NASA Facts

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B-52B "Mothership" Launch Aircraft

NASA's B-52B launch aircraft takes off carrying the third X-43A hypersonic research vehicle attached to a modified Pegasus rocket, on November 16, 2004. NASA photo ED04-0320-16 by Tom Tschida.

NASA's venerable B-52B launch aircraft, operated by the NASA Dryden Flight Research Center, has participated in some of the most significant projects in aerospace history. At retirement, the air launch and research aircraft held the distinction of being NASA's oldest aircraft, as well as being the oldest B-52 on flying status. At the same time, it had the lowest number of flying hours (2443.8) of any B-52 in operation, having been used exclusively in the role it continued to perform so reliably for nearly 50 years.

The B-52B, registration number 52-0008 (NASA tail number 008), rolled out of Boeing's Seattle plant as an RB-52B, and first flew on June 11, 1955. The aircraft was the 10th B-52 to come off the Boeing assembly line and was a U.S. Air Force test aircraft before it was assigned to support the X-15 research aircraft program at Dryden in 1959.

Missions

X-15 Program

NASA 008 was one of two B-52s used as "motherships" to air-launch the three rocket-powered X-15 aircraft for research flights. Aircraft 008 was the launch aircraft on 106 of the X-15 flights, flying a total of 161 captive-carry and launch missions in the X-15 program.

The X-15 was flown over a period of nearly 10 years – June 1959 to October 1968 – and set world speed and altitude records of Mach 6.7 and 354,200 feet in a program that investigated all aspects of manned hypersonic flight. Those records stood for almost 40 years. Information gained from the highly successful X-15 program contributed to development of the Mercury, Gemini, Apollo, and Space Shuttle manned space flight programs.

The other B-52 used in the X-15 program, tail number 003, was retired in 1969 and is on permanent display at the Pima County Air Museum in Tucson, Ariz.

The Lifting Bodies

Between 1966 and 1975, B-52 008 was the launch aircraft for 127 of the 144 flights of wingless lifting body aircraft that contributed to development of the Space Shuttle. Lifting bodies obtain aerodynamic lift from the shape of their bodies. The addition of fins and control surfaces allowed research pilots to stabilize and control the vehicles and maintain a predetermined flight path. Research flights with the vehicles proved that vehicles entering the atmosphere from space could be maneuvered to a safe runway landing - paving the way for full development of the space shuttle.

NASA's workhorse B-52B 008 flies over research pilot Bill Dana in 1969 following an HL-10 lifting body mission. NASA photo ECN 2203.

Space Shuttle Program Support

In 1977 and l978, and again in the 1983-1985 time period, 008 was used as the launch aircraft in the test and development of the parachute recovery system used to recover the Space Shuttle's solid rocket boosters.

From July to October of l990, the veteran B-52B was used for a series of eight tests of a drag chute deployment system to be installed on Space Shuttle orbiters.

The drag chutes permit the orbiters to land safely in a shorter distance and also help reduce tire and brake wear. The test unit, consisting of the test drag chute and its attachment and deployment systems, was installed in the tail of NASA 008, along with instrumentation to record loads and pressures on the deployed parachute and on the structure of the aircraft.

Tests were carried out at landing speeds ranging from 160 to 230 mph on a lakebed runway and also on the main concrete runway at Edwards. They demonstrated the initiation, deployment, inflation, and overall operation of the orbiter drag chute system. Data from the tests were used to validate predicted loads.

First operational use of the drag chute system was on Shuttle Endeavour, newest of the Space Shuttle fleet, during its first landing, May 16, 1992.

Miscellaneous Support

NASA 008 was the launch aircraft for several remotely piloted aircraft flown by Dryden in the 1970s and l980s to study spin-stall, high angle of attack, and maneuvering characteristics. They were the sub-scale F-15 spin research vehicle; the Highly Maneuverable Aircraft Technology, or HiMAT research aircraft; and the Drones for Aerodynamic and Structural Testing, or DAST project, which investigated aerodynamic loads alleviation.

The first of four lengthy series of test flights began in 1979 for a U. S. Air Force project to certify an extension of the operational life of the parachute recovery system on the F-111 crew escape module. The tests concluded in 1992. The tests, using 008 as the airdrop vehicle for the parachute test articles, were part of a continuing Air Force program to improve the recovery system's capability.

NASA 008 was used as the air launch platform for the first six commercially developed Pegasus rocket boosters. The three-stage Pegasus is designed to put a payload into earth orbit after being launched horizontally from a carrier aircraft's wing.

Pegasus was developed by Orbital Sciences Corporation under sponsorship of the Defense Advanced Research Projects Agency as part of the agency's Advanced Space Technology Program.

The first Pegasus launch from NASA 008 was on April 5, 1990, over the Pacific Ocean, about 60 miles southwest of Monterey, Calif.

NASA 008's primary mission for several years was launching the X-38 crew return vehicle. The maiden free-flight of the X-38 prototype space station lifeboat occurred in March 1998. Mission support continued until the X-38 project was cancelled in 2001.

Hyper-X

In its final role in aerospace history, NASA 008 served as the launch aircraft for NASA's Hyper-X program. The program's primary purpose was to explore an alternative to rocket power for space access vehicles. The Hyper-X program consisted of three unpiloted 12-foot long, hypersonic scramjet-powered X-43A research vehicles.

The first X-43A vehicle was lost on June 2, 2001, following termination of the flight after the Pegasus-derived booster rocket deviated from the planned trajectory.

The second X-43A launch proved the concept of hypersonic scramjet-powered flight. On March 27, 2004, NASA 008 carried the X-43A, mounted on a modified Pegasus booster rocket, up to the drop altitude of 40,000 feet. The rocket boosted the X-43A up to its test altitude of about 95,000 feet over the Pacific Ocean, where the X-43A separated from the booster and flew freely at its test speed of Mach 6.8. This was the first time an air-breathing scramjet powered aircraft had flown freely. In the process, it set a new world speed record for flight powered by an air-breathing engine.

The third and final X-43A also flew successfully on Nov. 16, 2004, following launch from NASA 008 on its final research mission. This X-43A, also launched from 40,000 feet, was boosted to a test altitude of 110,000 feet and a speed of about Mach 9.6.

It is interesting to note that NASA 008's first and last missions launched hypersonic research vehicles, the first being launch of the number one X-15 in 1960.

Retirement

Having participated in some of the most significant projects in aerospace history, NASA 008 was formally retired on Dec. 17, 2004. A joint NASA and U.S. Air Force ceremony marked the occasion.

Aircraft Modifications

After coming to NASA, a major structural modification to the B-52B was the cutout of a large notch in the aircraft's right inboard wing flap to accommodate the vertical tail on the three X-15 aircraft. This notch also served the Pegasus and Hyper-X projects.

Installation of various pylons used to carry research vehicles and test articles to be air dropped occurred over the years. The pylons were attached under the right wing between the inboard engine pod and fuselage. Each pylon was subjected to extensive drag, airflow and loads testing before use. On a historical note, the pylon used to attach the X-43A and its booster to the B-52B is the same pylon used for the X-15 program.

Special instrumentation was installed aboard NASA 008 to record and transmit test and research data and video to the Dryden Mission Control Room or other receivers during research missions. A second Launch Panel Operator position was added to augment the existing one for the Hyper-X program.

Aircraft Specifications

The NASA B-52B was powered by eight Pratt & Whitney J-57-19 turbojet engines, each producing 12,000 pounds of thrust with water injection. The aircraft had a top speed of 390 knots (448 mph) and a maximum operating altitude of more than 50,000 feet. It is 156 feet long, and has a wingspan of 185 feet.

The heaviest load the B-52B carried since it became a NASA launch aircraft was 53,100 pounds – the No. 2 X-15 with external fuel tanks used during that aircraft's fastest flights. The second heaviest load, at 47,772 pounds, was the space shuttle solid rocket booster recovery system tests, while the third heaviest load carried was the Pegasus rocket, weighing in at 41,152 pounds.