

NONREIMBURSABLE INTERAGENCY AGREEMENT IA1-39762  
BETWEEN  
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
LANGLEY RESEARCH CENTER  
AND  
THE AIR FORCE OFFICE OF SCIENTIFIC RESEARCH  
FOR  
COLLABORATION REGARDING RADIATIVE HEAT TRANSFER THROUGH  
FIBROUS INSULATIONS

ARTICLE 1. AUTHORITY AND PARTIES

The National Aeronautics and Space Administration Langley Research Center, located at Langley Research Center, Hampton, VA 23681 (hereinafter referred to as "NASA" or "NASA LaRC") enters into this Interagency Agreement (hereinafter referred to as "IAA") in accordance with 51 U.S.C. § 20113(e). The Air Force Office of Scientific Research, located at 875 North Randolph Street, Suite 325, Arlington, VA 22203-1768 (hereinafter referred to as "AFOSR") enters into this IAA in accordance with Space Act, Other Transactions Authority (OTA), 51 U.S.C. § 20113(e). NASA and AFOSR may be individually referred to as a "Party" and collectively referred to as the "Parties."

ARTICLE 2. PURPOSE

This IAA shall be for the purpose of leveraging the Parties' relevant research efforts to investigate the use of fibrous media as radiative thermal insulation materials. Accurate and efficient modeling is necessary to understand performance and to address design and manufacturing issues including sensitivity and tolerance issues. Efficient thermal insulation is necessary to protect entry vehicles in extreme environments. Radiation is the dominant mode of heat transfer at low pressure and high temperatures, and fibrous materials have received considerable interest as thermal insulations due to their attractive radiative heat transfer properties, low mass, and flexibility. Both NASA LaRC and the AFOSR are interested in the design and manufacture of efficient fibrous insulations for entry systems and hypersonic flight. NASA LaRC is interested in low mass and flexible fibrous insulations that will provide protection from radiative heat transfer in Hypersonic Inflatable Aerodynamic Decelerator (HIAD) and hot structure applications. Since the manufacturing and characterization of these materials with the desired parameter variations is challenging, achieving novel material designs is not feasible using brute force manufacturing and characterization techniques. AFOSR is currently funding the following low Technology Readiness Level (TRL) research efforts (0-2):

- "Computational Models of Radiative Heat Transfer Through Fibrous Thermal Insulation Protection Materials"; AFOSR Grant FA8655-23-1-7007 to Sabanci University; PI, Kursat Sendur
- "Electromagnetically Induced Modification of Metal Optical Properties"; FA9550-21-1-0339 w/ Kansas State University; PI, Matthew Berg (research applies to optical properties of fibers as well as opacifiers)

- "Predictive Models for High Temperature Fibrous Insulation"; AFOSR Grant FA9550-23-1-0335 to National University of Colombia; PIs, Jose Ramirez and Sergio Carvajal
- "Focused Manufacturing of Hypersonic Materials"; AFOSR Grant FA9550-22-1-0061 to State University of New York (SUNY); PI, Gary Scott

This collaboration will enable the development and validation of high-fidelity computational models for radiation heat transfer in fibrous thermal insulation materials. The validated models will be utilized to explore novel designs for efficient flexible fibrous materials in thermal protection systems (TPS) for aerospace applications such as HIAD and hypersonic vehicles.

This IAA supports NASA's 2022 Strategic Goal 3: Catalyze Economic Growth And Drive Innovation To Address National Challenges, Strategic Objective 3.1 Innovate and advance transformational space technologies, and the Entry Systems Modeling (ESM) project which is pursuing improved radiative models and characterization of fibrous TPS materials.

### ARTICLE 3. RESPONSIBILITIES

A. NASA LaRC will use reasonable efforts to:

1. Collaborate with AFOSR via meetings and technical exchange regarding computational modeling efforts needed to predict optical properties of fibrous thermal insulation materials and solve the radiation transport equation.
2. Develop efficient solution methodologies for the radiation transport equation.
3. Provide AFOSR with solution methodologies for the radiation transport equation and relevant data results and analyses resulting from NASA in-house high-fidelity computational modeling efforts.

B. AFOSR will use reasonable efforts to:

1. Collaborate with NASA LaRC via meetings and technical exchange regarding computational modeling efforts needed to predict optical properties of fibrous thermal insulation materials and solve the radiation transport equation.
2. Develop solution methodologies for predicting optical properties of fibrous thermal insulation materials.
3. Provide NASA LaRC with AFOSR optical properties and the solution methodologies for the predicting the optical properties.

### ARTICLE 4. SCHEDULE AND MILESTONES

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

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|--------------------------------|-----------------------|
| 1. Authority to Proceed (ATP). | Effective Date of IAA |
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| 2. NASA LaRC and AFOSR to collaborate via meetings and technical exchange regarding computational modeling efforts needed.   | As agreed upon during period of performance. |
| 3. AFOSR to provide NASA LaRC with optical properties and the solution methodologies for predicting the optical properties.  | Within six (6) months following Milestone 1  |
| 4. NASA LaRC to provide AFOSR with solution methodologies for the radiation transport equation and relevant data results and analyses resulting from NASA in-house high-fidelity computational modeling efforts. | Within five (5) months following Milestone 3 |

#### ARTICLE 5. FINANCIAL OBLIGATIONS

There will be no transfer of funds between the Parties under this IAA and each Party will fund its own participation. All activities under or pursuant to this IAA are subject to the availability of funds, and no provision of this IAA shall be interpreted to require obligation or payment of funds in violation of the Anti-Deficiency Act (31 U.S.C. § 1341).

#### ARTICLE 6. PRIORITY OF USE

Any schedule or milestone in this IAA is estimated based upon the Parties' current understanding of the projected availability of its respective goods, services, facilities, or equipment. In the event that either Party's projected availability changes, NASA or AFOSR, respectively, shall be given reasonable notice of that change, so that the schedule and milestones may be adjusted accordingly. The Parties agree that NASA's and AFOSR's use of its own goods, services, facilities, or equipment shall have priority over the use planned in this IAA.

#### ARTICLE 7. LIABILITY

- A. Each Party hereby waives any claim against the other Party or one or more of its Related Entities (defined below) for any injury to, or death of, the waiving Party or one or more of its Related Entities, or for damage to, or loss of, the waiving Party's property or the property of its Related Entities arising from or related to activities conducted under this Agreement, whether such injury, death, damage, or loss arises through negligence or otherwise, except in the case of willful misconduct.
- B. AFOSR further agrees to extend this waiver to its related entities by requiring them, by contract or otherwise, to waive all claims against NASA and its Related Entities for injury, death, damage, or loss arising from or related to activities conducted under this Agreement. For purposes of this Agreement, "Related Entities" shall mean contractors and subcontractors of a Party at any tier; grantees, investigators, customers, and users of a Party at any tier and their contractors or subcontractor at any tier; or, employees of the Party or any of the foregoing.

C. Notwithstanding the other provisions of this Article, the waivers of liability set forth in this section shall not be applicable to:

- i. Claims between a Party and its own Related Entity or between its own Related Entities;
- ii. Claims made by a natural person, his/her estate, survivors, or anyone claiming by or through him/her (except when such person or entity is a Party to this Agreement or is otherwise bound by the terms of this waiver) for bodily injury to, or other impairment of health of, or death of, such person;
- iii. Claims for damage caused by willful misconduct;
- iv. Intellectual property claims;
- v. Claims for damage resulting from a failure of a Party to extend the waiver of liability to its Related Entities, pursuant to paragraph B of this Article; or
- vi. Claims by a Party arising out of or relating to another Party's failure to perform its obligations under this Agreement.

#### ARTICLE 8. INTELLECTUAL PROPERTY RIGHTS - DATA RIGHTS

NASA and AFOSR agree that the information and data exchanged in furtherance of the activities under this IAA will be exchanged without use and disclosure restrictions unless required by national security regulations (e.g., classified information) or as otherwise provided in this IAA or agreed to by NASA and AFOSR for specifically identified information or data (e.g., information or data specifically marked with a restrictive notice).

#### ARTICLE 9. INTELLECTUAL PROPERTY RIGHTS - HANDLING OF DATA

A. In the performance of this IAA, NASA or AFOSR (as "Disclosing Party") may provide the other Party (as "Receiving Party") with:

1. data of third parties that the Disclosing Party has agreed to handle under protective arrangements or is required to protect under the Trade Secrets Act (18 U.S.C. § 1905) ("Third Party Proprietary Data"), or
2. Government data, including software, the use and dissemination of which, the Disclosing Party intends to control ("Controlled Government Data").

B. All Third-Party Proprietary Data and Controlled Government Data provided by Disclosing Party to Receiving Party shall be marked by Disclosing Party with a restrictive notice and protected by Receiving Party in accordance with this Article.

C. 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.

1. Third-Party Proprietary Data: The Disclosing Party's Third-Party Proprietary Data, if any, will be identified in a separate technical document.

2. Controlled Government Data: The Disclosing Party's Controlled Government Data, if any, will be identified in a separate technical document.
3. NASA Software and related Data: NASA Software and Related Data, if any, will be identified in a separate document. Notwithstanding paragraph D of this Article, such identified NASA Software and related Data will be provided to AFOSR under a separate Software Usage Agreement (SUA).

D. For such Data identified with a restrictive notice pursuant to paragraph B of this Article, including Data identified in an accompanying funding document, Receiving Party shall:

1. Use, disclose, or reproduce such Data only as necessary under this IAA;
2. Safeguard such Data from unauthorized use and disclosure;
3. Allow access to such Data only to its employees and any Related Entity requiring access under this IAA;
4. Except as otherwise indicated in D.3., preclude disclosure outside Receiving Party's organization;
5. Notify its employees with access about their obligations under this Article and ensure their compliance, and notify any Related Entity with access about their obligations under this Article; and
6. Dispose of such Data as Disclosing Party directs.

E. If the Parties exchange Data having a notice deemed ambiguous or unauthorized by the receiving Party, it should tell the providing Party. If the notice indicates a restriction, the receiving Party must protect the Data under this Article unless otherwise directed in writing by the providing Party.

F. Notwithstanding any restrictions provided in this Article, the Parties are not restricted in the use, disclosure, or reproduction of Data provided under this IAA that is:

1. known or available from other sources without restriction;
2. known, possessed, or developed independently, and without reference to the Proprietary Data;
3. made available by the owners to others without restriction; or
4. required by law or court order to be disclosed.

If a Party believes that any exceptions apply, it shall notify the other Party before any unrestricted use, disclosure, or reproduction of the Data.

## ARTICLE 10. INTELLECTUAL PROPERTY RIGHTS - INVENTION AND PATENT RIGHTS

Unless otherwise agreed upon by NASA and AFOSR, custody and administration of inventions made (conceived or first actually reduced to practice) under this IAA will remain with the respective inventing Party. In the event an invention is made jointly by employees of the Parties (including by employees of a Party's contractors or

subcontractors for which the U.S. Government has ownership), the Parties will consult and agree as to future actions toward establishment of patent protection for the invention.

ARTICLE 11. RELEASE OF GENERAL INFORMATION TO THE PUBLIC AND MEDIA

NASA or AFOSR may, consistent with Federal law and this IAA, release general information regarding its own participation in this IAA as desired. Insofar as participation of the other Party in this IAA is included in a public release, NASA and AFOSR will seek to consult with each other prior to any such release, consistent with the Parties' respective policies.

Pursuant to Section 841(d) of the NASA Transition Authorization Act of 2017, Public Law 115-10 (the "NTAA"), NASA is obligated to publicly disclose copies of all agreements conducted pursuant to NASA's 51 U.S.C. §20113(e) authority in a searchable format on the NASA website within 60 days after the agreement is signed by the Parties. The Parties acknowledge that, if this IAA is entered into pursuant to NASA's 51 U.S.C. §20113(e) authority, this IAA will be disclosed, without redaction, in accordance with the NTAA.

ARTICLE 12. TERM OF AGREEMENT

This IAA 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 January 31, 2025, whichever comes first.

ARTICLE 13. RIGHT TO TERMINATE

Either Party may unilaterally terminate this IAA by providing thirty (30) calendar days written notice to the other Party.

ARTICLE 14. CONTINUING OBLIGATIONS

The rights and obligations of the Parties that, by their nature, would continue beyond the expiration or termination of this IAA, e.g., "Liability and Risk of Loss" and "Intellectual Property Rights" and related clauses shall survive such expiration or termination of this IAA.

ARTICLE 15. POINTS OF CONTACT

The following personnel are designated as the Points of Contact between the Parties in the performance of this IAA.

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| Management Points of Contact                          |   |
| <u>NASA Langley Research Center</u><br>Laurie Roberts | <u>Air Force Office of Scientific Research</u><br>Ali Sayir |

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| Agreements Lead, Space Technology and<br>Exploration Directorate<br>Mail Stop: 104<br>Hampton, VA 23681<br>p. 757.814.6727<br>e. laurie.d.roberts@nasa.gov                                   | Program Manager for Materials for<br>Extreme Environments<br>875 North Randolph Street<br>Suite 325<br>Arlington, VA 22203-1768<br>p. 703.696.7236<br>e. ali.sayir.2@us.af.mil  |
| Technical Points of Contact  |   |
| <u>NASA Langley Research Center</u><br>Christopher G. Lang<br>Research AST, Structural Mechanics<br>Mail Stop: 190<br>Hampton, VA 23681<br>p. 757.864.9694<br>e. christopher.g.lang@nasa.gov | <u>Air Force Office of Scientific Research</u><br>Ali Sayir<br>Program Manager for Materials for<br>Extreme Environments<br>875 North Randolph Street<br>Suite 325<br>Arlington, VA 22203-1768<br>p. 703.696.7236<br>e. ali.sayir.2@us.af.mil |

#### ARTICLE 16. DISPUTE RESOLUTION

All disputes concerning questions of fact or law arising under this IAA shall be referred by the claimant in writing to the appropriate person identified in this IAA as the "Points of Contact." The persons identified as the "Points of Contact" for NASA and AFOSR will consult and attempt to resolve all issues arising from the implementation of this IAA. If they are unable to come to agreement on any issue, the dispute will be referred to the signatories to this IAA, or their designees, for joint resolution after the Parties have separately documented in writing clear reasons for the dispute. As applicable, disputes will be resolved pursuant to The Department of the Treasury's Intragovernmental Transaction Guide (Treasury Financial Manual, Vol. 1, Chapter 2, Part 4700, Appendix 10 (hereinafter, the "Intragovernmental Transaction Guide")).

#### ARTICLE 17. MODIFICATIONS

Any modification to this IAA shall be executed, in writing, and signed by an authorized representative of NASA and the AFOSR.

#### ARTICLE 18. APPLICABLE LAW

U.S. Federal law governs this IAA for all purposes, including, but not limited to, determining the validity of the IAA, the meaning of its provisions, and the rights, obligations and remedies of the Parties.

ARTICLE 19. LOAN OF GOVERNMENT PROPERTY

The parties shall enter into a NASA Form 893, Loan of NASA Equipment, for NASA equipment loaned to AFOSR.

ARTICLE 20. SIGNATORY AUTHORITY

Approved and authorized on behalf of each Party by:

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| NATIONAL AERONAUTICS AND<br>SPACE ADMINISTRATION<br>LANGLEY RESEARCH CENTER                  | AIR FORCE OFFICE OF SCIENTIFIC<br>RESEARCH  |
| BY: _____<br>Greg Stover<br>Acting Director, Space Technology and<br>Exploration Directorate | BY: _____<br>Colonel Janelle T.H. Jackson, USAF<br>Acting Director of AFOSR/Det 14<br>Commander |
| DATE: _____  | DATE: _____   |