ANNEX
BETWEEN
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
AND
RELATIVITY SPACE, INC.
UNDER
SPACE ACT UMBRELLA AGREEMENT
NO. SAA8-2033020, DATED 10/14/2020 SAA8-2033020.5

ARTICLE 1. PURPOSE

This Annex shall be for the purpose of collaboration and modeling activities related to prediction of the plume-induced environment caused by hot-staging in the Relativity Terran-R rocket. Plume engineering methods as well as computational fluid dynamics will be employed.

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 review of preliminary surface geometry simplifications and surface mesh for Staging plume impingement analysis with Relativity.
2. Review initial engineering code (i.e. Plume Impingement (PLIMP)) analysis with Relativity, at to-be-determined (TBD) number of separation trajectory points.
3. Provide PLIMP solution / run files to Relativity.
4. Review Loci-CHEM solution of a single TBD separation trajectory point with Relativity.
5. Provide Loci-CHEM solution / run files to Relativity.
6. Review Loci-CHEM solution of a second TBD separation trajectory point with Relativity.
7. Provide Loci-CHEM solution / run files to Relativity.
8. Provide Gaseous Radiation (GASRAD) plume radiation predictions at TBD separation trajectory points, based on observations from PLIMP and Loci-CHEM runs.

Relativity will use reasonable efforts to:

1. Provide Computer Aided Design (CAD) model of Relativity launch vehicle, including first and second stage base geometry and engine configuration, as well as top of first stage and any interstage.
2. Provide thrust chamber propellants, mixture ratio and chamber conditions.
3. Provide engine nozzle inner and outer contours.

4. Provide engine mass flow rate and thrust data for comparison with computational models.
5. Provide ascent trajectory and staging trajectory information.

ARTICLE 3. SCHEDULE AND MILESTONES

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

1. Relativity will provide: a. CAD model of Relativity launch vehicle, including first and second stage base geometry and engine configuration, as well as top of first stage and any interstage b. Thrust chamber propellants, mixture ratio and chamber conditions. c. Engine nozzle inner and outer contours. d. Engine mass flow rate and thrust data for comparison with computational models e. Ascent trajectory and staging trajectory information	Effective date + 2 weeks
2. NASA MSFC will provide review of preliminary surface geometry simplifications and surface mesh for Staging plume impingement analysis with Relativity	Milestone 1 + 3 weeks
3. NASA MSFC will review initial engineering code (i.e. PLIMP) analysis with Relativity, at TBD number of separation trajectory points	Milestone 2 + 3 weeks
4. NASA MSFC will provide PLIMP solution / run files to Relativity	Milestone 3 + 1 week
5. NASA MSFC will review Loci-CHEM solution of a single TBD separation trajectory point with Relativity	Milestone 2 + 6 weeks
6. NASA MSFC will provide Loci-CHEM solution / run files to Relativity	Milestone 5 + 1 week
7. NASA MSFC will review Loci-CHEM solution of a second TBD separation trajectory point with Relativity	Milestone 5 + 3 weeks
8. NASA MSFC will provide Loci-CHEM solution / run files to Relativity	Milestone 7 + 1 week

9. NASA MSFC will provide GASRAD plume radiation predictions at TBD separation trajectory points, based on observations from PLIMP and Loci-CHEM runs	Milestone 7 + 3 weeks

ARTICLE 4. FINANCIAL OBLIGATIONS

A. Partner agrees to reimburse NASA an estimated cost of $60,415 for NASA to carry out its responsibilities under this Annex.
Each payment shall be marked with NASA MSFC and SAA8-2033020.5.

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 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.
None
2. Third Party Proprietary Data:
None
3. Controlled Government Data:
None
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.

Technical Points of Contact

NASA George C. Marshall Space Flight Center
Christopher I. Morris
Aerosciences Branch Chief
Mail Suite: Aerosciences Branch/EV33
Marshall Space Flight Center, AL 35812
Phone: 256-684-2548
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RELATIVITY SPACE, INC.
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Long Beach, CA 90807
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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	RELATIVITY SPACE, INC.
BY: LISA BATES Digitally signed by LISA BATES Date: 2023.12.13 07:42:06 -06'00'	BY: DocuSigned by: Tim Ellis 1267D2BC3F3FA4B0...
Donald W. Holder Director Engineering Directorate	Tim Ellis Chief Executive Officer
DATE:	DATE: 12/12/2023