A350 or 787? EXCLUSIVE GUIDE
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CONVERSIONS
Which 757 conversion works best?

INVESTORS POLL
Your choice of favorite aircraft

MAINTENANCE
Key costs for over 40 aircraft

REVIEW
Is the 747-8 really a new aircraft?

KEY AIRCRAFT
Why the A380 and the 747-8 are a success

NARROWBODIES
A319 VS 737-700

NEW AIRCRAFT
The A380 has had a radical impact on the market

USED AIRCRAFT
Which aircraft has increased value the most?

A new publication from Airfinance Journal • July 2007 • Published by Euromoney
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The commercial aircraft industry is enjoying good times. Aircraft deliveries are at record levels and traffic growth over the next 5–10 years is expected to be significant and sustainable. Emerging growth markets across Asia, Eastern Europe and the Middle East has contributed to the demand for new aircraft, while low cost carriers have fuelled demand in Europe and America, particularly for single aisle aircraft.

But there is a cloud on the horizon - the environment. Whereas in the past noise has been the major issue, the focus has switched to emissions. Icao has now prepared draft guidance on the subject of an open, globally-based emissions trading scheme to cover air transport and its proposals are likely to be approved this year. The optimistic view for the industry, particularly the manufacturers, is that environmental pressures will ensure that the airlines retire older aircraft and switch to newer types. A more pessimistic view is that the current levels of growth are unsustainable and that this will eventually impact on the demand for commercial aircraft. In either case the commercial aircraft industry cannot afford to ignore the environment as an issue. Nonetheless the manufacturers’ longer-term forecasts remain bullish and they have broadly similar views of the potential market with the main discrepancies lying in the split between the various size categories of aircraft.

Boeing says the next 20 years (2006–2026) will see an average annual world economic growth rate of 3.1%, a growth in passenger numbers of 4.5%, a growth of revenue passenger kilometres of 5.0%, and a freight growth rate of 6.1%. For the equivalent period Airbus believes the RPK growth rate will be 4.8% and the corresponding freight growth rate will be 6.0%.

The US manufacturer concludes the world fleet of commercial jet aircraft will grow from 18,230 in 2006 to 36,420 aircraft by 2026. This growth plus the requirement for replacement aircraft means the market will need 28,600 new aircraft valued at $2.8 trillion over the next two decades. The Airbus forecast (also 20 years from 2006) predicts slightly fewer new deliveries of 26,654 aircraft valued at $2.6 trillion at current list prices.

These numbers are impressive but, as anyone with experience of the airline industry will tell you, passenger and freight demand is cyclic and highly susceptible to world crises. In downturns it is the most economic aircraft that survive. We trust this guide will help investors to judge the quality of their assets and potential assets.

*Geoff Hearn, editor, Air Investor*
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Ready, steady, go. *Airfinance Journal* presents which aircraft are the investors’ favourites.

**WORKHORSES WIN THE DAY**

Longevity, value for money and operational success. While the aviation industry enjoys its upswing, the fundamentals that banks, lessors and airlines look for in an aircraft for will hold sway over time. Many new models have appeared on the radar screen, but the demand for reliable, well-known aircraft has never been more obvious.

For those who expected the trials and tribulations at Airbus to push the European manufacturer to the bottom of the pile, its performance in the Airfinance Journal Investors’ Poll might come as a shock. The A320, ranks highly in terms of operational success, remarketing potential, residual value and value for money. One European-based investor says the A320 is the best performer and is very satisfied with this aircraft. But its position is overshadowed by the 737 and 777 aircraft, perhaps illustrating investors’ commitment to tried and tested performers.

Despite a series of launches and roadshows, Airbus’ latest aircraft have yet to win the hearts of the 100 investors polled by Airfinance Journal. As one investor says: “The A350 has a big challenge to cover such a wide design range.”

Comments about the A380 were also mixed. “For those airlines which need a big airplane for long haul, high-density work, the A380 is likely to be a success,” says an investor. “From an investor’s standpoint, it will probably be the scariest airplane in the market.”

While the majority of investors do not seem to be overly taken by the new aircraft on offer, many see them as having long-term potential. “The widebodies have to beware of the 787 and the A350XWB,” says one investor.

**Residual Value**

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>737-800</td>
<td>8.7</td>
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<td>737-700</td>
<td>8.6</td>
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<td>A319</td>
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<td>A330-200</td>
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<td>737-500</td>
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<td>777-200ER</td>
<td>7.4</td>
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<td>737-300</td>
<td>7.2</td>
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<td>777-300ER</td>
<td>6.8</td>
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<tr>
<td>777-200LR</td>
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**Residual value**

As more investors prepare to take asset risk into account when doing deals, the residual value of aircraft in these transactions becomes more important. The 737 and 777 aircraft win gold in this department, followed by the A320. Embraer’s new 195 aircraft looks set to join them next year. The A319 also does well, but Airbus’ position is subject to change. As one investor says: ‘Airbus’ unwillingness to adjust production rates during market downturns will always contribute to softer residual values on its product line.”

Another investor says that an aircraft’s residual value has more to do with the engines used. “Aircraft powered by GE engines generally keep a better residual value,” he says.

**Technical Characteristics**

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<td>747-400</td>
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<td>A321</td>
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<td>737-600</td>
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<td>767-200ER</td>
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**Value for Money**

<table>
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<th>Aircraft</th>
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<td>757-200</td>
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<tr>
<td>757-200</td>
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Value for money
This argument is dominated mostly by the ability to cut operational costs. Here, the ERJs and the 737 aircraft lead the way, followed by the 777-300ER. In addition to its residual value, the A318 is also fortunate in this area, while new aircraft such as the A380 do not feature.

“Airbus put its eggs in the wrong basket as the A380 will be a niche aircraft,” says an investor. Boeing’s extended-range aircraft are also noted for delivering value for money. The 737-300ER is in fifth place.

Remarketing potential
Always a major concern for lessors, an aircraft’s remarketing potential says a lot about the number of leases it will secure in its lifetime. The 777-300ER scores particularly well in this area.

Despite the generous scores awarded for remarketing potential, pricing remains an issue for investors.

“Manufacturers should manufacture – in fact, they design and assemble – and then they should sell,” says an investor.

He adds: “They should not be in the leasing game. Aircraft should be sold at a price that the market will accept, not one which is supported by export credit.”

Operational success
With a flurry of orders in the past year, it is easy to see why certain aircraft are referred to as workhorses.

In fledgling markets such as India, these aircraft are top notch for domestic carriers such as Indigo and Air Sahara. The 737-800 and the 767-300ER also do well. The demand for aircraft in developing markets such as China and India means that widebodies will have to work harder in the long-haul market.

Investor appeal
Growth in India and China has certainly helped to focus investors’ minds. The A320, the 737-800 and the A319 are the most sought-after aircraft as passenger travel continues to increase. Regional manufacturers such as Embraer and ATR are also regarded as ideal for these markets, whereas Bombardier is almost overlooked. “Bombardier needs to come up with a real 100-seater as the C Series is destined to fail,” says one investor. The picture does not seem altogether rosy for engine maintenance either, with one investor claiming that Rolls-Royce’s dominance of engine support has destroyed third-party participation and reduced competition.

“This has reversed the value comparison of the Pratt & Whitney- and Rolls-Royce-powered 757s for freighter conversion and will likely have a similar negative effect on Trent-powered products over time,” says the investor.

Most successful aircraft
While Airbus enjoys its moment of a good period of aircraft orders, latest innovations by Boeing threaten to change the game in five years’ time.

The 787 is rated by investors as an aircraft that will be the most successful in years to come. “Boeing is finally listening to the customer and appears to have eliminated certain levels of corporate bureaucracy,” says one investor.

The ERJ 190 is also a long-term favourite of investors, with the A350 and A380 close behind.
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Aeroméxico
- CFM56-7B (Two)
- JT8D-200 (Two)
- PW2000

Airblue
- V2500-A5
- CFM56-7B

Air China
- PW127
- CFM56-5B

Avianca
- JT8D-200 (Two)
- PW4168A

Avio
- Avio 
- JT8D-200 (Two)

GroatAir Airlines
- PW4000 (Two)
- CFM56-5B

Delta
- PW2000

Emirates
- A340-313 (Two)

Garuda Indonesia
- CFM56-3C1 (Two)

Germanwings
- PW4168A
- CFM56-5A

Iberia
- CFM56-5C4 (Two)
- JT8D-200 (Two)

Kenya Airways
- CF6-80C2
- PW4060-3

LOT
- PW4000 (Two)
- CF6-80C2

Malev
- CF6-80C2

Meridiana
- JT8D-200

México
- CF34-8C5 (Two)
- 3807A (Two)

Mexicana
- CFM56-5B (Three)
- JT8D-200 (Eight)

Oaur Air
- CFM56-5A

Shanghai Airlines
- CF34-3B1

South African Airways
- CFM56-5C4

Spanair
- JT8D-200

SR Technics
- PW4060-3

Thomas Cook
- PW4462-3 (Two)

Transmile Group
- PW4060-3

V2500-A5

Wizz Air
- CFM56-7B

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As the rollout of the first 787 nears, Boeing's massive investment appears to be paying off. Final assembly of the aircraft began at the end of May. The company says the first aircraft will take about seven weeks to assemble, but when production is in full swing the target will be to roll out an aircraft every three days.

The 787, or Dreamliner as it has been dubbed, provides a step change in fuel economy and speed compared to current generation widebodies. Boeing's confidence to invest so heavily in the aircraft's new technology stems from its bullish predictions for demand in the 787 category. Its latest forecast suggests that 6,230 twin-aisle aircraft in the 200 to 400-seat class will be required by 2025. Initial market reaction has undoubtedly been favorable.

The most recent order is typical of market enthusiasm and marks a breakthrough in a new region. Russian airline S7 has ordered fifteen 787s with an option for another ten aircraft in an order valued at $2.4 billion at list prices. S7 is the first Russian airline to order the aircraft. If S7’s general director, Vladislav Filyev, is correct the financial community shares the airline’s enthusiasm. He suggests: “banks are queuing up to support airlines purchasing the Dreamliner.”

Following the S7 order, Boeing says it has 584 firm orders from 45 airlines. According to the manufacturer this makes the 787 “the fastest-selling new aircraft in commercial aviation history.” There are currently three models on offer with a fourth in prospect. The 787-8 is the baseline model and is due to fly in the third quarter of this year with entry into service in 2008. The stretched 787-9 is due to follow in late 2010. The -3 is the same size as the -8, but is intended to be more efficient for shorter routes. It will typically offer more seats than the -8, as it will normally be configured in a two-class configuration rather than three classes that Boeing anticipates will be the norm for the other models.

Boeing says that customers continue to show strong interest in the potential fourth member of the family, commonly referred to as the -10. But the advent of the A350XWB is said to be causing the US manufacturer to look again at the -10's capabilities. A Boeing spokesperson told AirFinance Journal: “The 787 programme team is constantly engaged with customers and assesses their needs on a regular basis and we are studying larger versions of the 787. It is obvious to us that there is a market for a so-called 787-10 so it is very likely we will move forward with its development. This larger aircraft would seat about 300 passengers in a three-class configuration and could have expanded-range capabilities. The associated development costs would be relatively modest.” However, most industry observers believe it unlikely that the “-10” could enter service before 2012.

New Technology
The most striking aspect of the aircraft’s technology is the use of new materials. Composites account for around 50% of the 787’s weight. Large parts of the aircraft are constructed from the material, including the wing and the entire fuselage. This radical approach has helped in delivering the aircraft’s performance, although Boeing concedes that meeting the weight targets is a constant challenge. The 787 is offered with General Electric GEnx and Rolls-Royce Trent bleedless engines, which are major factors in the aircraft’s economic efficiency.

Boeing’s original comparison with the A330-200 claimed a fuel-burn advantage of nearly 20% per available seat for the 787 and a 30-minute saving in trip times on “longer sectors.” Boeing says that the 787’s 20% fuel consumption advantage contributes to a 10% advantage in operating costs over the A330.

As always maintenance costs figure prominently in manufacturers’ claims of superiority. They are unfortunately often difficult to quantify. Boeing provides some support for its assertions in citing increased maintenance intervals for the 787 compared to the 767.

If Boeing can avoid the pitfalls that beset the A380 in its final pre-production phase, the future for the Dreamliner looks very rosy indeed.

<table>
<thead>
<tr>
<th>Leading 787 characteristics</th>
<th>-3</th>
<th>-8</th>
<th>-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical seating</td>
<td>290 - 330*</td>
<td>210 - 250**</td>
<td>250 - 290**</td>
</tr>
<tr>
<td>Typical range km</td>
<td>4,600 to 5,650</td>
<td>14,200 to 15,200</td>
<td>14,800 to 15,750</td>
</tr>
</tbody>
</table>

*two-class **three-class
Source Manufacturer
The end of the road looked likely for the 747 at one stage, but the aircraft now appears to have a future in the guise of the 747–8 BACK FROM THE BRINK

Lufthansa’s $5.5 billion order of 20 passenger versions of the 747–8 at the end of 2006 has assured the 747’s comeback. Although factory-built freighters sustained 747–400 production through a lean period for passenger aircraft orders in the late 1990s and early 2000s, the demise of the aircraft had been widely predicted. Not least because of the competition from the A380.

But speculation that Boeing was planning to completely cease production of the 747 was stopped at the end of 2005 when the manufacturer announced it was going ahead with the stretched and re-engined 747–8. The launch model for the –8 series is the freighter version, the first of which is due to enter service in the third quarter of 2009.

The –8 designation was chosen to symbolise the transfer of technologies from the 787.

But the key factor in allowing a formal launch, after a number of false starts, was the availability of new technology engines. Boeing says the new aircraft will offer 8% lower seat costs than the 747–400 and 6% lower seat costs than the A380. The latter claim is strenuously rebutted by Airbus.

Categorically speaking

Despite making these comparisons Boeing insists that the 747–8 is in a different market category to the A380, a view apparently shared by Lufthansa. The German carrier says it sees the aircraft fitting between its 300-seat A340–600s and the A380, the first of which it still expects to receive before the 747–8I. Lufthansa’s 747–8s will have about 100 seats less than its A380s. Nonetheless there is undoubtedly competition between the two types and Boeing has previously intimated that it believes the launch of the 747–8 will restrict sales of the A380 to below 500 over the next two decades. Boeing in any case believes the large aircraft is smaller than Airbus’ predictions. The US manufacturer suggests that there will only be a requirement for 990 new aircraft in what it calls the “747 and larger” category.

Although Boeing is keen to play down the role of the A380’s troubles in the 747’s resurgence, there is little doubt that Airbus’ problems have helped the case for the aircraft. Boeing says it is in discussion with several carriers about the new aircraft of which three or four are said to be “seriously interested”. Sales are respectable with 77 aircraft now on order with 8 or 9 customers. Lufthansa, however, is as yet the only customer for the passenger version.

Legally speaking

One cloud on the horizon is the certification process for the aircraft. Boeing is planning to certify the aircraft as a derivative of the existing 747, the so-called “grandfather” procedure. The 747–400 was itself approved as an amendment to the -100, which was launched in 1966. Boeing maintains that as many parts are not changing, this is entirely normal and the Federal Aviation Authority has given its blessing. Airbus claims that this procedure means the aircraft will not be required to meet all the latest safety standards, particularly with regard to structural integrity.

With Lufthansa as the launch customer, Boeing will have to convince the European Aviation Safety Agency (Easa) that its plans are acceptable. At the very least Easa is said to be insisting on a full evacuation demonstration. Whatever the outcome of this row, there is no doubt that airlines will have a genuine choice when selecting airliners in large aircraft category. That at least is a first.

The following table provides the Technical Characteristics of the 747–8:

<table>
<thead>
<tr>
<th>Technical Characteristics</th>
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<tbody>
<tr>
<td>Official List price</td>
<td>272.5–282.5</td>
</tr>
<tr>
<td>Entry into service</td>
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</tr>
<tr>
<td>Max seating (exit limit)</td>
<td>660</td>
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<tr>
<td>Typical seating</td>
<td>467</td>
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<tr>
<td>Typical range</td>
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<tr>
<td>MTOW</td>
<td>440 tonnes</td>
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<tr>
<td>OEW</td>
<td>212 tonnes</td>
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<tr>
<td>MZFW</td>
<td>288 tonnes</td>
</tr>
<tr>
<td>Fuel capacity</td>
<td>243,120 litres</td>
</tr>
<tr>
<td>Engines</td>
<td>GE90-2B67</td>
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<tr>
<td>Thrust</td>
<td>298 kn (67,000 lbs)</td>
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<tr>
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<td>36,750 kg</td>
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<td>74,870 kg</td>
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<td>271 minutes</td>
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<tr>
<td>Block time 4,000 nm</td>
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<tr>
<td>Engine Options</td>
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<tr>
<td>Delivered in last 12 months</td>
<td>N/A</td>
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<tr>
<td>Parked aircraft</td>
<td>N/A</td>
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</tbody>
</table>
The launch of the A350 XWB at the end of 2006 gives Airbus a genuine competitor to Boeing’s 787.

AIRBUS’S ARSENAL

It was a tortuous route, but Airbus gave the A350 its industrial launch at the end of 2006. Having first insisted that its existing A330 was competitive with the 787 and then proposed the modest improvements to the original A350, Airbus is now committed to a major new development and is dubbing its latest incarnation the XWB (extra wide body).

In addition to a new cross-section, the A350XWB includes a wing with an increased sweep of 33 degrees. These two key changes leave no doubt that this is a completely new aircraft, whose development costs are reported to be around €10 billion.

Extended family
The intention is to form a family of three basic variants with typical capacities between 250 and 375 passengers (see table). These will be augmented by an ultra long-range version, the -900R, and by a freighter, the -900F, at a later date. All basic variants will be designed to have a range of 8,500 nm, which Airbus says will be the longest of any aircraft in its class. This size spectrum means the A350 XWB will take on some 777 models as well as the 787 family. Airbus says the XWB will have the highest content of new and advanced materials of any commercial aircraft that, it claims, will result in the lightest aircraft per seat in the size category. This is a crucial factor in lowering operating costs and, as always, is a source of claim and counter claim by Airbus and Boeing.

Airbus says that the benefits of the new technology will combine to give the baseline A350-800 an 8% advantage in cash operating cost per seat over the 787-8. This is, however, in part due to its higher seat count. A more direct comparison is arguably between the A350-800 and the 787-9, not least because the aircraft have similar ranges.

Airbus places a lot of emphasis on the A350’s new cabin that, in addition to the claimed extra seat width and headroom, will offer a lot of flexibility. A modular design should enable airlines to reconfigure the interior overnight, allowing them to adapt capacity to meet market demands.

The industrial launch provided a more detailed specification than was show at the original unveiling at the Farnborough Airshow in 2006, but there are still some unanswered questions. Not least of these is whether there will be a second engine supplier in addition to Rolls–Royce. A new generation of engines is integral to the design. Airbus says the new engines will offer a two percent improvement in specific fuel consumption compared to the original A350 design.

Delays in a full launch of the programme have led to target entry into-service dates being pushed back. The -900 is not expected to go into operation before the middle of 2013. The -800 is expected to be 12 months behind, with the -1000 targeted for 2015. If Airbus can meet its targets it will put pressure on the 787. In particular Boeing is said to be looking at improved payload-range capability for the 787-10.

The A350’s orderbook is still well behind that of the 787. The Acas database indicates that 102 aircraft are on order from 12 customers. Airbus will be hoping that with the new momentum in the programme orders will start to pick up. Airbus forecasts a demand for “small twin-aisle aircraft” of 3,750, so there is plenty of room for improvement.
The A380’s well-publicised problems have damaged Airbus. The aircraft must fulfill its promises to get the manufacturer back on track.

**ON THE LARGE SIDE**

Airbus’ goals for the A380 are lofty. “The A380 will carry more passengers over longer distances, allowing for projected passenger growth worldwide and helping to ease an increasingly congested environment. It will achieve this without increasing the number of air traffic movements and without negatively impacting the environment, thanks to significantly reduced noise and emissions levels.” They may achieve these aims, but getting there is proving very difficult.

The baseline version of the aircraft is the A380-800, which typically seats 555 passengers in a three-class layout. Other models, which have been presented by Airbus, include a longer-range version the -800R and a stretched -900 model. The stretched version would typically seat 650 passengers. There is also a shrinked -700 in the plans that would accommodate 465 seats in the three-class layout. A choice of engine is offered between the Engine Alliance GP7200 and the Rolls-Royce Trent 900.

Despite receiving joint European Aviation Safety Agency (Easa) and Federal Aviation Administration (FAA) Type Certification in December 2006, the image of the A380 has been tarnished by a series of delays. Entry into service has slipped by about 18 months from the original plan. Launch operator Singapore Airlines is now scheduled to receive the aircraft in October 2007. The freighter version of the aircraft is in limbo following UPS’ cancellation of its order. Delays to deliveries of initial GP7270-powered aircraft were set to be close to two years, but there are some signs that this has been recovered to some extent. Emirates, which is scheduled to be the first airline to receive the Engine Alliance powerplant, is hopeful that its aircraft will be ready early next year. The delays had put back the carrier’s target for entry into service to November 2008. However, the Dubai-based carrier plans to stick with the November date and use the extra time to ensure a “good level of maturity at entry into service”. There are also some signs that this has been re-covered to some extent. Emirates, which is scheduled to be the first airline to receive the Engine Alliance powerplant, is hopeful that its aircraft will be ready early next year. The delays had put back the carrier’s target for entry into service to November 2008. However, the Dubai-based carrier plans to stick with the November date and use the extra time to ensure a “good level of maturity at entry into service”. There are also some signs that this has been re-covered to some extent. Emirates, which is scheduled to be the first airline to receive the Engine Alliance powerplant, is hopeful that its aircraft will be ready early next year. The delays had put back the carrier’s target for entry into service to November 2008. However, the Dubai-based carrier plans to stick with the November date and use the extra time to ensure a “good level of maturity at entry into service”. There are also some signs that this has been re-covered to some extent. Emirates, which is scheduled to be the first airline to receive the Engine Alliance powerplant, is hopeful that its aircraft will be ready early next year. The delays had put back the carrier’s target for entry into service to November 2008. However, the Dubai-based carrier plans to stick with the November date and use the extra time to ensure a “good level of maturity at entry into service”. There are also some signs that this has been re-covered to some extent. Emirates, which is scheduled to be the first airline to receive the Engine Alliance powerplant, is hopeful that its aircraft will be ready early next year. The delays had put back the carrier’s target for entry into service to November 2008. However, the Dubai-based carrier plans to stick with the November date and use the extra time to ensure a “good level of maturity at entry into service”. There are also some signs that this has been re-covered to some extent.

From the outset, Airbus’ goal for the A380 programme has been to offer double-digit improvements in fuel burn and operating costs when compared to current 747s (The advantage is certainly eroded by the 747-8, although by how much is a matter of heated debate.)

### Current A380 orders

<table>
<thead>
<tr>
<th>Customs</th>
<th>No. on order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air France</td>
<td>10</td>
</tr>
<tr>
<td>China Southern Airlines</td>
<td>5</td>
</tr>
<tr>
<td>Emirates</td>
<td>43</td>
</tr>
<tr>
<td>Etihad Airways</td>
<td>4</td>
</tr>
<tr>
<td>ILFC</td>
<td>10</td>
</tr>
<tr>
<td>Kingfisher Airlines</td>
<td>5</td>
</tr>
<tr>
<td>Korean Air</td>
<td>5</td>
</tr>
<tr>
<td>Lufthansa</td>
<td>15</td>
</tr>
<tr>
<td>Malaysia Airlines</td>
<td>6</td>
</tr>
<tr>
<td>Quantas</td>
<td>10</td>
</tr>
<tr>
<td>Qatar Airways</td>
<td>2</td>
</tr>
<tr>
<td>Singapore Airlines</td>
<td>19</td>
</tr>
<tr>
<td>Thai Airways International</td>
<td>6</td>
</tr>
<tr>
<td>Virgin Atlantic Airways</td>
<td>6</td>
</tr>
</tbody>
</table>

### Technical characteristics

<table>
<thead>
<tr>
<th>List price ($ millions)</th>
<th>295 - 316</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical seating</td>
<td>555 (three class)</td>
</tr>
<tr>
<td>Typical range</td>
<td>8,300 nm</td>
</tr>
<tr>
<td>MTOW</td>
<td>560 tonnes</td>
</tr>
<tr>
<td>OEW</td>
<td>276.8 tonnes</td>
</tr>
<tr>
<td>MZFW</td>
<td>361 tonnes</td>
</tr>
<tr>
<td>Fuel capacity</td>
<td>310,000 litres</td>
</tr>
<tr>
<td>Engines</td>
<td>GP 7270/Trent 970</td>
</tr>
<tr>
<td>Thrust</td>
<td>70,000 lbs</td>
</tr>
</tbody>
</table>

[www.airfinancejournal.com](http://www.airfinancejournal.com)
Despite their success, the Boeing 737 and A320 families will have to be replaced with more advanced aircraft. But when will this happen?

**ADVANCING AVIATION**

By 2025 the world’s major airlines will need 19,818 single-aisle passenger aircraft to accommodate traffic growth and renew their fleets. This estimate comes from Airbus, which says that 4,488 of those aircraft will be recycled back into the fleet, necessitating a requirement for 15,330 new deliveries. Boeing’s view is that single aisle aircraft will constitute 61% of all aircraft deliveries (which represents 41% by value). This implies 16,598 new single-aisle aircraft will be required.

Not all of these new deliveries will be of the current generation of aircraft. While officially downplaying the prospects for next-generation replacements for the A320 and 737, Airbus and Boeing are increasingly engaged in the early study stages of their respective proposals.

**Airbus**

The European manufacturer is believed to have been targeting a provisional service-entry date of 2012/13. The Airbus A320 replacement study is referred to...
SINGLE AISLE AIRCRAFT

Tests of the GTF are aimed at positioning P&W for the launch of a full-scale development programme in late 2008

as the NSR, or New Short Range aircraft. Design concepts for the European manufacturer’s new aircraft reportedly revolve around an all-composite primary structure, more-electric systems, advanced aerodynamics and integrated avionics with provision for enhanced vision systems (EVS).

Airbus is believed to working on fine tuning improvements in fuel burn, emissions, noise and operating costs. The next stage in Airbus’ study is expected to examine industrial implications and to include airline advisory input.

Results from the Airbus study are reported to show that the inclusion of all the viable new technologies for a 2012 entry into service would provide benefits of 9-10% over the current A320/737NG models. Given the estimated $7 billion development costs for a replacement aircraft, there is considerable doubt that this is sufficient to justify launching a new aircraft in the envisaged timescale.

Boeing

The Boeing concept is said to be based on an all-composite 787-like structure with fly-by-wire, more-electric system architecture, integrated avionics flight deck, and a cabin cross-section “wider than the A320”. Aerodynamic improvements are said to include a longer span wing, single-slotted flaps, raked and blended-winglet wingtip options, blended fin root and 787-like nose.

Boeing calls its 737 successor study the 737RS, or Replacement Study. Earlier work on the so-called Yellowstone 1(Y1) is now understood to represent just one of several possible replacement concepts. Y1 is one of the three new-generation studies that emerged from the broad-based “Project 20XX” advanced technologies initiative that was behind the Sonic Cruiser and subsequently the 787. Y1 is thought to cover the 100- to 200-passenger range; Y2, which became the 787, covers the 200- to 350-seat range; and Y3 covers the range for what could eventually become a successor to the 777-300/300ER in the next decade.

Boeing is said to have accelerated the pace of the

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SINGLE AISLE AIRCRAFT

737RS study effort and planned to make its initial pass on prospective supplier teams during 2006, although it is not clear that this happened. Initial results from both Airbus and Boeing studies have, apparently, been less than stellar. Acting completely independently, the two studies have come up with similar results for their individual concepts, which fall far short of the ideal targets set for the 2012 timeframe airliner.

Alan Mulally, when he was still chief executive of Boeing Commercial Airplanes, said that Boeing could have a 737 replacement in service as early as 2012, which would imply a development-program launch in 2008 or 2009. “It’s a nice match with the 787 going into service,” he was quoted as saying. With such an early move, Boeing have pressed home its current advantage and push for dominance in the narrow-body market by launching the 737 replacement program while Airbus struggles to get the A350 ready.

Boeing has suggested the new jet program must provide technological advances that will make the 737 obsolete. Such advances will come from a new engine and from the next generation of Boeing composites technology, incorporating the lessons learned from initial 787 manufacturing, he said.

It is believed that both companies have concluded that the operating cost savings that would be derived from these technologies alone are insufficient to justify the launch of an A320/737 replacement. Both Boeing and Airbus will need an all-new engine, which the engine manufacturers say will not be ready until 2013-14, so the possible entry into service of such an aircraft could be possible around the middle of the next decade.

While this would, on the face of it, dent the hopes of anyone hoping to see a new generation in the near term, mid-term market pressure could still force the issue. There are some operators such as Southwest Airlines that have openly called for the start of work on a new aircraft to counter the rising cost of fuel, even if the improvement is “only” around 10% better than today’s aircraft.

New engines

Engines remain the key, as acknowledged by Boeing Commercial Airplanes President and CEO Scott Carson, who has been quoted as saying: “right now, there is no suitable engine. To build a 737 replacement without a next-generation engine would be a dreadful mistake for us to make.” Airbus’ view appears to be similar. In February 2006, the then Airbus chief executive Gustav Humbert said there were no imminent plans to create a new single-aisle aircraft to succeed the A320 family, with timing being dictated by market demand and the emergence of new engine technology.

With this in mind, Pratt & Whitney is trying to position itself to avoid CFM International repeating its dominance of the single aisle market, which it has achieved with its combined presence on the A320 and 737NG families. The US engine manufacturer has started assembly of its geared turbofan (GTF) demonstrator that is scheduled to begin ground tests in November. The GTF is expected to fly on the company’s 747 testbed around the middle of 2008. The programme is being referred to as the PW9000 and forms the basis for a range of new engines with thrust categories between 10,000 and 30,000lbs, which would include the new Airbus and Boeing single aisle aircraft.

Tests of the GTF are aimed at positioning P&W for the launch of a full-scale development programme in late 2008 with entry into service possible as early as 2012, which is ahead of the dates implied by Airbus and Boeing. This discrepancy is not seen as a problem by P&W’s president, Steve Finger. He suggests that nobody knows exactly when the new single aircraft will enter service and adds that P&W’s task is to make sure that it is prepared when the market is ready.

Together the delays and uncertainties including as yet the lack of a suitable new engine means that with current options and orders at least another 4,000 aircraft of the current generation will have been delivered by the time the new aircraft arrives, so there is a lot of life left in the current single aisle market for the existing models.
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By developing a single engine type to equip an entire fleet, PowerJet offers growing families the opportunity to achieve substantial economies of scale. And the flexibility to think big from the start.

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Assumptions for Aircraft Data pages

Seating/range
The numbers quoted for seating capacity are based on the manufacturers’ selling standard. Wide variations are possible, particularly for widebody aircraft.

The range shown is for still-air based on the “typical seating” figure and is intended to reflect typical airline capability. As such our figure is usually lower than that quoted by the respective manufacturer.

Technical Characteristics
The Maximum Take-off Weight (MTOW) shows the minimum and maximum options available for the type in question. There may be intermediate weights available.

The Operating Empty Weight (OEW) is based on the manufacturers’ figures. Airline weights are likely to be higher than those quoted.

Fuels and Times
The figures shown are our estimates based on zero winds and optimum flight levels.

Indicative Maintenance Costs
The C-check and heavy check reserves are based on typical check costs and intervals. No allowance is made for cabin refurbishment. The cost quoted for component overhaul excludes inventory support.

Future values
Are calculated in accordance with Istat rules.
Source: MachTwo.

Disclaimer:
There is no way of mapping Boeing/Airbus maintenance numbers to the reserve numbers published, unless the rules used and what is in each category is known. (For example trip segment time, labor rates, how much is outsourced vs. insourced, and what specific components are included in each category)
You can be confident that your GP7200 engines will be ready to perform when you need them. The Engine Alliance GP7200 is undergoing a rigorous testing and maturity program in the air and on the ground. Because reliability is a requirement for your A380. So is maintainability. That’s why we’ve used customer input over the past four years to fine-tune designs and procedures for easier accessibility of key components. You can count on the Engine Alliance as you count every on-time departure. We’re ready for take-off when you are. www.enginealliance.com
SHRT ON SALES

Our verdict: The A318 does nothing to contradict the received wisdom that “shrunk” aircraft are rarely successful.

How much?
Official list price ($ millions) 50 - 55

Can we get a discount?
Despite the A318’s slow sales, the success of the rest of the A320 family means Airbus are not desperate for sales.

The opposition
Competes with the 737-600 and with the larger Embraer E-jets.

History
Entry into service July 2003

Seating/range
Max seating 132
Typical seating 107 (8+99)
Typical range 1,350/2,925 nm

Technical characteristics
MTOW 59/68 tonnes
OEW 39 tonnes
MZFW 53 tonnes
Fuel capacity 23,860 litres
Engines CFM 56/PW6000
Thrust 96 – 106 kn (22-24,000 lbs)

Fuels and times
Block fuel 200Nm 1,660 kg
Block fuel 500nm 3,050 kg
Block fuel 1000 Nm 5,470 kg
Block time 200Nm 54 minutes
Block time 500Nm 94 minutes
Block time 1000Nm 160 minutes

Engine options (% current fleet)
CFM56-5B (100%)
PW6000 (<1%)

Fleet
Net orders: 100
Delivered 40
Delivered in last 12 months 10
Parked aircraft 0
Operators 6
Proportion of fleet on operating lease 31%

Source Acas May 2007
PART OF THE FAMILY

Our verdict: A hugely successful member of the A320 family. It remains a popular choice and many more will be ordered and delivered before the next generation of single aisle aircraft arrive.

How much?
Official list price ($ millions) 57 - 70

Can we get a discount?
This is one of Airbus’ best-sellers and discounts are hard to come by unless you are buying large numbers. It probably helps to buy a couple of A380s at the same time.

The opposition
The 737-700 is a tough competitor, but that’s about it.

History
Entry into service April 1996

Seating/range
Max seating 160
Typical seating 124 (8+116)
Typical range 1,620/3,330 nm

Technical characteristics
MTOW 64/76 tonnes
OEW 40 tonnes
MZFW 58 tonnes
Fuel capacity 23,860/29,840 litres
Engines CFM 56/V2500
Thrust 98 – 120 kn (22-27,000 lbs)

Fuels and times
Block fuel 200Nm 1,710 kg
Block fuel 500nm 3,140 kg
Block fuel 1000 Nm 5,620 kg
Block time 200Nm 54 minutes
Block time 500Nm 94 minutes
Block time 1000Nm 160 minutes

Engine options (% current fleet)
CFM 56-5A (15%)
CFM 56-5B (52%)
V2522-A5 (13%)
V2524-A5 (18%)
V2527M-A5 (2%)

Fleet
Net orders: 1,533
Delivered 969
Delivered in last 12 months 115
Parked aircraft 11
Operators 99
Proportion of fleet on operating lease 43%
Source Acas May 2007

Maintenance
C-check reserve $48 per flight-hour
Heavy check reserve $44 per flight-hour
Engine overhaul reserve $96 per engine flight hour
Engine LLP reserve $67 per engine cycle
Landing gear refurbishment $24 per cycle
Wheels brakes and tyres $86 per cycle
APU $51 per APU cycle
Component overhaul $145 per flight hour

Modifications/retrofits
The addition of a pair of over-wing exits increases the maximum passenger capability to 156.

Future values

Airbus A319-100
CFM56-5B6/P/V2522-A5 Engines

Source Acas May 2007
**AIRCRAFT GUIDE A320-200**

## HEAD OF THE FAMILY

Our verdict: The aircraft that transformed Airbus’ fortunes. It continues to sell well and has proved resilient even during Airbus’ current troubles.

### How much?

**Official list price ($ millions)**  57 - 70

### Can we get a discount?

EasyJet might like to think so, but you need a lot of leverage. If your A380s are late you might have some room for negotiation.

### The opposition

The A320 sits between the 737-700 and -800. It has better seat-mile costs than one and better trip costs than the other.

### History

**Entry into service**  March 1988

### Seating/range

**Max seating**  180

**Typical seating**  150 (12+138)

**Typical range**  2,340/2,700 nm

### Technical characteristics

**MTOW**  74/77 tonnes

**OEW**  42 tonnes

**MZFW**  61 tonnes

**Fuel capacity**  23,860/29,840 litres

**Engines**  **CFM56/V2500**

**Thrust**  111 – 120 kn (24-27,000 lbs)

### Fuels and times

**Block fuel 200Nm**  1,850 kg

**Block fuel 500nm**  3,390 kg

**Block fuel 1000 Nm**  6,080 kg

**Block time 200Nm**  54 minutes

**Block time 500Nm**  94 minutes

**Block time 1000Nm**  160 minutes

### Engine options (% current fleet)

- **CFM56-5A** (15%)
- **CFM56-5B** (52%)
- **V2522-A5** (13%)
- **V2524-A5** (18%)
- **V2527M-A5** (2%)

### Fleet

- **Net orders:**  2,795
- **Delivered:**  1,698
- **Delivered in last 12 months:**  164
- **Parked aircraft:**  23
- **Operators:**  156
- **Proportion of fleet on operating lease:**  43%

Source Acas May 2007

### Maintenance

- **C-check reserve**  $51 per flight-hour
- **Heavy check reserve**  $47 per flight-hour
- **Engine overhaul reserve**  $106 per engine flight hour
- **Engine LLP reserve**  $73 per engine cycle
- **Landing gear refurbishment**  $24 per cycle
- **Wheels brakes and tyres**  $86 per cycle
- **APU**  $51 per APU cycle
- **Component overhaul**  $145 per flight hour

### Modifications/retrofits

In October 2006 EADS signed an agreement with Russian aircraft manufacturer Irkut to perform a passenger to freighter (P2F) conversion of the A320 family. Starting in 2010, it is planned to convert an average of 30 A320s/A321s per year with production split between Germany and Russia.

### Future values

![Airbus A320-200 Future Values](https://example.com/future_values_graph.png)

<table>
<thead>
<tr>
<th>Year</th>
<th>Future Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>US$ Mn</td>
</tr>
<tr>
<td>2008</td>
<td>US$ Mn</td>
</tr>
<tr>
<td>2009</td>
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<tr>
<td>2021</td>
<td>US$ Mn</td>
</tr>
<tr>
<td>2022</td>
<td>US$ Mn</td>
</tr>
</tbody>
</table>

Source: Acas May 2007
OUT ON ITS OWN

Our verdict: The A321 has dominated the top end of the single aisle market and the end of 757 production has strengthened its position

### How much?

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost ($ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>List price</td>
<td>64 - 70</td>
</tr>
</tbody>
</table>

### Can we get a discount?

The lack of direct competition makes it unlikely, although the 737-900ER might help your case.

### The opposition

The A321 has seen off the 757 and the 737-900. The 737-900ER might prove more competitive.

### History

<table>
<thead>
<tr>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry into service</td>
<td>January 1994</td>
</tr>
</tbody>
</table>

### Seating/range

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Max seating</td>
<td>220</td>
</tr>
<tr>
<td>Typical seating</td>
<td>185 (16+169)</td>
</tr>
<tr>
<td>Typical range</td>
<td>2,070/2,700 nm</td>
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</tbody>
</table>

### Technical characteristics

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTOW</td>
<td>83/93.5 tonnes</td>
</tr>
<tr>
<td>OEW</td>
<td>48 tonnes</td>
</tr>
<tr>
<td>MZFW</td>
<td>71.5 tonnes</td>
</tr>
<tr>
<td>Fuel capacity</td>
<td>23,700/29,5000 litres</td>
</tr>
<tr>
<td>Engines</td>
<td>CFM56/V2500</td>
</tr>
<tr>
<td>Thrust</td>
<td>133 – 148 kn (27-33,000 lbs)</td>
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### Fuels and times

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Block fuel 200Nm</td>
<td>2,310 kg</td>
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<tr>
<td>Block fuel 500nm</td>
<td>4,230 kg</td>
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<td>Block fuel 1000 Nm</td>
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<tr>
<td>Block time 200Nm</td>
<td>54 minutes</td>
</tr>
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<td>Block time 500Nm</td>
<td>94 minutes</td>
</tr>
<tr>
<td>Block time 1000Nm</td>
<td>160 minutes</td>
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</table>

### Engine options (% current fleet)

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFM 56-5B (49%)</td>
<td></td>
</tr>
<tr>
<td>V2530-A5 (14%)</td>
<td></td>
</tr>
<tr>
<td>V2533-A5 (37%)</td>
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</tr>
</tbody>
</table>

### Fleet

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
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<td>Net orders</td>
<td>652</td>
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<td>Delivered</td>
<td>385</td>
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<td>Delivered in last 12 months</td>
<td>33</td>
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<td>Parked aircraft</td>
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<td>Operators</td>
<td>62</td>
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<tr>
<td>Proportion of fleet on operating lease</td>
<td>47%</td>
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Source: Acas May 2007

## Maintenance

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<th>Description</th>
<th>Cost</th>
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<tr>
<td>C-check reserve</td>
<td>$55 per flight-hour</td>
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<td>Heavy check reserve</td>
<td>$50 per flight-hour</td>
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<td>Engine overhaul reserve</td>
<td>$116 per engine flight hour</td>
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<td>Engine LLP reserve</td>
<td>$81 per engine cycle</td>
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<td>Landing gear refurbishment</td>
<td>$24 per cycle</td>
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<td>Wheels brakes and tyres</td>
<td>$86 per cycle</td>
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<tr>
<td>APU</td>
<td>$51 per APU cycle</td>
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<tr>
<td>Component overhaul</td>
<td>$145 per flight hour</td>
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</table>

## Modifications/retrofits

In October 2006 EADS signed an agreement with Russian aircraft manufacturer Irkut to perform a passenger to freighter (P2F) conversion of the A320 family. Starting in 2010, it is planned to convert an average of 30 A320s/A321s per year with production split between Germany and Russia.

### Future values

![Airbus A321-200 Future Values Graph](image)
NEW AIRCRAFT DATA: 737-600

RUNT OF THE LITTER

Our verdict: The 737-600 has the inefficiencies of a shrunk aircraft and is the least successful of the Next Generation Family. Competition from the larger members of the Embraer E-Jet family is a further threat.

How much?
List price ($ millions) 47 – 55

Can we get a discount?
More likely than for other models in the family

The opposition
Competes with the A318 and with the larger Embraer E-jets.

History
Entry into service October 1998

Seating/range
Max seating 132 @30in
Typical seating 110 @36/32
Typical range 3,150 nm

Technical characteristics
MTOW 56.2/66.0 tonnes
OEW 37.3 tonnes
MZFW 51.5/51.7 tonnes
Fuel capacity 26,020 litres
Engines CFM56
Thrust (BET*) 82 – 98 kn
*BET: Boeing Equivalent Thrust (18,400-22,000 lbs)

Fuels and times
Block fuel 200Nm 1,632 kg
Block fuel 500nm 2,928 kg
Block fuel 1000 Nm 5,138 kg
Block time 200Nm 53 minutes
Block time 500Nm 93 minutes
Block time 1000Nm 160 minutes

Engine options
CFM56-7B-20 (81.2%)
CFM56-7B-22 (18.8%)

Fleet
Net orders: 69
Delivered 69
Delivered in last 12 months 6
Parkerd aircraft none
Operators 8
Proportion of fleet on operating lease 45%

Source Acas May 2007

Indicative Maintenance Costs
C-check reserve $45 per flight hour
Heavy check reserve $40 per flight hour
Engine overhaul $92 per engine flight hour
Engine LLP $64 per engine cycle
Landing gear refurbishment $30 per cycle
Wheels brakes and tyres $47 per cycle
APU $54 per APU cycle
Component overhaul $145 per flight hour

Modifications/retrofits
There is little development work for this member of the family, reflecting its relative unpopularity compared to the rest of the 737 Next Generation family.

Future values

Source: Acas May 2007
Low-Cost Legend

Our verdict: The downturn has demonstrated the strength of this aircraft. Lessors and low cost carriers love it. Its popularity makes it hard to get hold of. Few slots are available until 2009

How much?
Official list price ($ millions) 54–64

Can we get a discount?
Not much. You are competing with hundreds of airlines worldwide

The opposition
Competes directly with the A319

History
Entry into service January 1998

Seating/range
Max seating 149@30in
Typical seating 126@36/32
Typical range 3,380 nm

Technical characteristics
MTOW 60.3/70.1 tonnes
OEW 38.4 tonnes
MZFW 54.7/55.2 tonnes
Fuel capacity 26,020 litres
Engines CFM56
Thrust (BET) 88-116 (19,700-26,100)*
*BET: Boeing Equivalent Thrust

Fuels and times
Block fuel 200Nm 1,659 kg
Block fuel 500nm 2,977 kg
Block fuel 1000 Nm 5,213 kg
Block time 200Nm 54 minutes
Block time 500Nm 94 minutes
Block time 1000Nm 161 minutes

Engine options (current fleet)
CFM 56-7B-20 (13.7%)
CFM 56-7B-22 (22.6%)
CFM 56-7B-24 (61.1%)
CFM 56-7B-26 (2.6%)

Fleet
Net orders: 1,354
Delivered 838
Delivered in last 12 months 96
Parked aircraft 7
Operators 52
Proportion of fleet on operating lease 40%

Indicative Maintenance Costs
C-check $47 per flight hour
Heavy check $42 per flight hour
Engine overhaul $96 per engine flight hour
Engine LLP $67 per engine cycle
Landing gear refurbishment $31 per cycle
Wheels brakes and tyres $48 per cycle
APU $54 per APU cycle
Component overhaul $145 per flight hour

Modifications/retrofits
Aviation partners produces blended winglets, which are available as an option. The cost is in the region of $650,000, but the fuel savings offset this and most buyers opt for the option. There is no factory-built freighter version and no conversion programme.

Future values

Source Acas May 2007
New aircraft data: 737-800

BIGGER BROTHER

Our verdict: This is arguably the optimum aircraft in the 737NG family with excellent cash operating costs.

How much?
Official list price ($ millions) 66–75

Can we get a discount?
The aircraft’s economics justify a high price and Boeing knows it.

The opposition
The most direct competitor is the A320 but the larger A321 offers better seat-mile costs.

History
Entry into service April 1998

Seating/range
Max seating 189 @30in
Typical seating 162 @36/32
Typical range 3,065 nm

Technical characteristics
MTOW 70.5/79.0 tonnes
OEW 41.7 tonnes
MZFW 61.7/62.7 tonnes
Fuel capacity 26,020 litres
Engines CFM56
Thrust (BET) 105 – 126kn*
*BET: Boeing Equivalent Thrust (23,700-28,400 lbs)

Fuels and times
Block fuel 200Nm 1,814 kg
Block fuel 500nm 3,319 kg
Block fuel 1000 Nm 5,860 kg
Block time 200Nm 54 minutes
Block time 500Nm 94 minutes
Block time 1000Nm 160 minutes

Engine options (current fleet)
CFM56-7B-24 (19.0%)
CFM56-7B-26 (56.2%)
CFM56-7B-27 (24.8%)

Fleet
Net orders: 2,190
Delivered 1,185
Delivered in last 12 months 177
Parked aircraft 4
Operators 104
Proportion of fleet on operating lease 50%

Source Acas May 2007

Indicative Maintenance Costs
C-check reserve $51 per flight hour
Heavy check reserve $45 per flight hour
Engine overhaul $104 per engine flight hour
Engine LLP $72 per engine cycle
Landing gear refurbishment $31 per cycle
Wheels brakes and tyres $48 per cycle
APU $54 per AP U cycle
Component overhaul $145 per flight hour

Modifications/retrofits
Aviation partners produces blended winglets, which are available as an option. The cost is in the region of $650,000, but the fuel savings offset this and most buyers opt for the option.

Future values

 Boeing 737-800
CFM56-7B26 Engines

Source Acas May 2007

www.airfinancejournal.com
**SAME SIZE BUT LARGER**

**Our verdict:** With the same maximum passenger capacity as the -800, the 737-900 has failed to dent the A321 market. Whether the ER version will change that remains to be seen.

**How much?**
- Official list price ($ millions): 67–77

**Can we get a discount?**
- More likely than for the rest of the 737 family

**The opposition**
- The 737-900 was meant to challenge the A321, but the (emergency-exit) limit on maximum passenger capacity has thwarted this plan.

**History**
- **Entry into service:** May 2001

**Seating/range**
- Max seating: 189@30in
- Typical seating: 162@36/32
- Typical range: 2,745 nm

**Technical characteristics**
- **MTOW:** 74.6/79.2 tonnes
- **OEW:** 43.0 tonnes
- **MZFW:** 62.7/63.6 tonnes
- **Fuel capacity:** 26,020 litres
- **Engines:** CFM56
- **Thrust (BET):** 108 – 121kn
  *BET: Boeing Equivalent Thrust (24,200-27,300 lbs)

**Fuels and times**
- **Block fuel 200Nm:** 1,911 kg
- **Block fuel 500Nm:** 3,567 kg
- **Block fuel 1000 Nm:** 6,385 kg
- **Block time 200Nm:** 54 minutes
- **Block time 500Nm:** 94 minutes
- **Block time 1000Nm:** 160 minutes

**Engine options (current fleet)**
- CFM 56-7B-24 (23.1%)
- CFM 56-7B-26 (76.9%)
- CFM 56-7B-27 (0.0%)

**Fleet**
- **Net orders:** 156 (inc. ER)
- **Delivered:** 53
- **Delivered in last 12 months:** 2
- **Parked aircraft:** 0
- **Operators:** 8
- **Proportion of fleet on operating lease:** 15%

**Indicative Maintenance Costs**
- **C-check reserve:** $53 per flight hour
- **Heavy check reserve:** $46 per flight hour
- **Engine overhaul:** $104 per engine flight hour
- **Engine LLP:** $72 per engine cycle
- **Landing gear refurbishment:** $31 per cycle
- **Wheels brakes and tyres:** $50 per cycle
- **APU:** $54 per APU cycle
- **Component overhaul:** $145 per flight hour

**Modifications/retrofits**
- The option for this aircraft is effectively the ER version

**Future values**
- Boeing 737-900
- CFM56-7B26 Engines

Source: Acas May 2007
WHO NEEDS AN A350

Our verdict: Despite all eyes being focussed on the 787 and A350, the A330-200 is a good aircraft, if you don’t need the range of the more fashionable models.

How much?
Official list price ($ millions) 160 - 169

Can we get a discount?
The 787 and A350 looming on the horizon might suggest that there is room for negotiation.

The opposition
The closest competitor is the 767-400ER, but with the Boeing aircraft effectively out of production there is little direct competition. The 787 will offer a lot more range, with a price to match, and in any case there is a bit of a queue for them.

History
Entry into service April 1998

Seating/range
Max seating 380
Typical seating 253 (12+36+205)
Typical range 5,810/6,080 nm

Technical characteristics
MTOW 230/233 tonnes
OEW 121 tonnes
MZFW 168/170 tonnes
Fuel capacity 139,100 litres
Engines CF6-80/PW4000/Trent 700
Thrust 303 – 320 kn (68-72,000 lbs)

Fuels and times
Block fuel 1,000 Nm 12,720 kg
Block fuel 2,000 Nm 23,710 kg
Block fuel 4,000 Nm 45,680 kg
Block time 1,000 Nm 184 minutes
Block time 2,000 Nm 299 minutes
Block time 4,000 Nm 529 minutes

Engine options (% current fleet)
CF6-80E (34%)
PW4168 (24%)
Trent 772B (39%)
Trent 772C (3%)

Fleet
Net orders 414
Delivered 256
Delivered in last 12 months 34
Parked aircraft 4
Operators 49
Proportion of fleet on operating lease 45%

Source Acas May 2007

Maintenance
C-check reserve $55 per flight-hour
Heavy check reserve $100 per flight-hour
Engine overhaul reserve $206 per engine flight hour
Engine LLP reserve $169 per engine cycle
Landing gear refurbishment $105 per cycle
Wheels brakes and tyres $255 per cycle
APU $73 per APU cycle
Component overhaul $285 per flight hour

Modifications/retrofits
There is some talk of a freighter version

Future values

Airbus A330-200
CF680E1A4/PW4168A/Trent 772B

US$ Mn

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ENOUGH RANGE FOR THE SHORT TERM

Our verdict: The A330-300 offers a good stop-gap before the 787 and A350XWB enter the market.

How much?
Official list price ($ millions) 178 - 188

Can we get a discount?
The aircraft will need to be sold at a discount to offset the cash cost advantage of the 787, but Boeing’s Dreamliner is still a long way off.

The opposition
The closest competitor is the 767-300ER. The 787 will offer a lot more range, with a price to match, and in any case there is a bit of a queue for them.

History
Entry into service December 1993

Seating/range
Max seating 440
Typical seating 295 (12+42+241)
Typical range 5,040 nm

Technical characteristics
MTOW 230/233 tonnes
OEW 121 tonnes
MZFW 173/174.9 tonnes
Fuel capacity 97,530 litres
Engines CF6-80/PW4000/Trent 700
Thrust 303 – 320kn (68-72,000 lbs)

Fuels and times
Block fuel 1,000 Nm 13,120 kg
Block fuel 2,000 Nm 24,460 kg
Block fuel 4,000 Nm 47,120 kg
Block time 1,000 Nm 184 minutes
Block time 2,000 Nm 299 minutes
Block time 4,000 Nm 529 minutes

Engine options (% current fleet)
CF6-80E (23%)
PW4164 (4%)
PW4168 (33%)
Trent 768 (2%)
Trent 772 (38%)

Fleet
Net orders: 282
Delivered 213
Delivered in last 12 months 24
Parked aircraft 4
Operators 28
Proportion of fleet on operating lease 31%
Source Acas May 2007

Future values

Maintenance
C-check reserve $63 per flight-hour
Heavy check reserve $107 per flight-hour
Engine overhaul reserve $206 per engine flight hour
Engine LLP reserve $169 per engine cycle
Landing gear refurbishment $105 per cycle
Wheels brakes and tyres $255 per cycle
APU $73 per APU cycle
Component overhaul $285 per flight hour

Comments
Unlike the -200, there are no current plans for a freighter version.
FOUR THE LONG HAUL

Our verdict: The A340-300 enjoyed some early success, but despite sound technical arguments for four engines on a long-haul aircraft, it has lost out to the twin-engined 777 family. The launch of the A350 hardly enhances its prospects.

How much?
Official list price ($ millions) 193 - 199

Can we get a discount?
Probably but perhaps not enough to stop you opting for an A350 or 787

The opposition
There are lot of competitors, many of which are also made by Airbus.

History
Entry into service February 1993

Seatings/range
Max seating 440
Typical seating 295 (12/42/241)
Typical range 5,850 nm

Technical characteristics
MTOW 260 tonnes
OEW 129 tonnes
MZFW 173 tonnes
Fuel capacity 141,500 litres
Engines CFM56
Thrust 151 kn (34,000 lbs)

Fuels and times
Block fuel 1,000 Nm 14,500 kg
Block fuel 2,000 Nm 27,030 kg
Block fuel 4,000 Nm 52,080 kg
Block time 1,000 Nm 179 minutes
Block time 2,000 Nm 294 minutes
Block time 4,000 Nm 538 minutes

Engine options (% current fleet)
CFM56-5C2 (13%)
CFM56-5C3 (8%)
CFM56-5C4 (79%)

Fleet
Net orders: 224
Delivered: 213
Delivered in last 12 months: 2
Parked aircraft: 0
Operators: 35
Proportion of fleet on operating lease: 32%

Source Acas May 2007

Maintenance
C-check reserve $48 per flight-hour
Heavy check reserve $87 per flight-hour
Engine overhaul reserve $124 per engine flight hour
Engine LLP reserve $69 per engine cycle
Landing gear refurbishment $126 per cycle
Wheels brakes and tyres $306 per cycle
APU $73 per AP cycle
Component overhaul $314 per flight hour

Comments
The -300 Enhanced entered service in 2004

Future values
# EXPECTING TWINS

**Our verdict:** The A340-500 has not made the impression on the 777 that Airbus would have hoped for, hence the A350.

## How much?

**Official list price ($ millions)**

211 - 219

## Can we get a discount?

Probably but perhaps still not enough to stop you opting for an A350 or 787

## The opposition

The 77-200LR has more range and the 77-300ER more capacity. But the real threat is the A350-900, which looks like a direct replacement.

## History

**Entry into service**

October 2003

## Seating/range

**Max seating**

375

**Typical seating**

313 (12/42/259)

**Typical range**

7,650/7,785 nm

## Technical characteristics

**MTOW**

365/368 tonnes

**OEW**

170.3 tonnes

**MZFW**

222 tonnes

**Fuel capacity**

214,810 litres

**Engines**

Trent 553

**Thrust**

236kn (53,000 lbs)

## Fuels and times

**Block fuel 1,000 Nm**

16,500 kg

**Block fuel 2,000 Nm**

30,750 kg

**Block fuel 4,000 Nm**

59,240 kg

**Bock time 1,000 Nm**

181 minutes

**Block time 2,000 Nm**

294 minutes

**Block time 4,000 Nm**

526 minutes

## Engine options (% current fleet)

Trent 553 (100%)

## Fleet

**Net orders:**

32

**Delivered:**

26

**Delivered in last 12 months**

5

**Parked aircraft**

0

**Operators**

6

**Proportion of fleet on operating lease**

8%

---

Source: Acas May 2007
MIGHT DO BETTER

Our verdict: The A340-600 is less directly threatened by the A350 and 787 families than other members of the A340 family.

How much?
Official list price ($ millions) 222 - 231

Can we get a discount?
Airbus is reported as saying it will offer commercial incentives to offset the cash operating advantages of the 777.

The opposition
The A340-600 sits between the 777-200ER and the -300ER.

History
Entry into service July 2002

Seating/range
Max seating 475
Typical seating 380 (12/54/314)
Typical range 6,750/7,110 nm

Technical characteristics
MTOW 368/380 tonnes
OEW 177.1 tonnes
MZFW 240 tonnes
Fuel capacity 194,680/204,500 litres
Engines Trent 550
Thrust 249kn (56,000 lbs)

Fuels and times
Block fuel 1,000 Nm 16,960 kg
Block fuel 2,000 Nm 31,600 kg
Block fuel 4,000 Nm 60,890 kg
Block time 1,000 Nm 177 minutes
Block time 2,000 Nm 294 minutes
Block time 4,000 Nm 526 minutes

Engine options (% current fleet)
Trent 556 (100%)

Fleet
Net orders: 122
Delivered 76
Delivered in last 12 months 16
Parked aircraft 0
Operators 10
Proportion of fleet on operating lease 22%

Source Acas May 2007

Maintenance
C-check reserve $56 per flight-hour
Heavy check reserve $101 per flight-hour
Engine overhaul reserve $192 per engine flight hour
Engine LLP reserve $156 per engine cycle
Landing gear refurbishment $126 per cycle
Wheels brakes and tyres $306 per cycle
APU $73 per APU cycle
Component overhaul $314 per flight hour

Comments
The extended-range high-gross-weight -600 was certificated in April 2006

Future values

Airbus A340-600
Trent 556 Engines
A CLASSIC IN ALL BUT NAME

Our verdict: The 747-400 is destined to end with the advent of the 747-8, but it continues to sell although mainly as a freighter.

How much?
Official list price ($ millions) 216 - 248

Can we get a discount?
Boeing is keen to keep production going until the arrival of the 747-8

The opposition
For many years the 747 had no competitors hence its success. But the 777-300 offers similar seat-mile costs and lower trip costs. The A380 despite its tribulations will provide the stiffest competition.

History
Entry into service 1988

Seating/range
Max seating 660
Typical seating 416
Typical range 7285/7585 nm

Technical characteristics
MTOW 396.9/412.8 tonnes
OEW 183/186 tonnes
MZFW 241.7/251.7 tonnes
Fuel capacity 216,840/ 240,540 litres
Engines CF6-80C/PW4000/ RB211
Thrust 264 – 281kn (59-63,000 lbs)

Fuels and times
Block fuel 1,000 Nm 20,090 kg
Block fuel 2,000 Nm 39,970 kg
Block fuel 4,000 Nm 77,770 kg
Block time 1,000 Nm 149 minutes
Block time 2,000 Nm 272 minutes
Block time 4,000 Nm 516 minutes

Engine options (% current passenger fleet)
CF6-80C2 (37%)
PW4056 (39%)
RB211-524G/H (24%)

Fleet (Passenger version)
Net orders (pax only): 467
Delivered (pax only): 467
Delivered in last 12 months (pax only): 0
Parked aircraft: 11
Operators: 63
Proportion of fleet on operating lease: 23%

Maintenance
C-check reserve $52 per flight-hour
Heavy check reserve $165 per flight-hour
Engine overhaul reserve $162 per engine flight hour
Engine LLP reserve $132 per engine cycle
Landing gear refurbishment $111 per cycle
Wheels brakes and tyres $510 per cycle
APU $72 per APU cycle
Component overhaul $345 per flight hour

Comments
There are large number of freighter conversion programmes including Boeing’s own offering the 747-400BCF

Future values

Source Acas May 2007
A GOOD STOPGAP

Our verdict: The launch of the 787 has perversely helped the aircraft it is intended to replace. The aircraft has been ordered to meet capacity requirements prior to the availability of the Dreamliner.

How much?
Official list price ($ millions) 133 - 149

Can we get a discount?
The 787 and A350 looming on the horizon might suggest that there is room for negotiation, but the lack of direct competitors in production might make it more difficult.

The opposition
The nearest competitor is the A330-200, but the Airbus aircraft is significantly larger.

History
Entry into service 1988 (1986 for original -300)

Seating/range
Max seating 350
Typical seating 218
Typical range 5,975 nm

Technical characteristics
MTOW 186 tonnes
OEW 92 tonnes
MZFW 133 tonnes
Fuel capacity 90,770 litres
Engines CF6-80C/PW4000/RB211
Thrust 57,100-63,300lbs

Fuels and times
Block fuel 1,000 Nm 10,304 kg
Block fuel 2,000 Nm 19,762 kg
Block fuel 4,000 Nm 40,911 kg
Block time 1,000 Nm 159 minutes
Block time 2,000 Nm 290 minutes
Block time 4,000 Nm 550 minutes

Engine options (% current fleet)
CF6-80C2 (62%)
PW4050 (32%)
RB211-524H (6%)

Fleet
Net orders: 618
Delivered 563
Delivered in last 12 months 10
Parked aircraft 6
Operators 85
Proportion of fleet on operating lease 42%
Source Acas May 2007

Maintenance
C-check reserve $52 per flight-hour
Heavy check reserve $84 per flight-hour
Engine overhaul reserve $167 per engine flight hour
Engine LLP reserve $142 per engine cycle
Landing gear refurbishment $54 per cycle
Wheels brakes and tyres $52 per cycle
APU $73 per AP U cycle
Component overhaul $193 per flight hour

Future values

Boeing 767-300ER
CF6-80C2B6/B6F/PW4060 Engines

Future Year
2007 2008 2009 2010 2011 2012
Future values
BEST OF A BUNCH

Our verdict: Part of Boeing’s very successful 777 family.

How much?
Official list price ($ millions) 190 - 213

Can we get a discount?
The 777-200ER has better cash operating-costs than its nearest rivals but the advertised price is still very steep.

The opposition
The A340 family provides the competition, but the two engines versus four-engines debate seems to be favouring the Boeing aircraft.

History
Entry into service 1997 for ER (1995 for original -200)

Seating/range
Max seating 440
Typical seating 301
Typical range 7,700 nm

Technical characteristics
MTOW 298 tonnes
OEW 146 tonnes
MZFW 200 tonnes
Fuel capacity 171,170 litres
Engines Trent 800
Thrust 400kn (93,000 lbs)

Fuels and times
Block fuel 1,000 Nm 13,720 kg
Block fuel 2,000 Nm 25,920 kg
Block fuel 4,000 Nm 52,550 kg
Block time 1,000 Nm 154 minutes
Block time 2,000 Nm 278 minutes
Block time 4,000 Nm 528 minutes

Engine options (% current fleet)
GE90-94B (39%)
P W4080/4090 (20%)
Trent 884/892/895 (41%)

Fleet (ER version only)
Net orders: 430
Delivered 394
Delivered in last 12 months 18
Parked aircraft 2
Operators 35
Proportion of fleet on operating lease 18%

Source Acas May 2007

Maintenance
C-check reserve $46 per flight-hour
Heavy check reserve $110 per flight-hour
Engine overhaul reserve $230 per engine flight hour
Engine LLP reserve $189 per engine cycle
Landing gear refurbishment $110 per cycle
Wheels brakes and tyres $325 per cycle
APU $74 per APU cycle
Component overhaul $280 per flight hour

Comments
Boeing is said to be studying a package of ‘enhancements for the 777-200ER

Future market value

www.airfinancejournal.com
AIRCRAFT GUIDE 777-200LR

A LONG WAY TO GO

Our verdict: Great if you need the world’s longest-range commercial aircraft currently in production.

How much?
List price ($ millions) 219 - 243

Can we get a discount?
It’s not Boeing’s top seller so there is probably a deal to be done.

The opposition
Out on its own at the moment but the 787 and A350 families will supersede it.

History
Entry into service 2006

Seating/range
Max seating 440
Typical seating 301
Typical range 8,690/9,450*nm

*includes three optional auxiliary fuel tanks

Technical characteristics
MTOW 348 tonnes
OEW 156 tonnes
MZFW 209 tonnes
Fuel capacity 202,570 litres
Engines GE90-110
Thrust 489kn (110,000 lbs)

Fuels and times
Block fuel 1,000 Nm 14,170 kg
Block fuel 2,000 Nm 26,790 kg
Block fuel 4,000 Nm 54,300 kg
Block time 1,000 Nm 152 minutes
Block time 2,000 Nm 277 minutes
Block time 4,000 Nm 527 minutes

Engine options (% current fleet)
GE90-110 (100%)

Fleet (LR version only)
Net orders: 47
Delivered 2
Delivered in last 12 months 0
Parked aircraft 0
Operators 1
Proportion of fleet on operating lease 0%

Source Acas May 2007

Maintenance
C-check reserve $49 per flight-hour
Heavy check reserve $120 per flight-hour
Engine overhaul reserve $257 per engine flight hour
Engine LLP reserve $211 per engine cycle
Landing gear refurbishment $110 per cycle
Wheels brakes and tyres $325 per cycle
APU $74 per APU cycle
Component overhaul $280 per flight hour

Comments
The -200LR being developed as the freighter version of the 777 family

Future values
Boeing 777-200LR
GE90-110B1Engines

Source: Acas May 2007
SIMPLY THE BEST?

Our verdict: It has been said that if the world could have only one commercial aircraft, this would be it. A bit strong perhaps, but it is very versatile.

<table>
<thead>
<tr>
<th>How much?</th>
<th>Maintenance</th>
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<tbody>
<tr>
<td>Official list price ($ millions)</td>
<td>C-check reserve: $47 per flight-hour</td>
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<tr>
<td>237 - 264</td>
<td>Heavy check reserve: $115 per flight-hour</td>
</tr>
<tr>
<td>Can we get a discount?</td>
<td>Engine overhaul reserve: $230 per engine flight hour</td>
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<tr>
<td>Why would Boeing give you one?</td>
<td>Engine LLP reserve: $189 per engine cycle</td>
</tr>
<tr>
<td>The opposition</td>
<td>Landing gear refurbishment: $110 per cycle</td>
</tr>
<tr>
<td>Aircraft types that can carry more than 350 passengers close to 8,000 miles are a bit scarce.</td>
<td>Wheels brakes and tyres: $325 per cycle</td>
</tr>
<tr>
<td>History</td>
<td>APU: $74 per APU cycle</td>
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<tr>
<td>Entry into service</td>
<td>Component overhaul: $280 per flight hour</td>
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<td>2004 for ER</td>
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<td>(1998 for original -300)</td>
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<td>Seating/range</td>
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<td>Max seating</td>
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<td>Typical seating</td>
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<td>365</td>
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<td>Typical range</td>
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<td>7,930 nm</td>
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<td>Technical characteristics</td>
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<td>MTOW</td>
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<td>318/352 tonnes</td>
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<td>OEW</td>
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<td>168 tonnes</td>
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<td>MZFW</td>
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<td>238 tonnes</td>
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<td>Fuel capacity</td>
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<td>181,200 litres</td>
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<td>Engines</td>
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<td>GE90-115</td>
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<td>Thrust</td>
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<td>511 kn (115,000 lbs)</td>
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<td>Fuels and times</td>
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<td>Block fuel 1,000 Nm</td>
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<td>15,530 kg</td>
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<td>Block fuel 2,000 Nm</td>
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<td>29,490 kg</td>
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<td>52,010 kg</td>
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<td>175 minutes</td>
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<td>289 minutes</td>
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<td>Block time 4,000 Nm</td>
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<td>519 minutes</td>
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<td>Engine options (% current fleet)</td>
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<td>GE90-110 (100% )</td>
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<td>Fleet (ER version only)</td>
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<td>Net orders:</td>
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<td>Delivered in last 12 months</td>
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<td>Parked aircraft</td>
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<td>Operators</td>
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<td>8</td>
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<td>Proportion of fleet on operating lease</td>
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<td>56%</td>
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<td>Source Acas May 2007</td>
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</tbody>
</table>

Maintenance:
- C-check reserve: $47 per flight-hour
- Heavy check reserve: $115 per flight-hour
- Engine overhaul reserve: $230 per engine flight hour
- Engine LLP reserve: $189 per engine cycle
- Landing gear refurbishment: $110 per cycle
- Wheels brakes and tyres: $325 per cycle
- APU: $74 per APU cycle
- Component overhaul: $280 per flight hour

Comments:
- A modification kit to reduce drag was introduced at the end of 2005

Future values:

### Boeing 777-300ER
**GE90-115B Engines**

<table>
<thead>
<tr>
<th>Future Year</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
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<tbody>
<tr>
<td>2007</td>
<td>180</td>
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<td>2021</td>
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<td>Source: As of May 2007</td>
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</table>
A critical factor in realizing such reliability in long-service engines is maintenance.

“OnPoint is the means whereby GE ensures comprehensive care of each customer’s engine assets consistent with that customer’s specific operational situation. OnPoint transcends flight-hour, time and material, spare parts, and similar ‘formula’ agreements and customizes a solution, in collaboration with the customer, that best serves the specific interests and business needs of that customer,” says Jacques Chausse, general manager, services marketing at GE Aviation.

“GE tailors solutions to the customer's requirements, whether long-term, short-term or somewhere in between.”

For example, if a customer wants an engine to stay on wing for only two or three years, either because they plan to retire the aircraft or are meeting lease return conditions, GE has a solution.

Short-term needs can be met by guaranteeing a sufficient level of OEM quality used-serviceable material and by buying back life-limited parts (LLPs) that have life remaining. An important aspect of OnPoint solutions is GE’s commitment to maintaining customer engines with GE and CFM materials in order to ensure the highest level of reliability and quality.

To that end, GE will customize an offering, from its materials resources of new and used parts, component repair, and technology-infusion products, combined with a work-scope collaboratively defined to economically meet “mission requirements” while maintaining stringent standards of OEM reliability, value, and support.

By engaging GE or its partner shops, customers can obtain guaranteed availability of, and accessibility to, the world’s largest supply of used material for GE and CFM engines.

This effectively addresses the need of operators with a short-cycle maintenance focus while providing proven reliability and durability as well as ensured configuration management to meet leasing requirements and support asset transferability.

Consider the following actual case. A low-cost carrier was starting up in an emerging region with a small fleet of aircraft. It was focused on managing costs over the short term—five or six years. Cash clearly was king.

The airline was considering a service offer to maintain the engines with non-OEM material and lower-cycle LLPs, hoping to show a savings per shop visit.
In working with the carrier, GE recognized that their needs were period-focused. Together, the airline and GE crafted a solution that included a CFM56-3 Advanced Upgrade kit that nearly halved the number of shop visits proposed in the competitor’s offer. Extra shop visits carry hidden costs, such as the downtime and labor associated with engine swaps as well as the cost of renting spare engines.

Furthermore, the upgrade embodied a higher level of technology that had the potential to save more than a half million dollars a year in fuel – savings that would begin immediately.

Finally, GE’s offer included commercial flexibility that spread the customer’s payments more uniformly over time, which translated to a quicker return on their investment.

The customer, recognizing the value of fewer shop visits, better fuel burn and payment flexibility, chose GE.

Alternatively, a customer may prefer a longer-term approach that incurs slightly more cost per shop visit, but that increases engine time on wing by as much as 40% and reduces overall maintenance costs, typically by 15 to 25%.

In such a case, a customer may choose an increased build standard in engines to achieve a longer-term dollar-per-flight-hour improvement, based to a great extent on the excellent exhaust gas temperature (EGT) margin of CFM and GE engines. GE applies work-scope and shop build processes to the relevant engine modules, combined with material selection and compliance with service bulletin standards, in order to allow maximum performance and component reliability.

Airlines benefit from GE’s incorporation of the appropriate LLP cycle content to fully utilize the engine reliability and performance and to further enable the higher build standard through insertion of available technology.

Repair is an important part of any truly cost-effective work-scope. GE introduces some 1,000 new repairs each year, accelerating introduction as engines come into their first shop visit cycle.

For example, repairs introduced since 2005 for CFM56-5B/-7B engines entering their first shop visit have accounted for approximately $200,000 in savings to customers.

However, repair that extends part life at the shop visit buys nothing if it compromises next-run time on wing, so GE adheres to a rigorous evaluation process for repairs, utilizing its knowledge as the OEM to assure that the part, as well as the engine, will meet the intended mission. All GE- and CFM-approved repairs comply with OEM standards for continued airworthiness and configuration management, thereby promoting acceptance and transferability.

GE has invested more than $1 billion annually in advanced technology and will invest $1.5 billion this year in design techniques and material technology that extend part life and reduce fuel and maintenance costs, emissions and noise.

Customers will benefit from this investment in the form of upgrades. Older assets will be infused with the new technology to enhance their efficiency, durability and reliability.

Three-dimensional aerodynamic (3D aero) design technology, for example, is a key element of many of the upgrade packages for mature engines. This technology did not exist when these engines entered service, but it is available now in the form of upgrades: 3D aero airfoils measurably improve the flow-path efficiency of the older engines in which they are introduced. The resultant lower fuel burn translates to operating savings and/or better range/payload, and the improved engine performance lengthens time on wing and reduces the degrading temperatures to which components are exposed.

Each new engine, part or technology upgrade undergoes a rigorous certification process. In addition to detailed component and subsystem design analysis and test, engines are ground-tested under every reasonably conceivable operating condition to understand the operating characteristics and to help provide safe, reliable aircraft operation at entry into service.

“GE tailors solutions to the customer’s requirements, whether long-term, short-term or somewhere in between.”

Upgrades are also subjected to these similarly rigorous processes. The CFM56-3 Advanced Upgrade kit had over 900 hours of testing on four engines, plus 50 hours of flight-testing. This is done because certifying new designs and parts requires a full-system perspective, and GE and CFM are committed to the safe and reliable operation of the engines they design and produce.

Product reliability does not stop at engine design. With endurance testing, fleet monitoring programs, and field and product support, GE and CFM monitor engines during operation to continually assess product performance. Through diagnostics, GE currently monitors the performance of more than 14,000 engines on wing to detect any issues before they become a problem. For example, over a 12-month period more than 110 potential high-cost events were prevented that resulted in saving operators millions of dollars.

GE shares the investor’s interest in maintaining the highest asset value while addressing each customer’s unique needs, ranging from long-term commitments to short-term solutions. With OnPoint solutions, using GE and CFM materials, customers are assured of an engine maintenance program with the highest level of reliability, quality, technology, acceptance and support.
The language may sound familiar but is it always being applied correctly? As appraisers of aviation assets, our opinions are solicited by the air transport community every day. Our governing body, the International Society of Transport Aircraft Trading (ISTAT) has laid down strict value definitions and as ISTAT members we must employ and adhere to them closely.

Perhaps the greatest distinction of all is the difference between Base Value and Current Market Value. During the recession of the early 1990s, asset values experienced an unprecedented shock to the system. As values came under severe negative pressure, ISTAT felt that a division between the intrinsic value of an asset - as opposed to its likely trading price - should be made. Thus, the Base and Current Market concepts were born and took over from the single definition of Fair Market Value. Base Value, in the words of ISTAT, is the “underlying economic value of an asset” which is “founded in the historical trend of values and in the projection of value trends.” This gives rise to the value curve – the performance of an asset over time in terms of its propensity to retain value. Around this curve hovers an array of transaction points which represent actual sales realized over the course of the asset’s life. These points will fall either above or below the base value in accordance with market conditions existing at that time. In other words, Base Value will prevail in a balanced market which is “open, unrestricted and stable” where supply and demand are in equilibrium. Given “an adequate amount of time for effective exposure to prospective buyers” (normally regarded as six to twelve months) sellers will achieve a price determined by market forces. This price will equate to Current Market Value. Apart from market equilibrium, there is one other instance where AVITAS considers Base and Current Market Value to be the same – for brand new aircraft. Not all appraisers are in agreement with this assumption and it is purely a matter of opinion.

For both of these definitions to remain valid, other conditions need to be met within the circumstances of a particular transaction. We use phrases such as “arm’s length”, “highest and best use” and “absence of duress”, but how do these apply in practice? For a transaction to be concluded at arm’s length, the parties involved must not be connected in any way which could compound the terms of the deal, especially with regard to price. For example, if Owner A sold an aircraft to Owner B, but it later transpired that the two were personally related, this may not be construed as a transaction occurring at arm’s length. The relationship could be interpreted by some as having taken the deal out of a purely business environment.

When is an asset being appraised for its “highest and best use”? This is when the asset is doing what it was intended to do. If I purchase a 737-300 and, instead of flying it, decide to open it as an interesting theme restaurant then the status of the asset could no longer be considered to be at its highest and best use. Similarly, the maximum take off weight of an aircraft is acknowledged in terms of a value adjustment as is the maximum engine thrust. Adjustments for the actual specification of the aircraft are frequently made, with other features attracting added value such as the presence of winglets.

For the valuation of an asset, a range of assumptions are made regarding physical condition. The asset, unless value adjustments are being made for condition, is usually assumed to be in half-time, half-life condition and the physical state of the asset is taken as being typical compared to other assets of similar type and vintage. This is also true for utilization, which must also be comparable to similar assets. If an asset has not been fully utilized, then it cannot be regarded as having been operated to its highest and best use.

As long as no party to a transaction is under “unusual pressure for a prompt sale” and there is an “absence of duress” then the two definitions can still be used. If, for any reason, this is not the case then the definition of Distress Value could well be more appropriate. So when is there sufficient distress for a distressed sale? More commonly, the distress will affect the seller. A bankrupt operator, a legal trustee or a bank obliged to try and dispose of an asset when a client goes into default – these will all be faced with distressed circumstances. In order to conclude a sale, the seller will have to offer a substantial discount over what would otherwise be the fair market value. In recent distressed times, these discounts have frequently been in the range of 25% to 35%. The marketing time involved is understood to be “artificially limited” and the seller can be described as “uncommonly motivated.” Such circumstances can also affect buyers. If buyers are eager enough to acquire particular assets they, too, could be labeled as uncommonly motivated and therefore willing to offer more in order to secure the deal.
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