

New widebody aircraft will begin to enter service in increasing numbers in the next few years. The aircraft they are likely to replace, and the reasons why, are identified here.

# Widebody fleet replacement options. Analysing the 777X, 787, A330neo & A350 XWB

**T**he new Airbus and Boeing twin-aisle, widebody families promise to lower aircraft cash operating costs. These include the A330neo, A350 XWB, 787 and 777X families.

The pace of new generation twin-aisle deliveries will increase over the next few years, with two 787 variants now in service and the first A350 due to commence airline operations before the end of 2014.

Deliveries will lead to the withdrawal of older generation types, some of which have already exceeded their initial expected service lives, due to delays in the 787 and A350 programmes.

The types most likely to be superseded, and the new generation variants likely to replace them, are discussed here.

## Current widebody fleet

The widebody types most likely to be replaced include A330s, A340s, 767s, 777s and 747-400s.

### A330-200/-300

There are two variants of the A330: the A330-200 and the A330-300.

The A330-200 is used primarily for

lower density long-haul operations and some intra-continental services. It accommodates 237-299 seats in two-class configurations, and 208-234 seats in tri-class layouts.

Airbus has upgraded the weight specifications of the A330-200 several times since it entered service. The most recent upgrade provides a range of 7,250 nautical miles (nm) (*see table, page 6*).

The largest A330-200 operators are Air China (30), China Eastern Airlines (24), Etihad Airways (24) and Emirates Airline (21). There are 482 A330-200s in service.

The larger A330-300 is used in a mix of intra-continental and long-haul

operations. It is configured with 271-311 seats in two-class layouts, and 221-292 seats in most tri-class layouts.

There have been a number of weight upgrades for the A330-300 series. Early-build aircraft manufactured between L/N 012-244 have lower weight specifications that restrict their range. These aircraft are likely to be the first A330s phased out of passenger service.

The latest weight upgrade for the A330-300 will provide it with a range of up to 6,100nm.

The largest A330-300 operators are Cathay Pacific (38), Singapore Airlines (27), China Airlines (24), Thai Airways (24) and Delta Air Lines (21). There are



*The 747-400 is unable to compete with twin-aisle, twin-engine designs in terms of cash operating costs. This makes it a prime candidate for replacement. Large numbers have already been replaced by the 777-300ER.*

## CURRENT, TWIN-AISLE AIRCRAFT SPECIFICATIONS

	A330-200	A330-300	A340-200	A340-300	A340-500	A340-600-
Standard two-class seating	246	300		300	282	359
Standard three-class seating			261			
MTOW (lbs)	533,519	533,519	606,271	609,578	837,756	837,756
Range (nm)	7,250	6,100	6,700	7,400	9,000	7,900
In service	482	515	5	158	16	85
	767-200	767-200ER	767-300	767-300ER	767-400ER	777-200
Standard two-class seating	216	216	261	261	296	400
Standard three-class seating	174	174	210	210	243	305
MTOW (lbs)	315,000	395,000	350,000	412,000	450,000	545,000
Range (nm)	3,900	6,850	4,450	6,750	5,600	5,240
In service	8	28	72	478	37	84
	777-200ER	777-200LR	777-300	777-300ER	747-400	747-400ER
Standard two-class seating	400		451		524	524
Standard three-class seating	301	301	368	386	416	416
MTOW (lbs)	656,000	766,000	660,000	775,000	875,000	910,000
Range (nm)	7,725	9,395	6,005	7,825	7,260	7,670
In service	404	55	60	505	256	6

## Notes:

- 1). Seat capacity figures based on standard manufacturer examples. Configurations and capacity will vary by airline.
- 2). In-service fleet numbers based on active aircraft and data from September 2014.

515 A330-300s in operation.

The A330 family remains popular, with outstanding orders for both variants.

### A340 family

The A340 family has the -200, -300, -500 and -600 variants. The -300 and -600 account for the largest numbers.

The A340-200 has up to 261 seats in a typical three-class configuration. Only five are left in service.

The most numerous A340 variant is the -300 series. The largest operators are Lufthansa (19), Swiss (15) and Air France (13).

The A340-300 is used as a long-haul workhorse, and aircraft are configured with 214-295 seats and dual- and tri-class configurations. It has a range of up to 7,400nm (*see table, this page*). There are 158 A340-300s in service.

The slightly longer A340-500 is an ultra-long-haul variant, with a range of up to 9,000nm. Emirates is the largest operator, and configures its aircraft with about 260 seats in three classes.

The A340-600 is the largest member of the family, and seats 267-320 in a three-class configuration. It has a range of about 7,900nm.

The largest operators are Lufthansa (24), Iberia (17) and Virgin Atlantic (13). There are a total of 85 in service.

The A340 family is no longer in production.

### 767 family

There have been five passenger-configured variants of the 767 family: the 767-200, 767-200 extended range (ER),

767-300, 767-300ER and 767-400ER.

There are few 767-200s and -200ERs left in passenger service, however.

The 767-300 is configured with 232-261 seats in a two-class configuration, and the -300ER is configured with 211-230 seats in a typical three-class arrangement.

The -300ER has a maximum range of 6,750nm (*see table, this page*). The -300 has a range of up to 4,450nm, and is mainly used for intra-continental operations.

The largest 767-300 operators are ANA (21), Delta (16) and Japan Airlines (14).

The largest operators of 767-300ERs are American Airlines (58), Delta (58), United Airlines (35) and Japan Airlines (32). There are 586 767-200s, -200ERs, -300s and -300ERs in operation.

The 767-400ER is the largest member of the family, with a 243 seat capacity in a three-class configuration. It can achieve a maximum range of 5,600nm.

All the active 767-400ERs are operated by Delta (21) and United (16).

There are no outstanding orders for passenger-configured 767s.

### 777 family

The 777 family includes the -200, -200ER, -200 long range (LR), -300 and -300ER.

The 777-200 is the oldest family variant, and is mainly used for intra-continental and shorter distance long-haul missions. Aircraft are configured in a mix of two- and three-class configurations, with 250-275 and 245-270 seats respectively.

The -200LR has a range of up to

9,395nm (*see table, this page*), and is used for ultra-long-range, inter-continental missions by a small number of airlines. The aircraft is configured with 250-270 seats in most tri-class arrangements. It also has about 270 seats in a dual-class configuration.

United (19) is also the largest operator of the standard 777-200. This variant is popular with ANA (16) and Japan Airlines (14).

The largest 777-200ER operators are United (55), American Airlines (47) and British Airways (BA) with 43. There are 488 777-200s and -200ERs in operation.

Delta (10) and Emirates (10) are the largest operators of 777-200LRs. A total of 55 -200LRs are in service.

### 777-300/-300ER

The 777-300 is used as a high capacity, intra-continental and domestic aircraft by airlines in the Asia Pacific. Seat arrangements in a dual-class configuration are 370-500 seats.

The 777-300ER has a range of up to 7,825nm (*see table, this page*), and is operated as an inter-continental aircraft. It has been used by a large number of airlines to replace 747 Classics and 747-400s. The aircraft is configured in a variety of seating arrangements, with 340-380 seats in two classes, and 280-390 in three classes.

The 777-300ER has been the most successful member of the family. The largest operators of the -300ER variant are Emirates (100), Cathay Pacific (43) and Air France (37).

In contrast there are only about 60 777-300s in active service. The largest operators are Emirates (12) and Cathay

## NEW TWIN-ENGINE, TWIN-AISLE AIRCRAFT SPECIFICATIONS

	A330-800neo	A330-900neo	A350-800	A350-900	A350-1000
Two-class seating	252	310	276	315	369
Three-class seating					
Engine Type	Trent 7000	Trent 7000	Trent XWB	Trent XWB	Trent XWB
MTOW (lbs)	533,500	533,500	571,000	592,900	681,000
Range (nm)	7,450	6,200	8,250	7,750	8,000
In service	0	0	0	0	0
Order backlog	10	117	34	547	170
	<b>787-8</b>	<b>787-9</b>	<b>787-10</b>	<b>777-8X</b>	<b>777-9X</b>
Two-class seating					
Three-class seating	242	280	323	350	400
Engine Type	GEnx-1B/Trent 1000	GEnx-1B/Trent 1000	GEnx-1B/Trent 1000	GE9X	GE9X
MTOW (lbs)	502,500	557,000	557,000		
Range (nm)	7,850	8,300	7,020	9,300	8,200
In service	177	3	0	0	0
Order backlog	296	429	139	43	243

## Notes:

- 1). Seat capacity figures based on standard manufacturer examples. These will vary by airline.
- 2). A330neo order backlog refers to commitments received by Airbus by the end of August 2014. Other order data is for aircraft on firm-order backlog as of September 2014.
- 3). There is an outstanding order for one additional 787 but the variant and customer are undisclosed.
- 4). A330neo MTOW rounded to nearest 100lbs following conversion from Airbus metric ton figure.

Pacific (12).

There are 505 777-300ERs in operation, and another 255 777-300ERs and one 777-200LR on order backlog. There are no outstanding orders for the -200, -200ER or -300 variants.

#### 747-400

There are more than 250 747-400s still operating in passenger configuration that are due to be replaced at some point. There are several variants of the 747-400 series, including the standard -400 and the -400ER.

The 747-400 and -400ER are configured in three and four classes, and airline configurations total 330-415 seats.

The 747-400 has a range of up to 7,260nm, and 7,670nm for the -400ER (see table, page 6).

The largest 747-400 operators are BA (46), United (24) and Transaero (20).

There are only six 747-400ERs in active service, all operated by Qantas.

The 747-400 series is no longer in production.

### New widebody programmes

There are four new twin-aisle, twin-engine aircraft families.

The A350XWB and 787 are clean sheet designs, while the A330neo (new engine option) and 777X will be derived from the proven A330 and 777 families.

New aircraft programmes only have a reduction in fuel burn and maintenance requirements as scope for improving their cash operating costs relative to current generation types. These aircraft will use new technologies to achieve these changes. (See *New widebody programmes assessment: 787-9/-10,*

*777X & the A350 family, Aircraft Commerce, December 2013/January 2014, page 4; and A330neo & 737 MAX 200 announced, 737 MAX specs released, Aircraft Commerce, August/September 2014, page 5).*

All four aircraft families will have more efficient, higher-bypass ratio engines. The A330neo, A350XWB, and 777X families will each be supported by a single engine manufacturer. Only 787 operators have a choice between two engine providers.

The A330neo and 777X are expected to have modified wings in addition to new engines. They are not expected to feature the same level of composite materials used in the construction of 787s and A350s, however. These composite materials are light and strong, and will contribute to fuel burn and maintenance cost reductions.

#### A330neo

There will be two variants of the A330neo: the A330-800neo and the A330-900neo.

The A330-800neo is expected to enter service in 2018. It will have a standard two-class configuration of 252 seats, and a range of up to 7,450nm. (see table, this page).

The A330-900neo should enter service in 2017. It will be capable of carrying 310 passengers in a typical two-class layout, and have a range of up to 6,200nm.

Both variants of the A330neo will be exclusively powered by Rolls-Royce (RR) Trent 7000 engines.

In certain operating scenarios, Airbus expects the A330-900neo to demonstrate fuel burn savings of up to 12% per trip

and 14% per seat compared to an A330-300.

Airbus also expects the A330neo to have 5% lower direct maintenance costs than the current A330 family.

Airbus had received 10 commitments for A330-800neos and 117 for A330-900neos by the end of August 2014.

#### A350 XWB

The A350 family includes three variants: the A350-800, the -900 and the -1000.

The A350-900 will be the first variant to enter service, before the end of 2014.

The A350-900 has a standard 315-seat two-class cabin configuration, and a range of up to 7,750nm (see table, this page).

The A350-800 is scheduled to enter service in 2016. It will accommodate 276 passengers in a typical two-class configuration, and have a range of up to 8,250nm.

The A350-1000 is due to enter service in 2017. It will be the largest member of the family, capable of flying up to 369 passengers, in a two-class layout, up to 8,000nm.

The A350 family will be exclusively powered by RR Trent XWB engines.

Airbus claims that the A350-800 will have 8% lower fuel burn per seat than the 787-8. It also claims the A350-900 will demonstrate 7.5% lower fuel burn per seat compared to the 787-9, and 25% per seat lower than the 777-200ER. Airbus also believes that the A350-1000 will burn 25% less fuel per seat than a 777-300ER.

At the end of September 2014 there were 34 A350-800s, 547 A350-900s and 170 A350-1000s on firm order backlog; a



total of 751 aircraft.

The largest A350-800 customer is Yemenia (10).

The largest A350-900 customers are Singapore Airlines (70), Qatar Airways (43), and Etihad Airways (40).

Qatar Airways (38), United (35) and Cathay Pacific (26) have the most A350-1000s on order.

## 777X

The 777X family will include two variants: the 777-8X and the 777-9X.

The 777-8X will be capable of flying 350 passengers, in a tri-class layout, up to a range of 9,300nm (see table, page 8).

The 777-9X will accommodate 400 passengers, in a standard three-class configuration, and be capable of operating up to a range of 8,200nm.

The GE9X series is the only engine option for the 777X family.

Few other details are available for the 777X family.

Boeing expects the 777X to offer 12% lower fuel burn and have 10% lower overall cash operating costs than the closest competing aircraft.

At the end of September 2014, there were 286 777X aircraft on firm order backlog, including 43 777-8Xs and 243 777-9Xs.

Emirates is the largest 777X customer to date.

## 787

The 787 family includes the 787-8, the 787-9 and the 787-10.

The 787-8 entered service in 2011. It has a standard tri-class seat capacity of 242 passengers, and a range of up to 7,850nm (see table, page 8). Actual airline configurations are 213-252 seats in a tri-class layout; similar to that of

767-300ERs configured for international operations.

The 787-9 entered service in 2014. It can accommodate 280 seats in a standard three-class cabin, and is capable of operating up to a range of 8,300nm.

Actual tri-class seating configurations of the 787-9's three operators are 252-264 seats; similar to some airlines' A330-200 and -300 configurations.

The 787-10 is the largest member of the family and is due to enter service in 2018. It will be capable of flying 323 passengers up to 7,020nm in a standard three-class cabin configuration. This aircraft will be close in capacity to a A330-300, although the 787-10 may actually be closer to larger types.

787 operators can choose between Trent 1000 and GENx-1B engines.

There are 177 787-8s in active passenger service. The largest operators are ANA (31), Air India (15), Japan Airlines (15) and Qatar Airways (15).

There are three 787-9s in active service, with deliveries having commenced in October 2014.

At the end of September 2014 there were 296 787-8s, 429 787-9s and 139 787-10s on firm order backlog. The programme has therefore totalled 1,044 firm orders.

Aeroflot has the most outstanding orders for 787-8s (22).

The International Lease Finance Corporation (ILFC) has the most outstanding orders for 787-9s (44), followed by ANA (41) and Etihad (41).

Etihad (30), Air Lease Corporation (30) and Singapore Airlines (30) have the largest outstanding orders for 787-10s.

## Market positioning

The A330-800neo and -900neo would make good respective

*The pace of new twin-aisle deliveries will continue to increase over the next few years. The first A350-900 is expected to enter service in late 2014.*

replacements for A330-200s and -300s from a capacity and range perspective.

Airbus has previously identified the 787-8 and 767-300ER/-400ER as the closest competitors to the A350-800.

Airbus views the A350-900 as competing with the 777-200 and -200ER, and the 787-9. Airbus also sees the A350-900 as a replacement option for A340-300s.

The A350-900 will have similar capacity to the A330-900neo, but 1,500nm longer range.

The A350-1000 is a replacement option for A340-600s and will compete with 777-300ERs and the 777-8X.

The 777-9X is the most suitable twin-engine candidate to replace 747-400s from a capacity perspective.

## The airline view

A number of airline case studies featuring operators with outstanding orders for new-generation twin-aisle aircraft have been included here.

The reasons each operator has for ordering the new aircraft, and the types they are likely to replace, are identified where possible.

## Emirates

Emirates is a long-haul carrier based in Dubai, United Arab Emirates. It has developed a strategy of connecting locations in the west and east via its hub.

Emirates' fleet includes 777-200s (2), 777-200ERs (6), 777-200LRs (10), 777-300s (12), 777-300ERs (100) A330-200s (21), A340-300s (4), A340-500s (8) and A380s (54). This totals 217 long-haul aircraft.

The airline has 35 777-8Xs and 115 777-9Xs on firm order, along with a backlog for 777-300ERs.

Emirates says that the 777X will be used to replace 777-200LRs and 777-300ERs, and for incremental fleet growth.

Emirates expects the 777X to deliver superior payload-range attributes compared to its current 777 fleet, allowing the carrier to serve markets that require a higher payload performance.

It will also use the 777X to deliver higher capacity on the current 777-300ER/-200LR network, but also to grow Emirates' presence into second- and

third-tier global cities.

Based on Emirates' mission rules, the 777X aircraft are expected to deliver 16-19% lower fuel burn compared to the 777-300ER, depending upon the variant.

In general, Emirates expects the 777X to provide a double-digit reduction in operating costs versus the 777-300ER.

Emirates admits that there are drawbacks associated with having a single-source engine supplier for the 777X, such as a lack of competition. It also points out that a single-engine option scenario can have advantages. Emirates suggests that used aircraft residual values can remain stronger when there is a single-engine provider, which makes financing and remarketing the aircraft simpler.

## IAG

International Airlines Group (IAG) is the parent company for British Airways, Iberia and Vueling.

BA's active widebody fleet consists of 767-300ERs (15), 777-200s (3), 777-200ERs (43), 777-300ERs (11), 787-8s (8), 747-400s (46) and A380s (7). This is a total of 133 long-haul aircraft.

BA is the world's largest operator of passenger-configured 747s.

IAG has 787-9s (22), 787-10s (12)

and A350-1000s (18) on order for BA. These will be used to replace the airline's ageing 747-400s.

Iberia's active widebody fleet includes A330-300s (8), A340-300s (5) and A340-600s (17).

IAG has eight A350-900s on order for Iberia. It also plans to secure an additional eight A330s for the Iberia fleet. These will be used to replace A340s.

IAG expects the 787s and A350s it has on order to provide cost efficiencies and financial benefits. It estimates they will deliver fuel cost per seat improvements of more than 20%.

## Lufthansa

Lufthansa is the national flag carrier of Germany.

Its widebody fleet currently includes A330-300s (19), A340-300s (19), A340-600s (24), A380s (12), 747-400s (19) and 747-8s (15). This is a total of 108 long-haul aircraft.

Lufthansa has 34 777-9Xs and 25 A350-900s on order, along with a number of 747-8s. It expects to receive the first A350-900 in 2016 and the first 777-9X in 2020.

The A350-900s and 777-9Xs will mostly be used to replace existing members of the fleet.

"The A350-900s will replace A340-300s," explains Nico Buchholz, group fleet management at Deutsche Lufthansa AG. "Some of the A350s will also provide incremental fleet growth."

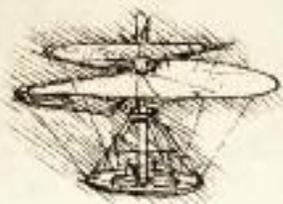
"The A350-900 fits nicely into our fleet structure," continues Buchholz. "It has the range to cover the whole network, with good comparative fuel burn characteristics. Other A340-300 replacement options included the 777-8X, but is too big; and the 787-10, which has a shorter range than the A350-900, and was not available as early. The 777-9Xs will replace the remaining 747-400s, and maybe at a later stage some of the A340-600s."

Lufthansa owns most of its fleet, providing it with more flexibility in terms of fleet retirements.

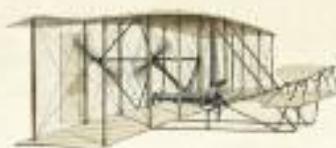
"The 777-9X is a good fit as a 747-400 replacement," claims Buchholz. "It is marginally smaller, but has attractive unit cost and performance characteristics."

"An aircraft's payload-range performance is a critical factor in Lufthansa's fleet selection process," adds Buchholz. "Most of the routes in our network fit within a 7,000nm range circle. The A350-900 and 777-9X will both be capable of operating at this range with a full payload."

"We are cautious about phasing out



A. Man aspires.



B. Man constructs.



C. Man soars.

FIG. 1 Building on where we came from to help you move forward.

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old aircraft,” continues Buchholz. “It is important to consider capital costs alongside the cash operating costs. The lower capital costs of depreciated older aircraft could outweigh the lower cash cost associated with the more efficient new types. Much will depend on long-term fuel prices. The higher the price of fuel, the larger the comparative cost savings of new aircraft. Environmentally all of our new aircraft will provide a significant improvement.”

Lufthansa’s A350-900s and 777-9Xs will have single-source engine providers. Competition is more likely to lead to lower maintenance and overhaul costs.

“For high maintenance cost items, such as engines, we prefer to see healthy competition between multiple suppliers,” says Buchholz.

Lufthansa expects that the A350-900s and 777-9Xs will deliver fuel burn savings of up to 25% per passenger for every 100 kilometres flown, and reduce unit costs by 20%, and the noise footprint by 30% compared to current aircraft.

## Leasing company view

Air Lease Corporation is a US-based aircraft leasing company. It has a portfolio of 212 aircraft, including narrowbody and widebody aircraft from Airbus and Boeing and regional jets and turboprops from Embraer and ATR.

Its airline clients include Air New Zealand, BA, Emirates, Etihad and KLM.

Air Lease Corp currently owns 34 widebody aircraft: two 767-300ERs, one 777-200ER, 10 777-300ERs, 16 A330-200s, and five A330-300s.

“We seek to own an aircraft for the first third of its life,” explains Ryan McKenna, head of strategic planning and investor relations at Air Lease Corp. “Long-term lease deals are arranged before the aircraft is delivered. Once the aircraft reaches seven or eight years of age, we sell it with a lease attached.”

Air Lease Corp was a launch customer for the A330neo and 787-10. It has 45 787-9/-10s and 25 A350-900s/-1000s on order backlog, along with 16 777-300ERs.

Air Lease Corp also has 25 commitments for A330neos. It focuses on three segments for twin-aisle aircraft.

The first contains aircraft with smaller passenger counts that optimise range, capacity, and frequency needs for airlines. The A330 is an example.

The second segment contains new ultra-long-haul types which have higher capital costs, such as the 787-9/-10 and A350-900/-1000.

The third segment contains the largest long-haul, twin-aisle aircraft, and is currently dominated by the 777-300ER.

“In the A330neo, Airbus has created a product for the smaller end of the twin-aisle market, capable of serving 80% of today’s long-haul routes,” claims McKenna. “This re-engined aircraft delivers good operating capabilities at a lower price point than the A350 or 787.”

McKenna believes that the 787-9 and -10 and the A350-900 and -1000 will go ‘head-to-head’ in the mid-size ultra-long-haul market. “The A350s and 787s are most likely to replace A340s and 747s initially,” says McKenna. “They may also replace smaller types, such as the 767 if operators want to increase capacity.”

*The 787 is the only new widebody family that offers more than one engine option. The 787-8 and -9 have already entered service, with 180 in operation.*

## Summary

A340s and 747-400s will be among the first types to be replaced by the new twin-aisle designs. With four engines they are unable to compete from a unit cost perspective, since they will burn more fuel and incur higher maintenance costs than a twin-engine type.

Older aircraft with inferior payload-range performance will be the first candidates for replacement among the 767, 777 and A330 families. This includes the 767-200, -200ER, -300 and -300ER; the 777-200 and -300s; and LGW versions of the A330-300.

There are more than 2,500 of these types in service, and at least 1,500 of these aircraft will come due for replacement in the short- to medium-term.

777-300ERs and higher weight versions of the A330-300 are the aircraft least likely to be replaced in the near term. There at least 750 of these aircraft in service, and more are due to be delivered.

The specific aircraft family and variant chosen to replace a current widebody fleet will vary by operator. Some airlines may select the type that offers the closest capacity and range to its current fleet. Others may wish to increase or reduce capacity and could therefore require larger or smaller aircraft.

The current order backlog suggests that aircraft in the A350-900 and 787-9 category are most in demand. These have been ordered to replace similar-sized aircraft such as the A340-300, or the 747-400s.

The four new widebody families are expected to deliver savings in operating costs, including up to double-digit reductions in fuel burn.

The A350 and 787 families are likely to provide the largest efficiency savings due to the more extensive use of composite materials.

New engine variants are influential in the superior fuel burn performance of the four new widebody families.

The A330neo, A350 XWB and 777X families each have a single engine provider. This raises concerns over levels of competition and the potential effect on spares and maintenance costs. **AC**

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