ 43,491.67
I.a.5.	Chemistry	4	\$ 236,092.28
I.a.6.	Computer Science	4	\$ 296,875.23
I.a.7.	Engineering Mechanics	32	\$ 1,478,740.29
I.a.8.	Laser & Optical Physics	26	\$ 424,971.78
I.a.9.	Physics	12	\$ 241,651.59
I.a.10.	Center for Physics Education Research	1	\$ 225,750.00
I.a.11.	Academy Center for Unmanned Aircraft Systems	4	\$ 554,764.74
I.a.12.	Center of Innovation	8	\$ 585,070.20
I.a.13.	Civil and Environmental Engineering Research	0	\$ -
I.a.14.	Electrical & Computer Engineering Research	2	\$ 182,664.07
I.a.15.	Science, Technology, Engineering & Math Outreach	3	\$ 1,269,846.66
I.a.16.	Center for Space Situational Awareness Research	6	\$ 495,176.03
I.a.17.	Human Performance Lab	0	\$ -
I.b.1.	Institute for Information Technology Applications	1	\$ 40,000.00
I.b.2.	Institute for National Security Studies	0	\$ -
I.c.1.	Behavioral Sciences & Leadership	1	\$ 140,000.00
I.c.2.	Foreign Languages and International Programs	0	\$ -
I.c.3.	Operations Research and Analytics	0	\$ -

In addition, the below table has been provided of the current USAFA BAA, USAFA-BAA-2015, to provide a reference for the grants, cooperative agreements and contracts awarded thus far. Again, this is provided for historical reference only and is not indicative of any future business plans for the USAFA.

USAFA-BAA-2015 AWARD STATISTICS AS OF MAY 18			
Section	Research Center, Institute, Department	Number of Awards	Average Award Value
I.a.1.	Aeronautics - Aeronautics Research	10	\$ 5,166,918.23
I.a.2.	Aeronautics - High Performance Computing Research	2	\$ 713,401.89
I.a.3.	Astronautics - Space Systems Research	0	\$ -
I.a.4.	Biosystems, Microbial - Life Sciences Research	2	\$ 741,934.35
I.a.5.	Chemistry	1	\$ 473,007.50
I.a.6.	Computer Science - Academy Center for Cyberspace	3	\$ 815,857.00
I.a.7.	Engineering Mechanics - Center for Aircraft Structural Life Ext.	8	\$ 5,240,959.00
I.a.8.	Laser and Optical Physics	6	\$ 3,619,261.00
I.a.9.	Physics - Space Physics & Atmospheric Research	3	\$ 1,898,798.52
I.a.10.	Center for Physics Education Research	0	\$ -
I.a.11.	Academy Center for Unmanned Aircraft Systems Research	1	\$ 194,800.00
I.a.12.	Center of Innovation	0	\$ -
I.a.13.	Civil and Environmental Engineering	2	\$ 59,189.00
I.a.14.	Electrical and Computer Engineering	3	\$ 660,413.00
I.a.15.	Science, Technology, Engineering and Math Outreach and Research	0	\$ -
I.a.16.	Center for Space Situational Awareness Research	0	\$ -
I.a.17.	Human Performance Lab	0	\$ -
I.b.1.	Institute for Information Technology Applications	0	\$ -
I.b.2.	Institute for National Security Studies	1	\$ 33,500.00
I.c.1.	Behavioral Sciences and Leadership	0	\$ -
I.c.2.	Department of Foreign Languages and Office of Intl' Programs	0	\$ -
I.c.3.	Interdepartmental Program of Operations Research and Analytics	0	\$ -

III. Eligibility Information

All responsible, potential applicants from academia and industry are eligible to submit white papers/proposals. USAFA particularly encourages white paper/proposals from small businesses, historically black colleges and universities, minority institutions and minority researchers. However, no portion of this BAA is set aside for a specific group.

There is no set limit to the number of white papers/proposals an institution or organization can submit to this BAA. The amount and period of performance of each selected white paper/proposal may vary depending on the research area and the technical approach to be pursued by the selected Offeror.

Proposals from Federal Agencies, including subcontracting/sub-Non-Federal Entity (NFE) efforts will not be evaluated under this BAA. Federal agencies should contact the Department of Research associated with the given technical area listed in Section I of the BAA to discuss funding through internal Government procedures.

Cost sharing is allowable but not required. IAW 31 U.S.C. 1342, the Government may not accept volunteer services, or employ personal services not authorized by law, except in cases of emergency involving the safety of human life or the protection of property. If potential NFEs propose time or effort to support a particular project under this BAA, all contributions and costs incurred must be quantified as either costs to be charged to the Government, or costs incurred by the NFE (NFE cost share).

IV. Application and Submission Information

- a. **Internet Address to Request Announcement Package** – This announcement may be accessed at Grants.gov and/or FBO.gov.
- b. **Marking of White Papers and Proposals** – As previously stated, **USAFA is seeking white papers which do not contain proprietary information.** If proprietary information is submitted, USAFA will make every effort to protect the confidentiality of the proposal and any evaluations. However, under the Freedom of Information Act (FOIA) requirements, such information (or portions thereof) may potentially be subject to release. If protection is desired for proprietary or confidential information, the proposer must mark the white paper and/or proposal with a protective legend found in FAR 52.215-1(e), Instructions to Offerors – Competitive Acquisition, (modified to permit release to outside non-government evaluators and support contractors retained by USAFA. See section V). **It is the offeror's responsibility to notify USAFA of proposals containing proprietary information and to identify the relevant portions of their proposals that require protection. The entire proposal (or portions thereof) without protective markings or otherwise identified as requiring protection will be considered to be furnished voluntarily to USAFA without restriction and will be treated as such for all purposes.** Because the Government anticipates the award of grants, cooperative agreements, and/or contracts, this statement is applicable to proposals for all three of these potential instruments.

c. **Content and Form of White Paper Submissions**

1. **Submission Requirements:** The initial request is for white papers, which minimizes the labor and cost associated with the production of detailed full proposals.

White papers must be submitted to 10MSG.LGCC@us.af.mil; they should not be submitted directly to the USAFA Technical POC. Do not submit white papers through Grants.gov.

2. **White paper Format:**

- Paper Size – 8.5 x 11 inch paper
- Margins – 1 inch
- Spacing – single or double spaced
- Font – Times New Roman, 10 or 12 point
- Page Limitation – None; although 3-5 pages is normal. Unnecessarily elaborate white Papers are not desirable
- Content – as described above
- Center – identify which of the USAFA Research Centers the submission is to be sent to for evaluation
- Contact Information – include an email address, phone number and physical address of submitting company.

Offerors shall not send .ZIP files or password protected files.

3. White paper Content:

- **Cover Page:** The Cover Page shall be titled “WHITE PAPER” and include the following:
 - BAA number “USAFA-BAA-2015”
 - Title of White paper that is descriptive of the research to be conducted
 - Estimated cost of proposed effort
 - Offeror’s administrative and technical points of contact, with telephone numbers and email addresses.
- **Technical Concept:** White papers must briefly describe the proposed research:
 - objective,
 - length of effort,
 - general/technical approach,
 - rough-order of magnitude cost,
 - anticipated outcome,
 - impact of specific research,
 - government/cadet involvement,
 - public purpose.

The white paper may also contain any unique capabilities or experience you have (e.g., collaborative research activities involving AF, DoD, or other Federal laboratory).

4. Evaluation Criteria: Each white paper will be evaluated by the USAFA Technical POC, to determine whether the proposed research appears to advance knowledge in the field, enhance understanding, and provide a direct benefit to the public, which is defined here as those outside the DoD who are in the public and/or private sectors. This evaluation will also determine whether the proposed research appears to be of particular value to the USAFA research department.

Subject to funding availability, all white papers will be evaluated under the following four primary criteria, as well as any specific conditions identified in calls posted against the BAA, of equal importance as they are all integral to achieving USAFA objectives, as follows:

- Technical merits of the proposed research,
- Potential relationship of the proposed research to the Department of Defense and/or USAFA,
- Potential for cadet/government involvement in the proposed research (cadet/government involvement is preferred however each NFE should identify and recommend a level of involvement that best fits their technical approach),
- The proposer’s/ principal investigator’s/ team leader’s/ key personnel’s qualifications, capabilities, related experience, facilities, or techniques or a combination of these factors are integral to achieving USAF objectives.

Upon completion of the review, white papers will be placed in one of three categories. Only white papers that meet agency needs will be funded. A breakdown of the criteria for each category follows:

Category I

- White paper is well conceived
- Scientifically and technically sound
- Pertinent to program goals and objective
- Offered by a responsible offeror
- Competent staff
- Supporting resources.

Category II

- Scientifically or technically sound but requires further development.

Category III

- Not scientifically or technically sound or does not meet agency needs.

Unless otherwise stated in a call, all white papers will be evaluated as stated above. Initial Government evaluations and feedback will be issued via formal letter from the USAFA Grants Officer, whether it be a letter denying the white paper for technical or budget reasons, or a RFP for a full Grants.gov proposal submission. Those offerors submitting white papers assessed as best meeting the needs of the evaluator will be asked to submit a technical and cost proposal, contingent upon funds availability.

For white papers that propose efforts that are considered of particular value but either exceed available budgets or contain certain tasks or applications that are not desired, USAFA may suggest a full proposal with reduced effort to fit within expected available budgets or an effort that refocuses the tasks or application of the effort to maximize the expected public benefit.

d. Content and Form of Invited Full Proposals

- 1. Submission Requirements:** Detailed full proposals will be subsequently requested from those Offerors whose proposed research projects have met the evaluation criteria listed above. Email notifications and discussions about white papers are not assurances of a subsequent award.

Full proposals must be submitted electronically through Grants.gov using the application template package associated with this BAA. There are several one-time actions your organization must have completed before it will be able to submit applications through Grants.gov. Well before the submission deadline, you should verify the person authorized to submit proposals for your organization has completed those actions. If not, it may take them up to 21 days to complete the actions before they will be able to submit applications.

Your organization must obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, registering with the System for Award Management (SAM) www.SAM.gov (previously Central Contractor Registry, or CCR), registering with the credential provider and registering with Grants.gov.

SAM Registration – Prospective awardee shall be registered in the SAM database prior to award, during performance, and through final payment of any award resulting from this

announcement. Offerors may obtain information on registration and annual confirmation requirements at www.sam.gov or AskSAM@gsa.gov.

- Applicants must:
 - Be registered in the System for Award Management (SAM) prior to submitting an application or proposal,
 - Maintain an active SAM registration with current information at all times during which it has an active Federal award or an application or proposal under consideration by an agency, and
 - Provide its DUNS number in each application or proposal it submits to the agency.

Grants.gov Registration - The Grants.gov Organization Registration Checklist at <http://www.Grants.gov/web/grants/applicants/grant-application-process.html> will guide offerors through the necessary process to register. Questions relating to the registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or email: support@grants.gov.

2. **Submitting the Application:** Application forms and instructions are available at Grants.gov. To access these materials, go to www.Grants.gov, select “Apply for Grants.” In the “Download a Grant Application Package” section, enter the funding opportunity number for this announcement (USAFA-BAA-2015). You can also search for the Catalog of Federal Domestic Assistance (CFDA) Number 12.800, for Research Interests of the U.S. Air Force Academy. On the Selected Grant Applications for Download page, click on 'download' under the heading “Instructions and Applications” to download the application package.

All required forms to be submitted as part of the proposal will be listed as a “mandatory form” in the ‘Instructions and Applications’ section on Grants.gov. Individual calls may have additional requirements; these requirements will be specified in the applicable call.

Proprietary information may be included on submitted forms, supporting documentation, and the Cost Proposal. All such information should be denoted with asterisks (***) at the beginning and end of the proprietary information; alternatively, a page with considerable proprietary information can display the statement “Proprietary Information” in its header or footer.

i. All Offerors must submit the application using the SF 424 Research & Related (R&R) series forms, which are further outlined in the following sections.

- **SF 424 R&R:** The SF 424 (R&R) form can be downloaded from the USAFA BAA application package. In Grants.gov, some fields will self-populate based on the BAA selected. Please fill out the SF 424 first, as some fields on the SF 424 are used to auto populate fields in other forms. The completion of most fields is self-explanatory except for the following special instructions:
 - Field 1:** The Applicant Identifier may be left blank.
 - Field 3:** The Date Received by State and the State Application Identified are not applicable to research.
 - Field 7:** Complete as indicated. If Small Business is selected, please note if the organization is Woman-owned and/or Socially and Economically Disadvantaged. If

the organization is a Minority Institution, select "Other" and under "Other Specify" note you are a Minority Institution (MI).

Field 9: List USAFA as the reviewing agency. This field is pre-populated in Grants.gov.

Field 16: Choose 'No' and check 'Program is Not Covered By Executive Order 12372'.

Attachments: All attachments to all Grants.gov forms must be submitted in PDF format (Adobe Portable Document Format). Grants.gov provides links to PDF file converters.

- ii. **Assurances (Non-Construction Programs):** All awards require some form of certification of compliance with national policy requirements. For that reason, an SF 424B needs to be completed and submitted with the application package via www.Grants.gov. For assistance awards, i.e., grants and cooperative agreements, proposers using the SF 424B (R&R) are providing the certification by completing block 17 of the form for all applicable national policy requirements as detailed on the form.
- iii. **R&R Other Forms:** The following other forms must be used for all electronic proposals: R&R Senior/Key Person Profile form, R&R Project/Performance Site Locations form, R&R Other Project Information form, the R&R Budget form and any other forms listed in the "Mandatory Forms" portion of Grants.gov. The R&R Subaward Budget Attachment Form is required when sub-awardees are involved in the effort. Primes should ensure that sub-NFEs' cost information reflects the same level of detail as the primes' cost information. The format should follow the Prime's submission as well. See section 4. Cost Proposal on submissions of the Prime's budget information.
- iv. **R&R Senior/Key Person Profile Form (Expanded):** Complete the R&R Senior/Key Person Profile Form for those key persons who will be performing the research. The principal purpose and routine use of the requested information are for evaluation of the qualifications of those persons who will perform the proposed research. For the principal investigator and each of the key personnel provide a resume and a list of significant publications; ensure it is attached to the R&R Senior/Key Person Profile Form.
- v. **R&R Personal Data Form:** Complete the R&R Personal Data Form for all PIs and Co-PIs. Note: while the information on the form is voluntary, the form itself is mandatory. See form header for further information.
- vi. **R&R Project/Performance Site Locations Form:** Complete all information as requested.
- vii. **R&R Other Project Information Form: Human Subject/Animal Use, Environmental Compliance and Certifications Regarding Lobbying Activities:**

Human Subject Use. Each proposal must address human subject involvement in the research by addressing Field 1 and 1a of the R&R Other Project Information Form. If Field 1 indicates "Yes," the U.S. Air Force must receive a completed OMB No. 0990-0263 form before a contract, grant, or cooperative agreement may be awarded to support research involving the use of human subjects. Attach the document to the R&R

Other Project Information Form. If using Grants.gov, a completed OMB No. 0990-0263 form shall be attached in field 12 of the R&R Other Project Information Form.

Refer any questions regarding human subjects to Laura Neal of the Analysis and Assessment Office, Institutional Review Board (IRB) at: (719) 333-6593 or via email at: Laura.Neal@usafa.edu or usafa.irb@usafa.edu. The IRB's website can be found at <http://www.usafa.af.mil/Leadership/Institutional-Review-Board/>

Animal Use. Each proposal must address animal use protocols by addressing Field 2 and 2a of the R&R Other Project Information Form. If selected for award, additional documentation IAW Air Force standards will be required. Refer any questions regarding animal subjects to Lt Col Donald W. Rhymer, Chair of the USAFA Institutional Animal Care and Use Committee (IACUC) at: (719) 333-4185 or via e-mail at: donald.rhymer@usafa.edu.

Environmental Compliance. Federal agencies making contract, grant or cooperative agreement awards and NFEs of such awards must comply with various environmental requirements. The National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. Sections 4321-4370 (a), requires agencies to consider the environmental impact of "major Federal actions" prior to any final agency decision. With respect to those awards which constitute "major Federal actions," as defined in 40 CFR 1508.18, federal agencies may be required to comply with NEPA and prepare an environmental impact statement (EIS) even if the agency does no more than provide grant funds to the NFE. Questions regarding NEPA compliance should be referred to the USAFA INSS Director. USAFA will qualify for a categorical exclusion from the need to prepare an EIS. U.S. Air Force instructions/regulations provide for a categorical exclusion for basic and applied scientific research usually confined to the laboratory, if the research complies with all other applicable safety, environmental and natural resource conservation laws. Each proposal shall address environmental impact by filling in fields 4a through 4d of the R&R Other Project Information Form. This information will be used by USAFA to make a determination if the proposed research effort qualifies for categorical exclusion.

Certifications Regarding Lobbying Activities. Grants and Cooperative Agreement awards greater than \$100,000 require a certification of compliance with a national policy mandate concerning lobbying. Applicants shall provide this certification by electronic submission of SF 424 (R&R) as a part of the electronic proposal submitted via Grants.gov (complete Block 17). The following certification applies to each applicant seeking federal assistance funds exceeding \$100,000:

- (1) No Federal appropriated funds have been paid or will be paid by or on behalf of the applicant, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any

agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the applicant shall complete and submit SF-LLL, "Disclosure Form to Report Lobbying," IAW its instructions.

(3) The applicant shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, and cooperative agreements) and that all sub-NFEs shall certify and disclose accordingly. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U.S.C. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

viii. Policy Requirements: Any award issued as a result of this announcement is subject to the following administrative, cost and national policy requirements contained therein.

- DoD Grant and Agreement Regulations (DoDGARs 3210.6-R)
- Office of Management and Budget (OMB) Super-circular 2 CFR 200 "Uniform Administrative Requirements, Cost Principles, and Audit Requirement for Federal Awards".
- 2 CFR 1103, "Interim Grants and Cooperative Agreements Implementation of Guidance in 2 CFR part 200".

3. Technical Proposal (Research and Related (R&R) Other Project Information Form: Project Narrative)

i. Format:

- Paper Size – 8.5 x 11 inch paper
- Margins – 1 inch
- Spacing – single or double spaced
- Font – Times New Roman, 10 or 12 point
- Page Limitation – None, although unnecessarily elaborate proposals are not desirable
- Attachments – submit in PDF format (Adobe Portable Document Format)
- Content – as described below.

ii. Content:

▪ Cover Page Should Include:

- BAA number "USAFA-BAA-2015"
- Title of proposal that is descriptive of the research to be conducted
- Identity of prime Offeror and complete list of subcontractors, if applicable
- Technical Point of Contact (name, address, phone, email)
- Administrative/Business Point of Contact (name, address, phone, email)
- Length of proposed period of performance.

- **Executive Summary:** Concise abstract of the proposed research effort. The executive summary provides a brief overview of the proposed program topic, objectives, methodology, and expected results. In addition, the executive summary

must state how the principal purpose of the research effort will support or stimulate a public purpose, beyond any benefits to the DoD.

- **Statement of Research Objectives (SRO):** A research description clearly detailing the scope and objectives of the effort and the technical approach. The proposed SRO may be incorporated as an attachment to the resultant award instrument. Thus, full proposals must include a severable self-standing SRO without any proprietary restrictions, which can be attached to the agreement award.

A major portion of the proposal should consist of a clear description of the technical approach being proposed. This discussion should provide the technical foundation/justification for pursuing this particular approach and why one would expect it to enable the research objectives of the proposal. Within the technical approach, include a detailed list of the research tasks/subtasks organized chronologically.

For all types of research, include a concise statement of how the proposed research supports or stimulates a public purpose, rather than providing a specific benefit to DoD. This public-benefits statement is an important part of the evaluation and award process.

- **Project Schedule and Milestones:** A table summarizing the schedule of research and reporting activities and milestones. Because the date of award is not known at time of application, we recommend a “month 1,” “month 2,” format, as opposed to naming specific months and dates.
- **Reports:** The following are sample reports that are typically provided (do not include software, prototypes, hardware as deliverables):
 - Technical and financial progress reports, quarterly
 - Presentation materials
 - Technical and financial reports, quarterly/final.
- **Management Approach:** A discussion of the overall approach to the management of this effort, including brief discussions of the total organization; responsibilities of the various personnel; project/function/subcontractor/sub-NFE relationships; government research interfaces; and planning, scheduling and oversight practices. Identify which personnel and subcontractors/sub-NFEs (if any) will be involved. Include a description of the facilities that are required for the proposed effort with a description of any Government-furnished equipment (GFE), hardware, software or information required, by version and/or configuration.
- **Offeror Qualifications:** A discussion of previous accomplishments and research by the Offeror institution in this or closely related areas; a discussion of the qualifications and/or resumes or curricula vitae of the proposed Principal Investigator and other key personnel.
- **Current and Pending Project and Proposal Submissions:** Principal Investigators and Key Personnel are required to provide information on all current

and pending support for ongoing projects and proposals, including subsequent funding in the case of continuing contracts, grants, and other assistance agreements.

Offerors shall provide information of any related proposal submissions from whatever sources (e.g., USAFA, NPS, Federal, State, local or foreign government agencies, public or private foundations, industrial or other commercial organizations).

4. Cost Proposal

- i. **Format:** The offeror **must** use the Grants.gov budget forms (including the SF 24 R&R Budget Form).

The Cost Proposal must include all figures, calculations, and supporting documentation for determining cost *allowability, allocability and reasonableness*. Justifications for costs must be explicitly stated.

In addition to a narrative, Offerors may elect to include as part of their Cost Proposal a spreadsheet showing calculations, unit price, and number of units in more detail than is possible in the required SF Research and Related (R&R) Budget Form. However, inclusion of a more detailed spreadsheet is **not** a substitute for a detailed narrative that explains calculations, justifies inclusion of budget items, and states the basis for the amounts listed.

Estimate the total research project cost. Categorize funds by year and provide annualized budgets for projects lasting more than one year. **Each budget year cannot exceed 12 months** (for example, a 3 year project would consist of 3 separate 12 month budgets). In addition to the Research and Related (R&R) Budget forms available on Grants.gov, the budget proposal should include a budget justification for each year, clearly explaining the need for each item.

- ii. **Content:** Costs proposed must conform to the following principles and procedures:
- 2 CFR Part 200, “Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards”
 - DoD’s interim implementation found at 2 CFR Part 1103, “Interim Grants and Cooperative Agreements Implementation of Guidance in 2 CFR Part 200”
 - DoDGARs, other than Parts 32 and 33
 - FAR Part 31.

The budget narrative must include the following:

Direct Labor: Provide individual labor categories and unburdened direct labor rates (number of total hours and hourly rate must be provided). For persons yet to be identified, provide general tables or schedules by labor category, which labor category will be used and why that labor category is appropriate.

Fringe Benefits: If the rates have been approved/negotiated by a Government agency, **provide a copy of the memorandum/agreement**. If the rates applied have

not been approved/negotiated, provide sufficient detail to enable a determination of allowability, allocability, and reasonableness of the allocation bases, and how the rates are calculated according to applicable OMB Circulars or FAR/Defense Federal Acquisition Regulations (DFARS) provisions. Applicable rates must be broken out by each budget year and clearly identify bases used.

Travel: The proposed travel cost should include the following for *each trip*:

- The purpose of the trip
- Origin and destination, if known (origin is typically known; if destination is unknown, state basis for estimating travel cost)
- Estimated duration
- Number of travelers
- Estimated cost per trip (based on current federal travel regulations).

Subcontractor/Sub-NFE Costs: Submit all subcontractor/sub-NFE proposals and analysis with your cost proposal (See FAR 15.404-3(b) and 2 CFR 200, Sub-NFE Monitoring and Management). If the subcontractor/sub-NFE will not submit cost and pricing information to the offeror, the subcontractor/sub-NFE must submit this information directly to the Government for analysis.

Consultants: Offerors are expected to utilize the services of their own staff to the maximum extent possible in managing and performing the project's effort. If the need for consultant services is anticipated, the nature of the proposed consultant services must be justified and included in the Technical Proposal.

The Cost Proposal must include the name of the consultant(s), primary organizational affiliation, each individual's expertise, and a breakdown of the consultant's hours, the hourly rate proposed, and any other proposed consultant costs, such as estimated travel costs and per diem rates.

Materials & Supplies: Provide an itemized list of proposed materials and supplies including quantities, unit prices, proposed vendors, and the basis for the estimate (e.g., quotes, prior purchases, catalog price lists). Include supporting documentation for the estimates. Provide a copy of your organization's purchasing policy/processes.

NFE-Acquired Equipment or Facilities: If acquisition of equipment and/or facilities is proposed, a justification for the purchase of the items must be provided. Provide an itemized list of all equipment and/or facilities costs as well as the basis for them and supporting documentation for the estimate (e.g., quotes, prior purchases, catalog price lists). Allowable items would be limited to research equipment not already available for the project. General purpose equipment (i.e., equipment not used exclusively for research, scientific or other technical activities, such as personal computers, office equipment and furnishings, etc.) should not be requested unless they will be used primarily or exclusively for the project. For computer/laptop purchases and other general purpose equipment, if proposed, include a statement indicating how each item of equipment will be integrated into the program or used as an integral part of the research effort.

Other Direct Costs: Provide an itemized list of all other proposed direct costs such as graduate assistant tuition, laboratory fees, report and publication costs, and the basis for the estimate (e.g., tuition schedules, quotes, prior purchases, catalog price lists). In addition to stating the basis for the cost estimates, include supporting documentation where possible.

Indirect Costs (i.e., Facilities and Administrative (F&A), Overhead, General and Administrative (G&A), etc.): Describe the rates and calculation of the costs for each rate category, listing the base on which the rate is applied. If the rates have been approved/negotiated by a Government agency, provide a copy of the memorandum/agreement.

- **For-Profit Entities:** IAW 32 CFR Part 34, for-profit entities are bound by the cost principles located at 48 CFR parts 31 and 231. Additionally, 48 CFR 31.203 (b) states that after direct costs have been determined and charged directly to the contract or other work, indirect costs are those remaining to be allocated to intermediate or two or more final cost objectives. Therefore, if indirect costs are applicable to the federal award being proposed, provide the proposed indirect cost rate and adequate documentation to determine whether the indirect costs are reasonable, allowable, and necessary for the effort.
- **All other non-Federal Entities:** IAW 2 CFR 200.56, indirect (F&A) costs means those costs incurred for a common or joint purpose benefitting more than one cost objective, and not readily assignable to the cost objectives specifically benefitted, without effort disproportionate to the results achieved. 2 CFR 200.414 requires previously negotiated indirect cost rates to be accepted by the Federal entity. If the non-Federal entity has never received a negotiated indirect cost rate they may elect one of the following options:
 - a. Utilize the de minimis rate of 10% of Modified Total Direct Costs (MTDC) indefinitely
 - b. Utilize the de minimis rate of 10% of Modified Total Direct Costs (MTDC) until the non-Federal entity chooses to negotiate a rate, which they may do so at any time
 - c. Elect not to use an indirect cost rate for the duration of the award. This option tends to be utilized by small non-profit entities that have very few federal awards and can directly charge all costs associated with their business to each federal award, consistently and appropriately.

Fee/Profit: Fee/profit is **unallowable** under grants or cooperative agreements at both the prime and sub levels.

NOTE: Failure to adequately provide detailed cost data will require the USAFA Grants Officer to contact the proposing organization for the requisite information. This will result in a delay of the award. All Offerors are required to submit a thoroughly detailed cost breakdown. The USAFA Grant Officer must be able to determine that all proposed costs are allocable, allowable and reasonable. A detailed budget and budget narrative will facilitate this cost analysis.

- e. **Grants.gov Application Receipt Notices** – The applicant’s approved account holder for Grants.gov will receive a confirmation page upon completing the submission to Grants.gov. This confirmation page is a record of the time and date stamp that is used to determine whether the proposal was submitted by the deadline. If there is an error, the system sends a rejection email notification to the institution and the institution must resubmit the application package. Applicants can track and are responsible for the status of their application by logging in to Grants.gov.

V. **Application Review Information**

Proposals submitted under this BAA are evaluated through a peer or scientific review process. If selected for contract award, evaluation will be on a competitive basis according to FAR 35.016(e), Public Law 98-369, Competition in Contracting Act of 1984, 10 USC 2361, and 10 USC 2374. If selected for grant/assistance instrument award, evaluation will use merit-based competitive procedures according to DoDGARS citation of 32 CFR Sec 22.315. Additionally, in accordance with 2 CFR 200.205, an evaluation of risk posed by applicants is required before they receive Federal awards. This evaluation may incorporate results of the evaluation of the applicant’s eligibility or the quality of its application. If the Federal awarding agency determines that a Federal award will be made, special conditions that correspond to the degree of risk assessed may be applied to the Federal award. In evaluating risks posed by applicants, the Federal awarding agency may use a risk-based approach and may consider any items such as the following:

- a. Financial stability;
- b. Quality of management systems and ability to meet the management standards prescribed in this part;
- c. History of performance. The applicant’s record in managing Federal awards, if it is a prior NFE of Federal awards, including timeliness of compliance with applicable reporting requirements, conformance to the terms and conditions of previous Federal awards, and if applicable, the extent to which any previously awarded amounts will be expended prior to future awards;
- d. Reports and findings from audits performed under Subpart F—Audit Requirements of this part or the reports and findings of any other available audits; and
- e. The applicant’s ability to effectively implement statutory, regulatory, or other requirements imposed on non-Federal entities.

Proposals may be evaluated by the appropriate USAFA Research Directors and USAFA Staff, other military services, DoD agencies, civilian agencies and non-Government sources. Non-Government sources can include academia, nonprofit institutions, and support contractor personnel. Non-Government evaluators are authorized access only to those portions of the proposal data and discussions that are necessary to enable them to perform their respective duties. Non-Government evaluators are also required to sign non-disclosure agreements which prohibit them from disclosing proprietary information submitted by contractors. Employees of commercial firms under contract to the Government may be used to administratively process proposals and may gain access to proprietary information contained in proposals and/or post award documentation. These support contracts include non-disclosure agreements prohibiting their contractor employees from disclosing any information submitted by other contractors. Subject to funding availability, all other proposals will be evaluated under the following six primary criteria, of equal importance, as follows:

- a. Technical merits of the proposed research;

- b. Potential relationship of the proposed research to the DoD and/or USAFA;
- c. Potential for cadet/government involvement in the proposed research (cadet/government involvement is preferred however each NFE should identify and recommend a level of involvement that best fits their technical approach);
- d. The proposer's, principal investigator's, team leader's, or key personnel's qualifications, capabilities, related experience, facilities, or techniques or a combination of these factors are integral to achieving USAF objectives;
- e. The likelihood of the proposed effort to develop new research capabilities and broaden the research base in support of U.S. national defense;
- f. The proposer's and associated personnel's record of past performance.

Following the evaluation, proposals will be placed in one of three categories. Category I proposals will be funded as possible, Category II proposals would only be funded following those in Category I and proposals considered to be Category III will not receive funding.

Category I

- Proposal is well conceived
- Scientifically & technically sound
- Pertinent to program goals and objective
- Offered by a responsible offeror
- Competent staff
- Supporting resources.

Category II

- Scientifically or technically sound but requires further development.

Category III

- Not scientifically or technically sound or does not meet agency needs.

Offerors must indicate in their proposal, unless a match is required, if they are “not willing or able to cost share” or “able to cost share and/or offer these facilities/equipment/etc”.

Further, be advised as funds are limited, otherwise meritorious proposals may not be funded. Therefore, it is important that proposals show strength in as many of the evaluation areas as practicable for maximum competitiveness.

The technical and cost information will be analyzed simultaneously during the evaluation process. The AF reserves the right to select for award any, all, part or none of the proposal received.

VI. Award Administration Information

- a. **Award Notices** – Should your proposal be selected for award, the Contracting or Grants Officer will receive correspondence from the Department/Center /Institute/Director stating this information. At that point, your business office will be contacted by the Grants or Contracting Officer to negotiate the terms of your award.
- b. **Reporting Requirements** – Grants and cooperative agreements typically require quarterly and/or annual and final technical reports, financial reports, final patent reports and closeout activities/documents. Contracts typically require annual and final technical and patent reports.

Additional deliverables may be required based on the research being conducted. Additional reporting requirements associated with certain awards will be based on the nature and source of funding. Failure to comply with terms and conditions of any federal awards, to include delinquent reports and close out information may deem an offeror ineligible for current and future awards.

- c. USAFA expects the performance of research funded by this announcement to be predominantly fundamental IAW DoD Instructions 5230.24 and 5230.27.

FAR Part 35 restricts the use of BAAs, such as this, to the acquisition of basic and applied research and that portion of advanced technology development not related to the development of a specific system or hardware procurement. Contracts and grants and other assistance agreements made under BAAs are for scientific study and experimentation directed towards advancing the state of the art and increasing knowledge or understanding.

*Note: See the DoDGARS definitions for basic, applied, and advanced research.

d. Ombudsman –

1. An ombudsman has been appointed to hear and facilitate the resolution of concerns from offerors, potential offerors and others for this acquisition. When requested, the ombudsman will maintain strict confidentiality as to the source of the concern. The existence of the ombudsman does not affect the authority of the Program Officer or Contracting Officer. The ombudsman may refer the party to another official who can resolve the concern.
2. Before consulting with an ombudsman, interested parties must first address their concerns, issues, disagreements, and/or recommendations to the Grants or Contracting Officer for resolution. Consulting an ombudsman does not alter or postpone the timelines for any other processes.
3. If resolution cannot be made by the Grants/Contracting Officer, concerned parties may contact the USAFA Ombudsman: Mr. James Anderson, Director of Contracting, 10th Contracting Squadron, USAFA. Telephone: (719) 333-2074. Email: James.Anderson.72@us.af.mil. Concerns, issues, disagreements and recommendations that cannot be resolved at the USAFA level may be brought by the concerned party for further consideration to the U.S. Air Force Pentagon, Washington DC 20330-1060, phone number (703) 588-7004.
4. The ombudsman has no authority to render a decision that binds the agency.
5. Do not contact the ombudsman to request copies of the solicitation, verify offer due date, or clarify technical requirements. Such inquiries shall be directed to the Grants/Contracting Officer.

- e. **Reporting Subawards and Executive Compensation** – Any grant or agreement award resulting from this announcement may contain the award term set forth in 2 CFR Part 25 and 2 CFR Part 170.

- f. **Additional Subcontract /Subaward Reporting Requirements** – The Federal Funding and Transparency Act and 27 Aug 2010 OMB memo, “Federal Spending Transparency and Subaward and Compensation Data Reporting” require that as of 1 Oct 10 awardees of contracts and NFEs of grants have been required to report Executive Compensation and First-Tier Subcontract/Sub-NFE Awards for any contract valued at \$30,000 or grant valued at \$25,000 or more excluding classified contracts or contracts/grants with individuals.

g. Payment Process – The USAFA does not set up automatic payments for NFEs. Therefore, all NFEs must access Wide Area Workflow (WAWF) and complete WAWF's Standard Form (SF) 270, Request for Advance or Reimbursement, for payment. Each NFE must register with WAWF at <https://wawf.eb.mil>.

h. Post-Award Surveillance- Post-award delegated offices will perform routine surveillance in partnership with USAFA GO to ensure proper performance measures are being met under the award. This includes technical reports, invoice audits, reviews of financial management systems and reporting accuracy. More detailed information will be provided in the negotiation stage of award, when risk determinations are made.

*** End of BAA Announcement ***