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## Boeing vs. Airbus: The Pendulum Begins to Swing Back to Boeing

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### **Airbus' 2004 Leadership Position Is Challenged**

After enjoying leadership of the market for large commercial airplanes for decades, Boeing lost that status in 2003 to the European challenger Airbus, which delivered 24 more airplanes in that year. Airbus went on to deliver 320 units in 2004 versus Boeing's 285. Orders were even more skewed toward Airbus in 2004, with 370 versus Boeing's 272.

Over the past six months, however, we have seen momentum shift toward Boeing. There are three factors that make a difference in market share: alignment with the installed base of aircraft; strength of product portfolio; and cost. Boeing is regaining lost ground versus Airbus with a strong widebody product portfolio that we believe is leapfrogging Airbus in performance. Second, the combination of a weaker dollar and aggressive cost reduction efforts have neutralized Airbus' prior cost advantage. Airbus aggressive market strategy in the narrowbody segment is likely to ensure a long-term narrowbody market share advantage, while Boeing retains a lead in the widebody installed base. We expect, therefore, that Airbus will continue to lead in share of unit deliveries through 2009, but that Boeing will take the lead by 2009 in the high-value widebody segment.

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### **Airbus' Installed Base Should Ensure Long-Term Narrowbody Share Advantage**

Airbus' most impressive market achievement has been its performance in overcoming Boeing's historical advantage to capture leadership in the industry installed base in narrowbodies. Controlling the installed base is increasingly important as airlines look to simplify their fleet structures and are stressing the importance of commonality. Commonality helps to cut maintenance costs, reduce pilot training requirements and simplify operations.

In evaluating the installed base, it is necessary to look specifically at the airplanes that drive commonality. Widebody and narrowbody decisions tend to be made separately today, with many airlines having different widebody and narrowbody suppliers. Commonality is more important for narrowbodies, because airlines view the Airbus and Boeing products as essentially equivalent (despite many competing claims to the contrary). Only a few airlines operate mixed narrowbody fleets and those tend to be airlines with strong government influence, particularly the major Chinese carriers.

Exhibit 40 shows the alignment of fleets by manufacturer. The installed base refers to the number of aircraft (new or old) that fall into the narrowbody or widebody categories. For narrowbodies, alignment means that the airline operates or has ordered from either the Boeing 737-NG family or the Airbus A320 family. An Airbus-aligned carrier will tend to grow its fleet or replace older narrowbodies with Airbus products. Unlike airlines operating 737-NGs, airlines operating only older 737s generally view the next purchase decision as an even choice between Airbus and Boeing. In Exhibit 40, Airbus' progress with narrowbodies is apparent. Airbus has 35% of the narrowbody installed base compared to only 30% for Boeing. There remain a large number of unaligned carriers in Europe and Asia. In Europe, these carriers are primarily small charter carriers or airlines in the former Soviet

Union that still operate older (primarily Russian) aircraft. The mixed carriers in Europe are exceptions, with SAS narrowbodies largely aligned with Boeing (SAS operates eight A321s) and easyJet in the process of moving to an Airbus fleet. We expect Airbus' advantage in narrowbodies to translate into long-term market leadership, because companies are reluctant to switch suppliers in this class.

#### Exhibit 40 Global Alignment of Passenger Aircraft Fleets (January 2005)

##### Widebodies

	North America	Europe	Asia	Australia/Pacific	Middle East	Latin America	Africa	Total	Share
Airbus	163	289	143	76	62	41	37	811	25.3%
Boeing	452	185	361	18	83	24	9	1,132	35.4
Mixed	-	159	511	-	93	-	17	780	24.4
Unaligned	48	191	102	9	45	24	58	477	14.9
<b>Total</b>	<b>663</b>	<b>824</b>	<b>1,117</b>	<b>103</b>	<b>283</b>	<b>89</b>	<b>121</b>	<b>3,200</b>	<b>100.0%</b>

**Boeing Position Advantage**  
Use of mixed fleets is common, limiting size of advantage  
  
More than one-third of market remains open — greatest opportunity in Asia, where Boeing leads

##### Narrowbodies

	North America	Europe	Asia	Australia/Pacific	Middle East	Latin America	Africa	Total	Share
Airbus	1,439	1,341	328	42	65	200	55	3,470	35.2%
Boeing	1,997	409	247	113	26	178	30	3,000	30.5
Mixed	23	362	336	-	-	-	114	835	8.5
Unaligned	245	1,067	591	17	77	310	236	2,543	25.8
<b>Total</b>	<b>3,704</b>	<b>3,179</b>	<b>1,502</b>	<b>172</b>	<b>168</b>	<b>688</b>	<b>435</b>	<b>9,848</b>	<b>100.0%</b>

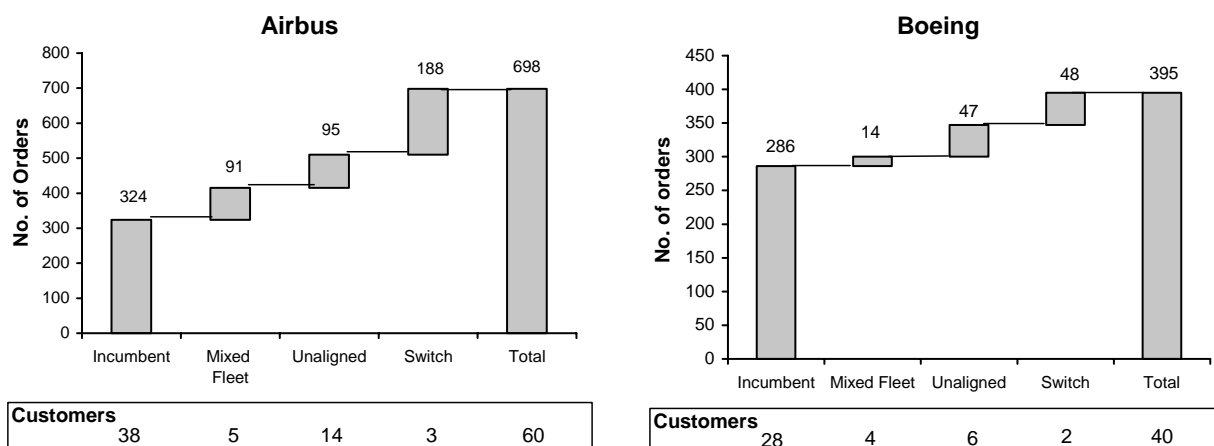
**Airbus Position Advantage**  
Understates Airbus lead, given LCC growth  
  
Orders likely to split by share of base  
  
Principal opportunity for share gain in Asia and with new carriers

**Note:** Shading indicates more than 60% of fleet.

Source: Airclaims and Bernstein analysis.

In widebodies, Airbus still trails Boeing, despite the success of the A330. For widebodies, alignment is defined as having A330s or A340s for Airbus and having 777s for Boeing. Boeing also retains the advantage in the fastest-growing market, Asia. The advantage of the installed base for widebodies can be less important than that for narrowbodies, as many carriers have mixed widebody fleets with different aircraft tailored to different routes. Yet, given the higher value and higher margins associated with widebodies, it will be important for Airbus to continue its focus on broadening its installed base.

The impact of the narrowbody installed base can be seen in Exhibit 41. Most customer orders are made with the supplier that is aligned with the customer's installed base. Airbus has achieved three major successes in getting Boeing customers to switch alignment: South African Airways (in 2001, prior to Exhibit 41), easyJet and Air Berlin (Hainan was also a switch in 2004, but less significant given the predisposition toward mixed fleets in China). The major Boeing switch from Airbus was at All Nippon Airways. Airbus also led in unaligned orders roughly by two to one. Many of these orders were from new low-cost carriers. Because of these wins, we believe that Exhibit 40 understates the strength of Airbus' narrowbody installed base, since the new low-cost carriers lack large active fleets, but are likely to have significant growth. Through 2009, we expect the installed base to enable Airbus to retain the lead in narrowbody orders. As described above, the widebody market remains much more open. While Boeing has the installed-base advantage, market shares will depend on the relative success of the A350 and 787 product launches.

**Exhibit 41 Narrowbody Direct Carrier Orders from Airbus and Boeing (2002-04)**

Source: Airclaims and Bernstein analysis.

**Expect Airbus Product Portfolio Advantage to Decline in 2008-10**

After trailing Airbus in new product development over the last five years, Boeing has now captured the advantage. With the 787 launch and the introduction of the 777-300ER and 777-200LR, Boeing has taken the lead in the valuable midmarket and large widebody segments.

Widebody aircraft generally deliver higher margins than narrowbodies, primarily because of the differentiation of the products. The A320 and the 737-NG families are viewed as roughly equivalent products by the airlines. Both sets of products can adequately address any of the intraregional needs of airlines. In contrast, widebodies have to respond to diverse range and payload requirements. Fuel efficiency is also much more important.

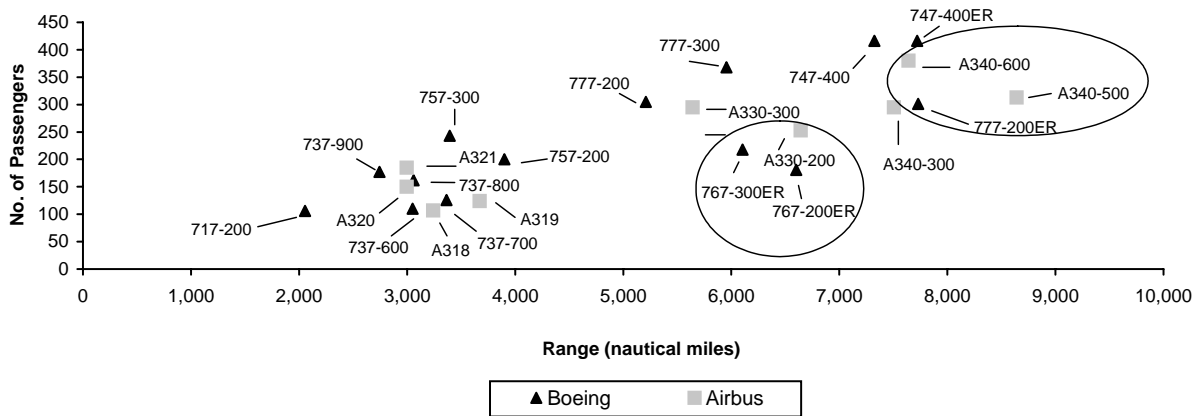
Airbus moved into the lead in product differentiation, first with the A330 and A321 (narrowbody, but differentiated by range/payload), and then with the A340-500 and A340-600. The A330 moved past the 767 and became a strong seller for Airbus, with high margins. The A340-500 and A340-600 offered greater range than competing 777 models. While the number of A340-500s sold remains small (16 deliveries to date and 26 in backlog), the airplane has provided the ability for carriers to complement their fleets with an airplane that provides commonality and enables non-stop flights on important long-range routes (e.g., Dubai-New York and Singapore-New York). In addition, the A321 came in just below the aging 757 to offer a smaller midmarket aircraft, providing commonality with the A320 family. Finally, in the very large segment, the new A380 is the most differentiated product in the market. We believe demand will continue for the A380, but expect it will serve a niche market on a limited number of hub-to-hub routes where high capacity is needed.

Differentiation goes in cycles and we now see the pendulum swinging back toward Boeing. With the 777-300ER and 777-200LR going into service, Boeing has taken the advantage relative to both of Airbus' new A340 models, as the 777 models offer greater range, lower maintenance costs, and higher speed and thrust than their A340 counterparts. Boeing's 787 will change the dynamic of the midmarket, where the Airbus A330 has owned the space against the 767. Airbus is responding to the 787 with a derivative of the A330, the A350. We believe that this was the company's only choice in order to not overly devalue the A330. As a derivative, the A350 is positioned to extend the product line for the A330, given its common type rating. There is the very

real risk, however, that pricing for A330 purchases may still weaken, as carriers look toward new product introductions (A350 or 787) in 2008-10.

Exhibit 42 shows the product portfolios for Airbus and Boeing from 1998 to 2003. The circled areas show portions where Airbus held the advantage, based on the A340-500, A340-600 and the A330. Exhibit 43 shows the product portfolios for Airbus and Boeing moving forward. This later period shows the new products (boxed), including the A350 and 787. Real transaction prices are difficult to ascertain, but we expect that any premium Airbus had been able to gain from its long-range products has now shifted to Boeing with the new 777 models. This effect should be seen in margins by 2007, when the bulk of long-range deliveries will come from 2005 orders.

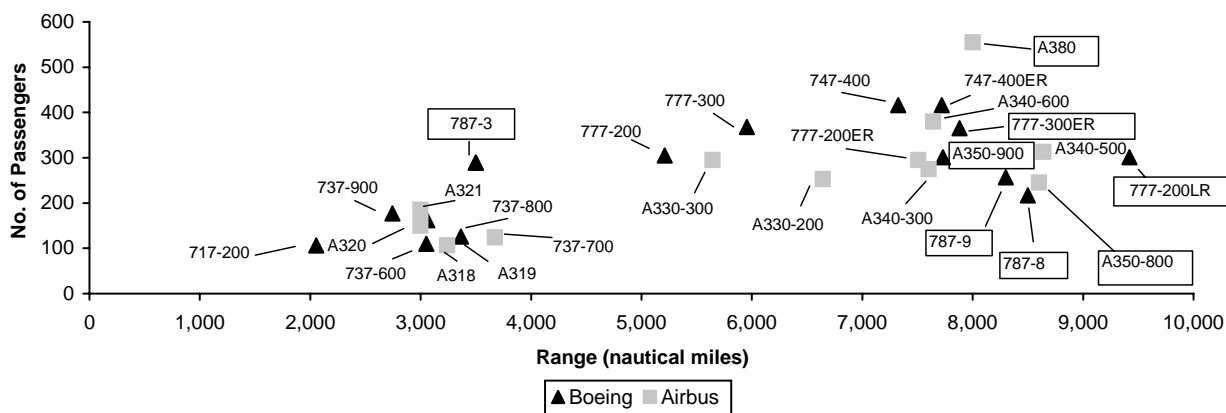
**Exhibit 42 Recent Airbus and Boeing Product Portfolios (1998-2003)**



○ = Area of Airbus Advantage

Source: Airbus, Boeing and Bernstein analysis.

**Exhibit 43 Future Airbus and Boeing Product Portfolios (2004-09E)**



□ = New Products

Source: Airbus, Boeing and Bernstein analysis.

**Battle for the Midmarket:  
787 vs. A350**

The challenge for Airbus is to make the A350, as a derivative, a success against the clean-sheet 787.

Boeing's 787 targets the midmarket and has the potential to recapture leadership in that segment. The product is intended to offer lower operating costs, with 20% better fuel efficiency than older models, as well as to support route fragmentation, a trend that has progressed steadily as suitable new equipment has become available. The airplane will likely have other advantages resulting from its composite structure that may be difficult to match, including longer maintenance intervals (e.g., D checks at 12 years versus six years; C checks at three years versus 18 months) and higher cabin pressure and humidity. Although the value of the cabin benefits is difficult to estimate, initial airline feedback is positive. In addition, Boeing will likely look to move its 787 technology platform to a next product (e.g., 737 replacement).

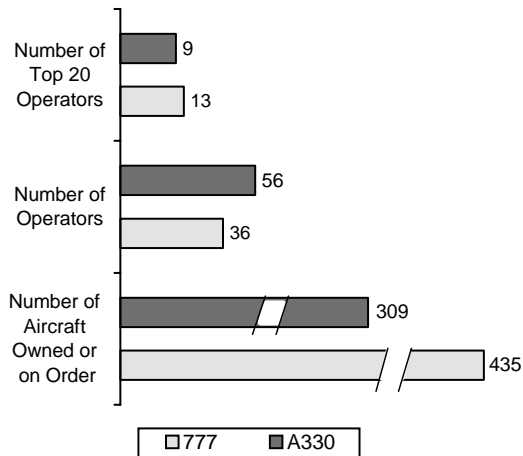
We see two principal risks for the 787. First, there are the cost and schedule risks. We estimate 787 development cost to Boeing to be approximately \$7.5 billion. There is risk here associated with the three variants to be introduced: the short-range 787-3; the base 787-8; and the stretch 787-9. It is optimal to introduce the larger 787-9 by the end of 2010 (as planned), when the A350 should be introduced. However, this compressed schedule raises the challenge of meeting cost and schedule targets. Second, the management of risk-sharing partnerships will be more complex and involve more responsibility than on any previous Boeing project. Contracts are structured as fixed-price arrangements, in order to remove performance risk from Boeing. Practically, however, there is no way to completely eliminate partner performance risk. Performance of the partnership structure will be an important area to watch, although we believe any potential problems will not become apparent until 2007 at the earliest.

Airbus, responding with the A350, faces a real competitive challenge. First, the A350 is planned to enter service two years after the 787. At an estimated cost above \$5 billion, the price is at least two-thirds of our estimate for Boeing's cash costs to bring the 787 into production, but Airbus will be constrained by the existing A330 design. Relative to the A330, Airbus has said it will take 8 tonnes (metric tons) of weight out of the A350, before engines. By contrast, Boeing is targeting a reduction of 8-10 tonnes versus the A330, including engines, with the advantage of a clean-sheet design. Airbus' reduction target will likely be a challenge, given existing design constraints. The addition of heavier high-bypass engines to the A350 will likely limit the weight reduction to 4-5 tonnes in any case. Furthermore, even though the A350 will be a derivative of the A330, the use of composites will require a new wing line for A350 production.

The advantage the A350 will have is the installed base of A330s, given the A350's common-type rating. While the 787 and 777 will have different type ratings, Boeing will be leveraging commonality. Differences training is intended to be low, at two to three days for pilots moving between a 787 and 777. Unlike Airbus, however, Boeing will most likely not be able to facilitate mixed-fleet flying across its types.

We expect the 787 to lead the A350 in performance. If, however, performance differences between the 787 and A350 turn out to be relatively small, the installed base should play a significant role in splitting the market. Exhibit 44 shows the number of A330s and 777s, as well as the number of operators of each. The A330 is now flown by more carriers than the 777, although at fewer of the largest carriers. While we expect the base of the A330 to ensure competitive demand for the A350, we are concerned that six

of the seven largest operators of A330s also fly 777s, which should neutralize any commonality advantage. In addition, the one carrier among the seven largest A330 operators that does not fly 777s (Northwest Airlines) already has made the decision to go with Boeing on the 787 (see Exhibit 45).

**Exhibit 44 Current Base of A330 and 777 Operators**

Source: Airclaims and Bernstein analysis.

**Exhibit 45 Number of A330s in Service or on Order by Airline**

Airline	Number of A330s
Emirates Airlines	29
Cathay Pacific	23
Korean Air	19
Malaysia Airlines	16
Air France	14
Northwest Airlines	14
Thai Airways International	12
Qantas	11
Qatar Airways	11
Dragonair	10
LTU	10
Lufthansa	9
Swiss	9
US Airways	9
Air Canada	8
Philippine Airlines	8
Aer Lingus	7
Garuda Indonesia	6
Gulf Air	6
Other	85

Note: Shading indicates also a 777 operator.

Source: Airclaims and Bernstein analysis.

The 787 will have the advantage of being first-to-market in 2008 versus the A350 in 2010 (assuming neither is hit by significant delays — a major assumption). The A350 will, however, have a size advantage during a period of rising airline demand (airlines tend to favor larger airplanes during the upcycle). Boeing's addition of six seats to the 787-8 narrows the gap to approximately 20 seats, but we expect the larger A350 to be attractive to many carriers. An important decision point will be when Boeing firms the in-service date for the 787-9. If this stretch aircraft, with 257 seats (like the A350-800) is brought out in 2010 (as now planned), Boeing will have more than neutralized the A350's size advantage.

### A380 — Success Level Will Not Be Known Until 2007

We see the A380 as a niche product, which should serve large hub-to-hub routes effectively. It has received enough orders to carry production well through the decade. One can debate whether or not the program will reach breakeven, but it does not matter at this point. We believe that the ultimate success of the airplane will not be known until it has been in service for one to two years and airlines have explored new ways to use the capability. For this reason, we expect surprises on the upside for the A380 to be unlikely until late 2007.

A successful A380 program should be about lowering seat-kilometer costs. Reducing airport congestion has been one of the principal arguments for the airplane. We see that as a minor issue, as only a few of the densest routes have stayed with very large aircraft. If the A380, however, delivers on its promise of 20% lower cost per available seat-kilometer, there will be considerable competitive pressure to use the airplane. If the A380 is introduced by a competitor on a key route (e.g., by Lufthansa versus Japan Airlines or ANA on Frankfurt-Tokyo) and delivers significantly lower costs,

the other airline will need to respond. In addition, we expect the most successful use of the aircraft will be at high density (above 700 seats), where the cost savings are assured and could enable new groups of passengers (e.g., from China or India) to access long-haul routes. Such high-density configurations are already being planned by some initial A380 customers.

Surprises on the downside for the A380 are still possible in the near term. We have seen weight issues, delays in the first flight, and delays in the first deliveries to Singapore Airlines. The A380 should add to profitability, but the real A380 profit impact should occur after the early, deeply discounted orders are delivered from 2006 into 2008.

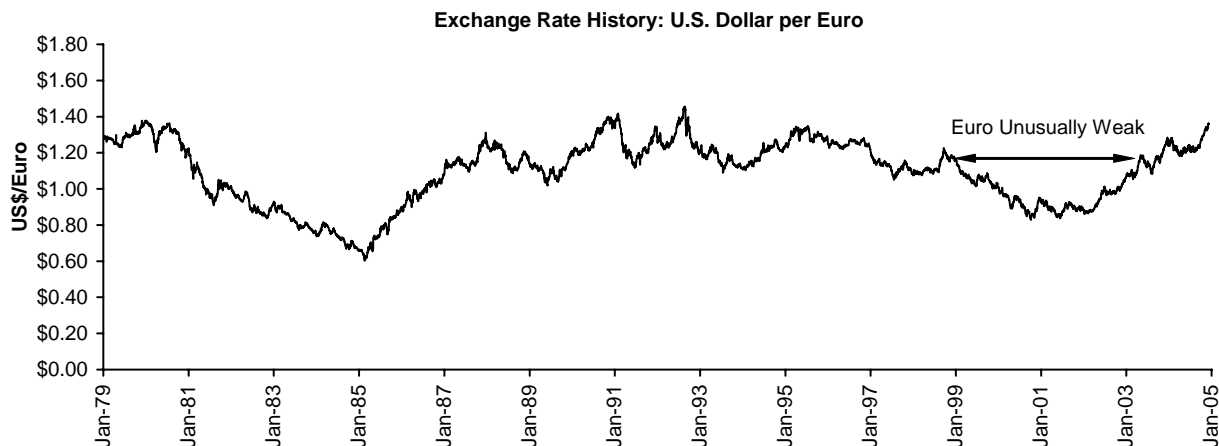
### Airbus Cost Leadership Coming Under Pressure

Airbus, through high levels of capital investment, appears to have achieved a significantly lower cost structure than Boeing in 2000 through 2003. As a basic estimate of cost difference, from 2001 to 2003, Airbus reported operating margins before R&D from 15.6% to 18.1%. During that same period, Boeing Commercial Airplanes' (BCA's) operating margins before R&D, on a unit cost basis, ranged from 6.8% to 12.7%. While the numbers are not precisely comparable, they indicate that Airbus' margin may have been at least 5% better than those at BCA, before R&D. Some of the Airbus advantage in those years was likely from premium prices on specific products (e.g., A330), but our assumption is that most of the difference was related to cost.

Part of the reason for Airbus' recent cost advantage was a period of unusual weakness for the euro versus the U.S. dollar from 1999 through 2003. In order to look at long-term price history for the euro, we use the European Currency Unit (ECU: 1 ECU = 1 euro) back to 1985, and an equal weighting of the French franc and German mark to extend our data back to 1979. As Exhibit 46 shows, the euro appears to have been unusually weak from 1999 into 2003, making Airbus more competitive than it would otherwise have been. However, with the euro now at \$1.27, the euro is above its long-term average against the dollar, placing Airbus' margins under pressure.

### Exhibit 46

### The Euro Was Unusually Weak vs. the U.S. Dollar from 1999 Until 2003



**Note:** Prior to January 1999, a European Currency Unit is used as a Euro proxy. Prior to May 1985, equal weighting of German mark and French franc used as a Euro proxy.

Source: FactSet and Bernstein analysis.

Airbus receives essentially all of its revenue in dollars, and is naturally hedged on approximately 54% of that revenue because of its purchases of subsystems, components and raw materials in dollars. Airbus has exposure on the remainder of its revenue, however, which covers final assembly, some structural components, SG&A, R&D, depreciation and amortization, and margin. Airbus hedges this residual exposure, largely through the use of forward contracts. Based on the company's reports, we estimate that the hedge book for all of 2004 was for approximately \$9.6 billion at a hedge rate of €1.00 = \$0.96. Since the actual exchange rate in 2004 was €1.000 = \$1.242, the hedge book for the year was worth approximately €2.3 billion. Since Airbus' EBITA for 2004 was €1.9 billion, so that without the benefit of the hedge book, Airbus would have been unprofitable and would have had a "core" EBITA of minus €400 million in 2004. Airbus' margins will be similarly enhanced for several years by its large portfolio of hedge positions. Hedges created during the weak-euro period will be highly profitable if the euro remains strong, and will offset the margin weakness that results from a strong euro. However, the value of the hedge portfolio will decline over time, and will reduce margins, creating a growing headwind for Airbus eventually as it becomes exposed to its true euro-based costs.

Airbus plans to address the challenge of a weaker dollar through cost reductions and higher volumes. Airbus is currently implementing its Route '06 cost-reduction program to reduce costs by €1.5 billion per annum by 2006. In addition, increasing delivery volumes will enable Airbus to better leverage its fixed costs (which are euro-denominated), which will improve dollar margins and increase the natural hedge on euro margins. When the cost initiatives and the effect of improved fixed-cost leverage are taken into consideration, as we will discuss in more detail in the chapter on Airbus, our analysis indicates that Airbus margins will stay near or above 2004 levels through 2006. Beyond 2006, however, as the hedges roll off and volume begins to flatten, margins will come down. Even if the dollar were to strengthen in 2007-08, the effect should be essentially the same, because Airbus' hedges on new sales would lock in today's high exchange rates for deliveries in the 2007-09 time frame.

For Boeing, a weaker dollar has provided breathing room while the company has addressed its own operating cost issues, and BCA has made significant operational improvements over the last two years.

Through the downturn, Boeing has cut its costs substantially. Revenue per employee is currently near the same point as it was at peak production levels, even though volume has dropped by 45%. Gross margins are also close to peak levels today, and operations at BCA have been streamlined so that narrowbodies are assembled (including paint and field test) at Renton in two-thirds of the time it takes Airbus in Hamburg, Germany or Toulouse, France.

Airbus remains a very strong operator, and we believe the overall changes at Boeing (including exchange rates) place BCA roughly at cost parity with Airbus rather than significantly ahead. Nevertheless, this is a major shift forward for Boeing relative to the last five years, particularly when we believe that Boeing should be able to capture premium prices for its widebody products.



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