

THE BOEING 7E7

We still have a lot to get done as we move toward authority to offer the 7E7 to our customers. The team is making great progress—understanding what our customer wants, developing an airplane that meets their needs, and defining a case that will demonstrate the value of the program.

—Michael Bair, Boeing Senior Vice President¹

In early 2003, Boeing announced plans to design and sell a new, “super-efficient” jet dubbed the 7E7, subsequently called the “Dreamliner.” However, news over the next six months depressed the market for aircrafts, which were already in sharp contraction. The United States went to war against Iraq, spasms of global terrorism offered shocking headlines, and a deadly illness called SARS resulted in global travel warnings. For those and other reasons, airline profits were the worst seen in a generation. This seemed like an incredible environment in which to launch a major new airframe project. Nevertheless, on June 16, 2003, at the prestigious Paris Air Show, Michael Bair, the leader of the 7E7 project, announced that Boeing was making “excellent progress on the development of the 7E7 and continues to be on track to seek authority to offer the airplane.”² In order to proceed with the project, Bair sought a firm commitment from Boeing’s board of directors in early 2004. If the board approved the plan, he could start collecting orders from airlines and expect passengers to start flying on the new jets in 2008. Between now and his recommendation to the board, he would need to complete a valuation of the 7E7 project and gain the support of Boeing’s CEO, Philip Condit, and the other senior managers. Would the financial analysis show that this project would be profitable for Boeing’s shareholders?

¹ “Bair Provides Update on Boeing 7E7 Dreamliner,” *Le Bourget*, 16 June 2003.

² “Bair Provides Update.”

This case was prepared by Professors James Tompkins and Robert Bruner using public information. It was written as a basis for class discussion rather than to illustrate effective or ineffective handling of an administrative situation. Copyright © 2004 by the University of Virginia Darden School Foundation, Charlottesville, VA. All rights reserved. To order copies, send an e-mail to sales@dardenbusinesspublishing.com. No part of this publication may be reproduced, stored in a retrieval system, used in a spreadsheet, or transmitted in any form or by any means—electronic, mechanical, photocopying, recording, or otherwise—without the permission of the Darden School Foundation. ♦

Origins of the 7E7 Project

Boeing had not introduced a new commercial aircraft since it rolled out the highly successful 777 in 1994. Later in the 1990s, however, Boeing announced and then cancelled two new commercial-aircraft programs. The most prominent of those was the “Sonic Cruiser,” which promised to fly 15% to 20% faster than any commercial aircraft and bragged of a sleek and futuristic design. Unfortunately, after two years of developing the Sonic Cruiser, Boeing’s potential customers were sending the message that passengers were not willing to pay a premium price for a faster ride. Boeing was now long overdue to develop a product that would pull it out of its financial slump, as well as help it regain the commercial-aircraft sales that the company had lost over the years to Airbus, its chief rival.

With the 7E7, an Airbus executive argued that Boeing seemed to be promising a “salesperson’s dream and engineer’s nightmare.”³ The 7E7, while carrying between 200 and 250 passengers, would be capable of both short, domestic flights as well as long, international hauls. It would use 20% less fuel than existing planes of its projected size and be 10% cheaper to operate than Airbus’s A330-200. At a time when major airlines were struggling to turn a profit, less fuel, cheaper operating costs, and long or short distance flexibility would be a very attractive package at the right price.

Skeptics of the 7E7 were not in short supply and suggested that the name “Dreamliner” was appropriate. To make the plane more fuel efficient, the 7E7 would be the first commercial aircraft built primarily with carbon-reinforced material, which was both stronger and lighter than the traditional aluminum. In addition, Boeing promised greater fuel efficiency by using a more efficient engine. Boeing claimed that the use of composites would also reduce its manufacturing costs. The goal would be to design a plane with fewer components that could be assembled in 3 days as opposed to the current 20 days that it took to rivet together the Boeing 767. The use of composite materials, however, had its risks. Composite materials were suspected as a contributory cause to a 2001 plane crash in New York and, therefore, would have to overcome regulatory scrutiny. Boeing would also have to change its production methods radically. The last time Boeing made a major production change was in 1997 in an effort to cut costs. However, because the process was not smooth, it resulted in two production lines being shut down for 30 days and hundreds of missed airline deliveries.

The ability to produce a short and long distance aircraft would also have to overcome engineering obstructions. Analysts argued that building a plane that would do short hops in Asia and long trans-Atlantic flights would require two versions of the plane with different wingspans.⁴ Boeing engineers considered the possibility of snap-on wing extensions. The question was whether this would be too costly, as well as being technically feasible.

³ “Will Boeing’s New Idea Really Fly?” *BusinessWeek*, 23 June 2003.

⁴ Noted by Richard Aboulafia, a senior analyst at Teal Group consultant, in “Will Boeing’s New Idea Really Fly?”

Finally, there was the matter of Boeing's board. Two of the most powerful members of the 11-person board, Harry Stonecipher and John McDonnell, were rumored to have raised serious concerns regarding the cost of the 7E7. While the cost of developing the 7E7 project could be as high as \$10 billion, there was an imminent veto threat if that number did not shrink by billions. More specifically the board wanted to keep 7E7 development costs down to only 40% of what it took to develop the 777. An additional pressure from the board was to keep the 7E7 per-copy costs to only 60% of the 777 costs. In response, Philip Condit, Boeing's CEO and chair, was quoted as saying that "Boeing has a responsibility to develop jetliners for less."⁵ He knew, however, that if Boeing did not take bold risks in the commercial-aircraft industry that their days as a serious competitor to Airbus were numbered.

Commercial-Aircraft Industry

In 2002, two companies, Boeing and Airbus, dominated the large plane (100+ seats) commercial-aircraft industry. While Boeing historically held the lead in this market, through a number of measures Airbus became number one. In 2002, Airbus received 233 commercial orders compared to Boeing's 176 orders, representing a 57% unit market share and an estimated 53.5% dollar value market share.⁶

Airbus Industry

Airbus was understandably proud of its growth. Established in 1970, by a consortium of European companies, it took Airbus 23 years to deliver its first 1000 aircrafts, another six years to deliver the next 1000, and only another three years (by 2002) to pass the 3000 aircraft milestone.⁷ In 1999, for the first time in its history, Airbus recorded more plane orders than its rival, Boeing.

Airbus's large plane commercial-aircraft products included the A300/310, A320, A330/340, and A380 families. Airbus touted the A300/310 family as having the flexibility to serve short-, medium-, and extended-range routes. The widebody, twin-engine aircraft was considered mid-size, with a typical passenger configuration of about 250 passengers. This family first flew passengers in 1983, and it was this aging fleet that provided a replacement opportunity for Boeing's 7E7. However, while Boeing was betting on the future demand for mid-size aircraft, Airbus announced its A380, superjumbo four-engine jet in 2000. The A380 was due to fly in 2006 with a 550-passenger configuration and long distance range of up to 8000 miles. It would be the largest passenger aircraft ever built.

⁵ "Losing Ground to Airbus, Boeing Faces a Key Choice," *Wall Street Journal*, 21 April 2003.

⁶ "2002 Commercial Results," www.airbus.com.

⁷ In 2001, Airbus formally became a single integrated entity through the transfer of Airbus related assets to the newly incorporated company. European Aeronautic Defense and Space Company (EADS) owned 80% of the new company, and BAE systems owned the remaining 20%.

The Boeing Company

Boeing was split into two primary segments: commercial airplanes and integrated defense systems. In 2002, it was awarded \$16.6 billion in defense contracts, second only to Lockheed Martin with \$17.0 billion. **Exhibit 1** shows that in 2002, each segment earned Boeing's revenues almost equally. In addition, while commercial-aircraft revenues had been falling, defense revenues had been rising. Analysts believed that Boeing was able to transfer significant amounts of technology from the defense R&D to the commercial-aircraft segment.

The commercial-aircraft segment produced and sold six main airframes designed to meet the needs of the short- to long-range markets: the 717, 737, and 757 standard-body models and the 747, 767, and 777 wide-body models. As of December 31, 2002, Boeing undelivered units under firm order of 1083 commercial aircraft and had a declining backlog of about \$68 billion. For 2003, it projected 280 commercial-aircraft deliveries and expected between 275 and 300 in 2004. Boeing estimated that in 2003, the revenues for its commercial-airplane segment would be approximately \$22 billion, down from \$28 billion in 2002. Recognizing the negative impact of the September 11th attacks on commercial-aircraft demand, Boeing cut the production rates for 2002 in half in order to maintain profitability in that segment.

Exhibits 2 and 3 show Boeing's balance sheet and income statement respectively. While Boeing's earnings were down significantly from 2001 to 2002, most of this was the result of an accounting change (SFAS No. 142). However, a drop in commercial-airplane deliveries from 527 in 2001 to 381 in 2002 also contributed to the decline.

Demand for Commercial Aircraft

The long-term outlook for aircraft demand seemed positive.⁸ Boeing's *Market Outlook* said the following:

In the short term, air travel is influenced by business cycles, consumer confidence, and exogenous events. Over the long-term, cycles smooth out, and GDP, international trade, lower fares, and network service improvements become paramount. During the next 20 years, economies will grow annually by 3.2%, and air travel will continue its historic relationship with GDP by growing at an average annual rate of 5.1%.

As shown in **Exhibit 4**, Boeing's 20-year forecast from 2003 to 2022, was for 24,276 new commercial aircraft in 2002, valued at \$1.9 trillion. The company predicted a composition of 4,303 smaller regional jets (fewer than 90 seats); 13,647 single-aisle airplanes; 5,437 intermediate twin-aisle airplanes; and 889 747-size or larger airplanes. This prediction reflected a

⁸ The primary sources for commercial-aircraft demand estimates include Boeing's *2003 Current Market Outlook* and Airbus's *2002 Global Market Forecast 2001–2020*. While both reports recognized the negative effects of "exogenous events" such as September 11, 2001, they both agreed on a healthy long-term outlook.

world fleet that would more than double, with one-fourth of the market coming from aircraft replacement and three-fourths from projected passenger and cargo growth.

Exhibit 5 illustrates Airbus's 20-year predictions for the years 2000–2020. Although the report was dated 2002, because of the September 11 attacks, numbers included the year 2000, to serve as a benchmark year. For that period, Airbus predicted the delivery of 15,887 new commercial aircraft in 2002, with a value of (U.S. dollars) \$1.5 trillion. This included 10,201 single-aisle aircraft; 3,842 twin-aisle aircraft; 1,138 very large aircraft, and 706 freighters. The 15,887-unit forecast did not include planes with less than 90 seats.

Although Boeing and Airbus's numbers are not directly comparable due to the slightly different time periods and aircraft classifications, it appeared that Airbus was more optimistic about the market for large aircraft than Boeing was. While Airbus predicted it to be a \$270 billion market, including 1138 passenger units, Boeing projected only \$214 billion with 653 passenger units. Boeing, however, estimated that the share of intermediate-size planes would increase from 18% to 22%. In its forecast, Boeing acknowledged that intermediate-size airplanes would economically allow airlines to fly the increased frequencies, city pairs, and nonstop flights requested by passengers. According to a recent study by Frost & Sullivan, they believed that the Airbus market projection for the A380 was “over-optimistic.”⁹

Aircraft Development and Lifecycle

The development of a new airframe was characterized by huge initial cash outflows that might require between one and two decades to recoup. For example, the development costs for the Boeing 777 were rumored to be \$7 billion. Any pricing would not only have to recoup the upfront development costs but also the production costs. In addition, pricing would be subject to rigorous, competitive pressures. In short, because of the financial strains a new product line might create, each new aircraft was a “bet the ranch” proposition. Over time, survival in the industry depended on introducing successful products and having the deep financial pockets with which to survive the initially gushing cash flow.

While aircraft sales were subject to short-term, cyclical deviations, there was some degree of predictability in sales. Sales would typically peak shortly after the introduction of the new aircraft, and then fall. Thereafter, sales would rise and fall as derivatives of the aircraft were offered. **Exhibit 6** shows the cycles for the first 20 years of the 757 and 767 sales.

The 7E7

The concept of the Boeing 7E7 was driven by customer requirements. Boeing originally announced in March 2001, its plans to build the Sonic Cruiser, a plane that would fly just below the speed of sound. The success of the Cruiser depended on whether passengers would pay a

⁹ “An Ongoing Rivalry,” *Avionics Today*, August 2003.

premium for a faster flight. However, potential airplane customers who had been interested in the Cruiser during a robust, commercial-air travel market were now focusing on survival. The events of September 11 and the bursting of the technology bubble led to a significant decline in airplane orders. As a result, Boeing solicited updated feedback from a number of potential customers who would soon need to replace their aging fleet of mid-range planes, such as the 757s, 767s, A300s, A310s, A321s, and A330s. Overwhelmingly, the revised message from customers was for a plane with lower operating costs.

Based on discussions with over 40 airlines throughout the world, Bair identified a fresh market to replace mid-size planes, based not only on lower operating costs, but also on the creation of a mid-size plane that could travel long distances, a feat previously viable by only large planes, such as the 747. Such flexibility would allow airlines to offer nonstop service on routes that required long-range planes but did not justify the subsequent larger size. Bair estimated there to be more than 400 city pairs (e.g., Atlanta–Athens) that could be served efficiently on a nonstop basis by the 7E7.

Boeing was considering two new members for the 7E7 family, a basic and a stretch version. **Exhibit 7** gives Boeing’s description of the two configurations. Other improvements for passengers included wider aisles, lower cabin altitude, and increased cabin humidity. In addition, the planes would include systems that provided in-flight entertainment, Internet access, real-time airplane systems and structure health monitoring, and crew connectivity. Furthermore, Boeing claimed the 7E7 would have the smallest sound “footprint” with the quietest takeoff and landing in its class.

Boeing projected a demand for between 2000 and 3000 planes of the 7E7 type within 20 years of each one entering service. A study by Frost & Sullivan predicted the sale of “at least 2000 B7E7s.”¹⁰ However, the demand was highly dependent on whether Boeing could deliver the promised 20% cheaper fuel costs and the range flexibility in a mid-size aircraft. Furthermore, if the range flexibility did require snap-on wings, such a design may significantly increase the building costs of the aircraft. Not only did Boeing face the engineering uncertainty of being able to deliver such an aircraft, but also the risk of its duplication by Airbus. Airbus had already stated that if the fuel efficiency was primarily generated by new engine designs, then it would simply order the more efficient engines for its planes. Any uncertainty in the 7E7 plane specifications and risk of competition clearly put downward pressure on both the price Boeing could demand, as well as the number of units it would be able to sell.

Financial Forecast and Analysis

Exhibit 8 contains a 20-year forecast of free cash flows from the Boeing 7E7 project consistent with public information released by Boeing, Airbus, analysts, and other experts in the field. See the **Appendix** for detailed forecast assumptions. The primary implication of the forecast is that the 7E7 project would provide an internal rate of return (IRR) close to 16%. This

¹⁰ “An Ongoing Rivalry”

assumes that Boeing would not only deliver the promised plane specifications, but that Airbus would be unable to replicate the 7E7 efficiencies.

Based on both analysts' and Boeing's expectations, the base case assumes that Boeing could sell 2500 units in the first 20 years of delivery. Pricing was estimated using 2002 prices for Boeing's 777 and 767. The 7E7 would be a hybrid of the two planes in terms of the number of passengers and range. By interpolating between the 777 and 767 prices, it was possible to estimate the value placed on the range and number of passengers. Using this methodology, without any premium for the promised lower operating costs, the minimum price for the 7E7 and 7E7 Stretch was estimated to be \$114.5 million and \$144.5 million, respectively, in 2002. The forecast assumed that customers would be willing to pay a 5% price premium for the lower operating costs.

The IRR, which is consistent with "base case" assumptions, was 15.7%. But, the estimate of IRR was sensitive to variations in different assumptions. In particular, some obvious uncertainties would be the number of units that Boeing would be able to sell and at what price. For example, if Boeing only sold 1,500 units in the first 20 years, then, as shown in **Exhibit 9**, the IRR would drop to 11%. This might occur if air travel demand worsened, or if Airbus entered this segment with a new competing product.

Additional unknown variables were the development costs and the per-copy costs to build the 7E7. Boeing's board was anxious to minimize those costs. The forecast assumes \$8 billion for development costs; however, analyst estimates were in the \$6 billion to \$10 billion range. The cost to manufacture the 7E7 was also subject to great uncertainty. On the one hand, engineers were challenged to build a mid-size aircraft with long-range capabilities. The engineering design to achieve this could push building costs up significantly. Conversely, if Boeing succeeded in using composite materials, which required a fraction of the normal assembly time, then construction costs would be lower. Consistent with Boeing's history, the base case assumes 80% as the percentage of cost of goods sold to sales. As shown in **Exhibit 9**, however, the IRR of the 7E7 was very sensitive to keeping production costs low.

Cost of Capital

Boeing's weighted-average cost of capital (WACC) could be estimated using the following well-known formula:

$$\text{WACC} = (\text{Percent Debt})(r_d)(1 - t_c) + (\text{Percent Equity})(r_e)$$

where:

r_d = Pretax cost of debt capital

t_c = Marginal effective corporate tax rate

Percent Debt = Proportion of debt in a market-value capital structure

r_e = Cost of equity capital

Percent Equity = Proportion of equity in a market-value capital structure

Exhibit 10 gives information about betas and debt/equity ratios for Boeing and comparable companies. **Exhibit 11** provides data about Boeing's outstanding debt issues. While Boeing's marginal effective tax rate had been smaller in the past, it currently was expected to be 35%. In June 2003, the yield on the three-month U.S. Treasury bill was 0.85%, and the yield on the 30-year Treasury bond was 4.56%. On June 16, 2003, Boeing's stock price closed at \$36.41.

Analysts pointed out that Boeing actually consisted of two separate businesses: the relatively more stable defense business and the conversely more volatile commercial business. Defense corporations were the beneficiaries when the world became unstable due to the terrorist attacks on September 11, 2001. Furthermore, the United States, along with some of its allies, went to war against Iraq on March 20, 2003. While Bush declared an end to major Iraqi combat operations on May 1, 2003, as of June 16, the death toll in Iraq continued to rise on a daily basis. A different type of risk emanated with the outbreak of SARS. On February 1, 2003, China announced the discovery of the deadly and contagious illness that subsequently spread to Canada and Australia. As of June 16, travel warnings were still outstanding. Thus, the question arose of whether one should estimate Boeing's cost of capital to serve as a benchmark-required rate of return. Would a required return on a portfolio of those two businesses be appropriate for evaluating the 7E7 project? If necessary, how might it be possible to isolate a required return for commercial aircraft?

Conclusion

Within the aircraft-manufacturing industry, the magnitude of risk posed by the launching of a major new aircraft was accepted as a matter of course. With huge, upfront, capital costs in an environment of intense technology and price competition, there was no guarantee of success or major significant losses if the gamble did not pay off. At a time of great political and economic uncertainty, Michael Bair said:

Clearly, we have to make a compelling business proposition. It could be [that] we'll still be in a terrible business climate in 2004. But you can't let what's happening today cause you to make bad decisions for this very long business cycle. This plane is very important to our future.¹¹

Central to any recommendation that Bair would make to Boeing's board of directors was an assessment of the economic profitability of the 7E7 project. Would the project compensate the shareholders of Boeing for the risks and use of their capital? Were there other considerations that might mitigate the economic analysis? For instance, to what extent might organizational and strategic considerations influence the board? If Boeing did not undertake the 7E7, would it be conceding leadership of the commercial-aircraft business to Airbus?

¹¹ "New Team, Name for Boeing 'Super-Efficient' Jet," *Seattle Times*, 30 January 2003.

Exhibit 1

THE BOEING 7E7

Revenues, Operating Profits, and Identifiable Assets
by Segment for the Boeing Company

	2002	2001	2000
<u>Revenues</u>			
Commercial airplanes	\$28,387	\$35,056	\$31,171
Integrated defense systems	24,957	22,815	19,963
Accounting eliminations and other	<u>725</u>	<u>1,047</u>	<u>187</u>
Total	\$54,069	\$58,918	\$51,321
<u>Operating Profit</u>			
Commercial airplanes	\$2,847	\$2,632	\$2,736
Integrated defense systems	2,009	2,965	1,002
Accounting eliminations and other	<u>(988)</u>	<u>(1,701)</u>	<u>(680)</u>
Total	\$3,868	\$3,896	\$3,058
<u>Identifiable Assets</u>			
Commercial airplanes	\$ 9,726	\$10,851	\$10,367
Integrated defense systems	12,753	12,461	12,579
Unallocated and other	<u>29,863</u>	<u>25,666</u>	<u>20,588</u>
Total	\$52,342	\$48,978	\$43,534

Source: Boeing Company, 2002 Annual Report.

Exhibit 2

THE BOEING 7E7

Boeing Balance Sheets
(\$ in millions)

	2002	2001
<u>Assets</u>		
Cash and cash equivalents	\$ 2,333	\$ 633
Accounts receivable	5,007	5,156
Inventories, net of advances, progress billings, and reserves	6,184	7,559
Other current assets	<u>3,331</u>	<u>3,497</u>
Total current assets	16,855	16,845
Customer and commercial financing-net	10,922	9,345
Property, plant, and equipment-net	8,765	8,459
Goodwill and other acquired intangibles-net	3,888	6,447
Prepaid pension expense	6,671	5,838
Deferred income taxes and other assets	<u>5,241</u>	<u>2,044</u>
Total assets	<u>\$52,342</u>	<u>\$48,978</u>
<u>Liabilities and Shareholders' Equity</u>		
Accounts payable and other liabilities	\$13,739	\$14,237
Short-term debt and current portion of long-term debt	1,814	1,399
Other current liabilities	<u>4,257</u>	<u>4,930</u>
Total current liabilities	19,810	20,566
Accrued retiree health-care and pension-plan liability	11,705	5,922
Long-term debt	12,589	10,866
Other liabilities	542	799
Shareholder' equity:		
Common shares	1,831	4,994
Retained earnings	14,262	14,340
Treasury shares	<u>(8,397)</u>	<u>(8,509)</u>
Total shareholders' equity	7,696	10,825
Total liabilities and shareholders' equity	<u>\$52,342</u>	<u>\$48,978</u>

Source: Boeing Company, 2002 Annual Report.

Exhibit 3

THE BOEING 7E7

Boeing Income Statements
(\$ in millions; except per-share data)

	2002	2001
Sales and other operating revenues	\$54,069	\$58,198
Cost of products and services	45,499	48,778
General and administrative expense	2,534	2,389
Research and development expense	1,639	1,936
Impact of September 11, 2001 charges/(recoveries)	(2)	935
Other operating expenses	<u>531</u>	<u>264</u>
Earnings from operations	3,868	3,896
Other income/(expense)	42	318
Interest and debt expense	<u>(730)</u>	<u>(650)</u>
Earnings before income taxes	3,180	3,564
Income taxes ¹	861	738
Net earnings before cumulative effect of accounting change	2,319	2,826
Cumulative effect of accounting change, net of tax	<u>(1,827)</u>	<u>1</u>
Net earnings	\$ 492	\$ 2,827
Earnings per share	\$ 0.62	\$ 3.46

Source: Boeing Company, 2002 Annual Report.

¹ Boeing's average tax rate consistent with reported financial performance for 2002 was 27%. Yet Boeing's marginal effective tax rate was 35%.

Exhibit 4

THE BOEING 7E7

Boeing Delivery Distribution Forecast 2003–2022

Seat Category	Models	2002 Dollars (billions)	Passenger Units Freighter Units Total Units
<u>Single-aisle</u>			
Small and intermediate regional jets	Fewer than 90 seats Regional jets	96.5	4,303 0 4,303
90–170	717-200 737-600/-700/-800 A318/A319/A320 Larger regional jets	575.5	11,249 58 11,307
171–240	737-900 757 A321	170.0	2,307 33 2,340
<u>Twin-aisle</u>			
230–310 (181–249)	767 A300 A310 A330-200	370.7	2,521 272 2,793
311–399 (250–368)	777 A330-300 A340	488.3	2,482 162 2,644
<u>Large</u>			
747 and larger (>400)	747-400 A380	214.0	653 236 889
Total		1,915.0	23,515 761 24,276

Source: Boeing Company.

Exhibit 5

THE BOEING 7E7

Airbus Delivery Distribution Forecast, 2000–2020

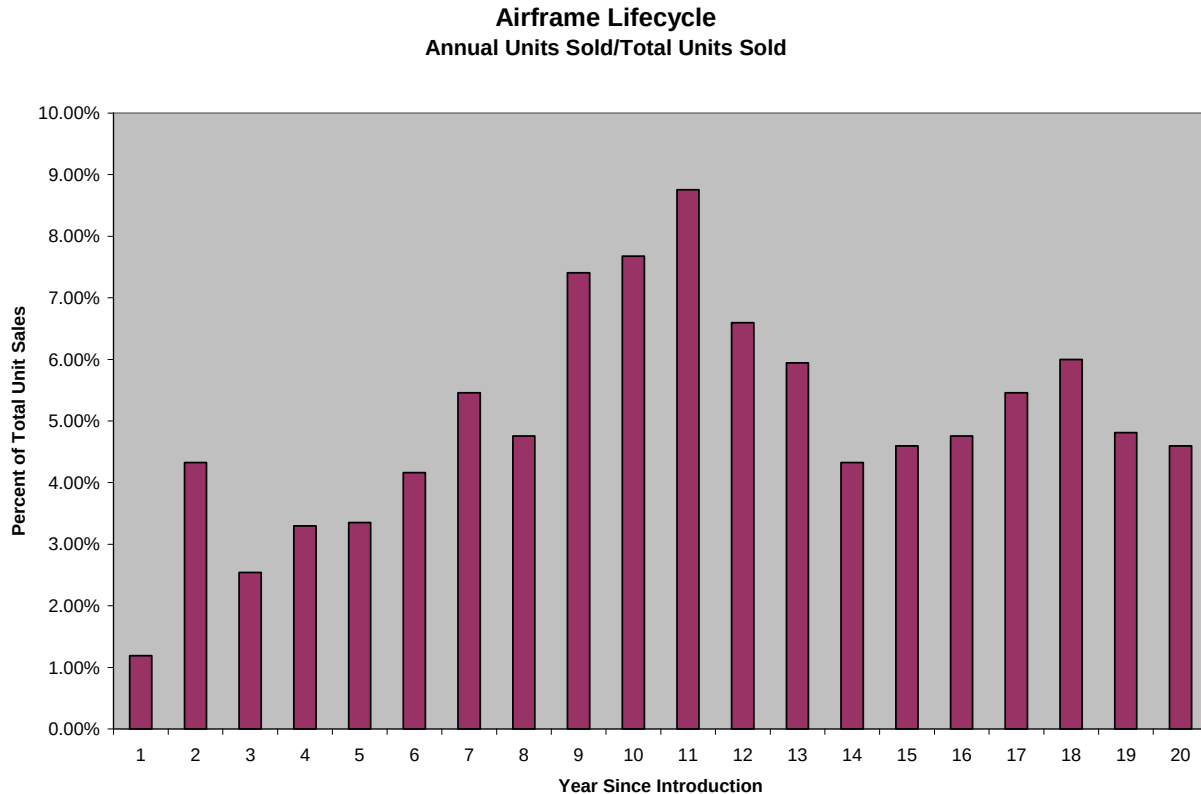
<u>Seat Category</u> (number of seats)	<u>Examples of Models</u>	2002 Dollars (billions)	Units
<u>Single-aisle</u> (passenger) (100–210)	A318, A319, A320, A321	609	10,201
<u>Twin-aisle</u> (passenger) (250–400)	A330, A340	524	3,842
<u>Very large</u> (passenger) (>400)	A380	270	1,138
<u>Freighters</u>		106	706
Total		1,509	15,887

Source: Boeing Company.

Exhibit 6

THE BOEING 7E7

Lifecycle of Unit Sales
(Averaged across the Boeing 757 and 767)



Source: Boeing Company Web site, www.boeing.com

Exhibit 7

THE BOEING 7E7

Description of Product Configurations for the
Baseline and Stretch Models of the 7E7

Boeing 7E7 Baseline Model Brief Description: The Boeing 7E7 Baseline is a super-efficient airplane with new passenger-pleasing features. It will bring the economics of large jet transports to the middle of the market, using 20% less fuel than any other airplane its size. Seating: 200 passengers in three-class configuration 300+ in single-class configuration Range: 6,600 nautical miles Configuration: Twin-aisle Cross Section: 226 inches Wing Span: 186 feet Length: 182 feet Cruise Speed: Mach 0.85 Cargo Capacity after Passenger Bags: 5 pallets + 5 LD3 containers Program Milestones: Authority to offer: Late 2003/Early 2004 Assembly start: 2005 First flight: 2007 Certification/entry into service: 2008	Boeing 7E7 Stretch Brief Description: The Boeing 7E7 Stretch is a slightly bigger version of the 7E7 Baseline. Both are super-efficient airplanes with new passenger-pleasing features. The Stretch will bring the economics of large jet transports to the middle of the market, using 20% less fuel than any other airplane its size. Seating: 250 passengers in three-class configuration 350+ in single-class configuration Range: 8000 nautical miles Configuration: Twin-aisle Cross Section: 226 inches Wing Span: 186 feet Length: 202 feet Cruise Speed: Mach 0.85 Cargo Capacity after Passenger Bags: 6 pallets + 8 LD3 containers Program Milestones: Entry into service 2010 likely, but depends on marketplace
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Source: Boeing Company.

Exhibit 8

THE BOEING 7E7Forecast of Boeing 7E7 Free Cash Flows
(\$ in millions)

Assumptions	
Initial price of 7E7	\$136.95
Initial price of 7E7 Stretch	\$170.87
Cost of goods sold (% of sales)	80%
Working capital requirement (WCR) as a % of sales	6.7%
General, selling, and administrative (GS&A) as a % of sales	8%
R&D expense (% of sales)	2.3% (excluding 2004–2007)
Capital expenditure (% of sales)	0.16% (excluding 2004–2007)
Development costs (2004–2009)	\$8,000
Total number of planes: yrs 1–20	2500
Total number of planes: yrs 20–30	Same as year 20
Inflation	2%
Marginal effective tax rate	35%

	2004	2005	2006	2007	2008
Revenues					
Planes delivered					30
7E7 planes					30
7E7 Stretch planes					0
7E7 price					\$136.95
7E7 Stretch price					
Total product revenues					4,108.64
Cost of goods sold					3,286.91
Gross profit					821.73
Depreciation	7.50	29.44	102.23	117.06	123.78
GS&A expense					308.15
Operating profit (before R&D)	(7.50)	(29.44)	(102.23)	(117.06)	389.80
R&D expense	300.00	900.00	3,000.00	900.00	694.50
Pretax profit	(307.50)	(929.44)	(3,102.23)	(1,017.06)	(304.69)
Taxes (or tax credit)	(107.63)	(325.30)	(1,085.78)	(355.97)	(106.64)
After-tax profit	(199.88)	(604.13)	(2,016.45)	(661.09)	(198.05)
Capital expenditure	100.00	300.00	1,000.00	300.00	206.57
Depreciation add-back	7.50	29.44	102.23	117.06	123.78
Change in WCR					275.28
Annual free cash flow	\$(292.38)	\$(874.70)	\$(2,914.22)	\$(844.03)	\$(556.13)

Exhibit 8 (continued)

	2009	2010	2011	2012	2013
Revenues					
Planes delivered	108	64	82	84	104
7E7 planes	108	51	41	42	52
7E7 Stretch planes	0	13	41	42	52
7E7 price	\$139.69	\$142.49	\$145.34	\$148.24	\$151.21
7E7 Stretch price		170.87	174.28	177.77	181.33
Total product revenues	15,086.93	9,488.14	13,104.49	13,692.60	17,291.79
Cost of goods sold	12,069.55	7,590.51	10,483.59	10,954.08	13,833.44
Gross profit	3,017.39	1,897.63	2,620.90	2,738.52	3,458.36
Depreciation	123.80	115.66	108.67	102.83	99.64
GS&A expense	1,131.52	711.61	982.84	1,026.94	1,296.88
Operating profit (before R&D)	1,762.06	1,070.36	1,529.40	1,608.75	2,061.83
R&D expense	647.00	218.23	301.40	314.93	397.71
Pretax profit	1,115.06	852.13	1,227.99	1,293.82	1,664.12
Taxes (or tax credit)	390.27	298.25	429.80	452.84	582.44
After-tax profit	724.79	553.89	798.19	840.98	1,081.68
Capital expenditure	124.14	15.18	20.97	21.91	27.67
Depreciation add-back	123.80	115.66	108.67	102.83	99.64
Change in WCR	735.55	(375.12)	242.30	39.40	241.15
Annual free cash flow	\$(11.09)	\$1,029.48	\$643.60	\$882.50	\$912.51

	2014	2015	2016	2017	2018
Revenues					
Planes delivered	136	119	185	192	219
7E7 planes	68	60	93	96	110
7E7 Stretch planes	68	59	92	96	109
7E7 price	\$154.23	\$157.32	\$160.46	\$163.67	\$166.95
7E7 Stretch price	184.95	188.65	192.42	196.27	200.20
Total product revenues	23,064.59	20,569.48	32,626.19	34,554.82	40,185.75
Cost of goods sold	18,451.67	16,455.59	26,100.95	27,643.86	32,148.60
Gross profit	4,612.92	4,113.90	6,525.24	6,910.96	8,037.15
Depreciation	99.95	100.84	103.70	106.87	110.54
GS&A expense	1,729.84	1,542.71	2,446.96	2,591.61	3,013.93
Operating profit (before R&D)	2,783.12	2,470.35	3,974.57	4,212.48	4,912.68
R&D expense	530.49	473.10	750.40	794.76	924.27
Pretax profit	2,252.64	1,997.25	3,224.17	3,417.72	3,988.40
Taxes (or tax credit)	788.42	699.04	1,128.46	1,196.20	1,395.94
After-tax profit	1,464.21	1,298.21	2,095.71	2,221.52	2,592.46
Capital expenditure	36.90	32.91	52.20	55.29	64.30
Depreciation add-back	99.95	100.84	103.70	106.87	110.54
Change in WCR	386.78	(167.17)	807.80	129.22	377.27
Annual free cash flow	\$1,140.48	\$1,533.31	\$1,339.41	\$2,143.88	\$2,261.44

Exhibit 8 (continued)

	2019	2020	2021	2022	2023
Revenues					
Planes delivered	165	149	108	115	119
7E7 planes	83	75	54	58	60
7E7 Stretch planes	82	74	54	57	59
7E7 price	\$170.29	\$173.69	\$177.17	\$180.71	\$184.32
7E7 Stretch price	204.20	208.29	212.45	216.70	221.03
Total product revenues	30,878.29	28,440.04	21,039.33	22,833.05	24,100.43
Cost of goods sold	24,702.63	22,752.03	16,831.46	18,266.44	19,280.34
Gross profit	6,175.66	5,688.01	4,207.87	4,566.61	4,820.09
Depreciation	112.89	114.85	115.88	117.16	118.63
GS&A expense	2,315.87	2,133.00	1,577.95	1,712.48	1,807.53
Operating profit (before R&D)	3,746.89	3,440.15	2,514.04	2,736.97	2,893.92
R&D expense	710.20	654.12	483.90	525.16	554.31
Pretax profit	3,036.69	2,786.03	2,030.13	2,211.81	2,339.61
Taxes (or tax credit)	1,062.84	975.11	710.55	774.13	818.86
After-tax profit	1,973.85	1,810.92	1,319.59	1,437.68	1,520.75
Capital expenditure	49.41	45.50	33.66	36.53	38.56
Depreciation add-back	112.89	114.85	115.88	117.16	118.63
Change in WCR	(623.60)	(163.36)	(495.85)	120.18	84.91
Annual free cash flow	\$2,660.94	\$2,043.63	\$1,897.65	\$1,398.13	\$1,515.90

	2024	2025	2026	2027	2028
Revenues					
Planes delivered	136	150	120	115	115
7E7 planes	68	75	60	58	58
7E7 Stretch planes	68	75	60	57	57
7E7 price	\$188.01	\$191.77	\$195.61	\$199.52	\$203.51
7E7 Stretch price	225.46	229.96	234.56	239.26	244.04
Total product revenues	28,115.61	31,630.06	25,810.13	25,209.53	25,713.72
Cost of goods sold	22,492.49	25,304.05	20,648.10	20,167.63	20,570.98
Gross profit	5,623.12	6,326.01	5,162.03	5,041.91	5,142.74
Depreciation	116.20	105.31	62.54	50.92	43.54
GS&A expense	2,108.67	2,372.25	1,935.76	1,890.72	1,928.53
Operating profit (before R&D)	3,398.25	3,848.45	3,163.73	3,100.27	3,170.68
R&D expense	646.66	727.49	593.63	579.82	591.42
Pretax profit	2,751.60	3,120.96	2,570.09	2,520.45	2,579.26
Taxes (or tax credit)	963.06	1,092.33	899.53	882.16	902.74
After-tax profit	1,788.54	2,028.62	1,670.56	1,638.29	1,676.52
Capital expenditure	44.98	50.61	41.30	40.34	41.14
Depreciation add-back	116.20	105.31	62.54	50.92	43.54
Change in WCR	269.02	235.47	(389.94)	(40.24)	33.78
Annual free cash flow	\$1,590.73	\$1,847.86	\$2,081.74	\$1,689.12	\$1,645.13

Exhibit 8 (continued)

	2029	2030	2031	2032	2033
Revenues					
Planes delivered	115	115	115	115	115
7E7 planes	58	58	58	58	58
7E7 Stretch planes	57	57	57	57	57
7E7 price	\$207.58	\$211.73	\$215.96	\$220.28	\$224.69
7E7 Stretch price	248.92	253.90	258.98	264.16	269.44
Total product revenues	26,228.00	26,752.56	27,287.61	27,833.36	28,390.03
Cost of goods sold	20,982.40	21,402.05	21,830.09	22,266.69	22,712.02
Gross profit	5,245.60	5,350.51	5,457.52	5,566.67	5,678.01
Depreciation	39.86	41.10	42.13	43.19	44.07
GS&A expense	1,967.10	2,006.44	2,046.57	2,087.50	2,129.25
Operating profit (before R&D)	3,238.64	3,302.97	3,368.82	3,435.98	3,504.68
R&D expense	603.24	615.31	627.62	640.17	652.97
Pretax profit	2,635.39	2,687.66	2,741.21	2,795.81	2,851.71
Taxes (or tax credit)	922.39	940.68	959.42	978.53	998.10
After-tax profit	1,713.00	1,746.98	1,781.78	1,817.28	1,853.61
Capital expenditure	41.96	42.80	43.66	44.53	45.42
Depreciation add-back	39.86	41.10	42.13	43.19	44.07
Change in WCR	34.46	35.15	35.85	36.57	37.30
Annual free cash flow	\$1,676.45	\$1,710.13	\$1,744.41	\$1,779.37	\$1,814.96

	2034	2035	2036	2037
Revenues				
Planes delivered	115	115	115	115
7E7 planes	58	58	58	58
7E7 Stretch planes	57	57	57	57
7E7 price	\$229.18	\$233.77	\$238.44	\$243.21
7E7 Stretch price	274.83	280.33	285.93	291.65
Total product revenues	28,957.83	29,536.99	30,127.73	30,730.28
Cost of goods sold	23,166.26	23,629.59	24,102.18	24,584.22
Gross profit	5,791.57	5,907.40	6,025.55	6,146.06
Depreciation	44.59	45.33	45.25	45.08
GS&A expense	2,171.84	2,215.27	2,259.58	2,304.77
Operating profit (before R&D)	3,575.14	3,646.80	3,720.72	3,796.21
R&D expense	666.03	679.35	692.94	706.80
Pretax profit	2,909.11	2,967.45	3,027.78	3,089.41
Taxes (or tax credit)	1,018.19	1,038.61	1,059.72	1,081.29
After-tax profit	1,890.92	1,928.84	1,968.06	2,008.12
Capital expenditure	46.33	47.26	48.20	49.17
Depreciation add-back	44.59	45.33	45.25	45.08
Change in WCR	38.04	38.80	39.58	40.37
Annual free cash flow	\$1,851.14	\$1,888.10	\$1,925.52	\$1,963.65

Exhibit 9

THE BOEING 7E7

Sensitivity Analysis of Project IRRs by Price, Volume,
Development, and Production Costs

Unit Volume (First 20 Years)	Price Premium Above Expected Minimum Price			
	0%	5%	10%	15%
1,500	10.5%	10.9%	11.3%	11.7%
1,750	11.9%	12.3%	12.7%	13.1%
2,000	13.0%	13.5%	13.9%	14.4%
2,250	14.1%	14.6%	15.1%	15.5%
2,500	15.2%	15.7%	16.1%	16.6%
2,750	16.1%	16.6%	17.1%	17.6%
3,000	17.1%	17.6%	18.1%	18.6%
Development Costs	Cost of Goods Sold as a Percentage of Sales			
	78%	80%	82%	84%
\$6,000,000,000	21.3%	18.7%	15.9%	12.6%
\$7,000,000,000	19.4%	17.0%	14.4%	11.3%
\$8,000,000,000	17.9%	15.7%	13.2%	10.3%
\$9,000,000,000	16.6%	14.5%	12.1%	9.4%
\$10,000,000,000	15.5%	13.5%	11.2%	8.6%

Note: The IRR consistent with “base case” assumptions is 15.7% and is indicated in italics in the table.

Source: Case writer’s analysis.

Exhibit 10

THE BOEING 7E7

Information on Comparable Companies
(Specially calculated betas estimated from daily stock
and market returns over the periods indicated)

	Boeing	Lockheed Martin	Northrop Grumman	Raytheon
Percentage of revenues derived from government (defense and space)	46%	93%	91%	73%
Estimated betas				
1. Value Line ¹	1.05	0.60	0.70	0.80
2. Calculated against the S&P 500 index: ²				
60 months	0.80	0.36	0.34	0.43
21 months	1.03	0.38	0.31	0.46
60 trading days	1.45	0.34	0.27	0.66
3. Calculated against the NYSE composite index: ²				
60 months	1.00	0.49	0.44	0.59
21 months	1.17	0.44	0.36	0.53
60 trading days	1.62	0.37	0.30	0.73
Effective marginal tax rate	0.35	0.35	0.35	0.35
Market-value debt/equity ratios	0.525	0.410	0.640	0.624

Sources: Case writer's analysis and *Value Line Investment Survey*.

¹ Value Line betas are calculated from a regression analysis between the weekly percentage change in price of a stock and the weekly percentage changes of the New York Stock Exchange Composite Index. The beta is calculated using the last five years of data.

² Regression periods for the 60-day, 21-month, and 60-month begin on March 20, 2003, September 17, 2001, and June 16, 1998, respectively. Regression periods end on June 16, 2003.

Exhibit 11

THE BOEING 7E7

Outstanding Bonds of the Boeing Company as of June 2003
(\$ values in millions)

Debt Amount	Debt Rating	Coupon	Maturity	Price	Yield To Maturity
\$202	A-	7.625%	2/15/2005	106.175	3.911%
\$298	A-	6.625%	6/1/2005	105.593	3.393%
\$249	A-	6.875%	11/1/2006	110.614	3.475%
\$175	A-	8.100%	11/15/2006	112.650	4.049%
\$349	A-	9.750%	4/1/2012	129.424	5.470%
\$597	A-	6.125%	2/15/2013	103.590	4.657%
\$398	A-	8.750%	8/15/2021	127.000	6.239%
\$300	A-	7.950%	8/15/2024	126.951	5.732%
\$247	A-	7.250%	6/15/2025	114.506	6.047%
\$249	A-	8.750%	9/15/2031	131.000	6.337%
\$173	A-	8.625%	11/15/2031	138.974	5.805%
\$393	A-	6.125%	2/15/2033	103.826	5.850%
\$300	A-	6.625%	2/15/2038	106.715	6.153%
\$100	A-	7.500%	8/15/2042	119.486	6.173%
\$173	A-	7.825%	4/15/2043	132.520	5.777%
\$125	A-	6.875%	10/15/2043	110.084	6.191%

Note: This table does not include the outstanding debt of Boeing's financing subsidiary, Boeing Capital Corporation.

Sources: Boeing Company 10-Q, Bloomberg Financial Services, and Mergent Online.

Appendix

THE BOEING 7E7

Assumptions Underlying the Forecast of Cash Flows

Revenue Estimation

In order to project revenues for the project, several assumptions were made about the expected demand and timing for the units, their price, and price increases.

Demand: Boeing estimated that in the first 20 years they would sell 2,000–3,000 units.¹ Frost & Sullivan, aviation industry analysts, predicted at least 2,000 units.² Analysis assumes 2,500 units in years 1 through 20. Years 20–30 assume unit sales equal to year 20. First delivery of 7E7 expected in 2008 and 7E7 Stretch in 2010.

Timing of demand: Units sold per year is the percentage of the total units in the first 20 years as shown in **Exhibit 6**. **Exhibit 6** uses an historical average of the 757 and 767 unit sales during their first 20 years. The Boeing 7E7 is expected to be a replacement aircraft for the 757 and 767. Analysis assumes the 7E7 Stretch accounts for only 20% of unit sales in its first year of delivery and 50% thereafter. If the total number of unit sales per year is an odd number, the 7E7 units are rounded up and the 7E7 Stretch are rounded down.

Price: The expected price of the 7E7 and Stretch version is a function of the 767 and 777 prices in 2002. Using range and capacity as the primary variables, the 7E7 and 7E7 Stretch would be expected to have a minimum price of \$114.5 million and \$144.5 million respectively in 2002 dollars. This does not include a premium for the expected lower operating costs and flexibility of the 7E7. The analysis assumes a 5% price premium as a benchmark, resulting in expected prices of \$120.2 million and \$151.7 million in 2002.

Rate of price increases: Aircraft prices are assumed to increase at the rate of inflation. Inflation is assumed to be 2% per year until 2037.

Expense Estimation

Cost of goods sold: The average cost of goods sold for Boeing's commercial-aircraft division was 80% over the three-year period 2000–2002. The range was 77.9% to 81.1%. The analysis assumes 80% as the COGS.

General, selling, and administrative expense: The average general, selling, and administrative expense for Boeing was 7.5% over the three-year period 2000–2002. The range was 7.4% to 7.7%. The analysis assumes 7.5% as the general, selling, and administrative expense.

¹ "New Team, Name for Boeing 'Super-Efficient' Jet," *Seattle Times*, 30 January 2003, 1.

² "An Ongoing Rivalry," *Aviation Today*, August 2003.

Appendix (continued)

Depreciation: Boeing depreciated its assets on an accelerated basis. The forecast uses 150% declining balance depreciation with a 20-year asset life and zero salvage value as the base.

Research and development as a percentage of sales: The average research and development expense for Boeing's commercial-aircraft division as a percentage of commercial-aircraft sales was 2.3% over the three-year period 2000–2002. The range was 1.8% to 2.7%. During that period, Boeing did not have any extraordinary new commercial-aircraft development expenses. The analysis, therefore, assumes 2.3% as the estimated research and development expense. That does not include the initial research and development costs required to design and develop the 7E7.

Tax expense: Boeing's expected marginal effective tax rate was 35%.

Other Adjustments to Cash Flow

Capital expenditures: The 1998–2002 average for capital expenditures as a percentage of sales was 0.93%. During this period, Boeing did not have any extraordinary new commercial-aircraft development expenses. At the time, Boeing had six families of aircraft: the 717, 737, 747, 757, 767, and 777. The average capital expenditures per family line, as a percentage of sales, was therefore 0.16%. This does not include the initial capital expenditure costs required to develop and build the 7E7.

Change in working capital requirements (WCR): For the years 2000–2002, Boeing had negative working capital due to factors such as advance customer payments. The analysis assumes that the commercial segment of Boeing would require positive working capital. The years prior to 2000, Boeing had positive working capital. The 1997–1999, three-year average of working capital as a percentage of sales is 6.7% with a range from 3.5% to 11.2%. The analysis assumes this percentage.

Initial development costs: Development costs include the research and capital requirements needed to design and build the 7E7. Analysts estimated between \$6 billion and \$10 billion.³ The analysis assumes \$8 billion. Assuming a launch in 2004, analysts expected spending to peak in 2006. Timing of the development costs are assumed to be 2004: 5%, 2005: 15%, 2006: 50%, 2007: 15%, 2008: 10%, and 2009: 5%. It is estimated that 75% of the initial development costs are research and development expenses, while the remaining 25% are capital expenditures.

Source: Case writer's analysis.

³ "Boeing Plays Defense," *BusinessWeek*, 3 June 2003.