The Airbus A380 - Towards a New Future for Air Transport
The future has arrived
A380 Family

159 firm orders
16 customers

(end April 2006)
21st Century flagship

- **Airbus A380**
  - 560t
  - 555 seats
  - 8000 nm
  - EIS 2006

- **Airbus A380F**
  - 590t
  - 150 t
  - 5620 nm
  - EIS 2008

Branding logos for various airlines are also shown.
A380 Cabin layout

- 2 full decks
- 4 aisles

96 Business
103 Economy

22 First
334 Economy

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Providing more capacity, more comfort

Upper deck - true widebody cabin
2-2-2 business class, common product with Airbus long range family

Main deck - the widest cabin ever
wider seats in every class

Large innovation potential
The lowest cost by far

Advanced systems & manufacturing processes

Advanced materials

Advanced powerplant
A380 maintenance advantages

**Integrated Modular Avionics**
- Common hardware
- Software upgrades onboard
- Flexibility for reconfiguration

**Maintenance Programme**
- Longer check intervals
- Low scheduled requirements

**Structures**
- GLARE and CRFP for less fatigue and corrosion
- Laser Beam Welding
- Standard repair procedures

**Onboard Maintenance**
- Cockpit server for all Manuals
- E-logbook, Airman, PMATs

**Electrical system**
- Variable frequency
- New Interactive Maintenance

**Fly-By-Wire**
- New Electro-Hydraulic Actuation
- Superior redundancy for High dispatch reliability

**New Hydraulics**
- Only 2 circuits, 5000 psi
- Maintenance free accumulators

Leading to 25% lower DMC per seat than the 747-400
The **GREEN GIANT** for our planet

The first long-haul aircraft with less than 3 litres per pax/100km fuel consumption*

* 5000 nm sector, Typical International Flight Profile, 555 pax
A380 and the environment

Trent 970 emissions as %age of CAEP 4*

CAEP 5 limits

Cleaner

* Preliminary emissions certification data
A380 vs. 747-400 noise contour

85dB(A) Noise Contour for take-off at FRA as calculated by Lufthansa with input of Boeing and Airbus nominal noise data for same take-off conditions

The A380’s double advantage

1. **The technology effect:** half the noise per movement

2. **The capacity effect:** fewer movements
A380 likely routes
Current customers

Over 60 airports will see the A380 by 2010

Subject to change, based on current A380 customer and airport statements - Status as at end of 2005
By end 2010, 69 airports will be ready for the A380
A380 airport compatibility is proven

Large airports, for operational checks

- Singapore
- Frankfurt

Small airports, for performance testing

- Medellin, Colombia
- Pointe-à-Pitre, Guadeloupe
- Tarbes, Southern France
- Iqaluit, Canada

More than 20 airports already visited
A380 First flight
A380 Flight tests

• From 27th April 2005 to 8th June 2006
• Aircraft flying : MSN 1, 4, 2, 7, 3
• 430 flights
• 1416 flight hours
• More than 100 pilots, including some 50 airline pilots
A380 Flight tests

• Test objectives
  ‣ Check of the aircraft behaviour
    – Direct and normal flight control law
    – Effect of speed, Mach number, altitude, aircraft weight and centre of gravity position
    – All flight phases, from take-off to landing.
  ‣ Check of the adequate functioning of the various aircraft systems during the various flight phases.

• Main results
  ‣ Excellent aircraft behaviour
  ‣ Control laws, and auto flight already very mature
    – Aircraft behaviour close to simulator
    – Successful autoland on flight 17, 35 days only after first flight
  ‣ Major systems working as intended during normal operations.
  ‣ Early safety checks carried out flawlessly
    – Landing gear gravity extension
    – Ram air turbine extension and functioning
    – Engine relight
Water trough tests

- 1 acceleration + 1 deceleration at ~70 kt
Frankfurt Airport compatibility checks – 29th October 05
Hot & high campaign in Medellin (Colombia)
Cold weather campaign in Iqaluit (Canada)
Cabin evacuation test – 26th March 06

- Certification requirement: Evacuation must be fulfilled in less than 90 seconds using half the number of doors.
- Result: 873 people evacuated in ~80 seconds.
Cabin Virtual First Flight – 10\textsuperscript{th} May 2006

- **TEST OBJECTIVES:**
- Test all cabin functions on ground with a representative passenger and crew loading during 5 hours on MSN 2.
- 474 passengers
- 22 crew members
Major R&T impacts from Flight Physics

**High Reynolds Number W/T Testing**
Reduction scatter in the performance figures through the development and application of High Re Test techniques: better prediction and therefore less margins for Performance guarantee (Conventional Tunnel = +/-0.75 % vs +/- 0.25 % in Cryogenic Tunnel) – To be translated into 1.3 dc (0.5 %) drag benefit.

**Nacelle anti-ice Cyclone concept**
50% reduction in Nacelle Anti-Icing system weight (100kg) plus reduced in Anti-Ice System Maintenance.

**Advanced Load Control**
Reduction of 2200kg of wing weight through further improvements in Aircraft load control (fatigue/manoeuvre/ turbulence Wing Loads alleviation).

**Integrated Wing Design**
- VHBR Engine Integration
- High Speed Wing Design
- Advanced CFD Simulation

More In-board loaded wing gave weight reduction of 4000kg (for a slight increase in induced drag) through improved understanding of High Reynolds/Mach wing aerodynamics plus a drag reduction of 3-4 dc (1.5%) through improved wave & installation drag handling.

**Optimal Tail and Empennage**
Variable thickness distribution of VTP/HTP gave mass reduction of 350kg, improve tail flow saved approximately 1.5dc (0.5% of drag).

**Methodology for Wake Vortex Prediction**
Validated methodology for wake vortex prediction and enabling A380 classified in the same category as B747 (instead of super heavy: +2NM). Benefits for marketing & Airport capacity.

**Droop Nose**
Lower drag, improved lift / drag ratio for take-off performance, tailored maximum lift.
Major R&T impacts from Powerplant

- Inlet acoustic liner (0-splice)
- Automated (FMS) Noise Abatement Departure Procedure
- Noise reduction landing gear fairing
- Nacelle anti-ice Cyclone concept
- Wing over-pressure tube noise suppression
Major R&T impacts from Structure

- Thermo-Plastic J-Nose
- CFRP Floor Crossbeams for upper deck
- CFRP Wing ribs
- GLARE® Partially in Upper Fuselage
- Laser Beam Welding in Lower Fuselage
- CFRP Horizontal tail plane designed for relaxed stability
- CFRP Rear Pressure Bulkhead
- Flap track panels in CFRP (Resin Transfer Moulding)
- Finite-Element Analysis Global Load Behaviour
- CFRP rear fuselage Section 19 / 19.1
- CFRP Center Wing Box
- 1st
Major R&T impacts from Systems

1. Integrated and modular avionics (IMA)
   - AFDX high speed bus network

2. Dual air conditioning pack
   - New concept based on two redundant pack

Electrical generation
- Solid state power controllers
- Variable frequency power generation

Vehicle flight control
- Enhanced vehicle control laws
  - e.g. “Brake to Vacate”
- Electro-hydraulic actuators
  - Two hydraulic (5000 psi) + two electrical channel architecture

1. Interactive man /machine interface

Cockpit

On board maintenance systems
- Based on open world network
A380 – first feedback

An excellent aircraft, already well appreciated by pilots and which will be very soon appreciated by passengers
The A380: flying today…

… an all-new, 21st century design

… on track in payload and range - and making much less noise

… achieved JAR and FAR certification - to the latest standards

… with true development potential - a future-proof family

… it will be the flagship of the 21st century!
Thank you
Major R&T impact on A380

**Flight Physics**
- High Reynolds number, low-drag wing design
- More inboard loaded wing

**Structure**
- Upper skin fuselage in GLARE®
- Composite centre wing-box (biggest in the world)
- Composite rear fuselage (Section 19)

**Powerplant**
- Zero-splice nacelle inlet acoustic treatment

**Systems**
- 2 hydraulic (5000psi) + 2 electrical channel architecture for flight controls and landing gear
- Integrated and modular avionics architecture (IMA)
- On-board maintenance system
- Variable Frequency Generators (VFG)

**Cabin**
- Advanced double-deck cabin design
- Advanced flexible fuselage payload systems

**Business Performance & Integration**
- Overall aircraft configuration
- Concurrent Engineering
- KBE for wing design
Some misperception…

• Correctly pointing out A380’s lower fuel / seat (than any 747)
• The figures on A380 emissions* are, however, as follows:

<table>
<thead>
<tr>
<th></th>
<th>A380 vs 747-400 (RR engines)</th>
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</thead>
<tbody>
<tr>
<td>HC</td>
<td>-96%</td>
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<tr>
<td>CO</td>
<td>-59%</td>
</tr>
<tr>
<td>Nox</td>
<td>-25%</td>
</tr>
<tr>
<td>smoke</td>
<td>-9%</td>
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</tbody>
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* Preliminary emissions certification data from RR

A380-800 / RR Trent 970
vs
747-400 / RR RB211-524H-T