STATEMENT OF WORK

Machinery Upgrades in support of Mars Exploration program PICA-Flex Thermal Protection System (TPS) Material

February 2025

National Aeronautics and Space Administration
Ames Research Center

Moffett Field, California

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1.0 Background

For the past three decades, Super Lightweight Ablator 561V (SLA-561V), Phenolic Impregnated Carbon Ablator (PICA), and Conformal PICA (C-PICA) developed in the Thermal Protection Materials Branch at NASA Ames Research Center has been the State of the Art (SoA) in ablative entry materials for Mars entry, Earth sample return, and return from Low Earth Orbit (LEO). SLA-561V requires first attaching honeycomb to the structure and then a hand packing operation into honeycomb cells. SLA-561V is not capable of surviving all future potential Mars entry missions, and is proprietary to Lockheed, resulting in limited applicability to the broader community. PICA and C-PICA are expensive, require a lengthy carbonization and infusion process involving complex equipment and infrastructure, which yield toxic byproducts, and require complex machining and integration techniques to create the tiled heatshield assembly with RTV (room-temperature-vulcanizing silicone) gap fillers. While both PICA and C-PICA have similar processes and can withstand ~1500 W/cm^2 at 1 atm, this is not required for Mars missions. Furthermore, these materials are not optimized for mass in low to moderate heat flux entry environments of interest to the Mars Exploration Program. While not as capable as a single piece PICA or C-PICA heatshield, all previous Mars mission fit within the expected performance capability of PICA-Flex (500 W/cm^2 0.5 atm).

Under a Mars Exploration Program proposal award, NASA Ames is working to establish Near-Net Shape (NNS) needling capability for fabrication of a single piece NNS PICA-Flex Thermal Protection System (TPS) at ~1m in diameter, extendable to ~5m, while continuing the characterization and development of PICA-Flex with targeted operational environments up to 500 W/cm^2. PICA-Flex, currently under development through an Internal Research and Development (IRAD) effort at NASA Ames, is a low-cost, rapidly producible, easily integratable flexible ablative TPS blanket that satisfies functional performance requirements of future Mars missions. While automated needling processes are not new, the novelty of the proposed effort is the automation of NNS needling processes to produce a single piece PICA-Flex heatshield using carbon and phenolic fibers that are blended at the batting stage prior to needling. Introducing the carbon and phenolic fibers together early in the manufacturing process eliminates the need for lengthy and costly carbonization and infusion steps, and the blanket nature of the TPS simplifies integration processes, which all will lead to dramatically reduce manufacturing cost by a factor of 3-4 and schedule by more than 50% when compared to traditional rigid PICA ablator systems.

AFFCO is currently the only producer of PICA-Flex material, and the only available provider identified capable of producing carbon/phenolic batting at R&D scales, which are critical to advancing the technology under the current budget.

2.0 Purpose and Scope

The purpose of this Statement of Work (SOW) is to upgrade the PICA-Flex production line at AFFCO by integrating a new feedbox carding line and rigging it into the current system, taking the current hand fabricated operation and integrating it into automatic processes at their facility.

3.0 Project Structure

The contractor shall provide all labor, materials, facilities, service, equipment, analysis, and management necessary to fabricate hardware defined in section 4.0.

4.0 Contract Line-Item Numbers

The effort described by this SOW shall be completed when all subcontract Contract Line Item Numbers (CLINS), defined in Table 1, are complete.

Table 1: Contract Line-Item Numbers (CLINS)

Line Item #	Part	[redacted]
1	Feedbox Card Line	[redacted]
2	Machinery Rigging Cost	[redacted]

5.0 Applicable Documents – N/A NASA Only.

6.0 Description of Tasks and Technical Requirements

6.1 Description of Tasks

Vendor is to procure and integrate new feedbox into the PICA-Flex card line per requirements specified in Section 6.2 of this document.

6.2 Technical Requirements

Technical requirements are documented below:

- Vendor shall have previous experience with fabrication of flight quality PICA-Flex TPS material
- Vendor shall be certified to ISO 9001 or better.
- Vendor shall procure and install a new feedbox card line capable of blending carbon and phenolic yarns together, in preparation for producing batting with a nominal width dimension of 48 inches.

7.0 Schedule

Table 2. Schedule for Deliverables

Activity	Responsible	Start Date	Delivery Date
Procurement of Feedbox	Subcontractor	March 2025	August 2025
Installation of feedbox into carding line	Subcontractor	March 2025	September 2025

8.0 Government-Furnished Property, Material, Equipment, or Information (GFP/M/E/I)

N/A

9.0 Travel

No travel costs anticipated.

10.0 Period of Performance

The period of performance for this effort shall be from March 2025 to September 2025.

11.0 Point of Contact (P.O.C) Information

NASA Ames Point of Contact (POC):

- Thermal Protection Materials and Systems Branch
- Address: Building 234 Room 117, NASA Ames Research Center, Moffett Field, CA 94035- 1000

NASA Ames Contract Specialist:

- NASA Ames Contract Specialist:
- Email:
- Address: