Research Funding Opportunities

Closing Date for Applications: May 9, 2023
Summary: The Aerospace Vehicles Division (RQV), Aerospace Systems Directorate (RQ), Air Force Research Laboratory (AFRL) conducts vehicle aerodynamic research in the following areas:

1) Fundamental and Applied Fluid Dynamics
   Fundamental and applied fluid dynamics is central to Air Force vehicle flight performance and mission success. Research in this area is intended to further understanding of internal and external aerodynamic flow physics and to apply this knowledge to better predict vehicle performance and integrate into future vehicles. Of particular interest are multidisciplinary investigations such as fluid-structure interactions (jet impingement, propeller slipstream interactions, vortex impingement, etc.), unsteady fluid dynamics (both at micro- and macro-levels), and technology development harnessing these interactions for increasing mission performance/effectiveness. Relevant approaches encompass analytical, computational, and experimental efforts to investigate current geometries and to incorporate into future designs.

2) Aircraft Design and System Enhancements
   Both enhancing current systems and designing new systems requires the creative process of generating new ideas for artifacts that do not exist. Additionally, trade studies comparing the application of new technologies or technology maturation are invaluable to decision makers. Much interest exists to further develop engineering design capability (both processes and tools) to better leverage limited resources and better support well informed decision-making. Relevant research and investigations include the various trade-offs in modeling fidelities, capturing effectiveness-based design concerns, and modeling uncertainties/sensitivities.

3) Flow Control Applications
   Smartly designing and applying flow control to air vehicle modifications and to future vehicle concepts is worthy of investigation to enhance capabilities and mission effectiveness. Both active and passive flow control applications are of interest including control of aerial refueling booms, flow separation/reattachment, high lift augmentation, stability and control throughout all flight regimes, and coupled effects realized through considering these possibilities early in vehicle design. The development of models over a range of predictive capability and computational complexity, including reduced order modeling, is beneficial depending on intended model use. Of particular interest is modeling the integration effects (i.e., size, weight, power, efficiencies, etc.) and operational impacts of flow control applications that could support new vehicle design.

4) Weapons Integration and Cavity Flow
   Cavity flow investigations and fluid dynamic modeling around multiple bodies is important to better understand the interaction of flow fields around the air vehicle and the flow dynamics in and around weapons bays. These phenomena are also relevant to external stores, turrets, external
antennae, propulsion system inlet flows, bleed air inlet dynamics, etc. Complex, unsteady, flow physics models are often necessary to capture driving effects, but trade-offs are needed to ensure efficient utilization of available engineering, computational, and experimental resources. Multidisciplinary considerations including store separation, store trajectory control, and vehicle-store interactions are especially relevant.

5) Propulsion Integration
Better understanding of the complex interactions between air vehicle aerodynamics and propulsion system fluid dynamics may lead to improved, more effective designs. Engines are embedded into a vehicle airframe for a variety of reasons surrounding mission effectiveness, so capturing the physics and operational impact is important. Improved modeling of distortions seen by embedded fans enables the use of more efficient, higher bypass engines, especially in transonic vehicles. At supersonic flight conditions, shock wave/boundary layer interactions and other viscous fluid phenomena become increasingly important. Recent integrated propulsion applications include Over-the-Wing Nacelles (OWN), Distributed Propulsion (DP), and Boundary Layer Ingestion (BLI).

6) Aero-Optics Interactions
Minimizing energy beam degradation through the air vehicle boundary layer and other distortions is essential to mission effectiveness and system efficiency. Interference is caused by numerous effects, including turbulence, flow separation, shock waves, and other fluid density fluctuations around external protuberances such as turrets. Understanding the resulting unsteady distortions allows modeling of relevant effects to ensure energy beam applications operate as intended. Additionally, technology applications or enhancements that mitigate these losses are relevant to future efforts.

7) Technology Applications and Operational Analysis
Modeling and simulation to investigate how upcoming technology applications overcome mission challenges and enhance overall effectiveness are relevant for both analyzing current systems and designing new systems. Operational analysis can also be used to drive research efforts for new technologies and alternative employment of not only material additions, but also new processes and applications. Often, new technology development enables new ways to accomplish known missions, provides additional insights with relevant evaluation metrics, and helps focus R&D resources to have the greatest impact.


Organization: NASA Solicitation Name: Early Stage Innovations
80HQTR19NOA01-19ESI-B2 Due Date: June 26, 2019 Summary: Space Technology Mission Directorate (STMD) and the Space Technology Research Grants (STRG) Program in particular, seek proposals from accredited U.S. universities to develop unique, disruptive, or transformational space technologies that have the potential to lead to dramatic improvements at the system level — performance, weight, cost, reliability, operational simplicity, or other figures of merit associated with space flight hardware or missions. Although progress under an award may be incremental, the projected impact at the system level must be substantial and clearly defined.

Our Nation’s universities couple fundamental research with education, encouraging a culture of innovation based on the discovery of knowledge. Universities are, therefore, ideally positioned to both conduct fundamental space technology research and diffuse newly-found knowledge into society at large through graduate students and industrial, government, and other partnerships. STMD investments in space technology research at U.S. universities promote the continued leadership of our universities as an international symbol of the country’s scientific innovation, engineering creativity, and technological
skill. These investments also create, fortify, and nurture the talent base of highly skilled engineers, scientists, and technologists to improve America’s technological and economic competitiveness.

Only accredited U.S. universities are eligible to submit proposals. Teaming is permitted - see solicitation for complete eligibility requirements as well as teaming restrictions. A PI (see solicitation for restrictions) or Co-I may participate in no more than two proposals in response to this appendix.

Historically Black Colleges and Universities and other Minority Serving Institutions are encouraged to submit proposals. In addition, NASA encourages submission of ESI proposals on behalf of women, members of underrepresented minority groups, persons with disabilities, and faculty members who are early in their career.

The Appendix exclusively seeks proposals that are responsive to one of the six topics:

- Rotating Detonation Rocket Engine Concept Development
- Chemical Heat Integrated Power Systems
- Rocket Plume-Surface Interaction Prediction Advancements
- Next Generation Durability and Damage Tolerance Methodologies
- Integration of Cryogenic Fluid Two Phase Numerical Modeling Techniques

Link: https://www.grants.gov/web/grants/view-opportunity.html?oppId=315718

Organization: ONR, Solicitation Name: Undersea Warfare Long Range Development Broad Agency Announcement N00253190001 Due Date: June 10, 2019

Summary: NUWC Keyport is soliciting research of interest in support of long range undersea warfare needs. The topics of interest are listed below:

01: Expand Unmanned Underwater Vehicles (UUV) capabilities through artificial intelligence (AI) to improve autonomous perception and situational awareness, including generation of world models, self-localization, and obtaining/processing information for autonomous planning, decision making, and task execution.

02: Novel methods for predictive analysis of UUVs through modeling and simulation, considering sub-system, system, and multi-platform performance. Methods should allow exploration of high-dimensional state-spaces and lend themselves to use for system design, validation and verification and/or mission planning.

03: Expand capabilities of Undersea Warfare (USW) tactical decision making through the use of machine learning and AI, enhancing environmental perception and deciphering of tactical information.

04: Investigate methods to enhance identification of anomalies in large datasets associated with performance test analysis to include data analytics, machine learning, and statistical modeling to improve accuracy.

05: Investigate innovative methods for autonomous predictive maintenance and intelligent failure detection of electro-mechanical systems. Methods should explore the use of data analytics and machine learning.

06: Investigate methods for mitigating hardware obsolescence in test equipment for electro-mechanical systems to minimize the Non-Recurring Engineering costs associated with the mitigation strategy. Methods may include hardware architectures and communication protocols.
07: Investigate and propose data analysis methods for the maintenance processing data in maintenance activity logs, which consist of electro-mechanical assembly and electronic component repair data. Develop methods to apply data analytics to the automated process control system used by the maintenance activity which, in turn, identify opportunities for process improvement initiatives and identify reliability trends of the subject trends in this analysis.

08: Research in acoustic measurements and characterization, including novel methods of acoustic alignment that minimize the required motion of source and receiver and quantify the error of those measurements, measurements in reverberant environments, and anechoic materials.

09: Research into novel methods for predictive analysis of maintenance through modeling and simulation of weapons systems, mechanical and electronic devices (pumps, motors, valves), and electronics assemblies considering component level, system and multi-platform solutions. Methods may include automated and self-learning simulated production environments to improve one or more of the following areas of interest: supply chain and logistics; employee productivity; asset utilization; decision making; and task execution.

10: Research in novel methods for assessment of enhanced multi-use mixed reality user interface (UI) capable of various Alternate Reality (AR) and Virtual Reality (VR) operations with military maintenance and industrial applications. Develop a gesture-based UI that effectively demonstrates uses in AR/VR or mixed reality context within UUV platforms, considering perception of the environment, decision making, and task execution. Methods may include modeling and simulation, physical platforms, or platform surrogates.

11: Investigate and propose innovative design methodologies for improving the manufacturability and performance of propellers, including rapid empirical assessment.

12: Methods are sought for testing of autonomy in UUVs and assessment of non-deterministic AI within UUV platforms, considering perception of the environment, decision making, and task execution. Methods may include modeling and simulation, physical platforms, or platform surrogates.

13: Investigate methods to enhance the capabilities of data processing systems utilized for system supportability and obsolescence forecasting of electro-mechanical systems through the use of machine learning and AI.

14: Investigate cutting edge methods related to advanced software development and software deployment, to include data standardization, shared infrastructures, automation, and cloud computing to modernize legacy architectures.

15: Evaluate and demonstrate the effectiveness of common fault tolerance strategies related to voting and the Byzantine general problem by creating a Large Array of Sensors circuit card assembly test platform using Commercial Off the Shelf (COTS) parts that is capable of functioning during various sensor failure cases. The assembly would need to be able to simulate both passive and active sensor failure and communicate an activity log, system status, and reduced sensor array. Empirical evaluation of proposed method(s) is preferred.

16: Investigate sensing/recording methods for specific environmental conditions (shock, strain, temperature, humidity, etc.) to allow users to better evaluate the state of electro-mechanical components after storage and transportation. Techniques should cover one or more of the following key areas: Power Source, Sensing, Low Power Processing, and Data Transmission. Empirical assessment of proposed method(s) is preferred.
17: Research to reduce hazards from electromagnetic radiation to ordnance during research, development, prototyping, production, and maintenance of energetic systems that may address automation, digitizing manual and analog processes, ergonomic/safe handling operations, hazardous waste operations, tool and asset management, and culture change.