# Department of the Navy SBIR/STTR Transition Program

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NAVAIR SPR-2025-0684

Topic # N193-144
A Hypersonic Environmental Testbed for Affordable and Standardized Materials Strength Testing
Physical Sciences Inc.

## WHO

**SYSCOM:** NAVAIR

**Sponsoring Program:** Naval Air Warfare CTR Aircraft Division, Lakehurst, NJ

**Transition Target:** Low-cost, contamination free materials testing in flows simulating hypersonic flight, with the hypersonic materials mechanical strength (HMMS) testbed.

**TPOC:** (301) 342-8074

**Other Transition Opportunities:** Direct sales of the of the hypersonic materials mechanical strength (HMMS) testbed

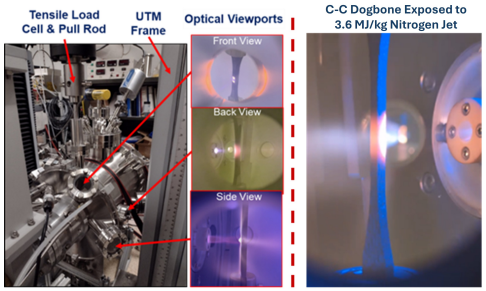


Image courtesy of Physical Sciences Incorporated

**Notes:** Figure Caption: Hypersonic materials mechanical strength (HMMS) testbed with 3 views of a dogbone sample during tensile testing.

HMMS Key Performance Parameters: Simulated Mach Number 3-17, Equivalent Altitude: 15-65 km; Max. heating rate:1500 W/cm2; Mechanical load capacity 50 kN; Treatment diameter less than 25 mm; Test cost per sample less than $500.

## WHAT

**Operational Need and Improvement:** The hypersonic materials mechanical strength (HMMS) testbed provides a low cost, high throughput, contamination free alternative to relatively expensive arc-jet testing for components and articles less than 1" in diameter. The testbed fills a current gap in DoD test infrastructure by providing the capability to measure mechanical strength properties under simulated hypersonic flight conditions.

**Specifications Required:** HMMS Key Performance Parameters: Simulated Mach Number 3-17, Equivalent Altitude: 15-65 km; Max. heating rate: 1500 W/cm2; Relevant flow velocities: 1.5-5 km/s; Enthalpies 1-14 MJ/kg, Stagnation Temperature 2300-5500 K; Mechanical load capacity 50 kN; Test cost per sample less than $200 per sample.

**Technology Developed:** Controlled, accurate, in-situ mechanical strength testing of samples in a hypersonic environment, with low cost (less than $500/sample) and high-throughput (~ 8 samples per day).

**Warfighter Value:** The technology provides an inexpensive, contamination free alternative to arc-jet testing of leading-edge component materials for hypersonic applications. In addition, the technology fills a current gap in DoD test infrastructure by providing the capability to measure mechanical strength properties under simulated hypersonic flight conditions. The technology therefore helps establish the viability of new material designs under development for hypersonic and /or propulsion systems applications. This new test capability helps accelerate the development cycle and reduce development costs of hypersonic and propulsion materials systems.

## WHEN

**Contract Number:** N68335-21-C-0683 **Ending on:** Jul 21, 2023

| Milestone | Risk Level | Measure of Success | Ending TRL | Date |
|---|---|---|---|---|
| Design Review | Low | Navy approval of Phase II design | 3 | 2nd QTR FY23 |
| Performance Validation Testing Complete | Low | Meet or exceed key performance parameters | 4 | 2nd QTR FY24 |
| Integrated Pumping System | Medium | Pump Enables Operation Over Specified Altitude Range | 5 | 4th QTR FY25 |
| Testbed Delivery | Medium | Successful Factory Acceptance Testing at NAVAIR | 6 | 3rd QTR FY26 |

## HOW

**Projected Business Model:** The projected business model of the HMMS testbed technology is based on two paths: 1) commercial testing services/contracts in which Physical Sciences Incorporated maintains a test facility and conducts sample testing for customers, and 2) sales of the HMMS testbed systems.

**Company Objectives:** To provide the Defense Community with alternative low-cost, high throughput materials HMMS testbed testing services and sales for developing thermal protection systems and materials for hypersonic applications.

**Potential Commercial Applications:** The MIDJet(TM) technology, a core component of the larger HMMS testbed technology, has commercial applications in semi-conductor processing, chemical vapor deposition, waste remediation, and as a source for high-power chemical lasers.

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