

**JAIPURIA INSTITUTE OF MANAGEMENT, NOIDA**

**PGDM / PGDM (M) / PGDM (SM)**

**THIRD TRIMESTER (BATCH 2023-25)**

**END TERM EXAMINATION, APRIL 2024**

(Set 2)

Course Name	Economics of Strategy	Course Code	20707
Max. Time	2 Hours	Max. Marks	40 MM

**INSTRUCTIONS:**

1. It is an open book exam (course book- Economics of Strategy- Besanko et.al./ Games of Strategy- Avinash Dixit),
2. Handwritten notes are not allowed.
3. Answer all questions

Q1. Use the following payoff matrix for a one-shot game to answer the following questions.

		Player 2		
		Strategy	C	D
Player 1	A	-10, -10	200, -100	
	B	-100, 220	140, 180	

- a. Determine the dominant strategy for each player. If such strategies do not exist, explain why not.
  - b. Estimate the secure strategy for each player. If such strategies do not exist, explain why not.
  - c. Evaluate the Nash equilibrium of this game. If such an equilibrium does not exist, explain why not.
- (3\*3=9 marks) (CLO3)

Q2. Read the case "Airbus and Boeing: Superjumbo Decisions" and answer the following questions.

- a. Examine the uncertainties each firm faces in this situation? Appraise their views on uncertainties whether it will be similar or different? (5\*2=10 marks) (CLO1)
- b. Organize all numbers in a payoff matrix of Boeing choice to develop now (D) a superjumbo 747-X or never develop (N), and for Airbus to be "in development of an offering (I) or stay out of (O) with superjumbo market with the A3XX.
  - (i) Of the possible outcome, Choose the most desirable for Boeing? (7 marks)
  - (ii) Assess whether Airbus will introduce the superjumbo jet or not? (7 marks)
  - (iii) Estimate the outcome of this competitive interaction between two companies?

(7\*3= 21 marks) (CLO2)

## AIRBUS AND BOEING: SUPERJUMBO DECISIONS

By the summer of 1999, Boeing was considering how to respond to Airbus's decision to announce by year's end whether or not it planned to proceed with a risky and costly project to develop the world's first commercial superjumbo jet. Airbus had been considering investing in such a project since the early 1990s. Its goal was to challenge the Boeing 747's 30-year monopoly on the very-large-aircraft (VLA) market—the market for passenger jets with more than 400 seats. The proposed project, if launched by Airbus, would lead to deliveries of the world's first superjumbo jet—the 550-seat A3XX—which was even larger than the Boeing 747. The superjumbo segment represented those planes that would carry more than 500 passengers in their standard configuration.<sup>1</sup> Airbus's development effort was expected to cost \$10 billion and take five years to complete.

Boeing had all but ruled out a new, full-scale development effort for its next-generation VLA.<sup>2</sup> In the late 1990s, it had “lost control of its factories, upset its customers with late deliveries, and plunged into its first loss in 50 years.”<sup>3</sup> Instead, Boeing was considering a more modest development effort to “stretch” its current 416-seat 747-400 plane into a new 440-to-520-seat “747-X” plane,<sup>4</sup> which would take an estimated five years and cost \$7.5 billion. How Boeing reacted to Airbus's announcement could affect its position in the VLA market for years. After all, Boeing had delivered 1,189 jumbo jets since the 1969 inception of the 747 jumbo jet.<sup>5</sup>

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<sup>1</sup> Daniel Michaels, “Airbus, Boeing See Plane Sales of \$1.3 Trillion—Forecasts for Next 20 Years Different in Composition of the Jetliner Market,” *Wall Street Journal*, June 15, 1999, eastern edition.

<sup>2</sup> “Aircraft Characteristics,” in “Widebody Aircraft Expert Guide,” special issue, *Airfinance Journal* (1999): 3.

<sup>3</sup> “Aerospace—Hubris at Airbus, Boeing Rebuilds,” *Economist*, November 28, 1998.

<sup>4</sup> “Aircraft Characteristics,” 3.

<sup>5</sup> “The Giant on the Runway—The Airbus A380,” *Economist*, October 13, 2007.

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This case was prepared using public information by Kenneth C. Lichtendahl Jr., Assistant Professor of Business Administration, and Samuel E. Bodily, John Tyler Professor of Business Administration. It was written as a basis for class discussion rather than to illustrate effective or ineffective handling of an administrative situation. Copyright © 2008 by the University of Virginia Darden School Foundation, Charlottesville, VA. All rights reserved. *To order copies, send an e-mail to [sales@dardenbusinesspublishing.com](mailto: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.*

## Recent History

At the beginning of 1998, Boeing chairman and CEO Phil Condit and its president and COO, Harry Stonecipher, issued the following statement in their 1997 annual report's "Message to Shareholders":

Our financial results for 1997 were very disappointing... We recorded a net loss of \$178 million. This was due to \$3 billion-plus in pretax charges—more than half of which were due to production problems in our commercial aircraft business. Our shareholders have every right to expect better. So do our airline customers, who have faced the problem of late deliveries of aircraft.

Despite record sales of \$56 billion and expenditures of \$1.9 billion on R&D, problems continued for Boeing in 1998. In early 1999, Condit and Stonecipher issued the following statements in their 1998 annual report's "Message to Shareholders":

As 1998 began, the problems confronting us were largely of our own making. In the midst of a boom market, we tried to do too much too soon in terms of raising production rates and coping with the variability involved in building several new models at one time and in limited quantities for new customers.

Toward the end of the year, we confronted another kind of problem, which was serious deterioration in the order book due to the Asian economic crisis. This hit us especially hard on the 747 program—our largest, and one of our most profitable airplanes. As a result, we are prepared to reduce production of the 747 from five per month at present to two per month in late 1999 and subsequently to one per month in early 2000, if market conditions fail to improve.

While Boeing was having financial difficulty and reducing production, Airbus was flying high. It was poised to overtake Boeing in orders booked for the first time in 10 years. In 1998, even though Airbus delivered only 229 planes to Boeing's 564, it booked orders of 556 to Boeing's 606. Moreover, it now had a commanding 51% productivity advantage: Airbus employed 143 workers per aircraft produced, whereas Boeing employed 216 workers per aircraft produced.<sup>6</sup>

## Divergent Forecasts of Demand

Each year at the Paris Air Show, Airbus and Boeing issued forecasts of commercial-aircraft demand for the next 20 years. They were issued in detailed, widely available reports. At the show in June 1999, Airbus issued its 80-page *Global Market Forecast*, and Boeing issued its 50-page *Current Market Outlook*. At the time, the forward-looking views of Airbus and Boeing were particularly divergent. On the one hand, Airbus foresaw a total market, including cargo, for

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<sup>6</sup> "Aerospace—Hubris at Airbus, Boeing Rebuilds."

1,500 VLA. On the other hand, Boeing saw "demand for 933 planes with more than 400 seats over the next two decades, out of which...360 planes [would have] more than 500 seats," according to Randy Baseler, vice president for marketing in Boeing's commercial-airplane group.<sup>7</sup>

The difference of opinion grew out of the views each company had about how the airline-carrier business would evolve. Boeing saw a sharp increase in the lower-density point-to-point flights between secondary airports, while Airbus still saw strength in the traditional high-density flights between hub airports.

An aerospace analyst at Goldman First Boston (GFB) had collected the viewpoints of the two parties (**Exhibit 1**), which converted the forecasts into mean estimates of annual jumbo- and superjumbo-plane deliveries. He also produced a report and spreadsheet of his calculations (**Exhibits 2 and 3**).

The GFB report also projected that annual jumbo deliveries in the next five years would range from 10 to 30, with a most likely estimate of 25 planes, based on information gathered from Boeing. Airbus likely shared this view of the VLA market, at least over the same time period. If no superjumbos were introduced by Airbus, Boeing would enjoy all the VLA sales. The GFB report projected that, in Boeing's view, VLA annual deliveries for the jumbo market (for years 6-40) would range between 21.15 and 51.15, with a most likely number of 36.15. The analyst saw that, for the most part, Airbus shared this view. He assumed Airbus's forecast was 0.04 planes fewer than Boeing's for the jumbo market in years 6-40.

In his previous studies of the introduction of new airplanes, the analyst had found it helpful to do a separate forecast of the number of initial orders taken from announcement to delivery of the first plane. He had seen that the Boeing 747 had had 178 total orders before its first delivery, on December 12, 1969, and the company went on to sell an average of 40 planes per year (an annual deliveries-to-initial-orders ratio of 22.5%). A similarly successful plane, the Boeing 777, had 137 total orders before its first delivery, on May 15, 1995. It went on to sell an average of 56 planes per year through mid-1999 (a ratio of 40.9%).

The GFB report projected that actual superjumbo market deliveries would be a multiple of total initial orders. On the basis of Boeing's public statements and his own expert judgment, the analyst surmised that Boeing's forecast of initial superjumbo orders would be in the range of 10 to 200 planes, with the most likely being 23.5 planes (the average was 77.83). On the basis of Airbus's public statements and the analyst's expert judgment, he concluded that Airbus's forecast of initial superjumbo orders would be in the range of 71.45 to 261.45 planes, with the most likely being 84.95 planes (the average was 139.28). This amounted to adding 61.45 to Boeing's forecast so that each company's forecast matched the mean estimates in **Exhibit 1**.

His approach to forecasting annual superjumbo deliveries was to place a range and uncertainty on the ratio of annual superjumbo deliveries to initial orders. Using his experience

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<sup>7</sup> Michaels.

and judgment, he projected that the minimum ratio of annual superjumbo deliveries (in years 6–40 of the product life cycle) to initial orders would be 10%; the maximum, 50%; and the most likely, 30%. Therefore, the average annual superjumbo deliveries (e.g., 30% of 139.28 is 41.79) matched the analyst's mean estimates derived from Airbus's 20-year forecasts in **Exhibit 1**.

The analyst then added jumbo deliveries to the product of superjumbo initial orders and the annual superjumbo annual deliveries-to-orders ratio. This combined projection of the annual VLA market deliveries (for years 6–40) gave an average annual delivery of 77.9 (for the Airbus perspective) and 59.5 (for the Boeing perspective), matching the point forecasts issued by Airbus and Boeing in their 1999 forecasts.

The attractiveness of the superjumbo depended on how the companies would share the VLA market segments. Because Boeing was already in the jumbo market, the GFB report stated that it would keep the entire jumbo market. If Airbus was the only company to introduce a superjumbo, it would receive the entire superjumbo segment. Because Airbus was likely to have a better offering with a larger, newer design, if both companies offered a superjumbo, Boeing would earn a 40% share of that segment, leaving 60% for Airbus.

### **The Decisions**

Was Airbus or Boeing right about the number of superjumbo aircraft that would be sold? And should either company bet significant shareholder value on it? These were huge questions. Boeing had to decide whether to develop the superjumbo stretch 747-X to compete with Airbus's potential new offering. On the one hand, if Boeing chose to put off developing the 747-X, it risked seeing Airbus take the entire superjumbo market. On the other hand, Boeing's hesitancy could pay off if Airbus's newly offered superjumbo received few orders, indicating that it might be unsuccessful in the market.

In rough terms, the present value of profit per plane, based on how sales would be spread over a 40-year product lifetime, was about \$25 million. All other dollar amounts in the GFB model were in present-value terms.

Exhibit 1

**AIRBUS AND BOEING: SUPERJUMBO DECISIONS**

Forecasts and Mean Estimates

**Airbus and Boeing 20-Year Forecasts<sup>1</sup>**

	Airbus View		Boeing View	
	Total	Annual	Total	Annual
Passenger jumbo market deliveries	560	28.0	565	28.3
Passenger superjumbo market deliveries	648	32.4	365	18.3
Large-capacity freighter (cargo) market deliveries	350	17.5	260 <sup>2</sup>	13.0
Total VLA market deliveries	1,558	77.9	1,190	59.5

  

Jumbo share of passenger VLA market	0.464	0.608
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**Goldman First Boston Mean Estimates<sup>3</sup>**

	Airbus View		Boeing View	
		Annual		Annual
Jumbo market deliveries (years 6–40)		36.11		36.15
Superjumbo market deliveries (years 6–40)		41.79		23.35
VLA market deliveries (years 6–40)		77.9		59.5

<sup>1</sup> *Global Market Forecast*, Airbus (1999): 40, 54; *Current Market Outlook*, Boeing (1999): 38–39.

<sup>2</sup> In 1999, Boeing forecasted demand for 650 new freighters over the next 20 years. The number 260 was obtained by using the same fraction of all freighters that would be large-capacity freighters (40%), which Airbus assumed in its 1999 forecast.

<sup>3</sup> The GFB mean estimates of annual jumbo market deliveries (years 6–40) were obtained by multiplying each firm's forecasted jumbo share of annual passenger VLA market deliveries (years 1–20) by forecasted annual large-capacity freighter market deliveries (years 1–20) and adding those numbers to each firm's forecasted annual passenger jumbo market deliveries (years 1–20). The estimates of the annual superjumbo market deliveries (years 6–40) were obtained by subtracting the estimate of each firm's annual jumbo market deliveries (years 6–40) from its forecasted annual VLA market deliveries (years 1–20).

## Exhibit 2

**AIRBUS AND BOEING: SUPERJUMBO DECISIONS**

## GFB Model with Airbus in Superjumbo Market

**Assumptions**

Airbus A3XX development costs	\$10,000	million
Boeing 747-X development costs	\$7,500	million
Airbus present value of profit per VLA	\$25	million
Boeing present value of profit per VLA	\$25	million
Boeing's savings from later 747-X development	0.1 <sup>1</sup>	
Boeing 747-X share of superjumbo market	0.4	

**Analysis**

	<u>Airbus</u>	<u>Boeing</u>
Boeing begins 747-X development in year 1? (Yes = 1, No = 0)		0
Annual jumbo market deliveries (years 1-5)	21.67	21.67
A3XX superjumbo initial orders at the end of year 5	139.28	77.83
Boeing begins 747-X development in year 6? (Yes = 1, No = 0)		0
Annual superjumbo market deliveries-to-orders ratio (years 6-40)	0.30	0.30
Annual jumbo market deliveries (years 6-40)	36.11	36.15
Annual superjumbo market deliveries (years 6-40)	41.79	23.35
Jumbo company deliveries (years 1-5)	0	108
Jumbo company deliveries (years 6-40)	0	1,265
Superjumbo company deliveries (years 6-10)	209	0
Superjumbo company deliveries (years 11-40)	1,254	0
VLA company deliveries (years 1-40)	1,462	1,374
Net present value	\$26,562	\$34,340

<sup>1</sup> Owing to near-term commitments to address Boeing's current production problems and to other development projects, a start of the 747-X development five years later was projected to cost 10% less in present-value terms.

Exhibit 3

**AIRBUS AND BOEING: SUPERJUMBO DECISIONS**

GFB Model with Airbus out of Superjumbo Market

**Assumptions**

Airbus A3XX development costs	\$10.000	million
Boeing 747-X development costs	\$7.500	million
Airbus present value of profit per VLA	\$25	million
Boeing present value of profit per VLA	\$25	million
Boeing 747-X share of superjumbo market	1	

**Analysis**

	<u>Airbus</u>	<u>Boeing</u>
Boeing begins 747-X development in year 1? (Yes = 1, No = 0)		0
Annual jumbo market deliveries (years 1-5)		21.67
747-X superjumbo initial orders at the end of year 5		77.83
Annual superjumbo market deliveries-to-orders ratio (years 6-40)		0.30
Annual jumbo market deliveries (years 6-40)		36.15
Annual superjumbo market deliveries (years 6-40)		23.35
Jumbo company deliveries (years 1-5)		108
Jumbo company deliveries (years 6-40)		1,265
Superjumbo company deliveries (years 6-10)		0
Superjumbo company deliveries (years 11-40)		0
VLA company deliveries (years 1-40)		1,374
Net present value	\$0	\$34,340