



PROPULSION TEST HISTORICAL ACCOMPLISHMENTS

SUMMARY

The White Sands Test Facility (WSTF) was established to perform testing of vital flight systems for the Apollo mission to land men on the Moon. Construction began in 1962, and the first tests were performed in 1964. WSTF Propulsion Testing has been an integral part of every United States manned flight mission and has supported many other programs associated with the safe exploration of space.

APOLLO PROGRAM

Service Module Propulsion System - From 1964 to 1969, fired the service module system and its 20,000-lbf thrust engine simulating the lunar mission duty cycle.

Lunar Module Propulsion System - From 1965 to 1970, performed system development and qualification tests of the 3500-lbf thrust ascent, and the 10,000-lbf thrust descent stages of the lunar module system under simulated altitude conditions. Special sampling and analysis of lunar module descent engine exhaust gas identified possible gas contaminants in the lunar rocks.

PLANETARY MISSION PROGRAMS

Viking Project - Performed landing site alteration test using a 1/3 segment of the Viking Lander.

Pioneer Project - Tested two trajectory insertion, solid-rocket motors under simulated altitude conditions.

Cassini Propulsion Module Main Engine Assembly Qualification Hot Fire Testing - Conducted a series of firings through the entire flight operating range, including a continuous 3-hour 20-minute firing. The Rocket Engine Assembly gimbal platform was moved through its range of motion during firing and non-firing periods.

SHUTTLE ORBITER PROJECT

High-Altitude Reaction Control Subsystem - Characterized off-nominal performance of the Primary Reaction Control Subsystem (PRCS) engines under vacuum conditions with helium gas ingestion, propellant temperature extremes, and various firing durations. This test data was used to characterize vehicle response to propellant acquisition system failures and to develop malfunction procedures.

Vernier Reaction Control Engine Life Test - Qualified the redesign of the combustion chamber fabrication and nozzle silicide coating processes. The tests included more than a million pulse firings of several of the 24-lbf thrust engines in a vacuum chamber.

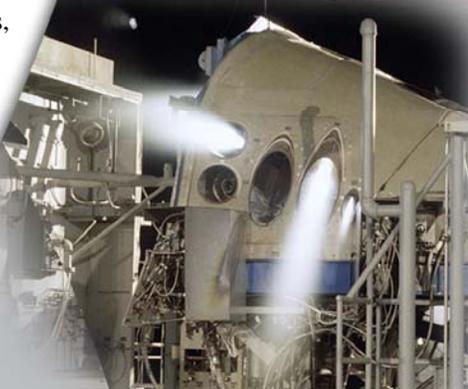
Primary Reaction Control Engine Leak Test - Established engine instrumentation response and helped establish safe operating limits for engines with leaking propellant valves.

Orbital Maneuvering Subsystem (OMS), Aft and Forward RCS Development and Qualification Tests conducted on these three systems include engine firing, propellant loading and off-loading, individual component functional testing, and many other related operations.

OMS, Aft and Forward RCS Propellant Tank Checkout - Designed, fabricated, and checked out the ground support equipment (GSE) for periodic integrity testing of the OMS and RCS propellant acquisition systems that are integral to the Space Shuttle Orbiter hypergolic propellant tanks. Developed the operating procedures and training program for identical GSE at Kennedy Space Center.

Up-rated Orbital Maneuvering Engine (OME) Demonstration - Demonstrated a mission duty cycle and characterized altitude operation of a pump-fed OME with various mixture ratios, start sequences, and purge procedures.

VRCS Reboost Qualification Test - Fired a Shuttle VRCS engine for up to 3 hours continuous duration to verify adequacy for reboosting the Space Station while docked to the Orbiter.



National Aeronautics and Space Administration

LYNDON B. JOHNSON SPACE CENTER
WHITE SANDS TEST FACILITY



OTHER NASA PROGRAMS SUPPORT

Skylab Project - Developed and conducted qualification tests of the Apollo service module RCS engines and propellant storage module used for the Skylab project.

Special Propulsion-Related Projects - Led the development and qualification of toxic vapor detectors and qualified a new personal protection system for hypergolic propellants.

DC-XA Flight Test Program - Refurbished and activated the propellant loading ground systems and provided launch support for the Marshall Space Flight Center DC-XA flight test program.

PRIVATE INDUSTRY PROJECTS

General Electric Industrial Research and Development Project - A private-industry project conducted in 1990 that qualified the hydrazine-nitrogen tetroxide propulsion system being developed by GE for its commercial communication satellite vehicles.

Lockheed Missiles and Space Company Bipropellant Industrial Research and Development Project - Ambient testing of a system that included three hypergolic monomethylhydrazine and nitrogen tetroxide 14-lbf thrust reaction control engines and one 200-lbf thrust hypergolic booster engine.

Solid Rocket Motor Test Projects - Fabricated a high-altitude test chamber for spinning and non-spinning tests of upper-stage geosynchronous orbit insertion rocket motors thrust motors (6,000 to 10,000 lbf) have been fired under simulated altitude conditions in this test chamber.

DEPARTMENT OF DEFENSE PROGRAMS SUPPORT

Minuteman Post-Boost Propulsion System Ageing and Surveillance Tests – Numerous tests to verify no degradation in performance from multi-year storage.

Operation and Deployment Experiments Simulator (ODES) - Conducted a series of engine acceptance and propulsion system qualification tests for Sandia National Laboratories (SNL). Designed and operated a set of GSE to fuel the post-boost vehicle and performed propellant loading at the SNL launch facility.

Mid-Course Space Experiment (MSX) - As a follow-up of the ODES project, provided propellant loading and unloading support and hypergolic propellant safety familiarization training for SNL and the U.S. Army Space and Strategic Defense Command.

Strategic Defense Initiative Delta 180 Payload Adapter System Project - Demonstrated mission duty cycle of the Delta 180 upper stage propulsion system under simulated altitude conditions.

Homing Overlay Experiment (HOE) Project - Qualified the two thrust-level propulsion systems for the first successful kinetic weapon system demonstration.

Integrated Apogee Boost System (IABS) Project - Conducted U.S. Air Force qualification tests on a flight-configured vehicle equipped with two Marquardt 100-lbf thrust R4D engines.

Single Stage Rocket Technology (SSRT) DC-X - In 1993, tested the four Pratt and Whitney RL-10 derivative engines in the 1/3-scale McDonnell Douglas SSRT spacecraft (DC-X) and associated GSE for the Ballistic Missile Defense Office. Designed and constructed the launch facility and supported flight testing at White Sands Missile Range (WSMR).

CONTACT

David L. Baker, NASA White Sands Test Facility, Acting Chief, Propulsion Test Office,
david.l.baker@nasa.gov, (575) 524-5605

