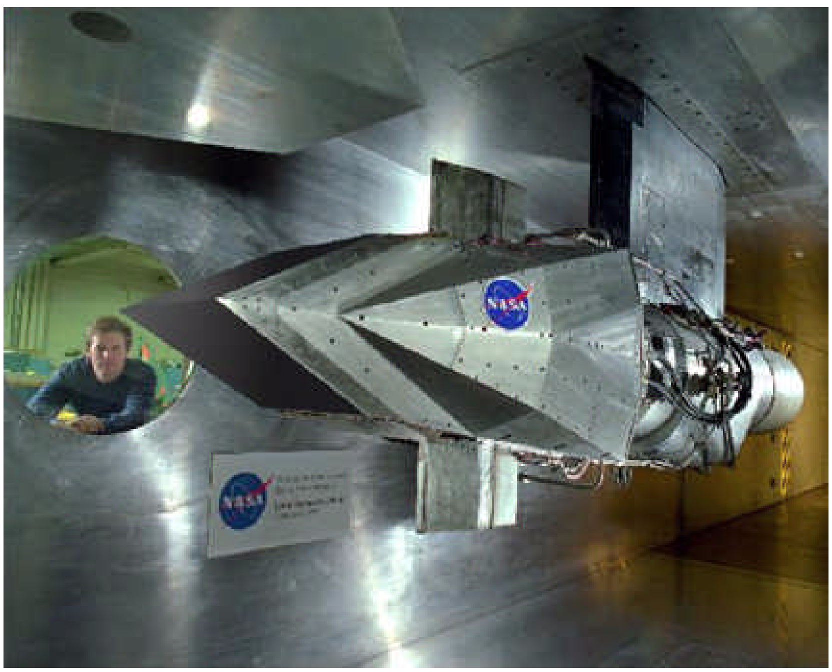
Two-Dimensional Bifurcated Inlet/Engine Tests Completed in 10- by 10-Foot Supersonic Wind Tunnel

A Two-Dimensional Bifurcated (2DB) Inlet was successfully tested in NASA Lewis Research Center’s 10- by 10-Foot Supersonic Wind Tunnel. These tests were the culmination of a collaborative effort between the Boeing Company, General Electric, Pratt & Whitney, and Lewis. Extensive support in-house at Lewis contributed significantly to the progress and accomplishment of this test. The results, which met or exceeded many of the High-Speed Research (HSR) Program goals, were used to revise system studies within the HSR Program. The HSR Program is focused on developing low-noise, low-polluting, high-efficiency supersonic commercial aircraft. A supersonic inlet is an important component of an efficient, low-noise vehicle.



Two-Dimensional Bifurcated Inlet and J85 Engine installed in Lewis’ 10- by 10-Foot Supersonic Wind Tunnel.

The Two-Dimensional Bifurcated (2DB) Inlet model is a mixed-compression inlet that was designed to efficiently and reliably convert the high supersonic airflow of a High-Speed Civil Transport (HSCT) into high-pressure, subsonic flow for a jet engine. This inlet concept is different from the external compression inlets used on most supersonic fighter aircraft. Testing began in October 1996 with a "cold-pipe" test. A cold pipe is a large valve used as a simple simulation of a jet engine. A year later, the cold-pipe hardware was replaced with a J85 turbojet engine. Recent tests characterized the operability and dynamics of the inlet installed in front of the J85 Engine. Testing was conducted over a range of supersonic Mach numbers as well as at some subsonic flow conditions.

Back end of installation showing the nozzle leaves of the J85 Engine.

When compared with an external compression inlet, a mixed-compression inlet has generally better efficiency but greater natural flow instability. This potential instability can be controlled through the proper choice of variable geometry. Features of this model included remotely variable ramp geometry, multiple bleed compartments, and bypass valves. Therefore, variable geometry features were needed to develop a robust control for this mixed-compression inlet over the entire High-Speed Civil Transport flight regime. Operation across variations in normal shock location, inlet unstart/restart, and angle of attack was demonstrated both with and without the J85 Engine installed.

This program is an example of a successful industry/NASA partnership. The test series was responsive to the needs of the HSR program. The end result was a test that brought efficient, robust mixed-compression inlet concepts one step closer to reality.

Find out more about the HSR Program and the 2DB Inlet http://www.grc.nasa.gov/WWW/Inlet/.

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