

The widebody fleet is expected to increase by about 50% over the next 10 years. During this process, the A330/A340/A350 & 777 families will come to dominate the fleet. By 2015, these two groups of aircraft will account for about half of widebody base checks.

Widebody maintenance market favours A330/A340/A350 & 777 families

The slump in air traffic in recent years has weakened demand for widebody, as well as narrowbody, base maintenance, which has undermined the man-hour (MH) rates that suppliers have been able to charge. Will widebody fleet growth over the next 10 years be enough to strengthen the maintenance market?

The global widebody fleet has been small than the narrowbody fleet, with many carriers unable to justify having their own maintenance facilities because their widebody numbers are low. Widebody base maintenance is a highly specialised business that involves niche work, such as heavy modifications, and also requires extensive tooling and large facilities.

The 747-200/-300, 747-400, DC-10, MD-11 and 767 have dominated the widebody fleet for the past 20-30 years. Many have operated under maintenance steering group 2 (MSG2) programmes, which have increased the volume of maintenance as these aircraft have aged.

The widebody fleet will soon be dominated by the A330, A340, A350 family, 777, 787 and 747-400. These all have MSG3 maintenance programmes, which include ageing aircraft inspections, and so generate a more predictable volume of work. A widespread misconception is that modern aircraft have longer base check intervals than older aircraft. There is actually very little in the C check intervals for older widebodies and newer types like the A330, A340, 777 and 747-400. The latest generation aircraft, however, the A350, A380 and 787, will have longer base check intervals.

Many modern widebodies are still young, however. The first D checks on the oldest A340s were not performed until 2002, and heavy structural checks have not yet been performed on other types.

Younger aircraft could still experience an increase in MH consumed during base checks because of rising non-routine ratios.

The maintenance efficiency of younger aircraft influences the overall market volume for widebody base checks. Maintenance suppliers will therefore be relying on fleet growth to expand the overall market. The important issue is which aircraft types will generate the highest number of base checks.

Base check volumes

The size of the base check maintenance market is first dependent on the size of each aircraft type. It is then determined by the aircraft's maintenance programme and average interval between subsequent C and D or structural checks. Interval utilisation is an element that affects average check interval.

The maintenance programmes of older and most younger generation widebodies do not differ much in terms of check interval. All Airbus types, however, have long base check cycles, of eight C checks, with two structural checks at the fourth (4C) and eighth (8C) check. The length of this cycle is 10 years, depending on the authorised maintenance programme of the specific operator. This compares with D check intervals of about five years for the 747, DC-10 and 767. Overall, maintenance programmes and check intervals alone have little influence on the number of base checks.

Maintenance intervals are also affected by the requirement for 'casualty' maintenance, for aircraft damaged in service and in need of repairs. Aircraft also generate maintenance when they change operators because they require bridging checks and interior reconfiguration. Interior reconfiguration for marketing purposes (for example,

installation of a new inflight entertainment system) is another factor influencing market volume. The volume of maintenance generated by these two factors is relatively small, and accounts for a fraction of the number of scheduled base checks. "Additional maintenance for bridging checks, change of ownership, cabin modifications and casualties is about 6-8% of the volume for regular base checks," explains Frank Martin, head of marketing at SR Technics.

Most current generation widebody aircraft have a base check interval of 12-18 months, but the majority of maintenance programmes for most aircraft types have a 15-month C check interval. Exceptions are the 777, which in many cases has a 12- or 24-month C check interval, and some A330s and A340s, which have been permitted an 18-month C check interval. The A350, A380 and 787 will have longer intervals.

The full C check interval is rarely utilised, since airlines have to coordinate operating schedules with hangar slot availability. This inevitably leads to compromises in check scheduling. Airlines also have to consider periods of peak traffic demand, and often find that checks have to be planned for low season times. Overall, an 90% utilisation of base check interval is typical, meaning that only 14 months of a 15-month interval are likely to be used, and 16-17 months of an 18-month interval. "Planning for check timing can be fairly accurate because many of the aircraft are used on long-haul flights. This means it is often possible to use about 95% of the interval," says Martin.

This rate of interval utilisation applies to all aircraft types. Since base check intervals are similar for most generations of aircraft, fleet size will have the biggest influence on the volume of base checks generated by widebodies.

WIDEBODY FLEET FORECAST DEVELOPMENT 2005-2015

Aircraft type/family	2005	2010	2015
747-400	624	700	710
747-8		10	130
777	548	837	1,060
787		120	370
A330-200/-300	391	595	625
A340-200/-300	238	266	290
A340-500/-600	75	214	320
A350		30	200
A380		96	240
Sub-total	1,876	2,964	4,185
747-200/-300	337	272	150
767 family	861	865	745
DC-10/MD-10	158	119	57
MD-11	173	195	193
A300-600	294	342	342
A310	204	207	165
Sub-total	2,027	2,000	1,652
Total	3,903	4,964	5,837

Source: Aerostrategy

Fleet development

It is generally accepted that traffic growth will lead to fleet expansion. A summary of forecast widebody fleet development over the next 10 years to 2015 is shown (see table, this page). This clearly shows the decline in the number of older generation widebodies, which are no longer in production, and the increase in the fleet of new generation aircraft to accommodate growth and replace older aircraft.

The total fleet comprises about 3,900 units in 2005 and is forecast to reach 5,800 by 2015, an increase of 45%. The new generation aircraft include the 747-400, 747-8, 777, 787, A330, A340 family, A350 and A380. This group accounts for about 50% of the fleet in 2005, a figure that is expected to rise to 70% (4,200 aircraft) by 2015.

The majority of the aircraft in this fleet are Boeing models, which are expected to maintain a dominant position over the next 10 years.

The group of older generation aircraft will decline by 17% from its current volume of about 2,000 to about 1,650.

New generation Boeing

This group of aircraft includes the 747-400, 747-8, 777 and 787. The 747-400, although not a new generation

aircraft, continues to be manufactured and is expected to continue to sell in small quantities until 2010 or 2011. The majority of 747-400s ordered will be freighters. The current fleet of 624 is forecast to grow by about 10 per year and reach 710 by the end of 2015, making the 747-400 the third largest fleet of all, as well as modern widebodies.

The 747-400 will be superseded by the larger 747-8, the first of which will not go into service until late 2009. The initial rate of production means the fleet should have only reached about 10 by the end of 2010. Annual production volumes will increase to 24 for the first few years, so the fleet will have only reached about 130 units by the end of 2015.

The 777 fleet of 550 aircraft at the end of 2005 is forecast to reach 840 by the end of 2010 and 1,060 aircraft by the end of 2015. This is an overall increase of 600 aircraft, with an average growth of about 40 per year. This will also make the 777 family the most popular widebody by 2015, although A330s, A340s and A350s combined will still outnumber the 777 by about 375 units.

The 787 has had a rapid sales success after being launched in mid 2004, attracted 233 firm orders and more than 300 commitments. The first aircraft is due to be delivered in 2008 and production is expected to increase from an initial rate of 20 per year to 50 per

year up to 2015, by when the fleet is likely to reach 370 units.

This development of modern Boeing types will take the fleet from the current volume of 1,170 aircraft to 2,270 by the end of 2015.

New generation Airbus

The group of modern Airbus widebodies will undergo some evolution over the next 10 years as two new types, the A380 and A350, enter service. The number of A340-500/-600s will also increase significantly.

The A330-200/-300 is currently the dominant type, with the A330-200 having sold well over the past nine years, and both types expected to continue selling until the A350 enters service. The A330 fleet will reach about 625 units by the end of 2015, representing an average annual delivery rate of 20 aircraft. The A330-200/-300 will be the second most numerous aircraft in operation by this time.

Sales of the A340-200/-300 have slowed considerably since the -500/-600 series aircraft and 777 family came on the market. The A340-300E has been the only model of the -200/-300 series to sell in any appreciable numbers. Orders are forecast to continue to be low at about 5-10 aircraft per year, although the type is eventually likely to be overshadowed by the A350-900. The number of A340-200/-300s is forecast to reach about 290 units in 2015, making it a niche aircraft in the widebody maintenance market, although it is close to the A330 and A340-500/-600 models.

The A340-500/-600 fleet is small, with aircraft having gone into operation in 2002 and 2003, and initial being weak. The fleet will have only reached 75 by the end of 2005. Sales are also expected to be weakened by the arrival of the A350-800/-900. The aircraft is expected to continue to sell at an annual rate of about 25, with the fleet reaching about 320 by the end of 2015.

The newly-launched A350 has so far won 140 commitments since late 2005. The A350-800 and A350-900 are pitched to compete with the 787-8/-9 and 777-200. The A350 is expected to become a major player in the medium-sized, long-haul aircraft market. Deliveries will start in 2010 at an expected annual rate of 30 units, taking the fleet to 200 aircraft by 2015.

The fleet of A330s, A340s and A350s is thus expected to increase from the current 704 aircraft to about 1,675 aircraft by 2015. These three types share much of the same basic structure and systems and so can be considered as one group or fleet from a maintenance point of view. This makes the A330/A340/A350 the largest fleet and most important



group of widebody aircraft.

The A380 will enter service in late 2006 and has won 149 firm orders to date. Deliveries will average 24 per year, with the fleet reaching 240 by 2015. The total number in service will therefore not be sufficient to sustain a large number of maintenance providers for this niche aircraft.

Old generation

The 767 family is the largest fleet of old generation widebodies. Although the 767 remains in production, there are few orders outstanding and production will be phased out as the 787 enters service in 2008.

The fleet of 860 aircraft is thus expected to continue to grow until about 2007, when it will reach its peak. Despite the arrival of the 787 and A350, the 767 will remain a popular workhorse. Many aircraft are still young and the aircraft is likely to have an active life of 25-30 years. A large number are likely to be converted to freighters over the next 10-15 years. The aircraft has a good range capability and so will offer freight carriers good performance. A few aircraft will be retired, however, and the fleet is forecast to decline to about 745 by 2015. Despite this, the 767 will be the fourth most numerous aircraft after the A330/A340/A350, 777 family and 747-400.

The 747-200/-300 fleet has been in gradual decline, accelerated by the advent of the A340-500/-600 and 777 family that have replaced large numbers of older widebodies. The 747-200/-300 are also maintenance-intensive, and no aircraft are likely to be put through their sixth D check. This implies a maximum life of

about 30 years for the aircraft. The last were built in 1987, suggesting all aircraft could be retired by 2017-2020. Most 747-200/-300s are operated as freighters or for niche passenger carriers. The fleet will decline by at least 25 units per year, and only about 150 will still be operational by 2015.

The DC-10 fleet has already declined significantly. The original fleet of about 400 passenger aircraft has been reduced to 160, including 34 MD-10s. The DC-10 fleet is expected to decline by about 10 aircraft per year for 5-7 years and then at a faster rate, leaving only about 25 in service by 2015. The MD-10s operated by FedEx are expected to remain in service.

The MD-11 has a unique capacity as a freighter that is in high demand, and all available aircraft are likely to be converted to freighter. All MD-11s are also likely to remain in operation for up to 30 years, and even longer in some cases. The first aircraft built in 1989 may therefore not be retired until about 2020. The fleet of active aircraft is therefore forecast to remain stable, with the few aircraft currently in storage, or being converted, joining the fleet.

The A300-600 is still being built in passenger and freighter variants, although at low annual rates of production. The fleet is forecast to reach its peak in 2008, but will stabilise over the next 10-15 years as many passenger models are likely to be converted to freighter.

All A310-200s have been converted to freighters, and the portion of A310-300s that have been modified is also steadily increasing. Most freighter aircraft will remain in service beyond 2015, but not all aircraft will get converted to freighter and so the fleet will gradually decline to

The A330/A340/A350 family will account for about 1,200 base checks per year by 2015; the largest of all widebody types. The A330 will account for about half of these checks.

about 165 by 2015.

Overall, the fleet of older generation aircraft is expected to peak at about 2,080 units in 2007 and gradually decline thereafter. The 767 family and A300-600/A310 will form the largest fleets.

Base check activity

The largest fleets that will develop over the next 10 years will generate a proportionate amount of base checks. The 777 will be the largest single-type, but the A330/A340/A350 will form the largest group with up to about 1,650 aircraft, and so generate the largest number of base checks (see table, page 42). This will make the 777 the second largest fleet.

The 747-400 will account for the third largest fleet, followed closely by the 767. The three main 747 variants will total about 990 aircraft. These four main groups will have a combined fleet of about 4,450 aircraft; about 85% of the widebody fleet. These will account for a similar portion of widebody base maintenance activity.

The 787, 747-8 and A380 will still be niche but growing markets by this stage, while the DC-10, MD-11 and A300-600/A310 will be specialised aircraft.

A330/A340/A350 families

The A330 and A340 have the same base maintenance programme as all other Airbus types: a system of eight C checks, with the C4 and C8 checks combining structural inspections and so forming the heaviest checks.

The maintenance planning document (MPD) interval for the C check is 15 months, and so the whole cycle has an interval of 120 months or 10 years. Some leading operators have, however, had their C check intervals extended to 18 months and the complete cycle interval to 11 or 12 years. For either C check interval, the A330/A340 have a heavy every fourth visit.

Given that an aircraft's first base check will take place the year after its delivery, that typical interval utilisation is about 85%, and given the additional work that is generated by switching between operators and owners; the fleet will generate on average a number of base checks each year equal to about 90% of the aircraft in service. The A330 fleet

stood at about 330 in 2004 and so will generate about 296 base checks in 2005, and the fleet of 390 in 2005 will generate about 350 checks in 2006. The growth of the A330 fleet to 625 aircraft by 2015 will generate about 550 base checks in 2015. "The A330 will be a dominant type in 10 years, and by then its number of base checks should have about doubled," predicts Martin.

Lighter C checks are currently consuming 5,000-6,000MH, but this is for aircraft in their first base check cycle. Not enough aircraft have yet entered their second base check cycle to give an indication of how this number of MH might change.

The A330 also uses in the region of 25,000MH in its smaller structural checks, the C4, and 40,000-45,000MH in its largest C8 check.

On the same basis, the A340-200/-300 fleet will generate about 210 base checks in 2005. The small increase in the fleet by 2015 will result in about 260 base checks in the same year. The A340-200/-300 consume a similar number of MH in their lighter C checks, but use about 5,000 more MH in their structural checks.

While the A340-500/-600 fleet will result in about only 50 base checks in 2005, the forecast development of a fleet of more than 320 will be generating about 270 base checks per year in 2015, a quarter of which will be structural checks. "The A340-500/-600 will experience one of the highest increases in the number of base checks. The first C4/IL checks are not due until 2006, but by 2015 the fleet should be generating about 80 heavy checks per year," says Martin.

The A340-500/-600 are too young for there to be reliable figures of MH consumed in later C checks in the cycle and the two structural checks. These aircraft are stretch developments of the A340-300, and some of their structures are also larger, so a larger number of MH are therefore expected to be used for the

WIDEBODY ANNUAL BASE CHECK FORECAST 2005-2015			
Aircraft type/family	2005	2010	2015
747-400	509	594	602
747-8			74
777	523	814	1,069
787			198
A330-200/-300	296	504	554
A340-200/-300	211	233	263
A340-500/-600	51	166	268
A350			116
A380		41	160
Sub-total	1,590	2,315	3,303
747-200/-300	286	231	128
767 family	732	735	633
DC-10/MD-10	134	101	48
MD-11	173	195	193
A300-600/A310	349	384	355
Sub-total	1,674	1,647	1,357
Total	3,264	3,998	4,660

routine structural inspections and non-routine defects that arise. Other portions of C checks, however, should use a similar number of MH to the A340-200/-300.

The C check interval for the A350 could be as long as 24 months, and the full base check cycle could have an interval as long as 14 years. On the basis that the actual achieved interval is 18 months, the fleet will be generating about 110 base checks by 2015.

These three major types will generate about 556 base checks in 2005, but this number will have increased to about 1,200 checks in 2015 (see table, this page). About half of these will come from the A330 fleet and 530 will be checks for all A340 variants. The A350 fleet should

have reached about 200 aircraft, and so generate in the region of 120 checks per year.

777 family

The 777 was developed with maintenance task intervals determined in phases. Tasks in the base checks have intervals of 12 and 24 months, and so operators have arranged base check programmes with checks with a basic 12-month interval. Like the 767, the 777 also has structural items that have intervals specified in calendar time and flight cycles (FC). Many operators thus have a system of a base check every 12 months, with checks alternating between light and heavy checks. Most operators

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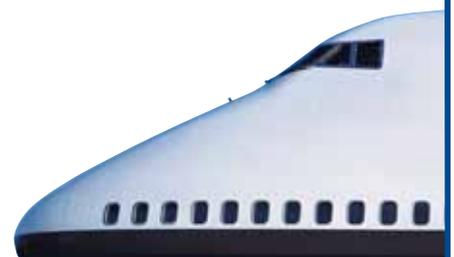
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complete their base check cycles every four years.

The C check interval means the annual number of checks is similar to the number of active aircraft. Considering the time-lag effect of aircraft delivery, the 500 aircraft in the fleet in 2004 will result in a similar number of checks in 2005. Development of the fleet to 1,060 aircraft by 2015 will generate about 1,070 base checks in the same year (see table, page 46).

Lighter C checks are consuming in the region of 5,000-6,000MH and heavier checks 7,000-9,000MH.

747-400

The 747-400 fleet varies in age between 0 and 16 years. Most aircraft are operated with a C check interval of 15-18 months and a D check every 60-72 months that coincides with the fourth C check. The cycle is thus completed about every five years. The fleet is therefore divided between aircraft that are in their first, second and third base check cycles. A small number of aircraft may be in their fourth cycle.

The average interval of 15-18 months means the fleet will generate an annual number of checks equal to about 85% of the fleet size. The fleet of 575 aircraft in 2004 will result in about 500 base checks in 2005, and fleet growth to 710 aircraft by 2015 will generate about 600 base checks annually (see table, page 46). One quarter of these will be D checks.

C checks consumed 5,000-6,000MH in early base check cycles, but the number of MH required will increase to 10,000-12,000 with higher cycles. Second D checks consume 55,000-60,000MH, but

this will also increase for the third and fourth D checks.

The 747-200/-300 fleet has an average interval of about 15 months and so is expected to generate about 130 checks in 2015. The new generation 747-8 may have an interval as long as 24 months, with some -400 operators having 18-month intervals on their checks. On this basis, the fleet is forecast to require about 75 base checks in 2015.

767 family

The 767 has a maintenance programme of system checks with an FH and 18-month interval and structural checks with an FC and 18-month interval. The interval for C checks is thus 18 months. The base check cycle is completed every fourth C check. The actual likely interval of 15 months means the base check cycle will be completed about every five years. The first three light checks consume 6,000-9,000MH, while the heaviest C4 checks use 20,000-25,000MH.

The average interval of 15 months means that the number of annual checks is equivalent to about 85% that of the aircraft in operation. The 767 fleet thus generates about 730 checks per year, which number is forecast to gradually decline over the next 10 years to about 630 checks (see table, page 46).

These four major types will generate about 2,300 base checks in 2005. By 2015 their dominance of the widebody fleet and fleet growth will have seen this number rise to about 3,700 checks per year. This is 80% of the total expected volume of annual checks that will be generated by the widebody fleet.

As an aircraft family, the 747 fleet will generate about 800 base checks each year in 2015. This will make it the third most important group of aircraft in the widebody maintenance market.

Other widebodies

The 787 will have a 36-month base check interval, the longest for all aircraft types. The first checks will not be performed until 2011 and the time-lag effect means the fleet will require about 198 checks in 2015. The A380 is expected to have a base check interval of 24 months, and on the basis of an actual interval of 20 months the fleet will only require about 160 checks in 2015.

The A300-600 and A310 will generate about 355 base checks, the most for all old generation types.

The MD-11 and 787 will have similar fleet sizes by 2015, with each generating about 200 checks per year. The 787 fleet will, of course, be growing at this stage while the MD-11 fleet will be gradually declining. The DC-10/MD-10 will have the smallest number of checks.

Maintenance market

Several factors make it difficult to determine how the supply of maintenance capacity compares to demand for base checks. One of these is because the use of hangar bays for both narrowbodies and widebodies, and civil and military aircraft. Some large airlines also do not sell surplus capacity to smaller airlines, while the surplus capacity of others is constantly varying.

"We try to analyse how much maintenance capacity is supplied to the market," says Martin "but this is difficult. It seems that there is a 10-15% oversupply of maintenance slots in the current market. We expect to see a peak in demand in 2007-2009 as the peak of aircraft that were delivered in the late 1990s come due for their first heavy checks. This anticipated peak is evident as operators are already asking for check slots.

"Although the fleet is expected to grow by about 30% over the next 10 years, there are also a few airlines building additional facilities because of the large orders that have been placed in recent years. This is especially in the Asia Pacific, Middle East and India. The overall supply-demand situation in the widebody maintenance market is therefore not expected to change much except for peaks in demand. Suppliers will still have to compete in terms of labour efficiency, quality and overall cost to the airline." **AC**