Educational Opportunities with NASA White Sands Test Facility

Joe Bullington
Commercialization Manager
Jacobs Technology
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WSTF Background

- Constructed 1962-64 to Support Apollo Project
- Component Facility of NASA Johnson Space Center
- Occupies 28 square miles of the SW Corner of White Sands Missile Range (WSMR)
- Annual Budget ~$85 Million (FY18)
- Headcount – 662
  - 47 NASA
  - 19 JSC matrixed
  - 596 Contractor
WSTF Background (Con’t)

- Large Buffer Zone and Controlled Remote Property for Hazardous Testing
- Moderate Desert Climate Ideal for Year-round Testing
- Environmental Permits in Place for Hazardous Testing
Customer Base

**Johnson Space Center** - International Space Station, Payloads, Crew Training, and Special Projects

**NASA Headquarters** and Other Field Centers; Orion, SLS, Commercial Crew

Customer Base (Con’t)

**Commercial Industry -**

Aerojet, Armadillo Aerospace, ASTM G4 Community, Blue Origin, Boeing, Cobham, National Center for Manufacturing, Orbital Sciences Corp, Pratt & Whitney, Scaled Composites, Inc., SpaceX, and WHA International
Orion

- Crew Cabin Materials and Experiment
- Engine Testing
- Propulsion Thruster Maintenance and Repair
- Hypervelocity Impact Testing (Orbital Debris Impact)
- Materials Compatibility
- Offgassing
- Composite Overwrapped Pressure Vessels
Space Launch System (SLS)

- Engine Testing
- Composite Overwrapped Pressure Vessels
- Materials Compatibility
- Offgassing
- Payloads
Core Capabilities

• Rocket Propulsion Testing and Evaluation
• Oxygen Systems Testing and Analysis
• Propellants and Aerospace Fluids Testing and Analysis
• Hypervelocity Impact Testing
• Composite Pressure Systems Testing and Analysis
• Flight Acceptance Standard Test
• Spaceflight Component Services
Rocket Propulsion Testing and Evaluation

Boeing CST-100
Launch Abort Engine (LAE)
Acceptance Testing

Boeing CST-100
Service Module on Test
Stand 301A in Preparation
for Hotfire Testing

Reaction Control System (RCS)
Boeing CST-100
Acceptance Altitude Testing
Oxygen Systems Testing and Analysis

Promoted Ignition of a Copper Rod in 1000 psi Oxygen

Ignition of a Teflon Hose in 1000 psi Oxygen
Propellants and Aerospace Fluids Testing and Analysis

Dual Tube Frangible Joint Test

Propellants and Characterization Testing
Hypervelocity Impact Testing

ISS Soyuz Vehicle Descent Module Test Article

COPV Target

Gun Lab

Whipple Shield
Composite Pressure System Testing and Analysis

- Broken COPV Fiber
- Mechanical Impact Testing
- Thermal De-Ply Analysis
- Post-Test COPV MMOD Burst Test Article
Flight Acceptance Standard Test

- Odor
- Offgass Toxicity
- Upward Flammability
- Heated Promoted Combustion
- LOX Mechanical Impact
Spaceflight Component Services (SCS)

OMS Engine Setup and Test Preparation

R40b Thruster
Test Facilities

• Rocket Engine System Test Stands with Vacuum
• Long-duration Large-altitude Simulation System
• Full-scale Hypergolic and Cryogenic Propulsion Test Systems
• Chemistry and Metallurgical Laboratories
• Flight Component Repair, Refurbishment, and Test Facilities
• High Energy Blast Facility
• Oxygen-enriched Atmosphere Test Facilities
• Hypergolic Materials and Components Test Facilities
• Remote Hypervelocity Test Laboratory Impact Test Facilities
Enabling Capabilities
Chemistry and Materials Laboratories

- MDAL Offgassing
- Space Environment Simulation
- Propellant Characterization
- Materials Technology
- Instrumentation Analytical & Analysis
Enabling Capabilities
Technical Services

Precision Cleaning of Flight Critical Items

Measurement Standards and Calibration Lab

Industrial and Scientific Imaging and Documentation
Enabling Capabilities

Machine

Weld

Valve Repair
Enabling Capabilities
Safety & Mission Assurance

• Performance and Configuration Mgt
  • Work Coordination, Asset Mgt, Project Leads, Drawing Control, Logistics

• Operations and Design
  • Design, Facility Maintenance, Electrical, HVAC, Heavy Equipment, and Plumbing
Enabling Capabilities
Safety & Mission Assurance

• Quality
• Safety
• Emergency Management Services
Environmental

Environmental Compliance

Environmental Restoration

Propellant Wastewater and Container Management

Plume-Front Groundwater Treatment System
WSTF Training Courses

- Oxygen Systems: Operation & Maintenance
- Fire Hazards in Oxygen Systems
- COPV Damage Detection Course
- Composite Pressure Systems and Structure NDE
- Hydrogen Training
- Hypergolic Propellants Training
- Standard Testing Course
Educational Engagement Opportunities

- University Student Interns – NASA (via USRA)
- University Co-Op Students – Jacobs
- Partnership with New Mexico Space Grant Consortium
  - Strategic planning, resources for grantees, etc.
- Engagement with NMSU Arrowhead Center
- Support for NASA-related special events
  - Road Tour, iTech, etc.
- Capstone Projects
  - Innovations & Problem-solving for WSTF
  - NMSU, NM Tech, UTEP
  - Funded by Jacobs
  - Supported by NASA and Jacobs
New Mexico Tech University - 3 Projects

1. Design challenge - How to contain hydrazine propellant, while applying tensile load to strand specimen for an extended period of time. Test chamber must not leak propellant when the tensile specimen ultimately fails. This test capability is crucial to the development of stress corrosion resistant materials for use in propellant storage applications. Ultimately, over two semesters, the team delivered a prototype system.

2. Second phase of work (new semester) worked to develop a similar system capable of containing liquid N2O4 in a similar stress corrosion type of scenario. This is a more complex problem due to the relatively high vapor pressure of N2O4, with containment only required for 2 weeks. A prototype was delivered by the team, validation was not completed due to semester expiration.

3. A new team is being chartered for this upcoming semester (Fall 2019) with the objective of developing an improved composite fiber strand gripping system capable of performance in cryogenic tests. To date, this has proven to be very problematic even for locations such as NASA LaRC.
New Mexico State University

We have sponsored a single team thus far. The team was a combined engineering (mech/elect) and engineering physics team tasked to modify WSTF’s existing PDV (photon Doppler velocimetry) system.

The existing system was only capable of working on highly reflective metallic surfaces, rendering it very limited in application. The team successfully developed and demonstrated an improved capability able to obtain usable data from non-metallic, low-reflectivity surfaces such as those of COPV’s.

At this time the improved system has been successfully demonstrated during pressurized COPV/hypervelocity testing adding a very new and useful capability to WSTF.
Capstone Projects - UTEP

A single project has been done this past semester involving use of additive manufacturing processes to engineer new hypervelocity sabots.

To date, launching of dense projectiles has been difficult as the existing sabot materials could not typically withstand launch forces.

New layered and engineered materials show great promise.

Work is continuing and looks promising - data is being presented in a paper at the Aeroballistic Range Association Meeting at Marquette University this week.
QUESTIONS?

SUGGESTIONS?

Joe Bullington
Commercialization Manager
Jacobs Technology
NASA White Sands Test Facility
Office: 575-525-7660
Cell: 575-202-5581
joe.bullington@nasa.gov
joe.bullington@jacobs.com