Changing the game
Will the world look different after the A380?

INCLUDES FIRST-EVER A380 CUTAWAY POSTER
A FLIGHT GROUP SPECIAL REPORT

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THE FLIGHT GROUP JUNE 2005
Now that the A380 has taken to the skies, the debate over whether the 555-seater will exert the same influence over the market as Boeing’s 747 did in the 1970s begins in earnest.

When Boeing’s 747 Jumbo Jet started criss-crossing the world’s major air routes in 1970, it changed the game for the airline business. Never before had airlines been able to sell 375 seats in one aircraft and fly people across the Atlantic. Later the aircraft became even better, flying more people further than ever.

It has taken 35 years, but finally the 747 has a challenger. Not only that, it has a rival that Airbus has deliberately designed to take a step-change in size. By almost every physical measure, the A380 leapfrogs the 747, and if Airbus sticks to its promises, the aircraft could have seat-km costs 15-20% better.

So, to mark the A380’s public debut at the Paris air show, this first-ever joint special report written by Airline Business and Flight International – which includes our A380 cutaway poster – asks whether the giant will change the game in the same way the 747 did 30 years ago.

Without doubt, from a technological perspective, the A380 is the largest step-change since Concorde. The sheer size of the aircraft has dictated that Airbus adopt smart new engineering solutions, from the structure to the hydraulic system. As with all new technologies, there will be teething troubles. The manufacturer and airlines expect this, but with the impact of a technical delay being magnified by the aircraft’s size, all are working furiously to ensure the A380 is as mature as possible on service entry.

Steep learning curve

On the ground, airports have never seen anything as large as the A380 and are spending millions to handle it. Despite the best-laid plans, the learning curve for airlines and airports will be steep as London Heathrow, Singapore Changi and Sydney Kingsford Smith will discover late next year.

In the air, the double-deck A380 will instantly give airlines 30% more seats than the 747 and...
As the A380 takes off, its biggest challenge is yet to come.

As the A380 takes off, its biggest challenge is yet to come. They are promising much for the interiors of their new aircraft, but the hard truth is that it will be bums on seats – and a lot of them – that will determine whether airlines make money with their new production tool. As a money-maker, some are even keener on a stretched A380. Then there is the prospect of all-economy A380s shuttling 700 people on trunk routes.

As an all-cargo transport, the aircraft offers one-third more payload than the 747 freighter. The ubiquitous Boeing is far from finished as a freighter, however, as a raft of new and converted 747s are entering the cargo arena.

Clearly, if the A380 is to mirror the 747 in changing the game, both for manufacturer Airbus and operators, it is market penetration that will count. While in sales terms the A380 has got off to a solid start, the dynamics of the high-capacity long-haul market are far more complex than they were 30 years ago. Today smaller widebodies such as the A340 and 777 have made major inroads into what were once traditional 747 markets. The passenger-carrying 747 fleet has been in decline for several years.

Thirty years ago, there were those who doubted whether the 747 would be a success – even some within Boeing itself – as supersonic transport beckoned. But rapid traffic growth meant the Seattle-based manufacturer’s gamble paid off. Airbus, too, is delivering the A380 into an economic upswing, although it is by no means as strong. But other factors are at play, such as competitive pressures and uncertainty over how new markets will develop. And perhaps the biggest unknown is whether capacity constraints really will drive carriers to larger aircraft.

Airbus has gained widespread industry praise for making the A380 a reality, but as the flight test programme gets under way, its biggest challenge is yet to come.

Max Kingsley-Jones
Commercial Aviation Editor
Flight International

Mark Pilling
Managing Editor
Airline Business

**How they compare – A380 versus 747**

<table>
<thead>
<tr>
<th></th>
<th>A380</th>
<th>747-400ER</th>
<th>% difference</th>
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<tbody>
<tr>
<td>Length</td>
<td>72.7</td>
<td>70.7</td>
<td>+3%</td>
</tr>
<tr>
<td>Wingspan (m)</td>
<td>79.8</td>
<td>64.4</td>
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</tr>
<tr>
<td>Wing area (m²)</td>
<td>845</td>
<td>541</td>
<td>+56%</td>
</tr>
<tr>
<td>Height (m)</td>
<td>24.1</td>
<td>19.4</td>
<td>+24%</td>
</tr>
<tr>
<td>Maximum take-off weight (t)</td>
<td>560</td>
<td>413</td>
<td>+36%</td>
</tr>
<tr>
<td>Range (km)</td>
<td>15,000</td>
<td>14,200</td>
<td>+6%</td>
</tr>
<tr>
<td>Maximum fuel capacity (l)</td>
<td>310,000</td>
<td>241,000</td>
<td>+29%</td>
</tr>
<tr>
<td>Accommodation (typical 3-class)</td>
<td>555</td>
<td>416</td>
<td>+33%</td>
</tr>
<tr>
<td>Installed thrust (lb)</td>
<td>280,000</td>
<td>252,000</td>
<td>+11%</td>
</tr>
<tr>
<td>Cargo payload – Freighter (t)</td>
<td>150</td>
<td>113</td>
<td>+33%</td>
</tr>
<tr>
<td>List price ($million)</td>
<td>272-292</td>
<td>198-227</td>
<td>+37% to +29%</td>
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</tbody>
</table>

**IN MY VIEW**

The A380 will enable us to increase capacity at the world’s slot-constrained airports – that alone means it is vital to our future.

CHEW CHOON SENG
CHIEF EXECUTIVE, SINGAPORE AIRLINES

The A380 will revolutionise air travel like the 747 did in the 1970s.

GEOFF DIXON
CHIEF EXECUTIVE, QANTAS
In the four years since the A380 was launched, Airbus has built a solid order book for the aircraft, although some observers have raised allegations of heavy discounting and question the size of the market, reports Mark Pilling.

After an initial flurry of orders from seven customers when the aircraft was launched in 2001, Airbus has added a couple nearly every year since (see graphic). By the end of May, Airbus had announced 154 firm orders and commitments for the aircraft. These include orders this year from China Southern Airlines for five A380s and from UPS for 10 A380 Freighters. Bagging these customers means Airbus has already met Leahy’s target of two new customers a year. “This is a good cruise speed,” says Scherer.

Healthy order book
He acknowledges that Boeing hotly disputes the size of the market for very large aircraft, but believes the healthy state of the order book to date proves airlines are ready for the A380. “We put our success down to the relevance of this aircraft,” says Scherer. “We are planning to produce more or less 40 aircraft a year. If you look at our 150 orders, that represents over four years of production that is already taken. This aircraft is a production tool that...
drops an airline’s costs 15-20% – you want to get your hands on it if you can afford it.”

So far, 12 passenger airlines, both of the world’s largest express package carriers, and one lessor have ordered the A380. Emirates – with its 43 orders – is by some distance the largest customer. Airbus forecasts a demand for around 1,600 A380-sized passenger and freighter aircraft over the next 20 years – mainly as a 747 replacement, especially in congested hub-to-hub operations – and it is confident it can capture at least 50% of that market.

Boeing is convinced carriers prefer smaller and more efficient airliners, like its 250-seat 787 and the 300-360-seater 777, to operate on point-to-point routes. However, it does see a market for 535 aircraft of over 400 seats (and equivalent-sized freighters) over a similar time period, and is studying whether to upgrade and stretch the 747 to offer a 450-seater – the 747 Advanced – from 2009.

At this early point in the A380’s life, nobody knows how successful the programme will be. Naturally enough, the chief executives of the airlines that have ordered it believe the aircraft really could change the long-haul game with its size and economic advantage. Airbus has already said this select group of carriers, plus a few others likely to order the aircraft, will operate the vast majority of A380s that enter service.

As the accompanying table shows, several large 747-400 operators are being targeted by Airbus as obvious sales candidates. These include Japan Airlines and All Nippon Airways, although neither appears a short-term prospect. “We are not giving up on Japan and are working very diligently with JAL and ANA on explaining the benefits of this aircraft,” says Scherer. US carriers are generally not in the financial position to order A380s today, but eventually will be. “It is a matter of waiting for the right time in the investment cycle,” he says.

Break-even target

From a commercial point of view, the Airbus party line is that it needs to sell 250 A380s, plus or minus 10%, for the programme to reach break-even. However, in December the company warned that research and development costs could exceed the planned $10.7 billion (in 1999 dollars) budget by some €1.45 billion.

Speaking earlier this year, departing Airbus chief executive Noel Forgeard said this overrun is “a risk between now and completion of the A380 programme around 2011”. He said Airbus is taking measures to limit any overrun and it will have only a “minor impact” on the profitability of the programme.

Scherer says the risk of overrun is partly down to the A380’s sales success: “A good portion is linked to the fact that we have sold more aircraft than we originally thought and consequently are looking at many more cabin variants to satisfy our customers than planned. We are ahead in terms of orders and so are ahead in terms of development cost. Perhaps we haven’t really driven that point home.”

An interesting twist to this story came in early April when the authors of an A380 project appraisal released their report. Originally written in early 2002 with financial backing from Boeing, but updated in mid-2004, the headline conclusion was that between 2006 and 2025 the A380 programme would lose $8.1 billion, mainly because of cost overruns and the aggressive discounting for large numbers of launch orders.

With Boeing’s involvement, the report is open to claims of bias, but the four respected US academics and consultants – Richard Aboulafia of the Teal Group, Aaron Gellman of Northwestern University, George Hamlin of MergeGlobal and Hans Weber of Tecop Consulting – stress that the US manufacturer was not consulted about their approach or the conclusions.

Heavy discounting

A key element of the report states that Airbus has been heavily discounting the A380. It suggests airlines have been paying launch prices of $130 million to $145 million, a huge 40% discount from earlier catalogue prices of $240 million to $250 million. Airbus quotes the A380’s current catalogue price as $272 million to $292 million, and Scherer says the alleged discounts mentioned in the report are a work of fantasy: “They’re bullshit, with a capital B and a capital S.”

Scherer will not reveal the price cuts Airbus does offer, but says he is “still amazed at the gossip that goes around this industry when it comes to aircraft transactions. Compared to normal commercial practice, are we doing extraordinary things to get this giant going? No, we’re not.”

Scherer says he is comfortable with reports that the company is a “little
The emergence of the 747 Advanced has slowed a few A380 sales campaigns

<table>
<thead>
<tr>
<th>Prospective A380 customers</th>
<th>747-400 fleet</th>
</tr>
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<tbody>
<tr>
<td>British Airways</td>
<td>57</td>
</tr>
<tr>
<td>Japan Airlines</td>
<td>44</td>
</tr>
<tr>
<td>United Airlines</td>
<td>31</td>
</tr>
<tr>
<td>China Airlines</td>
<td>30</td>
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<tr>
<td>All Nippon Airways</td>
<td>23</td>
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<tr>
<td>KLM</td>
<td>22</td>
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<tr>
<td>Cathay Pacific Airlines</td>
<td>19</td>
</tr>
<tr>
<td>Northwest Airlines</td>
<td>16</td>
</tr>
<tr>
<td>EVA Air</td>
<td>15</td>
</tr>
<tr>
<td>Air China</td>
<td>12</td>
</tr>
<tr>
<td>Air India</td>
<td>11</td>
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<tr>
<td>Air New Zealand</td>
<td>8</td>
</tr>
<tr>
<td>South African Airways</td>
<td>8</td>
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<tr>
<td>Asiana</td>
<td>6</td>
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<td>El Al</td>
<td>5</td>
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<table>
<thead>
<tr>
<th>Cargo airlines</th>
<th>747-400F fleet</th>
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<tbody>
<tr>
<td>Korean Air Cargo</td>
<td>16</td>
</tr>
<tr>
<td>Singapore Airlines Cargo</td>
<td>14</td>
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<tr>
<td>Cargolux</td>
<td>13</td>
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<tr>
<td>Atlas Air</td>
<td>11</td>
</tr>
<tr>
<td>Asiana</td>
<td>6</td>
</tr>
<tr>
<td>Cathay Pacific Airlines</td>
<td>6</td>
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<tr>
<td>Polar Air Cargo</td>
<td>6</td>
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<tr>
<td>Air France</td>
<td>5</td>
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<tr>
<td>KLM Cargo</td>
<td>3</td>
</tr>
<tr>
<td>EVA Air</td>
<td>3</td>
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</table>

Top 15 747-400 operators that have not yet ordered the A380 clearly shows the main sales prospects for Airbus. British Airways, along with the two Japanese majors, are key potential customers. Today BA is concentrating on debt reduction, but could order A380s in 2008 for 2010 delivery as it upgrades its fleet alongside the opening of London Heathrow’s Terminal 5.

For several carriers, A380 orders depend on whether Boeing launches its 747 Advanced. China Airlines, Japan Airlines, Cathay Pacific and Cargolux fall into this category. All Nippon Airways is a medium-term prospect after 2010 and is currently evaluating its large aircraft strategy. In the USA, United Airlines is not in the financial shape to place new orders, although Northwest Airlines is seen as a longer-term prospect, but not before 2010.

Air China could become the next A380 customer with an order before year-end for 10 aircraft, with two being leased from ILFC.

But the commercial team is playing down the next steps for the aircraft for the time being. “Clearly there are growth plans for this airplane and we would expect airlines like Emirates to be interested, but it is not decided yet when this will take place or by how much it will be stretched,” says Scherer.

The manufacturer may even go against convention and launch the stretch first. “An increased capacity version has a good chance of coming first because I don’t see any challenge on range at this point.”

“"There is no doubt that we will order the stretched A380. What we’ve got now is the mini version."

Maurice Flanagan, vice-chairman, Emirates Group

Who’s next?

The emergence of the 747 Advanced has slowed a few A380 sales campaigns

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bit ahead” of the A380’s business plan: “Airbus constructed a business case for the A380 and we are doing very well indeed compared to that. That wouldn’t be the case if we were running around discounting the hell out of it to get the numbers up. It is the relevance of the aircraft that is driving demand.”

Scherer admits that in the early days of the programme, some people wondered whether the size and price of the aircraft would demand a new dynamic in sales and financing. “Even in our company, people had a little stage fright. But it is not a different way of selling – it is business as usual.”

However, the A380 sales process has benefited from an industry trend towards deals that tie in more wide-ranging performance guarantees, and a deeper level of manufacturer support.

“We are selling to very large, sophisticated airlines and there are a number of ways and there are a number of areas where we can customise transactions to suit the needs of the airlines.”

747 Advanced threat

As Airbus begins flying the A380, Boeing is being pressed by carriers to decide whether to launch its 450-seat 747 Advanced. Although a couple of A380 sales campaigns have been slowed down by the possibility of carriers choosing the 747 Advanced, it is “not a major threat”, says Scherer. It is mainly cargo and not passenger carriers that have been taking time to evaluate the 747 Advanced. And, as Scherer notes, the notable size difference between the aircraft means they are addressing different market segments.

There will be even more clear blue water between the 747 and the A380 when the Airbus aircraft is stretched to hold around 650 passengers. Traditional aircraft development sees a more powerful aircraft with a higher gross weight, giving more range, coming first. These improvements are then fed into a stretched variant which has the range of the original aircraft.

Emirates has already said it would snap up the proposed A380-900 stretch if it became available. “There is no doubt that we will order the stretched A380. What we’ve got now is the mini version,” says Maurice Flanagan, vice-chairman, Emirates group.

Airbus has built plenty of growth potential into the A380 – “We have not designed an aircraft with an 845m² wing for nothing,” says the programme’s senior vice-president engineering, Robert Lafontan.
IT HAS LONG BEEN ASSUMED that the A380’s entry into service next year will be the point at which the French and German shareholders of Airbus’s parent, EADS, will begin an orderly retreat from aerospace. Privately owned French media company Lagardère, the French government and German car maker DaimlerChrysler control 15%, 15% and 30% of EADS, respectively (see chart over). For different reasons, each has been looking for an exit from the industry. That may now not be so straightforward.

Machinations between French politicians and the two governments over the appointment of chief executives at EADS and Airbus and a mooted mega merger with French defence giant Thales have made a smooth withdrawal more complicated than it might have been a year ago. There is also the suggestion that Airbus’s performance in the market may entice Lagardère and DaimlerChrysler to hold on to their stakes for a bit longer.

Machinations between French politicians and the two governments over the appointment of chief executives at EADS and Airbus and a mooted mega merger with French defence giant Thales have made a smooth withdrawal more complicated than it might have been a year ago. There is also the suggestion that Airbus’s performance in the market may entice Lagardère and DaimlerChrysler to hold on to their stakes for a bit longer.

Lagardère and DaimlerChrysler ultimately both want to concentrate on their core businesses of publishing and selling cars. The French government is keen to divest itself of its remaining industrial shareholdings, but under the right terms. Not surprisingly, both Lagardère and DaimlerChrysler will seek to get the best price for their stakes in EADS, which could be offered to private and institutional buyers. Investors (including a number of US financial houses) already own 30% of the business through shares traded in the Frankfurt, Madrid and Paris stock exchanges. The French government also wants the best value for its taxpayers, but has a desire to keep a strategic and political hand on the tiller of Europe’s big aerospace project.

For several years, Airbus has been a cash cow for its two shareholders, EADS and junior partner BAE Systems, as it has slowly wrested market leadership in the airliner market from US rival Boeing. In 2004, Airbus accounted for nearly two-thirds of EADS’s revenues and almost four-fifths of its net earnings, contributing €20.2 billion ($26 billion) and €1.9 billion, respectively. Despite having abandoned civil aircraft construction in its own right, 20% shareholder BAE also makes almost one-fifth of its revenues and profits from Airbus.

At times, the media’s focus on Airbus seems almost to frustrate EADS’s senior management, who repeatedly stress the importance of its defence, civil helicopter and space divisions. EADS’s strategy of developing the rest of its business has been reasonably successful. The launch of the Airbus A400M military transport, the signing of the four-nation Tranche 2 order for Eurofighter, Eurocopter’s strength in the US civil rotorcraft market and the turning around of the ailing space arm have all boosted EADS’s prospects outside the civil aircraft market.

But in the eyes of many, EADS and Airbus are one and the same and their fortunes inextricably entwined. When a major Airbus order is announced, EADS shares get a boost; when worries emerge over Airbus costs or market share, the price wobbles.

Window to sell
The 12 months following the A380’s entry into service in late 2006 has been seen as an obvious window for the main shareholders to sell. The first airline flights of Europe’s highest-profile civil aircraft programme since Concorde will command headlines all over the world and within months, hundreds of thousands of passengers will have flown on the double-decker.
SHAREHOLDERS

“BAE would come under pressure from the UK government not to sell [its stake in Airbus]. It’s a huge mistake to think of it just as a liquid asset”

Industry analyst

Airbus will finally be generating revenues from A380 customers to begin paying back the $12 billion invested in the programme. All that is likely to ramp up the stock market price and deliver Lagardère and DaimlerChrysler the windfall they seek. For Lagardère, there is another benefit in selling after 2007 – that is the point at which the company no longer becomes liable for capital gains tax on any sale. According to one analyst, the media giant’s suggestion that it is waiting for the world to accept the A380 is a “smokescreen” and tax is the real reason for its desire to sell in two years’ time.

But recent events have cast doubt on whether that window of opportunity still applies. If the A380 and Airbus’s other products perform better than expected over the next two years, the temptation may be for Lagardère and DaimlerChrysler to keep their shares a bit longer. Both have pressing demands on investment: Lagardère is keen to develop its on-line media interests, DaimlerChrysler needs to spend on new product development in the car industry. With Airbus performing strongly, the gamble might be between cashing in on a valuable asset or hanging on for increasing returns.

The French government’s role is also crucial. Its 15% stake in EADS dates from when state-owned Aerospatiale was merged with Lagardère’s Matra defence division just before EADS itself was created in 2000. Airbus and EADS really matter to the French. Not only do they create high-tech jobs, but the French state sees Airbus as a symbol of its world status. As for the rest of EADS, the Paris government is sensitive about its defence assets falling into overseas hands. It has a direct or indirect stake in its four main suppliers – EADS, Dassault, Thales and missile house MBDA. If the French government and Lagardère sell their stakes, the pressure will be on to find a “friendly” domestic buyer, says one analyst.

Delicate balance

The delicate French-German balance within EADS is important. EADS and Airbus were created as European projects – the balance of ownership delicately divided between the national aerospace champions of France and Germany, with Spain’s Casa given a smaller stake. BAE Systems, which remained outside EADS, retained its 20% share in Airbus after its reorganisation in 2001 from consortium to integrated company. Politics and national ambition played, arguably, a bigger role than pure market forces. Cracks began to appear in the EADS marriage last year when rumours emerged that the French government was pushing for a merger with Thales – which would have given the French a bigger shareholding than the Germans. The plan is believed to have been vetoed by DaimlerChrysler, although some believe it may yet happen, with Lagardère and the French government selling their stakes in EADS to allow the merger to go ahead and the balance between overall French and German interests maintained.

Another complication comes from Spain. The 2000 deal gave the Spanish state – through its holding arm SEPI – a 6% stake in EADS. In exchange, state-owned Casa, a partner in the former Airbus Industrie consortium, was bundled into EADS. Now Madrid wants to raise cash from Spanish banks to increase its stake closer to 10%. It believes this would give its industry a bigger slice of EADS’s and Airbus’s R&D and industrial investment. But the French and German partners are not keen for taxpayers’ money to be used to ramp up Spain’s shareholder base.

While a question mark hangs over the future ownership of EADS, there is also the suggestion that BAE may sell its 20% stake in Airbus. Under the deal that set up the current Airbus entity in 2001, BAE must offer its stake first to EADS if it wants out. There are differing views on BAE’s thinking. It has made no secret of its ambition to be one of the top five US prime contractors and a transatlantic defence giant, but Airbus still gives it political and industrial clout. It reaps the benefits of investment across its defence programmes.

Pressure not to sell

Being part of Airbus gives massive kudos to a UK government that has seen several of its other big aerospace entities fall into foreign hands or close. “Airbus gives BAE very strong access politically,” says one analyst. “You get rid of that at your peril. BAE would come under immense pressure from the UK government not to sell. It’s a huge mistake to think of it just as a liquid asset it can sell whenever it wants.”

Ironically, the final obstacle to any change in EADS and Airbus ownership might come from the USA. The current spat between Washington and Brussels over subsidies and tax breaks for Boeing and Airbus could drag on for years if the World Trade Organisation wades in. At risk could be state-provided loans for developing the A350, Airbus’s answer to Boeing’s mid-size 787. Doubts over such a crucial programme may put a very different complexion on Airbus’s – and therefore EADS’s – attractiveness to investors, no matter how well the A380 performs between now and the end of its first year of service.

Additional reporting by Helen Massy-Beresford
All change

Airbus has created its biggest, most technically advanced airliner ever, and at the same time undergone a complete restructuring of its organisation, writes Max Kingsley-Jones from Toulouse

WHEN THE A380 PROGRAMME became a reality on 19 December 2000, the senior executives of the team that had brought the ultra-large airliner from the concept to definition stage stepped aside to make way for younger blood. But it was not just the executives that were changing to make the A380 happen, for Airbus was about to undergo the biggest transformation in its 30-year history, with its four shareholders becoming two and the manufacturer being reorganised from its consortium structure into an integrated company. While this revamp was essential for the A380 to succeed, it also created another potential difficulty in what was going to be a complex period in the manufacturer’s history.

The man chosen to succeed Airbus legend Jurgen Thomas at the helm in December 2000 was Frenchman Charles Champion (then 45 years old) – an ex-Aerospatiale engineer who had been running Airbus’s single-aisle production immediately before his appointment. Thomas had steered the A3XX concept from its beginnings in the early 1990s as Airbus’s answer to the perceived global need for “ultra-high-capacity airliners” to succeed the Boeing 747. He had formed Airbus’s Large Aircraft division in an off-site office adjacent to the Airbus headquarters near Toulouse-Blagnac airport and, with his team, set about shaping the double-decker into an aircraft that would provide Airbus salesmen with the best product for the market place.

Building a new Airbus

But soon after the A380 launch with 50 commitments from six customers, Thomas handed the reins over to Champion to manage the transition from paper project to revenue-earning long-haul workhorse in less than 72 months after the go-ahead.

“The A380 is the first fundamentally new Airbus to be developed since the A320,” says Champion. “And when we launched the programme in December 2000, we did what we are not supposed to do, according to the book.”

He is referring to the fact that industrial best-practice recommendations suggest new products should use existing processes and tools, the existing organisation, and demonstrated technologies. Airbus was about to break all three ground rules.

There is some debate, even within Airbus, about just how bold the A380’s technological leap is. “Depending on who you speak to, the A380 is somewhere between the A320 and Concorde,” says Champion. “In certain areas, some say it is more advanced in terms of step than Concorde – the key issue is the size, which means you must master everything related to flexibility of the structure and also the weight.”

So, as Airbus began the biggest technology leap in its history, Champion says the development team also had to contend with another possible hurdle – reorganisation. “On the very same day the A380 was launched, Airbus became an integrated company. We came out of a system where we had five balance sheets and five separate entities – four ex-partners plus Airbus – where we now have only one.”

Under the old consortium structure, each programme had four programme directors, each responsible for his own profit and loss. There were also four chief engineers, each in charge of his workshare of the aircraft.

“On top you had an Airbus person in charge of the relationship with customers, co-ordinating and managing technical issues at aircraft level and performing the flight tests,” says Champion. This could result in “big fights” between the various parties when there were issues to resolve.

“We’ve shifted to a mode where we have one chief engineer – Robert Lafontan – who is in charge of the whole aircraft,” says Champion. Below him, instead of the traditional four “national organisations”, the programme was broken down into “physical deliverables associated with the aircraft itself – we didn’t follow the lines of the national borders but the lines of the industrial border”. This resulted in the creation of integrated development teams across Airbus for the first time. This saw the co-location of engineering and procurement staff, as well as representatives from the risk-sharing partners and vendors.

The A380 development was broken down into nine international aircraft component management teams...
A380 development was broken up into nine management teams

Champion says that although the effort did not change the A380’s overall configuration, it created “big debates across the whole team and this allowed us to have a better design base”.

**Design targets**

The CDBTs were given targets for various aspects of design responsibility, such as weight and parasitic drag levels. Each system team also has specific targets for direct maintenance costs, mean time between unscheduled removals, and despatch reliability.

“Unlike previous programmes, the team does not only cover engineering and manufacturing aspects like recurring costs, but also support costs,” says Champion.

The level of ground testing undertaken on the A380 programme is unparalleled, with Airbus having built fully integrated “aircraft zero”, “cabin zero” and “landing gear zero” rigs in Toulouse, Hamburg and Filton, respectively. On top of that, bench tests of every significant component of the aircraft are being undertaken across Airbus and its vendors.

“We’ve invested more in testing than ever before,” says Champion. “And we decided to do additional test rigs, which were not part of the original business case, so as not to spend more money later on, and to improve the maturity and early detection of issues usually found during flight-testing.”

An example of this is extra structural tests carried out on the A380’s composite/metal rear fuselage section. Airbus decided to undertake a previously unplanned “rear-end test” of the complete aft section with simulated loads as a “risk mitigation” and to validate the design as soon as possible.

During the rear-end test, Airbus suffered a highly publicised breakage, but Champion says: “Because the loads were not representative, we considered doing nothing. But after discussions, because we had identified a sensitivity to lateral loads that was higher than anticipated, we decided to reinforce the THSA [trimmable horizontal stabiliser actuator] bracket, which adds just a few kilos to weight.”

Despite all the pre-flight testing, Champion is sure there “will still be surprises” now the A380 is airborne. “We have a step gap of technology on the A380, so even though we put much more effort into maturity before the first flight, the sheer fact that the complexity of the aircraft is much higher will mean we will have glitches. But these should be in the areas where we are not fully representative on the test benches.”
Airbus is introducing a raft of new technologies on the A380, not least in the cockpit. **David Learmount** reports from Toulouse on the new systems developed for the giant.

ON THE A380 FLIGHTDECK, AIRBUS has been struggling with a self-created dichotomy – it wants the environment to make pilots from other Airbus fly-by-wire types feel immediately at home while offering them unparalleled, fingertip access to information, and to displays that promise a new level of aircrew situational awareness.

Handling similarity will be created artificially – an easy task with digital systems. This begins with the feel of the controls, says chief test pilot Jacques Rosay. A given sidestick displacement will produce the same result in the A380 as in the relatively tiny A318, even if greater inertia means it will take a little longer for a change in flight trajectory to take place.

Immediately after the first flight, Rosay said: “Within the first minutes of the flight, we [he and fellow pilot Claude Lelaie, senior vice-president flight division] were impressed by the ease of handling of the aircraft, which was in line with what we had felt in the simulator. We have no doubt any Airbus pilot would immediately feel at home in the A380.”

No revolutions here, then. Yet Rosay and executive vice-president engineering A380 programme Robert Lafontan insist the aircraft is, in many ways, more revolutionary than the Aerospatiale/Baes Concorde was in its day. They do not claim any one system makes it so – it is the total package.

To illustrate this claim, Rosay summarises the flightcrew’s four traditional

**IN MY VIEW**

**Jean-Cyril Spinetta**

Chief Executive, Air France

“The A380’s seat-mile costs will be significantly lowered compared to the other long-range aircraft on the market.”
IN MY VIEW

“...The cabinets will be designed to create an environment that complements our intention to make everybody feel like a distinguished guest.”

DR SHEIKH AHMED BIN SEIF AL NAHYAN CHAIRMAN, ETIHAD AIRWAYS

The A380’s central nervous system

The aircraft’s network server system (NSS) is its central nervous system. It is an Airbus designed and engineered system for creating an unprecedented ability to integrate information from all types of sensor and information source. The “ops domain” of the NSS is the part with a two-way data flow, accepting uploaded data and amendments for each flight, as well as providing information to other systems.

The security-critical part of the NSS includes the avionics domain, which controls and integrates the aircraft avionics system. It has a two-way interface with the avionics but is separated from the ops domain by a diode, providing a one-way feed outward to the ops and so to the on-board information system (OIS) interface. These on-board information terminals (OIT) are large screens just outboard of each pilot’s main instrument panel.

As it interfaces with the OITs, the NSS ops domain is essentially an electronic flight bag (EFB), says Airbus experimental test pilot engineering flight operations Peter Chandler, providing “anything that is traditionally in paper format” – aircraft documentation, company documents, aircraft manuals, and charts. “Longer term, where we can link it to the avionics, we will enable it to take information from the aircraft systems,” he adds. “So, for example if you have an alert come up on the ECAM, we can use the signal to generate a sort-cut to the correct pages in the documentation. But that’s like taking the information through the diode from the avionics into the OIS.”

The NSS avionics domain is linked with the central maintenance system – also an integral part of the NSS. “Clearly that has to be linked directly to the avionics to pick up any [avionics] failure or fault signals,” says Chandler. “Eventually we would like to allow specific information to transfer the other way so, for example, having worked out the performance on the OIT, you transfer it directly into the flight management system (FMS),”

Until this is done, Airbus has put in a toggle switch to enable the pilots to communicate with the avionics domain from their OIT keyboards. They are either in connection with the ops domain or the avionics, but never both.

Rosay says the manufacturer is studying setting up a link for highly specific data – such as performance data – but it is necessary to develop strict protocols for this. “I am confident it will be done,” he adds.

INTEGRATED SYSTEMS
The A380 as a technological step-change

Systems integration

The network server system/onboard information system (NSS/OIS) provides a greater degree of integration between flight-control functions, sensors, avionics and systems control – all aimed at providing the flightcrew with full situational awareness and total aircraft control. The NSS could be likened to a central nervous system for the aircraft. The OIS is a fully integrated electronic flight bag (EFB) in its own right, containing an aircraft library with charts, aircraft and company manuals and a fully updatable aviation information services (AIS) database. But it is also linked into the NSS (see diagram).

Executive vice-president A380 programme Charles Champion says this system is the prime justification for claiming the aircraft is a massive technological advance, comparing the step-change as being “somewhere between the A320 and the Concorde” in the number of changes it introduces. He explains: “The complexity at the level of aircraft systems integration is much higher than the civil air transport world has seen before.”

Size

Senior vice-president engineering for the A380 programme, Robert Lafontan, says the aircraft’s size alone makes it a step-change because, in aircraft, complexity increases with size, as does the need for electrical, hydraulic and pneumatic systems capability. The rationale for changing from a 204bar (5,000lb/ft²) to 340bar hydraulic system, for example, was the need for more powerful control actuators without increasing their weight, or the diameter of the hydraulic tubes. Lafontan says the sheer number of advanced-technology manufacturing techniques, components and capabilities being introduced and integrated in one aircraft makes the A380 a major advance as a total system.

Because size increases the aircraft’s unit price, dispatch reliability becomes more critical, says Lafontan. So the aircraft also had to be designed with unprecedented systems redundancy and damage tolerance.

Control/systems redundancy

The A380 will be the first civil air transport aircraft capable of flying with a total hydraulic failure, using electricity to operate only the flight control surfaces, says Lafontan. It can also operate with only one electrical generation source, or only one hydraulic source. Lafontan says the A380 will have two separate rudders and rudder systems, two elevators and three ailerons each side, plus the spoilers. All primary control surfaces are operated...
by both electrical and hydraulic actuators. There is one 150kVA generator per engine, two on the auxiliary power unit, and the ram air turbine (RAT) has a rotor diameter of well over 1m, with a 75kVA output. The RAT produces electrical power only. The aircraft has three flight-management systems, but Lafontan says it needs only two – the third is to heighten dispatch reliability.

**Performance**

Lafontan says the challenges even before programme go-ahead, taken together, required a major advance. He lists the need to: exceed by significant margins the mission-capability, economics, comfort and performance of the Boeing 747; meet today’s considerably more stringent safety and environmental certification standards; and make the aircraft viable for operation at existing airports.

**Materials usage**

Components and structure made of composite materials comprise 25% of the A380 by weight, which compares with 10% in the A320, 16% in the A340-500/600 and about 3% in the original A300. The main parts where metal alloy components have been replaced by composites are the centre wing box, wing ribs, upper deck floor beams, and almost the entire tail section and empennage. A composite/metal laminate material, Glare, has been used for a significant proportion of the upper fuselage. More use has been made of the less dense alloy aluminium lithium than was originally planned. Airbus says this is because although variations of it have been available for a long time, it is now more mature as a specialist material.

**Active load alleviation**

The A380 will use its own version of passive load alleviation using the fuel-management system. This will be deployed for wing-bending relief and centre-of-gravity control, but it is not a fundamental advance on the principles adopted in the A340-500/600, just a more mature, more sensitive system. The A380’s load alleviation advances are mainly in active load control, having a system that enables more sensitive recognition of any manoeuvre to enable faster control surface reaction. This is achieved through the use of sharper control software algorithms and better sensors – such as the three sideslip detector vanes on the aircraft’s nose – just below the cockpit windshield, in addition to accelerometers. The sideslip vanes are a first in a commercial transport aircraft.

**Digital mock-up systems**

Extensive use of digital mock-ups during the design and manufacturing process enables closer interface with customers, and better “design loop” between component manufacturers and assemblers. It also enabled the final assembly building and line to be optimised before construction. Finally, component maintenance access could be tested before design/layout is finalised.

OIS functions like a class 3 electronic flight bag (EFB), but is not yet fully integrated. Chandler says that if the pilots wanted any supplementary information after dealing with a failure, “today they would normally get out one of the manuals, but in the future those manuals will be in the OIS. One of the things we will do – by taking signals from the avionics side of the NSS – is to offer the crew links to the appropriate pages in any of the documents”.

When A380 pilots key in the aircraft weights to calculate take-off performance, Chandler says this will “in the short term” be performed with an EFB – the weights will be entered manually into the OIS performance module. This is done using either pilot’s pull-out table QWERTY keyboard and cursor control. A USB stick or other data-bearing unit could be plugged into the system to upload flight information, weather, NOTAMS, load sheets and flight plan, and any amendments for the NSS ops domain. “The load sheet will appear as one of the items on the OIS screen,” says Chandler. From the OIS take-off performance module, the crew can enter the derived take-off speeds into the flight management system (FMS). Airbus is working on setting up a link to transfer highly specific information – such as performance data – to reduce the chance of manual transcription errors when entering data into the FMS, but Rosay says extremely strict protocols will be needed for this.

Chandler says information that is already in the FMS, such as the aircraft and departure runway, should transfer to the OIS easily, “so it will actually come up with the page, for example, for Heathrow runway 27L.”

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**Meeting the design challenges**

Airbus spent much of the last decade refining its design for the A380 under the “A3XX” project name, but was faced with some major challenges in the months before the launch following feedback from customers.

“When designing the A380, the first challenge was not to make a ‘copy and paste’ of an existing product,” says the programme’s senior vice-president engineering, Robert Lafontan. “We decided to have a significant step over the 747 in passenger capacity and mission…and a double-digit operating cost reduction.”

With the A3XX concept fully defined by the start of 2000, the sales team received authority to offer in mid-2000 and began securing launch commitments. The reaction from airlines was good and commitments rolled in, but it was not all good news, says Lafontan: “Market feedback was to be quieter, to have more range and more cargo volume.”

The major drive was the requirement to comply with the most stringent night-time departure noise requirements – dubbed “QC2” – at London Heathrow which gave the most headaches. In fact it was a condition of Singapore Airlines’ order and resulted in Airbus delaying the delivery target by several months.

With Airbus anxious to launch the programme by the end of 2000, Lafontan says his team “had three months” to refine the design. The starting point was a revamp of the engines’ design to make them quieter, says Lafontan: “We increased the engine fan size by 6in [15cm], the nacelle diameter by 9in and lengthened the nacelle by 20in to have more acoustic treatment to be quieter.”

Airbus also introduced a “droop nose” concept for the inner slat which would enable the aircraft to fly a steeper take-off trajectory, reducing community noise levels. But there were some serious knock-ons. “All these changes meant we needed to redo the iteration on the engine integration to the wing, which of course impacts the escape-slide installation, and the rotor-burst and flutter characteristics,” adds Lafontan.

He achieved the objectives, the customers were happy with the revamped version and Airbus launched the A380 on 19 December 2000.
Feeding time

The arrival of the A380 on some of the world’s busiest routes will cause the biggest upheaval in airline network dynamics for decades. Mark Pilling examines the impact it will make

FOR THE FIRST TIME IN OVER 35 years, carriers have the opportunity to make a step-change in the capacity they can offer with one airliner. When Boeing’s 375-seat 747-100 entered service with Pan American World Airways in January 1970, it was a huge leap in capacity compared to the 250-seat McDonnell Douglas DC-8 Super 60, which had been the largest commercial jet airliner. At the time, the DC-8 and the 140-seat Boeing 707 were the mainstays of the intercontinental fleet.

The A380 does not offer quite such a jump in size as that from the DC-8 to the 747, but with most carriers planning 490-530 seats in it, many will be selling about 30% more seats than a typical 747-400 flight. For leading A380 customers, the early network planning is perhaps the easiest, with the aircraft placed on the obvious trunk routes.

For launch operator Singapore Airlines (SIA), the “kangaroo route” between Australia and Europe via its Singapore base will be a key market for its A380s. Routes apart from Singapore-London and Singapore-Sydney will be announced in due course, says SIA, which adds it will not change the frequency of service on its A380 routes because there is growth to be had.

“The natural A380 routes will be tackled first,” says Dr Joachim Schneider, vice-president A380 entry into service at Lufthansa. “We will look at routes that have such a high demand that even today they could use more aircraft because of slot or timing restrictions.”

Airbus has long contended that the aircraft will play a major role in allowing carriers to grow at congested hubs. Virgin Atlantic is a perfect example. Although it is the second-largest long-haul carrier at London Heathrow, it still has less than 3% of the airport’s slots to serve its network, says chief executive Steve Ridgway. “The A380 will be a perfect antidote to the Heathrow slot constraint problem and will enable us to continue growing.”

SIA’s senior executive vice-president (operations and services) Lt Gen Bey Soo Khiang says: “The A380 is important to our overall capacity growth and fleet renewal strategy. It allows some capacity growth without frequency increase along routes which are currently slot-constrained.

Radical changes

“It is still premature to say if radical changes will take place in the marketplace with the introduction of the A380. For instance, the launch of the 747 almost 40 years ago brought down the per seat-mile operating cost because of its larger capacity and improved technology. Also, it altered the concept of air travel because it carried more people over longer distances. But the extra capacity did not radically change the marketplace as was predicted by some, mainly because of the pent-up demand for air travel at that time.”

But will something similar happen this time? “Some routes are ready for the A380,” says Chris Tarry of the CTIRA consultancy. The bigger challenge will be to generate the feed required to fill A380s on the second wave of routes on which it will operate. “The issue airlines face is they have got to be able to aggregate demand over a hub,” says Tarry. “Because they have more seats on offer, they will have to fight harder for the traffic to fill it.”

The seating gap between current three-class 747 configurations and A380 plans differs a lot from carrier to carrier. SIA will look to fill 100 more seats on its A380s compared with its 747s, and Lufthansa will have an extra 160. But Virgin may have less of a jump. “To be honest, it isn’t a gargantuan leap in size,” says Ridgway, whose carrier will go for 500-550 seats in its A380s. “Our Gatwick-based 747-400s are already at just over 450 seats.”

Whatever seat densities airlines go for, there will be capacity hikes in the most competitive markets. “There is going to be a price and capacity war, for example on the kangaroo route,” says David Stroud, managing director of UK-based Airport Strategy & Marketing.

He reckons there will be some “real hub battles”, particularly in Asia, where Bangkok, Kuala Lumpur and Singapore will all have home-base A380 operators. The aircraft “creates pressure on these hubs because they will need to fill all these A380s up”, says Stroud, but its arrival also “re-energises the hub”.

Feeder networks

Asian airports with expanding A380 operations have to start thinking harder about developing their feeder networks, he says, and about the increasing influence of low-cost carriers in the region. Because these carriers usually do not interline, their feed role diminishes, he adds. The growth of Dubai as a connecting hub for Europe-Asia traffic is another major threat to the Asian hubs. “There are already some big flows out of Dubai and it is doing some damage to Singapore Changi in particular,” says Stroud (see box on p22).

Competitive pressure will also ramp up between Frankfurt, London and Paris as Lufthansa, Virgin Atlantic and Air France introduce A380s on heavy transatlantic routes. “The A380 will first operate on New York and Montreal routes, starting in summer 2007, and then on Asian routes like Tokyo and Beijing from summer 2008,” says Jean-Cyril Spinetta, chief executive of Air France. “The seat-mile costs will be significantly lower with the A380 compared to other long-range aircraft.”

With seat-km costs advertised at 15% better than the 747-400, the A380 will give operators a significant advantage over competitors with current widebodies, says Lufthansa’s Schneider. “This is the major reason why we bought the aircraft. We think it will be absolutely critical for any major carrier to have that tool available.”

But for now, operators say they will be cautious about adding too much capacity. “We will grow into markets as they grow – we don’t plan to swamp markets and ruin the business there,” says Schneider. “That is not wise. But it will be a fast-moving game where
“We will grow into markets as they grow – we don’t plan to swamp markets and ruin the business there”

Dr Joachim Schneider, Lufthansa

everybody observes everybody else.”

Ridgway of Virgin agrees, adding: “Like all carriers, we need to drive down seat-mile costs as yields are not expected to recover and the pressure on yields will remain. We won’t throw capacity at a market that is suddenly over-served. Our initial A380 orders are relatively modest and we can take a sensible decision on how to integrate them into the network.”

The Asian group of future A380 operators generally regards the aircraft as fitting into an all-new category for growth purposes, rather than as a Boeing 747-400 replacement. Some are reticent about where they will use their aircraft, but Asia-Europe will clearly see much of the action, with some operators extending their services to Australia and within Asia. The transpacific will also see some A380 services. For the most part, Asian carriers do not appear to be concerned about the market becoming flooded with so many extra seats, because many of the routes on which the A380 will operate already need additional capacity. “With the A380 being introduced at a time of surging demand for air travel, and initially on routes which are already growth-constrained through barriers such as slots and curfews, we are confident that the impact will be positive for both the airlines operating the aircraft and the consumer,” says SIA’s Bey.

Thai Airways International, which has six A380s on order, will use its aircraft mostly on high-density routes to key cities in France, Germany and the UK. The aircraft will be “all for expansion, not replacement”, says Kawin Asawachatroy, vice-president corporate product and service development.

Regional routes

Sang-ngun Pornpaiboonstid, vice-president of Thai’s corporate planning department, says that as well as Europe, A380s will be used on regional routes in Asia. “Our European flights leave at night. Leaving here at midnight is a good time to be arriving in Europe in the morning. Coming back here in the morning of the next two days we have the daytime available, so we will supplement it in the regional routes where we see destinations which fit those aircraft,” she says. “Perhaps in China, at places where growth is very fast, like Shanghai, the aircraft can leave here at 11am or 10am and come back before the midnight departure to Europe.”

Kawin says Thai is not concerned about too many extra seats entering the market because loads are already high on routes the A380s will use. He also says the planned service improvements on the aircraft and the fact that overall operating costs will be lower should

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**Initial A380 destinations**

<table>
<thead>
<tr>
<th>Carrier</th>
<th>Service entry</th>
<th>Main base</th>
<th>First destinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air France</td>
<td>April 2007</td>
<td>Paris</td>
<td>New York JFK, Montreal, Beijing, Tokyo</td>
</tr>
<tr>
<td>China Southern</td>
<td>2007</td>
<td>Guangzhou</td>
<td>n/a</td>
</tr>
<tr>
<td>Emirates</td>
<td>October 2006</td>
<td>Dubai</td>
<td>London, Sydney, Melbourne</td>
</tr>
<tr>
<td>Etihad Airways</td>
<td>2007</td>
<td>Abu Dhabi</td>
<td>London, Mumbai, New Delhi</td>
</tr>
<tr>
<td>FedEx Express</td>
<td>August 2008</td>
<td>Memphis</td>
<td>Asia</td>
</tr>
<tr>
<td>Korean Air</td>
<td>Late 2007</td>
<td>Seoul</td>
<td>Los Angeles, New York JFK, Paris</td>
</tr>
<tr>
<td>Lufthansa</td>
<td>Late 2007</td>
<td>Frankfurt, Munich</td>
<td>New York, New Delhi, Singapore, Bangkok</td>
</tr>
<tr>
<td>Qantas Airways</td>
<td>October 2006</td>
<td>Sydney, Melbourne</td>
<td>Los Angeles, London</td>
</tr>
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<td>Qatar Airways</td>
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<td>Doha</td>
<td>London</td>
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<tr>
<td>Singapore Airlines</td>
<td>October 2006</td>
<td>Singapore</td>
<td>London, Sydney</td>
</tr>
<tr>
<td>Thai Airways Int’l</td>
<td>Late 2008</td>
<td>Bangkok</td>
<td>London, Paris, Rome</td>
</tr>
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<td>UPS</td>
<td>2009</td>
<td>Louisville</td>
<td>China</td>
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<tr>
<td>Virgin Atlantic</td>
<td>Spring 2008</td>
<td>London Heathrow/Gatwick</td>
<td>New York, Kennedy, Hong Kong, Sydney, Los Angeles</td>
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</tbody>
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**Key A380 hubs and route networks**

www.flightinternational.com
Booming Dubai spurs Emirates A380 optimism

When Emirates management is asked where it will put the 43 A380s it has ordered, it points not so much to particular destinations as to Dubai itself. “Dubai is a very powerful magnet,” says Maurice Flanagan, the carrier’s vice-chairman. “The growth here is absolutely phenomenal. We just can’t get enough hotel rooms.”

Chairman Sheikh Ahmed bin Saeed al-Maktoum says Dubai is looking to double the number of available hotel beds from 45,000 to between 90,000 and 115,000 over the next five or six years. Dubai, originally founded as a trading port, has always been the most prominent commercial centre in the United Arab Emirates and is less reliant on oil than its neighbours. The past decade has seen a big state effort to turn Dubai into the region’s main international trading hub.

Dubai is booming and saw a 16.7% rise in GDP last year. At least 80% of the population are expatriate workers, who account for most of the traffic in Dubai’s two largest markets, the UK and the Indian sub-continent, both of which will be served by A380s. Flanagan says about 100,000 expatriate workers are from the UK.

“Emirates believes a combination of the local Dubai economy, its geographical position at the crossroads of key routes between Europe and Asia/Australasia, and the attraction of duty-free shopping will build the critical mass needed to make Dubai an A380 hub. The carrier is also looking beyond its traditional markets, with Sheikh Ahmed pointing to the USA as a target. It is also looking to fly beyond Australia,” Flanagan adds.

Malaysia Airlines managing director Ahmad Fuaad Dahan says the carrier’s A380s “will provide much-needed extra capacity on existing routes”. Its six aircraft are earmarked for European routes and to Australia/New Zealand. “Of the long-haul routes, the kangaroo route between Australia/New Zealand and Europe contributes significantly to our coffers,” says Ahmad Fuaad, and there is room for growth in these sectors. He says that for the 2003/4 financial year to March, the kangaroo route brought 56% of total revenue, with an average passenger load factor of 70%.

Ahmad Fuaad does expect some yield erosion, however. “Most of the airlines will be using the A380 on high-density long-haul routes,” he says. “There will be a massive injection of capacity, which will provide for growth. As the A380 is equipped with the latest technology and provides better-quality service, it will raise the benchmark on customer experience and expectations. The lower operating cost of the A380, together with the massive capacity increase, may exert pressure on yields.”

“Supply and demand

Analysts agree fares will have to fall for carriers to fill A380s. “There is no running from the eternal: supply and demand economics,” says Blair Pomeroy, a partner at Mercer Management Consulting. “We think this spike in capacity will push yields down in the short to medium term until demand growth catches up. There will be limits on the ability of carriers to stimulate local demand. Expect increased levels of passenger poaching. A380 and other big ‘new metal’ operators will continue to use price and added amenities to steal competitors’ non-stop traffic and aggregate it at their hubs.”

The worst-case scenario is yields falling and the A380’s operating economics less rosy than expected, hitting profitability. The industry’s record on matching capacity to demand to achieve decent yields and profits is not good. The danger is the A380 will make it even harder to square this circle.”

“We are excited to be having the A380 as part of our long-haul fleet before the 2008 Olympic Games in Beijing”

Li Kun, chief operating officer, China Southern Airlines

use its A380s across the Pacific. It recently firmed up a deal for the first aircraft, the first to be delivered in 2007 – ahead of the Beijing Olympic Games in 2008 – and the last in 2010. Of all the Asian carriers, China Southern will be stepping up most in size, because the other future operators have 747-400s. China Southern’s largest passenger aircraft is now the Boeing 777, which it uses to Los Angeles from its Guangzhou base.

Chief operating officer Li Kun says: “We are excited to be having the A380 as part of our long-haul fleet before the summer Olympic Games begin on 8 August 2008.” This suggests services will be operated from the capital.

In 4.32 billion ringgit ($1.1 billion), or 56% of total revenue, with an average passenger load factor of 70%.

“On routes where we are facing challenges in getting additional slots, we will be able to deploy this aircraft, uplifting more passengers at a time using existing frequencies,” says Ahmad Fuaad. “As Malaysia’s national carrier, we are well positioned in the region and, with encouraging traffic growth on our long-haul routes, slot constraints in key destinations and the A380’s expected cost advantages, we believe there is a strong economic rationale for this addition to the fleet.”

Ahmad Fuaad does expect some capital.

Network
Prepare for arrival

The A380 will alleviate some capacity issues on the ground, but it has already forced airports to get ready to handle a new size of aircraft and more passengers.

Colin Baker reports from London

THE ARRIVAL OF THE A380 IS A double-edged sword for airports. On the one hand, airports that are experiencing capacity problems – and there are plenty of those – will see passenger throughput increased without any more aircraft movements. On the other hand, the extra scale of the A380 is a challenge for airports, given the step up in size from the Boeing 747, previously the largest passenger aircraft an airport could expect to handle.

During the flight-test programme, Airbus will begin proving flights to airports in the first wave to receive A380 services. This group has not been finalised, but could include some surprises, such as Orlando, Florida. As of this month, six airports are ready for the A380 – Guangzhou, China; Incheon, South Korea; Hong Kong; Kuala Lumpur, Munich and Tokyo Narita. Two more are being built – the new airports at Bangkok and Doha – and 13 others have construction work under way to accommodate the giant.

Airbus reports “good progress” at five other airports, with four still at the planning phase. There has been some welcome news this year from Los Angeles International Airport (LAX), which had been the most notable laggard in preparing for the A380. LAX’s $11 billion master plan was finally agreed at the end of last year, but implementation is still awaited.

LAX was one of five airports causing Airbus some concern as the A380’s entry into service inched closer. “The situation at LAX is now much better,” says Willy-Pierre Dupont, director of infrastructure and environment at Airbus. “The problems were basically political,” he adds, pointing to issues such as noise and pollution concerns. The master plan is still awaiting approval by the US Federal Aviation Administration (FAA).

LAX hopes to be able to widen one of its southern runways by November 2006 to 60m (200ft) to accommodate the first A380 flights, which will be operated by Qantas, but as a back-up it is also applying for FAA dispensation to operate on a 46m runway width. One A380-compatible gate will be ready at the airport’s Tom Bradley terminal in November 2006, with another one in April 2007. There will also be two remote gates at the western end of the airport served by buses.

The airport says it thinks this will be “adequate” for the 2006-2010 timeframe and has no plans to follow up on a proposal by Airbus to relocate two taxiways to make way for further A380 stands, although options for handling more A380s are being studied for the master plan. Virgin Atlantic has postponed plans to operate A380s to LAX because of concerns over the airport’s readiness for the aircraft, but, along with Air France, Singapore Airlines, Korean Air and FedEx Express, is expected to serve the airport during the 2007-2010 timeframe, bringing a total of seven to nine daily flights.

Despite the problems with LAX, Dupont believes the agreement on the master plan means the airport is on the right track. “What is important is regular dialogue,” he says. “However, if airports have to turn down A380 flights, there are plenty of others who will be very happy to have more traffic.”

Another one on the Airbus watch list has been the new Bangkok International Airport, which is still under construction. As a new facility, it will be A380-compatible, but Dupont says: “We need a real opening date.”

The much-delayed airport is now slated to open in the middle of next year, which Dupont says would be “fine”.

Auckland’s international airport is also being monitored, mainly because it had less notice than most other airports that it was to receive the super-jumbo. Emirates plans to begin flights to Auckland from Dubai in late 2006 or early 2007.

“They will need to adapt one or two gates,” says Dupont. “The main problem is limited resources.” The airport plans to spend NZ$27 million ($19 million) over the next three years on runway, taxiway and terminal upgrades to become A380-compatible. In its annual report, Auckland says it is “committed to being A380-capable”.

New airport

Abu Dhabi, which is building a second terminal and has plans for a new airport to open in 2009, is also being monitored now the emirate’s new flag carrier, Etihad Airways, is an A380 customer. But unlike Auckland, resources are less of an issue. “They have plenty of money,” says Dupont.

With Etihad’s neighbour, Emirates, planning an extensive A380 network into the Indian subcontinent, Karachi is coming under the spotlight as a possible destination and the timing of development of a new facility is causing concern. “The planning process is rather slow,” says Dupont.

In Europe, London Gatwick is being looked at after one or two carriers expressed an interest in flying there. Airport operator BAA has asked them to wait until it has a chance to prepare
facilities. Meanwhile, BAA is making sure London Heathrow, a key A380 destination, is up and running for the super jumbo next year.

BAA has spent a massive £450 million ($840 million) to make Heathrow A380-friendly, with four gates being built onto what will become Pier 6 with connections to Terminal 3. This is scheduled to be ready for the first Heathrow A380 operations in May or June of next year. There will also be two A380 gates in Terminal 4 by late 2006/early 2007.

Another early A380 airport, Dubai, will have the most extensive facilities for the super jumbo, however. The airport’s new Terminal 3 will have 23 gates designed to handle the A380.

A key consideration for all A380 airports is whether to add a third air bridge to smooth the flow of passengers during turnaround. Airbus initially suggested two bridges to doors on the main deck, as with Boeing 747’s.

Upper deck loading

However, talks with airlines soon led the manufacturer to realise that an air bridge to the upper deck (as well as one to the maindeck) was the preferred option because carriers wanted to look after their premium passengers, who will generally be seated in this cabin.

Airbus insists two bridges will be adequate, and the option of a third bridge is up to the airlines and airports. Frankfurt Main, for instance, is opting for three bridges, and is trialling a new automated system for simultaneous positioning.

Costs, as ever, are a key concern. Dr Joachim Schneider, vice-president A380 entry into service at Lufthansa, says: “The big question is how to finance it. Our position is that we cannot afford to raise costs in our business.”

Some airports, such as San Francisco and Heathrow, have gone for two air bridges, one to each deck, with Heathrow operator BAA telling carriers they will have to fund a third bridge if they want it.

Dupont says airports that are serving carriers with a high proportion of A380 transfer traffic are the most likely to go for three bridges because passenger throughput will be a priority. “The big hubs, such as Singapore and Dubai, are going for three bridges,” he adds.

David Gamper, director of facilitation and technical/safety at the Airports Council International (ACI), says: “Simulation studies show that it should be perfectly feasible for total turnaround time not to exceed 90min, as for the 747, which is very important for the airports.”

Dupont says airlines’ performance levels differ widely in loading and unloading passengers.

Gamper says airports may need to adapt their departure lounges to take more passengers. San Francisco thinks it will need to have at least 620m² (6,700ft²) to accommodate a typical A380 load of 555 passengers waiting to board. In general, the size of areas such as check-in, passport control and baggage handling should be adequate for the A380 without major changes. Airports usually have spare check-in facilities, says Gamper, and often already cope with simultaneous 747 operations – although staffing of these desks by the airlines is an important issue.

The problems being faced on the airside are mirrored on the landside, where the A380’s extra size is also forcing airports to adapt. However, regulators and the aviation industry have come up with a compromise to enable airports to be certificated for A380 operations while minimising capital expenditure and operational disruption.

Coping with the giant

The International Civil Aviation Organisation’s (ICAO) Annex 14 contains standards and recommended practices for aerodrome reference Code F operations, added in 1999 – applying to airports handling aircraft with wingspans between 65m and 80m and outer main gear wheel span of between 14m and 16m. For the A380, which has a wingspan of 79.8m – just below the Code F limit – a runway width of 60m is the prescribed code, whereas the baseline for airports that were built to cater for the 747 is the Code F specification of 45m.

The cost and disruption involved in upgrading older airports to meet the Code F requirements for wingspan led airports, airlines and regulators to
The extra wheelspan has been less of an issue than wingspan, just creeping over the upper Code E limit. According to AACC, this avoids the need for a taxiway width increase above the 23m prescribed for Code E, although the taxiway shoulders should be widened to give an overall taxiway and shoulder width of 60m (see graphic).

There have been some concerns about the risks of an A380 deviating from the centre line of the taxiway, given the size of the aircraft. But recent studies at Amsterdam, Paris CDG, Frankfurt, Sydney, New York JFK and Heathrow airports concluded that deviation for larger aircraft was actually slightly less than that for smaller aircraft. “This may be because pilots take more care because they are operating larger aircraft,” says Gamper. “Thus taxiway-to-taxiway separation only needs to be increased by the A380 wingspan increase.”

But pilots fear safety standards could be compromised for financial reasons. Pointing to the high proportion of airports that will receive the A380 despite their non-compliance with Code E, Capt Dennis Dolan, president of the International Federation of Air Line Pilots, warns: “Our fear is that a number of these marginal airports will, for commercial reasons, seek waivers to the Annex 14 requirements to allow A380 operations.”

Common sense
Airbus insists the move to allow A380 operations at Code E airports is just common sense. “If you widen runways just for the sake of widening, you are increasing your costs for nothing,” says Dupont, pointing to the fact that ICAO has given the all-clear to Code E operations. “At existing airports, the cost savings are huge,” he says.

Airlines seem fairly confident that airports will be able to meet the airside challenges posed by the A380. “We are pretty satisfied with the work achieved by Airbus together with the airport community,” says Schneider at Lufthansa.

Airlines can look back to history for reassurance. Pointing to the move towards increasing runway width and taxiway separation, Johan Orsinger, senior consultant at Frost & Sullivan, notes: “Interestingly, this is the exact method followed in 1975 to make airports capable of handling what was then the biggest bird in the sky – the Boeing 747.”

**“Our fear is that a number of these marginal airports will, for commercial reasons, seek waivers to Annex 14 requirements”**

Capt Dennis Dolan, president, IFALPA
IN MY VIEW

We expect to offer a more comfortable, more pleasant flight experience

CHO YANG HO
CHAIRMAN, KOREAN AIR

With a floor area nearly 50% greater than that of the 747-400 and the ability to put in 35% more seats than Boeing's jumbo jet, the A380 offers the largest space over its two decks that any airline has ever had to play with. But some question whether carriers really will be able to do anything different when the economic pressure to make money with the aircraft is paramount.

"Our intention is to install more spacious relaxation areas than on other aircraft," says Jean-Cyril Spinetta, chief executive of Air France. "But we must be realistic. It would be ridiculous to imagine we would have swimming pools or gambling tables or showers, for example." But he adds: "It's obvious this aircraft will offer unprecedented comfort with tailored facilities. The cabin interior will be very innovative, but not totally mind-blowing."

The inside story of the A380 is one of the most closely guarded secrets in the airline business. Launch operators and arch-rivals Singapore Airlines (SIA) and Emirates are almost paranoid about the other getting a glimpse of their cabin designs, both in the drawing offices and on the production line at Airbus in Toulouse and Hamburg.

"Emirates is going berserk to make sure we put curtains around its aircraft," says an Airbus insider.

Like all A380 customers, Emirates and SIA are promising something innovative for their real estate. "We were looking for cabin dimensions that enable our creative in-house people and our consultants to give free play to their imagination," says SIA chief executive Chew Choon Seng.

But so far, most carriers are not promising the more exotic features Airbus showed in its initial ideas for the A380. "If you look at the impression generated from the Toulouse mock-ups, you get trapped in a false direction seeing things like bars and swimming pools," says Dr Joachim Schneider, vice-president A380 entry into service at Lufthansa. "Space in an aircraft is the most valuable in the world and we need to make good use of it."

Airlines are tight-lipped about how they will use the space afforded by the double-deck interior of the A380. Will the aircraft literally be an air bus, or is a new era in cabin comfort approaching? Mark Pilling in London, Andrew Doyle in Hamburg, Nicholas Ionides in Singapore and Emma Kelly in Perth report

THE FLIGHT GROUP JUNE 2005

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Hard economics

Peter Knapp, creative director at airline branding and design agency Landor Associates, says: "Naturally the decision primarily rests on the balance sheet. You will see a few token gestures of in-innovation and ground-breaking design, but at the end of the day not many, and only on a few of the carriers." The sheer size of the A380 means carriers should recognise how different the design challenge is, he adds. "The danger would be to just extend the traditional language of current aircraft interior design and scale it up. Designers will be dealing with a small architectural project. It's so big, the A380 is no longer a room – it is now a hall."

Knapp believes what airlines do with their A380s could be pivotal for the future of air travel. "It will determine whether air transport falls into a new era of functionality that is operationally based, or whether it puts the romance of travelling back into the sky." Boarding an aircraft with 500 or more other people will feel just like getting onto a bus, he says. "The A380 could become the antithesis of functional transportation."

Although carriers are giving precious little away about their interior plans, the talk is of generating a memorable passenger experience. "Being the first airline in the world to operate the revolutionary aircraft presents excellent opportunities for change and innovation, and we are taking full advantage of them," says Lt-Gen Bey Soo Khiang, senior executive vice-president (operations and services) at SIA. "Because of the sheer size of the aircraft, changes
will be evident throughout the entire cabin. The concept of premium flying will see advances and, most importantly, the romance of air travel will be enhanced."

Lufthansa’s Schneider says: “We want to position the A380 to be our flagship, not only with respect to size but also in bringing a new dimension in passenger experience. This is very important. The aim is not only to be more efficient.”

But how different will the A380 really be? “The aircraft brings new opportunities compared to the 747,” says Schneider. Every economy passenger will get more space, for example. “With 10-abreast seating in economy, you get 1-2in [25-50mm] more width compared to the 747 – that is really something customers will feel.”

The opportunity to provide large communal spaces comes from the space underneath and around the stairs between the main and upper decks. Airbus mock-ups show features such as a bar, meeting area or duty-free shop. “Everyone will try to do something there and so will we,” says Schneider. Virgin Atlantic has said it will offer a casino/gaming area and space for people to exercise and “stretch their legs”.

Knapp at Landor adds: “Although you can never get away from the fact that people are on a tin tube, there will be the opportunity to give choice to [economy] passengers.” Today that choice is restricted to the small private space afforded by the seat they sit in, but the A380 may offer the space to create social situations.

“That would make a difference,” says Knapp. “The thought that passengers could go to a bar and socialise would be very interesting. There would be an extension of the business mindset, giving business travellers the change to spend leisure time with colleagues, while for leisure passengers, the beginning of the holiday would be in the air.”

Relaxation area

Most carriers are likely to introduce some social areas in their A380s. Some, like Virgin Atlantic, have featured bars in business class for years. Singapore Airlines, too, has a relaxation area on its ultra-long-range A340-500s. Virgin’s Upper Class bar has six fixed bar stools and is a popular place for business travellers to congregate at after a meal.

However, Virgin has so far kept its bars to the business cabin. The problem with introducing one to economy would be dealing with the number of people likely to use it, although on special occasions and press trips, Virgin’s bars have thronged with people.

Qantas has already said it will have onboard special lounge areas in first, business and economy sections, as well as facilities for business meetings and presentations. “We are finalising a range of major new product and service enhancements that will include new seat designs, special lounge areas,

A380 cabin configurations

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<td>Virgin Atlantic</td>
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Notes: *All seating is three-class apart from Emirates. It is planning three variants of the A380: three-class long-range, three-class medium-range and two-class medium-range. c=circa. n/a=not announced.
CABIN

Taking a closer look inside the A380’s cabins

Airbus unveiled the first dimensionally accurate partial A380 cabin mock-up at the Aircraft Interiors show in Hamburg, Germany, in early April. “We completed detailed design a year ago. It’s a very flexible aircraft to configure,” says A380 senior marketing analyst Corrin Higgs.

The mobile mock-up features a 10-abreast main deck economy section – minus centre overhead bins – and six-abreast business class on the upper deck. Offered by Airbus as standard options for the cabin lining are a choice between “cool” and “warm” colour shades and two patterns, though customisation is possible. “Airlines can pay for something else,” says Higgs.

Overhead luggage bins can be fixed “super-bins”, or an articulated design, each sized to accommodate three standard-size carry-on roller-bags. “These are the first articulating bins on an Airbus,” says Higgs.

The ceiling height on the main deck is about the same as that on the A340 and Boeing 747. Higgs says that each economy seat will be about 1in (25mm) wider than on the 747, and there is an extra inch for each aisle. The extra width gives airlines the option to insert a double-armrest to split each centre row of four seats. Every existing A380 customer has opted to install 10-abreast economy seating on the main deck. A “small majority” of airlines are installing first and business class on the upper deck, with the rest opting to locate first on the main deck and a mix of business and economy upstairs, says Higgs.

The upper deck of the A380 is “rather like the upper deck of the 747”, says Higgs, in terms of its shape and the provision of floor-mounted luggage bins for window seat passengers.

However, the twin-aisle design is much wider than that of the 747, and is in fact 100mm (4in) wider than the main deck of the A330/A340 family, allowing a comfortable 2-4-2 arrangement in economy.

A 13-person crew-rest module can be installed at the rear of the upper deck, displacing revenue seating, or alternatively a 12-person module can be located in the cargo hold, reducing freight capacity.

Economy class could feature 10-abreast seating on the main deck

The only carrier planning different configurations is Emirates, which has not decided whether to have only six-abreast business class on the upper deck. Offered by Airbus as standard options for the cabin lining are a choice between “cool” and “warm” colour shades and two patterns, though customisation is possible. “Airlines can pay for something else,” says Higgs.

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passengers and the back for economy. “We are already looking at five or six different options and that is not even sufficient – there are still a lot more options that we will look at,” he adds.

Malaysia Airlines (MAS) managing director Ahmad Fuaad Dahlan says: “We need to provide a balance between market expectations for better personal space and legroom in our flagship aircraft vis-à-vis reaping the benefits of lower seat cost per mile given the expected commercial efficiency of the aircraft. The A380 will be our all-new flagship. It will be equipped with the latest technology and comforts to offer a quality of service that will be the golden benchmark of the future.

Upscale elegance

“The A380 cabin and seat design will embody luxury in upscale elegance, which conveys an image of control and modernity of the air travelling experience. It will combine prestige with a clear and functional design offering a redefinition in the luxury class theme that sets new standards in emotion and functionality as well as in design and state-of-the-art technology.”

MAS expects all-economy class on the main deck and first and business classes upstairs. “It makes sense that the premium classes are together and are given the upper deck,” says the carrier. “They will get more privacy that way, as well as benefit from some common front-end facilities and services that we are planning.”

Korean Air (KAL) chairman Cho Yang Ho, says: “We are committed to a new dimension of service and are responding to the needs of our passengers while improving operating efficiency and cost structure. The economics of the A380 support our strategy.”

Creating a fantastic new experience in economy is tough, but in the premium cabins, carriers can go further. Gary Chapman, president of Emirates airport services group Dnata, says Emirates will have showers in the first-class cabin. The problem carriers have, says Ronald Kuhlman, vice-president of the Unisys R2A consultancy, is how exclusive they can make the A380 feel for the highest-paying customers. The choices for premium passengers to select dedicated services, such as corporate jets or the business-class-only long-range A319 and 737s, could have an impact on long-haul widebody services. As Knapp of Landor says: “How can you feel that exclusive when you are one of 500 people?”

Most carriers are planning three-class A380s in the first wave of operations, but analysts believe the aircraft’s low seat-mile costs may attract low-cost players interested in long-haul services. “I would not be surprised if operations like a high-density New York to London shuttle will come along eventually, especially if premium traffic is sucked away to other aircraft,” says Ronald Kuhlman, vice-president of the Unisys R2A consultancy.

“I am looking out for people putting 650 seats on the A380,” says David Stroud, managing director of UK-based Airport Strategy & Marketing. “It will be very interesting to see what happens in the Chinese market, for example, where carriers could make high-density seating work.”

Emirates is already thinking of high-density A380s. It is planning a two-class 644-seat variant for shorter-range routes to the Indian subcontinent from Dubai. And the carrier makes no secret that it wants the stretched A380 sooner rather than later. High-density versions of this aircraft would seat upwards of 700 people. As Tim Clark, Emirates president, said in a recent article in Airline Business: “We would enter a new dimension of long-haul travel.”

Spacious areas for relaxation could be a big feature of the A380
ENTRY INTO SERVICE

Everything possible is being done to ensure that when the A380 enters service, it is as reliable as a mature airliner. Max Kingsley-Jones reports from Toulouse

Ready to fly

AIRBUS MAY BE ONLY AT THE beginning of the A380’s flight test programme, but the manufacturer and the launch airlines have spent the past four years preparing for the giant’s introduction into revenue service. For the manufacturer, this means ensuring the A380 exhibits the reliability performance of a mature airliner from day one, and for the airlines, it involves gearing up for operations with the world’s largest airliner.

The introduction of the A340-600 three years ago was Airbus’s final rehearsal ahead of the A380’s arrival – and it was not exactly a copybook performance. Airbus acknowledges the aircraft is still not delivering satisfactory reliability levels and has undergone a series of modifications to resolve in-service problems.

Airbus knows it cannot afford a repeat of the A340 experience with the A380 – or any other new programme – and senior executives are confident the tools are in place to ensure it does not happen.

“It is a stated corporate objective for the A380 to be mature at entry into service,” says Philippe Mhun, vice-president customer services, A380 programme. “Part of [A380 chief engineer] Robert Lafontan’s design team has a specific group of six or seven people covering what we call ‘MRS’ – maintainability, reliability and supportability – of the A380.”

Mhun – the former head of long-haul fleet engineering and maintenance at Air France whom Airbus

What the airlines say

Report by Colin Baker in Dubai, Nicholas Ionides in Singapore, Emma Kelly in Perth and Mark Pilling in London

If Airbus manages to keep to its planned development schedule, three airlines are due to take delivery of their first A380s next year – Singapore Airlines (SIA), Emirates and Qantas. But plans for what should be the most publicised service-entry since Concorde have been under way since the programme began.

SIA is due to be the first A380 customer to take delivery, in the second half of 2006. Service entry of its Rolls-Royce Trent 900-powered aircraft is due soon after. The first destinations for SIA’s A380 will be the two extremes of the “kangaroo route” – London Heathrow and Sydney.

The airline does not anticipate major operational problems. “Since we announced our order of the A380 in 2000, we’ve been working closely with Airbus and all other technical suppliers to bring the A380 into service,” it says. “This is to ensure the A380 will operate in a manner that complements the airline’s overall safety and service philosophy.”

SIA intends to equip its A380s with a configuration of around 480 seats, and the airline’s senior executive vice-president (operations and services), Lt Gen Bey Soo Khiang, says it intends to fill the aircraft to the maximum from the start, rather than undersell to allow for flexibility in the operation. With its A380s having 30% more seats than the
Airbus has set a despatch reliability target of 99%, which it will try to achieve from entry into service, and a key part of the effort to achieve maturity was the decision to create test devices specifically to evaluate the integration of components and systems, the so-called “aircraft zero”, “cabin zero” and “landing gear zero”.

“These devices reflect properly the way the aircraft behaves in operation. We have facts and data to substantiate the way the aircraft will behave, and that’s why I’m confident the maturity is really under control,” says Mhun.

Charles Champion, executive vice-president A380 programme, says that as well as undertaking more ground testing than ever before to ensure system maturity, a new approach was taken to the selection of vendors and risk-sharing partners. “Maturity and customer in-service aspects were considered as a driving factor as much as the weight and the purchasing cost,” he says.

“For the first time, we looked not only at the recurring cost aspect, but also at the customer services and maintenance costs aspects. And we managed to get direct maintenance cost [DMC] guarantees in accordance with the overall DMC target of the A380 that we are committed to with our customers.”

One area of the previous programme that has continued to give problems is the fuel system, and this was one element of the A380 for which Airbus decided to bolster testing. “We set up several fuel test rigs in the UK, which were not originally planned in the development programme,” says Champion. “It is testing the fuel management computer software, and...”
“We’ve warned customers that all functions might not be available from day one”

Charles Champion, executive vice-president, A380 programme

over the last year this has been formalised. “Now each business has an A380 readiness cell looking at specifics,” he says, adding that in maintenance and engineering, for example, the cell is now looking at software issues, spares provision and planning maintenance systems. Cox says Qantas is “absolutely on track” with its A380 planning and happy with its progress as it enters the detailed, final readiness phase. Because of the way Airbus and A380 customers have worked together on maturity issues, Qantas believes the A380’s entry into service will be “the most reliable ever...we put the expectation on Airbus and they are responding that it will be very mature from day one”.

First destinations
One of the airline’s first A380 destinations will Los Angeles, and the airline is working closely with the city’s LAX airport on three levels – the airfield and relocating a runway, detailed discussions on how the terminal needs to be modified to cater for the aircraft, and putting plans in place to support the aircraft from an engineering point of view. "We are putting in place a very detailed programme to manage the aircraft to ensure all parts of the airline are ready and all parts will work seamlessly together,” says Cox. “This programme is more comprehensive than Qantas has ever done before. We’ve introduced new types into service before but this is a level of programme management that couldn’t have been imagined before.”

The high level of support from Airbus is enabling this level of programme management to happen, says Cox. "We will understand what this aircraft can do on a level never known before,” he says, adding that the airline can plan better impact to the airline, are as critical as flight critical items. For example, you can’t depart with some non-operating toilets. So for the first time, we’ve applied the exact same methodology to the cabin environment as the one we have for airworthiness systems.”

In-service problems
In parallel with the reliability effort, Airbus is also looking to address the time taken to rectify an in-service problem. “Today a good dispatch reliability rate is not enough – the length of a technical delay is also an issue,” says Mhun.

Airbus has several strings to its bow to improve this area of the A380’s performance that come from the MRS effort, namely enhanced support and improved maintainability – and all the experience gained on the A380 will set the datum for all future programmes, beginning with the A350.

“Because of the specific context of A380 operations – high capacity, long haul, and no substitute aircraft available – we have created our ‘enhanced support’ programme,” says Mhun.

Using its built-in test equipment and sophisticated communications platform, the A380 will be able to relay messages automatically via the airline to the Airbus “AIRTAC” 24h technical AOG centre in Toulouse about any technical problems it is experiencing during the flight.

Airbus is doubling the staffing of the AIRTAC AOG management team as part of a move to upgrade the support to airlines from “reactive” to a “proactive” mode, says Mhun. “Before the airline calls our centre, we will already have prepared accurate procedures or recommendations to trouble-shoot or undertake structural repairs. Previously, AIRTAC was only in reactive mode, with analysis provided by the airline.”
Meanwhile, Airbus, together with airlines and vendors, has created a so-called “virtual warehouse”. Managed by AIRTAC, this is a database that can provide information on the availability of spares for the A380 around the world, and can be interrogated automatically from the air. “This will be a great help when you have to make a decision about the repairability of a system at an outstation,” says Mhun.

He says most of the new functions of the enhanced support plan will be tested during the A380’s route-proving programme early next year, and some trials are also being undertaken with launch operator Singapore Airlines on its A340-500 fleet.

Once the problem has been identified and spare parts delivered to the aircraft, Airbus has also ensured the repair is achieved as quickly as possible. The “MRS” effort has involved “maintenance experts challenging the future maintainability of the A380’s design... to make the maintenance processes easier and more efficient”, says Mhun.

“We have built in much more despatchability on the A380”

Philippe Mhun, vice-president customer services, A380 programme

“The size and weight of components is much greater than for previous aircraft – for example, each air generation system unit in the wing root weighs 400kg – and we had to work with the designers to make sure the removal and installation of equipment is easier and safe for the mechanics.”

Fast repairs
To guard against a potential technical problem significantly delaying an A380 flight, Airbus has set requirements for the time to remove and reinstall certain components. “We want to be sure that they can be replaced within the two- to-three-hour turnaround time we are going to experience with the A380,” says Mhun.

As the date for the launch of revenue services looms on the horizon, Airbus is now into detailed bilateral meetings with all next year’s A380 operators – SIA, Emirates and Qantas. Mhun says the technical assistance Airbus will provide for service-entry will comprise teams of 12 specialist engineers assigned to support each launch operator.

“The teams will be stationed at any A380 station, for example in SIA’s case that will initially be Singapore, London Heathrow and Sydney,” says Mhun.

“We are taking a ‘base approach’ rather than an ‘airline approach’ and these resources will be shared at each station by whoever operates there.”

Mhun says he expects the teams to be in place for between three and six months for each new operator, “but we have the flexibility to have them available as long as is required”.

Once the aircraft is in service, Airbus wants to avoid the problems of past programmes, when repetitive faults took too long to be fixed. “We’ve learnt from earlier programmes that reducing the time needed to fix a problem and incorporate a modification is appreciated by customers, so we aim to speed up the engineering process to fix the recurrent technical issues,” says Mhun.

This will involve a team comprising engineers from AIRTAC, the design office and the “poor performing vendors”, as well as airline representatives being co-located at the AIRTAC offices. “They will identify any recurrent technical issues, determine the cause of the problem and implement the fix,” says Mhun.

The process is already under way, with customer service engineers having been sent to the flight test team to monitor any potential problems.

“Any issues being raised as part of flight testing could be qualified as a potential in-service problem and would require a fix before service entry,” says Mhun.
Joint effort

The huge investment required to support the A380 in service means it is highly likely there will be tie-ups between maintenance, repair and overhaul players, report Colin Baker in Dubai, Emma Kelly in Perth and Max Kingsley-Jones in Toulouse.

So the first A380 major checks are not likely to begin until around 2012, giving the MRO companies breathing space to finalise their strategies. The airline arms of several of the world’s key MRO players already have the aircraft – Air France, Emirates, Lufthansa and Singapore Airlines – and some have given a glimpse of their plans for A380 MRO.

Dubai centrepiece
By the time the A380 enters service late next year, Emirates will have a maintenance facility to match the scale of the super jumbo. “We are further advanced than most people,” says Emirates manager engineering facilities, Bob Lunn. He is confident Emirates will have the largest A380 maintenance facility in the world – not surprising given that the airline’s current orderbook for 45 of the aircraft represents almost one-third of all A380 sales to date.

The site’s new offices will open for business in December, with line maintenance expected to begin in January 2006. The complex will comprise eight A380 hangars – four dedicated to heavy maintenance checks, three for light maintenance, and one reserved for painting.

Given the airline’s insistence that it will eventually operate the proposed -900 stretched version of the A380, each of the hangars is designed to handle the larger variant. The 110m x 105m (360ft x 344ft) hangars will have a footprint of 11,500m² (124,000ft²) with two mezzanine levels and craning systems made of three moving bridges.

Emirates management makes clear, however, that given the rapid growth of the Emirates fleet, its top priority is catering for its own fleet rather than seeking third-party work. “We will look at third-party business, but it will always be secondary to the core needs of Emirates,” says Gary Chapman, president of Emirates sister company Dnata, the Dubai airport services company, adding that the carrier is not currently looking at joint ventures for A380 maintenance.

The A380’s operator base and fleet size will remain relatively limited during its early years in service and, with high investment in spares and infrastructure to maintain the giant, the prospects are strong for joint ventures among leading maintenance, repair and overhaul (MRO) companies.

At least one tie-up has been announced – the partnership between Air France Industries (AFI) and Lufthansa Technik (LHT) on A380 component overhaul – and insiders believe more are on the cards.

Airbus is keen to guide its customers with the MRO aspects of the aircraft, and will eventually incorporate it into its recently launched MRO Network, says Philippe Mhun, vice-president customer services, A380 programme. “We are waiting for some of our MRO partners to build A380 experience for them to be on board our future A380 MRO network.”

Mhun says the size of the aircraft means most players will have to build new facilities, so the investment required will see “only major players” participate.

Airbus has set up the A380 maintenance programme and provided customers with the maintenance manual and tooling recommendations. “In terms of heavy maintenance, the interval is six years for intermediate check and 12 years for heavy check,” says Mhun. This compares to five and 10 years typically for the A340.
“We have a clear intention to support this aircraft differently and more innovatively than any other aircraft”

David Cox, Qantas

components supply, not only for the future A380 fleets of Air France and Lufthansa, which between them have placed orders for 25 aircraft, but also for all A380 operators worldwide,” the partners say. The inventory needed to operate the A380 component pool will be purchased by the partnership and responsibility for management and repair split 50/50 between the two players.

With Lufthansa’s first A380 due to arrive at its Frankfurt-Main hub in 2007, LHT has already broken ground on a four-bay A380 line maintenance hangar at the airport which will open in time for the first aircraft.

Further co-operation could also be ahead, says LHT executive board chairman August Henningsen: “I see the possibility of a link with other A380 players. I would not rule out co-operation with one or a number of parties.”

Henningsen says LHT will be in a position to undertake A380 maintenance at its Hamburg headquarters. A mobile extension for one of the hangars capable of handling an A380 is due to be available by September.

Although the need for an A380 heavy check capability is less pressing, the company sees a more urgent need to provide a covered A380 facility because of the potential demand for a government/corporate A380 conversion. “A VIP A380 is going to happen sooner or later,” says Henningsen, although he adds LHT is not currently holding any “firm discussions” with potential clients.

LHT has been pursuing a strategy of creating centres of excellence for various sectors of its business, one of the most notable being the establishment of the former Philippines Airlines maintenance facilities in Manila – now LHT Philippines – as the specialist for A330/A340 heavy checks.

Competitive Asian rates

With the high number of man hours an A380 heavy check is likely to generate – such as the removal and refurbishment of over 500 seats – observers believe the highly competitive labour costs offered by an Asia-based maintenance centre will make it hard to justify carrying out most heavy checks in a high-cost region such as Europe.

Qantas has started to scope out training issues for its A380 maintenance needs and has opened preliminary talks with Australia’s regulator, the Civil Aviation Safety Authority.

“We are still 14 months out, though, so we are still at the developmental stage of how we are going to tackle A380 maintenance and support,” says David Cox, Qantas executive general manager engineering, technical operations and maintenance services.

The airline is now looking at the details of how to structure support for the aircraft. “In the next six months we’ll be making decisions,” says Cox. “We have a clear intention to support this aircraft differently and more innovatively than any other aircraft.”

When Qantas introduced the Boeing 747, it had a partnership with United Airlines and a similar approach is expected with the A380. The airline confirms it has been in discussions with other A380 customers about possible partnerships to manage the engineering and maintenance requirements of the new fleet. The airline is known to have explored a possible engineer-

New materials toughen up the A380

Airbus has conceived the A380 to be more durable during the rough and tumble of airline service through the use of new materials and production techniques, says the programme’s vice-president customer services, Philippe Mhun.

The long maintenance interval and the increased use of carbonfibre and Glare materials in the structure of the A380 leads Airbus to anticipate a “much better behaviour of the aircraft in terms of corrosion”, he says.

“For the aircraft’s lower shelf we have used laser-welded shells – the stringers and skin panel are welded rather than riveted – which minimises the water ingestion and therefore improves corrosion protection,” Mhun says that the replacement of rivets with welds on large portions of the fuselage reduces fatigue, as “the stress spread is improved because it is not just on the rivet but spread out to all the stringer/skin weldings”.

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The A380 Freighter faces a tough fight in the cargo market with its incumbent rival, the Boeing 747, but Airbus is confident that its superior range and economics will win through. Peter Conway reports from London

IF THE A380 FREIGHTER IS GOING to be a new paradigm for the air cargo industry, it is taking a while to catch on. Indeed, a sure way to get an airline cargo manager rolling his eyes in the past year or two has been to ask whether his airline has any plans to buy the freighter.

The reason is air cargo’s love affair with the 747F, which shows no sign of abating. This year’s hot freighter is not the A380F or even the proposed 747 Advanced Freighter or the 777-200 long-range freighter that Boeing is trying to launch, but the 747-400SF passenger-to-freighter conversion. Ever since it was first offered in late 2003, airlines have been falling over themselves to book conversion slots.

Air cargo’s enthusiasm for the 747 is not surprising. It was, after all, designed originally as a military transport and has cargo-friendly features, such as the famous nose door (although this is available only on factory-built models, not conversions) and its ability to carry 3m (10ft)-high pallets on its main deck.

The A380F, in contrast, is an unknown quantity. It will carry only 2.4m-high pallets (like most other freighters), will have no nose door, and its upper deck will require a special high loader that can reach the dizzy height of 8m above the ground. Carriers are worried that not all the exotic airports freighters tend to fly to in pursuit of cargo will have such high loaders, or the necessary taxiways. They also worry about the ease of interlining pallets with their existing 747F fleet, and that there will not be enough routes to fill the A380F’s 150t payload.

Set against such concerns is the fact that the A380F is already a great success. Production freighters are typically launched well behind the passenger variant – the first 747-400F was not delivered until four years after the passenger variant, for example, and the 777 freighter is not due to take to the air until 2008 or 2009, 14 years after the passenger variant was launched.

By contrast, the prototype A380F is already being built – the metal was cut on 12 April – and test flights will begin in the third quarter of 2007. And Airbus has already had 27 orders – 10 from FedEx Express, 10 from UPS, five from ILFC and two from Emirates.

As Richard Carcaillet, director product marketing for the A380 at Airbus, points out, 20 airlines took part in design consultations. “The top six cargo carriers in the world are all either A380F or A380 passenger customers. Remember too that it is still three and a half years to the first freighter delivery. All this makes me relaxed and optimistic that the freighter will be a success like the passenger variant.”

Stronger structure

The A380F’s freighter variant grew out of consideration of future stretch and long-range versions of the passenger aircraft, which would need a 590t maximum take-off weight instead of 560t for the current model. The strengthened wing and structure of this future stretch model are being used for the freighter, which will also have special fuselage panels – stronger than usual, with no windows – and an excellent sheer and bending capability, making it less sensitive to the positioning of different weight pallets. “This was always a strong point of the 747F, but we have done even better,” says Carcaillet.

The lack of a nose door has also been compensated for with an exceptionally wide main deck cargo door – 4.27m against 3.4m on the 747F. Add in a wider main deck and a good proportion of the outsize cargo that needs nose-door loading will fit into the A380F, says Carcaillet.

He also says nose doors are not as vital as Boeing suggests. “In our consultations, airlines accepted, after discussion, that the nose door does have weight/cost implications, and that the nose loader is not available at all airports. Boeing is also offering a 777 freighter which has no nose door, and no wide cargo door either.”

On the high-loader question, Carcaillet says seven manufacturers have attended meetings and development is under way at several of them. He insists the availability of high loaders at airports on major routes will not

IN MY VIEW

“The health of the air cargo industry could not have found a better shot in the arm than Airbus’s jumbo A380.”

FRED SMITH
CHAIRMAN, FEDEX
be a problem, but Airbus is also urging equipment manufacturers to look at a portable solution to change ordinary loaders into upper-deck ones which the A380F could carry in its belly.

To counter the charge that a three-deck freighter will take longer to unload, Carcaillet says manufacturers are also planning to make the loader longer – so it can take more pallets or containers at once. “And remember that this loader will be usable for the main deck too, so it will also benefit two years, and one more in 2011, with options for 10 more – and UPS, which takes delivery from 2009-2012, see the A380F as a double-sized replacement for the MD-11 freighters that currently link their US, Asian and European hubs. Both reckon they will deploy the freighters initially across the Pacific, adding Europe a year or so later.

It is the combination of payload and range that makes the A380F so attractive to these two express carriers. The MD-11F can take up to 90t on 7,400km (4,000nm) routes, but FedEx and UPS talk of payloads of 60-70t on the 9,250km routes between hubs such as Cologne and Hong Kong or Osaka and Memphis. So the A380F offers a doubling of both payload and cubic capacity – 1,080m³ (38,000ft³) compared with 540m³ for the MD-11.

There are some special factors at work for express operators, however. Time pressures mean they tend to fly direct between hubs, whereas conventional freighter operators often stop at intermediate points to pick up cargo or counteract imbalances, so the A380F’s extra range (10,360km against 7,770km for the 747-400F) matters less to them. Also, express carriers tend to land and take off at night, so they are keen to cut aircraft movements (and noise) as much as possible. Scott Roby, manager long-range planning at UPS Airlines, admits that being able to make the best use of available slots was one factor that swayed UPS to order the A380. Container commonality

The nature of express operators’ existing fleets also means they will not have to adjust container sizes to use the A380F. “The containers we currently use on the MD-11F will fit fine onto the main deck of the A380F, and on the upper deck we will use A300 or 767 containers,” says Roby. “Apart from the high loaders, there are no other particular entry-into-service considerations for the freighters.”

But these advantages do not necessarily apply to conventional cargo operators, leading Boeing to suggest that although the A380F is a good express aircraft, it won’t work for conventional heavy freight. This draws a particularly vigorous response from Carcaillet.

“I am relaxed and optimistic that the A380 Freighter will be a success like the passenger variant”

Richard Carcaillet, director product marketing, A380

other widebody freighters,” he says. With all these improvements, Airbus estimates it will take 91min to do a complete turnaround for the A380F – the same time as for the 747-400 conversion. With a nose door, he concedes the 747-400 is 10min quicker.

Certainly, existing purchasers of the A380F are not worried about high loaders or airport infrastructure. Instead, what excites them is the aircraft’s performance statistics. Both FedEx – the launch customer, taking three A380Fs in 2008, three in each of the following
“FedEx and UPS are not just express carriers any more,” he says. “They are also getting into heavy freight, and have purchased these aircraft for international business where heavy freight is a factor.” Roby confirms this, pointing to UPS’s recent purchase of freight forwarder Menlo. “As we go forward, we will be growing not just in express, but in heavy freight,” he says, “and the A380 will enable us to offer both.”

Airbus’s counter to the “express only” tag is to point to the A380’s three possible loading configurations – which Carcaillot says makes it more flexible than the 747F. A dense configuration has 17 pallets on the upper deck, 29 on the main deck and 13 on the lower deck, while putting 25 pallets on the upper deck gives a “middle of the road” loading pattern. For express operators, a low-density arrangement squeezes 33 pallets onto the main deck by putting one row crosswise.

**Exceptional capacity**

This enables the A380F to make the best of its exceptional cubic capacity, which could be important in an industry where the trend is for less dense cargo (for example, smaller electronic products in more packaging). Using the industry standard 10ib per cubic foot density, Carcaillot says its middle and lighter density configurations give 31% more volume than the 747-400F, and with the 8-9lb per cubic foot densities he says are being studied by some Asian airlines, it can have up to 50% more volume than the 747-400F.

This is also part of Airbus’s answer to the 3m (10ft)-high pallet question. “If you don’t have 10ft-high pallets, you are stuck with relatively poor space utilisation on the 747-400F,” says Carcaillot. “Lots of pallets are not 10ft high. In fact, most pallets on existing freighters – including A300s and MD-11s – are only 8ft high.”

As well as its better cubic capacity, there are other arguments that might win over conventional cargo carriers to the A380F. Airbus figures say the aircraft will have 24% lower cash operating costs, and 18% better fuel efficiency per tonne than the 747-400F.

At Emirates, the only confirmed conventional user of the aircraft and due to take delivery soon after FedEx in 2008, Ram Menen, senior vice-president cargo, reckons this will create “a new benchmark for discounting” on routes it operates. “The A380F is the aircraft of the future and the shape of things to come. The situation is no different from when 747 freighters first appeared in the early 1970s.” Emirates has not said where it will deploy the aircraft, but Asia to Europe or Dubai to the USA would be good candidates.

What of other airlines? Carcaillot is confident of another freighter customer this year, and there are signs the icy reception given to the A380F by conventional carriers may be cracking. Marc Boudier, executive vice-president of Air France Cargo, admitted the A380F would be a good freighter, but the carrier’s priority was to replace its ageing 747-200F freighters with new 777 Freighter. Boudier also doubted whether Air France Cargo had enough routes on which to operate an A380F with the three to four frequencies a week it aimed for. “But that could change in the next decade,” he said.

**Better economics**

Singapore Airlines is also on record as considering the A380F, and even China Airlines and Cargolux, both stalwart 747-400F customers, say they see a need for a next-generation freighter with better economics and larger capacity than the 747-400F. Both hope Boeing will launch its 747-400 Advanced Freighter to fill that gap. This is the “wild card” that could affect the A380F’s future, says Bob Dahl, project director for consultants Air Cargo Management Group in Seattle.

Dahl says the presence of the A380 passenger version in the fleets of major airlines could sway the argument for the freighter. “Right now the argument favours the 747-400 freighter, but in 10 years it could easily favour the A380F or the 777F for the same reason,” he says. Boudier says this is a key factor at Air France. “If we can order a freighter that has commonality of maintenance and crewing with our passenger fleet, that is a very important consideration.”

ILFC is also optimistic about the A380F. Not known for its huge freighter portfolio, the lessor has ordered five of the aircraft, although president John Plueger says it has the option to switch these back to passenger orders. But he does not expect that to happen. “We get our first passenger A380 in spring 2007 and the first possible freighter in 2009. By the time they are delivered, I am confident there will be market demand for them.”