

ANNEX
BETWEEN
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GLENN RESEARCH CENTER
AND
RADIAN AEROSPACE INC.
UNDER SPACE ACT UMBRELLA AGREEMENT
NO. SAA3-1726, DATED 08/28/2022 (ANNEX NUMBER 02).

ARTICLE 1. PURPOSE

The purpose of this Annex (“Annex” or “Annex 02”) is to provide Radian Aerospace Inc. (“Radian”) with the capabilities and characteristics of the various NASA Glenn Research Center (“GRC”)-derived inorganic aerogel composites available, combined with optimal formulations derived from Annex 01 under Space Act Umbrella Agreement No. SAA3-1726 (“Annex 01”) to create a hybrid aerogel composite (HAC). NASA GRC will assist in material evaluation regarding the placement of the multilayer insulation (MLI) containing the HAC system within a Radian-developed vehicle structure for optimal thermal insulation. NASA GRC will perform a baseline characterization and feasibility study to determine optimal formulations, best practices for composite interface adhesion, and vehicle placement.

ARTICLE 2. RESPONSIBILITIES

A. NASA GRC will use reasonable efforts to:

1. Provide Inorganic Aerogel Reinforced Composite Baseline Characterization. NASA GRC will use reasonable efforts to evaluate and perform a baseline characterization of the various aerogel materials that are available and suitable for aerospace applications requiring extreme temperature mitigation. This analysis will include poresize/surface area analysis, thermal analysis, mechanical analysis, and energy absorption/impact analysis.
2. Perform an Optimization Study and down-select of inorganic aerogels and the fiber matrix utilized for structural support. Selection of primary polymer aerogel to be used as potential tank solution.
3. Fabricate Optimal formulations based on superior thermal properties. Optimal formulations to be fabricated according to specifications determined by the Partner.
4. Assess the optimal layup/stack of the hybrid organic/inorganic aerogel composite within the MLI of the tank system of the vehicle. Investigate optimal placement of aerogel within the tank system to provide the best insulating capability between the Liquid Oxygen (LOX) and the Tank Thermal Protection System (TPS).
5. Provide a final report to Radian.

Radian will use reasonable efforts to:

1. Provide additional components needed for the assembly of the engineering demonstration unit (EDU) stack 1 (EDU-1).
2. Provide defined target environment and expected materials properties. Temperature, pressure, and any relevant data integral to optimization of material fabrication.
3. Provide candidate materials for struts, structure, and/or tank parts to NASA GRC for aerogel material placement and characterization study.

ARTICLE 3. SCHEDULE AND MILESTONES

The planned major milestones for the activities for this Annex defined in the "Responsibilities" Article are as follows:

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| 1. NASA GRC will provide written assessment of Annex 01 derived polymer aerogel to be used in baseline study for Annex 02. | On or about January 2024. |
| 2. NASA GRC will assemble and evaluate EDU-1 of the proposed layup using current Inorganic Aerogel Composite materials and optimal polymer aerogel derived in Annex 01 and provide a report or summary. | On or about February 2024. |
| 3. Radian will provide NASA GRC with target properties for the HAC as well as materials to be used in EDU stack. | On or about February 2024. |
| 4. NASA GRC will perform Inorganic Aerogel Composite Baseline Characterization. | On or about June 2024. |
| 5. NASA GRC will perform an optimization study and down-select of inorganic aerogels and the structural fiber reinforcement. | On or about August 2024. |
| 6. NASA GRC will identify optimal bonding processes to create a HAC comprised of the optimal inorganic formula embedded within a fiber substrate and the optimal organic aerogel determined in Annex 01. | On or about September 2024. |
| 7. NASA GRC will design and characterize the optimal lay-up of the MLI stack of the optimized HAC for EDU-1. | On or about November 2024. |
| 8. NASA GRC will fabricate Radian-defined optimal HAC. | On or about December 2024 |
| 9. NASA GRC will provide final report to Radian. | On or about December |

2024.

ARTICLE 4. FINANCIAL OBLIGATIONS

A. Partner agrees to reimburse NASA a total estimated cost of \$233,947.00 for NASA to carry out its responsibilities under this Annex. The payment schedule is as follows:

Partner agrees to pay NASA GRC a first installment of \$62,000.00 prior to initiation of work under this Annex, and a second installment of \$98,947.00 prior to the start of Milestone No. 4 of this Annex. A third installment of \$73,000.00 will be paid to NASA by Partner prior to the start of Milestone No. 7 of this Annex.

Each payment shall be marked with NASA GRC and Annex No. SAA3-1726-02

B. NASA will not provide services or incur costs beyond the current funding. Although NASA has made a good faith effort to accurately estimate its costs, it is understood that NASA provides no assurance that the proposed effort under this Annex will be accomplished for the estimated amount. Should the effort cost more than the estimate, Partner will be advised by NASA as soon as possible. Partner shall pay all costs incurred and have the option of canceling the remaining effort, or providing additional funding in order to continue the proposed effort under the revised estimate. Should this Annex be terminated, or the effort completed at a cost less than the agreed-to estimated cost, NASA shall account for any unspent funds within 120 business days after completion of all effort under this Annex, and promptly thereafter, at Partner's option return any unspent funds to Partner or apply any such unspent funds to other activities under the Umbrella Agreement. Return of unspent funds will be processed via Electronic Funds Transfer (EFT) in accordance with 31 C.F.R. Part 208 and, upon request by NASA, Partner agrees to complete the Automated Clearing House (ACH) Vendor/Miscellaneous Payment Enrollment Form (SF 3881).

ARTICLE 5. INTELLECTUAL PROPERTY RIGHTS - DATA RIGHTS

A. Data produced under this Annex which is subject to paragraph C. of the Intellectual Property Rights - Data Rights Article of the Umbrella Agreement will be protected for the period of one year.

B. Under paragraph H. of the Intellectual Property Rights - Data Rights Article of the Umbrella Agreement, Disclosing Party provides the following Data to Receiving Party. The lists below may not be comprehensive, are subject to change, and do not supersede any restrictive notice on the Data provided.

1. Background Data:

The Disclosing Party's Background Data, if any, will be identified in a separate technical document.

2. Third Party Proprietary Data:

The Disclosing Party's Third Party Proprietary Data, if any, will be identified in a separate technical document.

3. Controlled Government Data:

The Disclosing Party's Controlled Government Data, if any, will be identified in a separate technical document.

4. The following software and related Data will be provided to Partner under a separate Software Usage Agreement: None.

ARTICLE 6. TERM OF ANNEX

This Annex becomes effective upon the date of the last signature below ("Effective Date") and shall remain in effect until the completion of all obligations of both Parties hereto, or fourteen (14) months from the Effective Date, whichever comes first, unless such term exceeds the duration of the Umbrella Agreement. The term of this Annex shall not exceed the term of the Umbrella Agreement. The Annex automatically expires upon the expiration of the Umbrella Agreement.

ARTICLE 7. RIGHT TO TERMINATE

Either Party may unilaterally terminate this Annex by providing thirty (30) calendar days written notice to the other Party.

ARTICLE 8. POINTS OF CONTACT

The following personnel are designated as the Points of Contact between the Parties in the performance of this Annex.

Management Points of Contact

NASA

Timothy D. Smith
Supervisory Aerospace Engineer
Mail Stop: 162-7
21000 Brookpark Road
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RADIAN AEROSPACE

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Technical Points of Contact

NASA

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RADIAN AEROSPACE

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Esther.Deena@radianaerospace.com

ARTICLE 9. MODIFICATIONS

Any modification to this Annex shall be executed, in writing, and signed by an authorized representative of NASA and the Partner. Modification of an Annex does not modify the terms of the Umbrella Agreement.

ARTICLE 10. SIGNATORY AUTHORITY

The signatories to this Annex covenant and warrant that they have authority to execute this Annex. By signing below, the undersigned agrees to the above terms and conditions.

NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION
GLENN RESEARCH CENTER

RADIAN AEROSPACE, INC.



BY: _____
Michael J. Barrett
Director, Space Flight Systems

BY:  _____
Curtis Gifford
COO Radian Aerospace

DATE: _____

DATE: Jan 12, 2024