Task Number: 003/013

Title: Technical Support for Supersonic & Hypersonic Inlet Experimental Research

General Scope of Work
SOW Summary *should define respective responsibilities of Government and Contractor*

Statement of Work:
The objective of this task is to perform experimental research and analyses on inlets and inlet systems and their associated propulsion systems. This is for advanced aerospace vehicles such as those that are part of subsonic, supersonic and hypersonic projects (e.g., ISTAR). Furthermore, it is necessary to apply knowledge gained from these activities to tasks associated with vehicle-related research in NASA Glenn wind tunnels. The inlets and inlet systems and their associated propulsion systems are required to operate efficiently over an unusually wide range of conditions and interact with the complete propulsion system and vehicle. Testing as part of these projects is conducted in facilities ranging in size and capability from the NASA Glenn 1x1 Supersonic Wind Tunnel (SWT) to the 10x10 SWT.

Specific Work Elements:
To meet the objective, the Inlet Branch requires technical support for advanced inlet experimental and analytical projects and their associated propulsion systems. Work elements include participation in the conception, conduct, analyses and reporting associated with research projects that utilize state-of-the-art analytical tools and experimental test techniques and application of the knowledge gained from these activities to tasks associated with vehicle-related research in NASA Glenn wind tunnels. Specifically, the elements are the following:

1. Experimental test projects shall be defined, and progress and schedules reported.

2. Requirements for research instrumentation shall be established, and data reduction requirements defined.

3. Computer analysis programs shall be utilized to aerodynamically analyze and assist in the design of the advanced inlets and their associated propulsion systems.

4. The efforts of supporting professional and technical groups shall be coordinated. This includes personnel from other divisions at NASA Glenn that may be participating in the work. Examples include participation in the design and procurement of test hardware and coordination of computing instructions with the Computer Services Division

5. Research, data analyses and comparisons of experimental results with existing theories and computational results shall be performed, reports prepared and oral presentations of the results made.

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Task Number: 010/020

Title: Environmental Durability of Advanced Materials

General Scope of Work
SOW Summary *should define respective responsibilities of Government and Contractor*

Subtask 1:

A high level of skill, ingenuity, and technical expertise is required for reliable and repeatable deposition of materials onto various substrates with differing compositions and complex shapes. Significant development work may be required to achieve the desired compositions and morphology of the coating. Material property testing is conducted to assess the quality and performance of the deposited coating. Close collaboration with lead research scientist/engineer and conscientious maintenance, modifications, calibration, operation and accurate record keeping of the plasma spray rigs and associated instrumentation is critical to the success of the research activities.

The Performance-Based Contractor shall provide the necessary technical expertise necessary to:

1. Develop and optimize deposition parameters, and apply single- and multiple-layered coatings for structural and functional research materials.
2. Apply/optimize coatings by plasma spraying onto various substrate materials to meet NASA programmatic goals.
3. Practice and maintain awareness of safe operating procedures in the laboratories and attention to the proper and timely calibration of equipment.

Subtask 2:

A wide variety of material types are tested, such as ceramics, metals, polymers and composite systems. Mach 0.3 Burner Rig, HPBR and QARE Rig studies of these research materials are required for this subtask. Testing under extreme conditions, such as high heat flux, high temperature conditions, at high flow velocities and elevated pressures are necessary. Burner rig operations require hearing protection and annual auditory testing as well as handling/spill prevention of fuels. The oxygen and hydrogen-fueled QARE requires special training in handling hydrogen tanks and working with high concentration mixtures of hydrogen and oxygen. Close collaboration with lead research scientist/engineer and conscientious maintenance, modifications, calibration, operation and accurate record keeping of the testing facilities and other instrumentation is critical to the success of the research activities.

Performance Based Contractor shall provide the technical expertise necessary to:

1. Conduct oxidation, erosion and hot corrosion tests of advanced materials under simulated engine conditions.

2. Develop techniques and perform experiments to determine the thermal shock resistance of advanced materials.
3. Perform experiments on processing and characterizing advanced materials.
4. Continue development, up-grades and operation of the test rigs to provide the appropriate test parameters/procedures to best evaluate the performance of the aerospace propulsion and power materials for NASA and industry technology development projects.
5. Conduct pre- and post-test evaluation/sample documentation for reporting, along with the test parameters and data to the research requestor.
6. Practice and maintain awareness of safe operating procedures in the laboratories and maintain properly and timely calibration of equipment.

Subtask 3:

Characterizing advanced material behavior and degradation behavior in aerospace propulsion environments requires carefully controlled, high-temperature laboratory tests. A variety of tests are conducted to determine the environmental durability of various materials in controlled atmospheres. Diffusion bonding experiments are important in the study of the chemical compatibility of different materials. Conscientious operation and maintenance of sensitive laboratory equipment is required. In addition, complete knowledge and experience in machining appropriate test specimens and performing post-test metallographic sample preparation is needed.

The Performance Based Contractor shall provide the technical expertise necessary to:

1. Perform experimental system set-up, execute furnace-based testing of research material specimens, which would include metals, ceramics, polymers and their composites, and prepare for/coordinate obtaining chemical, microstructural analysis and evaluation.
2. Conduct TGA, furnace and vacuum hot pressing testing of advanced materials and coatings.
3. Perform machining of specimens, conduct metallographic preparation of research materials for microscopic characterization, and determine/measure and specimen/material physical properties important to the individual studies.
4. Practice and maintain awareness of safe operating procedures in the laboratories, and around laboratory sites, and maintain proper and timely calibration of instruments.

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Task Number: 155/010

Title: Solar Thermal Systems, Dynamic Power Conversion, & Thermal Management

General Scope of Work
SOW Summary *should define respective responsibilities of Government and Contractor*

GESS shall provide qualified engineers and designers to accomplish the following work elements in the areas of solar thermal systems, power conversion, and thermal

management systems:

1. Conduct trade studies and system analyses on thermal power conversion systems in support of Advanced Radioisotope Power System development.
2. Prepare detailed designs of specialized aerospace hardware and test support hardware.
3. Work with the GRC Fabrication Division (Machine Shop, Instrumentation Group) and external vendors to produce specialized aerospace hardware and test support hardware.
4. Conduct FEA Structural and Dynamic analysis to support RPT design efforts.
5. Assist in planning and performing tests to develop and verify technologies.
6. Document test results and data analysis.
7. Serve on SBIR phase I and phase II proposal reviews.
8. As part of the reporting requirements of this Task Order, the contractor shall include any open risks associated with this task (cost, schedule, technical requirements) including any mitigation activities.

SPECIFIC WORK ELEMENTS:
1. Assist in the analyses and design development of advanced RPS systems.
2. Assist in the analyses of missions using advanced RPS and other power conversion systems, including applications such as power generation for lunar, mars, other planetary, and deep space missions.
3. Provide engineering design, analysis, fabrication, and test support related to primary and secondary solar concentrators and solar sails.
4. Provide engineering design, analysis, fabrication, and test support related to Solar and Radioisotope power conversion systems.
5. Provide engineering design, analysis, fabrication, and test support related to advanced thermal management systems research.

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Task Number: 207/012

Title: Electromagnetic Compatibility (EMC) Technical Support to ISO Committee TC-20

General Scope of Work
SOW Summary *should define respective responsibilities of Government and Contractor*

1) Support activities associated with NWI proposal to standardize EMI test reporting requirements for space flight equipment. The focus of the document is on non-compliant test results.

2) Participate in the development of the new draft ISO standard and coordinate the evaluation by government and industry of proposed improved test methods contained in the NWI.

3a) Perform EMI laboratory testing at GRC to verify the new test methods against traditional MIL-STD based test methods as an improvement in measurement technology.

3b) Provide mission unique EMI design, test, and analysis of equipment-level hardware to ensure EMC on integrated space experiment payloads.

4) Support ISO committee meetings, EMC conferences, and Symposiums in order to coordinate the development of NWI to standardize EMI test reporting with the international EMC community.

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Task Number: 254/015

Title: Electromechanical Systems Development

General Scope of Work
SOW Summary *should define respective responsibilities of Government and Contractor*

General Scope of Work
Provide services to design, build, and evaluate the performance of power system elements for use in the next generation of launch vehicles and aircraft. In particular, provide services to design and fabricate experimental hardware and test-fixtures for evaluating the performance of power system elements such as: electrical power distribution centers, electrical generators and turbo-alternators, flight or thrust vector control actuators, mechanical and electrical energy storage devices, voltage converters and frequency inverters, and photovoltaic array controllers. Additionally, provide services to integrate any combination of these elements into system-level demonstrations. Services will require mechanical; electrical and electronic; heat transfer; materials and stresses; machine design; fluid power; piping and instrumentation; design/layout, machining, and fabrication; test-bed engineering; and management skills. Contractor shall purchase hardware and software. Hardware shall include at least five current-limiting power controllers (CLPC's). Hardware and software purchases shall not exceed 350k$.

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Task Number: 319/012

Title: Engineering and Design support for Facilities

General Scope of Work
SOW Summary *should define respective responsibilities of Government and Contractor*

SOW
The contractor shall:
Provide project engineer duties performing planning, coordination, design, development, installation, check out and problem solving for large projects. Provide analysis, design studies, reviews and evaluations and advise on issues affecting the high voltage system.

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Task Number: 442/004

Title: Service Module

General Scope of Work
SOW Summary *should define respective responsibilities of Government and Contractor*

The task includes development of the vehicle architecture concept, supported by the following preliminary analyses:
Power balance
Thermal analysis
Structural assessment
Sizing model
Concept of operations

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Task Number: 487/000

Title: CLV- Project Management Scheduling Support

General Scope of Work
SOW Summary *should define respective responsibilities of Government and Contractor*

The CLV Project Office requires the support of experienced scheduler(s) and budget analyst(s) with the ability to develop and organize activity based (WBS product oriented) on the CLV technical tasks GRC has with the MSFC. Expert proficiency in the following software applications is required: Power Point, Excel, Microsoft Project, Access, and Word. The task will also require an integrated project schedule to track major activities, milestones, and resources for CLV Project Office management and CLV Project Management.

The work will require the development of all programs/project schedules and the tracking and identification of scheduling issues that cross project boundaries and will require reporting of feedback on individual critical path scheduling items. For this task all schedule inputs and changes, provided by CLV Project technical task managers, are to be reviewed by the analyst for consistency and viability and reported on to CLV Project Office management.

Task requires proficient schedule analyst capabilities at a high level. This requirement should involve personnel with proficient oral and written communication skills for project activity coordination.

The CLV Project Office requires support for CLV of budget resource tracking analysis.

Proficiency and knowledge of the NASA IEMP system is required, along with knowledge and efficiency in Microsoft PowerPoint, Word & Excel.

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Task Number: 492/000

Title: Advanced development propellant tanks

General Scope of Work
SOW Summary *should define respective responsibilities of Government and Contractor*

The Government TR will provide detailed Exploration Systems Architecture Study (ESAS) design details for the LO2 propellant tank (dimensions, temperatures, launch loads, etc.) to start modeling efforts. The Contractor shall provide a preliminary design model based on this information, and proceed with very basic analysis of this geometry including assessment of square-root-of-2/2 dome geometry for manufacturability, and materials assessment to confirm the operation of the analysis modeling tool(s) (Genoa, Cobstran) in preparation for Task 2 analysis of the two CEV contractor designs. The Contractor shall perform analysis of launch loading conditions and proof and burst pressure test loads. The tank design shall include mounting provisions and fill and drain lines. A square root of 2/2 dome design shall be assessed for manufacturability. The analysis shall include secondary stress effects from the mounting provisions. Review the tank material choice(s) and recommend improvements when possible. A more detailed secondary stress analysis will be performed only after a CEV Contractor down-select has occurred.

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Task Number: 493/000

Title: LSAM Propulsion System Modeling and Analysis

General Scope of Work
SOW Summary *should define respective responsibilities of Government and Contractor*

Contractor personnel will perform LSAM modeling, analysis, and trade studies using the SIZER code.

Government personnel will develop a full understanding of the system modeling, analysis, and trade studies performed with the SIZER code and will use this information to design and fabricate physical models.