1.

ISAAC Clean Room System

(Integrated Structural Assembly of Advanced Composites)

Statement of Work

Building 1232A / Room 101

July 22, 2015

ISAAC CLEAN ROOM ENCLOSURE
STATEMENT OF WORK

Revision Record Sheet

Revision Designation	Date	Description

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2. *Introduction/Background*

The Clean Room is part of the overall ISAAC system and will enclose the robotic equipment completely. It will provide a number of advantages for composites development and testing such as a cleaner operating environment, additional security and safety. The Integrated System Assembly for Advanced Composites, or ISAAC is located in Bldg. 1232A, Room 101 at NASA Langley Research Center.

3. *Scope of Work*

The primary focus of this task is the fabrication and installation of an enclosure to enclose the ISAAC robotic system and to serve as a functional clean room for research operations. This enclosure shall have retractable sections that will open to provide access for the existing gantry crane in Room 101. To create this controlled clean room the enclosure will require HVAC and filtration systems to qualify it as an ISO Class 7 (ISO 14644-1) clean room. All utilities that are part of the clean room shall interface with building utilities and the enclosure contractor shall be responsible for providing these. All final utility connections will be completed on a separate contract. Award of this project will based on a Best Value Determination.

4. *Objectives*

The clean room will provide a cleaner environment in which to operate the ISAAC system, temperature control, humidity control, and will provide security features that will limit access during proprietary work, and also provide another level of personnel safety. One important aspect that researchers want to study is how humidity and temperature affect the properties of composite materials during fabrication. Controlling these conditions requires a closed environment that the clean room will provide. Other NASA centers, state government, and other government agencies as well as outside academic and industry partners are interested in investigating their ideas and developments with this system.

5. *Description of the Work / Contractor Tasks*

5.1. Provide 100% design for the fabrication and installation of enclosure built of noncombustible materials. Specifications to be provided by the clean room provider.

5.2. All interior finish (exposed wall and ceiling surfaces) shall be Class-A with flame spread rating of 0-25 as per ASTM E84. Detailed criteria can be found in Chapter 10 of NFPA 101. Be advised of special requirements for plastic materials. Non-combustible is any material having passed the ASTM E136 test. We mandate compliance with all NASA requirements including STD 8719.11, LPR 1710.11, all NFPA codes/standards including the Life Safety Code and National Electrical Code, International Codes (Building, Mechanical, Fire, Plumbing), OSHA, Factory Mutual, Underwriters Laboratories UL, as well as COD standards.

5.3. Structure must comply with all IBC requirements, including structural, loading and anchoring requirements to safeguard against movement/collapse. ISAAC is mounted on a 2-ft. thick concrete base with extensive rebar with a specified max floor loading of 250 psf and a second limit of a max 5,000 lb load over a 2.5-sq.ft. area.

5.4. Four personnel doors from enclosure are required, two each at the north and south end sections; this complies with the number and remoteness of exits for fire safety. Ensure doors and door hardware, including latching and locking configurations meet code and are clearly depicted on design submittals. Submit details on doors including door hardware and how they will be secured to NASA Fire Chief.

6. *Deliverables*

5.1. Hard walled, Cleanroom Specification: Class 7 (ISO-7) per ISO 14644-1 with retractable sections.

5.1.1. Enclosed volume: 40’ Wide, 71’ long, 19’6” high.

5.1.2. Retractable sections: Minimum 30’ long moveable length providing overhead and side access. Multiple movable sections allowed. All moveable sections must fit within the 40’ x’ 71’ footprint and conform to crane clearance requirements.

5.1.3. Floor access: Hardware required for section opening and closing must not protrude above the floor and be designed such that a 4” wheel can freely traverse the opening with a maximum 1/8” variation in height.

5.1.4. Vertical walls: Opaque sheet or sandwich panels rigidly attached to frame, exposed fasteners on the inside only.

5.1.5. Windows: Clear Polycarbonate sheet. Located along entire length of both long sides and entire length of one end wall. Height from 3’-6’ minimum, 3’-7’ max, rigidly attached to frame with fasteners accessible from inside only.

5.1.6. Ceiling: Translucent polycarbonate sheet or sandwich construction. Fixed in frame with fasteners accessible from inside only.

5.1.7. Doors: 1-3/4” solid core wood, or 1-3/4 sandwich metal doors with metallic frames. Hinges and fasteners accessible from the inside only.

5.1.8. Overhead bridge Crane clearance: 3” minimum over entire width of cleanroom enclosure

5.1.9. Wind loads: 10 psf (High bay door open)

5.1.10. Floor attachment: Must be anchored to the floor. Bolts must be removable with relative ease.

5.1.11. Floor loading: 250 psf

5.1.12. Evidence from clean room provider that all exposed wall and ceiling finishes will be Class A with a flame spread of 0-25 per ASTM E84. This information will be submitted to the NASA Fire Chief for approval.

5.1.13. Lighting shall be provided to maintain illumination of 25 foot-candles at a height of 4 feet above floor level through the entire enclosure.
5.1.14. Operations and Maintenance (O&M) manuals for the clean room structure.
5.1.15. Operations and Maintenance manuals for the clean room HVAC and filtration system.
5.1.16. Recovery from opening/closing cycle:
System shall demonstrate the ability to return to an ISO-7 airborne particulate state after opening/closing cycle by satisfying the follow required test:

- Begin with closed cell in ISO-7 compliant airborne particulate state, HVAC system operational.
- Move robot to operator end of track.
- Open enclosure 15 feet and leave open for 10 minutes.
- Close enclosure and secure.
- Airborne particulate distribution must return to Class ISO-7 standard within 3 hours.

5.2. Integrated Closed-loop Temperature Control System
5.2.1. HVAC system shall be controlled via BACNET DDC system provided with building automation control interface.
5.2.2. Temperature: 65-85F year-round, +/- 2F
5.2.3. Recirculation and makeup air in accordance with all requirements of A1
5.2.4. Outdoor Heat Exchanger Ambient conditions: Avg. Temps (Winter Deg. F): Jan. Hi 46 Low 30 & (Summer Deg. F): July Hi 85 Low 71
5.2.5. Heat Loads: Sensible Heat Loads : Robotic equipment: 4000W
5.2.6. Personnel sensible heat: (6) continuous occupants
5.2.7. Wall, floor and ceiling heat flux
5.2.8. Lighting heat load: Determined by supplier solution to lighting requirement
5.2.9. Latent Heat: (6) person continual occupancy
5.2.10. Makeup air flow rate: Per Cleanroom Air change requirement or personnel makeup air- whichever is greater
5.2.11. Makeup air condition: Indoor ambient
5.2.12. Temperature control to be integrated with particulate and humidity control (single system).
5.2.13. Condensate drain interface
5.2.14. Outdoor heat exchanger
5.2.14.1. Coordination with facility coordinator for outdoor unit location, power and line routing

5.3. Integrated Closed-loop Humidity Control System
5.3.1. 50%-80% RH year-round +/- 5% RH at any temperature indicated under temperature control requirements

5.3.2. Humidity control to be integrated with particulate and temperature control (single system).

5.4. Supplier is responsible for system sizing, performance analysis and identification of utilities requirements to satisfy performance requirements. Supplier to provide the Government with written report documenting results of analyses, sizing calculations, and utility requirements within 30 days after Authority to Proceed (ATP).

5.5. Power/signal: NEC-compliant boxes and conduit for 120V, 1- phase power will be provided at 6' intervals along the non-moving portions, except for the areas occupied by the robotic system controls and doors. Cleanroom contractor will provide penetrations though the cleanroom enclosure suitable for finish by on-site NASA contractor. Penetrations suitable for signal, alarm, and network conductors will be provided for later service completion. Minimum of (4) penetrations suitable for ¾" EMT to be provided. Final quantity and locations to be determined in coordination with the NASA facility coordinator.

5.6. Supplier to supply the Government with final utilities and facility modifications required to support the installation of the cleanroom within 60 days after authority to proceed. An interface integration meeting will be held within 60 days after ATP to confirm final system interface requirements.

5.7. A site visit may be arranged for potential Contractors by contacting the NASA representative for this project. If possible field verifications of the site are recommended prior to any construction.

7. Other Considerations

Indoor Ambient Environment

Contractor HVAC design and sizing shall assume the following indoor ambient conditions in B1232A:

Particulates: Class ISO-9 per ISO 14644-1
Temperature: 80F (summer), 68F (winter)
Humidity Ratio: 117 gr/lbm (summer), 8 gr/lbm (winter)

(grains per lb-mass)

Applicable Documents: Codes and Standards

- NASA STD 8719.11, Safety Standard for Fire Protection
- LPR 1710.11, LaRC Fire Protection Handbook
- 29 CFR Part 1910, OSHA Regulations
- IBC, International Building Code
- IMC, International Mechanical Code
- IFC, International Fire Code
- NFPA 1, Fire Code
- NFPA 101, Life Safety Code
- NFPA 70, National Electrical Code
- NFPA 72, National Fire Alarm Code
- NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
- FM, Applicable Factory Mutual Data Sheets
- OSHA 29 CFR 1926 Safety and Health Requirements for Construction
- EPA 40 CFR Protection Of The Environment
- ANSI / ASHRAE 62.1-2010 Ventilation for Acceptable Indoor Air Quality Standard, (latest version)
- ASHRAE Handbook – HVAC Applications (latest version)
- ASHRAE Handbook – Fundamentals (latest version)
- ASHRAE / ANSI Standard 90.1 (latest version)

Milestones

30 days ATP: Detailed design drawings and analyses
60 days ATP: Facility interfaces confirmed
180 days ATP: Cleanroom performance checkout, compliance inspections completed
{ATP: Authority to Proceed}

Government-furnished property

No Government property has been identified for this project.

Government-furnished information

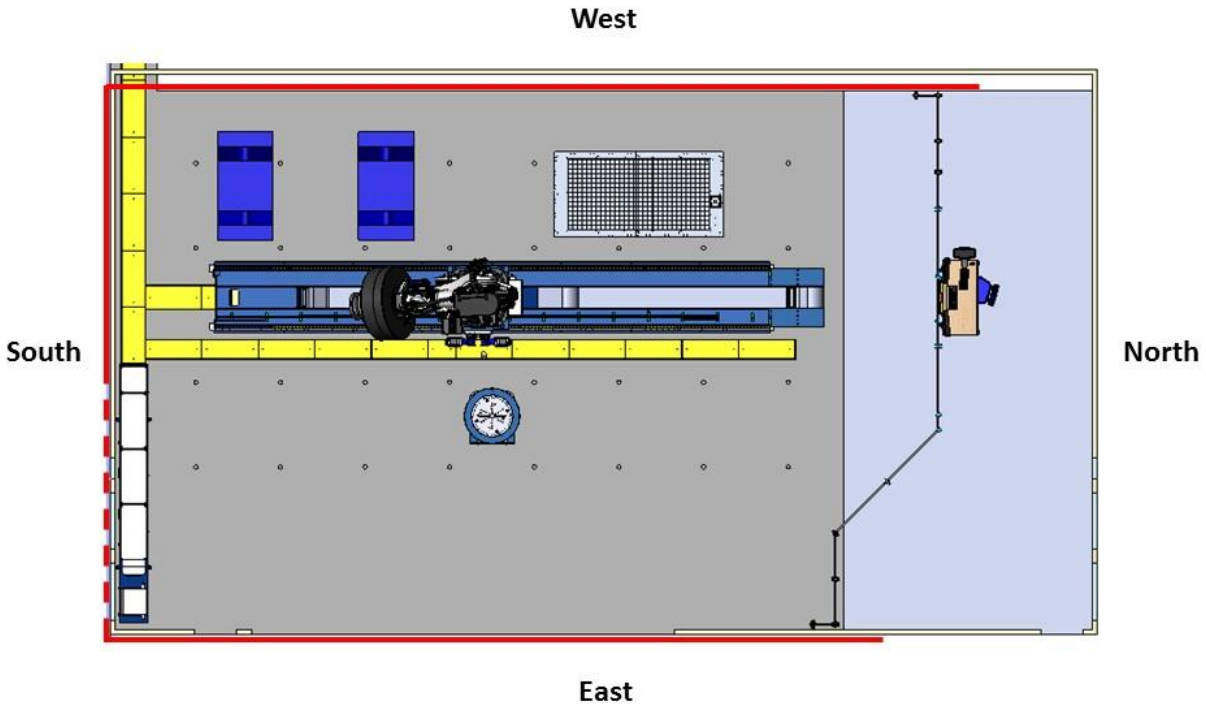
At the Contractor's request Government information, such as NASA standards, facility drawings, will be provided to the Contractor.

Other information needed for performance of task:

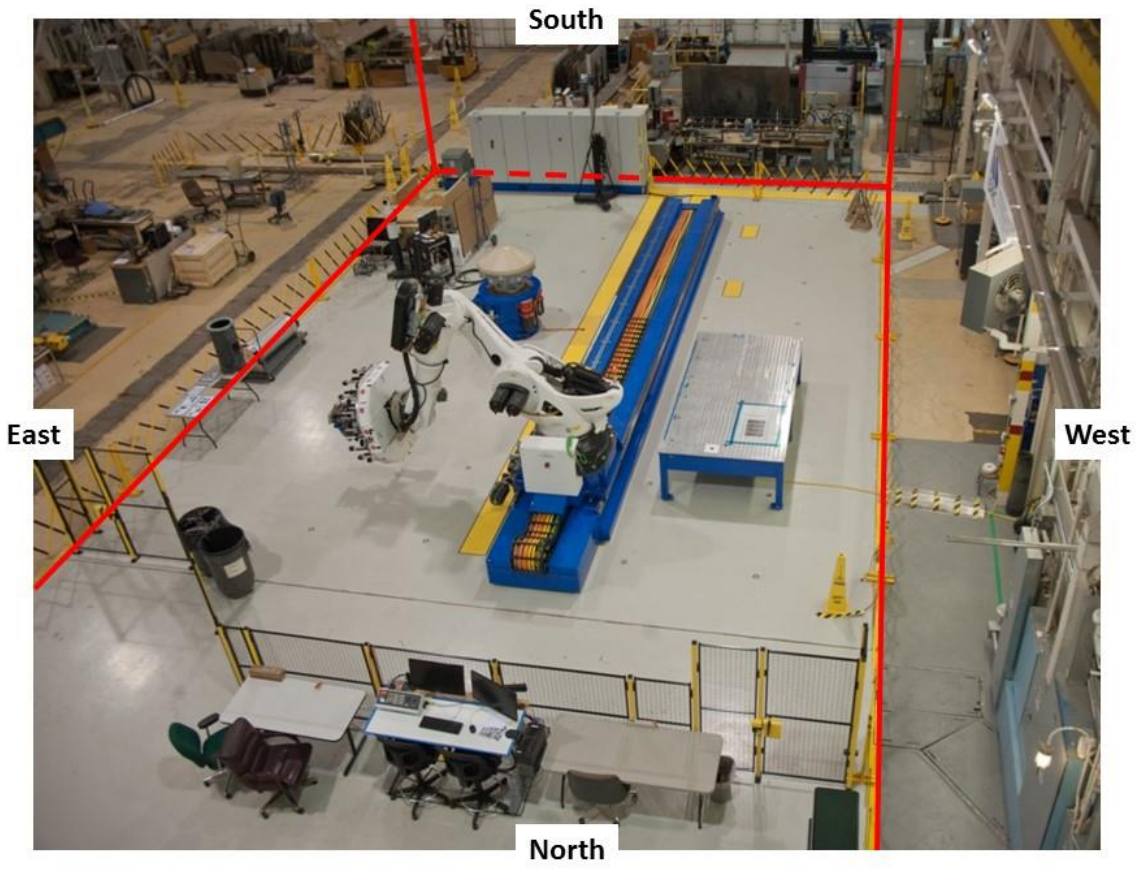
1. This task order shall be awarded based on Best Value Determination.
2. Construction activities will require working with the ISAAC customers regarding scheduling. Limiting downtime of the ISAAC system is an extremely important factor in this project. From start of construction until end of the project as certified by the Fire

Marshall the ISAAC system will be completely offline, which will negatively impact the system schedule and its customers.

3. The HVAC provider will supply a system for this clean room that, in case of issues with system, a response to a trouble call will be expedient. Consider a manufacturer with system repair capabilities within a 50 mile radius and/or can respond within 24 hours maximum. An extended warranty will be considered for the HVAC system to support repairs.



9.1 Plan View of ISAAC in Bldg. 1232A, Room 101



9.2 Clean Room Position in Room 101 (in red)