NASAfacts

# Propulsion Testing

## *At John C. Stennis Space Center*

Under NASA Stennis Space Center's Engineering and Science Directorate, rocket engine propulsion test activities are conducted on one-of-a-kind national test facilities collectively valued at more than $2 billion. SSC is America's largest rocket engine test complex and is surrounded by a 125,000-acre acoustical buffer zone, which is considered a national asset. State-of-the-art facilities at SSC include the A, B and E test complexes, designed for rocket propulsion testing that ranges from component to engine to stage level.

SSC was established as a national testing center for flight-certifying all first and second stages of the Saturn V "Moon Rocket" for the Apollo manned lunar landing program.

SSC is the home of NASA's Rocket Propulsion Test Management Board, which has total responsibility to manage all NASA rocket engine testing, including facilities at the Marshall Space Flight Center in Alabama, the White Sands Test Facility in New Mexico and the Glenn Research Center's Plum Brook Station in Ohio.

SSC works directly with the Rocket Propulsion Test Management Board and the National Rocket Propulsion Test Alliance to provide test services to a variety of customers, including NASA, the Department of Defense and commercial entities for the development of propulsion systems, engines, subsystems and components.

**The Moon Rockets, Space Shuttle, and Ares**

The center conducted the first static test firing of the Apollo Saturn V second-stage prototype engine April 23, 1966, and less than a year later, began testing the first and second stages of the rocket. This testing led to one of humankind's most phenomenal achievements when, on July 20, 1969, Americans landed on the moon.

When the Apollo Program ended in December 1972, the test stands were converted from the Apollo/Saturn V configuration to accommodate space shuttle main engines, and on May 19, 1975, the first test of an SSME took place. On April 12, 1981, the first space shuttle, Columbia, lifted off from the launch pad at Kennedy Space Center in Florida, powered by engines tested at SSC.

Every SSME undergoes acceptance testing at SSC. The engine is installed vertically in SSC's A-2 Test Stand, where an acceptance test firing is performed. Once proven flight-worthy, the engine is transported to KSC for installation on an orbiter. SSC also conducts "green run" testing for major SSME components,

**SSC's rocket engine test stands provide test operations for the development and certification of propulsion systems, engines, subsystems and components.**

ensuring all engine parts have been exposed to flight-like environments prior to use on a shuttle flight.

NASA plans to use the space shuttle until its retirement in 2010 to help finish assembly of the International Space Station. To meet that goal, SSC is committed to rigorous testing, important to any flight program, to make sure today's SSMEs are safer, stronger and more reliable than ever.

Meanwhile, the new Ares rocket is being developed to replace the space shuttle as part of NASA's Constellation Program. The Ares I crew launch vehicle and the Ares V cargo launch vehicle will help America return to the moon, then travel to Mars.

The upper stages of the Ares I and Ares V vehicles will be powered by the J-2X engine, currently in development. Core components for development of the J-2X engine are being tested on SSC's A-1 Test Stand.

The first stage of the Ares V cargo launch vehicle will be powered by five Pratt & Whitney Rocketdyne engines. SSC currently is testing and certifying that engine, as well as serving as a developmental rocket engine component and subscale test facility for future-generation rocket engines.

**The Test Stands**

Three stands, A-1, A-2 and the dual B-1/B-2, were built in the early 1960s to test the first and second stages of the Apollo Saturn V rocket that safely transported Americans to the moon.

The A Test Complex consists of two single-position, vertical-firing test stands designated A-1 and A-2. Configurations for the A Test Complex test stands have consisted of full flight-stage and main propulsion systems, and single-engine testing at sea level and altitude simulation.

**Artist concept of the A-3 Test Stand for testing the J-2X engines that will carry humans back to the moon.**

**SSC's A-1 Test Stand, site of the first space shuttle main engine test in 1975, conducted its final space shuttle main engine test in 2006. A-1 then began a new chapter in its legacy: conversion to testing J-2X engines, which will power the upper stage of NASA's new crew launch vehicle, the Ares I.**

In May 2007, NASA announced its intention to build a new test stand at SSC for testing the J-2X rocket engine. The A-3 Test Stand will allow engineers to test the J-2X engine's operating parameters by simulating conditions at different altitudes. Construction began on the A-3 Test Stand in summer 2007, with the first test scheduled to be conducted in 2010. The A-3 Test Stand is the first large test stand to be built at SSC since the 1960s.

The B Test Complex consists of a dual-position, vertical, static-firing test stand designated the B-1/B-2 Test Stand. First stages of the Apollo Saturn V rocket were static fired in the B-2 test position for acceptance testing from 1967 to 1970. SSC presently leases the B-1 test position to Pratt & Whitney Rocketdyne for testing of the RS-68 engine. As currently configured, B-1 has two engine test positions.

The E Test Complex was constructed as a result of several national propulsion development programs in the late 1980s and early 1990s. The versatile, three-stand complex includes seven separate test cells capable of testing that involves ultra high-pressure gases and cryogenic fluids.
The test stands are linked by a 7½-mile canal system used primarily for transporting liquid propellants. Additional features of the test complex include test control centers, data acquisition facilities, a large high-pressure gas facility, a high-pressure industrial water facility served by a 66-million gallon reservoir and an electrical generation plant.

National Aeronautics and Space Administration

John C. Stennis Space Center
Stennis Space Center, MS 39529-6000
(228) 688-3333

**www.nasa.gov**



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