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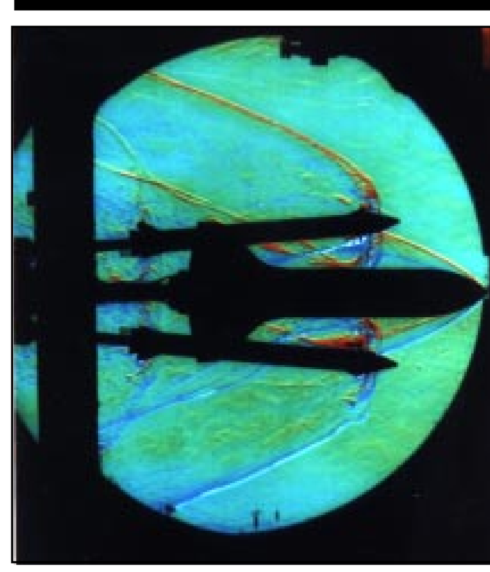
Space Shuttle set to launch 100th mission today

One of the final space shuttle configurations tested at AEDC in 1976. The scale model of the STS or Space Transportation System is shown just before a staging test in the von Karman Gas Dynamics Facility's Tunnel A. (file photo)



Above, shuttle separation tests examined dual solid booster separation from the shuttle external tank in 1974.

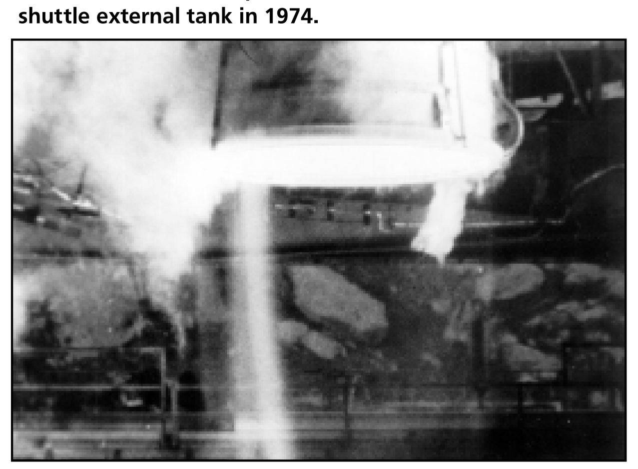
100 launches

Now at the dawn of the 21st century, the space shuttle is about to launch for the 100th time when Discovery lifts off today on STS-92, an International Space Station assembly flight. By that time, the space shuttle will have launched about 1.36 million kilograms (3 million pounds) of cargo into space and 596 passengers.

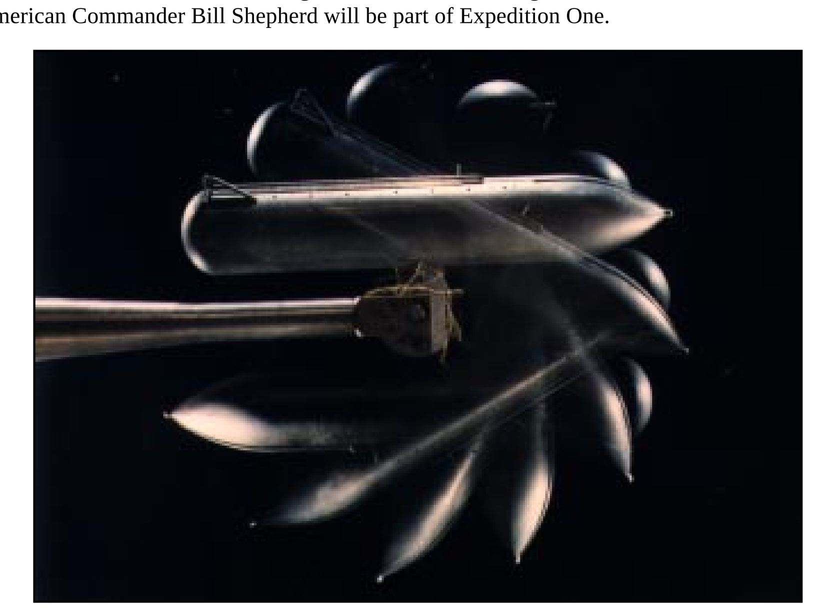
The shuttle fleet will cumulatively have spent almost 2 years in orbit and amassed almost 15 years of passenger-hours in flight. More than 850 payloads will have flown, and the shuttle will have deployed more than 60 payloads and retrieved more than two dozen. The shuttle has supported two space stations; made three maintenance flights to the Hubble Space Telescope; launched planetary missions to study Jupiter, Venus and the sun; and conducted hundreds of studies of the effects of weightlessness on materials, plants, animals and human beings in onboard laboratories. Although flying for two decades, the shuttle still will have more than three-quarters of its design lifetime available. Out of 100 flights designed for each orbiter, when STS-92 — the 100th overall flight for the program — is completed, Discovery will be the most-flown shuttle with 28 flights to its credit. Columbia will be second with 26 flights. Atlantis will have made 22 trips to space and Endeavour will have completed 14 flights.

This launch is the final mission before permanent habitation of the new International Space Station begins with an Oct. 9 launch from the Gagarin Cosmonaut Training Center in Star City, Russia. American Commander Bill Shepherd will be part of Expedition One.

Source: NASA



This image was captured by high-speed video at the Marshall Space Flight Center Technology Test Bed in 1990 during development ground testing. It shows streaking in the plume that was visible only milliseconds prior to main engine failure. The Optical Plume Anomaly Detector provided advance warning of such performance defects and will initiate engine shutdown before a failure might occur.



Tumbling reentry heat loads on the shuttle tank were measured on a scale model in 1974. The model was rotated longitudinally in test conditions simulating flight at 5,500 mph.

Blastoff

Space shuttle's flight through AEDC history

By Dana Davis
AEDC Public Affairs

Almost 20 years ago, *High Mach* featured the headline, "Shuttle will open new era of space exploration" in anticipation of the first shuttle mission. One hundred missions later, that "prophesy" is fulfilled.

Thirty years ago, AEDC engineers embraced the space shuttle concept as an infant. As the years went by, the center held its hand as it entered its toddler stage.

After "learning to walk," the shuttle was ready to leave the testing nest and make her maiden voyage into space in 1981 with astronauts John W. Young and Robert L. Crippen. They orbited the earth 35 times on a test run with NASA's newest baby.

Like the child who returns for reassurance, the shuttle has returned to the center throughout the years for additional testing.

Tiles

Tests conducted at the center in the 1970s were instrumental in helping NASA develop the shuttle's orbiter's TPS or Thermal Protection System. In 1973, after the insulating scheme was proposed, AEDC tests enabled engineers to visually inspect heat distributions on an orbiter model.

In 1976, four materials being considered for use as shuttle insulating materials were run through a battery of 40 wind tunnel tests, generating surface temperatures which exceeded 900 degrees.

Tests were conducted in 16T that revealed turbulent airflow around the beam can cause tiles to loosen from the orbiter's skin forward of the cavity. Data from this test program also led to two other modifications which will spare the tiles from damaging forces.

Tank

In 1974, aerodynamic tests were conducted to determine whether or not the external tank will be jettisoned and burned up as it tumbles into the atmosphere. The tests verified the tank actually does break up. An abort sequence was also tested simulating separation of the external tank at an alternate point during the mission.

Two decades later

In 1990, scientists at AEDC developed a device for use in ground testing to observe the exhaust plume of the space shuttle main engine to provide advance warning of performance defects and to initiate engine shutdown before a failure might occur.

At the request of NASA, AEDC developed the Optical Plume Anomaly Detector to monitor the health of the SSME at the Marshall Space Flight Center technology Test Bed during the SSME developmental ground testing.

Last year, AEDC conducted for NASA-Marshall Space Flight Center flight hardware materials tests on the shuttle's external tank panels. Questions about recurring foam loss from the intertank and potential damage to the orbiter sparked an investigation.

The loss of external tank foam material and subsequent damage to reentry tiles was a concern because it could cause tile replacement costs to significantly increase, however, it was not a flight safety issue.

As a result of the data gathered from ground tests at NASA-MSFC and AEDC as well as the STS-95 launch, a team of In-Flight Anomaly investigators from Lockheed Martin Michoud Space Systems, manufacturers of the space shuttle external tank, recommended a solution to the problem – venting.

Above, a NASA orbiter model was tested in 1978 in the center's 16-foot transonic wind tunnel. This series of tests provided data on the effects of vertical stabilizer deformation on flight control. Below, a two percent model of the orbiter, external fuel tank and solid rocket boosters is inspected prior to a test to measure aerodynamic forces acting on the total vehicle configuration. (file photos)

Where is it now?

NASA, Lockheed Martin Agree On X-33 plan

NASA and Lockheed Martin have agreed on a plan to go forward with the X-33 space plane program, to include aluminum fuel tanks for the vehicle's hydrogen fuel, a revised payment schedule and a target launch date in 2003.

The launch date is contingent on Lockheed Martin's ability to compete and win additional funding under the Space Launch Initiative. NASA and Lockheed believe it is critical to continue work to solve the last remaining barrier to low-cost, reliable access to space.

The restructured plan focuses on providing milestone payments to Lockheed Martin's industry team for completed testing and delivery of their hardware and software systems this year.

Additionally, the plan includes greater emphasis on mission safety and more ground demonstration of critical technology prior to actual flight.

These steps are being taken by NASA to ensure quality and mission success. NASA is intent on ensuring that the lessons learned from other programs are taken into consideration in any go-forward planning.

The project requires no additional funding from NASA through March 2001. The project will need additional funding for completion, and Lockheed Martin can compete for those funds through the Space Launch Initiative.

The NASA/Lockheed initiative is demonstrating the most advanced breakthroughs in rocket technology in the past 30 years.

"We've demonstrated this on the ground, and now we want to continue to work toward flight demonstration," said Art Stephenson, director of NASA's Marshall Space Flight Center, Huntsville, Ala.

Stephenson noted that the program has so far delivered a revolutionary new rocket engine; a robust, reusable, metallic thermal-protection system; and software and sensors that automatically determine and predict failures and errors before they affect the flight.

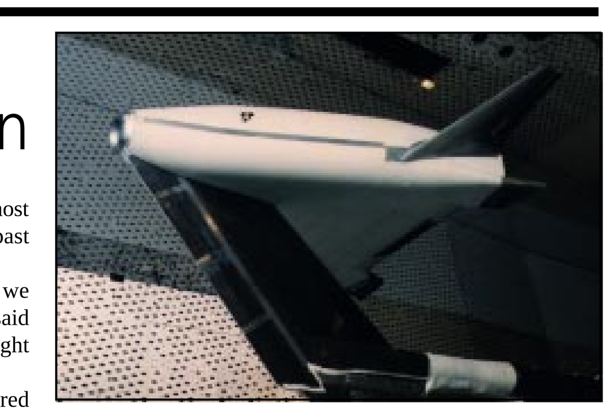
This technology is applicable to the space program and eventually to the commercial aircraft industry.

The program has also developed a small-scale version of a future "spaceport," at Edwards Air Force Base, Calif., which can be operated with a significantly smaller ground crew than required at traditional launch facilities.

The sub-orbital X-33 is designed to demonstrate advanced technologies that will dramatically increase launch vehicle reliability and lower the cost of launching payloads to low Earth orbit from $10,000 to $1,000 per pound.

The government-industry partnership began in July 1996.

Source: NASA Release: 00-157



A 7.75 percent scale model of Lockheed Martin Skunk Work's X-33 in the 16-foot transonic wind tunnel in 1997. (file photo)

Artist rendering of X-33 (VentureStar)