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Challenge Airbus

Figure 1 A computer-generated image of the 555-seat, double-decker A380

From the 1980s, through talks with airlines and airports, Airbus identified a need for an aircraft larger than a 747: an aircraft with more capacity, range and comfort, which would also be significantly more efficient, quieter and less polluting.

Any new large aircraft design had to fit within an 80 m footprint (nose to tail, wing tip to wing tip) and its height was restricted to 80 ft (24.4 m) – allowing it to use today's airports, runways and ground-support infrastructure.

With passenger traffic increasing by around 5% a year over 20 years, airports such as Heathrow are running out of slots to accept more flights; building new airports and runways is not an acceptable solution. At least part of the answer is to increase the capacity of the planes as well as their efficiency.

Airbus forecasts a market for over 1400 of these large aircraft, including freighters, over the next 20 years to 2020 – a potential market valued at $330 billion. With the market demand for the product and a challenging set of requirements, Airbus set to work at its centres of excellence across Europe to ensure the aircraft would meet the efficiency and performance targets required.

Spanning 36.3 m from fuselage to wing tip, the A380 wing has nearly twice the surface area of the former largest, the Airbus A340-600.

Airbus has earned a reputation for considered and staged introduction of new technology with each new aircraft model it introduces. However, for A380 the teams calculated that substantial innovation would be required in virtually all areas, including aerodynamics, structures, systems and design processes.

For the UK-based wing and fuel system design team, the starting point was clear: the wing span must be under 80 m! Innovations have included new methods of optimising designs, including rapid prototyping using stereolithography, the use of an integrated aerodynamics analysis suite, and knowledge-based and concurrent engineering-driven design processes. New systems technologies have been introduced, including using fuel for wing load relief and, for the first time on a civil aircraft, the use of 34.5 MPa hydraulic systems pressure. New materials – the

Figure 2 A380 wings being delivered from the UK

most advanced metallics and composites – are being used for virtually every component. The latest new manufacturing processes and construction principles are also being used.

Thinking big

Spanning 36.3 m from fuselage to wing tip, the A380 wing has nearly twice the surface area of the former largest, the Airbus A340-600. The astonishing scale includes a measurement of over 45 m along the wing's leading edge.

The size of each aircraft section has presented other major challenges for the Airbus team and its suppliers, including provision of materials, factory handling and especially delivery of the completed sections to the aircraft final assembly line.

Airbus operates a fleet of Airbus Super Transporter aircraft, known as Belugas because of their whale-shaped fuselages. These move and deliver sections between factories and final assembly lines for existing Airbus models. With delivery rates at more than 300 aircraft a year, these planes are daily visitors to the manufacturing sites of Airbus in the UK, France, Germany and Spain. However, completed sections of the A380 won't fit into the Beluga.

Special delivery

Teams were set up to study other potentially viable delivery solutions and a combination of river, sea and road transport was decided upon for the A380. This integrated transportation system involves special dedicated transportation jigs for each section. These are carried on self-propelled road trailers, river craft and a dedicated 'ro-ro' ship.

From the UK, for example, the wings began with a short road journey from the Broughton, North Wales factory to the nearby River Dee. There they were loaded onto a river craft which made the 18-mile trip along the river to the Port of Mostyn. At Mostyn the ship arrived from Hamburg with a fuselage section onboard; it collected a pair of wings and continued via St Nazaire for more components, then on to Pauillac near Bordeaux. From Pauillac sections travelled by barge on the River Garonne to Langon where they were transferred to road transporters for the final leg to Toulouse.

In Toulouse today, four aircraft are in final assembly and the first flight is due in early 2005. Two non-flying static and fatigue test aircraft are also assembled.

The Airbus team has risen to the challenge to produce the world's largest civil airliner. Orders from 13 major airlines stand at an unprecedented level at this stage, with 139 firm orders and commitments plus options. Airports world-wide are preparing to accept their first A380s when the aircraft enters service in 2006. ■