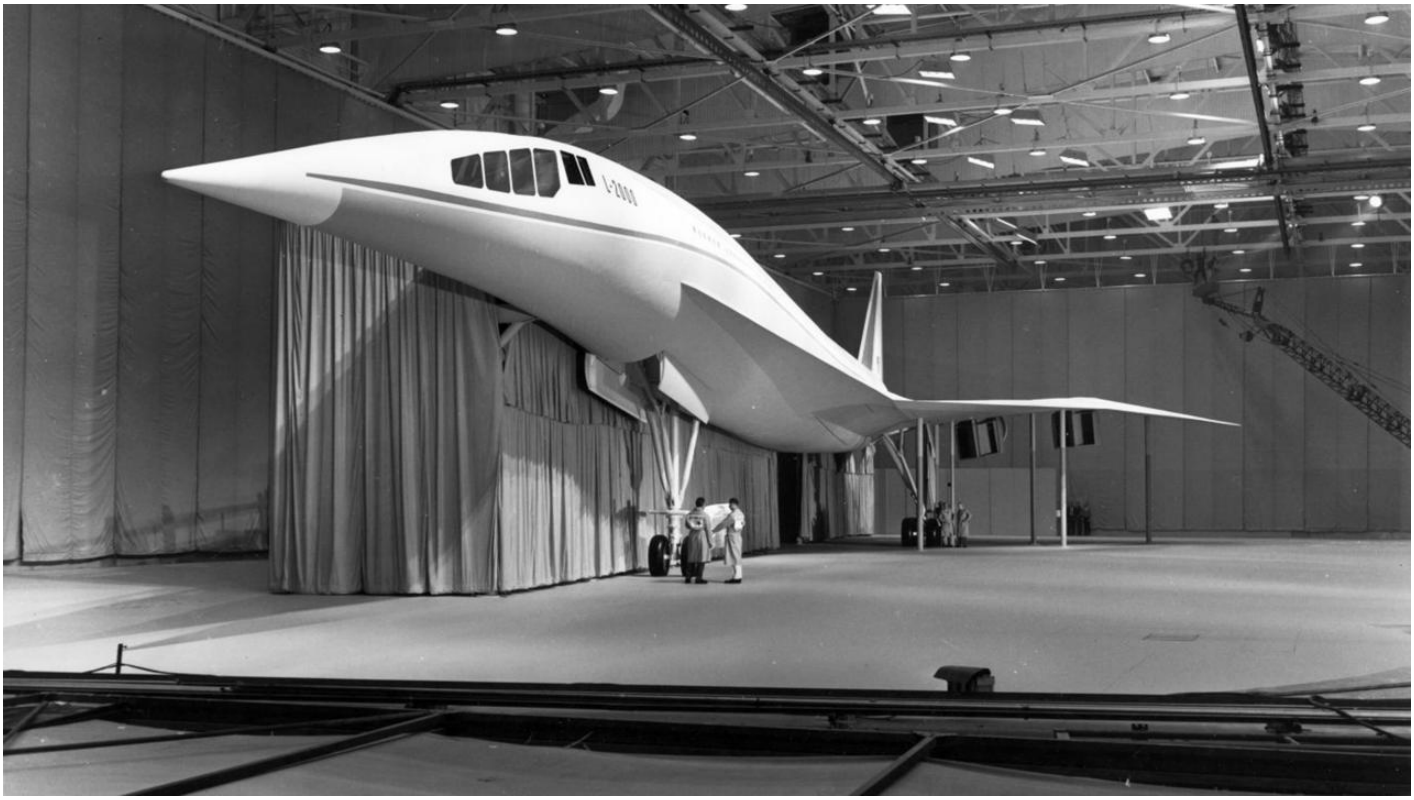
THE AMERICAN CONCORDES THAT NEVER FLEW

News / Manufacturer



In November 1962, the British and French governments announced a deal that caused great distress in the boardrooms of American planemakers.

The two countries announced plans to jointly build a new airliner, one that would be able to fly at more than twice the speed of sound. The aircraft – to be called 'Concorde' – would be the most advanced civilian aircraft in the world, showing that European aircraft manufacturers could create the most bleeding-edge designs.

US president John F Kennedy rose to this sudden challenge; the Anglo-French Concorde would have competition. America would create its own rivals to the European design, building a giant, passenger-carrying jet capable of flying faster than a rifle bullet.

The state-sponsored project selected two designs for further selection, one from airliner giant Boeing and another from Lockheed. But the programme became mired in political turmoil, environmental protests and spiralling costs. Neither of 'America's Concordes' ever flew.

The announcement of the Anglo-French Concorde concerned the US (Credit: Getty Images)

Today, however, supersonic flight is back on the agenda in the US, after more than 45 years in limbo. Lockheed recently announced a collaboration with Nasa to design a quieter supersonic jet that may, one day, carry passengers. So, what can be learned from the story of America's failed Concorde rival?

In the 1960s, Boeing and Lockheed were two of the most experienced aircraft manufacturers in the world. Boeing had revolutionised air travel with ever-more-reliable jet airliners. Lockheed had designed the first aircraft capable of flying at more than twice the speed of sound, the F-104 Starfighter, and was working on even faster military designs.

Even before Concorde was announced, American aircraft companies were seriously looking at the feasibility of a supersonic passenger plane, or a Supersonic Transport (SST). One company, Douglas Aircraft, produced a concept in 1961 for an airliner that could fly at three times the speed of sound (Mach 3). Douglas not only believed that such an aircraft could be flying by 1970, but that there would be a market for hundreds of aircraft.

Concorde, it turned out, was not the only reason to focus American attention. On the other side of the Iron Curtain, the Russian design bureau Tupolev was also creating a supersonic transport and airliner, the Tu-144. To be beaten in the supersonic airliner arena by the British and the French was one thing – to be shown a clean pair of heels by the Russians was another.

The quest for a supersonic airliner became almost as important to the US as the race to the Moon. "You look back to that time and there really was a lot of technological advancements in aeronautics," says Peter Coen, Nasa's supersonic project manager at Langley Research Center in Virginia. "Whether it was a consideration of the market and what type of aircraft might be needed, or whether it was a case of one-upping Russia and Europe."

President Kennedy's carrot to Lockheed and Boeing was that the government would pick up 75% of the cost of the programme if either could produce a design that could rival Concorde. Both

companies had done private research – “paper studies” as they’re known – on supersonic transport since the late 1950s. Most of these studies mirrored the Russian and European research, creating delta-winged aircraft.

As aircraft started being fitted with jet engines, and travelling at far faster speeds, the standard design that had served propeller-driven aircraft for decades was no longer desirable; straight, plank-like wings created too much drag. With a too-powerful jet engine, these wings would snap off. The triangular shape of delta wings provided a stability that could withstand the stresses of enormous speed – aircraft like the French Mirage III fighter and the Russian MiG-21 had already proven the delta shape could easily go to Mach 2 and beyond.

Lockheed chose the delta layout for their design, intended to fly at 2,000mph (3,200km/h) while carrying 270 passengers. Boeing’s design was supposed to be able to fly at Mach 2.7 (1,800mph), carry more than 270 passengers, and be able to fly more than 4,200 miles (6,700 kilometres).

Boeing chose what’s known as ‘variable geometry’ – or swing wings, as they became known – in their initial design. The wings would be straight at low speeds, improving the aircraft’s handling at take-off and landing, and then swing back closer to the aircraft’s body as it picked up speed. And the US government must have been impressed – after a great deal of further testing, Boeing’s concept was chosen as the winner on 1 January 1967. But the 2707’s progress was anything but smooth.

Kit Mitchell was the principal scientific officer at the then Royal Aeronautical Establishment (RAE) in the 1960s, and worked on Concorde. He says the Boeing 2707’s main problem was that it was trying to do too much, and that so much of the technology needed to do it was still in its infancy.

The fact that the 2707 was supposed to fly hundreds of miles an hour faster than Concorde “had huge implications”, says Mitchell.

“When we were building Concorde, we were pushing technology as far as it could possibly go at the time. They were pushing for something that was just too difficult.”

The 2707 project was Boeing's major priority during the late 1960s (Credit: Boeing)

Mitchell says that the 2707's extra speed would have caused enormous challenges for every single part of the aircraft. At such speed, the aircraft experiences enormous heating – parts of Concorde's metal skin heated to well over the boiling point of water; the very tip of the nose could be as hot as 127C when cruising at Mach 2. "Everything – from the sealants, to the electrical wiring, to the windows, you name it, had to especially designed for a 'hot' airplane.

"A lot of this was unknown territory."

But few could criticise Boeing for not throwing enough resources at the design. Mike Lombardi, Boeing's resident historian, says: "To put into context just how ambitious this was, when Boeing was working on supersonic transport, the company was also designing what would be the 747 Jumbo Jet, and the 737 airliner had just entered service. There was the space programme to get a man on the Moon, which Boeing was heavily involved in, and there were some military projects as well.

"We were going to the Moon and building the 747, and 2707 was still the number one project at Boeing.

"Joe Sutter, who was in charge of building the 747, said how difficult it was to get engineers to design that airplane because they were all committed to supersonic transport."

National pride was at stake. But the political will wasn't enough to solve the enormous design challenges to get Boeing's swing-wing giant into the air. Some military jets had already been designed to use the technique, but these were small, carrying two crewmembers at most. Scaling that up to something that could carry almost 300 people was a huge challenge. "The problem Boeing had was that it meant a tremendous amount of extra weight," says Lombardi. "The bearings had to be really heavy, and the weight became almost prohibitive. The design team literally had to go back to the drawing board."

Even when the designers moved to a delta wing shape, says Mitchell, they still couldn't solve some of the weight problems which meant the aircraft was very fuel hungry and couldn't get from the US to Europe on internal fuel. "That's the same problem the Concorde prototype and pre-production models had too, however. We had to keep refining the design, and the production model was the first one that could actually cross the Atlantic."

Wings were not the only problem. The sonic boom the 2707 would create as it broke the sound barrier would be another issue. "Once it became apparent just how disturbing that was," Coen says, "it put paid to the idea of supersonic flight over the US."

A full-size mock-up of the delta-winged Boeing 2707 was built in Seattle (Credit: Boeing)

This would be the same issue that would affect Concorde. Dozens of Concordes had been ordered by airlines as the Anglo-French project gathered speed – including US airlines such as Pan Am and TWA – but these orders melted away as it emerged that the environmental constraints would limit the aircraft's use to flying over the ocean, far away from populated areas. (It's why British and French Concordes only flew to destinations on the east coast of the US.)

"The model that most airlines use means that they can't have an airplane that they can only use on a few routes," says Coen – if you're going to use expensive supersonic aircraft, then you have to use them on as many routes as possible so they pay for themselves.

Fuel was relatively cheap when the 2707 was being designed in the 1960s, but Boeing's design burned so much of it that the sheer costs of it might have offset the traditional argument in favour of supersonic transports – that they take less time to fly between airports so each aircraft can carry out more flights per year.

"What ended up killing [Boeing's design], and eventually Concorde itself, was the amount of fuel you had to burn. It became prohibitive," says Lombardi. "There was the recession of 1971, and the cost of oil started to rise. But even if it hadn't ended then, the oil crisis of 1973 would have killed it.

It would have ended up being a disastrous project if it had still gone ahead."

Boeing became a household name because of the aircraft that did make it into the air – the ones which took ordinary people on holidays near and far. But even if the 2707 failed to make it into the air, Lombardi says there were silver linings.

Nasa and Lockheed will collaborate on a new supersonic demonstrator (Credit: Nasa)

"The 2707 had a lot of effect on the development of the 747, he says. "The thinking was that all the world's airlines would want supersonic transport, and no-one would buy these subsonic airliners. So Boeing had to plan that some time in the 1970s they would have to turn all these 747s into cargo freighters. It turns out that we only needed to start doing that a few years ago."

And despite the project's failure, some of the things Boeing learned made its way into other experimental vehicles the aerospace giant built in the following decades, including some of the unmanned vehicles built in recent years, such as theHigh Speed Civil Transport project during the 1990s. And the super-critical wing, a design tweak now routinely used on modern airliners to limit shockwaves and reduce drag, came out of the 2707 project.

Lockheed's ill-fated L-2000 design will live on, in a way, thanks to the collaboration with Nasa and Lockheed to fly an experimental demonstrator to research the supersonic aircraft of the future. Perhaps, in years to come, a US-built supersonic airliner will finally take to the skies – with no pesky Concorde to get in the way this time…

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