

ANNEX  
BETWEEN  
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
GLENN RESEARCH CENTER  
AND NORTHROP GRUMMAN  
UNDER SPACE ACT UMBRELLA AGREEMENT  
NO. SAA3-1724, DATED 12/19/2022 (ANNEX NUMBER 07).

ARTICLE 1. PURPOSE

This Annex shall be for the purpose of supporting Northrop Grumman's (NG) evaluation of their sub-kilowatt Hall Current Thruster (HCT) through extension of an electromagnet thermal cycle test and performance of two segments of short duration thruster operation.

ARTICLE 2. RESPONSIBILITIES

**A. NASA will use reasonable efforts to:**

1. Continue an electromagnet thermal cycle test for four (4) months (approximately 800 cycles). (Background: This test was initiated under a different funding mechanism, which concludes September 31, 2024.)
2. Provide the diagnostics, data acquisition system, and thrust stand for a 350-hour short duration wear test in Vacuum Facility 8 (VF8).
3. Provide the diagnostics, data acquisition system, and thrust stand for two weeks of thruster characterization testing in VF8.
4. Provide the necessary support personnel to operate and maintain the Magnet Cycle Rig (MCR) and VF8.
5. Provide research engineers to operate the NG HCT in VF8 when NG personnel are not onsite at GRC.
6. Promptly communicate in writing any test anomalies to NG.
7. Ship recovered xenon to NG's xenon processing vendor.
8. Participate in NG-led regular meetings to discuss test progress, as needed, as agreed upon between both parties.
9. Participate in NG-led data reviews to discuss test results, as needed, as agreed upon between both parties.

**B. NG will use reasonable efforts to:**

1. Provide personnel to oversee installation, operation, and removal of the NG HCT, at the minimum during key test events (GRC will otherwise operate the HCT according to NG test procedures).
2. Provide a test plan, provide test procedures, and conduct a Test Readiness Review (TRR) for each test in VF8 prior to commencement of the tests
3. Provide all xenon propellant required for the full duration of testing in VF8.
4. Provide empty bottles appropriate for xenon recovery.
5. Make arrangements with a vendor for processing recovered xenon, and provide NASA GRC all required information and documentation to ship the recovered xenon to the vendor.
6. Perform the majority of the data processing required to extract meaning from the raw test data.
7. Lead all regular meetings and reviews.

### 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. GRC resumes electromagnet thermal cycle test.   | Approximately October 2024. |
| 2. GRC completes electromagnet thermal cycle test.                                       | Approximately February 2025 |
| 3. NG delivers HCT and test plan to GRC for HCT Short Duration Wear Test (SDWT).         | Approximately October 2024  |
| 4. NG delivers adequate xenon and xenon recovery bottles to conduct the HCT SDWT to GRC. | Approximately October 2024. |
| 5. NG holds TRR for HCT SDWT with GRC.   | Approximately October 2024. |
| 6. GRC conducts HCT SDWT in VF8.   | Approximately October 2024. |
| 7. NG delivers HCT and test plan to GRC for HCT characterization.                        | Approximately January 2025. |
| 8. NG delivers adequate xenon and xenon recovery bottles                                 | Approximately January       |

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| to conduct the HCT characterization to GRC.                        | 2025.  |
| 9. NG holds TRR for HCT characterization with GRC.                 | Approximately January 2025.                    |
| 10. GRC conducts two (2) weeks of HCT characterization in VF8.     | Approximately January 2025.                    |
| 11. GRC ships recovered xenon to NG's processing vendor.           | As needed as agreed upon between the Parties.  |
| 12. NG and GRC support meetings and reviews.                       | As needed and agreed upon between the Parties. |
| 13. GRC delivers all test data and supporting documentation to NG. | As needed as agreed upon between the Parties.  |

#### ARTICLE 4. FINANCIAL OBLIGATIONS

A. Partner agrees to reimburse NASA an estimated total cost of \$165,458 for NASA to carry out its responsibilities under this Annex in accordance with the following payment schedule:

The Partner agrees to pay NASA GRC \$50,164 prior to initiation of work under this Agreement, \$59,994 one week prior to the start of Milestone No. 03 (preparations for HCT SDWT), and \$55,300 one week prior to the start of Milestone No. 07 (preparations for HCT characterization).

Each payment shall be marked with [GRC and SAA3-1724-07].

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 120 business 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 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 two (2) years 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. TERMINATION

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

Eric J. Pencil  
Project Manager  
Mail Stop: 301-3  
21000 Brookpark Road  
Cleveland, OH 44135

Northrop Grumman

Tactical Space Systems Division (TSSD)  
Michael Glogowski  
NG Fellow / MEP Chief Engineer  
45101 Warp Drive  
Dulles, VA 20166-6874

Phone: 216.977.7463  
eric.pencil@nasa.gov

Phone: 703.406.5448  
michael.glogowski@ngc.com

**Technical Points of Contact**

NASA  
Gabriel F. Benavides  
Research AST  
Mail Suite: 301-3  
21000 Brookpark Road  
Cleveland, OH 44135  
Phone: 216.433.2914  
gabriel.f.benavides@nasa.gov

Northrop Grumman  
Tactical Space Systems Division (TSSD)  
Alex Nikrant  
Principal Mechanical Engineer  
45101 Warp Drive  
Dulles, VA 20166-6874  
Phone: 703.406.5631  
alex.nikrant@ngc.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**

NATIONAL AERONAUTICS AND  
SPACE ADMINISTRATION  
GLENN RESEARCH CENTER

NORTHROP GRUMMAN  
TACTICAL SPACE SYSTEMS  
DIVISION (TSSD)

BY: \_\_\_\_\_  
Michael J. Barrett  
Director of Space Flight Systems

BY: \_\_\_\_\_  
Alan Hegarty  
Principal Subcontract Administrator

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

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