NASA Facts

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LASRE Project

Linear Aerospike experiment takes flight. A NASA SR-71 successfully completed its first flight as part of the NASA/Rocketdyne/Lockheed Martin Linear Aerospike SR-71 Experiment (LASRE) Oct. 31, 1997, at NASA's Dryden Flight Research Center, Edwards, Calif. The goal of the first flight was to evaluate the aerodynamic characteristics and the handling of the SR-71/linear aerospike experiment configuration. The aerospike engine was not fired during the flight. (NASA photo EC97-44295-99)

The LASRE project concluded its flight operations phase in November 1998.

The goal of the experiment was to provide in-flight data to help Lockheed Martin validate the computational predictive tools it has been using to determine the aerodynamic performance of a future potential reusable launch vehicle.

LASRE included a 20-percent-scale, half-span model of the X-33 (minus the fins) that was rotated 90 degrees and equipped with eight thrust cells of an aerospike engine. The experiment, mounted on the back of an SR-71 aircraft, simulated the operation of the X-33. The experiment focused on determining how a reusable launch vehicle's engine plume would affect the aerodynamics of its lifting-body shape at specific altitudes and at speeds reaching approximately 750 miles per hour. The interaction of the aerodynamic flow with the engine plume could create drag; design refinements looked to minimize that interaction.

During the flight research program, the aircraft completed seven research flights from NASA's Dryden Flight Research Center, Edwards, Calif. Two initial flights were used to determine the aerodynamic characteristics of the LASRE apparatus on the back of the aircraft. The first of those two flights occurred Oct. 31, 1997. The SR-71 took off at 8:31 a.m. PST. The aircraft flew for one hour and 50 minutes, reaching a maximum speed of Mach 1.2 and a maximum altitude of 33,000 feet before landing at Edwards at 10:21 a.m. PST, successfully validating the SR-71/pod configuration.

Five follow-on flights focused on the experiment; two were used to cycle gaseous helium and liquid nitrogen through the experiment to check its plumbing system for leaks and to check engine operation characteristics. The first of these flights occurred March 4, 1998. The SR-71 took off at 10:16 a.m. PST. The aircraft flew for one hour and 57 minutes, reaching a maximum speed of Mach 1.58 before landing at Edwards at 12:13 p.m. PST.

During three more flights in the spring and summer of 1998, liquid oxygen was cycled through the engine. In addition, two engine hot firings were conducted on the ground.

A final hot-fire flight test did not take place due to the liquid oxygen leaks in the test apparatus. The ground firings and the airborne cryogenic gas flow tests provided enough information to predict the hot gas effects of an aerospike engine firing during flight.

Hardware and Aircraft

The experiment itself was a small, half-span model of a lifting body shape. The model contained eight thrust cells of an aerospike engine and was mounted on a housing known as the "canoe," which contained the gaseous hydrogen, helium, and instrumentation gear.

The model, engine, and canoe together were called the "pod." The entire pod was 41 feet in length and weighed 14,300 pounds. The experimental pod was mounted a NASA SR-71.

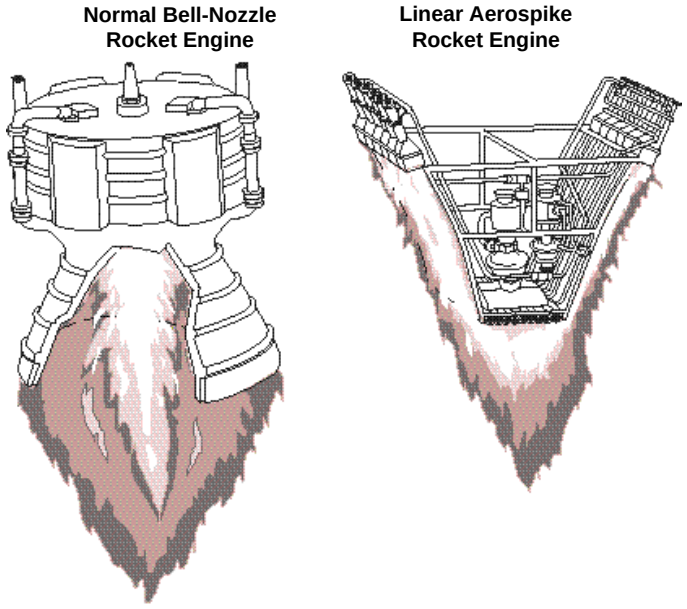
NASA and Space Transportation

Lockheed Martin may have used information gained from LASRE and the X-33 Advanced Technology Demonstrator to develop a potential future reusable launch vehicle. NASA and Lockheed Martin were partners in the X-33 program through a cooperative agreement.

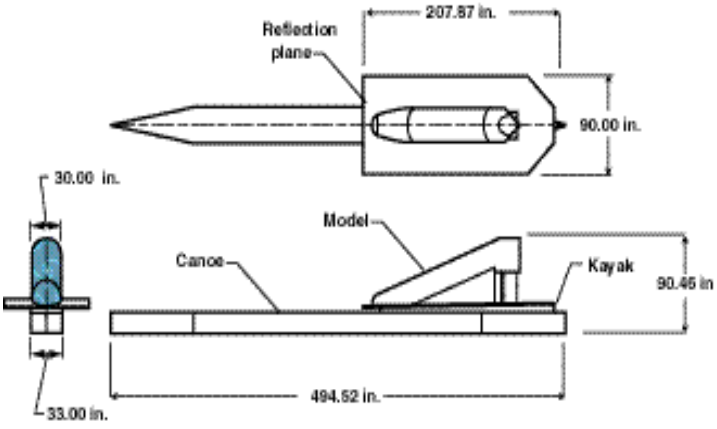
The goal of the X-33 program, and a major goal for NASA's Office of Aero-Space Technology, was to enable significant reductions in the cost of access to space, and to promote the creation and delivery of new space services and other activities that would improve U.S. economic competitiveness. The program implemented the National Space Transportation Policy, which is designed to accelerate the development of new launch technologies and concepts to contribute to the continuing commercialization of the national space launch industry.

Both the X-33 and the smaller X-34 technology testbed demonstrator were under the Space Transportation Program Offices at NASA Marshall Space Flight Center, Huntsville, Ala. The air-launched, winged X-34 also was to demonstrate technologies applicable to future-generation reusable launch vehicles designed to dramatically lower the cost of access to space.

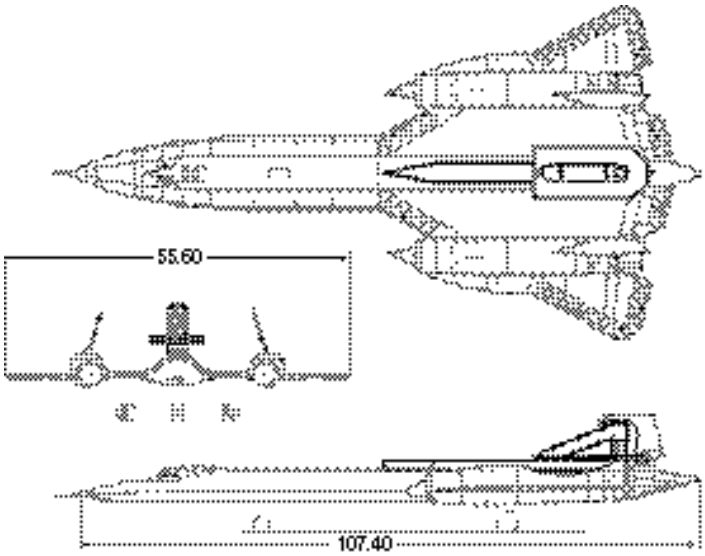
SR-71 with aerospike experiment.



Rocket engines.



Pod design.



Three view of SR-71 with pod.