



A Look Back at Space Mission Engine Testing at the Santa Susana Field Laboratory

NASA administers 451.2 acres in two areas (Areas I and II) of the SSFL. From the mid 1950s through the early 1980s, the U.S. Army, U. S. Air Force (USAF) and NASA regularly conducted research, development and testing of rocket engines in Area II (and early on, in Area I). There was subsequent occasional testing until 2006. The USAF administered the Area II land until 1973. NASA has administered Area II since 1973, and 41.7 acres of Area I since 1976.

Test Stands were open-framed metal structures with concrete foundations and related buildings. Each had multiple testing positions. All SSFL test stands are now inactive; several have been removed.

Coca I was further modified in 1972 and 1973, with the installation of new work platforms. These substantially increased its length and width to accommodate testing on the larger Space Shuttle Main Engine (SSME) and the stand was renamed Coca Test Stand A-3. Additional modifications were made in 1978. Coca IV was the newest of the original test stands, with construction completed in 1964. It is 134 feet high, 98 feet long and 73 feet wide. It, too, underwent modifications in 1972 and 1973, with additional work platforms that increased its length and width, for SSME work.

Saturn Apollo Program, Engine Testing at SSFL

The Saturn Apollo program was established by NASA in 1960. Much of its support work took place at SSFL, where the mission was developmental testing of engines for the Saturn IB rocket and its successor, the Saturn V. The Saturn V stood more than 364 feet tall and weighed over 431,000 pounds. The capsule containing three Apollo astronauts would sit atop this rocket.

From the middle 1950s into the beginning of the 21st century, Santa Susana Field Laboratory (SSFL) rocket engine testing provided pivotal data for the development and improvement of many weapons and space vehicles. They ranged from the Atlas Intercontinental Ballistic Missile to the Space Shuttle Main Engine. Initially, testing was conducted in cooperation with the U.S. Air Force (USAF). This fact sheet provides a look back at the important work that was conducted at SSFL.

NASA rocket engine testing took place at locations known as “test areas.” Each area had multiple firing positions, known as Test Stands. Nearly all these stands were built between 1954 and 1957 and named Alfa, Bravo, Coca and Delta. The accompanying chart (see other side) shows testing programs for particular engines at all the test stands. After the 1960s most engine testing took place at the Coca stands, although some limited NASA and USAF testing took place at the other stands through 2006.

In the 1960s, two of Coca Test Stands, Coca I (Building 733) and Coca IV (Building 787), were used to support the Apollo program, which sent astronauts to the Moon. Coca I, completed in 1956, was originally 48 feet tall, 40 feet long and 37 feet wide. To meet the needs of the larger engines supporting Apollo, it was replaced by a larger stand, 105 feet tall, in 1962.



Coca Test Stand IV was used during Apollo and Space Shuttle testing.

for your information

Saturn Apollo (continued)

During most of the 1960s, staff from Marshall Space Flight Center (MSFC, in Alabama) tested several large, liquid-fueled rocket engines at SSFL for the Apollo program. Early on, all four test areas (Alfa, Bravo, Coca and Delta) in SSFL Area II were used, as were the older Bowl and Canyon test areas in Area I. Most tests were conducted on the J-2 engine (and some on Atlas engines). The Rocketdyne division of the former North American Rockwell Corporation began J-2 development in 1960, at its nearby Canoga Park, CA facility. The J-2 engine originally had a thrust of 200,000 pounds.

NASA conducted its first “static” test (the engine mounted to the test stand, as opposed to being launched) at SSFL in 1962. A J-2 version with 230,000 pounds of thrust was developed in 1965. From 1964 to 1968, the most active period, nearly all Saturn V testing took place at the large Coca I and Coca IV stands. The Saturn V rocket used what was termed a “battleship configuration” for simulated flight, consisting of five J-2 engines. Together, they provided the million pounds of thrust for rocket launches required by the Apollo program.

There were hundreds of engine tests at SSFL to support the Saturn Apollo program. In all, Apollo had 33 missions (launched from the Kennedy Space Center), with the first of 11 manned launches taking place in December 1968. Apollo 11 was the first to the Moon in July 1969. Apollo 17 was the last mission, in December 1972. The program was cancelled in 1973. Work with the former Union of Soviet Socialist Republics on the joint Apollo-Soyuz program ended in 1975.

Space Shuttle Main Engine (SSME) Program at SSFL

The Space Shuttle Main Engine (SSME) is the first reusable liquid booster engine for human space flight. Fueled by liquid hydrogen and liquid oxygen, three SSMEs power each Space Shuttle mission. The SSME was also manufactured by Rocketdyne. Along with the Solid Rocket Boosters (SRBs), they provide the thrust to launch the shuttle and, after the SRB’s are jettisoned, to push the shuttle into orbit. They operate for eight minutes after launch, with a thrust of 375,000 pounds and an accumulated “run-time” life of 7.5 hours (55 engine starts). From 1974 to 1988, NASA conducted SSME tests at SSFL. These were conducted in concert with the Mississippi Test Facility – later known as the National Space Technology Laboratory (NSTL) and now known as the Stennis Space Center – under MSFC supervision.

SSFL tests were conducted on several essential engine components (including turbo-pumps, engine nozzles and combustion devices) while NSTL testing focused on entire engine systems. SSFL conducted what is referred to as sea-level, static testing. High-altitude testing was conducted at NSTL and on flights from the Kennedy Space Center. Together, NSTL and SSFL evaluated the performance of every engine component and propulsion system.

The first “hot firing” test of the SSME program took place at SSFL’s Coca I stand in April 1974. The pace increased in the years prior to launching the first Space Shuttle (Columbia, in April 1981) as NASA increased the accumulated test firing time to 80,000 seconds. In 1979 and 1980, NASA conducted a total of 35 test firings as scheduled, mostly at the Coca I (renamed A-3) Test Stand. By early 1980, SSFL and NSTL had combined on more than 100,000 seconds of test firing time, as a prelude to certifying the engines for flight.

Through the years, the Coca I and Coca IV Test Stands were used for well over 700 “hot fire” tests - and more than 500 related laboratory tests - on the SSME. The last at Coca took place in 1988. Then, in 1999 and 2000, Coca IV was further modified to support testing of the unrelated Delta IV Expendable Launch Vehicle. It was taken out of service in 2000. These test stands, along with two each from Alfa and Bravo, have been identified as eligible for placement on the National Register of Historic Places. ■

For further information, please contact

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SSFL Test Stand Utilization

Stand	Program	Agency
ALFA	Navaho	USAF
	Jupiter	USAF
	Thor	USAF
	Atlas	USAF
	RS-27	NASA
BRAVO	Thor	USAF
	Atlas	USAF
	E-1	NASA
	Delta	NASA
COCA	Atlas	USAF
	J-2	NASA
	Saturn IB	NASA
	Saturn V	NASA
	SSME	NASA
Delta	Jupiter	USAF
	Thor	USAF
	Atlas	USAF
	RS-27	NASA