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Boeing and Airbus: Competitive Strategy in the Very-Large-Aircraft Market

In 1999 Airbus Industrie was reconsidering continuing its investment in building the world's first superjumbo jet airliner. For a \$20 billion company, this \$12 billion gamble could literally make or break the thirty-year-old European consortium. Airbus senior executives were sharply divided. Some argued that the superjumbo project was exactly what the market was waiting for, given commercial aviation business trends. Airbus had already invested \$500 million in this project, putting it ahead of Boeing in development. Why not take advantage of its lead? The problem was that Boeing had just announced it would launch a stretched version of its 747 that would carry nearly as many passengers as Airbus's superjumbo and would be produced for half Airbus's forecast investment. Boeing's commercial strength with Asian airline companies, built on decades of selling the 747, was also a factor. Without the early backing of some of these Asian companies, the Airbus project would never materialize. Boeing's announcement had surprised Airbus's executives, since for years Boeing had said the superjumbo market was too small to enter profitably. What could have made Boeing change its mind? And should Airbus enter this market, too?

Commercial Aviation Industry Drivers and Fundamentals

Drivers of the Current Demand

Airbus and Boeing customers were a mixture of airlines (both inter- and intra-continental), leasing companies, and financial institutions. The timing of order placements depended on a complex variety of factors, but orders tended to increase after airline profitability recovered from a period of low returns (see **Exhibit 1**). The profitability of airlines was driven by a variety of factors, including oil prices and the number of competitors in the same routes. The airlines' profitability also impacted the likelihood of new aircraft order placement by leasing companies, which in some years had accounted for two-fifths of Airbus's backlog and one-quarter of Boeing's. The more airlines sought to renegotiate the terms of their aircraft leases and/or return leased aircraft to lessors, the less likely the leasing companies and financial institutions were to place additional aircraft orders. Airplane order volume was uneven because of the way airlines forecast their own demand, often based on gross domestic product (GDP) growth, with results sensitive to gaps between predicted and realized growth. A study by Morrison and Winston indicated that GDP growth falling short of its predicted trend caused airlines to have excess

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capacity, while GDP growth exceeding its predicted trend caused airlines to have insufficient capacity.

Another demand driver for the leasing companies and financial institutions was the residual value of the aircraft. Because these firms owned the aircraft as assets, the increasing secondhand market value of the aircraft encouraged them to purchase aircraft. A third demand driver was fleet growth, which included replacement demand. The worldwide fleet of large passenger airplanes exceeded 12,000. This figure had almost doubled in the past fifteen years, and was set to increase 2 to 4 percent a year according to many industry forecasts (see **Exhibit 2**). In 2004 the average age of all Airbus airplanes was seven years; the average age for Boeing and McDonnell Douglas was fifteen years, which meant that close to half their fleets were nearing retirement, assuming that the lifespan of an airplane was thirty years.

The Future of Demand: Hub-and-Spoke or Point-to-Point? Regular Airlines or Low-Cost Companies?

Changing flights and waiting for connecting flights was time-consuming and unappealing to travelers. In fact, the growth of point-to-point traffic was what had fueled growth for low-cost airlines in Europe. They serviced routes between places that the traditional national carriers serviced only via hubs. The increasing demand for point-to-point traffic had led to an increased demand for smaller airplanes, which could operate more frequently and with fewer passengers. The Boeing 737 had been the winner in this segment so far. Intercontinental flights continued to operate predominantly from a hub-and-spoke model; the Boeing 747 had nearly exclusive control of this market.

By and large, Boeing was a strong supporter of “point-to-point” commercial travel. It argued that the airline market was fragmenting, with more growth coming from direct flights rather than from flights between big hub airports. Airbus believed that the “hub-and-spoke” would continue to dominate commercial flight and that, as landing slots at airports became scarcer, airlines would want to pack as many people as possible into their planes. Customers, meanwhile, would be attracted by the extra space and comfort on the larger planes. Although most runways were too short for the proposed superjumbos, Airbus believed that by the time manufacturing commenced, international airports on transcontinental flights would be upgraded.

The Main Cost Drivers in the Commercial Aerospace Industry

Variable costs corresponded to approximately 60 percent of sales.¹ Manufacturers grappled with several fixed costs. Labor corresponded to approximately 10 percent of sales; depreciation and amortization (converging with capital expenditures in the long run) was about 5 to 6 percent of sales; and research and development (R&D) could range from 6 to 10 percent of annual sales (though Boeing’s level was less than 3 percent of sales for R&D at the end of the 1990s).

For the launch of a new line of airplanes, there were additional and substantial sunk costs:

- The cost of developing new planes was very high because of the intensive studies required for technical or marketing reasons. Planes purchased was an important

¹ Morgan Stanley, EADS, September 2002.

investment item for carriers, and it engaged them on a broad range of issues (e.g., maintenance, pilot engaging and training, comfort and security) for the lifetime of the plane within the airline, which could range from twenty-five to thirty years.

- The new plane assembly lines might be different, requiring new facilities investment.

The investment risk could be somewhat mitigated by improving manufacturing costs through learning curve effects, whose existence might be signaled via occurrences of pricing below marginal costs during the initial stage of production (to quickly accumulate experience).²

But overall, new plane development often turned into large “bet the company” operations.

In the 1960s, Boeing spent heavily to develop the 747, and, in the early going, nearly sunk the company amid weak demand and other snarls. But ultimately, that first jumbo jet helped pave the way for Boeing's long dominance. . . . Competitors who didn't make such expensive capital investments fell by the wayside. That was the fate of McDonnell Douglas Corp.'s Douglas Aircraft unit. Its products faded out after a series of crashes and competitive woes starting in the 1970s, followed by the one illness from which no program could recover: management's hesitation to pay heavily for advancements and new planes.³

The big bets did not always pay off: the failures of the Anglo-French Concorde and Lockheed Corp.'s three-engine L-1011 airliner demonstrated that even when enough money was committed up front, success was not guaranteed. In any case, the size of the investment for a new plane was a key indicator of how much the jet manufacturer was ready to commit the company's future to that new plane.

The Critical Role of the Engine Suppliers

Turbo engines were the most expensive component of an aircraft. Whenever a customer purchased an aircraft, it had to specify the engine supplier. When new aircraft were designed, the engine suppliers placed bids specifying the cost at which they would provide the engines. Though exclusivity rarely occurred in the 1990s, aircraft manufacturers typically approved two engine suppliers for a new aircraft design. Engine suppliers, like the aircraft manufacturers, would dedicate resources to their design and manufacture once customers expressed interest in a new plane. Four major players existed in the 1990s: CFM International, General Electric, Pratt & Whitney, and Rolls Royce. Their commitment to invest in a new engine for a new superjumbo would be critical (see **Exhibit 3**).

² Pavcnik Arwin, “Airbus Versus Boeing Revisited,” Dartmouth College, March 2003.

³ “Big Gambles in the New Economy,” *Wall Street Journal*, November 3, 1999.

Two Competitors for One Market: Boeing and Airbus

The Leader—Boeing

The commercial airplanes segment of the Boeing Company was involved in development, production, and marketing of commercial jet airplanes and in providing related support services, principally to the commercial airline industry worldwide. Boeing was a leading producer of commercial airplanes and offered a family of commercial jetliners designed to meet a broad spectrum of passenger and cargo requirements of domestic and foreign airlines. This family of commercial jet airplanes included the 717, 737 Next-Generation, and 757 standard-body models, and the 747, 767, and 777 wide-body models. Boeing had phased out some of its older models, the 737 Classic for example. One key to Boeing's dominance was its largest commercial jet, the 747. In 1993 its latest version, the 747-400, could carry up to 450 passengers in a three-class configuration and sold at \$150 million each. With orders for 1,180 planes, Boeing "owned" the market and was not yet threatened by Airbus Industrie or McDonnell Douglas, its two main competitors. Taking into account the replacement effect, the 747 represented a secured rent for the near future. On average, Boeing would sell thirty-eight B-747s a year.

Except for that segment, Boeing's commercial airplane sales were subject to intense competition, primarily from Airbus. The major focus of commercial airplane development activities had been the 737 Next-Generation-900 model, the 747-400ER, the 747-400ERF, the 767-400ER, the 777-200LR, and the 777-300ER (see **Exhibit 4** and **Exhibit 5**). In the large-airplane category, Boeing had been continually innovating and, with the larger-capacity and extended-range versions of its existing large airplanes, it offered a wide range of products to its customers.

In the 1990s, especially after Phil Condit became CEO, Boeing was transformed through a series of measures designed to increase shareholder value and returns while decreasing risks. A new series of financial goals were used to measure the company's progress toward increasing shareholder value. The company established a long-term goal of achieving an annual net return on sales of 7 percent and maintaining or increasing this level of profitability throughout a full business cycle. Capital expenditures and R&D were announced for two years at a time (see **Exhibit 6**). Operations were realigned in order to address financial and production performances issues within its commercial airplanes segment.⁴ In 1998 Boeing named a new chief financial officer, whose role at General Motors had been to implement a business risk management program that engaged line management to better identify and then hold to an acceptable level the risks inherent in the achievement of business objectives. "This type of activity is directly on target with what we are seeking to accomplish at Boeing," Condit said.⁵

The Challenger—Airbus Industrie

Airbus was established in 1970 as a consortium of French, German, and later, Spanish and UK companies. Over time, it had become one of the two largest suppliers of commercial airplanes. By 1999 it had delivered more than 3,000 airplanes and received more than 4,500 orders from more than 180 customers. Until 2000 the main shareholders of Airbus were Daimler-

⁴ Boeing Web site, October 7, 1998.

⁵ "Boeing Names General Motors Executive as New CFO," Boeing Web site, November 16, 1998.

Benz (Germany), British Aerospace (UK), Aerospatiale (France), and Construcciones Aeronauticas SA (Spain), a minor partner. Though the consortium was not publicly listed, it was not a government-run company. Daimler-Benz was a publicly listed company. British Aerospace was privatized in 1985, though the UK government still owned a “golden share” with special voting rights, mainly because of the defense activities of the company, and some of the national security requirements they induced (e.g., limitation of foreign capital, right to check foreign members of the board). Aerospatiale was partially privatized in February 1999, with the “reference shareholder”—33 percent of shares—being Groupe Lagardere, a French publicly listed company, 20 percent publicly floated, and 44 percent still in the hands of the government (but with the intent to be sold). Even though Airbus could benefit from some public backing, especially in the form of low-cost loans, it was also competing for equity and credibility in the capital markets against Boeing, especially because of Airbus’s publicly listed founding partners. Though some of the stockowners were European countries, Airbus did not receive financial support from them and primarily relied on the same creditors in the capital markets as Boeing.

The Airbus range of products consisted of three families of airplanes:

- The A320 family: A318, A319, A320, and A321 (single-aisle, 107 to 185 seats)
- The A300/A310 family (twin-aisle, 220 to 266 seats)
- The A330/A340 family (long-range, 253 to 380 seats)

A key driver for Airbus had been the market share won from Boeing. As its market share approached 50 percent, Airbus had to find new means to fuel growth. It was more attractive for Airbus to use new and better products to acquire airline customers. One key selling point for Airbus was the development of commonalities (including standardized parts and technology) across the whole range of Airbus planes. These commonalities were based on a standard “Airbus” flying environment (e.g., fly-by-wire technology), permitting much shorter training time for pilots and engineers to transition from one Airbus airplane model to the other, streamlined maintenance procedures, and reduced parts holdings. The cost effectiveness of these commonalities for an airline increased with the number of Airbus planes the company owned. However, even though Airbus had proposed a substitute to Boeing for nearly all the classes of planes with more than one hundred seats, by the mid-1990s the jumbo segment was still dominated by the 747, thus forcing any airline with important long-range routes to own 747s. This necessarily reduced the attractiveness of Airbus commonalities, since no major airline could limit itself to Airbus planes, and might reduce the attractiveness for the three current families of Airbus planes.

The Market Unfolds: The Six-Year Boeing and Airbus Industrie “War of Nerves”

1993–1995: The Beginning of a Beautiful Friendship

On January 5, 1993, Boeing revealed that it was negotiating with Deutsche Aerospace, the aircraft division of Germany’s Daimler-Benz group, to study the feasibility of jointly developing a 550- to 800-seat aircraft that could enter service early in the twenty-first century with a range of

8,050 to 11,500 miles.⁶ The price per aircraft could exceed \$200 million. Daimler-Benz was talking to British Aerospace about joining this new consortium. Together, British Aerospace and Daimler-Benz owned a majority stake in the Airbus Industrie consortium.

The next day France's Aerospatiale, the third partner in the Airbus Industrie consortium, announced that it was also interested in talking to Boeing. In effect, Airbus had opened discussions with Boeing for possible cooperation in the superjumbo market. The rationale for cooperation was the very large risk that this market represented, according to public statements at that time by John Hayhurst, Boeing vice president in charge of large-aircraft development. On the one hand, some routes in the world, especially rapidly growing Asian-European or Asian-American routes, might need a larger aircraft than the 747. The number of take-off and landing slots was becoming ever more limited at crowded airports; because of time zone differences and the closure of most world airports during the night, the time window to send one plane from one continent to another was very small. On the other hand, Boeing and Airbus seemed to concur that such a larger aircraft might require a \$10–15 billion investment. In view of the sales projection, there could be room for but one aircraft in this market in order to recoup such an investment.

Another reason for cooperation was the situation of both Boeing and Airbus. Boeing had already committed to the development of the new 777 airliner and the updating of its bestselling 737. Airbus, on the other hand, had used \$13 billion in European subsidies over the last twenty years—and it was doubtful that European governments would commit to such level of investment now that Airbus had surpassed McDonnell Douglas and become the world's second largest commercial aircraft manufacturer, with 25 percent market share.

Though the development of the superjumbo was initiated by Boeing and its early exploratory talks with Deutsche Aerospace, and Boeing claimed its top management was deeply committed to the new enterprise,⁷ Boeing let it be known that it was considering a superjumbo of its own—a stretched version of its current 747 that would be cheaper to develop. Such talk added to the nervousness of Airbus and weighed on its decision to cooperate with Boeing.⁸ This very unusual decision for Boeing and Airbus to cooperate signaled to Wall Street that the companies did not consider control of the hypothetical superjumbo market an opportunity to gain a competitive edge over each other. It could also have signaled Airbus's intention to ease competitive pressure and avoid too much of a price struggle on the different categories of planes with Boeing by allowing Boeing to preserve rents from its quasi-monopoly on the 747.⁹

1995: The Break-Up

In July 1995 Boeing announced that it was stopping development of the superjumbo in cooperation with Airbus.¹⁰ The stated reason was that market demand was insufficient to develop the “very large commercial transport.” However, Boeing reiterated its interest in developing new versions of its existing 747 and pursuing the development of its 777 family of planes, whose first

⁶ “Boeing, Four Members of Airbus to Study Jointly Developing Jet,” *Wall Street Journal*, January 28, 1993.

⁷ Ibid.

⁸ “Now for the Real Big One,” *The Economist*, January 9, 1993.

⁹ Boeing exploratory talks had also at one point included McDonnell Douglas, which had at the time already scaled back its development investment on the MD-12, a plane carrying from 430 to 600 people (*Wall Street Journal*, January 7, 1993). McDonnell Douglas would not take part in the following Airbus-Boeing cooperation.

¹⁰ “Boeing Co.: Plans for ‘Super-Jumbo’ Jet Are Shelved, as Expected,” *Wall Street Journal*, July 11, 1995.

type, the 777-200, had been introduced in May. The 777-300 actually launched in 1998 with a higher capacity that let it, in effect, replace earlier versions of the 747 prior to the 747-400.¹¹

Some journalists, perhaps fed by leaks from both sides, believed a strong strategic consideration had also ended the cooperation. Boeing did not want to develop a superjumbo jet carrying fewer than six hundred passengers that could cut into sales of the 747-400, which had a maximum capacity of 420 seats in its three-class configuration. However, some Airbus members wanted to develop a range of planes starting with a five-hundred-seat version that would compete partially with the 747-400.

1996–1997: The “Virtual War”

In February 1996 Phil Condit, the former general manager of Boeing’s 777 division, which he had led from its inception in 1989, became the new CEO of Boeing. At that time the commercial airplane industry, which had suffered from a slump in the early 1990s, seemed poised for a rebound. Worldwide air passenger traffic was expected to grow at 5 percent a year, with strong growth in the Asia-Pacific region, especially in China, building momentum.¹²

In April 1996 Boeing held a “working group” meeting attended by representatives of seventeen major world carriers, aimed at better defining the stretched 747’s market and refining technical and economic requirements. The specialized press was informed of this working group and of some details of the talks. Boeing anticipated that the 747-500X and 747-600X would be certified and first deliveries made by late December 2000. This would be more than two years before Airbus Industrie’s competing project, the 550- to 630-seat A380, which was planned for 2003 but had not yet secured developmental funding.¹³ With a new wing and a stretched fuselage, the 747-500X would accommodate 462 passengers and the longer 747-600X 548 passengers (both in a three-class configuration).¹⁴ Boeing also announced that investments “to do major derivatives of our 747—including development expenses and investments in tooling—will be in excess of \$5 billion. It’s hard to imagine that Airbus can do a totally new airplane for what they say will be an \$8 billion investment.”¹⁵ For Boeing, the announcement continued, “the market isn’t large enough to justify an investment anywhere from \$12 billion to \$15 billion,” a figure based on the very large commercial transport developed during the Boeing-Airbus cooperation. This argued for a derivative airplane based on the 747-400, in a program similar to that for the 777-300, a stretched derivative of the 777-200. Publicly released market projections by the two competitors differed significantly: Boeing claimed that the market for superjumbos over the next fifteen years would amount to 470 aircraft, while Airbus announced it would reach 1,500 aircraft. As a comparison, the Boeing 747 had sold about 1,000 planes in the twenty-five years since its 1970 launch.¹⁶

Early reactions from airline companies were positive, with Cathay Pacific expecting to join Nippon Airways and Thai International to help launch the program by Boeing at the end of the year, similar to the launch of the stretched 777-300 in 1995. This was an important point, since

¹¹ “Boeing Looking Ahead to 21st Century,” *Boeing News*, July 10, 1995.

¹² “Boeing Projects Continued Airline Profitability,” Boeing Web site, March 6, 1996.

¹³ “Boeing Poised to Offer Stretched 747 Versions,” *Aviation Week & Space Technology*, July 1, 1996.

¹⁴ The 747-400 accommodated 420 passengers in a three-class configuration.

¹⁵ “Boeing Outlines the Value of Its 747 Plans,” Boeing Web site, September 2, 1996.

¹⁶ “Reach for the Sky,” *The Economist*, September 7, 1996.

until that moment only British Airways and Singapore Airlines had signaled interest in a new 747-500X and -600X aircraft.¹⁷ In a related development, GE and Pratt, two U.S. engine makers and fierce rivals in the industry, announced in a surprise move that they would create a joint venture to design the engines of the new Boeing stretched 747.¹⁸

In September 1996 at the Farnborough Air Show—a key event in the aerospace industry often used to officially launch new projects—Boeing announced all these details and stressed that the company was “now focusing its efforts on developing the 747-500X and -600X.”¹⁹ However, it stopped short of formally launching and funding the development of the program, officially because negotiations to sign up its first customer were not yet completed.²⁰ Airbus responded in October by announcing it would speed up its plans and try to present a preliminary design by the end of 1997.²¹ Its list price of \$198 million for its proposed 550-seat A380 was just under the \$200 million cost for the stretched 747,²² with an announced development cost of \$8 billion—well below the initial \$12–15 billion initial estimate. At the same time, Boeing announced that development costs for the stretched 747 models could run up to \$7 billion, or 40 percent more than the \$5 billion estimate,²³ reflecting some analysts’ estimates. At this cost, the new 747 would still be relatively inexpensive to develop, borrowing systems technologies from the 777. At the same time, McDonnell Douglas decided to abandon its MD-XX project for a new superjumbo jet. In December 1996 it unveiled a new partnership with Boeing to help develop the stretched 747.²⁴ This conclusively ended Airbus’s dreams of partnering with Boeing or McDonnell Douglas.

In January 1997, to the surprise of many observers, Boeing announced that it would stop focusing on the development of the stretched 747 since “sufficient market demand has not yet developed to justify committing the significant investment required to develop larger versions of the 747.”²⁵ Officially, the program was not completely shut down since “some employees will continue working to develop an airplane larger than today’s 747.” Company stock increased by 6.9 percent after the announcement.²⁶ Airbus announced it would stick to its planned \$8 billion investment, stating that it projected demand for about 1,400 planes with more than four hundred seats, while Boeing estimated orders of about five hundred planes with more than five hundred seats. However, other industry executives interviewed in the specialized press said Airbus’s investment could cost up to \$16 billion and the consortium would find it very difficult to fund such a project. Also, Airbus’s A380 relied on airlines’ continuing to use hub-and-spoke systems. Past years, especially with the success of the 777, pointed to increased interest by carriers in point-to-point services on long-haul routes. In that respect, for Boeing these factors made for an increasingly risky 747 stretch, while some of the 767 and 777 derivatives’ development investment could cost as little as \$200 million each.

While Airbus continued to favor the A380 by announcing the signing of some risk-sharing partners, such as Belairbus of Belgium, Alenia SpA of Italy, Saab-Scania AB of Sweden, and a

¹⁷ “Cathay Anticipates 747-500/600 Order,” *Aviation Week & Space Technology*, March 25, 1996.

¹⁸ “Pratt, GE Unite for New 747 Engine,” *Aviation Week & Space Technology*, May 13, 1996.

¹⁹ “Boeing Outlines the Value of Its 747 Plans.”

²⁰ “Reach for the Sky.”

²¹ “Airbus Advances Date for Details on Superjumbos,” *Wall Street Journal*, October 10, 1996.

²² “Airbus Begins Marketing Superjumbo at a Price Similar to Boeing’s Models,” *Wall Street Journal*, November 5, 1996.

²³ “New Boeing 747s Could Cost \$7 Billion to Develop,” *Wall Street Journal*, November 1, 1996.

²⁴ “Boeing’s New Buddy,” *The Economist*, December 7, 1996.

²⁵ “Boeing Redirect Product-Development Efforts,” Boeing Web site, January 20, 1997.

²⁶ “Boeing’s 747 Decision Shifts Rivalry with Airbus,” *Wall Street Journal*, January 22, 1997.

group of South Korean companies, Boeing announced in February 1997 that it was merging with its main U.S. competitor, McDonnell Douglas.²⁷ In its market outlook published a month later, Boeing insisted that intermediate-size airplanes such as the 767 and the 777 were the fastest-growing segment of the market, and “there’s no market demand right now for an airplane larger than our 747 jumbo jet.” However, Boeing “continues to study the market and, if the potential develops for that size of airplane, we’ll be ready with an excellent design.”²⁸ In September 1997, while Boeing completed its merger with McDonnell Douglas, it offered the first public appearance of the 777-300, a stretched version of the 777, capable of carrying from 328 to 555 passengers, depending on the class configuration, and with a range of 6,560 miles. The 777-300 would replace the 747-100/200 models, while burning one-third less fuel and having 40 percent lower maintenance costs. However, its range and passenger capability were below those of the 747-400, which had a range of 8,290 miles and a passenger capacity of 420 to 568.²⁹ Typical routes for the 777-300 would include Tokyo-Singapore, Honolulu-Seoul, and San Francisco-Tokyo. At this time the 777 airplane family had captured more than 67 percent of the market share for airplanes in its class. At the same time, Boeing announced it was considering spending \$1 billion on developing expanded versions of the 747 jumbo jet in a bid to counter Airbus on what Boeing labeled a “market niche.”³⁰

1997–1998: The Cool-Off

In the second half of 1997 and after, the world airline industry was significantly affected by the Asian economic crisis. As the region’s aviation industry reeled, routes were slashed and passenger traffic plummeted. Since most Asian airline debt was in U.S. dollars and currencies were being devalued dramatically, debt was becoming a major drain on finance. Consequently, many Asian airlines began looking for ways to pawn off their planes, whether Boeings or Airbuses.

All these events started impacting Airbus, which was sticking to its A380 project, heavily geared toward the Asian market. In February 1998 Airbus announced that a need for further design work would delay the delivery of the superjumbo to late 2004, but it remained committed to the program.³¹

1999: The Boeing Surprise

In early 1999, as some Asian economies were recovering, Airbus still officially intended to formally launch the development of the A380 by 2000, with six hundred employees working on plans for the superjumbo and first deliveries scheduled in 2005—a two-year delay on the initial plan. However, the project still needed partners, commitments from initial buyers, and financing. Airbus was now planning an investment of \$10 billion or more.³² Boeing continued to be skeptical, while adding that there was a “reasonable possibility” that a stretched 747 would emerge. In its market projections, Boeing predicted that over the next two decades “only 930

²⁷ “Airbus Lines Up Superjumbo Partners, Examines Boeing-McDonnell Merger,” *Wall Street Journal*, February 5, 1997.

²⁸ “Boeing Projects Healthy Airplane Demand Over Next 20 Years,” Boeing Web site, March 4, 1997.

²⁹ “Boeing Rolls Out World’s Largest Commercial Jetliner,” Boeing Web site, September 8, 1997.

³⁰ “Boeing May Spend \$1 Billion to Develop Extended 747s to Combat Airbus Planes,” *Wall Street Journal*, September 10, 1997.

³¹ “Superjumbo Jet Projects Hits a Nine-Month Delay,” *Wall Street Journal*, February 12, 1998.

³² “Boeing Seriously Studies Development of Longer-Range 747 with Added Seats,” *Wall Street Journal*, April 28, 1999.

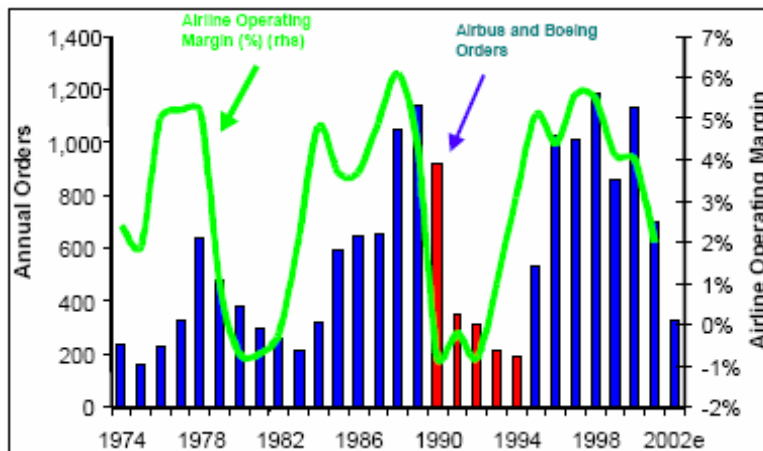
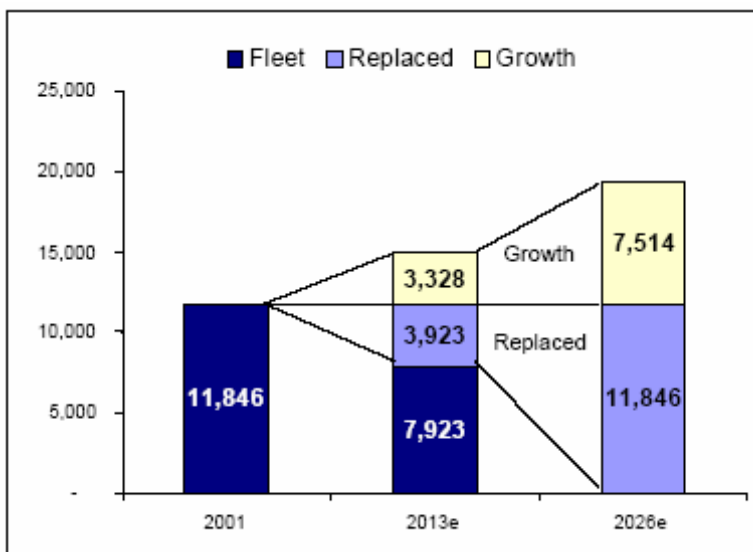
planes delivered would be in the 747-and-larger category, less than 40 percent of which would be five-hundred-plus-seat airplanes.”³³ All new aircraft designs with six hundred or more seats were receiving only “a low level” of research. In the meantime, Airbus started lining up low-cost loans from European governments. It still planned to sell its A380 for \$200 million each, while 747-400 price tags could range as high as \$197 million.

In September 1999, however, Boeing staged a surprise comeback in the fight against Airbus’s A380. Phil Condit announced that there was enough demand now among 747 operators to justify the development of a “747-X stretch” that would carry 500 to 520 passengers in a three-class configuration more than 7,500 nautical miles. Condit expected Boeing to proceed with the development of its new 747 version “sometime in the next two years.” This would put Boeing’s new jumbo jet two years ahead of the first delivery of the A380. Analysts in the specialized press said any Boeing offer of a longer-range, stretched 747 could undermine the demand for the A380 and hamper its launch. Even Airbus spokespeople recognized this, but countered that airlines also demanded a new-technology jet to replace the basic 747 design created in the 1960s. To show its determination, Boeing said it assumed Airbus would proceed with the development of the A380. Boeing also said development of its stretched 747 would cost only a fraction of the A380³⁴—about \$2–4 billion—versus the now-projected development cost of more than \$12 billion for the Airbus A380, a plane with up to 650 passengers in a three-class seating. Airbus had already poured \$500 million into its new jet. By the end of the year, its board had to decide whether or not to pursue the A380 project.

³³ Boeing Web site, June 14, 1999.

³⁴ “Boeing to Proceed with Bigger 747 Jet—Move Sets Stage for Fight with Airbus Industrie in Costly Market Sector,” *Wall Street Journal*, September 20, 1999.



Exhibit 1: Industry Orders Increase after Margins Recover**Exhibit 2: Commercial Aircraft Fleet Development, 2001–2026e**

Source: Morgan Stanley Research

Exhibit 3: Overview of the Main Engine Suppliers

CFM INTERNATIONAL. CFM began as a joint venture between General Electric and the French company Snecma in 1974 to manage the CFM56 engine program. Traditionally GE made the motor while Snecma produced the fans and rotors and did the final assembly.

During the mid-1990s CFM witnessed an increased demand for its engines for planes with more than one hundred seats. With the advent of the Airbus A320 family, CFM received more than 60 percent of the orders for these planes and, between 1995 and 1997, witnessed a 65 percent increase in overall engine deliveries.³⁵

Though business appeared to go well, differences arose between GE and Snecma in 1996. Disagreements over development and sales strategies led GE to plan new engine development without Snecma, and Snecma chairman Bernard Dufour was fired by the French government.³⁶

GENERAL ELECTRIC. General Electric Aircraft engines accounted for approximately 10 percent of GE's annual profits. In addition to developing and making aircraft engines on its own, GE was involved in alliances with Snecma (CFMI) and Pratt & Whitney (detailed below). It was the second largest supplier for replacement parts and refurbishing engines.

PRATT & WHITNEY. A division of United Technologies, Pratt & Whitney had been making aircraft engines since 1925. It was actively involved in the development and manufacturing of commercial and military engines, as well as engines for the U.S. Space Shuttle. During the 1980s Pratt & Whitney developed the PW4000 series turbofan engines to service the Airbus A300 and A310 aircrafts and Boeing 747, 767, and MD-11. During the 1990s it designed engines specifically for the Airbus A330 twinjet and the 777. In the mid-1990s nearly half of all commercial planes had Pratt & Whitney engines.

As the 1990s progressed, Pratt & Whitney had issues maintaining its competitive advantage. A significant decrease in military sales and lower-than-anticipated commercial sales of aircraft to Asia resulted in 1998 layoffs of 6 percent of the work force (2,000 people) as it dealt with increased competition.³⁷ Plans moved from minimizing fuel consumption and designing new engines to redesigning all of the engines for low cost and low maintenance to regain market dominance.

GE and Pratt & Whitney formed an alliance in May 1996 to meet Airbus' requirement of a totally new engine with a \$1 billion development cost. In November they signed a memorandum of understanding with Airbus to allow discussions on engine specification. By 1998 development for Airbus had progressed to the point where they hoped to have an engine available by 2002. GE would do the hot section and controls of the engine, while Pratt & Whitney would be responsible for the low-pressure system and final assembly.³⁸ The alliance was also looking at developing engines for Boeing's proposed stretched 747 but needed specifications. Plans were scrapped in 1997 when Boeing exited the market, but began again in 1998 when Boeing altered its plans. Though the design process was ongoing, neither of the proposed superjumbos had been formally launched.

³⁵ Stanley W. Kandebo, "Industry Turnaround Boosts CFMI Deliveries," *Aviation Week & Space Technology*, April 22, 1996.

³⁶ "Mixed Results on Alliances," *Air Transport World*, August 1996.

³⁷ "Pratt & Whitney Division to Eliminate 2,000 Jobs," *Wall Street Journal*, October 12, 1998.

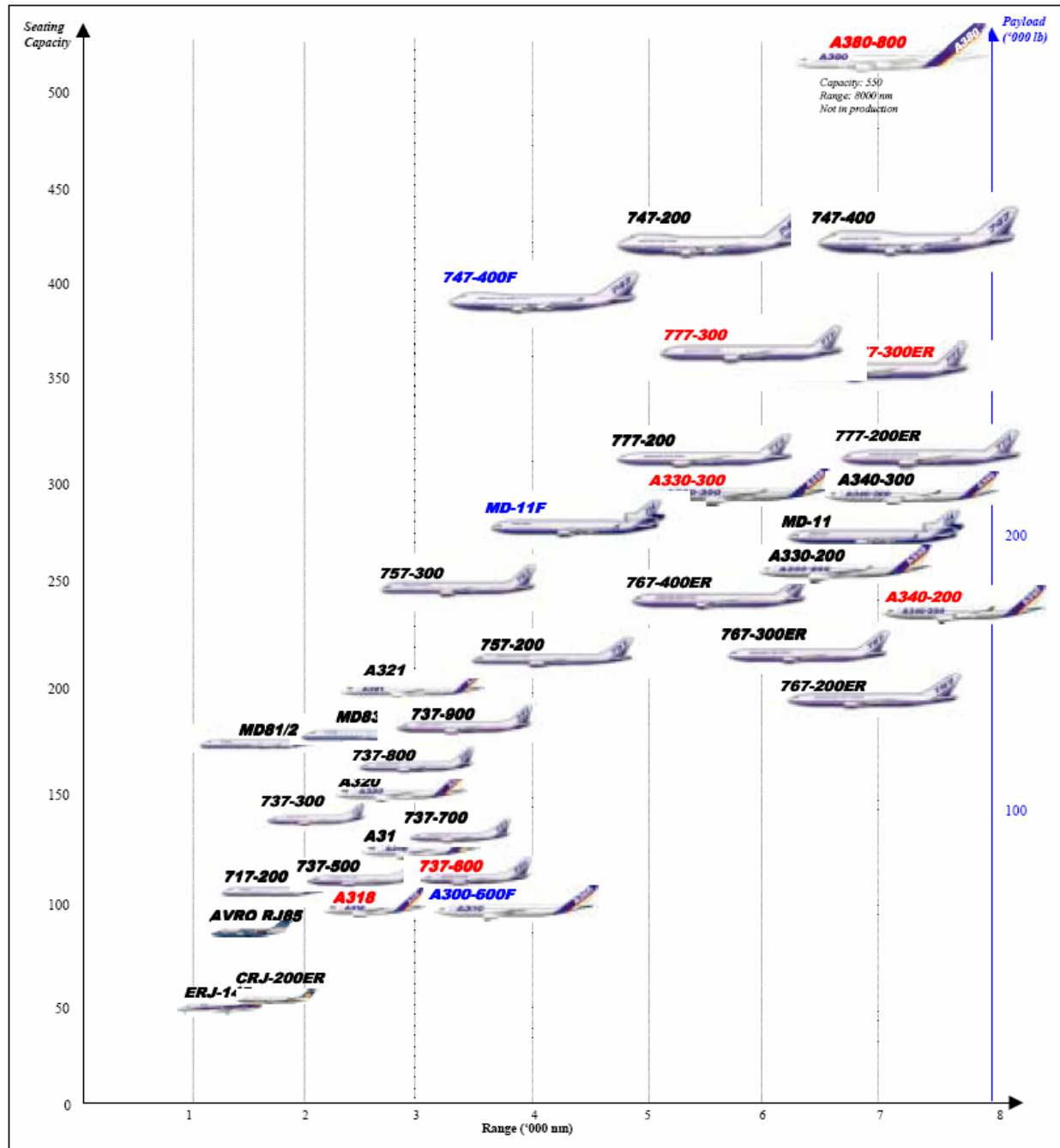
³⁸ Stanley W. Kandebo, "Engine Alliance Refines GP7267 Design for A380," *Aviation Week & Space Technology*, July 6, 1998.

Exhibit 3 (continued)

ROLLS ROYCE. Rescued from bankruptcy in 1971 by the British government, Rolls Royce received hundreds of millions of dollars to rebuild. It heavily invested in technology and became a leader in the field. Requiring a lower return on sales than its competitors (6 percent versus GE's 18 percent and Pratt & Whitney's 10 percent), it was highly successful in contract bidding in the 1990s.³⁹ Competitors accused Rolls Royce of receiving state aid but were unable to prove it. It had also become the leading supplier of spare parts and the only manufacturer able to refurbish competitors' engines.

While others formed alliances to develop new engines, Rolls Royce began developing the Trent 900 for the superjumbo market. Uncertain of who would utilize it, Rolls Royce made competitive bids with the engine to both Airbus and Boeing. With the alliance of GE and Pratt & Whitney, it appeared feasible for Rolls Royce to achieve profits in the superjumbo market as a result of limited competition. Unlike its competitors, the Trent 900 was designed so that with very minor alterations it would be compatible with either proposed superjumbo.

³⁹ "Roll-Royce Flies High," *The Economist*, June 28, 1997.

Exhibit 4: Comparative Spatial Differentiation Model—Boeing and Airbus Airplanes**Boeing and Airbus: Aircraft Seating Capacity**

Source: Boeing and Airbus

Exhibit 5: Boeing and Airbus Industrie Airplane Models and Their Characteristics

Manufacturer	Model	Type	Range (km)	Passenger Capacity	Orders	Deliveries	# of Customers	Price (\$)
Airbus	300-600	Wide-body	7,700	266	208	206	23	109,950,000
Airbus	300-600F	Wide-body	7,000	Payload: 120,800 lb	126	38	2	109,950,000
Airbus	300-B1/2/4	Wide-body	4,630	251	249	249	35	109,950,000
Airbus	310-200	Wide-body	9,600	220	85	85	18	86,900,000
Airbus	310-300	Wide-body	9,600	220	260	255	44	86,900,000
Airbus	330-200	Wide-body	11,850	253	229	98	24	129,150,000
Airbus	330-300	Wide-body	10,400	295	178	114	18	143,300,000
Airbus	340-200	Wide-body	14,800	239	28	28	11	124,350,000
Airbus	340-300	Wide-body	13,500	295	206	184	28	153,500,000
Airbus	340-500	Wide-body	15,800	313	20	0	4	167,000,000
Airbus	340-600	Wide-body	13,900	380	42	0	7	162,950,000
Airbus	380-800	Wide-body	14,800	555	85	0	6	251,250,000
Airbus	380-800F	Wide-body	10,410	Payload: 331,000 lb	2	0	1	251,250,000
Boeing	747-400	Wide-body	13,565	416	443	426	34	197,000,000
Boeing	747-400ER	Wide-body	14,295	416	6	0	1	197,000,000
Boeing	747-400ERF	Wide-body	9,200	Payload: 248,600 lb	8	0	3	206,500,000
Boeing	747-400F	Wide-body	8,230	Payload: 248,300 lb	91	63	12	197,750,000
Boeing	767-200	Wide-body	7,446	181	128	128	17	100,750,000
Boeing	767-200ER	Wide-body	12,220	181	112	111	28	106,000,000
Boeing	767-300	Wide-body	8,603	218	104	104	7	113,750,000
Boeing	767-300ER	Wide-body	11,305	218	509	451	39	121,000,000
Boeing	767-400ER	Wide-body	10,450	245	40	24	3	132,000,000
Boeing	777-200	Wide-body	9,649	305	89	81	10	161,500,000
Boeing	777-200ER	Wide-body	14,316	320	398	258	28	171,250,000
Boeing	777-200LR	Wide-body	16,880	301	3	0	1	199,750,000
Boeing	777-300	Wide-body	11,029	368	58	38	10	190,250,000
Boeing	777-300ER	Wide-body	13,686	365	46	0	6	216,500,000
Boeing	MD-11	Wide-body	13,230	258	136	136	23	139,750,000
Boeing	MD-11F	Wide-body	7,310	Payload: 200,300 lb	59	59	8	139,750,000

Exhibit 6: Boeing Key Financials for 1999 and 2000 (\$ in billions)

	1999	2000
<i>Revenue</i>		
Commercial airplanes	\$38	\$30
Military aircraft and missile systems	12	12
Space and communications	7	7
<i>Total revenue</i>	\$58	\$49
<i>Operating margins</i>		
Commercial airplanes	4.5–5.0%	5.5–6.5%
Military aircraft and missile systems	9–10%	10–11%
Space and communications	5–6.0%	4.5–6.0%
<i>Total operating margins</i>	5.5–6%	5.5–6.5%
Research and development	\$1.4–1.5	\$1.4–1.7
Employment (in thousands)	195–200	185–195
Capital expenditure	\$1.4–1.5	\$1.4–1.5
Depreciation and amortization	\$1.5–1.6	\$1.5–1.7