

ANNEX
BETWEEN
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
AND BLUE ORIGIN, LLC
UNDER SPACE ACT UMBRELLA AGREEMENT
NO. SAA-EA-20-29343, DATED 2/8/2020 (ANNEX NUMBER 24).

ARTICLE 1. PURPOSE

The purpose of this Annex shall be for NASA to measure various mechanical properties of selected alloys during exposure to liquid hydrogen (LH2). This testing will be conducted at the George C. Marshall Space Flight Center Hydrogen Test Facility (Bldg. 4628).

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 MSFC will use reasonable efforts to:

1. Fabricate test specimens from raw material.
2. Perform testing in liquid hydrogen (LH2), which shall not exceed the following:
 - a. 1000 tensile tests,
 - b. 375 fracture toughness tests,
 - c. 70 high cycle fatigue (HCF) tests,
 - d. 300 low cycle fatigue (LCF) tests,
 - e. 50 Modulus of Elasticity tests,
 - f. 50 Poisson's Ratio tests, and
 - g. 50 fatigue crack growth rate (da/dN) Paris and Post Paris Region tests.
3. Perform data analysis on the test data.
4. Provide written test reports.
5. Return post-test specimens to Blue Origin.

B. Partner will use reasonable efforts to:

1. Provide raw material to be used for fabricating test specimens.
2. Provide test plan, including test parameters.

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. Blue Origin provides raw material and test plan | One month after Effective Date, and then monthly after first delivery until all material has been delivered |
| 2. NASA MSFC fabricates test specimens | Within one month of Milestone 1 completion. |
| 3. NASA MSFC performs testing and data analysis | Within 2 weeks of Milestone 2 completion |
| 4. NASA MSFC provides written test report | Within 10 working days of Milestone 3 completion |
| 5. NASA MSFC returns post-test specimens | Within 1 month of completion of testing |

ARTICLE 4. FINANCIAL OBLIGATIONS

A. Partner agrees to reimburse NASA an estimated cost of \$4,984,419 for NASA to carry out its responsibilities under this Annex. The Partner agrees to pay NASA MSFC \$1,000,000 prior to initiation of work under this Agreement, another three installments of \$1,000,000 every five months as work continues, and a final installment of \$984,419 five months after the fourth installment of \$1,000,000. No more than 10% of the total amounts collected under this annex shall be spent on Hydrogen Test Facility modifications necessary for placing a new LH2 tank.

Each payment shall be marked with MSFC SAA-EA-20-29343.24.

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 one year 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 two years.

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 February 7, 2025, whichever comes first.

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.

Technical Points of Contact

NASA George C. Marshall Space Flight
Center

Bryan Tucker
Lead Materials Engineer
Mail Suite: EM22

BLUE ORIGIN, LLC

Myles Fullen
Materials & Process Engineer
21218 76th Avenue S
Kent, WA 98032-2442

Marshall Space Flight Center, AL 35812
Phone: 256.544.6264
bryan.p.tucker@nasa.gov

Phone: 615.440.7525
mfullen@blueorigin.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
GEORGE C. MARSHALL SPACE
FLIGHT CENTER

BLUE ORIGIN, LLC

BY: _____
Mary E. Koelbl
Director, Engineering Directorate

BY: _____
Jessica Curry
Sr. Manager, Subcontracts

DATE: _____

DATE: 12/1/2022