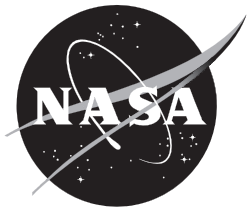

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Facilities Requirements Document

NASA White Sands Test Facility
TS-406 Thrust Measurement System

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Abbreviations

DR	Design Review
FRCR	Facilities Requirements Change Request
FRD	Facility Requirements Document
SCT	Safety Critical Threshold
SSA	System Safety Analysis
TMS	Thrust Measurement
TS	Test Stand
WSTF	White Sands Test Facility

1.0 Introduction

The Propulsion Test Office at the NASA White Sands Test Facilities (WSTF) supports various NASA programs including flight hardware acceptance and qualification testing of reaction control engines and other propulsion components. Thrust measurement systems (TMS) are an integral part of the test systems, providing test article thrust performance verification.

2.0 Objective

The objective of this document is to establish the technical requirements for replacing the current obsolete TMS. The current system is no longer supported by industry and does not provide the capability and capacity required to support Propulsion's current and future needs.

3.0 Facilities Requirements

3.1 General Requirements

Specifications listed below are minimum system requirements. The Vendor shall provide the listed items.

3.1.1 Thrust Stand

- Measure up to 200-lbf in the primary axial direction.
- Configured to interface to the current test stand mounting table.
- System accuracy of 0.15% or better from 0 to 200-lbf (full scale).
- System shall support field replaceable load and calibration cells.
- Load cell(s) shall be dual bridge with overload safety factor of 1.5 times the full-scale value.
- Interface to the load cell shall be a PT02E-10-6P connector with the following pin outs:
  - Pin A: + Excitation
  - Pin B: + Signal (positive reading for tension)
  - Pin C: - Signal
  - Pin D: - Excitation
  - Pin E: - Sense
  - Pin F: + Sense
- Designed to handle a Safety Critical Threshold (SCT) minimum safety factor of 3.0 on yields for all steady state, transient, and dynamic loads.
- Universal flexures shall have a safety factor of at least 1.5 to yield.
- Provide fluid & wiring schematics, CAD models, operation manuals, data reduction equations, and bill of materials.

3.1.2 Calibration System

- Include an integrated pneumatically actuated and remotely controlled calibration system.
- Pneumatic system shall operate using a nitrogen supply of:
  - Max 250 PSIG
  - Nominal 200 PSIG

- Include an automated calibration system for the TMS. This shall include software, a computer, 19-in. rack mountable control system.
- Shall utilize bridge B of the load cell(s) to verify bridge A.
- Calibration Pneumatic Controls will be in a National Electrical Manufacturers Association (NEMA)™[1] 4 enclosure.

3.1.3 Operational Environment

- Painted portions of the system will utilize two-part epoxy hypergolic resistant paint made by Sherwin Williams.
- Operate within the following environmental conditions unless specifically stated within this document:
  - Temperature range 0 °C to 65 °C.
  - Relative humidity range 20% to 80% noncondensing.
  - Operate in a vacuum down to 0.01 psia.

3.1.4 WSTF Deliverables

WSTF shall provide the following items.

- Cabling between the bunker to the test stand.
- Test stand mounting plate.
- Thruster mounting interface specification.
- Specific hardware to integrate with WSTF existing nitrogen supply system.
- Specification/part number of the two-part epoxy hypergolic resistant paint made by Sherwin-Williams®[2].
- Work with the vendor to provide WSTF's knowledge and experience to implement precision control of the pneumatic cylinder for calibration.
- Load cell mating connector PT06E-10-6P-SR.

4.0 Verification/Validation Requirements

The system will be verified and validated in accordance with standard WSTF procedures based on the requirements outlined in this document. Yield strength shall be provided for all components. Welded parts shall be inspected by a third party per ASTM E1444 (2026).

5.0 Reports and Reviews

Changes to the facility will be subject to a design review (DR) and a system safety analysis (SSA). All official documentation for the SSA/DR review process shall be archived by the WSTF Propulsion Test Office.

[1] NEMA™ trademark pending, National Electrical Manufacturers Association, Rosslyn, VA.
[2] Sherwin-Williams® is a registered trademark of SWIMC LLC, Cleveland, OH.

6.0 Identification of Existing Hardware to be Used

WSTF's existing bunkers, cableways, facilities power, nitrogen system, and test stand mounting structure at Test Stand (TS-)406 will be utilized.

7.0 Facilities Requirements Document Changes, Special Processes, and Nonconforming Product

All changes to this facility requirements document (FRD) will be authorized by a facilities requirements change request (FRCR).

The Project Manager, Project Leader, and the Design Review Committee must approve all products not conforming to design specifications prior to use.

All changes to this FRD will be authorized by a facilities requirements change request.

No special processes are required.

8.0 Schedule

System Final Design shall be completed by September 30, 2026.

Hardware listed in the document shall be procured by November 30, 2026.

Installation, integration, and system verification and validation shall be completed by January 31, 2027.

References

ASTM E1444. *Standard Practice for Magnetic Particle Testing for Aerospace*. American Society of Testing Materials (ASTM International), West Conshohocken, Pennsylvania, May 2026.