Losing the right stuff
American know-how has led the world of aviation since the Wright brothers. But U.S. investment in basic research is dwindling.

For anyone with business in Asia, it would be a dream come true: Hop aboard a sleek, 300-passenger jet at Kennedy International and 3½ hours later—barely time enough for a meal and a movie—disembark in Tokyo. Given up by the U.S. in 1971 as a technological turkey with potential environmental problems and no obvious market, the supersonic transport is an idea that’s back. This time, the numbers are in order.

Passenger traffic in the Pacific basin, already huge, is forecast to increase four times by the turn of the century. And the Pacific route avoids the sonic problem that killed off the SST last time around. There’s only one catch: The U.S. doesn’t have the technology. America’s aviation lead has always depended upon a solid base of fundamental research by the National Aeronautics and Space Administration and its predecessor, the National Advisory Committee on Aeronautics. NASA developed the high-speed airliners used first on military bases and then on jet airliners. NASA sponsored the research that made commercial jets in the 1930s structurally quieter. Companies like McDonnell Douglas and Boeing, as big as they are, cannot afford to undertake long-term, high-risk research that may never pay off—or duplicate NASA’s $1.5 billion investment in wind tunnels. Even with NASA research in hand, they bet the company every time they develop a new airplane. "If we know the basic technology is sound," says John Swihart, corporate vice president at the Boeing Company, "we can do the job.

Foreign competition
Experts warn that a dwindling NASA aeronautics budget has left the U.S. at the starting gate in the new race for the SST. Always a minuscule part of NASA’s overall budget, funding for aeronautics has dropped by a third in real terms since 1980, to the current $720 million a year—an amount that equals the cost of about seven Boeing 747s. If the U.S. misses the next big step in aeronautics, it could find its dominant share of the world’s transport-aircraft market evaporating like a contrast. With the U.S. running a trade deficit of $170 billion a year, a technologically made-civil jet airliner and engines are one bright spot, exporting $35 billion a year, or more than 59 billion—almost twice as much as the second-ranked agricultural products. The market share for a turn-of-the-century SST is estimated at $200 to $500 billion—a market that means there’s room for only one new model. "If we turn back our backs to it, we’ll give it up to the Europeans or the Japanese," says Raymond Colladay, head of the Defense Advanced Research Projects Agency, and, until last month, NASA’s aeronautics chief. At last year’s Paris Air Show, the French, British and Soviets all showed models of advanced high-speed transports.

Racing the benefits
NASA’s last major aeronautics research program, a 10-year $6 billion-dollar aircraft-energy-efficiency program launched after oil prices skyrocketed in the 1970s, produced a cornucopia of technologies that are now showing up on subsonic planes. They include fuel-saving engines, slippery shapes and composite structural materials—fibers such as graphite embedded in a metal or plastic matrix—that are stronger and lighter than aluminum. General Electric, for example, joined NASA to develop its "superfan" uninstalled fan engine—a jet turbine driving two rows of propellers—only after NASA pushed high-speed propeller technology for years. GE’s new engine is expected to go into service on McDonnell Douglas’s MD-11, a successor aircraft to the successful MD-80 series of airliners. In 1992, the new plane will burn 20 to 40 percent less fuel, making the MD-11 10 percent cheaper to operate. As significant as these improve ment have been, they are still basically variations on a 30-year-old theme. The speed and altitude of the commercial jet transport fleet have not changed during that time, and even European Airbus planes pose increasingly sharp competition. Next year, if the SST proves itself, it can get the money, NASA hopes to initiate another $1 billion, 10-year research program, this time to lay in place the fundamentally new technologies that Boeing or McDonnell Douglas will need to build an SST. To serve the Pacific, the plane would have to carry 300 to 400 passengers at around Mach 3—three times the speed of sound—for up to 7,500 miles. Although the aircraft might cost twice as much as a 747, it could haul so many more passengers in a day that ticket prices could be about the same.

The technical challenges are formidable. A new SST would have to meet stringent noise standards to operate from existing airports. NASA already is sponsoring atmospheric studies to determine if a fleet of SSTs would re lease enough nitrogen oxides to damage the ozone layer, a potential villain today. Ozone studies for the SST in the 1970s were not conclusive; some showed ozone would be increased, others that it would be depleted. Atmospheric models today are much more sophisticated and are expected to produce more accurate data. No one wants to shoot from the lip in this area," says Samuel Dally, head of NASA’s advanced vehicles division at Langley.

To obtain the necessary speed and fuel economy, engineers will have to boost engine-combustion temperature well beyond the performance of current turbines. Advanced materials, such as carbon composites, will be necessary to resist the high temperatures. Engineers also are grappling with some tricky design problems to achieve supersonic airflow through the engines. That would pay off with engines smaller and lighter than current power plants, in which more heat is lost. More importantly, these future engines will allow a new generation of airplanes—derivatives of present kerosene fuel.

A NEW SUPersonic TRANSPORT
Unlike the present-day Concord, a turn-of-the-century supersonic passenger jet would have the range to cross the Pacific in a single hop and the efficiency to make it pay off. The necessary technological ingredients:

Shape tailored to reduce supersonic shock waves
From a boom to a tumble

Advanced temperature-resistant and lightweight materials, plus powerful new design tools such as supercomputers.

Projected cost: Twice that of a Boeing 747—about $200 million.