

**When the world's first superjumbo was unveiled**, she blew the competition out of the skies. Onlookers marvelled at her elegance and style, but few realised the incredible challenges that had already been overcome to construct the new Queen of the Skies.

By DANIEL WEISS

PHOTO: RICHARD KOH

REAST

# E

## ven before they take to the skies, the giant wings of the Airbus A380 have already completed an epic journey.

Too large to fit in Airbus's Beluga Super Transporter freight planes, the 36-metre, 50-tonne wings are taken via barge and then specially constructed ship from the north Wales factory where they are made to the French town of Pauillac. Then it's onto another barge for the 40-kilometre trip up the Garonne River, where GPS sensors chart the course precisely to keep the precious cargo from scraping against low-slung bridges. The last leg is via truck convoy, which snakes its way for three nights along 240 kilometres of rural roads purposely widened and improved to facilitate the passage.

When the wings arrive in the company's Toulouse assembly plant in southern France, they are joined by other sections of the plane that have made similar journeys: the vertical tail plane from Germany; the belly fairing from Spain; the engines from the United States or Britain. The entire plane is assembled within a support structure seven storeys tall. Laser Assistance Spatial Positioning (LASP) ensures that the sections are aligned properly. Each wing is guided into position using an overhead crane and then attached to the fuselage with 8,000 bolts. One thousand employees are involved in the assembly and testing in Toulouse, and once the operation gets into its stride, it will take five days to assemble a single A380.

But assembly represents just 5 percent of the total labour that goes into constructing an A380. In all, the plane contains 4 million com-

ponents produced in 30 different countries. It makes unprecedented use of lightweight composite materials that help burn less fuel, as well as state-of-the-art electronics that help ensure smooth, safe operation. Able to carry up to 840 passengers in an all-economy layout or 450-600 with multiple classes, the A380 is not only the largest passenger airplane in the world, it is a marvel of modern engineering.

But all this engineering excellence is pointless if the passengers are not happy. The first thing an A380 passenger notices is the extreme quiet. "You could barely hear the engines when the plane took off," says James Wallace, an aerospace reporter for the *Seattle Post-Intelligencer* who flew from

The finished wings of the A380 travel overland (opposite page) to the final assembly site in **Toulouse, France**. Opened in May 2004, the main assembly hall (below) is 490 metres long, 250 metres wide and 46 metres high. This, along with other buildings on the site, contain **32,000 tonnes of steel** (the equivalent of four Eiffel Towers).



PHOTOS: PHOTOLIBRARY; AIRBUS S.A.S.

### A380 STATISTICS

● Max. fuel capacity: 310,000 litres ● Max. range: 8,200 nautical miles (15,200 km) ● Max. takeoff weight: 560 tonnes ● Weight (empty): 277 tonnes





PHOTO: AIRBUS S.A.S.

Singapore to Sydney on the inaugural A380 commercial flight, operated by Singapore Airlines in October 2007. “The noise factor is something special with the A380,” he says. Indeed, the new plane’s cabin is half as loud as in a Boeing 747, resulting in some novel challenges for Singapore Airlines. It has been forced to outfit galley cupboard doors with rubber insulation so that their now-audible slamming won’t disturb passengers.

### Streamlined Design

Much of the noise reduction has been thanks to the design of the A380’s four engines. These high-bypass engines use wider fans to maximise the ratio between cool air that passes through the outer reaches of the engine’s fans to hot air that passes through its centre. As a result, each engine is able to produce the necessary 31.75 tonnes of thrust while making far less noise than other airliner engines. In addition, the engine’s protective shell, or nacelle, is designed without splices that typically generate aerodynamic noise. The cabin has also been silenced through acoustical insulation and the placement of the engines somewhat further out on the giant wings. The magnitude of the wings also helps the A380 to lift off with 20 percent less runway length than the 747 and to attain altitude in less time, further reducing the plane’s “noise footprint” on takeoff.

The A380’s high-bypass engines, along with reduction in weight and improved aerodynamics, are key to also improving fuel efficiency. The use of composite materials – primarily carbon fibre reinforced plastic – to make up 25 percent of the aircraft has saved 15 tonnes. (In addition to the fin and the horizontal tail plane, which have been made of composites on earlier Airbus planes, the A380 is the first commercial airliner to have composite wing ribs and a composite centre wing box, where the wings join the fuselage. And much of the A380’s fuselage skin is



France is home to four Airbus manufacturing sites, **three final assembly lines** and the company’s headquarters. Workers building the A380 have to deal with construction on an unprecedented scale. Even painting Singapore Airlines’ first A380 took 21 days and used more than **2,200 litres** of chromate-free paint.

● Auxiliary power unit produces enough energy to supply 800 homes with heat and power

● Total weight of external paint: 531 kg

● Total no. of cabin windows: 220





made of GLARE, a highly durable glass fibre-aluminium laminate.) The use of higher-pressure fluid in the hydraulic control channels that drive ailerons, wing flaps and other components in the steering system, as well as the replacement of one of the customary three hydraulic channels with two electric ones, has shaved off another three to four tonnes due to reduced fluid volume and narrower pipes. Among several design alterations that help reduce aerodynamic drag, the air conditioning packs have been moved from the belly fairings to the wing leading-edge area - again, thanks to those oversized wings.

The net result is that the A380 burns almost 20 percent less fuel per seat-kilometre than the 747-400. This improvement “is really a quantum leap, a generational change,” says Stephen Forshaw, vice-president for public affairs at Singapore Airlines. “The fuel efficiency of this aircraft on a per seat-mile basis is about equivalent to a small hybrid car. The A380 is the most fuel-efficient jet aircraft ever built, and that’s really important for our industry.”

#### Health and Safety

Pilots familiar with other Airbus planes should be able to make the

## NOTABLE PLANES IN HISTORY

► **Antonov An-225 Mriya** is the world’s largest flying plane. With a wingspan of 88 metres, it is 84 metres long and has a maximum takeoff weight of 600 tonnes. It was originally designed to carry the Russian space shuttle Buran.



► **Boeing 747-400ER** has an increased takeoff weight of 412 tonnes, allowing it to travel about 760 kilometres further than existing 747-400s. It has a length of 70.6 metres and a 64.4-metre wingspan.

► **Hughes H-4 Hercules** (aka the “Spruce Goose”) was designed to carry two tanks or 750 troops. Made entirely of birch (not spruce), it made its first and last flight in 1947. Its 97-metre wingspan was the widest of any plane in history.



► **Ekranoplan KM**, also known as the Caspian Sea Monster, was a type of Russian sea plane operational in the mid-1960s. Over 100 metres long, it was able to travel about 400 kilometres per hour just several metres above the water in an attempt to evade radar.

► **Lockheed C-5 Galaxy** is the largest airlifter in the US Air Force. It has the ability to take off and land in distances as short as 1,500 metres. Its maximum takeoff weight is 381 tonnes.



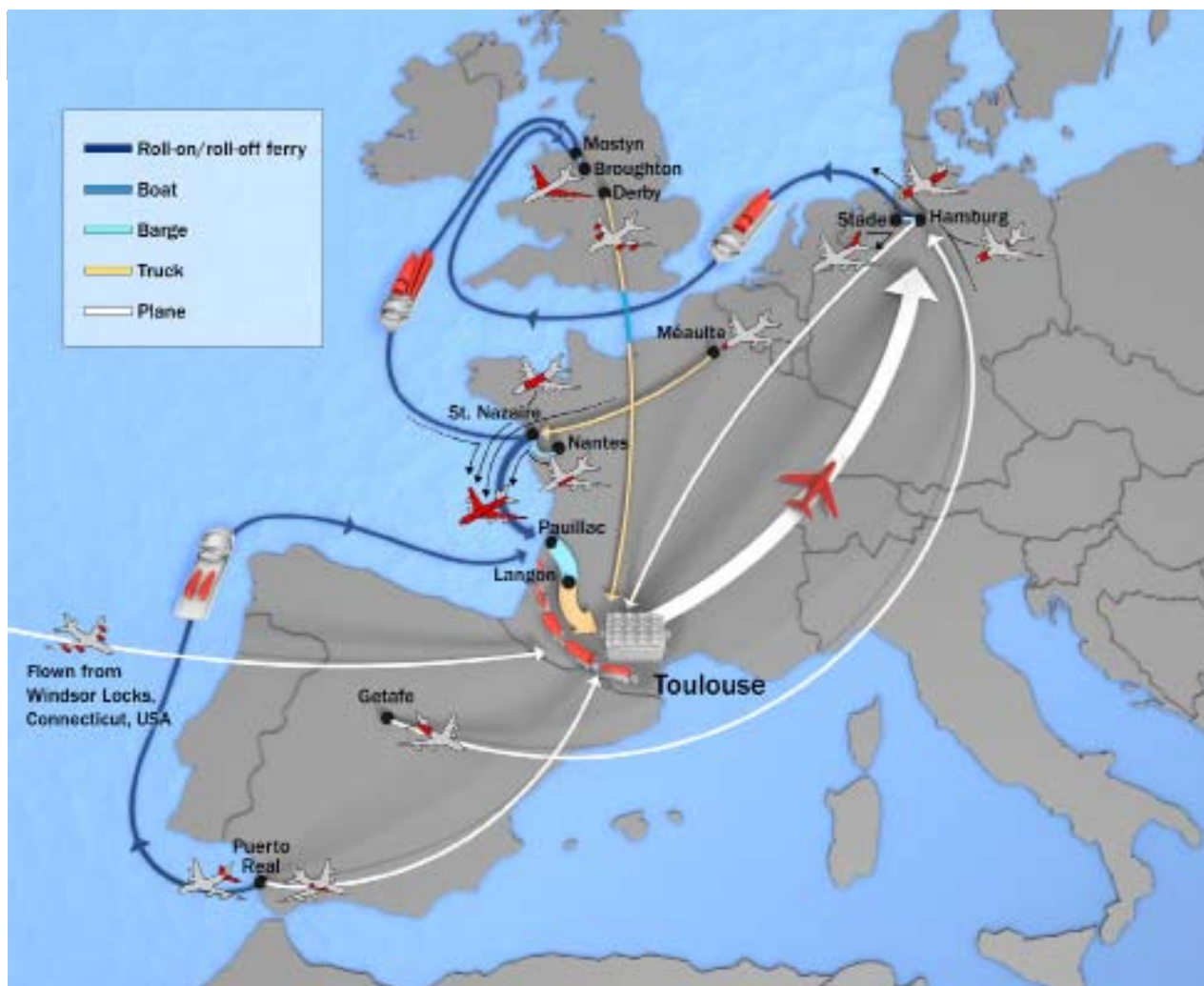


ILLUSTRATION: EMILY COOPER

**Flight of the Beast** To get a completely assembled A380, parts undergo an extensive journey spanning five different countries and five modes of transport.

transition to the A380 easily. A mere 12 days of retraining on a specially designed simulator is all it takes. They will find the cockpit very similar to earlier planes, just more interactive. The plane is also outfitted with a health monitoring system that keeps tabs on the engine and other systems, and communicates any problems to ground-based satellites via its Airman communications device. For problems that can be resolved during a flight, the system displays the relevant documentation on one of the cockpit's eight display screens. Recently, the system detected a malfunctioning engine component on an A380 Singapore Airlines flight to London, giving the maintenance crew on the ground at Heathrow Airport ample warning to locate the spare part and prepare

for the repair. As a result, the crew saved at least two hours - a precious window given the plane's quick turnaround time in London.

A year and a half on from its commercial debut, the A380 is settling into its position as the new queen of the skies. Singapore Airlines crews report that passengers treat the plane as a celebrity, stopping to pose with it for photographs. Singapore has divided its A380 cabin space into 12 luxury first-class suites, 60 business-class seats and 399 economy seats. The suites are the most luxurious accommodations available on a commercial airliner, with a full 3 square metres of floor space, a metre-wide seat and a separate double bed that folds down from the wall. Even the economy seats are about 2 centimetres wider than the

industry standard. Emirates, which began flying the A380 in August 2008, provides showers for its first-class passengers, while first- and business-class travellers have access to lounges.

Whether the A380 will go on to dominate the jumbo jet market as long and thoroughly as the 747 did remains to be seen. Qantas became the third airline to fly the A380 in October last year but recent orders have been somewhat disappointing. This is due, in part, to volatile fuel prices and the global economic slowdown. But Airbus continues to look ahead, forging on with plans for a stretched version of the plane that would take full advantage of those giant wings, adding another 6.4 metres in length, and capacity for over 100 more passengers. ■

● Engine thrust: approx. 31.75 tonnes ● Engines suck in over 1.25 tonnes of air per second ● During takeoff, wings flex upwards over 4 metres ● Total volume of three decks: 1,570 cubic metres



Living up to its celebrity status, the A380 was one of the star attractions of the **Singapore Airshow** in February 2008. After being towed down the runway, it performed an **aerial display** for the crowd of admiring onlookers.

PHOTO: RICHARD KOH

