

ANNEX  
BETWEEN  
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
LYNDON B. JOHNSON SPACE CENTER  
AND BLUE ORIGIN, LLC  
UNDER SPACE ACT UMBRELLA AGREEMENT  
NO. 29343, DATED 2/8/2020 (ANNEX NUMBER 45).

ARTICLE 1. PURPOSE

This Annex shall be for the purpose of collaboration with Blue Origin in the areas of engineering analysis and testing in the development of commercial space transportation systems. The purpose of this radiant heat test series is to further investigate and characterize the efficacy and both thermal and mechanical responses of metallic and ceramic matrix composite heat shield materials. These types of test facilities are not commercially available and exist exclusively within NASA JSC's unique Radiant Heat Test Facility (RHTF).

This testing aides in the development of the Thermal Protection System (TPS) heat shield on the New Glenn launch system.

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

NASA will use reasonable efforts to:

1. Provide technical guidance for the test setup, instrumentation and test planning
2. Prepare a detailed test plan
3. Prepare an Integrated Hazard Analysis report
4. Plan and conduct a Test Readiness Review
5. Setup and prepare test articles for testing
  - A. Provide and operate heat flux probes to collect cold wall heat flux measurements for each run
6. Conduct radiant heat tests of the candidate TPS tiles
  - A. Record thermal-couple resistance from interface locations provided by partner
  - B. Provide pre- and post-test emissivity measurements of each test article
7. Inspect and photograph the test articles before and after testing
8. Assemble test data and deliver to the partner
9. Return test articles to the partner

BLUE ORIGIN will use reasonable efforts to:

1. Provide test requirements and target test conditions
2. Provide Safety Data Sheets (SDS) for materials to be tested
3. Provide a list and description of the test articles
4. Provide description of the test article instrumentation
5. Support development of detailed test plan
6. Provide instrumented test articles for radiant heat testing
  - A. Provide thermocouple and interfacing leads requirement
  - B. Provide mounting and data recording interface locations for testing of the thermocouples and Linear Variable Displacement Transducers (LVDT)

### ARTICLE 3. SCHEDULE AND MILESTONES

The planned major milestones from Effective Date (ED), Receipt of Hardware (RH), and Date of Last Test Completion (TC) for this Task Plan are as follows:

Blue Origin will provide test articles to NASA JSC	ED + 30 days
NASA JSC will perform 10 consecutive days of TPS testing completing as many runs as possible using no longer than a 60 minute heater run duration	RH + 30 days
NASA JSC will perform 5 consecutive days of TPS testing completing as many runs as possible using no longer than a 60 minute heater run duration	RH + 50 days
NASA JSC shall provide all raw data files and executables from all runs and upload to Blue Origin File Transfer Protocol (FTP) site or hard drive	TC + 30
NASA JSC shall provide a test summary report outlining the runs completed and results for each run	TC + 60

### ARTICLE 4. FINANCIAL OBLIGATIONS

A. Partner agrees to reimburse NASA an estimated cost of \$133,946.74 for NASA to carry out its responsibilities under this Annex.

The Partner agrees to pay NASA JSC \$107,000 prior to initiation of work under this Agreement, and another \$26,946.74 one week prior to the start of Milestone No. 3.

Each payment shall be marked with JSC and Annex 45.

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 one year 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 Lyndon B. Johnson Space Center  
Stan Bouslog  
Senior Discipline Expert  
Mail Stop: ES3  
2101 NASA Parkway  
Houston, Texas 77058  
Phone: 281.483.3327  
stan.a.bouslog@nasa.gov

Blue Origin, LLC  
Candy Guerrero  
Senior Manager, Subcontracts  
21218 76th Avenue S  
Kent , WA 98032-2442  
Phone: 253.437.9300 x 15533  
cguerrero@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.

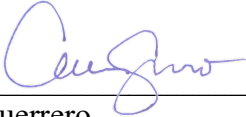
ARTICLE 10. SIGNATORY AUTHORITY

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  
LYNDON B. JOHNSON SPACE  
CENTER

BLUE ORIGIN, LLC

BY: \_\_\_\_\_  
Julie Kramer White  
Director, Engineering

BY:  \_\_\_\_\_  
Candy Guerrero  
Sr. Manager – Supply Chain  
Subcontracts

DATE: \_\_\_\_\_

DATE: September 14, 2023