

AVIATION

Concorde is more than a devastatingly beautiful folly, it is a way of life for its users. And following its darkest hour, it is now set to spawn an heir.

Concorde's supersonic son

By Christian Sylt in New York

After the fatal crash in 2000, Concorde's relaunch 15 months later couldn't have come at a worse time for the airline industry. Airline occupancy rates (known as load factors) were falling, carriers were collapsing and many analysts believed that an aircraft with return ticket prices of around #10,000 no longer had a place in a market dominated by budget carriers. But despite the bleak economy and several safety scares, Concorde has reclaimed its customers, and adds handsomely to British Airways' bottom line. And now BA has news for the doubters. Concorde will be replaced by a supersonic heir.

This is astounding news. Production of commercially-viable supersonic aircraft has confounded the biggest players in the aerospace industry since Concorde made its debut back in 1976.

At the end of 2002 Boeing scrapped its plans for a near-Mach 1 plane called the Sonic Cruiser, billed as a potential successor to Concorde. This was set to knock a fifth off journey times but add a premium of around 15 per cent to business-class fares.

A similar fate has befallen supersonic business jets. In 2000, NetJets, the fractional ownership brand, abandoned plans to acquire Dassault's Falcon SST, an aircraft capable of carrying eight passengers at speeds of up to Mach 1.8. Although the predicted purchase price of between #70 million and #80 million would be manageable, the warranty and servicing costs for supersonic aircraft are massively magnified. A conventional jet engine requires an overhaul every 7,000 operating hours compared to every 200 hours for supersonic jet engines.

The tricky problem of overcoming the sound barrier, and the environmental, technical and economic provisions this entails, was even enough to kill NASA's High-Speed Civil Transport programme in 1999. NASA's brief was to produce an official follow-up to Concorde and the only comparable contender remaining is Japan's #200 million National Experimental Supersonic Transport project. This is designed to fly twice Concorde's range and seat three times the number of passengers, but after the first unmanned test model crashed in July 2002, its future also looks decidedly uncertain.



Top: Captain Mike Bannister is Concorde's chief pilot and heads up British Airways' division for the supersonic aircraft.

Right: Concorde has been soaring into the skies for almost 30 years.

So when Concorde eventually retires from service, the supersonic segment will have a sky clear of rival aircraft. But Mike Bannister, Concorde's chief pilot, says that business travellers have become dependent on its speed and convenience and says this is what is driving development of its successor. "The human race has never taken backward steps for very long," he says.

"There will be a pause between Concorde stopping flying and the start of its next generation but I'm absolutely convinced it will happen."

He says that the next-generation Concorde should appeal more to the leisure market, with between 250 and 300 seats per plane but crucially a cruising speed either equivalent to the current aircraft or "marginally slower" at around Mach 1.8. Anything higher than Mach 2 creates heating problems which require much more sophisticated technology to resolve. Bannister suggests a transpacific range which is double Concorde's and would make it more flexible for leisure travel. "There need to be three classes rather than Concorde, which has one class," he says.

The proposition would involve paying an extra 20 per cent but cutting conventional air-travel times by half.

Although he won't say which manufacturer might build Concorde's successor, Bannister does say: "Maybe some of the technology on the Sonic Cruiser will work its way across to the next-generation Concorde". He adds that

Not even military jets can fly at twice the speed of sound for two hours as Concorde does.

it will "undoubtedly" employ the latest systems such as fly-by-wire navigation, which enables the captain to guide the plane using electronic instruments without looking through a windshield. This would incur a big weight-saving benefit by removing the need

for Concorde's heavy bendable nose, which is used to see the runway as it makes steep ascents and descents. "It will also make it easier and cheaper to build, but it won't be built unless there's at least 250," says Bannister.

Developing and building hundreds of high-tech planes capable of supersonic flight and having massive fuel capacities could cost as much as #30 billion. Inside sources suggest a new engine must be built because Concorde's Rolls-Royce engines consume too much fuel

and make too much noise. Mike Powell, an analyst at Dresdner Kleinwort Wasserstein (DrKW), agrees that the engine technology needs to be much quieter than Concorde's, both on take-off and landing and also when travelling. If not, the plane would not be able to fly over continental Europe or the US because of the sonic booms produced by breaking the sound barrier. Bannister simply says the plane "needs to meet all environmental regulations".

Bannister believes that governments will not get as involved in an aviation project as the UK and France did with Concorde's construction, "unless it's just fundamentally underwriting". Concorde's successor would also need backing from aerospace companies: "It's going to be such an expensive project that it would need international collaboration," says Bannister. But the current turmoil in the industry and weak economic environment puts a question mark over the exact nature of this collaboration.

Ironically, one of the biggest obstacles to getting the new plane off the ground may be its predecessor – with Concorde still in service after almost 30 years, it's hard to imagine a time when it won't be ruling the skies.

First conceived in 1956 when Britain and France started work on developing a >

CONCORDE'S CHRONOLOGY

- 1956** Start of supersonic airline research in Europe.
- 1960** British Airways' forerunner BOAC accepts its first Concorde reservation.
- 1962** British and French governments sign an agreement for joint design, development and manufacture of supersonic airliner.
- 1967** Roll-out of first prototype at Toulouse.
- 1969** (2nd March) First flight of Concorde 001 from Toulouse.
- 1969** (9th April) First flight of Concorde 002 from Filton, Bristol.
- 1972** BOAC orders five Concorde.
- 1976** (21st January) Inauguration of commercial supersonic travel by British Airways from London to Bahrain and by Air France from Paris to Rio de Janeiro.
- 1976** (24th May) London-Washington service starts.
- 1977** (22nd November) Inauguration of British Airways' London-New York service.
- 1996** (7th February) Concorde completes its fastest transatlantic crossing to date, flying from New York to London in two hours 52 minutes and 59 seconds.
- 2000** (August) British Airways suspends its supersonic operations following the accident involving an Air France Concorde outside Paris on 25th July.
- 2001** (7th November) Concorde returns to supersonic commercial service with a flight from London to New York.

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◁ supersonic plane, Concorde is one of the longest-serving aircraft currently in commercial use. Supersonic services began on 21st January 1976 when BA flew a Concorde from London to Bahrain; flights to New York followed in November 1977. But since Concorde is fundamentally a frivolous way of crossing the Atlantic, its development wasn't driven by demand. Financing the scheme was far from a smooth ride and in today's economy, where cost-cutting in companies is common, the plane probably would not have even taken off.

During the 1960s, 18 carriers had options on 79 Concorde aircraft, but the 1973-74 fuel crisis made the plane far less attractive. Coupled with the cost of spare parts, this led to only BA and Air France converting their options; in the end a mere 16 planes were produced by British Aerospace (now BAE Systems) and EADS. Only 14 of these were eventually sold and they were bought on terms which suited the carriers because they knew that neither the British nor French governments had any leverage in the matter. As a result British and French taxpayers paid dearly, shelling out \$11.25 billion in today's money to subsidise what was essentially a status symbol for their nations.

Bannister admits that when Concorde was still on the drawing board, "the ability to develop technology and be a world leader in the technological field was a very important piece of the jigsaw". And every element of the plane was produced for the sole purpose of flying as fast as possible on the world's busiest business route – between London and New York. Business travellers are prepared to pay a huge premium for this speed, and Concorde pulls it off today with the same effortless ease as it did on the day of its launch. It has never needed a successor.

The challenge of building an heir to Concorde becomes apparent when considering just what a work of art the original is. Concorde's dart-like design has a fuselage a mere 2.9 metres wide and its four Rolls-Royce engines come complete with reheat afterburners to produce a total of 152,000 pounds of thrust. This is four times more power than the latest military jets have at their disposal and enough to take the plane to double the cruising height of a 747 – 18,288 metres.

With weight critical, a fuel capacity of 119,500 litres gives Concorde a range of 6,667 kilometres – enough to get it across the Atlantic. But doing so takes some gas guzzling, and the plane consumes 25,629 litres of fuel per hour. Surprisingly, Bannister says that Concorde uses less fuel across the Atlantic than a conventional 747, and its secret is speed. Although it burns fuel at over twice the rate of a 747, it cruises at 2,160 kilometres per hour, which is twice as fast as any other commercial aircraft.

As Bannister proudly points out, not even military jets can fly at twice the speed of sound for two hours as Concorde does, and this is its USP. An average journey from London to New York takes just over three hours and passengers don't suffer jet lag since the plane arrives at roughly local time, an hour before it departed. So leaving London before noon, the plane still arrives in New York in the morning and business users save the day, which would otherwise be spent travelling. Bannister explains that Concorde is even used like a commuter shuttle by around 100 customers – some fly in for the afternoon to close deals where face-to-face meetings are required.

Bannister says that the next generation Concorde should appeal more to the leisure market with between 250 and 300 seats per plane, a cruising speed either equivalent to the current aircraft or 'marginally slower' at around Mach 1.8, and a transpacific range.

"On the internet you can't see people blink and on videoconferencing you can't see people standing with cue boards or whispering assistance," says Bannister. He claims that taking Concorde is a "no-brainer" when the deal being signed may be worth the equivalent of thousands of tickets. He says that as many as 10 per cent of the aircraft's business customers fly for this reason, and Concorde offers them an indispensable service. Anyone who needs to travel between London and New York as fast as possible really has no other option but Concorde since even private planes aren't as quick. All the more reason for Bannister to boast: "There is a supersonic business jet – it's called Concorde."

Concorde's business model is borne out by its customer base. Business travellers make up 80 per cent, 10 per cent are high net worth or famous individuals, five per cent are entertainers and the remaining five per cent are on "one-off" trips. "BA's Concorde clients predominantly come from the UK with about 10 per cent from Europe," says Bannister, but he adds that Air France's Concorde carries more customers from Europe and slightly fewer business travellers since Paris is not as important a financial centre as London.

But BA boldly boasts that not only is Concorde's business model strong, it is also successful. Since they entered commercial service, BA's Concorde have clocked up 50,000 flights and carried over 2.5 million passengers. The company claims load factors are consistently between 50 and 65 per cent and with a break-even point believed to be around 40 per cent, this would require an average of 40 seats to be filled per flight. ▷

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◁ However, as many as a quarter of Concorde's seats may be sold at discounted rates, upgraded from business class or offers obtained through frequent flyer miles. But even if the average price a passenger pays for a ticket is a third less (£7,000), BA's lowest load-factor estimation of 50 per cent would still pull in £175,000 per flight. This would yield a profit of at least £25,000 per flight and £17.5 million each year. Mike Powell from DrKW says that across its lifetime, Concorde generates a profit and reasons that "at the end of the day, BA will always insist that it makes money because if it didn't, BA wouldn't fly it".

Clipping Concorde's wings seemed almost inconceivable until 25th July 2000. The aircraft had ruled the skies for almost 25 years without a serious accident, but then a chartered Air France Concorde crashed in Paris, killing all on board along with four people on the ground. Air France's five remaining Concordees were grounded immediately, and three weeks later BA was forced to ground its seven-strong fleet when the French and UK civil aviation authorities took the almost unprecedented step of withdrawing the aircraft's certificate of airworthiness. Critics claimed that Concorde was too old to fly again and that the supersonic era was over.

Attacking the age of the fleet is easy to do. Since Concorde was custom-built it is incredibly expensive to build new planes from scratch. So rather than adding to the fleet, BA has always repaired or refurbished its existing aircraft. But with so few Concordees flying so rarely, detractors pointed out that the aircraft had a 'hull loss' rating (the average amount of times a plane is completely written off) of 11.64 per one million flights – compared with the average of 0.84 for a Boeing 737.

Bannister is adamant that because Concorde only flies for a few hours per day, "in aeroplane years, it has done about the same number of hours as a four- to five-year-old 737 and about the same number of landings as a four- to five-year-old 747". And although Concorde's spotless reputation had been blemished by the crash, it showed BA how business travellers had become dependent on a supersonic service.

"When we weren't flying, our customers were saying 'I really need that ability to save a day of travelling' and one of the things that came over really strongly was the effect of that on their business model," says Bannister. During the crash enquiry he served as a technical adviser to the UK Air Accidents Investigation Branch and persuaded the public that the modifications made to the aircraft would be sufficient to make it safe to fly. Bannister claims he "never had a doubt" that Concorde would fly again because the incident resulted from "a series of unique events".

All it took to tarnish Concorde's stunning safety record was a small piece of titanium left on the runway at Roissy-Charles de Gaulle. This started a chain reaction culminating in the fatal crash: when Concorde's wheel rolled over it, the titanium wasn't crushed but cut into the tyre. A huge 1.4-metre piece of rubber weighing 4.5 kilos was cut off and hurled



against the underside of the fuel tank. This then started a shockwave inside, which forced a piece of lining through the tank and led to a massive release of fuel at 100 litres per second. The debris from the impact clipped a tiny unprotected area of wiring, causing a spark which ignited the fuel.

Both BA and Air France wanted the planes back within a year since the cut-throat transatlantic business was still booming and Concorde gave them a strategic edge over their rivals. Once again, the UK and French governments came on board, but instead of providing financial help, they simply ensured that the different parties developing modifications across Europe were working in tandem so that BA and Air France could adopt the same modifications at the same time.

BA had already committed £20 million to a modern interior refurbishment but the safety modifications for its fleet cost a further £27

million. And BA didn't just buy new parts; it paid for the invention of new tests to ensure the aircraft was as safe as possible.

Concorde's manufacturers developed a four-stage process which involved investigating the accident, designing and testing modifications, stripping the aircraft for installation and producing repair kits. But Bannister says that one of the most impressive aspects of the programme was that BA had to do each process of engineering and testing concurrently. Although this took just 15 months to finish, doing the stages in sequence would have taken three years. Surprisingly, there were no modifications to Concorde's cramped 1960s-vintage cockpit. This is almost identical across both fleets so that the airlines' pilots can fly any of the planes; any cockpit changes would have entailed retraining. In fact, the bulk of the repairs did not interfere with the aircraft's systems at all.

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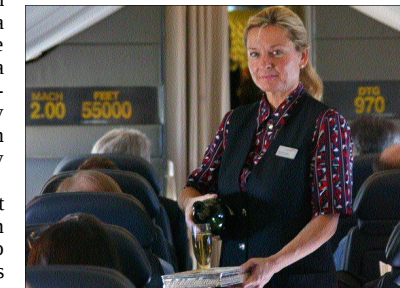
It took a week to rebuild and the test was then repeated with the new tyre, which only sustained a minor cut in the tread. The cycle of simulated take-off and landing was continued five times and the tyre simply deflated. The only time any rubber was lost was when an under-inflated tyre made a simulated landing with a locked brake on a wet runway and encountered some debris. But Bannister says the pieces of rubber that came off were far smaller than the one that caused the Air France disaster.

And since every extra pound of weight on Concorde equates to a pound more fuel required, the new tyres served another important purpose as they are around 160 kilos lighter than their predecessors. The new interior saves 360 kilos, so although the Kevlar coatings add 180 kilos to the 'unusable fuel weight' and a 400-kilo weight penalty, the modified plane ends up 140 kilos lighter than its predecessor.

From the outset, BA shared information about the accident and repair efforts with its core customers. Out of its 100,000 Concorde tickets sold annually, it had 2,000 long-time clients. Every few weeks after the crash, BA's directors updated them. Bannister even invited 50 of them to look inside the modified plane in March 2001, and says their main concern was how soon the plane would be flying again.

Concorde's certificate of airworthiness was reinstated on 5th September 2001. But no sooner had the champagne corks popped than the black cloud of 11th September overshadowed the celebrations. The public panicked about air travel and BA's stock lost 38 per cent of its value over the following month. However, after a crisis consultation with Concorde's regulars, BA concluded the launch wouldn't be ill timed.

Bannister says that although they were concerned about the threat of terrorism, this gave them an increased urgency to get back aboard Concorde to travel quicker between work and family. "They also know 80 per cent of the people on board and British Airways knows 100 per cent so they feel safer," he adds. So on 7th November 2001, Concorde returned to the skies between London and



New York. The most noticeable alterations as a result of the terrorist attacks were the switch from metal to plastic cutlery and the ban on in-flight chats to the captain, who is now locked behind armour-plated cockpit doors.

But although the plane is both mechanically and aesthetically improved from its 2000 version, the reverse is true of its parent

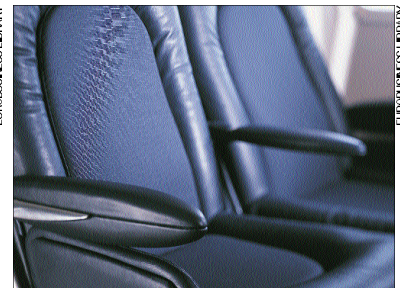
company's economic environment. "The market is about 30 per cent lower than it was before the crash," says Powell from DrKW, who claims he would be surprised if Concorde was generating a profit right now.

However, the greatest threat to trade on Concorde still comes from safety scares. Recent reports of a rudder falling off mid-flight and the plane's nose not locking into position for supersonic flight have only helped raise fresh concerns. Powell is adamant that the relaunch has been successful and strengthened BA's profile in the industry. "Concorde was already a very safe aircraft and it is now ridiculously safe," he says. And BA has prevented the possibility of accidents on chartered Concordees by cancelling this service, which accounted for around 10 per cent of operations prior to the 2000 grounding.

This will also help extend Concorde's airframe lifespan and Bannister believes that the plane could continue flying for a long time to come. He explains that during its development, supersonic travel was simulated 21,000 times on a full-size model of the aircraft. The team arbitrarily decided to divide this by three to arrive at a finite life for Concorde of 6,700 supersonic flights.

Bannister says: "At the beginning it was felt that the aircraft was unlikely to do 6,700 flights but in 1998 when the lead plane was coming up to that amount we had 17 years experience of actual supersonic operation. So to go a small step towards the 21,000 limit we invested about £1.5 million to compare 24 areas on the plane and the test model. We found that the plane was performing significantly better than the model in 18 of them and better or the same in the other six. And because we did that, we upped its lifetime limit to 8,500 flights, which will come up around 2009."

He believes that there is "no technical reason" why the aircraft can't carry on flying for another 15 to 20 years; extending the aircraft's lifespan when it is next up for review would, he says, be "a straightforward commercial decision".



This could answer the question of when Concorde's follow-up will begin flying. "I'm not sure I'd put money on it appearing in the next 15 years," says Powell. But even then, if Concorde is still crossing the Atlantic with its current speed and safety record, committing the final funds for a follow-up could still be tough for BA to justify.