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Supersonic Speed, Bit Binary Bit

Stewart Taggart 05.27.02 | 2:00 AM

WOOMERA, South Australia -- Sandwiched between today's cattle-car jumbo jets and tomorrow's suborbital transport, Japan believes there's a niche for a revamped and updated supersonic jet -- say around 2012.

Japan's National Aerospace Laboratory (NAL) now has a scale-model mockup of the plane, an 11-meter-long, two-ton beast sitting in the Australian desert, set to be test-flown in early July. Designed exclusively by supercomputer, the NAL has jumped directly from binary equations to flight tests of the new plane -- skipping wind tunnel tests entirely.

Given this radical change from aviation design orthodoxy, testing this bird in the wide-open spaces of Australia provides plenty of leeway for things to go wrong. However, the long-term result of successful tests here could be a new generation of Mach 2, long-range 300-seater supersonic jets that could fly from New York to Tokyo in six hours, roughly one-third the time needed currently for the trip using conventional jets.

For its part, Japan is betting a newer, cleaner, less-noisy version of supersonic jet technology will find a ready market among high-fare businesspeople a decade from now.

Strapped to an ordinary rocket, the prototype will be carried to a height of 19 kilometers, where the two will separate. The supersonic test jet will then fall from 19 kilometers to 12 kilometers in altitude in just over a minute, hitting Mach 2.

During this part of the flight, 900 sensors will record flight data such as temperature, pressure and airflow as frequently as 10,000 times per second. The jet will then spend the subsequent 10 minutes executing a series of "S" turns to slow down before landing on airbags in the central Australia desert.

Total flight time, including launch: roughly 14 minutes. Four such test flights of the test jet are planned, stretching into next year.

In the past, most new aircraft have been designed by making models, testing them in wind tunnels and progressively tweaking them to make them better. But if this new gull-winged, hourglass-shaped javelin of a plane performs as expected, it could propel a new, more rapid means of aircraft design in which designers skip wind tunnels altogether and leave the work to supercomputers, using such technologies as the "inverse method" and "computational fluid dynamics."

The "inverse method" merely means setting performance specifications for the plane and letting supercomputers use their binary discretion in developing the optimal design. "Computational fluid dynamics" means -- essentially -- replacing wind tunnel tests with software equations.

Last year, a NASA-commissioned study identified halving the commercial aviation flight time between the United States and the Far East and Europe as a major technology goal. It identified further advances in supersonic technology as the only likely way to achieve this goal, but noted significant technological hurdles remained in the way -- particularly in reducing the adverse environmental effects of supersonic flight, such as noisy sonic booms and atmospheric pollution.

These Australian flight tests won't directly address either of those problems, but instead will concentrate on the aerodynamics of a future supersonic jet that could hold more than 300 people in a fuselage roughly comparable to a 767. Supersonic jets in current operation seat little more than 100, and tall people sometimes must hunch over to get inside.

Ultimately, NAL researchers believe the sonic boom problem can be reduced to a noise level no greater than that of a 747 by progressively lengthening, narrowing and tweaking the characteristic needle nose of the present generation of SSTs.

Far more daunting, however, will be creating engines that are environmentally acceptable while still sleek enough to withstand the huge aerodynamic pressures of Mach 2. So troublesome is this engine problem that the Japanese NAL group at first plans to test only a stripped-down test plane with no engines attached. Only later will a second jet with an engine configuration attached be flown to see how it behaves.

Clearly, NAL is eyeing an aviation market that may exist nearly 10 years from now. This will be a period when lumbering conventional jumbo jets may still be carrying people in crowded conditions, and before the arrival of dramatically new engine technologies such as scramjets that fly at five or six times the speed of sound.

Such scramjets might carry people from New York to Tokyo in just two hours, but may not be available until 2020 or later. This supersonic jet being tested by NAL could be in the air by 2012.

At this point, Japan has no intention of building such a jet itself, but aims to develop supersonic aerodynamic design expertise that will earn it a place in any consortium that does.

"Some people always will choose time over money," says Takeshi Ohnuki, an NAL aerospace engineer who's leading the test-flight effort. "That means there will always be a need for supersonic transport."