

ANNEX NO. 8
BETWEEN
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
AND
BLUE ORIGIN, LLC
UNDER SPACE ACT UMBRELLA AGREEMENT SAA2-403403
FOR
AEROCAPTURE TRADE STUDY – PHASE 1

ARTICLE 1. PURPOSE

This Annex shall be for the purpose of performing a trade study to determine feasibility of aerocapture for the Blue Origin Lunar Clipper. The study will attempt to, where possible, isolate the aerocapture analysis from the broader Lunar Clipper vehicle architecture to minimize impacts to that system.

This Annex focuses on Phase 1 of the study – trajectory design of two primary architectures: (1) a deployable heat shield architecture (blunt body) and (2) an integral heat shield architecture (slender body). Subsequent efforts will be executed via future Annex(es).

The legal authority for this Annex, consistent with the Umbrella Agreement, is in accordance with the National Aeronautics and Space Act (51 U.S.C. § 20113(e)).

ARTICLE 2. RESPONSIBILITIES

A. NASA LaRC will use reasonable efforts to:

1. Collaborate with Partner for purposes of technical interchange discussions and information exchange.
2. Develop three degrees of freedom (3-DoF) flight trajectory simulation for aerocapture of an Earth hyperbolic approach from cislunar space.
3. Conduct in-atmosphere simulations using Partner-provided initial states.
4. Identify heatshield material candidates.

B. Partner will use reasonable efforts to:

1. Collaborate with NASA LaRC for purposes of technical interchange discussions and information exchange.
2. Provide initial states and mass properties (for the specified range of mass, velocity, and entry flight path angle) required for NASA trajectory propagation.
3. Provide payload outer mold line (OML) and/or dimensions.

ARTICLE 3. SCHEDULE AND MILESTONES

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

1. Partner to provide: a. reimbursement as outlined in Article 4. Financial Obligations. b. initial states and mass properties. c. payload OML and/or dimensions.	Within two (2) weeks following Effective Date of Annex
2. NASA LaRC to develop 3-DoF flight trajectory simulation.	Within two (2) months following Milestone 1
3. NASA LaRC to conduct in-atmosphere simulations using Partner-provided initial states.	Within two (2) months following Milestone 2
4. NASA LaRC to deliver heatshield material candidates.	Within two (2) months following Milestone 3

ARTICLE 4. FINANCIAL OBLIGATIONS

A. Partner agrees to reimburse NASA an estimated cost of \$80,437 for NASA to carry out its responsibilities under this Annex.
Each payment shall be marked with **Langley Research Center SAA2-403403, Annex 8.**

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 will account for any unspent funds within six (6) months after completion of all efforts under this Annex, and promptly thereafter, at Partner's option, return any unspent funds to Partner or apply any unspent funds to other activities under the Umbrella Agreement.

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 (1) 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, a period of one (1) year, or the expiration of the Umbrella Agreement, whichever comes first. This 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:

Technical Points of Contact

NASA Langley Research Center

F. McNeil Cheatwood
Senior Technologist for Planetary Entry,
Descent, and Landing
Mail Stop 489
Hampton, VA 23681
Phone: 757.864.2984
f.m.cheatwood@nasa.gov

Blue Origin, LLC

Dr. Christopher Schulz
Senior Director, Advanced Development
Programs
21218 76th Avenue S
Kent, WA 98032-2442
Phone: 903.232.4960
cschulz@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
LANGLEY RESEARCH CENTER

BLUE ORIGIN, LLC

BY: _____
David A. Dress
Director of Space Technology and
Exploration Directorate

DocuSigned by:
Wade Davis
19390BCCEC5D489...
BY: _____
Wade Davis
Senior Commercial Advisor

DATE: _____

DATE: 6/28/2022 | 10:39 AM PDT
