

ANNEX NO. 2
BETWEEN
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
AND
UNITED LAUNCH ALLIANCE, LLC
UNDER
SPACE ACT UMBRELLA AGREEMENT SAA1-37876
FOR
CONTINUATION OF VERA PRELIMINARY DESIGN EFFORTS

ARTICLE 1. PURPOSE

This Annex shall be for the purpose of the continuation of VERA project efforts through the preliminary design phase. Efforts include programmatic and technical resources for the development of the HIAD requirements and design, along with the evaluation of the high-capacity Manufacturing Development Units (MDUs); and the planning and execution of ground-based testing activities.

NASA procurements made under this Annex in support of NASA's responsibilities herein are considered government property. All government property will be retained by NASA LaRC. Procurements may include, but are not limited to, component purchases for the EDU, MDUs, and Flight Test Article, hereinafter referred to as the Developmental Test Articles (DTA). Partner's use of government property is limited to Partner's responsibilities under this Annex. Any other Partner use requires written permission from NASA LaRC and may require additional agreement(s) with NASA including, but not limited to, property loan agreement(s) in accordance with the Loan of Government Property article in the Umbrella Agreement. No such agreements are guaranteed.

The legal authority for this Annex, consistent with the Umbrella Agreement, is in accordance with the Space Act, Other Transactions Authority (OTA), 51 U.S.C. § 20113(e).

ARTICLE 2. RESPONSIBILITIES

A. NASA LaRC will use reasonable efforts to:

1. Provide project management support to include development and maintenance of project planning and control tools (e.g., financial reports and analyses, integrated master schedule, risk registry, and data configuration management system).
2. Develop subsystem level requirements and verification plans including GSE and instrumentation.
3. Develop PDR-level re-entry environments and analyses (flight mechanics, aerodynamics and aerothermal, thermal, and structural, and splashdown environments).
4. Provide technical support for the ULA inflation system design, interfaces, and test plan. Verify inflation system design, interfaces, and test planning meet Interface

- Control Document (ICD) (BL-SPEC-001103) definitions and SCD (BL-SPEC-001102) requirements (i.e., flow rate, gas temperature, time to initial inflation, maintenance of design, operating pressure).
5. Provide technical input to ULA mission timeline to verify ICD/SCD requirements are met to accommodate inflation of the deployable aeroshell, re-entry of the RM, parachute deployment, and ocean landing.
 6. Define tooling, Transportation & Handling (T&H) equipment, Mechanical Ground Support Equipment (MGSE), Electrical Ground Support Equipment (EGSE), or instrumentation required for the VERA HIAD and identify the responsible equipment provider (ULA or LaRC).
 7. Provide preliminary design of GSE to be used for assembly, integration, packing, and testing of DTA.
 8. Lead the following meetings and reviews:
 - a. VERA Technical Interchange Meetings (TIMs)
 - b. VERA Programmatic and Technical working groups
 - c. VERA Supplier visits and meetings
 - d. VERA Preliminary Design Review (PDR)
 9. Participate in ULA meetings and reviews including, but not limited to:
 - a. ULA Interim Design Reviews (IDRs)
 - b. ULA Mission Critical Design Review (CDR) (and associated meetings)
 - c. ULA Programmatic and Technical working groups
 - d. ULA Engineering Review Boards
 - e. ULA Program Management Reviews (PMRs)
 10. Provide test planning, model fabrication or procurement, test execution, and post-test analysis for the following aerodynamic and aerothermal ground-based testing activities.

Test	Location	Tentative Dates
Aero-2: Follow-on Low-speed Aerodynamics Captive Testing (if required)	LaRC 12-ft Low Speed Wind Tunnel (LSWT) or LaRC Vertical Spin Tunnel (VST)	June 2024
Aero-3: Transonic Aerodynamics Testing	LaRC Transonic Dynamics Tunnel (TDT)	July 2024
Aero-4: Aerodynamics Free Flight Testing	LaRC Vertical Spin Tunnel	June 2024
Aero-6: Hypersonic Aerodynamics Screening	LaRC Mach 10 Tunnel	September 2024
Aero-7: Wake Flow Visualization	LaRC Mach 10 Tunnel	Winter 2024
Heat-2: Hypersonic Aeroheating Payload	LaRC Mach 6 Tunnel	September 2024

11. Provide test planning, procurements and post-test analysis for thermal material (Arcjet) testing efforts to be conducted at Boeing Large-Core Arc Tunnel (LCAT) and NASA LaRC and provide test execution for thermal material testing at NASA LaRC.
12. Continue design, fabrication, testing, and post-test analyses of the DTA as follows.
 - a. Complete development of MDUs, including cord and webbing, and inflatable structure tori.
 - b. Complete testing of MDUs to include damage tolerance tests, hydrostatic burst tests, and strap indentation tests on inflatable structure torus articles.
 - c. Perform MDU post-test analyses.

B. Partner will use reasonable efforts to:

1. Inform NASA LaRC of any updates to the ULA requirements and constraints that would affect the VERA HIAD development such as the aeroshell outer mold line (deployable nose cone (DNC) and HRS conic), DNC TPS, data recovery system, entry state, VTS separation system.
2. Utilize NASA LaRC technical support and insight for inflation system design, interfaces, and test planning, to ensure ICD definitions and SCD requirements are met (flow rate, gas temperature, time to initial inflation, maintenance of design, operating pressure).
3. Provide mission timeline to NASA LaRC that accommodates inflation of the deployable aeroshell, re-entry of the RM, parachute deployment, and ocean landing.
4. Lead the following reviews:
 - a. ULA IDRs
 - b. ULA Mission CDR (and associated meetings)
 - c. ULA Programmatic and Technical working groups
 - d. ULA Engineering Review Boards
 - e. ULA PMRs
5. Participate in NASA LaRC meetings and reviews including, but not limited to:
 - a. VERA TIMs
 - b. VERA Programmatic and Technical working groups
 - c. VERA PDR

ARTICLE 3. SCHEDULE AND MILESTONES

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

1. Authority to Proceed	Upon Effective Date of Agreement + Availability of
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	Partner Funding at NASA
2. MDU Evaluations Complete	NLT December 20, 2024
3. VERA PDR	NLT January 31, 2025
4. Preliminary Design of GSE Complete	NLT March 31, 2025

ARTICLE 4. FINANCIAL OBLIGATIONS

A. Partner agrees to reimburse NASA an estimated cost of \$13,340,658.06 for NASA to carry out its responsibilities under this Annex.

Partner authorizes NASA to transfer to this Annex, any un-obligated funds remaining under Annex 1 to SAA1-37876 upon expiration or completion of all obligations, whichever comes first. The amount transferred will be applied towards the next Funding Installment due. Should additional expenditures under Annex 1 to SAA1-37876 be processed, this will reduce the un-obligated funds available for transfer to this Annex and Partner agrees it will be responsible for providing funds necessary to cover any shortfall, if needed. Similarly, should actual expenditures under the Annex 1 to SAA1-37876 be less than obligated amounts, the excess funds will be transferred to this Annex. At the completion of this Annex, any unspent funds will be processed in accordance with Article 4.B, below.

The partner agrees to pay NASA LaRC the following:

Funding Installment	Amount	Schedule
Installment 1	\$7,000,000.00	Within one (1) week following full execution of this Annex
Installment 2	\$5,000,000.00	By September 1, 2024
Installment 3	\$1,340,658.06	By January 10, 2025

Each payment shall be marked with LaRC SAA1-37876, Annex 2.

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 90 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 June 30, 2025, 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	
<u>NASA Langley Research Center</u>	<u>United Launch Alliance, LLC</u>

Joe Del Corso Project Manager, Vulcan Engine Recovery Aeroshell (VERA) Mail Stop 104 Hampton, VA 23681 p. 757.864.9441 e. joseph.a.delcorso@nasa.gov	Caleb Weiss Program Manager 9501 E. Panorama Circle Centennial, CO 80112 p. 303.391.4630 e. caleb.c.weiss@ulalaunch.com
Technical Points of Contact	
<u>NASA Langley Research Center</u> F. McNeil Cheatwood Senior Technologist for Planetary Entry, Descent, and Landing Mail Stop 489 Hampton, VA 23681 p. 757.864.2984 e. f.m.cheatwood@nasa.gov	<u>United Launch Alliance, LLC</u> Caleb Weiss Program Manager 9501 E. Panorama Circle Centennial, CO 80112 p. 303.391.4630 e. caleb.c.weiss@ulalaunch.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
 LANGLEY RESEARCH CENTER

UNITED LAUNCH ALLIANCE, LLC

BY: _____
 Greg Stover
 Acting Director, Space Technology
 and Exploration Directorate

BY: _____
 Don Tidwell
 Contract Administrator

DATE: _____

DATE: _____