AN ECONOMIC AND FINANCIAL REVIEW OF AIRBUS INDUSTRIE

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PREFACE

When GRA undertook this study on the economics of Airbus Industrie under contract to the Department of Commerce, it was recognized that GRA would have to acquire, analyze and interpret data and information often of a sensitive and confidential nature. Consequently, it was agreed between the parties that GRA would be able to offer a guarantee that those sources would be thoroughly protected.

The reliability of the conclusions reached in the report is heavily buttressed by the data and information GRA was able to obtain, supported in many cases by conversations with individuals in a position to elaborate upon them and describe the conditions surrounding the transactions they represented. GRA was highly gratified by the responses of such people and organizations--who must unfortunately remain unidentified. They have our thanks.

GRA wishes to acknowledge the guidance and assistance of several people. Mr. Jonathan C. Menes, Director, Office of Finance, Industry and Trade Information, U.S. Department of Commerce, was the project technical monitor for the project. He provided technical input on forecasts and costs, and coordinated contacts with both industry and government. His encouragement and support were of inestimable value. Ms. Sally H. Bath, Office of Aerospace, was always ready, willing and able to provide insights as to the nature of European support for the aircraft industry. She also was a tireless reviewer of draft reports and contributed many factual and stylistic suggestions. Mr. A.M. Brueckmann, Division Director in the Office of Minerals, Metals and Commodities, helped in the analysis and interpretation of the cost estimates used in the study.

At GRA, Dr. Jerome Bentley and Dr. Earl Bomberger prepared the discounted cash flow analysis and developed much of the theoretical work which underlies the analysis. Mr. Keith Campbell contributed to the analysis of foreign government support of Airbus. Still others worked tirelessly on the project and their efforts are appreciated.

While GRA received much input and comment from U.S. Government sources, the analysis, findings and conclusions are those of GRA and not necessarily those of the United States Government. Responsibility for any errors or omissions remains with us.

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Executive Summary

AN ECONOMIC AND FINANCIAL REVIEW OF AIRBUS INDUSTRIE

This report was prepared for the International Trade Administration of the U.S. Department of Commerce (DOC). It examines the economics of Airbus Industrie (AI) civil transport programs and the potential effects of AI's presence on both the market for civil transport aircraft and on competing U.S. firms. One of the primary reasons for conducting this study was to develop data and information on AI's operations and the levels of government support its programs receive because AI does not provide detailed information on either its own financial performance, or the support it receives from member governments through funding of AI-related efforts in their own countries.

Another important reason for conducting the study was to deepen understanding of the complex web of relations between the participating companies, the governments and the AI consortium. Airbus Industrie is a multi-national consortium of aircraft manufacturers organized to develop, produce and sell commercial transport aircraft. The enterprise's shareholders are Aerospatiale of France, British Aerospace of the United Kingdom, Deutsche Airbus (owned by Daimler-Benz) of West Germany and Construcciones Aeronauticas S.A. (CASA) of Spain. Governments of the member companies are also signatories of agreements among themselves that guarantee political as well as financial support for AI's aircraft programs. There are no separately-published financial results for AI itself or data reflecting the investments made by the member firms on AI's behalf. One must recognize that there is a degree of uncertainty in the numeric estimates presented below because they involve estimates of past, current and future sales prices, delivery quantities and costs for AI aircraft.

Key findings and conclusions include the following:

Commercial Viability of Airbus Industrie Programs

- o AI programs, taken individually or as a group, have not been and will not become commercially viable in the foreseeable future; all programs have a negative net present value when the cash flows are discounted at an average interest rate of 8.7 percent per year, which is reflective of commercial borrowing costs in Europe.
- o A privately-financed firm would not have invested in any of the AI programs because none of these programs would show sufficient profits.

AI Industrie Cash Flows Through 2008

- o The original A300 (launched in 1968) sustained significant negative cash flows even with the provision of government launch aid. These losses have been compensated for, in part, by additional government support in the form of production subsidies and equity infusions to AI member companies.

- It is estimated that the A300-600/A310 program (launched in 1977) will generate a negative nominal cash flow[1] of $12.9 billion in 1990 dollars from inception through 2008. The A320/A321 programs (launched in 1983) is estimated to produce a negative nominal cash flow of $4.9 billion in 1990 dollars from inception through 2008.

- The A330/A340 program (launched in 1987) is estimated to generate a positive nominal cash flow of $3.2 billion through the year 2008 (in 1990 dollars), although it will not produce a positive net present value using commercial rates of interest.

- The most recent AI programs--A320/A321 and A330/A340--are projected to fare much better in financial terms today than when they were originally launched due to the recent exceptionally strong market for transport aircraft. As incremental cash flow turns positive, there should be no reason for additional government support.

Government Subsidies and Support

- To date, the governments of France, West Germany and the United Kingdom have disbursed total support of $8.2 billion to AI member companies. Another $2.3 billion has been pledged for the A330/A340 program. In addition, there are $3.0 billion in supports committed to Deutsche Airbus as part of the merger between Daimler-Benz and MBB, the parent company of Deutsche Airbus.

- If AI had to pay commercial rates for its net government support, the total funds committed would be valued at $25.9 billion in 1990.

- The AI member-companies governments have provided almost 75 percent of the development funds the various AI aircraft. The financial analysis of AI indicates that there is little likelihood that such support will be repaid in full.

Pricing

- Airbus' "real" prices are affected by the value of the dollar relative to other major world currencies because Airbus sells its aircraft in dollars but purchases many inputs in European currencies. The realignment of currency values since 1985 has placed strains on the consortium's finances and has caused AI companies to return to their governments for additional support; at present, only the West German Government has responded positively through an exchange rate guarantee.

- AI has been able to increase prices during the strong aircraft market over the last two years. However, even at these higher prices, AI programs will not be commercially viable by 2008.

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1. "Nominal cash flow" excludes any interest charges.

- A sensitivity analysis indicates that AI programs fare better under a high-price, low-quantity-delivered scenario than under a low-price, high-quantity-delivered scenario.

Market Effects of AI

- Only a limited number of privately-financed firms can exist in the market for specific types of transport aircraft--e.g., narrow-body airliners with 130 to 180 seats. Worldwide deliveries of transport category aircraft are limited to several hundred units per year. In addition, average unit costs of production decline as output (in the relevant range) increases and the costs to launch a new program are very great. Consequently, only a few firms will succeed in selling enough units to take substantial advantage of declining unit costs.

- AI has avoided the traditionally high financial barriers to entry into the aircraft manufacturing industry through the receipt of substantial--and continuing--government support. Such support has ensured that AI will be one of the world's limited number of aircraft manufacturers.

- AI member firms are able to undertake activities which support AI programs only because they, in turn, are supported through grants, loans and/or investments by their respective governments.

- AI has greater staying power in the market than comparable privately-financed firms. So long as AI partner companies continue to receive subsidies from their governments, AI can continue to compete effectively without the necessity to make its programs financially viable.

- Continuing support for AI programs is anticipated. Certain European governments have already committed substantial sums to AI in the form of grants with no repayment requirements. For example, the West German Government has committed almost $3 billion to support the production costs of Deutsche Airbus.

- AI will remain a force in the aircraft market for the foreseeable future. Labor policies in Europe cause program termination costs to be exceptionally high. Participating governments expect AI to produce significant external benefits including growing high-technology employment and stimulation of other advanced-technology industries in Europe. Furthermore, AI is viewed as a successful example of European cooperation which its governments would be loathe to dismember especially as Europe integrates.

Effects on U.S. Industry

- Without government support, AI cannot exist and Western Europe's share of the worldwide transport market will be lower. Until recently, the impact of AI has been limited to preserving approximately the market share historically enjoyed by European producers.

- If AI continues to sell its aircraft below its costs, U.S. firms will lose market share even while being pressured to lower their own prices. As a consequence, both current and expected profits for U.S. firms will decline due to continued government support for AI programs.

- Reduced profits on current U.S. programs have significant impacts because U.S. aircraft manufacturers have traditionally relied heavily upon internally-generated funds to make the necessary multi-billion dollar investments in new aircraft programs.

- Lower than expected profits on existing U.S. programs may discourage the introduction of new, advanced-technology U.S. aircraft. This is especially important since AI has recently introduced or announced new-technology models in both the narrow-body and wide-body markets.

- The reduced prospects for profit in the U.S. industry and diminished earnings on current programs may cause U.S. firms to seek additional providers of capital that also will share financial risks. One approach is "partnerships" with non-U.S. firms where, in the long run, U.S. firms could lose control of new-technology aircraft programs. Furthermore, one of the possible conditions for foreign investment could be arrangements which result in significant transfers of U.S. technology overseas.

- The exchange rate difficulties of AI and AI-member companies have resulted in U.S. aerospace firms receiving contracts covering components of Airbus aircraft beyond what was previously expected. However, such work has been largely confined to the less technologically innovative aspects of the aircraft.

- AI is now considering additional extensions of its product line, including a 100-seat jet transport and an advanced supersonic airliner. In the latter case, the worldwide market is likely to be able to sustain only one manufacturer. If AI pursues this program with government support, it could either preclude U.S. manufacturers from participating in this market segment or force one or more of them to join forces with AI on terms unfavorable to the U.S. industry.

Chapter 1

INTRODUCTION

1.1 Study Purpose

The U.S. Department of Commerce (DOC) contracted with Gellman Research Associates, Incorporated (GRA) to undertake an analysis of the various Airbus Industrie (AI) aircraft programs. The purpose of the analysis was to--

- Inform the U.S. Government about the likely economic performance of AI's aircraft programs;
- Document the past levels of government support provided to the AI member-companies by their governments;
- Assess the financial viability of AI aircraft programs to determine whether they could have been undertaken by a commercial entity;
- Examine the effects of Airbus Industrie on the U.S. aircraft, aircraft engine and avionics manufacturing industries.

1.2 Airbus Industrie

This chapter provides background information on AI, including how it is organized and governed, how it pays for its inputs, and why it receives government support.[1] AI is a multinational consortium of aircraft manufacturers organized to design, produce and sell commercial airline aircraft. AI produces (or has under development) basic aircraft models including the A300, A310, A320, A321, A330 and A340. Table 1-1 provides a history of AI products from the firm's inception in 1968 into 1990. The table reflects that AI has launched a number of new aircraft models and derivatives in the 1980's; this is in keeping with one of the consortium's stated goals to offer a family of aircraft comparable to that of the Boeing Company. Airbus aircraft compete worldwide with aircraft built by both Boeing and McDonnell Douglas.

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1. Government support for AI activities is actually provided to its consortium partners. For convenience of presentation, the term "Airbus" (or AI) is used herein to denote any support, policies or activities by Airbus Industrie or its partners relating ultimately to the design, development, manufacture and marketing of the products of Airbus Industries (AI).

Table 1-1

HISTORY OF AIRBUS INDUSTRIE AIRCRAFT PROGRAMS

Model	Launch Year	Seats*	Fuselage	Status	Competing Aircraft
A300	1968	267	Wide-body	Out of Production	DC-10/L-1011
A310 (D)	1977	218	Wide-body	In Production	B-767
A300-600 (D)	1977	267	Wide-body	In Production	B-767/DC-10
A320	1983	150	Narrow-body	In Production	B-737, MD-80
A321 (D)	1989	180	Narrow-body	In Development	B-757, MD-80
A330	1987	328	Wide-body	In Development	B-767, MD-11, B-767-X**
A340	1987	262	Wide-body	In Development	B-747, MD-11

(D) indicates derivatives of preceding aircraft.

* Mixed Configuration.
** MD-11 in development; B-767-X announced.

1.2.1 Airbus Industrie Organization

AI is owned by its member-companies. These include Aerospatiale of France, Deutsche Airbus of West Germany[2], British Aerospace Plc (BAe) of the United Kingdom and Construcciones Aeronauticas SA (CASA) of Spain. The governments of the member companies also are signatories on agreements among themselves regarding their commitments to AI's civil aircraft programs.

Airbus Industries is constituted as a Groupement d'Interet Economique (GIE), a French form of partnership which has full legal personality, is not required to report financial results and is not liable to pay taxes on its profits unless it so elects. The members of a GIE are jointly and separately liable to third parties, without limitation, for its debts and obligations; however, such debts and obligations are shared in proportion to their respective membership rights.[3] In the broadest sense, the GIE relationship involves not only the member companies (British Aerospace, Aerospatiale, Deutsche Airbus, and CASA) but also their respective governments.

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2. Deutsche Airbus (DA) is the entity in West Germany which is a partner in the Airbus consortium. DA is now controlled by Daimler-Benz as a result of its merger with Messerschmitt-Bolkow-Blohm (MBB).

3. British Aerospace Public Limited Company Offer of Ordinary Share, May 1, 1985, p. 20.

The participants in AI have changed over time. Aerospatiale and Deutsche Airbus were the original members of the GIE; British Aerospace and CASA joined at later dates.

Figure 1-1 shows the legal structure of Airbus Industrie. The four partner companies form the supervisory board. The management of AI answers to both the member companies and to the latters' respective governments. In turn, the AI "partner" governments are committed to promoting the success of AI programs.

The present members of AI and their respective interests in AI are as follows:

- Aerospatiale--37.9 percent;
- Deutsche Airbus--37.9 percent;
- British Aerospace--20 percent;
- CASA--4.2 percent.

Each member is obliged to finance all of the cost of goods and services (including its own) supplied from its country for AI programs. All other expenses of AI, including the costs of goods and services supplied from non-member countries, have to be financed by the members in proportion to their respective shares. The books of AI are kept in dollars and inputs from the member-countries are usually priced in dollars.[4]

1.2.2 Functioning of the Airbus Industrie Consortium

Decision-making in AI involves two parallel mechanisms. The first links the industrial partners responsible for technical and commercial issues with the central functions of AI. The other is a network of official committees which monitors AI's progress and the various Airbus-related agreements on behalf of the sponsoring governments. In other respects, responsibility for the AI GIE is vested in the "owners" of AI who also happen to be its main subcontractors. Consequently, there is a duality of company-members as owners and company-members as subcontractors.[5]

There are three elements to the governmental oversight of AI: the inter-governmental committee, the Airbus executive committee and the Airbus executive agency. The inter-governmental committee (IGC) consists of senior officials of the sponsoring government ministries. It formally approves the launch of new projects although, given their political importance, this is usually subject to oversight from a higher political level. The IGC is also concerned with the commercial status of the overall AI enterprise.

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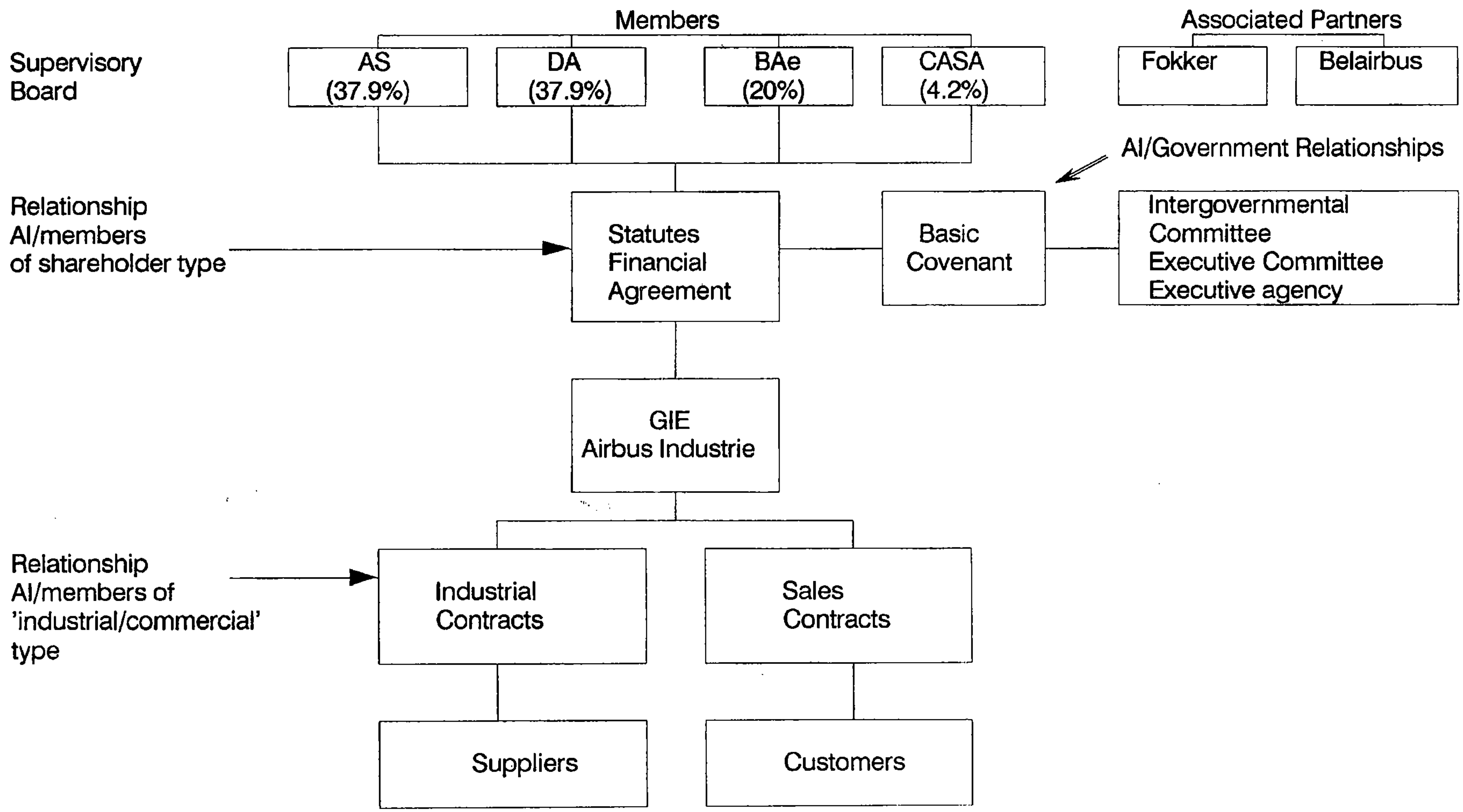
4. Each company's revenue stream is a stated percent of the price of the aircraft sold. Aircraft prices are escalated using U.S. inflation indices. Offering 1985, op cit., p. 29. One reason Airbus keeps its books this way is that commercial aircraft contracts traditionally have been denominated in dollars.

5. Keith Hayward, International Collaboration in Civil Aerospace, London: St. Martin's Press, 1986, pp. 65-67.

Figure 1-1

AIRBUS INDUSTRIE LEGAL STRUCTURE



SOURCE: Keith Hayward, "International Collaboration in Civil Aerospace", St. Martin's Press, 1986, p. 66.

The Airbus executive committee concentrates on routine Airbus operations. It oversees the inter-governmental agreements and the repayments to governments based on aircraft sales. The executive committee also monitors the work-sharing agreements and examines the effects of aircraft design or production changes on the overall distribution of work among member firms.

The AI executive agency based in Paris disburses funds for the work shipped from members to AI and oversees the distribution of AI receipts to the member companies.

While the ownership proportions in AI are fixed, work-shares on individual aircraft programs may be divided somewhat differently among the nations. A country's share of the work is greatly influenced by the capital it is willing to invest in the development of a given program.

1.2.3 AI Financing of AI-Related Activities

Expenditures of AI's revenues are divided into three general categories:

- o Routine allocations to support AI management and marketing efforts;
- o Non-recurring costs of program development paid to member-companies (from which government development subsidies are to be repaid);
- o Invoiced production costs paid to member-companies for inputs.[6]

AI's outlays are based upon an annual budget proposed by AI to its members and approved by its Board. Such payments cover AI's marketing costs, after-sales support and assembly operations; also included are the overhead costs of Airbus member-companies related to Airbus projects. The GIE itself does not publish annual financial statements. The details of AI's financial relationships with the member companies are not transparent. They are aggregated in the corporate accounts of the AI partners. This makes it difficult to determine the financial success (or failure) of the AI enterprise. As Keith Hayward observes: "In practice, the flow of cash and profits or losses between the consortium and its owners is so wholly discretionary as to leave Airbus' books virtually meaningless if viewed in isolation from the Airbus accounts kept by the owners."[7]

The prices charged AI for inputs are negotiated between AI and its members. These prices provide the basis of an invoicing system linking AI to its contractor-owners. At the launch of each new aircraft type or major variant, the members collectively determine the proportion of the total cost of the aircraft represented by each increment of work or service. This valuation is derived from detailed studies on the development and production processes and reflects an assessment of the complexity of the work, its commonality with earlier programs, man-hour and material requirements and other related factors.[8]

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6. There may well be differences between the costs incurred in producing inputs to AI aircraft programs and the invoices provided to AI.

7. Ibid., p. 78.

8. Ibid., p. 79.

Table 1-2

RESULTS OF AIRBUS INDUSTRIE*

(Sales $ Millions)

Year	Sales	Profit (Loss)
1980	$1,403	($90)
1981	$1,523	($110)
1982	$2,114	($129)
1983	$1,671	($322)
1984	$2,582	($400)

* As much as sales are a good indicator of business activity, the results show only a conventional picture because of the particular characteristics of the financial relationships between Airbus Industrie and its members. (Table explanation translated by GRA.)

SOURCE: Senat Rapport General No. 67, Premiere Session Ordinaire de 1986-1987, p. 22, (11/17/1986).

Even though AI and its member companies publish very little financial information about the revenues, costs and profits of the consortium, some information has been made public. Table 1-2 is a report of AI sales and losses for the 1980-1984 period. (The source document was not explicit as to whether these "sales" figures relate to receipts from customers or production costs.) "Sales" ranged from $1.4 billion in 1980 to $2.6 billion in 1984. Operating losses were between $90 million in 1980 and $400 million in 1984. In total, AI reported operating losses of about $1 billion on sales of $9.3 billion from 1980 through 1984. A more recent report estimated AI annual revenues to be $4.0 billion and projected them to more than double over the next few years. However, the enterprise was not projected to be profitable until 1995.[9]

Airbus Industrie (in contrast to the member companies) accounts directly for very little of the cost of development and production of AI aircraft. AI's primary responsibilities lie in marketing which includes pricing the products. In fact, AI has been criticized by the governments and by some of its members for setting prices at uneconomic levels. Hayward observes, "... the 1985, changes in Airbus Industrie's

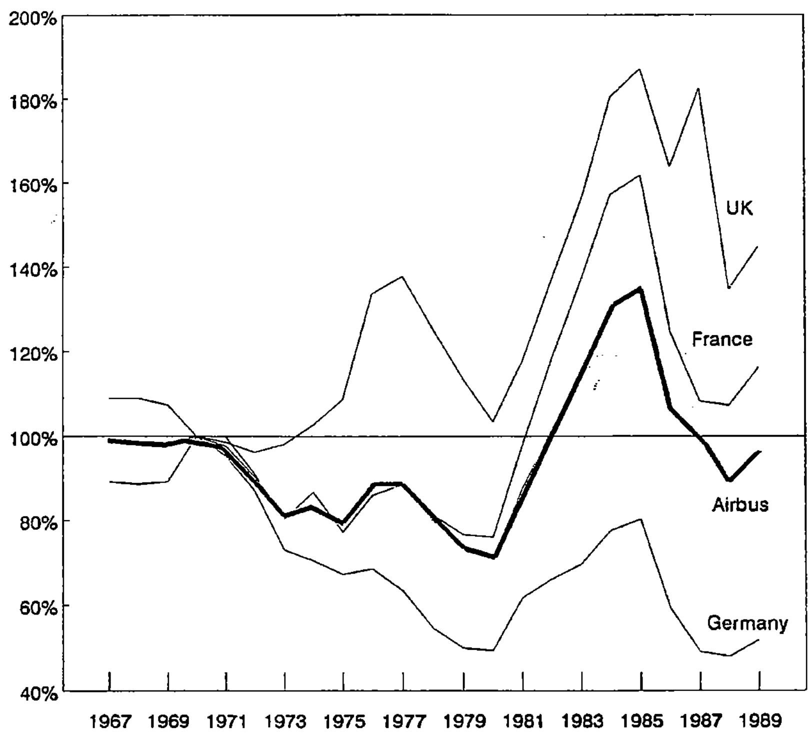
9. A. Postlethwaite, "Airbus Debates Its Corporate Future," Flight International, May 23, 1990, p. 23.

management structure were, in part, a result of the members wanting to increase their direct control over Airbus Industrie's commercial strategy... But on occasion, Airbus Industrie has appeared more concerned to win a sale than to pay due regard for its cost."[10]

The finances of AI and its members are affected by changes in relative exchange rates among the several countries and in the United States dollar's exchange value. AI's sales are denominated in dollars (subject to inflation indexation based on U.S. price levels) while a large part of its inputs are purchased using French Francs, German Marks and British Pounds. The movement of currencies against one another can affect AI finances independently of other business factors (see Figure 1-2). For example, the fall of the dollar against the D-Mark in recent years has created cost pressures on Deutsche Airbus. Because revenues are denominated in weak dollars, revenues have been insufficient to cover production costs denominated in strong D-Marks. Since 1985, France and the U.K. also have seen the dollar fall versus their currencies.

Figure 1-2

DOLLAR EXCHANGE RATES FOR AIRBUS, UK, FRANCE, AND FRG*
(AS PERCENT OF 1970 RATE)



* The Airbus exchange rate is the weighted average (by ownership share) exchange rate for the three countries.

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10. Hayward, op cit, p. 80.

There have been some attempts to place AI on more of a commercial footing. One notable example was the report of the "Four Wise Men," a group of independent businessmen commissioned by the governments of the member companies, which called for reform of AI practices including the development of meaningful financial accounts for the entity. Recently there have also been calls to establish AI as a public limited company.

1.2.4 Profiles of the Member Companies

Each of the three major Airbus member-companies--Aerospatiale, British Aerospace and Deutsche Airbus (owned by Daimler-Benz)--is a diversified aerospace manufacturer serving both civil and military markets. They manufacture aircraft, helicopters, tactical missiles, ballistic and space systems and other aerospace products. Aerospatiale is almost entirely owned by the French Government.

Table 1-3 shows that almost 65 percent of Aerospatiale's sales were for export in 1988. On a consolidated basis, the enterprise lost $7.4 million on sales of $6.4 billion (1988 U.S. Dollars), which includes its Airbus-related activities.
Following a period of nationalization, British Aerospace (BAe) was "privatized" between 1981 and 1985. The firm had revenues (including Airbus-related sales) of $10.1 billion in 1988 on which it had a profit of $279 million (see Table 1-4). These data reflect the then-recent acquisition of Rover, an automobile manufacturer. Civil aircraft accounted for 16 percent of its business which was just over half the size of its military aircraft business. BA exported about 60 percent of its output in 1988.

Table 1-3

AEROSPATIALE NET OPERATING REVENUES BY SEGMENT FOR 1988
($ Millions-1988)

Division	France	Export	Total	Percent
Aircraft	$488.8	$1,293.7	$1,782.5	27.8%
Helicopters	$267.7	$767.0	$1,034.7	16.1%
Tactical Missiles	$393.7	$550.4	$944.2	14.7%
Strategic & Space Systems	$763.5	$153.5	$917.0	14.3%
Other	$16.8	$0.2	$17.0	0.3%
Joint Ventures*	$249.5	$1,467.0	$1,716.5	26.8%
Total	$2,180.0	$4,231.8	$6,411.8	100.0%
Percent	34.0%	66.0%	100.0%	
Consolidated Net Profit:*				($7.4)

*Includes results of Airbus-related sales.

SOURCE: Aerospatiale "Results 1988", p. 15.

Table 1-4

BRITISH AEROSPACE TURNOVER IN 1988
BY PRODUCT LINE
($ Millions- 1988)

Division	UK	Export	Total	Percent
Military Aircraft & Support Services	$735.7	$2,226.8	$2,962.5	29.4%
Guided Weapon & Electronic Systems	$1,458.9	$935.7	$2,394.6	23.8%
Civil Aircraft*	$285.7	$1,353.6	$1,639.3	16.3%
Motor Vehicles	$1,312.5	$792.9	$2,105.4	20.9%
Property Dev.	$8.9	$675.0	$683.9	6.8%
Space	$44.6	$192.9	$237.5	2.4%
Other	$7.1	$39.3	$46.4	0.5%
Total	$3,853.6	$6,216.1	$10,069.6	100.0%
Percent	38.3%	61.7%	100.0%	
Net Profit*				$278.6

*Includes results of Airbus-related sales.

SOURCE: British Aerospace PLC Annual Report & Accounts 1988*, p. 39.

MBB, the parent company of Deutsche Airbus, achieved sales of $4 billion in 1988 and a profit of $57 million (see Table 1-5).[11] AI transactions are included in sales but they are not reflected in profits (or losses). In 1988, MBB derived almost one-half its business from military markets. Civil aircraft accounted for about 40 percent of sales. In 1989, MBB merged with Daimler-Benz, a conglomerate with interests in the automotive and aerospace industries, among others.

1.3 Rationale for Government Support of Airbus Industrie Programs

The AI family of transport aircraft is produced by a multi-national consortium of aerospace companies. These firms receive significant financial support from their governments specifically for the AI projects. To understand AI and AI-related activities and their potential for influencing the worldwide aircraft manufacturing industry--and U.S. manufacturers in particular--it is important to recognize why certain European governments have chosen to make a substantial and continuing investment in the manufacture of commercial transport aircraft.

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11. This report uses the latest available annual report from MBB, which was issued prior to the merger of MBB into Daimler-Benz.

Table 1-5

MBB TURNOVER IN 1988
BY CUSTOMER & PRODUCT LINE
(Millions of Dollars- 1988)

		Net Sales	Percent
By Customer:	Military	$1,860.9	46.0%
	Civil*	$2,184.5	54.0%
	Total	$4,045.5	100.0%
By Product Line:	Military Aircraft	$841.5	20.8%
	Civil Aircraft*	$1,480.1	36.6%
	Helicopters	$255.1	6.3%
	Defense Systems	$836.4	20.7%
	Space Systems	$351.7	8.7%
	Other	$280.7	6.9%
	Total	$4,045.5	100.0%
Net Profit**		$56.6	

*Includes Airbus-related sales.
**Does not include Airbus-related loss.

SOURCE: MBB Consolidated Annual Report 1988", pp. 6,52.

Benefits for the four European nations involved in Airbus--France, West Germany, Great Britain and Spain--can be divided into two categories: those that are measurable and those that are not. Included in the latter category are a host of benefits which relate primarily to the importance of the civil aircraft manufacturing industry in advanced economies. These include:

- o Spill-over effects into other industries;
- o Prestige;
- o Support for other domestic and foreign policy objectives.

While they are inherently immeasurable, these types of benefits are important to public policy decisionmaking if only because of their role in national and international politics. Also, the very "immeasurability" of such benefits makes it convenient to cite them in making a case for public-sector intervention where the measurable benefits are insufficient to justify an activity.

Measurable benefits are realized primarily in two ways:

- o Any increase in <u>profits net of government financial supports</u> that may result in the aircraft manufacturing and supplier industries in the four nations;

- o Consumer benefits enjoyed by citizens of the four nations through lower fares, to the extent such fares are lower because aircraft prices and/or operating costs are less than they otherwise would have been.

It is important to recognize that government policies designed to pursue additional profits in an industry are likely to benefit a country's economy only when the overall market supports a small number of firms worldwide. The aircraft manufacturing industry is characterized by both high sunk costs and significant learning economies. A firm entering this industry must be prepared to commit billions of dollars to develop a single product even though only a relatively small number of aircraft will be delivered each year, with deliveries beginning some years after the initial commitment. Once spent, these billions are sunk and cannot be recovered either fully or easily by selling off the underlying assets. A more complete description of the commercial aircraft manufacturing industry is contained in Appendix A.

Incumbent firms also have important advantages over new entrants because unit production costs decline as output increases. Termed the "learning curve effect," this means that an incumbent's unit costs may be considerably lower than a new entrant's. The learning curve effect also implies that incumbent firms have the potential to earn abnormal profits, at least during periods when airline demand for aircraft is high. The large size of the investment required, the limited number of units sold each year, the difficulty of liquidating assets in the event of financial difficulty and the learning curve effect make the aircraft manufacturing industry both risky and oligopolistic. By creating and sustaining AI, the governments of the AI-member companies have ensured that at least one of the limited number of civil aircraft manufacturers will be European.

1.4 Commercial Viability of AI

The evaluation of Airbus Industrie, which makes up the remainder of this report, considers only a subset of measurable benefits--the economic viability of AI as a commercial enterprise. Measuring the effects of Airbus on other aspects of the member countries' economies is beyond the scope of the present study; the only issue analyzed here is whether AI aircraft programs, taken separately or together, are or can be expected to become commercially viable. For the purposes of this study, commercial viability means that a private-sector firm would be willing to invest in such a project; that is, expected revenues must exceed all projected costs, including repayment of government supports, by an amount sufficient to defray the cost of the funds employed.[12]

Recoupment of all costs is the appropriate test of aircraft prices as stated in Article 6 of the Agreement on Trade in Civil Aircraft:

> Signatories agree that pricing of civil aircraft should be based on a reasonable expectation of recoupment of all costs, including non-recurring programme costs, identifiable and pro-rated costs of military research and development on

12. More precisely, commercial viability means that the expected activities' present discounted value of the net cash flows, using the private sector cost-of-funds, exceeds zero after repayment of all government supports.

aircraft, components and systems that are subsequently applied to the production of such civil aircraft, average production costs and financial costs.[13]

Because this Agreement applies to the behavior of signatory countries, it can be interpreted as requiring that government support be provided only in cases where there is a reasonable expectation that it will be repaid, including finance costs (e.g., interest).

AI programs can only be considered commercially viable if AI's investors (including governments) are receiving a market rate of return (just as the investors in McDonnell Douglas and Boeing must). In such a case, AI would be meeting the same financial market tests as its rivals. However, if AI programs prove not to be commercially viable but continue to receive public support, then AI has what some term an "unfair advantage" over its rivals at least to the extent that it would not have to earn a market rate-of-return on invested capital. As a result, (all other things being equal), a firm such as AI might then post and perhaps maintain prices below those that could be sustained by an otherwise identical private entity and capture market share on the strength of continuing government-provided support rather than on its ability to produce and market competitive aircraft efficiently.[14]

It should be noted that even if AI efforts are not commercially viable, the European partners may still believe that the sum of measurable and immeasurable net benefits is positive.[15] In such a case, what is beneficial for Europe would be detrimental to privately-financed competitors because AI would have an impermissible advantage under the Aircraft Agreement in that it would not have to earn a market rate of return on invested capital and might not even have to pay back the financial support received from the governments of the member-companies.

It also is important to consider why the AI member-companies would remain involved in an enterprise that is not likely to attain commercial viability on its current and announced aircraft programs. In economic terms, because the governments provide the vast majority of development funding for new aircraft programs--as well as production subsidies for on-going programs when needed--AI and its consortium "partners" face few (if any) financial barriers to entry in the markets addressed by AI.

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13. General Agreement on Tariffs and Trade, Agreement on Trade in Civil Aircraft, Article 6: Government Support, Export Credits and Aircraft Marketing (Geneva: 1985) effective from January 1, 1980.

14. It is important to distinguish between two types of subsidies: those for aircraft development and those for production. In general, development subsidies are monies advanced at the beginning of a program which make the program feasible; these funds are sunk and are not likely to influence aircraft pricing decisions. Production subsidies, however, reduce the unit cost of aircraft and may be reflected in lower aircraft prices.

15. There is an emerging body of literature which seeks to determine if countries are better off by subsidizing monopolisticly competitive industries such as commercial aircraft manufacturing. Economic models have been applied to AI but the empirical results are mixed. See, for example: G. Klepper, "Industrial Policy in the Transport Aircraft Industry," Institute of World Economics and CEPR, July 1989; Baldwin and Krugman, "Industrial Policy and International Competition in Wide-Bodied Jet Aircraft," in Trade Policy Issues and Empirical Analysis, University of Chicago Press, September 1989; and Katz and Summers, "Can Interindustry Wage Differentials Justify Strategic Trade Policy?" in Trade Policies for International Competitiveness, University of Chicago Press, September, 1989.

Moreover, these firms face relatively high economic costs (and perhaps exceptional political costs) if they exit from such markets. Over and above any write-offs of plant and equipment that may be required, reductions in employment in Europe lead to mandated high termination payments. The low company-borne costs of entry, the availability of production supports and the high labor-related cost of exit stand in marked contrast to the situation faced by firms driven primarily by commercial considerations; such firms face high entry costs, do not receive subsidies and have lower exit costs.

From the perspective of the governments of the AI member-companies, there would be high political and social costs attendant to either sharp reductions in activities or withdrawal from the civil transport aircraft manufacturing industry. As discussed in Chapter 2, while the annual level of government support to the member-companies may be high from the perspective of a commercial firm, it is not large in absolute terms (less than one billion dollars per year in total or a few hundred million dollars annually for any one country). The governments therefore could afford to continue their support for AI regardless of the consortium's commercial viability.

FINANCIAL SUPPORT PROVIDED TO AIRBUS MEMBER COMPANIES BY THEIR GOVERNMENTS

2.1 Introduction

Tracing the finances of Airbus Industrie is difficult because, as a Groupement d'Interet Economique (GIE)--a "partnership" under French law--AI is not required to (and does not) publish financial statements. Its economic performance must be traced by indirect means. One method of doing so is to trace government support for AI from the national budgets of member states to the consortium members. This is the approach used in the current chapter. It should be noted, however, that only incomplete information is available on government support for AI and therefore the figures shown in this chapter almost certainly understate government financial involvement in the consortium.

A second method of assessing AI's economic performance is to estimate the sales revenues and costs of each AI program and calculate a net cash result for each. This second approach is applied in subsequent chapters.

2.2 Total Government Support Provided

Since its inception, the member companies of Airbus Industrie have benefited from various types of financial support provided by their governments. As will be shown in this chapter, the support provided by governments includes repayable development grants, support of related research and development, production subsidies, exchange rate supports, equity infusions and loans. Although such government support has been provided since AI's inception, the largest amount of funds was committed in the 1980's when AI launched its latest major programs, the A320, A330 and A340.

Table 2-1 summarizes the value of support to the Airbus member companies in France, West Germany and the United Kingdom.[1] The table distinguishes between several types of support by the three governments to member companies:

- o Launch Aid Disbursed: Funds already expended to launch AI programs;
- o Launch Aid to be Disbursed: Funds pledged by each government to the A330/A340 program;

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1. Data from Spain are not included because CASA holds only a small percentage of the AI programs. However, the Spanish Government provides direct financial support to CASA for its Airbus activities. The governments of Belgium and the Netherlands also support the AI-related activities of the AI affiliates, Belairbus and Fokker respectively.

Table 2-1

GOVERNMENT SUPPORT OF AIRBUS AIRCRAFT PROGRAMS IN FRANCE, WEST GERMANY AND UNITED KINGDOM: FUNDS COMMITTED THROUGH 1989 ($ MILLIONS CURRENT)

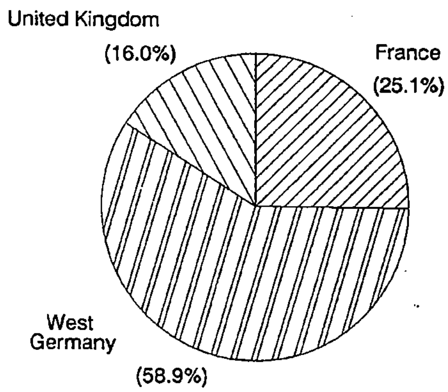
Funds Committed	France	West Germany	United Kingdom	Total
Launch Aid Disbursed				
A300/310	$988.4	$1,489.5	$82.9	$2,560.8
A320	755.2	790.3	393.9	1939.4
A330/340	193.0	316.1	421.2	930.3
All Aircraft	1936.6	2595.9	898	5430.5
Launch Aid to be Disbursed				
A330/340	682.9	1264.5	325.0	2272.4
Total Launch Aid	$2,619.5	$3,860.4	$1,223.0	$7,702.9
Other Support Disbursed	1035.3	924.2	883.9	2843.4
Other Support to be Disbursed	--------	2985.2	--------	2985.2
Total Support Committed	$3,654.8	$7,769.8	$2,106.9	$13,531.5
Repayments to Date	373.2	68.5	20.7	462.4
Net Support Committed	$3,281.6	$7,701.3	$2,086.2	$13,069.1
Net Support Committed at Government Opportunity Cost*	$6,463.5	$9,099.7	$3,804.4	$19,367.6
Net Support Committed at Private Borrowing Cost*	$9,961.2	$11,589.1	$3,979.8	$25,851.5

* Calculated by applying the cost of funds of the government and private sector borrowing rate in each country as appropriate to the net balance of funds committed each year to reflect the value of support in 1989.

Sources: Tables 2-2, 2-4, and 2-5.

Figure 2-1

PERCENTAGE OF COMMITTED GOVERNMENT SUPPORT BY COUNTRY *



* Net support committed through 1989, from Table 2-1.

- o Other Support Disbursed: Other types of support provided such as equity infusions, long-term loans, research and development funding, production subsidies or other miscellaneous targeted supports;
- o Other Support to be Disbursed: Other funds pledged as production subsidies, exchange rate guarantees or capital infusions.

2.2.1 Aggregate Support of the Three Governments

In total, the three countries through 1989 committed about $13.5 billion in support to AI aircraft programs. As shown in Figure 2-1, West Germany accounted for over half of the committed government support while France committed 25 percent and the UK 16 percent. Launch aid already disbursed by 1989 for the development of the AI product line accounted for over $5.4 billion. At that time an additional $2.3 billion had been committed to complete the development of the A330/A340. This will be disbursed over the next few years, bringing the total launch aid alone that the governments will have provided to almost $8 billion.

The three governments have also made available nearly $3 billion in other support through 1989. West Germany has committed almost another $3 billion to Deutsche Airbus to subsidize future production costs and to cover unfavorable exchange rates. This latter commitment was made as part of the acquisition of MBB by Daimler-Benz.

Of the total funds committed, approximately $500 million (or less than four percent) had been repaid as of year-end 1989. France's Aerospatiale has made the largest repayments--$373 million to date. The West German Government suspended required repayments of development funds in the early 1980's. British Aerospace's obligation to repay government-provided development funds only began in 1989 with repayments of the development support for the A320.

The total value of government supports for AI consortium-members exceeds the $13 billion figure shown in Table 2-1. To determine the true value of such support to the AI member-companies, it is necessary to consider the time value of the funds they receive from two perspectives. First, the value of the funds to the governments providing them must be considered. At a minimum, there are opportunity costs to these governments as reflected conservatively by the government's cost of borrowing. By applying the government borrowing rate in each country to the outstanding balance of funds provided in each year, the value of the committed supports becomes more than $19 billion in 1989. From the governments' standpoint, it is also appropriate to add a risk premium since, under AI's agreements, the funds may never be repaid.[2]

A second means of determining the true economic value of public support for AI-related activities requires determining the value such resources would have for a private-sector firm. For a company operating solely on a commercial basis, aircraft development funds cannot be obtained at the government borrowing rate. Thus the private opportunity cost of such granted funds is significantly greater. At the prime private sector borrowing rate in each country, the value of committed net government support by 1989 had reached almost $26 billion. (This assumes that the AI

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2. The repayable launch aid provided by governments operates as a levy on each aircraft sold. If sales are below the quantity assumed in the repayment formula, the government is not fully repaid.

member-companies were sufficiently creditworthy to have borrowed all the required aircraft development funds in private capital markets. The actual cost of capital for these firms would clearly have been higher given the riskiness of the investments. Thus the $26 billion estimate is conservative.)

Figure 2.2

NET SUPPORT COMMITTED TO AI MEMBER COMPANIES BY THE GOVERNMENTS OF FRANCE, WEST GERMANY AND THE UNITED KINGDOM (AS OF 1989)

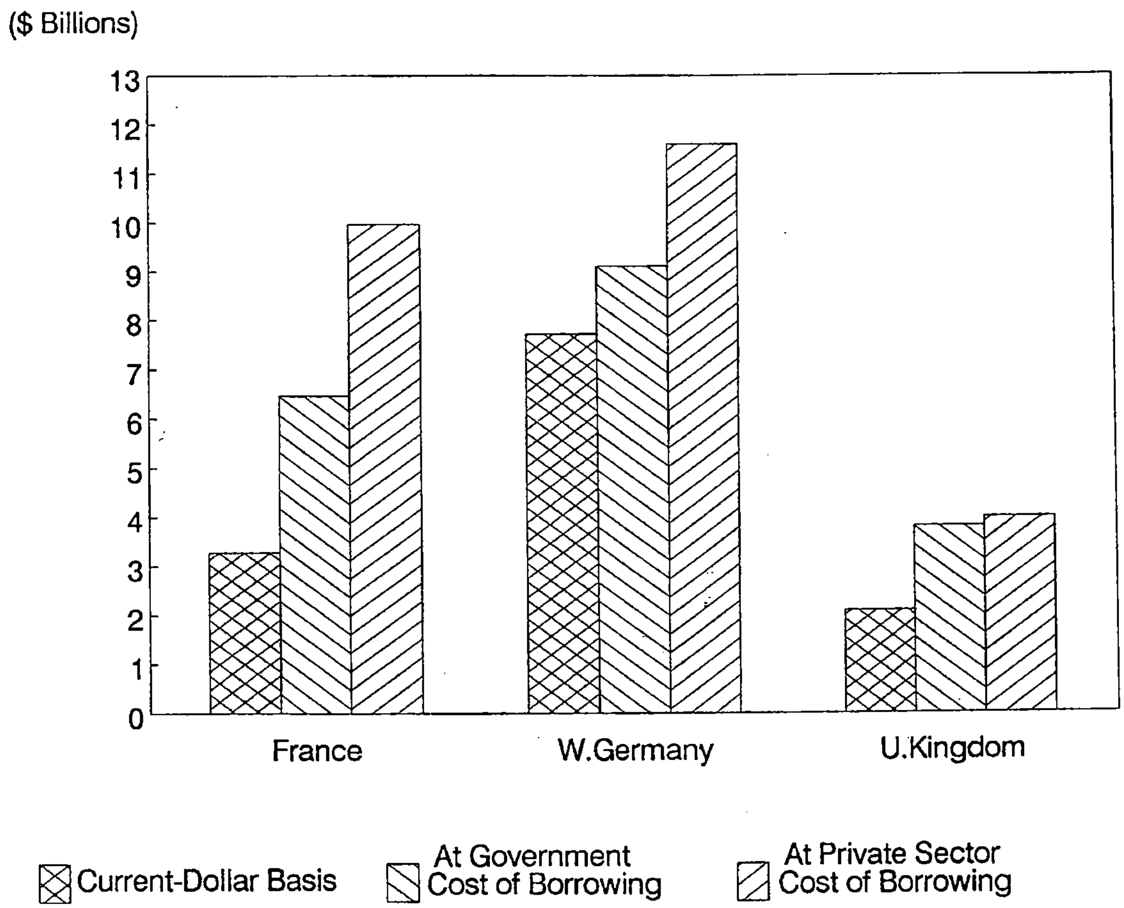


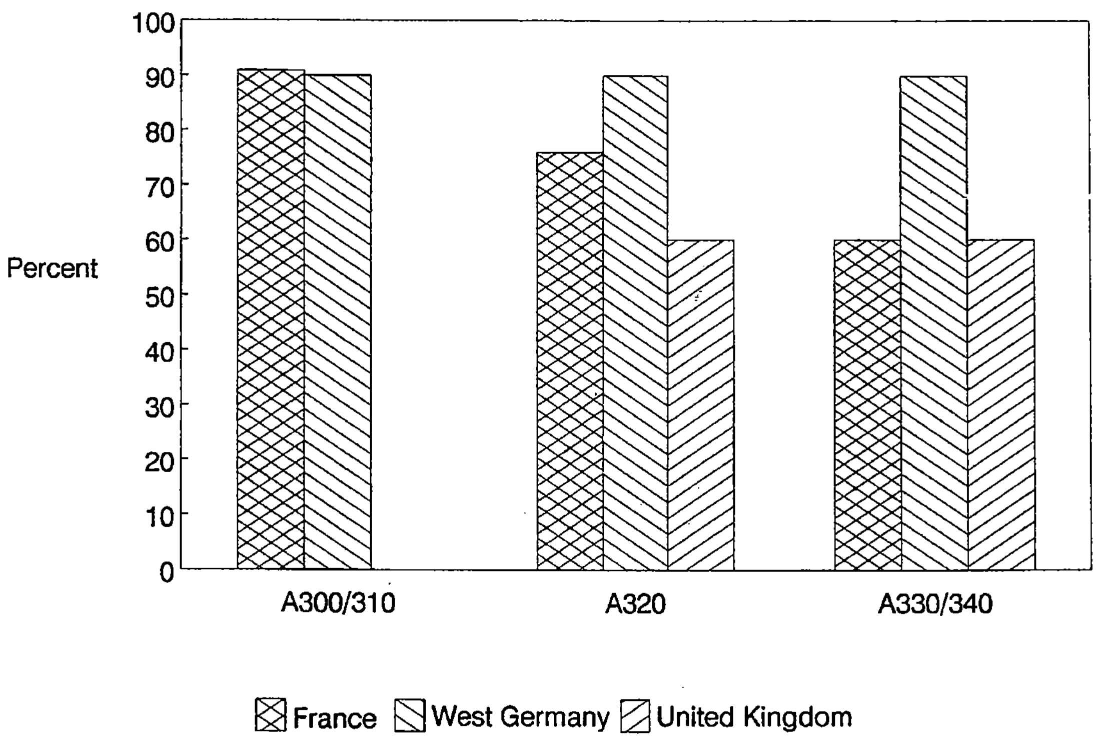
Figure 2-2 illustrates the value of each country's net AI program support, as of 1989, at both the government cost of borrowing and the private sector cost of borrowing. When the public or private opportunity costs are taken into account, the total value of government supports for AI increases significantly.

2.2.2 Launch Aid and Repayment

The governments of West Germany, France and the United Kingdom support AI and its aircraft program principally by providing aircraft development funds. Figure 2-3 shows the portion of development costs for each program supported by governments through the provision of repayable launch aid grants to the member-companies. In the aggregate, the governments have provided about 74 percent of the development funds for the AI aircraft programs. Such financing is intended to be repaid mostly from levies on future aircraft sales. The rate of repayment per-unit-sold varies among the AI partners; it also differs with aircraft model and the delivery position of the aircraft. (A very small portion of the money advanced to some members of the consortium is based on a fixed repayment schedule. British Aerospace repayments through 1989 have been of this type.) In most cases, repayment terms are not made public. The AI member-companies and governments assert that such information is proprietary, citing competitive concerns.

Figure 2-3

PERCENT OF AI PROGRAMS DEVELOPMENT COSTS
SUPPORTED BY LAUNCH AID



Sources: Figures 3-2, 3-4, and 3-5.

The per-unit-delivered basis of the repayment schedules means that government recoupment of development funds depends solely upon the number of aircraft units actually delivered. Since the funds advanced are for specific aircraft development programs, i.e., the A300/A310, A320 and A330/A340, the repayment scheme can lead to situations where more or less than the funds advanced are ultimately repaid. In cases where fewer units than projected are delivered, repayments can fail to match the funds advanced and vice versa. Therefore, the government funds advanced to the AI member-companies are more akin to common or preferred stock where returns are contingent on performance. However, no commercial company could borrow money in the private market on such favorable terms.

Any determination of an "adequate return" for the governments must take into account the time value of money. In an AI program, this calculation depends on the amount and timing of government funding provided, the per-aircraft repayment arrangement, the number of aircraft sold and the time pattern of deliveries for such aircraft. There is no explicit interest cost associated with the funds advanced; whatever return a government receives on its "investment" is therefore implicit.

The remainder of this chapter traces the flow of government funds to the AI member-companies in France, West Germany and the United Kingdom. A more detailed analysis of this support can be found in Appendix B of this report.

2.3 Individual Country Data on Government Support

2.3.1 French Government Support

Table 2-2 shows the support provided by the French Government for AI programs. Nearly all these funds have been disbursed to Aerospatiale. On a current basis (unadjusted for inflation), the net funds committed (as of year-end 1989) total almost $3.3 billion (including present commitments for the A330/A340 for which disbursements continue through 1996). If the government recognized the opportunity cost of such funds, the total amount committed, less repayments, would conservatively have been $6.5 billion in 1989. For a private company which could borrow at the prime rate in France, the value of the net funds committed would come to nearly $10 billion in 1989.

Of the French Government's total commitments for Aerospatiale's participation in Airbus, over two-thirds has been in the form of repayable launch aid. The remainder consists of R&D support for the aircraft equipment developed for use on AI aircraft and to provide debt and equity funds to enable Aerospatiale to engage in AI-related activities.

The terms of repayment for the launch aid funds provided to Aerospatiale, where they are known, are provided in Figure 2-4. The only repayment formula actually made public was for the A300 program. Nevertheless, there have been derivative A300 programs as well as other new programs funded since the introduction of the A300. As shown in Table 2-3, the French Government has indicated various milestones for the repayment of the funds advanced for the combined A300/A310 program. The repayment point varies depending on the exchange rate between the French franc and U.S. dollar. When the A310 was launched, repayment was projected to be complete at between 800 and 900 deliveries. For the A320, repayment of the nominal funds advanced for development will be complete when

Table 2-2

FRENCH GOVERNMENT SUPPORT COMMITTED FOR AIRBUS PROGRAMS AS OF 1989

		FF Millions	$ Millions
Launch Aid:	**Disbursed**		
	A300/A310	6,375.0	$988.4
	A320	4,871.0	$755.2
	A330/A340	1,245.0	$193.0
	To be Disbursed		
	A330/340	4,405.0	$682.9
	TOTAL LAUNCH AID	16,896.0	2,619.5
Other Support:	**Disbursed**		
	Aircraft Equipment	703.0	$109.0
	Proving of Technology	1,002.8	$155.5
	Equity Infusions	3,772.0	$584.8
	Long-term Loans	1,200.0	$186.0
	TOTAL OTHER	6,677.8	1,035.3
Total Support Committed		23,573.8	$3,654.9
Repayments to Date		2,434.0	$373.2
Net Support Committed		21,139.8	$3,281.7
-- at Government Opportunity Cost		41,690.0	$6,463.6
-- at Private Borrowing Cost		64,250.6	$9,961.3

Sources: 1) Launch Aid and funds for aircraft equipment and proving of technology as reported in Chapter 53 of the annual budget of the Transport Ministry.

2) Equity infusions from "Senat Rapport No 62, Premiere Session de Ordinaire 1983-1984" and Aerospatiale Annual Reports 1984, 1987, 1988.

3) Long-term loan from "Aerospatiale Annual Report", 1984, p. 5.

Table 2-3

NUMBERS OF UNITS REQUIRED TO BE SOLD TO REPAY FRENCH GOVERNMENT LAUNCH AID

Date of Estimate	Number of Units to be Sold: A300/310	(Notes)	A320	(Notes)	Repayment Exchange Rate
1980	800	(10)			---------
1981	800-900 600	(9) (9)			FF4.5/$1 FF5.5/$1
1982			600-700	(7,8)	Current
1983			500-600	(6)	Unstated
1984			600	(5)	FF8/$1
1985	550	(4)	600	(4)	FF8/$1
1986	550	(1)	600 700 500	(2,3) (3) (3)	FF8/$1

Notes:

(1) Program Budget Repayment Early by the 1990s. Assemble Nationale, Rapport No 395 (October 9, 1986), p. 17.
(2) Ibid, A320 program repayment in year 2000, p. 18.
(3) Senat, "Rapport General No 67", Nov. 17, 1986), p. 20.
(4) Senat, "Rapport General No 96" (Nov. 21, 1985), p.26. FF 1 unit change in dollar exchange rate changes repayment by 100 units.
(5) Assemblee Nationale, "Avis No 2370", (Oct. 10, 1984), p. 17.
(6) Senat, "Rapport General No 62", (Nov. 21, 1983), p. 28.
(7) Assemblee Nationale, "Rapport No 1165", (Oct. 21, 1982), p. 37.
(8) Repayment point of 450 units is only one version (eg, A320-200).
(9) Assemblee Nationale, "Avis No 475", (Oct. 16, 1981), p. 24.
(10) Assemblee Nationale, "Avis No 1981", (Oct. 9, 1980), p. 32.

600 units are delivered, according to French Government sources. There are no available estimates of the number of A330/A340 deliveries that must be made to repay such development funds. However, GRA estimates that nominal repayment will occur with the 750th unit delivered.

As shown in Figure 2-4, no repayments are indicated for the government's equity contributions to Aerospatiale. (GRA includes no data for government support to or repayments from SNECMA, the French aircraft engine manufacturer which produces equipment used on commercial transport aircraft including those manufactured by AI.) GRA was unable to identify repayment provisions related to public aid provided to French aircraft equipment suppliers that serve Aerospatiale and AI. The government's rationale for such aid is to increase the proportion of French inputs to Airbus programs and to assure that such inputs are concentrated as much as possible in high technology AI aircraft equipment such as avionics.

Figure 2-4

FRENCH TERMS OF GOVERNMENT SUPPORT TO AEROSPATIALE FOR AI PROGRAMS

Aircraft Development Support		
	A300:	Government provided 90% of development funds. Total nominal funds being repaid over 404 units at an increasing per unit amount.*
	A310:	Government provided 92% of development funds. Terms not stated but French note that nominal aid being repaid for A300/310 over 800 to 900 units.
	A320:	Government provided 76% of development funds. Nominal funds to be repaid over 600 units.
	A330/340:	Government committed 60% of development funds. No statement of repayment terms. (GRA estimates nominal repayment to be complete at 750 units.)
Capital Infusions		No repayment requirement identified.
Other Support**		No repayment requirement identified.

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* .0006 of aid repaid per unit over Nos. 1-131.
.0017 of aid repaid per unit over Nos. 132-151.
.0035 of aid repaid per unit over Nos. 152-404.

** Consists of aircraft equipment and proving of technology.

Sources: Percentage of development costs in the form of government launch aid taken from Assemble Nationale Rapport No 920, Premiere Session Ordinaire De 1989-90 (Oct./f12, 1989), p.16; repayment tems from Figure 2-5.

2.3.2 West German Government Support

Table 2-4 reflects the support provided by the West German Government for Airbus programs. In current terms, West Germany has committed about $7.7 billion net of repayments as of 1989. At the government borrowing rate, the net funds advanced are valued at $9.1 billion in 1989. To a commercial firm which had to borrow the funds, they had a value of $11.6 billion at year end 1989.

Of total West German Government commitments to Deutsche Airbus, about one-half is repayable launch aid and the other half relates to production supports (either direct subsidies to production or funds to offset exchange rate differences which implicitly support production costs). A small amount of support has also been provided for R&D related to component technologies for AI programs.

Table 2-4

GERMAN GOVERNMENT SUPPORT COMMITTED FOR AIRBUS PROGRAMS AS OF 1989

		DM Millions	$ Millions
Launch Aid	**Disbursed:**		
	A300/310	2,827.0	1,489.5
	A320	1,500.0	790.3
	A330/340	600.0	316.1
	To be Disbursed:		
	A330/340	2,400.0	1,264.5
	TOTAL LAUNCH AID	7,327.0	3,860.4
Other Support	**Disbursed:**		
	Production Supports	1,097.9	578.5
	Civil Components	147.3	77.6
	Aircraft Electronics	69.9	36.8
	Exchange Guarantees	439.0	231.3
	To be Disbursed:		
	Production Supports	2,000.0	1,053.7
	Exchange Guarantees	3,666.0	1,931.5
	TOTAL OTHER SUPPORT	7,420.1	3,909.4
Total Support Committed		14,747.1	7,769.8
Repayments to Date		130.0	68.5
Net Support Committed		**14,617.1**	**7,701.3**
-- **at Government Opportunity Cost**		17,271.6	9,099.9
-- **at Private Borrowing Cost**		21,996.2	11,589.1

Sources: Development and disbursed production supports from annual budgets of the Ministry of Economics; support for Civil Components and Aircraft Electronics Program from GRA "Analysis of Foreign Support for Aeronautical Research and Technology" (May 1984) pp. 4-5; and rate guarantees to be disbursed for the "Federal Republic of Germany Monopolies and Mergers Commission Report" Tables 12 and 13.

Figure 2-5

WEST GERMAN TERMS OF SUPPORT FOR GOVERNMENT PROVIDED FUNDS

Aircraft Development		
	A300/310:	Government provided 90% of development funds. No explicit schedule of repayment. Repayments deferred in 1982 to 1990's. DM 525 million converted to non-repayable grant.*
	A320:	Government provided 90% of development funds. Nominal funds to be repaid at 600 units.
	A330/340:	Government provided 90% of development funds. Government funds front-loaded. No terms released on repayment. (GRA estimates nominal repayment at 750 units.)
Production Support		No repayment requirement identified.
Guaranteed Loans (for Production of A300/310)		DM 1.9 billion converted to repayable development grant. This grant is now being absorbed by government as part of the Daimler/MBB merger .
Other Support**		No requirement for repayment.

* GRA estimates that nominal repayment would have occurred at 800 to 900 sold units if repayment had repayments not been suspended.

** Consists of civil components and aircraft electronics programs.

Sources: Percentage of development funds provided: West German Monopolies and Mergers Commission, report on the merger of MBB and Daimler-Benz, Tabe 11, p.67. A320 development fund repayment from Airbus statement quoted in "Flight International" (May 26, 1984), p.1380.

Figure 2-5 reflects the lack of specific information about Deutsche Airbus' repayment of its government's development funding. Repayment of such funds was suspended in 1982 after only DM130 million ($65 million) had been recouped by the government. Resumption of launch aid repayment for the A300 and A310 is supposed to occur in the 1990's. Repayment of grants (formerly government-guaranteed loans to finance production) is also scheduled to commence during this time period. However, GRA views the repayment of either type of funding as unlikely.

For the A320, Deutsche Airbus' repayment of the nominal funds advanced for development will reportedly be complete when 600 aircraft are delivered. No statements have been issued as to when similar development funds advanced for the A330/A340 will be repaid (fully or even partially). GRA estimates that if Deutsche Airbus resumes repayment, full recoupment of the nominal funds advanced for the A330/A340 will occur when 750 aircraft are delivered.

As part of the inducement to Daimler-Benz to take on the Deutsche Airbus (DA) responsibilities of MBB, the German Government provided for the financial rehabilitation of DA by committing additional government funds. The government assumed responsibility for production loans of DM750 million ($395 million) and also agreed in 1989 to compensate Daimler for exchange rate losses on the A300/A310/A320 until 1996; DM 2.5 billion ($1.3 billion) was committed for this latter purpose. (DM 439 million was budgeted for exchange rate supports through 1989.) The government also agreed to provide more limited support of exchange rate losses in the amount of DM 1.64 billion ($863 million) for the 1997-2000 time period. The exchange rate supports are a form of contingent production subsidy in that they are used to offset differences in DA revenues and costs when the mark is strong relative to the dollar. In this situation, DA input costs are greater than the revenue received for AI-related output.

In a review of the takeover of MBB by Daimler-Benz, the Federal Republic of Germany Monopolies Commission conducted an extensive study of the committed financial support for Deutsche Airbus. In their report, it is noted that undisbursed but committed production subsidies for the A300/A310 and A320 amounted to DM 2 billion ($1.05 billion) in 1989. With significant additional government support already committed to Deutsche Airbus, it is unlikely that much, if any, of the West German Government support will be repaid.

2.3.3 United Kingdom Government Support

As Table 2-5 indicates, the U.K. Government has provided $2.1 billion for AI programs including funds to be disbursed for the A330/A340. The first installment ($20.7 million) on the fixed repayment to the government for the A320 was made in 1989. The value of net government support at the government cost of borrowing was $3.8 billion by 1989. To a private firm, such government supports would be valued at $4.0 billion as of 1989.

Almost 60 percent of the total committed U.K. Government support to British Aerospace has been in the form of launch aid. The remainder has been capital infusions (debt and equity) which GRA believes allowed BAe to pursue AI activities.

Figure 2-6 provides the repayment details regarding government support for BAe participation in AI programs. It has been reported that the nominal government funds thus far provided for A320 development will be repaid after 600 units have been delivered. As part of this, there is a fixed repayment of 50 million pounds of UK government support which is to occur between 1990 and 1992. Regarding the A330/A340, GRA estimates that development aid will be fully repaid on a nominal basis when 750 units have been delivered.

Table 2-5

UNITED KINGDOM GOVERNMENT SUPPORT COMMITTED FOR AIRBUS PROGRAMS AS OF 1989

		Pounds (Millions)	Dollars (Millions)
Launch Aid	Disbursed:		
	A300/310	50.0	$82.9
	A320	237.5	$393.9
	A330/340	254.0	$421.2
	To be Disbursed		
	A330/340	196.0	$325.0
	TOTAL LAUNCH AID	737.5	$1,223.0
Other Support	Disbursed:		
	Capital Infusions	533.0	$883.9
Total Support Committed		1,270.5	$2,106.9
Repayments to Date		12.5	$20.7
Net Support Committed		**1,258.0**	**$2,086.2**
-- at Government Opportunity Cost		2,306.6	$3,825.2
-- at Private Borrowing Rate		2,412.3	$4,000.5

Sources: 1) Launch Aid and Repayments from "Annual Supply Estimates" for the Department of Industry.

2) Capital infusions from:
"Accounts Relating to Issues from the National Loan Fund; Aircraft and Shipbuilding Industries Act 1977," various years.

"Offer for Sale of Ordinary Shares British Aerospace Public Limited Company" (February 1981) pp. 28,33, and 47.

"British Aerospace PLC Offer of Ordinary Shares" (1985), p.14.

"British Aerospace Annual Report and Accounts" (1985), p.60.

GRA believes that a series of equity investments in BAe during the 1970's and 1980's actually represented further government support for the firm's participation in AI programs. This is based on a review of BAe annual reports over a number of years which detail the financial shortfalls related to its AI-related activities. While BAe is active in many segments of business, no other program reported consistent financial shortfalls.

It should be noted that some government funds were direct equity investments from the public treasury while other monies were received by BAe for company stock sold contemporaneously with the sale of the government's shares. By allowing the company to offer new shares at that time, the government took a reduction in the return it could have realized without such stock dilution. Such a reduction has been viewed by GRA as a further government investment in BAe.

Figure 2-6

UNITED KINGDOM TERMS OF SUPPORT FOR GOVERNMENT-PROVIDED AID

<u>Aircraft Development</u>

A310:	No explicit funds provided by government; no requirement to repay 50 million pound entry fee.
A320:	Government provided 60% of BAe development costs, to be repaid with real return to government. A. 200 million pounds to be repaid over 600 units. B. 50 million pounds to be repaid: 1990: 10 million pounds 1991 and 1992: 20 million pounds per year.
A330/340:	No terms released. Government provided 60% of BAe development costs. Funds provided early in development (front loaded). Payment designed to provide real returns to government. (GRA estimates nominal repayment at 750 units.)

<u>Capital Infusions</u> No repayment required except for dividends paid while British Aerospace was government-owned. Other infusions net of one-time dividend payment at initial privatization in 1981. (Privatization was accomplished in two steps, in 1981 and in 1986.)

Sources: Development Aid repayment for A320 column 1670 House of Lords Debate (April 21, 1988), Earl of Bessborough. Development Aid repayment for A330/340 "have to remain commercially confidential," Lord Beaverbrook, column 1678, House of Lords debate (April 21, 1988).

2.4 Summary

The European governments have provided support to AI member-companies from the inception of Airbus Industrie in 1968. Every major program was started with repayable launch aid, but little of this has been repaid. In fact, given developments in West Germany, it is unlikely that this government's support of Deutsche Airbus ever will be repaid. Launch aid provided by the French and U.K. governments may be repaid in part; however, these governments have provided significant other support to buttress the finances of Aerospatiale and British Aerospace respectively. It can be concluded that AI was able to enter and remain in the commercial aircraft industry only through substantial amounts of government support.

Chapter 3

DEVELOPMENT OF THE ANALYTIC FRAMEWORK TO ASSESS THE VIABILITY OF AIRBUS INDUSTRIE AIRCRAFT PROGRAMS

3.1 Introduction

The prior chapter estimated the "visible" levels of support provided by governments to the AI member-companies. A second way to assess the economic performance of AI is to model the likely financial results of each of its aircraft programs. This requires an examination of whether--

- o AI aircraft programs break even on a cash basis;
- o AI programs are commercially viable--that is, whether they provide reasonable expectation of recovering costs, including the cost of capital;
- o The government supports provided to AI can be repaid;
- o The governments are likely to receive a return on their investment;
- o Additional government supports will be necessary.

In order to answer the above questions, a discounted cash flow model was constructed for each AI aircraft program. The model considers quantities of aircraft sold, prices realized, development and production costs and the government support provided to the AI member-companies. This chapter describes the inputs to the model. The following chapter reports the results for each Airbus aircraft program.

3.2 Airbus Production Forecasts

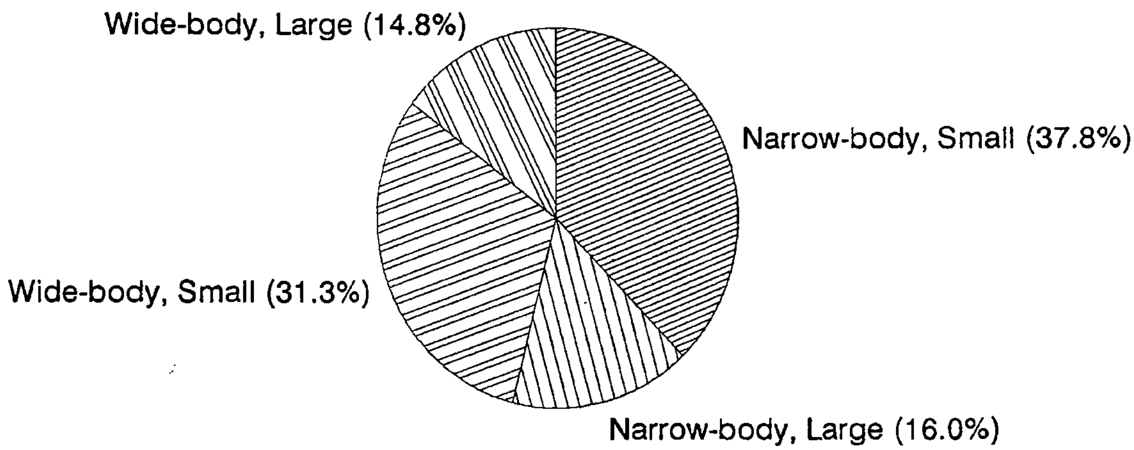
GRA, in conjunction with the U.S. Department of Commerce (DOC), reviewed forecasts of the world civil aircraft market (excluding the USSR) prepared independently by Airbus Industrie, Boeing Commercial Airplane Company and McDonnell Douglas Aircraft Company. The forecasts covered the period 1990 to 2008 inclusive. The three projections of the total market size were quite consistent. The principal difference was in the number of airlines included in the definition of the world market for aircraft. The forecasts of the total number of aircraft to be delivered by the three manufacturers in the 1990 to 2008 period are as follows:

- o Airbus: 11,643;
- o Boeing: 11,359;
- o McDonnell Douglas: 12,156.

These forecasts were then reconciled by GRA/DOC to establish a baseline projection of 11,499 aircraft to be delivered from 1990 to 2008.

Figure 3-1

BASELINE PROJECTION OF CIVIL TRANSPORT AIRCRAFT DELIVERIES WORLDWIDE 1990 TO 2008



Class	Description	Units
Narrow-body, Small	170 seats or less	4351
Narrow-body, Large	171 seats or more	1843
Wide-body, Small	171 to 340 seats	3604
Wide-body, Large	341 seats or more	1701

Table 3-1

MANUFACTURERS' SHARES OF ORDERS IN UNITS 1980 TO 1989 (PERCENTAGE)

Narrow-Body

Year	Total Orders	Airbus(1)	Boeing(2)	Douglas(3)	Other(4)
1980	293	0.0%	87.7%	6.8%	5.5%
1981	201	0.0%	81.1%	9.5%	9.5%
1982	182	0.0%	48.9%	47.8%	3.3%
1983	201	0.0%	52.7%	21.4%	25.9%
1984	347	14.7%	38.0%	33.7%	13.5%
1985	534	7.3%	61.4%	19.9%	11.4%
1986	578	25.4%	40.7%	20.8%	13.1%
1987	410	14.1%	58.5%	21.7%	5.6%
1988	919	12.5%	54.6%	27.6%	5.2%
1989	1,290	18.8%	53.8%	15.2%	12.2%
1980-89	4,662	13.2%	55.4%	21.2%	10.2%

Wide-Body

Year	Total Orders	Airbus(5)	Boeing(6)	Douglas(7)	Other(8)
1980	115	25.2%	54.8%	10.4%	9.6%
1981	82	47.6%	36.6%	9.8%	6.1%
1982	69	7.2%	23.2%	69.6%	0.0%
1983	48	12.5%	83.3%	4.2%	0.0%
1984	65	33.8%	49.2%	9.2%	7.7%
1985	119	44.5%	52.9%	2.5%	0.0%
1986	146	16.4%	72.6%	11.0%	0.0%
1987	284	47.9%	44.4%	7.7%	0.0%
1988	246	22.0%	54.5%	23.6%	0.0%
1989	457	49.0%	42.2%	8.8%	0.0%
1980-89	1,516	36.3%	49.2%	13.2%	1.3%

Source: Data provided by the U.S. Department of Commerce.

(1) A320/321
(2) B-707/720/727/737/757
(3) DC-9/MD-80
(4) F-28/BAC-111/F-100/BAe-146
(5) A300/310/330/340
(6) B-747/767
(7) DC-10/MD-11
(8) L-1011

The three manufacturers project aircraft deliveries using different disaggregations of aircraft size categories. For purposes of this study, GRA employed four size categories to disaggregate the baseline forecast. The aircraft categories and the projected deliveries in each are shown in Figure 3-1. With the baseline forecast established, the projection of future AI deliveries involved estimating the market share AI will capture in each aircraft size category.

An aircraft manufacturer's market share depends directly on its available products and their performance, its pricing policies and its production costs. AI has been building market share over the last 10 years as it has brought a number of new aircraft types to market such as the A310, A320, A330 and A340.

Table 3-1 shows the annual distribution of orders over the 1980 to 1989 period for narrow-body and wide-body aircraft. In this period, AI had a 13.2 percent share of narrow-body orders (the A320 was not launched until 1983 with first deliveries in 1988). The AI share of wide-body orders was 36.3 percent over the 1980 to 1989 period.

Table 3-2

ESTIMATED AIRBUS MARKET SHARE *

1990 - 2008

	Scenario		
Aircraft Type	Low	Base	High
Narrow-Body	18.1%	19.7%	22.2%
Wide-Body	24.5%	31.5%	34.3%
Total	21.1%	25.1%	27.8%

* Markets for jet commercial airline aircraft.

The AI market shares were developed under low, baseline and high ranges. Explicit consideration was taken of current and announced products in each size category of aircraft. It is expected that Boeing's B-767-X will add another competitor in the wide-body segment, reducing the AI share from that observed during the 1980 to 1989 period. The narrow-body share for AI should exceed the average in the period 1980 through 1989 since AI offered no such aircraft until mid-decade. The GRA/DOC market share projections based on deliveries are shown in Table 3-2.

The forecast market shares were applied to annual delivery schedules to estimate deliveries for each AI aircraft in each scenario over the 1990 to 2008 period. The delivery forecasts consider when new AI models such as the A321, A330 and A340 will be available and assume that the A310 will be phased out in 2002. Total deliveries for the various AI models between 1990 and 2008 are shown in Table 3-3.

Table 3-3

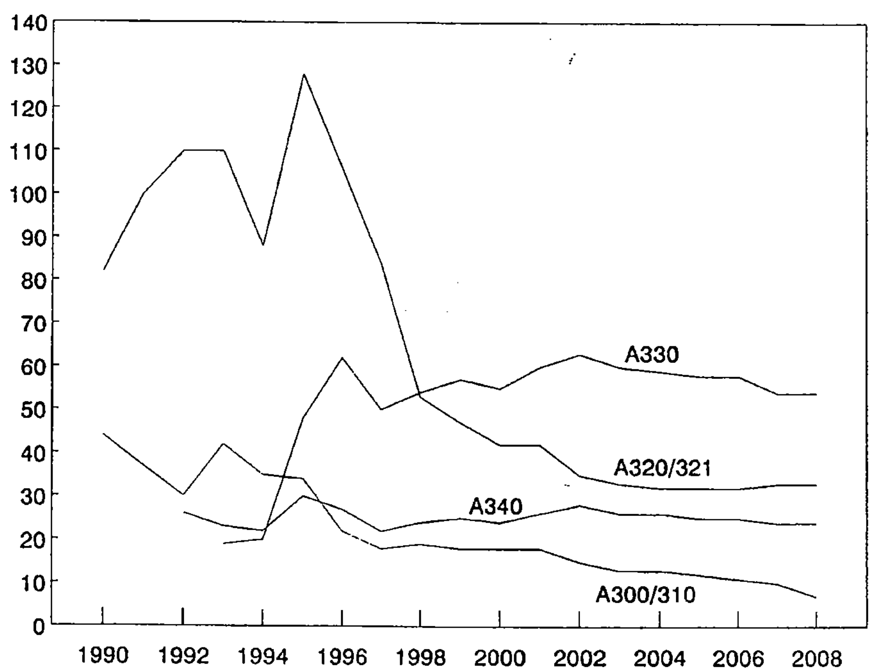
AIRBUS AIRCRAFT DELIVERY SCHEDULES BY MODEL: 1990 TO 2008

Model	Scenario Low	Scenario Baseline	Scenario High
A300-600/600R	200	245	266
A310-200/300	139	169	183
A320-200	769	814	860
A321	353	408	517
A330	626	831	905
A340	334	426	463

Annual delivery schedules are shown in Figure 3-2 and are used in the discounted cash flow analysis in Chapter 4. These schedules are based on annual demand as projected by the manufacturers. As Figure 3-2 illustrates, AI narrow-body aircraft deliveries will peak in the mid-1990's. This is consistent with the manufacturers' projections for the overall market.

Figure 3-2

ANNUAL DELIVERIES OF AIRBUS AIRCRAFT: 1990 TO 2008, BASE CASE SCENARIO



Airbus will have to install significant additional manufacturing capacity to meet the projected delivery peak in the mid-1990's. In fact, it will have to double production between 1990 and 1995. Other manufacturers also are adding capacity to meet this delivery peak. As such, AI and other manufacturers may end up with excess capacity in the late 1990s and beyond. If demand were to fall below projections, manufacturers would have incentives to reduce aircraft prices. This eventuality is not included in the pricing scenarios discussed below. Airbus may be particularly prone to do so because of its high cost of employee termination.

Before leaving this issue, it is important to note that the underlying forecasts of the three manufacturers are relatively optimistic. None of the forecasts includes either a substantial run-up in real fuel prices, a recession or a price war. The projected delivery schedules should therefore be favorable for AI aircraft programs.

3.3 Airbus Industrie Aircraft Prices

Determining the price in a specific aircraft transaction is difficult. Prices quoted in the literature often include spares, training and other add-ins. Whether the price quoted is in current-year or delivery-year dollars can make a price difference of ten or twenty percent depending on inflation and the time between order and delivery. Manufacturers grant price concessions via "side-letter" agreements which are very carefully guarded. Launch orders typically are priced at a large discount.

Ultimately, market conditions at the time of the transactions are the main determinants of aircraft prices. When manufacturers are saturated with orders, their bargaining position relative to airlines is strengthened and prices tend to rise. At times when demand is slack, airlines gain the upper hand and can extract favorable concessions from both airframe and engine manufacturers.

GRA has monitored AI aircraft transaction prices since 1987. This research included reviews of public reports of aircraft purchase transactions as well as an ongoing program of confidential interviews with airline and leasing company executives directly involved in aircraft transactions. In all cases GRA sought to obtain AI aircraft transaction prices which did not include spares and other services and which reflected all price concessions. Care was also taken to adjust the reported prices using the dollars of the year in which the transaction took place.

The estimates used in this study reflect the significant changes which occurred in the airliner market during 1988 and 1989. As shown above in Table 3-1, narrow-body aircraft orders more than doubled from 1987 to 1988 and wide-body aircraft orders almost doubled from 1988 to 1989. This increase in orders raised prices of all commercial jet aircraft above levels embedded in orders made only two years ago. To account for the run up in prices, the discounted cash flow analysis employs a two-tier price for the most recent AI models. One set of prices in each scenario reflects market conditions for orders placed before the explosion in demand; the second set accounts for the higher prices witnessed more recently. The prices for each aircraft shown in Table 3-4 are denoted as early (pre-market growth) or late (post-market growth). All prices reflect consensus estimates of the study team.

Table 3-4

AIRBUS AIRCRAFT CONSENSUS PRICES BY MODEL AND DELIVERY PERIOD
($ Millions 1990)

Model and Delivery Period	(Notes)	Scenario Low	Base	High
A300B	(1)	$50	$50	$50
A300-600 early	(2)	$60	$60	$60
A300-600 late	(3)	$57	$60	$65
A310 early	(4)	$54	$54	$54
A310 late	(5)	$54.5	$56.5	$58.5
A320 early	(6)	$29	$29	$29
A320-200 late	(7)	$32.7	$34.3	$36.1
A321 in 1994	(8)	$35	$41	$46
A330 launch	(9)	$63	$63	$63
A330 other	(10)	$74.5	$81.0	$92.5
A340 launch	(11)	$71	$71	$71
A340 other	(12)	$78.5	$85.5	$88.25

Notes:
(1) Delieveries completed in 1986; no longer in production.
(2) A200-600 and A200-600R delivered through 1991.
(3) A200-600 and A200-600R delivered 1992 and beyond.
(4) A310-200 and A310-300 delivered through 1991.
(5) A310-200 and A310-300 delivered 1992 and beyond.
(6) A320-200 delivered in 1993 and beyond.
(7) A320-100 and A320-200 delivered through 1992.
(8) A321 delivered in 1994 and beyond.
(9) A330 launch orders (92 units).
(10) A330 other orders.
(11) A340 launch orders (101 units).
(12) A340 other orders.

As Table 3-4 shows, GRA developed three price scenarios to match the three scenarios for projected AI deliveries. The base case scenario assumes Airbus will be able to sustain post-1989 prices through the horizon of the analysis. The low price corresponds to the high delivery quantity scenario for each model while the high price reflects the low delivery quantity scenario.[1] This breakdown allows the financial analysis in Chapter 4 to examine different AI strategies, such as the pursuit of high market share.

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1. The relationships between relative price changes and quantities delivered reflected in Tables 3-3 and 3-4 were developed judgmentally. They are consistent with elasticity estimates found in C. Shields, R. Stern, and A. Deardoff, "Estimates of the Elasticities of Substitution Between Imports and Home Goods for the United States," (Unpublished manuscript, Department of Economics, University of Michigan, undated).

3.4 Airbus Aircraft Costs

Two U.S. aircraft manufacturers independently provided the Department of Commerce with estimates of development and production costs for each AI model. Each company's estimates were not provided to GRA. Instead, DOC merged the two sets of cost data and provided a single estimate to GRA. GRA reviewed the merged data for reasonableness by examining factors such as the learning curve in the recurring cost functions, the recurring cost-per-pound of airframe weight and the cost per seat of each aircraft, as well as the absolute level of development costs.[2] The recurring costs for derivative aircraft reflected the benefits of prior movement along the learning curve. The DOC-provided data also included estimates of engine costs and the costs of buyer-furnished equipment (BFE).

All costs are stated in 1990 U.S. dollars and are expressed at the average dollar exchange rate for the 1971 to 1989 period for France, West Germany and the United Kingdom. The average exchange rates were employed so that the results of the financial analysis would not be dependent on exchange rate conditions during a single year.

3.5 Summary

The estimated AI prices and costs are used along with the forecast delivery quantities to carry out the financial evaluation of the AI aircraft programs in Chapter 4.

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2. GRA adjusted the DOC-provided development costs for the A321. An amount of $400 million was included to allow for the costs of relocating the A321 production line from France to West Germany. Implicit in this addition by GRA is the assumption that had A321 production been undertaken in France, it would have made use of existing A320 facilities and so would have avoided this additional investment burden.

Chapter 4

THE FINANCIAL ANALYSIS OF AIRBUS AIRCRAFT PROGRAMS

4.1 Introduction

The results of the financial analysis of the AI aircraft programs are presented in this chapter. Each program is examined on two levels. First, a net present value analysis is employed using a commercial rate of interest. Second, a nominal cash flow analysis is undertaken with no imputation of interest. Both versions of the model utilize the estimated prices, quantities and costs of Airbus programs discussed in Chapter 3. The net present value cash flow model is described briefly below and in detail in Appendix C.

4.2 Evaluation Approach

The financial analysis of AI aircraft programs expresses revenues, costs and government supports in 1990 dollars. All AI revenues are received in U.S. dollars but a majority of the costs and government supports are incurred in foreign currencies that fluctuate in value relative to the dollar. Such costs and government supports are given in 1990 dollars, adjusted to reflect the average exchange rate for the 1971-1989 time period.

The cash flow model developed for this study traces funds into and out of each AI aircraft program. Cash expenditures begin with development, which requires five to six years for an entirely new aircraft and two to three years for a derivative. While AI does receive some payments for orders placed during the later years of the development cycle, the initial stage of an aircraft program is particularly expensive because it must be supported without cash derived from aircraft deliveries. However, AI programs benefit from the in-flow of government support during the development stage which helps to compensate for the lack of customer payments.

The analysis in this chapter traces revenues and costs incurred once development starts on an aircraft model until the last unit is produced, or through the year 2008, whichever is earlier. The financial model calculates the revenue and cost stream for each aircraft delivered. Revenues are assumed to be received in the following pattern:

- Two years prior to delivery: 2 percent;
- One year prior to delivery: an additional 21 percent;
- Year of delivery: the final 77 percent.

All production costs are assumed to be incurred in the year the aircraft is delivered.

The analysis develops the effects of government launch aid on each AI aircraft program separately. AI member-companies receive launch aid in return for a promise to repay it as units are delivered. The exact details of these arrangements are held confidential by AI. GRA has made the simplifying assumption that repayment of government launch aid is spread evenly over units produced according to the following schedule:[1]

	Program	Units
o	A300:	300
o	A300-600:	300
o	A310:	300
o	A320:	600
o	A330:	375
o	A340:	375

It is important to note that the government subsidies considered in the cash flow model are limited to launch aid as identified in Chapter 2. While AI firms have received other types of subsidies from their governments, most of these subsidies have not been targeted for a specific program. Some of the subsidies have been used to defray R&D expenses, for example, while others have been devoted to offsetting the effects of currency fluctuations. Although insufficient information exists to allocate these subsidies to specific programs, the aggregate value of committed "other" support is on the order of $5.8 billion.[2] The effects of AI subsidies are therefore understated in this analysis.

It is also important to note that the cash flow results are based on what is known now about market prospects and about AI. Regarding the latter, no consideration is given to:

- o The impacts of possible derivatives of the A330/A340 on either costs or revenues;
- o The impacts of sales beyond 2008;
- o The terminal value of AI as of 2008.

---

1. Actual repayment schedules for government support of AI are complex. The assumptions here of a constant repayment per unit delivered are made to simplify the calculations. The French Government noted that repayment of A300/A310 support would occur with 800 to 900 units delivered. GRA took the higher amount and apportioned it across the three basic models. No repayment schedule is included for the A321 as AI indicates that it will fund development of this derivative without explicit government supports.

2. See Table 2-1.

The financial model examines all cash flowing into and out of each AI aircraft program from the following perspectives:

- Program cash flow: Cash into and out of each aircraft program without consideration of the time value of money. (The effects of subsidies are excluded from these cash flows; only annual production and development costs and revenues from aircraft sales are included.)

- Program net present value: The net present value of program cash flows using the average cost of money in the private sector.

- Company cash flow: Cash into and out of the AI member-companies without consideration of the time value of money. (Subsidies received and repayments made are included in these cash flows.)

- Company net present value: The net present value of AI member-companies' cash flow using the average cost of money in the private sector.

- Government cash flow: Cash into and out of the AI member-governments without consideration of the time value of money. (Subsidies paid and repayments received are included in these cash flows.)

- Government net present value: The net present value of government cash flow using the average cost of money in the private sector.

4.3 Financial Viability

The principal test of commercial viability of AI and its aircraft programs is the net discounted cash flow anticipated (or realized) for each program. For the purpose of this study, commercial viability means that a private-sector firm would be willing to invest in a project; that is, expected revenues exceed all costs, including repayment of government supports, by an amount sufficient to defray the cost of the funds employed. In this section, AI programs are evaluated in the same manner that a private-sector firm would view them; only total program cash flows are relevant in such an analysis. Therefore, the effects of subsidies on cash flows are excluded.

The fifth column of Table 4-1 presents the results of the commercial viability test for the base case. For each AI aircraft program the annual total program cash flows have been discounted back to the year of program launch using the weighted average real commercial interest rate of 8.7 percent.[3] In other words, the net present values shown in Table 4-1 provide a perspective on the expected returns on each AI project at the time the investment decision was made, using the most recent information on prices realized, quantities delivered and program costs. In total, all AI aircraft programs are estimated to have an NPV of $21 billion. To facilitate comparison among the programs, all of the figures are expressed in 1990 dollars.

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3. This discount rate was developed by weighting the commercial lending rate in France, West Germany and the United Kingdom by their respective shares of AI projects. The same rate, based on historic averages, is used for all programs; however, a more formal approach would develop a separate discount rate for each program based on past and forecast market interest rates from the launch of the program until production ceases.

None of the AI aircraft programs shown in Table 4-1 is commercially viable. This means that neither the AI programs taken together nor any of the individual aircraft programs is likely to earn a market rate of return.

4.4 Nominal Cash Flows

The sixth column in Table 4-1 presents the nominal cash flows (defined to exclude interest) for each program, exclusive of the time value of money. Nominal cash flow totals are the sum of cash inflows and outflows without consideration of the opportunity cost of the funds. No commercial firm could afford to ignore the alternative uses of its funds. Even under this less stringent test of viability, only the A330/A340 program has a positive nominal cash flow indicating that revenues will exceed costs but not by an amount sufficient to earn a market rate of return.

Table 4-1

AI AIRCRAFT PROGRAMS ARE NOT COMMERCIALLY VIABLE

BASE CASE PROGRAM CASH FLOWS ($Millions 1990)

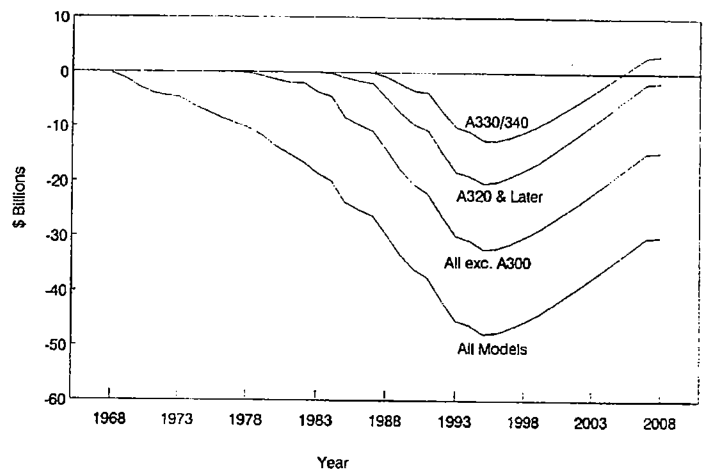
Program		Launch Date	Units Delivered	Average Price(1)	NPV of Cash Flow	Nominal Cash Flow
A300	(2)	1968	246	$50.0	($7,854)	($15,426) (4)
A300-600		1977	319	$60.0	($5,868)	($12,899) (4)
A310	(3)	1977	334	$54.9		
A320		1983	886	$32.0	($3,528)	($4,920)
A321		1989	409	$41.0		
A330		1987	831	$78.8	($3,701)	$3,212
A340		1987	427	$81.8		

(1) Weighted average price in 1990 dollars from Table 3-4 applied to base case annual quantity delivered.
(2) A300 production ended in 1986.
(3) A310 production assumed to end in 2002.
(4) The large losses shown here result in part from expressing losses incurred in the 1970s and 1980s at 1990 price levels.

Figure 4-1 shows the cumulative program cash flows for groupings of the AI aircraft programs. Only the A330/A340 generate a positive cumulative cash flow. However, when the A320/A321 program cash flow is added to that for the A330/A340, the sum of these programs has a negative cash flow.

Figure 4-1

CUMULATIVE NOMINAL PROGRAM CASH FLOW
FOR GROUPS OF AIRBUS AIRCRAFT MODELS



4.5 Alternative Scenarios

Table 4-2 shows the results of the financial analysis for the AI aircraft programs assuming that on-going programs achieve higher quantities of sales than in the base case but at lower prices. This scenario reflects one strategy to increase market share, a stated goal of AI. In every program, the net present values and nominal cash flows are lower under this scenario than in the base case. As a result, no program is commercially viable and none achieves a positive nominal cash flow.

Table 4-2

AI PROGRAM VIABILITY WOULD DETERIORATE
IF PRICES FELL

LOW PRICES, HIGH QUANTITIES. PROGRAM CASH FLOWS
($ Millions 1990)

Program	Units Delivered	Average Price(1)	NPV of Cash Flow	Nominal Cash Flow
A300-600	340	$58.0	($6,017)	($13,791)
A310	345	$54.2		
A320	932	$31.2	($4,891)	($7,514)
A321	521	$35.0		
A330	903	$73.1	($5,198)	($2,088)
A340	465	$76.7		

(1) Weighted average price in 1990 dollars using data from Table 3-4 applied to high annual quantity delivered.

Table 4-3 shows the financial performance of AI under a scenario where it increases prices but with the resultant sale of fewer units. The analysis shows that while no program is commercially viable, the A330/A340 program now has a positive nominal cash flow. Moreover, with this scenario, the positive nominal cash from the A330/A340 is large enough to offset the negative cash flow of the A320/A321 program. This means that the most recent AI programs could, in the aggregate, earn a small return but the return would not be large enough to allow the programs to be undertaken on a commercial basis (i.e., to repay the investment including subsidies at market rates of interest).

Table 4-3

AI PROGRAM VIABILITY WOULD IMPROVE IF PRICES INCREASED

HIGH PRICES, LOW QUANTITIES. PROGRAM CASH FLOWS
($ Millions 1990)

Program	Units Delivered	Average Price(1)	NPV of Cash Flow	Nominal Cash Flow
A300-600	274	$62.9	($5,725)	($11,990)
A310	302	$55.4		
A320	844	$32.8	($2,569)	($3,062)
A321	355	$46.0		
A330	626	$88.4	($2,914)	$5,760
A340	334	$88.3		

(1) Weighted average price in 1990 dollars from Table 3-4 applied to low scenario annual quantity delivered.

4.6 Company and Government Views

Table 4-4 shows the results of the financial analysis applied separately to AI companies and to member governments assuming that repayments are made. Neither the companies nor the governments achieve a positive net present value from participation in the AI programs. For the governments, this means that, even if repayment is made, it will not be sufficient to provide an 8.7 percent real return on the governments' investment. Also, of course, repayment of the government subsidies only worsens company financial results.

Table 4-4 also shows the nominal cash flows of the AI programs to the companies and the governments assuming repayment of government subsidies. The governments receive more in repayment than provided in subsidies but at the cost of reduced company nominal cash flow. The companies fare so poorly for the A300-600/A310 and A320/A321 programs that they are not likely to repay all of the government funds advanced.

Table 4-4

IF SUBSIDY REPAYMENTS ARE MADE, AI AIRCRAFT PROGRAMS ARE NOT VIABLE FROM COMPANY OR GOVERNMENT PERSPECTIVES

Base Case Net Present Values by Program ($ Millions 1990)

	Program	Company	Government
A300-600/A310	($5,868)	($5,203)	($666)
A320/A321 (1)	($3,528)	($3,214)	($315)
A330/A340	($3,701)	($3,226)	($475)

Base Case Nominal Cash Flow by Program ($ Millions 1990)

	Program	Company	Government
A300-600/A310	($12,899)	($13,094)	$195
A320/A321	($4,920)	($5,806)	$886
A330/A340	$3,212	$1,145	$2,067

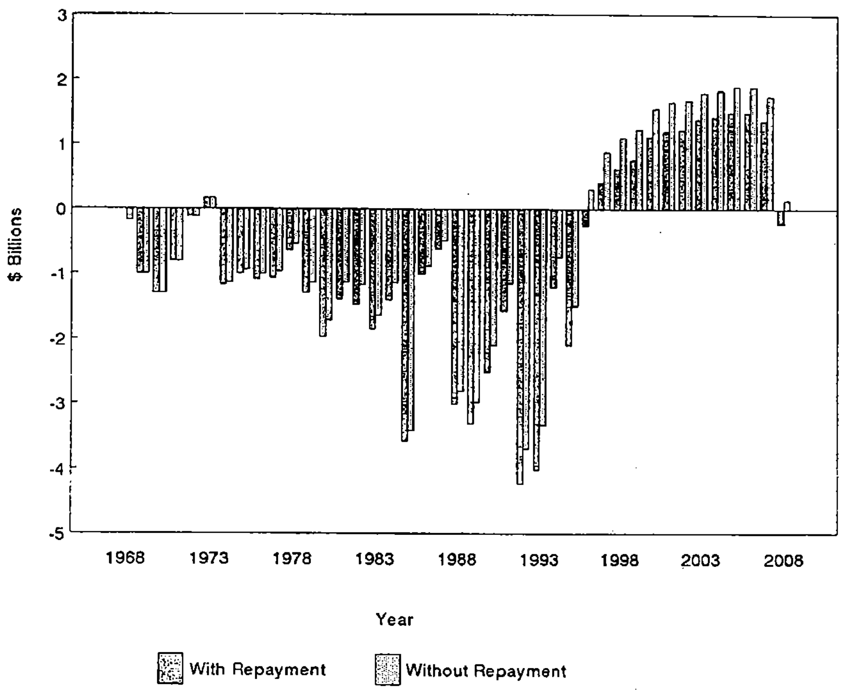
(1) No explicit government subsidies have been identified for the development of the A321.

Figure 4-2 shows the annual company cash flows for all AI programs both with and without repayment of nominal government support. The programs start to generate positive cash flow in the mid-1990's. While the AI programs show considerable cumulative nominal company cash shortfalls from inception through 2008, they should begin to show positive incremental cash in the near future even with repayment of government launch aid on a nominal basis. Consequently, there does not appear to be any further need for additional financial support for AI programs from the governments of the AI-member firms.

This review of company and government accounts as constructed is consistent with West Germany's suspending the repayment of launch aid, and with France, West Germany and the United Kingdom all providing significant amounts of government support in excess of launch aid to the Airbus member-companies. In fact, this additional aid appears to have been necessary to enable member companies to continue to participate in the AI consortium.

Figure 4-2

ANNUAL COMPANY CASH FLOWS WITH AND WITHOUT REPAYMENT OF GOVERNMENT SUPPORT*



*Both cash flows include provision of government development support.

4.7 Conclusions

There are four findings from the financial analysis worth highlighting:

- o No Airbus aircraft program is likely to be commercially viable.
- o Because of past losses on the A300 (including derivatives) and A320 programs, there is little prospect that AI member-companies will be able or required to repay all the launch aid provided for those programs, even without a charge reflecting the opportunity cost of such funds.
- o Future programs such as the A330 and A340 will not produce a commercial rate of return but may provide sufficient funds to repay the nominal government support provided for those programs.
- o AI programs should begin showing positive <u>incremental</u> cash flow in the near future; therefore, there does not appear to be a need for additional government support.

These findings are key factors used in Chapter 5 to evaluate the effects of AI on the market for civil transport aircraft and on U.S. firms.

Chapter 5

EFFECTS OF AIRBUS ON THE UNITED STATES AIRCRAFT MANUFACTURING INDUSTRY

5.1 Introduction

This chapter considers the effects of AI and its several programs on the long-term viability of U.S. manufacturers of civil transport aircraft.[1] It utilizes the results of the prior chapter on the commercial viability of the several AI aircraft programs. It is shown that the ability of AI's competitors to earn market rates of return on invested capital may be threatened in the long run. Under such circumstances, private enterprises will not be able to sustain their present level of involvement in the industry.

The characteristics of the transport aircraft market cause the actions of AI to affect its competitors directly. The worldwide demand for large civil transport aircraft is limited to several hundred units per year and actual demand is primarily determined by the present and projected profitability of the airlines. The loss of a single airline's order for new aircraft is often significant for a manufacturer. Recognizing this, the airlines are often able to use the bids made by competing manufacturers against one another to keep prices at a competitive level.

Given the limited number of units ordered and delivered each year, only a few firms can succeed in selling enough aircraft both to take advantage of declining unit production costs and to cover their sunk costs. On the supply-side, average unit production costs decline as output increases (over the relevant range) and the sunk costs related to any single aircraft program are large.

The formation of the AI consortium has imparted significant rigidity in the structure of the civil transport aircraft manufacturing industry. The AI members have agreed among themselves to undertake no programs competitive to AI programs either by themselves or in partnership with other non-AI companies. If, for example, a U.S. company wanted to subcontract a major assembly to an AI member-company, there would be great difficulty in doing so. Most importantly, the three largest civil aircraft manufacturers in Europe have removed themselves as potential joint venture partners with other companies, unless the activity involves the entire AI consortium. Such rigidity is strengthened because the AI agreements are not only among the member-companies but also their governments. Because of the financial supports provided to AI by these governments, they also may be reluctant to allow other companies within their countries to undertake programs competitive with those of AI (especially if this other company required governmental financial support for the program).

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1. There are only two manufacturers in the world (except the U.S.S.R.) which manufacture aircraft in the same size and performance categories as AI. These are U.S. companies--Boeing and McDonnell Douglas.

5.2 Effects of AI on the Aircraft Manufacturing Industry

Competition in all markets, including the transport aircraft market, is maintained through entry of new firms or products. The introduction of a new aircraft model is bound to have an effect on the prices of at least those aircraft already in production which are reasonable functional equivalents for some applications. Airlines will evaluate the effects of each new aircraft on their profitability and re-evaluate what they are willing to pay for existing aircraft types (including used aircraft). If the newly-offered aircraft is more productive on missions relevant to the airline then the airline will be willing to pay less for existing aircraft. If enough airlines reach the same conclusion, the prices paid for existing aircraft will fall (in real terms).

At the same time, if the new model is able to capture a significant portion of the market, then the incumbent competitive aircraft producers will also experience higher average costs than would have been the case in the absence of the new aircraft type. This is because fewer of the "older" aircraft will be produced which means that less of the economies of scale will be realized. In the end, the rate of return on the existing aircraft programs will be reduced, and producers will have to evaluate means to improve the performance of older aircraft or consider replacing them with new or derivative aircraft models.

This type of competition is desirable. In the end, consumers are better off if, through competition, firms are induced to be both efficient producers and innovative. As long as the firms can compete on an equal footing, the market is the best mechanism of resource allocation.

The limited number of firms in the civil transport manufacturing industry makes competition tenuous. If a single firm were to dominate one or more aircraft size categories to the extent that there were no close substitutes for its aircraft, then competition would be harmed; the learning curve effect would cause the dominant firm's unit costs to be far below those of prospective competitors. In effect, a dominant firm could reduce or eliminate prospective competitors' participation in the market by pricing at levels unprofitable for the other firms.

Unwarranted entry can also be damaging in a market such as that for civil transport aircraft where sunk costs are so high and learning effects are so large that only a few firms (perhaps as few as two in any particular size category) can survive in the long run.

When a new aircraft is brought to market and is unlikely to be commercially viable, the results can be economically and socially undesirable. In the short-run, prices will fall but output will not expand commensurately.[2] If the new model is sustained in the market by continued provision of government support (without the practical prospect of repayment), and if the long-term profit-potential in the market is reduced to levels below the rate-of-return necessary to attract and sustain private capital in-flows to aircraft manufacturers, then the new, inefficient producer may displace a more efficient incumbent in one or more aircraft market segments.

This highly undesirable result could be permanent. The presence of a government-supported firm, coupled with the substantial cost of entry (or re-entry) into the industry, represents a high barrier to entry to any potential private competitors.

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2. Shields et al., op cit. estimate that the price elasticity of demand for transport aircraft is -0.49.

It is not desirable for a less-efficient firm to displace a more efficient competitor or cause the latter to reduce significantly its activities in a market because more resources will be required to produce the same output. In competitive markets, the more efficient firms are rewarded; other entities, unable to earn a market rate-of-return, either change their modes of operation or exit the market. This process provides companies with significant incentives to produce efficiently; as long as there is effective competition in the market, prices will reflect these efficiencies. In such circumstances, airline customers worldwide will be the beneficiaries--and so will their customers.

Based upon the material presented above, AI clearly represents the less efficient competitor in the present market for civil transport aircraft. Without long-standing government subsidies, AI would not be able to compete with the more efficient producers.

The effects of AI on its competitors in the civil transport aircraft market will be manifest only over a considerable period of time. In the short-run, because of the high cost of exiting the market for aircraft, AI may have a beneficial effect on prices paid by airlines and, therefore, on the fares paid by airline customers in markets that are sufficiently competitive. At present, U.S. aircraft manufacturers can sustain existing programs as long as such programs earn positive operating profits. However, the long-term effects are likely to be undesirable. Specifically--

- Assuming AI continues to sell at prices below those necessary to sustain a commercial rate of return, the expected profits for U.S. firms will decline either because they lose market share or because they are forced to meet lower market prices.

- Because private firms depend on internally-generated capital which would decline with reduced market share, low profits may mean that the capability of U.S. firms to launch new aircraft will be diminished--and even may be eliminated.

- Lower expected profits may discourage U.S. firms from introducing new-technology aircraft. In addition, U.S. firms must overcome the fact that AI has recently introduced new-technology models in both the narrow-body and wide-body markets. These markets may not support additional entries from both U.S. firms.

- The lower prospects for profit in the industry may cause U.S. firms to seek additional foreign investors. It is conceivable that these firms could eventually lose control of new programs and may even be asked to transfer valuable technologies overseas as a condition of foreign investment.

5.3 Effects of AI on Future Programs

The effects of AI on the aircraft manufacturing industry depend, in part, on whether it continues to develop new aircraft models using government support without provision of a commercial return either to AI or its investors. AI asserts that development of its most recent derivative, the A321, will be undertaken using financing obtained on commercial terms. If AI were to operate its recent and future programs on commercial terms, it would mitigate many of its undesirable (from society's standpoint) long-run effects on its competitors and on airline customers.

AI and its member companies have begun to explore future aircraft programs. These include a 100-seat jet transport aircraft as well as an advanced supersonic airliner.[3] If AI were to rely on government supports to enter these markets, without reasonable prospects for earning a commercial return, it may well preclude entry by competitors--including U.S. firms. This is especially the case for an advanced supersonic airliner because the likely size of the market for this vehicle is so small that there may be room for only one market entrant--albeit a grouping of firms. Even if AI only threatens to enter the supersonic market with government funds, it may force U.S. manufacturers to join with AI for this program. In such a situation, U.S. leadership in the aeronautics industry could be threatened, especially if U.S. companies were forced by circumstance to join with AI as junior partners.

5.4 Effects on the U.S. Aircraft Components Industry

The effects on U.S. aircraft component manufacturers from AI's presence in the market are mixed. Some U.S. companies are suppliers to AI. Table 5-1 shows the estimated U.S. content of the various Airbus aircraft models. Historically, the U.S. content of AI aircraft consisted principally of systems and components, e.g. avionics and engines. In some of the more recent AI programs, U.S. manufacturers have been awarded contracts for airframe sub-assemblies even while participation in the more technologically-advanced inputs has decreased. This has occurred largely as a result of AI actions to reduce the effects of unfavorable exchange rates between the member-companies' national currencies and the U.S. dollar.

A more disturbing trend has been the "Europeanization" of the advanced technology avionics and control systems on AI aircraft. In part, this has resulted from explicit strategies of the AI governments, especially that of France, to capture more of the high value-added production within their own industries. As noted in Chapter 2, the French and West German governments have subsidized research and development in these areas. In fact, one of the stated reasons for West Germany's insistence that the A321 production facility be located in that country was to control the more technologically interesting work in the cockpit and in systems integration.

5.5 Long-Term Implications for the U.S. Economy

As long as it produces aircraft that are not commercially viable, there is a threat that Airbus Industrie, a less efficient producer, will supplant U.S. manufacturers of aircraft and components in one or more markets. Since many of the inputs used in civil transport aircraft come from the advanced-technology sectors of the U.S. economy, the effects on economic growth and the long-term viability of the economy will be magnified beyond the loss in jobs or the reduction in output in the transport aircraft field alone. It is important to note that whatever the impact of any such loss to the U.S. economy, the cause for the loss can be traced to the continued subsidization of AI. It is the subsidization of AI, not its success in the market, which should be an issue for U.S. policy.

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3. Postlethwaite, op cit; and, Aviation Daily, June 18, 1990, p. 535.

Table 5-1

U.S. CONTENT OF AIRBUS AIRCRAFT (INCLUDES U.S. CONTENT OF ENGINES)

Model	Engine Manufacturer	U.S. Content (In Percent)
A300	GE/PW	29%
A300-600	GE/PW	29%
A310	GE/PW	29%
A320	CFM	17%
	IAE	12%
A330	GE/PW	32%
	RR	9%
A340	CFM	22%

Notes:
GE: General Electric (US)
PW: Pratt and Whitney (US)
CFM: CFM International (US/France)
IAE: International Aero Engines (Multinational)
RR: Rolls Royce (UK)

Source:
Senat Rapport General No. 59, Premiere Session Ordinaire de 1989-1990 (Nov 21, 1989), p.46.

In summary, then, the pressure of inefficient AI programs in the marketplace will cause the size of the U.S. civil aeronautics industry to be smaller than it would be otherwise. Resources will be reallocated to other investments where achievable rates of return are higher. However, it is possible that the greatest losses to the U.S. economy will come as a result of the loss of significant, beneficial spillover effects for sectors other than aviation as well as in the economy more generally. It is important to note that these losses are likely to be permanent because only a very small number of manufacturers are likely to survive in any given aircraft size category. Moreover, new entry by a privately-financed firm into any segment of the large transport market is unlikely.

5.6 Conclusions

If AI continues to require and receive government subsidies, the potential long-term effects could well include the following:

- U.S. aircraft producers will have fewer funds to invest in new programs;
- U.S. manufacturers will be less likely to launch new programs and U.S. manufacturers could choose to withdraw from at least some segments of the market;

- While some U.S. component manufacturers benefit from sales to AI, it is likely that sales resulting from increased production by AI will be more than offset by the reduced sales of U.S. component suppliers to U.S. manufacturers;

- With U.S. manufacturers finding it harder to generate funds from existing programs, they may need to turn to foreign sources of capital which may require transfers of technology in return for providing these funds.

- The negative consequences of a subsidized foreign aircraft producer will be magnified in other sectors of the economy, especially in industries that produce inputs to aircraft manufacturers and to the aircraft manufacturing process.

- These negative effects are likely to be permanent given the difficulty of a manufacturer entering the market for commercial aircraft.

Appendix A

THE ECONOMICS OF THE COMMERCIAL AIRCRAFT INDUSTRY

The demand for civil transport aircraft coupled with the economics of production help explain why there are so few manufacturers in the world. The reasons for this market structure are as follows:

- First, the unit cost of producing aircraft declines as output (in the relevant range) increases. As a result, the average unit cost of production for any particular aircraft falls as sales increase;
- Second, enormous financial resources must be assembled to launch new or even derivative aircraft;
- Third, worldwide demand for transport category aircraft is limited to several hundred units per year on average.

As a consequence, only a few privately-financed firms will succeed in selling enough units to take advantage of the declining unit costs and remain competitive.

Despite the fact that only a limited number of firms will produce a particular type of aircraft (e.g., narrow-body or wide-body), competition among manufacturers to win a particular sales order is typically keen. The reason is that airlines are often able to exercise monopsony power in purchasing aircraft. So long as there exists two reasonably competitive aircraft in the market, an airline can play one manufacturer off against another to obtain attractive prices.

In such a market, any manufacturers' actions will have a direct effect on the others. The discussion in this section provides background on the analysis in Chapter 5 of the effects of Airbus Industrie on the market for transport aircraft.

A.1 Demand for Transport Aircraft

The factors which drive airline markets vary considerably. In the deregulated U.S. market, the demand for aircraft is determined primarily by economic considerations. Foreign carriers, however, sometimes take political considerations more into account when buying aircraft. The practical economic considerations will be discussed first, followed by the complicating effects of political considerations.

A.1.1 Market Determinants of Demand

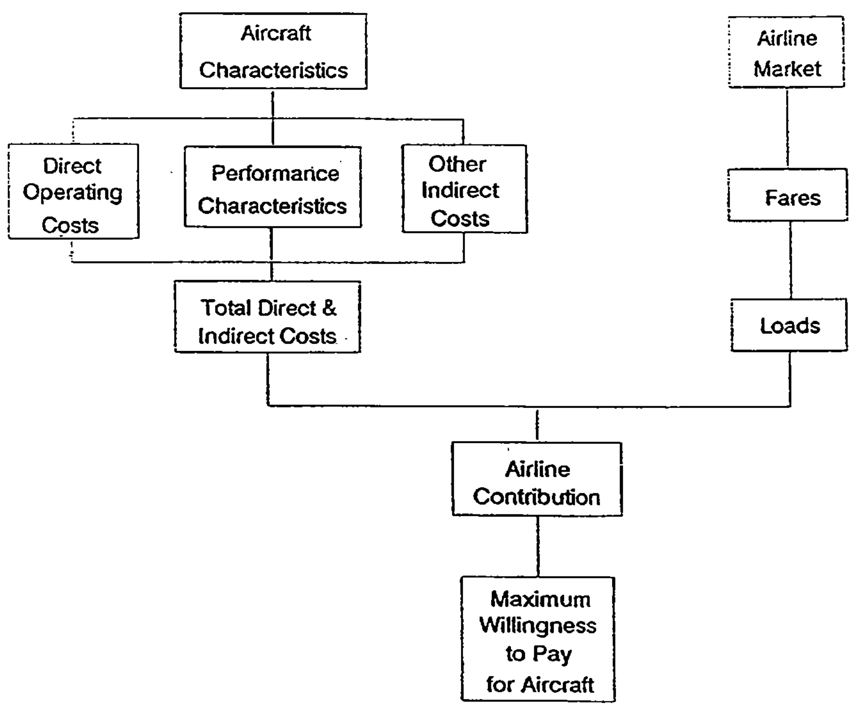
While there are ways for airlines to differentiate their products (through the use of alternative service offerings, computerized reservations systems, frequent flyer programs, etc.), the standard economic model of the firm is appropriate for the purpose of examining the demand for aircraft. As applied to airlines, the model holds that the firm seeks to maximize its long-run profit by providing transportation over an optimized route system.

In evaluating alternative aircraft, an airline can choose between new and used equipment. It selects among alternatives characterized by different ranges, sizes, fuel efficiency, maintenance costs, and crew costs. The carrier ranks its options based upon each aircraft's performance in the context of its present and anticipated route studies. Figure A-1 is a simplified representation of the type of analysis conducted by airlines. Using such an analysis, the firm is able to develop estimates of its maximum willingness-to-pay for each aircraft type. Obviously, all other things being the same, the firm will prefer aircraft ranked highest on this basis.

The analysis in Figure A-1 shows that the total cost of operating an aircraft over a route network depends upon direct operating costs, performance characteristics, and indirect costs. For the market(s) it serves, the firm knows the likely fare, number of passengers and number of flights required. It then estimates the revenues and costs (less ownership costs) of operating the aircraft. The difference is the annual "contribution" that will be left to cover ownership costs. The maximum amount the airline is willing-to-pay for the aircraft is equal to the present value of expected future contribution, discounted using the firm's marginal cost of capital.[1]

Figure A-1

AIRLINE AIRCRAFT ANALYSIS



1. Depreciation must be deducted from the contribution to yield a net return before taxes.

This process allows the firm to rank all possible alternatives, including both used and new aircraft. Among other things, it shows the airline is often willing to trade-off higher investment cost for a lower direct operating cost. This particular trade-off can become especially important when fuel prices are expected to rise, because the relative value of the more fuel-efficient aircraft rises with increases in fuel prices.

By evaluating each available aircraft in each of its city-pair markets, the airline develops an overall ranking. The result is a fleet plan which guides the carrier's demand for aircraft over time. The airline constantly reassesses the aircraft market, looking for changes in its demand, in prices of fuel and other inputs, the availability of new types of aircraft, and the availability of both new and used aircraft. It acquires aircraft when the purchases will increase the carrier's profitability, and therefore increase the value of the firm. The purchase decision will depend upon the prices for aircraft actually offered in the market rather than the airline's maximum willingness-to-pay.

Depending on circumstances, a carrier may be able to improve its return significantly by playing one manufacturer off against another. As offer prices fall, the carrier's profitability improves. This form of "monopsony power" is most likely when:

- There are few other airlines actively seeking aircraft;
- Competition is keen between aircraft models marketed by different manufacturers;
- Manufacturers' backlogs are low.

On the other hand, a manufacturer can often control its price within a narrow range if these circumstances are reversed. The timing of the carrier's acquisition decision may therefore affect dramatically the long-term profitability of a purchase for both the carrier and the manufacturer.

During 1988 and 1989 the civil transport aircraft market strengthened considerably. Manufacturer backlogs are now high and the time span between order and delivery is quite long. Some models are now sold out through 1993 or 1994. In this environment aircraft prices have also risen significantly.

A.1.2 Complicating Factors

Agreements for the sale of airliners are among the most complex known, due in large measure to the number of complicating factors that the carrier (or owner, if leased to a carrier) and the manufacturer of the aircraft must take into account. Most of these factors can be measured in monetary terms and factored into the analysis of the manufacturer's offer price. However, there remain political influences which can be important in aircraft investment decisions, especially those made in countries where the airline is government-owned. When these political issues affect purchases in the marketplace, benefits and costs cannot be entirely internalized by the firm; i.e., they cannot be reduced to financial terms. Following is a discussion of both types of factors: monetary and political.

The two types of complicating factors that can be reduced to monetary values include:

- Commonality of fleet;
- Terms and conditions in aircraft sales agreements.

Commonality of Fleet--Airlines have significant incentives to minimize the number of different aircraft models and the number of manufacturers represented in their fleets. (Commonality can refer to aircraft types and/or engine types.) One manufacturer estimates that if an airline purchases an aircraft type from a new manufacturer to replace one already in its fleet, all other things being equal, the new manufacturer's price must be ten percent below that of the incumbent to offset commonality advantages.

These commonality savings can be segregated into a few categories:

- o Aircrew training costs: Airliners manufactured by the same company often share the same cockpit configuration and training requirements. This reduces crew training costs and increases crew flexibility.

- o Training and scheduling of maintenance personnel: Aircraft manufactured by the same company often share similar maintenance characteristics which allow field personnel to complete maintenance work more easily. This also reduces the number of aircraft with which personnel must be familiar, increases the quality of maintenance and overhead services, increases scheduling flexibility of the crews and reduces training costs.

- o Home base and field inventory: The greater the number of types of aircraft and the more manufacturers represented in the fleet, the larger the absolute size of the inventory of component spares required to be held at home base and in the field.

- o "X" Efficiency: Changing manufacturers can upset the established regimen of operating and maintaining aircraft. Airframe and engine manufacturers both provide close field support to airlines. Working relationships developed over the years are difficult to replace overnight and labor productivity maintaining aircraft from new suppliers is likely to be lower, at least temporarily, than for aircraft from incumbent suppliers.

For these reasons, an airline is willing to pay more for an aircraft which is similar to ones already in its fleet than for other competing aircraft, all other things being the same.

Attributes of Aircraft Sales Agreements--There are several important dimensions of the offer price for an airliner which can have a direct bearing on its actual cost to the acquirer. For new aircraft, separate prices are provided for the airframe, engines, airline-specified equipment and, often, for avionics. The airframe and much airline-specified equipment are the responsibility of the aircraft manufacturer while the engines and avionics are often bought separately. (In the very latest aircraft, avionics may not be an option of the buyer given the functionally integrated nature of such aircraft's airframe and control systems.)

Engine selection is particularly important because power may account for as much as 50 percent of total life-cycle capital costs even thought it represents as little as 20 percent of the initial investment in the aircraft. Engines contain the preponderance of the rotating parts in an aircraft which are subject to wear and tear. Replacement parts as well as maintenance labor and overhead costs represent a significant part of the life-cycle costs of aircraft engines. Today, many new widebody aircraft models have multiple engine types available. This allows carriers to achieve engine commonality across different aircraft types.

Training and spares also are typically included in the offer price for new aircraft. Training of the air and ground crews and spare parts availability are important determinants of the ease and efficiency with which new aircraft are integrated into an airline's fleet.

The sales agreements for new aircraft also typically include progress payment schedules from the time the contract is signed until the day of delivery. Progress payments are made on a periodic basis with the last increment due at delivery. Manufacturers can materially alter the present value of a sales agreement by changing the progress payment schedule.

Sales agreements sometimes include financing arrangements. Especially during periods of slack demand, manufacturers may provide lease or other financial arrangements that are better than those otherwise available. Export financing supported by governments can be made especially attractive as nations attempt to encourage overseas sales. (An OECD arrangement on aircraft sales financing has disciplined the use of export credit financing.)

Agreements covering the purchase of new aircraft also include performance and warranty guarantees. Performance guarantees include fuel efficiency and payload/range relationships as well as other operating parameters (e.g., maintenance man-hours per flight hour). Warranties usually cover the manufacturer's obligations for repair of the aircraft within a specified time period or number of flight hours after it has been placed in service.

Finally, such contracts often include special arrangements made between the manufacturer and the airline. These arrangements might cover:

- Optional (i.e., additional) aircraft together with the terms and conditions associated with their conversion to orders;
- Discounts granted on "white-tail" aircraft;[2]
- Assignment of value to aircraft traded in by the carrier;
- "Favored-nation treatment" with respect to all or some of the aircraft ordered;[3]
- The provision of aircraft on an interim basis until new aircraft can be delivered.

The number and variety of such arrangements make aircraft procurement contracts especially complex. While both parties have a good idea of the monetary value of these factors, they make it difficult for third parties to determine the price at which the aircraft changed hands. Often manufacturer concessions are treated in a side letter to the sales contract which is not disclosed to any parties except buyer and seller.

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2. "White-tails" are aircraft built without firm purchase commitments. U.S. manufacturers historically have rarely built white-tails because of the high carrying charges of such aircraft. Airbus has built a significant number of white-tails in order to keep their production lines open during times of slack demand.

3. Favored-nation status means that the buyer will receive the difference between its price and the lowest price paid by any subsequent buyer in a similar transaction for a specified period of time. This benefit is usually reserved for early buyers of a new aircraft type.

A.1.3 Political Considerations and the Demand for Aircraft

All privately-owned airlines share the same basic desire to maximize profits from their operations. However, many foreign airlines are government-owned and are often operated in part for national prestige and to serve international political and business interests. In making sales to these airlines, manufacturers must present not only economically viable products but also take political considerations into account. These considerations can include:

- o Manufacturing offsets which require local content in the products (agreements to incorporate locally manufactured components for sales to all customers);
- o Barter arrangements (taking part of the sales revenue in the form of goods instead of money);
- o Counter-trade (assisting the aircraft purchaser to export products to third countries).

There may also be purely political considerations in the purchases made by foreign airlines to which the manufacturer may or may not be able to respond.

A.1.4 Summary of the Demand Side of the Market for Transport Aircraft

Any "Model" of the airlines' flight equipment purchasing decision process should begin with the following general assumptions:

- o Airlines seek to maximize profits from operations;
- o Alternative aircraft are ranked on the basis of their expected profit contribution on each carrier's route system;
- o Economically rational decisions are made based upon which aircraft is likely to maximize the long-run return to the airline;
- o Aircraft prices can be affected significantly by the number of airlines in the aircraft market at any given time, how direct the competition is between aircraft types and the number of aircraft in manufacturers' backlogs;
- o Decisions reached on economically rational grounds can be more or less influenced by complicating factors, especially political considerations;
- o Such external factors can sometimes be governing in the ultimate decision.

A.2 Economics of Aircraft Supply

This section describes the economics of the production of new civil transport aircraft and then reviews the consequences for competition in the market for such aircraft. Two key elements dominate the economics of production in this industry:

- o High sunk costs;
- o Learning curve effects and scale economies of production.

Both of these tend to limit the number of competitors in the field.

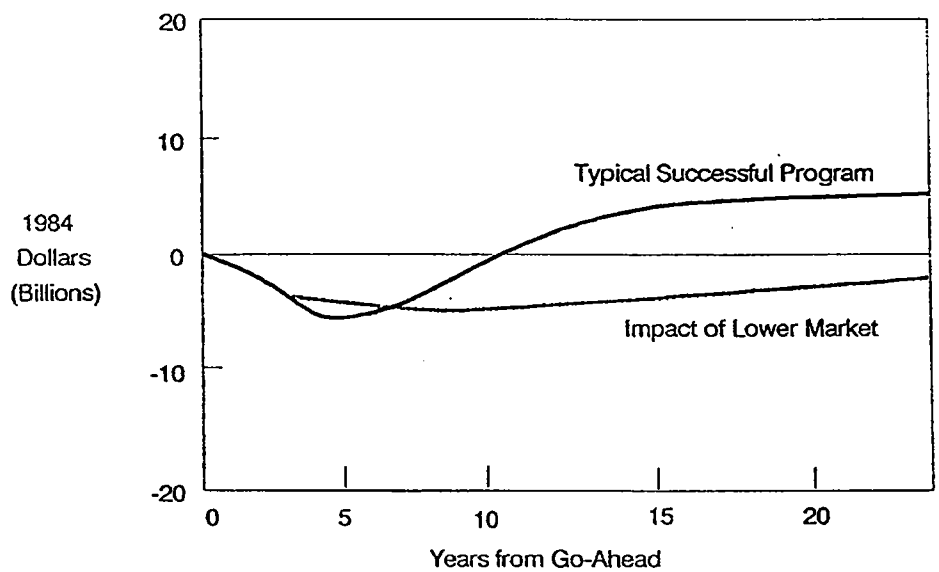
A.2.1 High Sunk Costs

Making a commitment to build a new aircraft today can entail between $2 and $4 billion in fixed costs for development, tooling and certification. Even derivatives of existing aircraft can cost more than a half-billion dollars to develop and certify. Such large up-front commitments make financing a new aircraft program a formidable challenge even for experienced, established, large manufacturers. Another consequence of high sunk costs is the relatively long time period over which a firm must endure negative cash flows to accommodate a new program. The firm must therefore find either internal or external sources of funds to offset such negative cash flows. Often, a firm must "bet the company"[4] on each new airliner put into service.

Figure A-2 depicts the cumulative cash flows for a medium-sized aircraft program over a 25-year period. The most important aspect of the graph is the depth of the negative cash flows of the program. Even a successful program can produce cumulative deficits of $5 billion after five years. This amount is perhaps most dramatic when compared to the stock market values of the shares of firms such as Boeing and McDonnell Douglas.

Figure A-2

CUMULATIVE CASH FLOW
MEDIUM-SIZE AIRCRAFT



Basic curve adopted from report of Aviation Advisory Commission.

Source: T. Bacher, "The Economics of the Commercial Aircraft Industry", February 1984, p. 13.

4. Newhouse, "The Sporty Game," The New Yorker, (June 14, 21, 28 and July 5, 1982). The author uses this terminology to reflect the fact that the negative cash flow associated with the launch of an airliner program often exceeds the net worth of the company.

The significant financial effort required to produce a new aircraft is itself a barrier to entry into the industry. But it should be recognized that this financial requirement is, in part, a result of the complexity of the task of integrating numerous technologies into the product. Incumbent aircraft manufacturers have a significant advantage over potential new entrants in their ability to deal efficiently with this complexity. One key reason is the economics of the "learning curve."

A.2.2 Learning Curve and Scale Economies of Production

Even incumbent manufacturers have a significant amount to learn about the production of any new aircraft types as new technologies and manufacturing techniques are introduced. As a consequence, the marginal costs of production decline over a substantial range of output with production workers becoming more familiar with the methods required to assemble an aircraft efficiently.

The total investment incurred through the production and delivery of the first unit of a new model is exceedingly high. At present, the production costs of the first aircraft unit can range from $500 million to a multiple of that amount.

Learning curve benefits are but one reason the aircraft manufacturing industry exhibits economies of scale. Average costs of production also decline due to:

- Increased Plant Capacities: Up to some point, scale economies can be realized by investing more heavily in production equipment as capacity levels are increased;
- Managerial Economies: Because all commercial aircraft programs involve multiple subcontractors, average unit managerial costs decline as rates of production increase;
- After-Sales Support: Field support of various sorts is important to making sales and holding customers; it necessarily requires geographical ubiquity. Therefore, costs of providing such support declines markedly as the "market density" of a manufacturer's products increases.

These sources of scale economies--learning curve effects, plant capacity, managerial economies and after-sales support--also represent barriers to entry into the industry.

A.2.3 Consequences of Production Economics

There are a number of consequences of the two features of production economics of the industry which are important to understanding the long-term viability of manufacturers. These consequences can best be understood in the context of:

- Industry structure;
- Length of product life cycle;
- Role of a family of airliners;
- Risk.

Industry Structure--The combination of high sunk costs, and learning curve and scale economies inevitably results in a limited number of competitors in the industry. A new entrant must overcome three important advantages typically enjoyed by such incumbents:

- Financial capability--Incumbents are more likely to have access to sufficient capital to launch new products;

- Production experience and managerial economies--Incumbent manufacturers' experience in developing earlier aircraft types makes them more efficient developers and producers of new types;

- Learning and scale economies--Existing products marketed by incumbent manufacturers already reflect the lower costs derived from learning curve experiences; in turn, this provides such manufacturers with additional pricing flexibility when competing with a new-entrant's aircraft; also, the size of an incumbent's plant typically is large relative to the size of the market.

For all these reasons, the barriers to entry into the commercial aircraft manufacturing business are relatively high. Exit costs are also high since closing a production facility usually requires writing-off much investment and redeploying or liquidating assets. In addition, personnel dismissal and relocation costs can be sizable. For example, the reported cost to Lockheed of closing the L-1011 line was $400 million.[5]

High sunk costs and learning curve economics also have implications for competition among incumbents. A manufacturer that is first in the market with a new aircraft of a particular size and range category can have an advantage over its competitors. Once a commitment is made to development and the associated costs are sunk, the manufacturer of the new product can take advantage of the learning curve to price new aircraft aggressively, at least in part to discourage entry by a competitor. The ability of the firm to price strategically in this manner rises as the project moves closer to production.

Length of Product life Cycles--Because of the substantial resources devoted to launching a project and because of the realities of the learning curve, manufacturers have substantial incentives to extend the life cycles of their products. In this business, product life cycles are extended largely through the development and introduction of derivative aircraft. While the development costs of these derivatives can be high--in some cases over $500 million--the manufacturer views the investment on an incremental basis. That is, if by opting to build the derivative it can earn at least a competitive return on the additional investment, then it is rational to proceed..pa

Not all derivative aircraft require very large investments. Derivatives can be developed by changing a number of aircraft features either singly or in combinations. By extending the product life of a basic aircraft type, the manufacturer is able to move down the learning curve further than would otherwise be possible. The manufacturer then has the option of changing its pricing policies either to discourage entry of a new-technology aircraft or to maintain the competitiveness of its older-technology airliners, or both at the same time in some cases.

The Role of a Family of Aircraft--For years, some aircraft manufacturers have enjoyed a substantial advantage over their competitors because they built a family of aircraft. Boeing is certainly the best example. Many of these aircraft share compo-

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5. Wall Street Journal (February 2, 1982), p. 44. This figure explicitly excludes operating losses on the program. Other sources report that the operating losses were as much as $2.5 billion for the L-1011 program.

nents which reduces the number of unique parts required to assemble each model. Common parts and assembly requirements also make possible the efficient manufacture of different aircraft on the same line. For example, the B-707, B-737 and B-757 aircraft all share the same basic fuselage--and have used the same assembly facilities at Renton, Washington. Labor productivity on well-established lines such as these is extremely high, in part, because learning curve benefits can be translated from one generation of aircraft to another.

An additional advantage of having a family of products is that it reduces the market risk faced by a company. A downswing in the demand for one particular size of aircraft may be offset by an increase in demand for another. A firm can shift its labor among the main production lines of the family and thereby reduce the effects of business cycle fluctuations.

Risk-sharing--As previously noted, there is substantial risk inherent in airliner manufacturing. Firms often have to "bet the company" when making a launch decision. Traditionally, U.S. firms have used internally-generated funds to launch new programs. Because of the risk inherent in new aircraft launches, debt is generally unavoidable especially in the development phase.

Manufacturers often attempt to reduce risk by spreading it among "risk-sharing" partners. Typically, these partners are suppliers of materials or components for the new aircraft. For example, Airbus Industrie is a partnership of risk-sharing companies, each of which, however, is supported by its national government. Boeing also has risk-sharing relationships with Canadian, Japanese and Italian companies and with some of its U.S. subcontractors. McDonnell Douglas has similar arrangements with Italy, China and Canada for its transport programs.

Another important role of partners--whether risk-sharing or not--is to provide market access. Often, the participation of a foreign partner can make a manufacturer's aircraft more acceptable in key markets.

A.2.4 Summary of the Supply Side of the Market

The cost structure of the commercial aircraft manufacturing industry implies that only a few competitors will exist in the marketplace. There are a limited number of individual firms capable of making the financial commitments required to launch and maintain a family of commercial aircraft. Furthermore, direct competition between aircraft manufactured by different companies can substantially reduce the profitability of both. This is one of the key reasons why producing a family of aircraft is so important to the long-term survival of individual transport aircraft producers.

A.3 Conclusion

Chapter 5 concludes that the limited number of firms in the civil transport industry can make effective competition fragile. If one firm becomes dominant, competition can be harmed; the learning curve effect would cause the dominant firm's unit costs to be far below those of competitors. In effect, a dominant firm could reduce or eliminate competitors' participation in the market by pricing at levels that are unprofitable for other firms. The high cost of entering the business could make the paramount position difficult to assault, although even a dominant firm would have to be concerned with market access.

Unwarranted entry can also be damaging in a market like civil aircraft where sunk costs are so high and learning effects are so large that only a few firms (perhaps as few as two in any particular size category) can survive in the long run.

When a new aircraft is brought to market and is unlikely to be commercially viable, the results can be economically and socially undesirable. If the new model is sustained in the market by continued infusions of government support (without the practical prospect of repayment), and if the long-term profit-potential in the market is reduced to levels below the rate-of-return necessary to attract and sustain private capital in-flows to aircraft manufacturers, then the new, inefficient producer may displace a more efficient incumbent in one or more aircraft segments.

This highly undesirable result could also be permanent. The presence of a government-supported firm, coupled with the substantial cost of entry (or re-entry) into the industry, represent high barriers to entry to any potential private competitors.

Appendix B

GOVERNMENT SUPPORTS: DETAILED COUNTRY DATA

B.1 Introduction

B.1.1 Organization of the Appendix

This Appendix contains detailed data on the funds provided by the Airbus partner governments to their respective manufacturers for Airbus projects. The appendix presents data for French Government support provided to Aerospatiale (Section B.2), West German Government support to Deutsche Airbus provided to MBB (Section B.3) and United Kingdom Government support provided to British Aerospace (Section B.4). While much of the funds provided have been in the form of loans and/or repayable advances, the majority of repayments have been either deferred or canceled. Because financial support data have been obtained from foreign government budgets, there is a need to convert such estimates to U.S. dollars. Factors used for currency conversion and interest imputation are discussed immediately below in Section B.1.2.

B.1.2 Conversion and Financial Factors

Throughout the appendix, conversion of currencies at the then-current levels is accomplished using the factors in this section. To determine the opportunity cost of government funds, rates were obtained from the International Monetary Fund. Where data were incomplete, these rates were estimated by GRA as indicated. The objective was to obtain a foreign country rate that was analogous to a U.S. short term Treasury Bill ("T-Bill") rate. The value of the funds to companies was computed using commercial lending rates for the foreign countries. Rates were selected to be analogous to the U.S. "prime rate," which indicates the cost of funds to a creditworthy borrower.

B.1.3 Exchange and Lending Rate

Data for France are shown in Table B-1, for West Germany in Table B-2 and for the United Kingdom in Table B-3. Later calculations of government opportunity cost and value to the firm of government support are accomplished by using the foreign country government borrowing and commercial lending rates to calculate the cumulative value of the support in 1989. This amount is then converted to U.S. dollars using 1989 exchange rates. In the discussion below, funds that are shown on a current basis represent the amount provided in the year it was provided, without adjustment for changes in price levels or inclusion of interest.

B.2 French Government Support of Airbus Industrie

Societe Nationale Industrielle Aerospatiale (SNIAS or Aerospatiale) is owned almost entirely by the Government of France. Development grants for new products (provided by the French Ministry of Transport under Chapter 53-22 of the capital section of the civil aviation budget) are the principal form of government support of SNIAS civil aircraft programs.

Table B-1

FRANCE: EXCHANGE AND BORROWING RATES

	Franc/Dollar Exchange	Dollar/Franc Exchange	Gov't Lending	Private Lending
1967	4.95	0.20	0.061	0.126
1968	4.92	0.20	0.062	0.127
1969	4.95	0.20	0.066	0.133
1970	5.55	0.18	0.071	0.128
1971	5.54	0.18	0.068	0.121
1972	5.05	0.20	0.063	0.118
1973	4.46	0.22	0.073	0.143
1974	4.81	0.21	0.097	0.176
1975	4.28	0.23	0.086	0.159
1976	4.77	0.21	0.083	0.150
1977	4.91	0.20	0.088	0.155
1978	4.51	0.22	0.081	0.151
1979	4.25	0.24	0.086	0.159
1980	4.22	0.24	0.121	0.187
1981	5.43	0.18	0.179	0.207
1982	6.57	0.15	0.157	0.203
1983	7.62	0.13	0.129	0.189
1984	8.73	0.11	0.120	0.188
1985	8.99	0.11	0.101	0.177
1986	6.93	0.14	0.077	0.164
1987	6.01	0.17	0.094	0.158
1988	5.96	0.17	0.091	0.157
1989	6.45	0.16	0.087	0.158

SOURCES: Exchange: 1970 to 1987 from DOC.
1967-1969 from WEFA-CEIS First Quarter Rates.
T-Bill: 1980 TO 1986 from IMF.
1967-1979 from econometric calculations
Lending: 1970-1986 from DOC.
based on GAA52 and NAA52 French Government Bond Rates
1967-1969 from econometric calculations based on T-bill rates.
All 1987-89: "International Financial Statistics," Jan. 1990, IMF.

Table B-2

WEST GERMANY: EXCHANGE AND BORROWING RATES

	Dmark/Dollar Exchange	Dollar/Dmark Exchange	Gov't Lending	Private Lending
1967	3.99	0.25	0.050	0.065
1968	3.99	0.25	0.045	0.063
1969	3.93	0.25	0.061	0.081
1970	3.66	0.27	0.085	0.130
1971	3.49	0.29	0.065	0.111
1972	3.19	0.31	0.049	0.085
1973	2.67	0.37	0.080	0.151
1974	2.58	0.39	0.080	0.177
1975	2.46	0.41	0.053	0.111
1976	2.51	0.40	0.052	0.080
1977	2.32	0.43	0.051	0.071
1978	2.00	0.50	0.044	0.059
1979	1.83	0.55	0.059	0.083
1980	1.81	0.55	0.074	0.120
1981	2.26	0.44	0.097	0.146
1982	2.42	0.41	0.061	0.135
1983	2.55	0.39	0.059	0.101
1984	2.84	0.35	0.053	0.098
1985	2.94	0.34	0.042	0.095
1986	2.17	0.46	0.039	0.088
1987	1.80	0.56	0.058	0.084
1988	1.76	0.57	0.061	0.083
1989	1.90	0.53	0.069	0.093

Source: Exchange Rates: 1967-1969 from WEFA-CEIS
1970-1989 from DOC
Government: 1967-1978 60-90 day Treasury Bill Rates: Bundesbank.
1978-1989 IMF Treasury Bill Rate 13460C.ZF
Private: 1967-1978 private current account credits, Bundesbank.
1978-1989 private current account credits, IMF.

Table B-3

UNITED KINGDOM: EXCHANGE AND BORROWING RATES

	Pound/Dollar Exchange	Dollar/Pound Exchange	Gov't Lending	Private Lending
1970	0.42	2.40	0.070	0.073
1971	0.41	2.44	0.056	0.075
1972	0.40	2.50	0.055	0.075
1973	0.41	2.45	0.093	0.080
1974	0.43	2.34	0.114	0.090
1975	0.45	2.21	0.102	0.090
1976	0.56	1.80	0.111	0.090
1977	0.57	1.75	0.077	0.098
1978	0.52	1.92	0.085	0.088
1979	0.47	2.12	0.130	0.139
1980	0.43	2.33	0.151	0.162
1981	0.49	2.04	0.130	0.133
1982	0.57	1.75	0.115	0.118
1983	0.65	1.54	0.096	0.098
1984	0.75	1.33	0.093	0.097
1985	0.78	1.28	0.116	0.123
1986	0.68	1.47	0.104	0.108
1987	0.76	1.32	0.097	0.096
1988	0.56	1.79	0.096	0.103
1989	0.60	1.66	0.106	0.136

SOURCE: 1970-1986, US DOC
1987-1989 IMF "International Financial Statistics," Jan. 1990.

In many cases funds have been provided prior to the formal launch of a new program. The French have allocated such funds to a generic type of new aircraft (e.g., medium-haul) rather than to a specific model (e.g., A320). In this report, such funds have been linked to the specific Airbus models. Other forms of aid have been provided to Aerospatiale and to equipment suppliers which benefit Airbus programs.

There are a number of ways to consider the value of French government support to Airbus programs. In determining the overall level of support, the analysis is limited to support documented by original sources. French Government aid can be tied to Aerospatiale and Airbus in a few areas:

- o Development grants for specific Airbus aircraft models;
- o Development grants for aircraft equipment;
- o Development grants for proving of technology;
- o Capital infusions to support Aerospatiale.

The latter three categories of aid cannot be allocated to specific aircraft models within the Airbus product line.

Table B-4

SUMMARY OF CUMULATIVE FRENCH GOVERNMENT SUPPORT TO AIRBUS (1967-1989)

Current Basis	FF MILLIONS	$ MILLIONS
Launch Aid: A300/A310	6,375.0	$988.4
A320	4,871.0	$755.2
A330/A340	1,245.0	$193.0
Aircraft Equipment	672.5	$104.3
Proving of Technology	762.8	$118.3
Equity Infusions	3,772.0	$584.8
Compulsory Loans	1,200.0	$186.0
TOTAL	18,898.3	$2,930.0
Less Repayment	2,434.0	$373.2
Net Support to Date	16,464.3	$2,552.6
To be Disbursed: A330/340	4,405.0	$682.9
Total Net Support	20,869.3	$3,235.6
At Government Opportunity Cost (as of 1989)		
Launch Aid: A300/A310	21,142.7	$3,277.9
A320	7,457.0	$1,156.1
A330/A340	1,408.8	$218.4
Aircraft Equipment	1,060.7	$164.4
Proving of Technology	1,271.2	$197.1
Equity Infusions	6,960.1	$1,079.1
Compulsory Loans	1,846.8	$286.3
TOTAL	41,147.3	$6,379.4
Less Repayment	4,160.5	$645.0
Net Support to Date	36,986.8	$5,734.4
To be Disbursed: A330/340	2,857.0	$442.9
Total Net Support	39,843.8	$6,177.3
At Private Borrowing Rate (as of 1989)		
Launch Aid: A300/A310	40,760.9	$6,319.5
A320	10,035.8	$1,555.9
A330/A340	1,514.5	$234.8
Aircraft Equipment	1,470.4	$228.0
Proving of Technology	1,836.6	$284.7
Equity Infusions	10,725.5	$1,662.9
Compulsory Loans	2,550.1	$395.4
TOTAL	68,893.7	$10,681.2
Less Repayment	5,986.0	$928.1
Net Support to Date	62,907.7	$9,753.1
To be Disbursed: A330/340	2,103.0	$326.0
Total Net Support	65,010.7	$10,079.2

In total, the French Government disbursements have totaled FF18.9 billion ($3.0 billion) in current terms (see Table B-4). Almost all of the aid has been provided to Aerospatiale, and the majority of these funds have been for aircraft development projects. Another FF4.4 billion ($683 million) is committed to complete development of the A330/A340. Net of repayments to date (1989), the French Government has made net commitments of FF20.9 billion ($3.2 billion) for participation in AI.

The opportunity cost of net committed funds in 1989 to the French Government is estimated to be about FF39.8 billion ($6.2 billion), if valued at the Government's cost of borrowing. To a creditworthy commercial firm operating in France, the net committed funds would be worth FF65.0 billion ($10.1 billion) at the commercial lending rate.

Section B.2.1 details the support for aircraft development, Section B.2.2 covers repayments and Section B.2.3 details the other forms of assistance provided to Airbus programs by the French Government.

B.2.1 French Government Development Funds

As noted above, the principal form of support by the French Government for Aerospatiale's participation in the Airbus program is through development funds provided by the Ministry of Transport. Table B-5 shows Aerospatiale's share of development costs for each Airbus program and the portion of these funds provided in the form of refundable advances by the government. Overall, Aerospatiale has received, or is scheduled to receive, almost FF16.8 billion (current) or over 70 percent of its Airbus development funds from the French Government. The Aerospatiale share of the A300 and A310-200 development was entirely government-funded while the French Government has funded from 60 to 76 percent of the development costs of the Airbus aircraft.

The data in Table B-5 show funding levels on a current basis (then-year), which excludes the time value of the funds advanced.

Table B-5

PARTICIPATION OF THE FRENCH GOVERNMENT
IN AIRBUS PROGRAMS
(MILLIONS OF CURRENT FRANCS)

Model	Development Cost	Government Aid	% Government Aid
A300B2/B4	2,452	2,452	100%
A300-600	1,002	668	67%
A310-200	2,765	2,765	100%
A310-300	690	412	60%
A320	6,380	4,880	76%
Subtotal	13,289	11,177	84%
A330-340	9,400	5,650	60%
Grand Total	22,689	16,827	74%

SOURCES: Assemble Nationale Rapport #920 Premiere Session Ordinaire De 1989-90 (October 12, 1989), p. 16.

Table B-6

FRENCH GOVERNMENT FUNDS BUDGETED FOR THE DEVELOPMENT OF AIRBUS AIRCRAFT PROGRAMS

AUTORISATIONS DE PROGRAMME

(Current FF Millions)

	A300/A310	A320	A330/A340	TOTAL
1967	20.0			20.0
1968	90.0			90.0
1969	0.0			0.0
1970	326.0			326.0
1971	330.0			330.0
1972	320.0			320.0
1973	326.0			326.0
1974	255.0			255.0
1975	132.0			132.0
1976	0.0			0.0
1977	45.0			45.0
1978	227.0	75.0		302.0
1979	503.0	25.0		528.0
1980	623.0	25.0		648.0
1981	605.0	25.0		630.0
1982	905.0	220.0		1,125.0
1983	960.0	500.0		1,460.0
1984	630.0	400.0		1,030.0
1985	206.5	640.0		846.5
1986	103.0	1,240.0		1,343.0
1987		1,050.0	130.0	1,180.0
1988		528.0	587.0	1,115.0
1989		275.0	909.0	1,184.0
Total	6,606.5	5,003.0	1,626.0	13,235.5

(Current $ Millions)

	A300/A310	A320	A330/A340	TOTAL
1967	$4			$4
1968	$18			$18
1969	$0			$0
1970	$59			$59
1971	$60			$60
1972	$63			$63
1973	$73			$73
1974	$53			$53
1975	$31			$31
1976	$0			$0
1977	$9			$9
1978	$50	$17		$67
1979	$118	$6		$124
1980	$148	$6		$154
1981	$111	$5		$116
1982	$138	$33		$171
1983	$126	$66		$192
1984	$72	$46		$118
1985	$23	$71		$94
1986	$15	$179		$194
1987		$175	$22	$196
1988		$89	$99	$187
1989		$43	$141	$184
Total	$1,172	$734	$261	$2,167

CREDITS DE PAIEMENT

(Current FF Millions)

	A300/A310	A320	A330/A340	TOTAL
1967	19.0			19.0
1968	68.0			68.0
1969	23.0			23.0
1970	227.0			227.0
1971	310.0			310.0
1972	415.0			415.0
1973	290.0			290.0
1974	263.0			263.0
1975	184.0			184.0
1976	1.0			1.0
1977	35.0			35.0
1978	169.0	75.0		244.0
1979	463.0	10.0		473.0
1980	563.0	25.0		588.0
1981	590.0	25.0		615.0
1982	826.0	300.0		1,126.0
1983	880.0	380.0		1,260.0
1984	680.0	370.0		1,050.0
1985	230.0	568.0		798.0
1986	100.0	1,050.0		1,150.0
1987	39.0	1,135.0	105.0	1,279.0
1988		658.0	338.0	996.0
1989		275.0	802.0	1,077.0
Total	6,375.0	4,871.0	1,245.0	12,491.0

(Current $ Millions)

	A300/A310	A320	A330/A340	TOTAL
1967	$3.8	$0.0	$0.0	$3.8
1968	$13.8	$0.0	$0.0	$13.8
1969	$4.6	$0.0	$0.0	$4.6
1970	$40.9	$0.0	$0.0	$40.9
1971	$56.0	$0.0	$0.0	$56.0
1972	$82.2	$0.0	$0.0	$82.2
1973	$65.1	$0.0	$0.0	$65.1
1974	$54.7	$0.0	$0.0	$54.7
1975	$43.0	$0.0	$0.0	$43.0
1976	$0.2	$0.0	$0.0	$0.2
1977	$7.1	$0.0	$0.0	$7.1
1978	$37.5	$16.6	$0.0	$54.1
1979	$108.9	$2.4	$0.0	$111.3
1980	$133.4	$5.9	$0.0	$139.3
1981	$108.7	$4.6	$0.0	$113.3
1982	$125.7	$45.7	$0.0	$171.4
1983	$115.5	$49.9	$0.0	$165.4
1984	$77.9	$42.4	$0.0	$120.3
1985	$25.6	$63.2	$0.0	$88.8
1986	$14.4	$151.6	$0.0	$166.0
1987	$6.5	$188.9	$17.5	$212.8
1988	$0.0	$110.5	$56.7	$167.2
1989	$0.0	$42.6	$124.3	$167.0
Total	$1,125.5	$724.2	$198.6	$2,048.3

Source: Chapter 53-22 of French Ministry of Transport Budget 1983 to 1989. Data for 1967 to 1982 from Assemblee Nationale Rapport No 1165, Premiere Session Ordinaire de 1982-1983 (Oct 21,1982), p. 35.

The data in Table B-6 show the yearly budget authority (autorizations de programme--AP--or commitments) and budget credits (credits de paiment--CP--or disbursements) since the inception of the Airbus programs in 1967. All funds are in current units. (The differences between Table B-5 and Table B-6 cannot be reconciled from the source documents. However, the disparity between the amount for the A320 shown in Tables B-5 and B-6 may relate to the fact that prior to the launch of the A320, funds were identified as being for "medium haul aircraft." In total over 13 billion francs have been committed to date for the A300, A310, A320, A330 and A340 programs:

- A300/310--FF6.6 billion A.P.
  FF6.4 billion C.P.

- A320--FF5.0 billion A.P.
  FF4.9 billion C.P.

Table B-6 also shows the support provided for the A300/A310, A320 and A330/A340 programs from 1967 through the 1989 budget year in current dollars. When these are added to the future commitments for the A330 and A340, the French Government will provide over $3.0 billion in nominal terms to the development costs of Airbus programs.

French Government funding for the A330 and A340 programs began in 1987 and these funds will be budgeted from 1987 through the mid-1990's. Table B-7 shows estimates of the launch aid to be provided to Aerospatiale for the A330/A340 aircraft during the 1987 to 1996 time frame. Over FF4 billion ($683 million) remains to be disbursed for the 1990 to 1996 period. Aerospatiale will receive 60% of the development funds from the French Government as repayable launch aid and will have to seek the remainder from the capital markets. Since A330/A340 government support is front-loaded, Aerospatiale's need to fund cash flows on the private market is reduced. Aerospatiale has a FF380 million line of credit in the Paris market and another $600 million line of credit in the Eurodollar market.[1] Thus it has lined-up all necessary funds for the A330/A340 program.

B.2.2 Repayment of French Government Development Funds

Repayment of the development grants began in the 1970's. To date only a small portion of the funds advanced for the A300 and A310 programs have been repaid (see Table B-8). No A320 repayments have been reported through the 1989 budget. With no consideration of the opportunity cost of the funds provided, only FF1.5 billion or 47.8 percent of the A300/A300-600 funds and FF944 million or 30.3 percent of the A310 funds have been repaid. Only FF2.4 billion of the FF12.5 billion (19.5 percent) total development aid disbursed to date has been repaid.

While the appropriate rate with which to value the French Government support of Airbus is discussed elsewhere in the report, a minimum rate of interest would be the cost of these funds to the French Government (i.e., the rate at which the government can borrow). At the other end of the scale would be the rate which Aerospatiale would have to pay to obtain such funds in the market. (Because Aerospatiale is government-owned, the cost of borrowing would depend on whether the French Government assumed a "full faith and credit" obligation for Aerospatiale's debt.)

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1. Flight International, May 30, 1987.

Table B-7

FRENCH GOVERNMENT SUPPORT FOR DEVELOPMENT OF A-330/A-340 (CURRENT MILLIONS)

Year	(FF)	($) (1)
1987	105.0	$16.3
1988	338.0	$52.4
1989	802.0	$124.3
1990	1,212.0	$187.9
1991	1,013.0	$157.1
1992	780.0	$120.9
1993	600.0	$93.0
1994	300.0	$46.5
1995	250.0	$38.8
1996	250.0	$38.8
TOTAL	5,650.0	$876.0

(1) Converted with 1989 exchange rate from Table B-1.

SOURCES: Total: Assemblee Nationale Rapport No. 920, 1989-90, p.16.
1989-90: Assemblee Nationale Rapport No. 925, p.44.
1991-96: Spending estimated by GRA based on total A330/340 development budget.

Using the government borrowing rate as a lower bound for the opportunity cost of funds, a conservative evaluation of the French Government's cost of its investment in Airbus can be made. Tables B-8 (in French Francs) and B-9 (in U.S. dollars) show the repayments deducted from the government development aid. The unrepaid advances accrue interest at the French Government borrowing rate. It can be seen that the total unpaid value of the advances amounts to FF25.8 billion or $4.0 billion as of 1989. If Aerospatiale had had to borrow the government-provided development funds in the financial markets (as would a U.S. company operating on a commercial basis), the total unrepaid launch aid to date is valued at FF52.3 billion or $8.1 billion as of 1989.

Table B-8

REPAYMENT OF FRENCH GOVERNMENT DEVELOPMENT SUPPORT
(FF MILLIONS)

Year	Total Disbursements	Repayments A300	A310	TOTAL	Current Net Disbursements	Cumulative Net Disbursements Current	Gov. Rate	Private Rate
1967	0.0			0.0	0.0	0.0	0.0	0.0
1968	0.1			0.0	0.1	0.1	0.1	0.1
1969	0.0			0.0	0.0	0.1	0.1	0.1
1970	0.2			0.0	0.2	0.3	0.4	0.4
1971	0.3			0.0	0.3	0.6	0.7	0.8
1972	0.4			0.0	0.4	1.1	1.2	1.4
1973	0.3			0.0	0.3	1.4	1.6	1.9
1974	0.3			0.0	0.3	1.6	2.1	2.5
1975	0.2			0.0	0.2	1.8	2.4	3.2
1976	0.0			0.0	0.0	1.8	2.6	3.6
1977	0.0	53.0	0.0	53.0	(53.0)	(51.2)	(54.7)	(57.0)
1978	0.2	37.6	0.0	37.6	(37.4)	(88.5)	(99.5)	(108.6)
1979	0.5	37.3	0.0	37.3	(36.8)	(125.3)	(148.1)	(168.5)
1980	0.6	49.1	0.0	49.1	(48.5)	(173.9)	(220.4)	(257.6)
1981	0.6	93.2	0.0	93.2	(92.6)	(266.4)	(369.0)	(422.7)
1982	1.1	296.1	0.0	296.1	(295.0)	(561.4)	(768.3)	(863.4)
1983	1.3	154.9	14.4	169.3	(168.0)	(729.5)	(1,057.1)	(1,226.3)
1984	1.1	124.7	48.3	173.0	(172.0)	(901.4)	(1,376.5)	(1,661.2)
1985	0.8	192.2	108.2	300.4	(299.6)	(1,201.0)	(1,845.4)	(2,307.8)
1986	1.2	112.4	122.3	234.7	(233.5)	(1,434.6)	(2,275.0)	(2,957.6)
1987	1.3	161.9	170.0	331.9	(330.6)	(1,765.2)	(2,851.3)	(3,807.8)
1988	1.0	66.9	304.7	371.6	(370.6)	(2,135.8)	(3,513.8)	(4,832.3)
1989*	1.1	110.7	176.1	286.8	(285.7)	(2,421.5)	(4,130.5)	(5,927.7)
Total	12.5	1,490.0	944.0	2,434.0	(2,421.5)			

SOURCES:
1977 to 1980 data from: Senat Rapport General No. 69 Premiere Session Ordinaire 1984-85 (11/19/84), P.23
1981 to 1985 data from: Senat Rapport General No. 67 Premiere Session Ordinaire 1986-87 (11/17/86), P.24
1987-89 data from: Senat Rapport General No. 59 Premiere Session Ordinaire de 1989-90. p. 40.

*Through July 1, 1989.

Table B-9

REPAYMENT OF FRENCH GOVERNMENT DEVELOPMENT SUPPORT
($ MILLIONS)

Year	Total Disbursements	Repayments A300	A310	TOTAL	Current Net Disbursements	Cumulative Net Disbursements Current	Gov. Rate	Private Rate
1967	$0	$0	$0	$0	$0	$0	$0	$0
1968	$0	$0	$0	$0	$0	$0	$0	$0
1969	$0	$0	$0	$0	$0	$0	$0	$0
1970	$0	$0	$0	$0	$0	$0	$0	$0
1971	$0	$0	$0	$0	$0	$0	$0	$0
1972	$0	$0	$0	$0	$0	$0	$0	$0
1973	$0	$0	$0	$0	$0	$0	$0	$0
1974	$0	$0	$0	$0	$0	$0	$0	$1
1975	$0	$0	$0	$0	$0	$0	$1	$1
1976	$0	$0	$0	$0	$0	$0	$1	$1
1977	$0	$11	$0	$11	($11)	($10)	($11)	($12)
1978	$0	$8	$0	$8	($8)	($20)	($22)	($24)
1979	$0	$9	$0	$9	($9)	($29)	($35)	($40)
1980	$0	$12	$0	$12	($11)	($41)	($52)	($61)
1981	$0	$17	$0	$17	($17)	($49)	($68)	($78)
1982	$0	$45	$0	$45	($45)	($85)	($117)	($131)
1983	$0	$20	$2	$22	($22)	($96)	($139)	($161)
1984	$0	$14	$6	$20	($20)	($103)	($158)	($190)
1985	$0	$21	$12	$33	($33)	($134)	($205)	($257)
1986	$0	$16	$18	$34	($34)	($207)	($328)	($427)
1987	$0	$27	$28	$55	($55)	($294)	($474)	($634)
1988	$0	$11	$51	$62	($62)	($359)	($590)	($811)
1989*	$0	$17	$27	$44	($44)	($375)	($640)	($919)
Total	$2	$229	$144	$373	($371)			

Sources: Table B-1, B-8.
*Through July 1, 1989.

B.2.3 Other French Government Aid

The French Ministry of Transport also provides funding for a few generic development programs such as:

- o Equipements du bord (aircraft equipment or avionics);
- o Developpements Technologiques Probatoires (development for proving purposes).

It is not clear whether these programs support Airbus projects exclusively as they are funded along with Airbus, aeroengine and helicopter programs. However, some funds for product development are likely to represent funding, at least in part, for suppliers to Aerospatiale and Airbus programs. Table B-10 shows authorizations and credits for aircraft equipment in the 1977 to 1989 time period. Almost FF673 million ($104 million) in credits were provided.

Table B-10

FRENCH GOVERNMENT SUPPORT OF AIRCRAFT EQUIPMENT (MILLIONS)

	(FF)		($)		Cumulative Totals (FF)		
	Authorized	Credits	Authorized	Credits	Current	Gov. Rate	Private Rate
1977	0.0	0.0	$0.0	$0.0	0.0	0.0	0.0
1978	0.0	0.0	$0.0	$0.0	0.0	0.0	0.0
1979	25.0	15.5	$5.9	$3.6	15.5	16.8	18.0
1980	36.0	20.0	$8.5	$4.7	35.5	41.3	45.1
1981	40.0	40.0	$7.4	$7.4	75.5	95.8	102.7
1982	40.0	40.0	$6.1	$6.1	115.5	157.2	171.6
1983	40.0	40.0	$5.2	$5.2	155.5	222.6	251.6
1984	60.0	45.0	$6.9	$5.2	200.5	299.7	352.4
1985	74.0	64.0	$8.2	$7.1	264.5	400.5	490.1
1986	90.0	90.0	$13.0	$13.0	354.5	528.4	675.1
1987	83.0	93.0	$13.8	$15.5	447.5	680.0	889.6
1988	90.0	100.0	$15.1	$16.8	547.5	850.7	1,144.5
1989	125.0	125.0	$19.4	$19.4	672.5	1,060.7	1,470.4
TOTALS	703.0	672.5	$109.5	$104.0	Cumulative Totals (1989 $)		
					$104.3	$164.4	$228.0

Source: Budget vote--Transports Aviation Civile.
Chaptire 53-22 for 1980 to 1989.
Chaptire 53-24 for 1979.

Table B-11 shows the authorizations and credits for proving of technology during the 1977 to 1989 time period. It can be seen that FF762.8 million ($119.7 million) in credits have been provided for this activity. Tables B-10 and B-11 also show the credits for aircraft equipment and proving of technology on a cumulative basis using the government and commercial borrowing rates.

Table B-11

FRENCH GOVERNMENT SUPPORT FOR PROVING OF TECHNOLOGIES(1) (MILLIONS)

	(FF)		($)		Cumulative Totals (FF)		
	Authorized	Credits	Authorized	Credits	Current	Gov. Rate	Private Rate
1977	15.0	12.0	$3.1	$2.4	12.0	13.1	13.9
1978	25.0	15.0	$5.5	$3.3	27.0	30.3	33.2
1979	31.5	20.0	$7.4	$4.7	47.0	54.7	61.7
1980	25.0	20.0	$5.9	$4.7	67.0	83.7	97.0
1981	25.0	30.0	$4.6	$5.5	97.0	134.0	153.2
1982	70.0	50.0	$10.7	$7.6	147.0	212.9	244.5
1983	100.0	80.0	$13.1	$10.5	227.0	330.7	385.8
1984	125.0	80.0	$14.3	$9.2	307.0	460.0	553.4
1985	100.0	52.0	$11.1	$5.8	359.0	563.7	712.5
1986	124.0	1.5	$17.9	$0.2	360.5	609.0	831.0
1987	97.3	147.3	$16.2	$24.5	507.8	827.6	1,133.1
1988	140.0	130.0	$23.5	$21.8	637.8	1,044.4	1,460.7
1989	125.0	125.0	$19.4	$19.4	762.8	1,271.2	1,836.6
TOTALS	877.8	762.8	$133.4	$100.3	Cumulative Totals (1989 $)		
					$118.3	$197.1	$284.7

Source: Budget vote–Transports Aviation Civile.
Chaptire 53-23 for 1980 to 1989.
Chaptire 53-24 for 1977 to 1979.

(1) Developpements Technologiques Probatoires 1982 to 1984.
Developpements Exploratoires 1977 to 1981.

Hayward[2] notes that there was (and is) significant competition for equipment subcontracts among the Airbus partner countries as well as with other suppliers such as those in the U.S. He notes that the French Government provides significant financial support for the equipment sector and, as a result, French firms enjoy a price advantage when competing for Airbus subcontracts.

Another area where the French Government has funded programs which indirectly benefit Airbus was in the development of the GE-Snecma CFM-56 aircraft engine. While this powerplant is also used in the B-737, DC-8 and the KC-135RE, it was the launch engine for the A320. In order to maintain a conservative estimate of the support provided to Aerospatiale's Airbus programs, only those programs which are directly related to an Airbus aircraft are considered below. Funding for the CFM-56 engine is excluded.

Aerospatiale has received other aid from the Government of France although it is not possible to conclusively state that such aid was explicitly for Airbus participation. Table B-12 contains a recapitulation of the capital infusions to Aerospatiale for the 1978 to 1989 time period. Overall, FF3.8 billion ($679.8 million) of equity infusions were provided. These capital infusions are also shown valued at the government borrowing rate (FF7 billion or $1.08 billion) and at the private borrowing rate (FF10.7 billion or $1.7 billion). However, Airbus programs were losing money during this time period, and these equity infusions would have allowed Aerospatiale to sustain such losses.

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2. Keith Hayward, International Collaboration in Civil Aerospace, St. Martin's Press, (1986), pp. 75-78.

Table B-12

FRENCH GOVERNMENT CAPITAL INFUSIONS TO AEROSPATIALE (MILLIONS)

	Current		Cumulative (FF)		
	(FF)	($)	Current	Gov. Rate	Private Rate
1978	550.0	$122.0	550.0	594.4	633.1
1979	200.0	$47.1	750.0	863.0	965.5
1980	150.0	$35.5	900.0	1,135.5	1,324.1
1981	142.0	$26.2	1,042.0	1,506.2	1,769.6
1982	130.0	$19.8	1,172.0	1,893.1	2,285.2
1983	0.0	$0.0	1,172.0	2,137.3	2,717.1
1984	100.0	$11.5	1,272.0	2,505.8	3,346.7
1985	0.0	$0.0	1,272.0	2,758.9	3,939.1
1986	0.0	$0.0	1,272.0	2,972.4	4,584.3
1987	1,250.0	$208.0	2,522.0	4,620.6	6,757.3
1988	1,250.0	$209.8	3,772.0	6,402.4	9,260.5
1989	0.0	$0.0	3,772.0	6,960.1	10,725.5
TOTAL	3,772.0	$679.8	Cumulative Totals (1989 $)		
			$584.8	$1,079.1	$1,662.9

Source: (1) Senat Rapport General No. 62, Premiere Session Ordinaire de 1983-1984, p. 46.
(2) Aerospatiale Annual Report 1984, p. 1.
(3) Aerospatiale Annual Report 1987, p. 1.
(4) Aerospatiale Annual Report 1988, p. 2.

Government-provided long-term debt is shown in Table B-13. The government's FF1.2 billion one-time payment was equivalent to $137.5 million at 1984 exchange rates. Using the opportunity cost of these funds to the French Government, they were worth FF1.8 billion ($286.0 million) in 1989. If Aerospatiale had to borrow such funds in the commercial market, these loans would be valued at FF2.6 billion ($395.0 million) in 1989.

Table B-13

LONG TERM DEBT OF AEROSPATIALE PROVIDED BY THE FRENCH GOVERNMENT (MILLIONS)

	Nominal Value		Gov't Rate		Private Rate	
	(FF)	($)	(FF)	($)	(FF)	($)
1984	1200	137.5	1200	137.5	1200	137.5
1989	1200	137.5	1846.8	286.3	2550.1	395.4

SOURCE: Aerospatiale Annual Report 1985, P. 5.
Exchange & Lending Rates: Table B-1.

B.3 West German Government Support of Airbus

The Airbus Consortium member in West Germany is Deutsche Airbus, a 100%-owned subsidiary of Messerschmitt-Bolkow-Blohm (MBB). Even though MBB owns all Deutsche Airbus stock, its results are not consolidated with MBB's financial statements.[3] Thus, it is difficult to trace West Germany's contributions to Airbus except through government budgets. In 1989, MBB merged with Daimler-Benz, and substantial future support was pledged by the West German Government so that Daimler-Benz would agree to assume the Deutsche Airbus responsibilities of MBB.

The principal means of support to Deutsche Airbus is through development grants provided by the West German Ministry of Economics. These funds are not separated by Airbus program (e.g., A300, A310, A320, A330 and A340) in the budget documents. Secondary source materials must be used to evaluate such support in detail. The Ministry of Economics also provides subsidies for production and sale of Airbus aircraft. The West German Government converted DM1.9 billion ($669 million) of government-guaranteed loans for A300 and A310 to repayable grants because Deutsche Airbus could not repay interest or principal on this debt. GRA has determined from budget documents of the Ministry of Economics that an additional DM800 million was converted to a development grant. As part of the merger of MBB into Daimler-Benz, the West Germany Government committed an additional DM6 billion in future support of Deutsche Airbus for exchange rate guarantees and production subsidies. The Ministry of Research and Technology (BMFT) has funded two programs--civil components and aircraft electronics--which are intended to support the Airbus programs.

A summary of the identifiable government support for Deutsche Airbus in West Germany is shown in Table B-14 on three bases: (1) current basis; (2) opportunity cost to the government; and (3) value to a firm operating on a commercial basis. On a current basis, the West German Government committed a total of DM14.6 billion ($7.7 billion) in support of Airbus. The majority of aid has been for aircraft development, although significant government funds have been provided for production support and to offset exchange rate effects.

The West German deutsche mark (DM) historically has been a strong currency relative to the dollar. Thus costs incurred in DM have been paid for by revenues in a weakening dollar. In addition, the German civil aircraft industry is less well-developed than that of France and the UK so that MBB may have been a less efficient producer than the other Airbus member companies. For these reasons it is likely that Deutsche Airbus revenues have fallen short of production costs. This has been recognized by the West German Government and compensated for by the past and future support for production and exchange rate differences.

The opportunity cost to the West German Government of the total aid provided for Airbus programs is also shown in Table B-14. This has amounted to DM16.2 billion ($8.5 billion) when valued at the government borrowing rate. A company which had to raise such funds in the market would have valued the net aid provided at DM20.9 billion ($11.0 billion) using the private sector cost of funds in Germany.

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3. MBB Consolidated Annual Report-1985, p. 34. MBB reports Airbus-related sales but does not carry Deutsche Airbus results into its profit and loss accounts.

Table B-14

SUMMARY OF WEST GERMAN GOVERNMENT SUPPORT TO AIRBUS: 1967-1989

		DM Millions	$ Millions
Current Basis			
Development Funds:	A300/310	2,827.0	$1,489.5
	A320	1,500.0	$790.3
	A330/340	600.0	$316.1
Production Supports		1,097.9	$578.5
Civil Components Program		147.3	$77.6
Aircraft Electronics		69.9	$36.8
Exchange Insurance		439.0	$231.3
TOTAL		6,681.1	$3,520.1
Less Repayments		130	$68.5
Net FRG Support		6,551.1	$3,451.6
To be Disbursed:			
Production Supports		2,000.0	$1,053.7
Development Funds		2,400.0	$1,264.5
Exchange Rate		3,666.0	$1,931.5
Total		8,066.0	$4,249.7
Total Net Support		14,617.1	$7,701.3
At Government Opportunity Cost (as of 1989)			
Development Funds:	A300/310	5,226.6	$2,753.7
	A320	1,843.4	$971.2
	A330/340	654.6	$344.9
Production Supports		1,870.0	$985.2
Civil Components Program		258.4	$136.1
Aircraft Electronics		109.3	$57.6
Exchange Insurance		482.4	$254.2
TOTAL		10,444.7	$5,503.0
Less Repayments		199.8	$105.3
Net FRG Support		10,244.89	$5,397.7
To be Disbursed:			
Production Supports		1,544.0	$813.5
Development Funds		1,852.9	$976.2
Exchange Rate		2,547.2	$1,342.0
Total		5,944.1	$3,131.8
Total Net Support		16,189.0	$8,529.5
At Private Borrowing Rate (asof 1989)			
Development Funds:	A300/310	9,325.8	$4,913.5
	A320	2,044.7	$1,077.3
	A330/340	669.2	$352.6
Production Supports		2,707.3	$1,426.4
Civil Components Program		375.9	$198.1
Aircraft Electronics		148.7	$78.3
Exchange Insurance		498.1	$262.4
TOTAL		15,769.7	$8,308.6
Less Repayments		272.5	$143.6
Net FRG Support		15,497.2	$8,165.0
To be Disbursed:			
Production Supports		1,423.1	$749.8
Development Funds		1,707.8	$899.8
Exchange Rate		2,280.3	$1,201.4
Total		5,411.2	$2,851.0
Total Net Support		20,908.4	$11,016.0

Section B.3.1 reviews development aid provided by the West German Government. Section B.3.2 details the relationship between Deutsche Airbus and MBB. It also discusses the merger of MBB into Daimler-Benz. Section B.3.3 reviews other types of financial support by the West German Government for Airbus programs.

B.3.1 Government Development Funds

The West German support for Airbus is listed in Einzelplan 09, which is the budget of the Ministry of Economics. The funding is listed under Title Group 09 for the functions 662 91 and 892 91. The total budget is divided into the following categories:

- "Furthering of aviation technology," which represents the total funding under this class;
- "Financial sales assistance" (listed in some years only);
- "Production support" (listed in some years only);
- "Subsidies for development of civil aircraft."

The explanation under Title Group 09 notes that:

"The development of modern civilian aircraft requires the use of financial resources of such an amount that they can neither be borne by single companies nor by consortiums of companies. Moreover, the aviation industry should become less dependent on military orders for its survival. It is for that reason that the development of civilian planes including civilian engines is being furthered through public funding ("subsidies"). For the development of single projects up to the serial manufacturing payments with "profit participation" up to 60% of the costs are allowed. If international cooperative projects are involved, this percentage may be exceeded.

The most prominent project is the Airbus. To the version A300 which has been adjusted to the latest technical developments, the versions A310 and A320 have been added. Through the expansion of the production range to become an Airbus family, the conditions for a competition with the American market leader have been improved. Moreover, the basic versions are being adjusted through improvements. The aviation industries of France, Great Britain, Holland, Belgium, Spain and West Germany are participants. Through the continuous furthering of this major European cooperative project (Airbus family), a contribution is being made towards the integration of the European aviation industry. Subsidies are prepared for 1987 for the development of the twin project A330/340. The expenditures, coordinated between the relevant departments and authorized by budget committee of the German parliament, are being managed under special guidelines.

Besides moneys for the furthering of development, the aviation industry may receive--under specific circumstances--marketing help to secure its competitiveness. Such means are allowed under title 662 91. Administrative costs may be booked against the same title for the channeling through of the marketing assistance moneys which are administered by the Kreditanstalt for Wiederaufbua (Frankfurt: Direct Lending Portion of German Export Financing Bank) on the basis of a contract. Before the payment of the public moneys, all income received by kfw is to be shown in the framework of the execution of the aforementioned contract."[4]

The Einzelplan also lists a summary of Title Group 09 which shows the money authorized from 1963 to 1989 and indicates how much of the total amount was in the form of sales and support subsidies (see Table B-15). The development amount is presumably the difference between the total amount and the amount for sales and production support. The development funds appear to track fairly well year-to-year in that if one adds the money for the new year to the prior cumulative sum, the new cumulative sum is approximately produced. Sales support is excluded from further consideration because of the OECD Arrangement on Official Export Credits for Civil Aircraft Export Financing.

The support provided to Deutsche Airbus from 1967 to 1989, shown in Table B-15, includes some funds for the VFW-614 and other programs. However, in the aggregate these data are comparable to the reported DM5.1 billion advanced to date for the Airbus program. (DM600 million was for the A330/A340, DM1.5 billion was for the A320 and DM3.1 billion was for the A300/A310. Of the amount for the A300/A310, DM525 million has been written off, leaving a balance of DM4.6 billion in repayable advances.)

Table B-15

MINISTRY OF ECONOMICS BUDGETED SUPPORT TO AIRBUS

	Development			Production	Exchange	Cumulative		
	Other	Airbus	Total	Airbus	Guarantee	Marketing	Development	Total
1967	25.0	10.0	35.0					112.7
1968	6.5	35.5 *	42.0					161.7
1969	–	--	98.0					259.7
1970	6.0	124.0	130.0					389.7
1971	3.0	187.0	190.0					579.7
1972	1.0	209.0	210.0					789.7
1973	5.0	210.0	215.0					1,004.0
1974	5.0	208.0 *	213.0	25.0				1,248.0
1975	7.0	189.0 *	196.0	62.0				1,516.0
1976	5.0	134.0	139.0	100.0 *		217.0	1,586.0	1,803.0
1977	31.4	75.0	106.4	136.1 *		413.0	1,726.0	2,139.0
1978	99.1	89.0	188.1	39.8		409.0	1,812.0	2,221.0
1979	27.0	116.0	143.0	138.0		712.3	1,802.0	2,514.3
1980	39.0	168.0	207.0	168.0		915.2	2,018.0	2,933.2
1981	31.0	309.0	340.0	59.0		988.6	2,345.0	3,333.6
1982	61.0	264.0	325.0			1,001.4	2,726.0	3,727.4
1983	13.0	167.0	180.0			1,001.4	3,063.0	4,064.4
1984	13.0	197.0	210.0			1,274.3	3,073.0	4,347.3
1985	28.0	542.0	570.0			1,271.4	3,725.0	4,996.4
1986	27.0	364.0	391.0			1,371.7	4,115.0	5,486.7
1987	27.0	475.0	502.0			1,371.7	4,479.0	5,850.7
1988	8.0	507.0	515.0	165.0	200.0	1,371.7	4,954.0	6,325.7
1989	8.0	560.0	568.0	205.0	239.0	1,571.7	5,461.0	7,032.7
TOTAL	476.0	5,139.5	5,713.5	1,097.9	439.0			

1988 non-Airbus development budget estimated from 1990 allocations.
*Includes Airbus & VFW 614.
SOURCE: Einzelplan 09, Budget of the Ministry of Economics, various years

4. Einzelplan 09 1987 (draft). Explanation translated by GRA.

The German Ministry of Economics budget does not distinguish between development funds provided for the A300/A310 and the A320 programs. Table B-16 contains GRA estimates of the distribution of the development grants between these two programs.

Of the scheduled repayments of the government development funds advanced to Deutsche Airbus, only DM130 million of the development grants were paid back before the repayments were suspended.

Table B-16

ESTIMATE OF A-300/310 AND A-320 LAUNCH AID PROVIDED BY WEST GERMANY
(MILLIONS, CURRENT)

	(DM)		($)	
	A-300/310	A320	A-300/310	A320
1967	10.0	-	$2.5	-
1968	35.5	-	$8.9	-
1969	0.0	-	$0.0	-
1970	124.0	-	$33.9	-
1971	187.0	-	$53.6	-
1972	209.0	-	$65.5	-
1973	210.0	-	$78.7	-
1974	208.0	-	$80.6	-
1975	189.0	-	$76.8	-
1976	134.0	-	$53.4	-
1977	75.0	-	$32.3	-
1978	89.0	-	$44.5	-
1979	116.0	-	$63.4	-
1980	168.0	-	$92.8	-
1981	309.0	-	$136.7	-
1982	264.0	-	$109.1	-
1983	167.0	-	$65.5	-
1984	197.0	-	$69.4	-
1985	99.0	443.0	$33.7	$150.7
1986	37.0	327.0	$17.1	$150.7
1987	0.0	475.0	$0.0	$264.3
1988	0.0	255.0	$0.0	$145.2
1989	0.0	0.0	$0.0	$0.0
TOTAL	2,827.5	1,500.0	$1,118.3	$710.9

SOURCE: Einzelplan 09, Ministry of Economics, various years.

Table B-17 shows the DM3.0 billion ($1.6 billion) allocated for the A330 and A340 programs for the 1988 to 1996 time period. GRA has estimated a pattern of annual budget amounts for these funds whereby ultimately the West German Government will have provided development funding of about DM9 billion for Deutsche Airbus' participation in the Airbus programs. (DM2.8 billion for the A300/A310, DM1.5 billion for the A320 and DM3.0 billion for the A330/A340.) In addition, DM1.5 billion has been disbursed and DM5.7 billion committed for production subsidy, including direct supports and provisions to offset unfavorable exchange rates.

Table B-17

WEST GERMAN GOVERNMENT SUPPORT FOR DEVELOPMENT OF A330/340: ASSUMED SCHEDULE (2)
(MILLIONS CURRENT)

	(DM)	($) (1)
1988	200.0	$105.3
1989	400.0	$210.5
1990	600.0	$315.8
1991	500.0	$263.2
1992	500.0	$263.2
1993	400.0	$210.5
1994	200.0	$105.3
1995	100.0	$52.6
1996	100.0	$52.6
TOTAL	3,000.0	$1,578.9

(1) Converted at 1989 exchange rate from Table B-2
(2) GRA estimate of funding by year after 1990, based on total aid of DM3.0 billion. West German Monopolies and Mergers Commission report on the MBB-Daimler merger, Table 11.

B.3.2 MBB and Airbus Industrie

As noted above, the West German Government provides significant support to MBB for its Deutsche Airbus activities. In June 1987, the West German Government authorized DM4.9 billion ($2.7 billion) for MBB. Of this, DM3 billion ($1.66 billion) is in the form of repayable grants to be used for the A330/A340 program (see above). This amount represents 90 percent of the German development costs. MBB will have to raise DM150 million by itself.[5]

Deutsche Airbus has government-guaranteed bank loans totaling DM2.7 billion to ensure current production. An additional DM1.9 billion ($1.05 billion) will be provided from 1988 through 1994 to cover bad debt on A300/A310 production loans, since too few A300/A310 aircraft were sold, and MBB cannot repay the interest or principal. These funds were originally provided to MBB as guaranteed loans for the Airbus program.

Up through 1981, Deutsche Airbus had contracted loans totaling DM7.85 billion with government guarantees. Of this, DM2.04 billion was in sales financing.[6] In 1982, the government also indefinitely postponed the repayment of funds advanced for the A300 (guaranteed support level of DM4.1 billion).[7] (There are conflicting reports over how much of the A300/A310 launch aid has been repaid.)

5. Wall Street Journal, June 4, 1987, pg. 27; and Aviation Week and Space Technology, June 8, 1987.

6. Paris Aviation Magazine International, May 15, 1982.

7. Sud Deutsche Zeitung, March 25, 1982.

As part of the merger of MBB into Daimler-Benz, the West German Government made substantial financial commitments as part of a restructuring of Deutsche Airbus. Table B-18 shows the additional supports provided. They include DM2.0 billion ($1.1 billion) in production supports for the A300/A310 and A320 programs. Also included are DM4.9 billion ($2.6 billion) in additional supports for these programs. (The total development funds for the A330/A340 are shown in Table B-17.)

Table B-18

FEDERAL REPUBLIC OF GERMANY
AIRBUS SUPPORT FUNDS TO BE DISBURSED
(1990-2000)

	DM Millions	$ Millions
Production Subsidies		
A300/310	1,500.0	$790.3
A320	500.0	$263.4
	2,000.0	$1,053.7
For the MBB-Daimler Merger		
A300/310 Loan Guarantee Redemption*	750.0	$395.2
A300/310/320 Exchange Rate Guarantee to 1996	2,465.0	$1,298.7
Exchange Rate Guarantee 1997 to 2000	1,640.0	$864.1
	4,855.0	$2,558.0
Development Funds		
A330/340	2,400.0	$1,264.5
Total Support to be Disbursed	9,255.0	$4,876.2

SOURCE: West German Monopolies Commission Report, Tables 12 & 13.

*Forgiveness of debts owed for production supports.

B.3.3 Other Forms of Government Support

Part of the West German research budget, particularly that of the Ministry of Research and Technology (BMFT), supported the Airbus program for the 1979 to 1982 time period. In a paper[8] given by Dr. H. Hertrich, Ministerialrat of BMFT in 1983, he noted that

> "the civil components program contains the pre-development and testing of critical parts and sub-systems of airplanes and helicopters including engine components. The predominant goal of this program was and is the technical security of the German industry as a partner of the Airbus program. In the Airbus program the competition takes place on two

8. Dr. Ing, H. Hertrich, "10 Jahre Forderung Der Luftfahrtforschung" BMFT (1983), p. 5. (Translation by GRA).

levels. On the one hand, the European consortium, Airbus Industrie, is on the world market in strong competition with predominantly Boeing after Lockheed has been forced out and McDonnell Douglas is considerably weakened. On the other hand, there is continuous competition among the Airbus partners in an effort to obtain or take over technologically important parts of development in order to qualify in the long run as an indispensable partner."

Dr. Hertrich goes on to say:

"In tight technical cooperation with the aerodynamic project of the civil component program, research regarding the Airbus program was done under the following topics:

Luftfahrtforschung" BMFT (1983), p. 5. (Translation by GRA)

-digitization of the flight control systems;

-gust-load alleviation;

-reduced stability;

-energy management."

Dr. Hertrich also notes that the department had Battelle Institute in Frankfurt examine the situation of the German manufacturers of civilian aviation electronics and that this showed areas for the subsidization of technology. He noted that three German manufacturers have been selected by Airbus Industrie to supply digital electronics to Airbus. Page 21 of Dr. Hertrich's report notes the following support of BMFT for the 1979 to 1982 time period:

- o Manufacturing technology--DM28.5 million;
- o Technology of aircraft electronics--DM36 million;
- o Technology of control systems--DM40.3 million.

These funds along with the civil components program represent 60% of the aviation research program of BMFT.

Tables B-19 and B-20 show the history of support for two Airbus-related programs during the 1975 to 1984 time period (data for later years were not available for inclusion in this report). The civil components program received DM147.3 million ($65.7 million) and the aircraft electronics program received funding of DM69.9 million ($29.6 million). The aid for the civil components program, as shown in Table B-19, has an opportunity cost to the government of DM258.4 million ($136.1 million), while it would be valued by a private company at DM375.9 million ($198.1 million). As shown in Table B-20, the aid to the aircraft electronics program has an opportunity cost to the government of DM109.3 million ($57.6 million). Its value to a company operating on a commercial basis would be DM148.7 million ($78.4 million).

B.3.4 Value of West German Government Support

Table B-21 shows the A300/A310 (less repayments), A320 and A330/A340 development aid, production subsidies and exchange rate supports already provided to Deutsche Airbus, all valued at the opportunity cost of the funds to the government.

Table B-19

WEST GERMAN GOVERNMENT CUMULATIVE FUNDING OF AIRBUS-RELATED CIVIL COMPONENTS PROGRAM (MILLIONS)

	Annual Funding (DM)	($)	Cumulative Funding (DM) Current	Gov. Rate	Private Rate
1975	8.1	$3.29	8.1	8.5	9.0
1976	8.0	$3.19	16.1	17.4	18.4
1977	9.0	$3.88	25.1	27.7	29.3
1978	14.7	$7.35	39.8	44.3	46.6
1979	17.5	$9.56	57.3	65.5	69.4
1980	20.4	$11.27	77.7	92.2	100.6
1981	13.5	$5.97	91.2	116.0	130.7
1982	10.2	$4.21	101.4	133.9	160.0
1983	20.2	$7.92	121.6	163.1	198.4
1984	25.7	$9.05	147.3	198.8	246.0
1985	0.0	0.0	147.3	207.1	269.4
1986	0.0	0.0	147.3	215.2	293.0
1987	0.0	0.0	147.3	227.8	317.4
1988	0.0	0.0	147.3	241.7	343.9
1989	0.0	0.0	147.3	258.4	375.9
TOTAL	147.3	$65.70			
			Cumulative ($ 1989)		
			$77.6	$136.1	$198.1

Sources: 1975 and 1976 from: GRA, "Government Financial Support for Civil Aircraft Research, Technology & Development in Four European Countries" (Oct 31, 1978), p. 60.

1977 to 1984 from: GRA,"Analysis of Foreign Government Support for Aeronautical Research & Technology Expeditures" (May 9,1984) pp.4-5.

Table B-20

WEST GERMAN GOVERNMENT CUMULATIVE FUNDING OF AIRBUS-RELATED AIRCRAFT ELECTRONICS PROGRAM (MILLIONS)

	Annual Funding		Cumulative Funding (DM)		
	(DM)	($)	Current	Gov. Rate	Private Rate
1975	0.0	$0.0	0	0.0	0.0
1976	0.0	$0.0	0	0.0	0.0
1977	0.0	$0.0	0	0.0	0.0
1978	0.0	$0.0	0	0.0	0.0
1979	4.5	$2.5	4.5	4.8	4.9
1980	5.2	$2.9	9.7	10.7	11.3
1981	15.1	$6.7	24.8	28.3	30.2
1982	16.5	$6.8	41.3	47.5	53.0
1983	16.2	$6.4	57.5	67.5	76.2
1984	12.4	$4.4	69.9	84.1	97.3
1985			69.9	87.6	106.6
1986			69.9	91.0	115.9
1987			69.9	96.4	125.6
1988			69.9	102.2	136.0
1989			69.9	109.3	148.7
TOTAL	69.9	$29.6			
			Cumulative ($ 1989)		
			$36.8	$57.6	$78.4

Sources: 1975 and 1976 from: GRA, "Government Financial Support for Civil Aircraft Research, Technology & Development in Four European Countries" (Oct 31, 1978), p. 60.

1977 to 1984 from: GRA, "Analysis of Foreign Government Support for Aeronautical Research & Technology Expeditures" (May 9,1984) pp.4-5.

It can be seen that aid is valued as follows:

- o A300/A310--DM5.0 billion ($2.6 billion);
- o A320--DM1.8 billion ($971.2 million);
- o A330/A340--DM654.6 million ($344.9 million);
- o Production support--DM1.9 billion (1.0 billion);
- o Exchange rates support--DM482.4 million ($254.2 million).

Table B-21

WEST GERMAN GOVERNMENT CUMULATIVE SUPPORT FOR AIRBUS VALUED AT THE GOVERNMENT RATE OF BORROWING

(DM MILLIONS)

	Net A-300/310	A-320	A-330/340	Production	Exchange Rate	Cum. Total
1967	10.5	0.0	0.0	0.0	0.0	10.5
1968	48.1	0.0	0.0	0.0	0.0	48.1
1969	51.0	0.0	0.0	0.0	0.0	51.0
1970	189.9	0.0	0.0	0.0	0.0	189.9
1971	401.3	0.0	0.0	0.0	0.0	401.3
1972	639.9	0.0	0.0	0.0	0.0	639.9
1973	918.2	0.0	0.0	0.0	0.0	918.2
1974	1,216.0	0.0	0.0	27.0	0.0	1,243.0
1975	1,480.1	0.0	0.0	93.8	0.0	1,573.9
1976	1,692.0	0.0	0.0	203.8	0.0	1,895.9
1977	1,857.2	0.0	0.0	357.3	0.0	2,214.6
1978	1,912.3	0.0	0.0	414.7	0.0	2,327.0
1979	2,096.2	0.0	0.0	585.2	0.0	2,681.4
1980	2,347.2	0.0	0.0	808.9	0.0	3,156.1
1981	2,829.7	0.0	0.0	952.1	0.0	3,781.8
1982	3,183.9	0.0	0.0	1,010.2	0.0	4,194.1
1983	3,462.0	0.0	0.0	1,069.8	0.0	4,531.8
1984	3,732.6	0.0	0.0	1,126.0	0.0	4,858.5
1985	3,992.5	461.6	0.0	1,173.2	0.0	5,627.4
1986	4,186.7	819.4	0.0	1,219.0	0.0	6,225.0
1987	4,431.2	1,370.0	0.0	1,290.2	0.0	7,091.3
1988	4,701.5	1,724.1	212.2	1,544.0	212.2	8,181.7
1989	5,026.8	1,843.4	654.6	1,870.0	482.4	9,394.7
Cumulative Support (1989 $)						
	$2,648.5	$971.2	$344.9	$985.2	$254.2	$4,949.8

Source: Data from Tables B-2, B-16, and B-17.

In total, these amount to DM9.4 billion ($4.9 billion) at the government opportunity cost of the funds provided through 1989. Table B-22 shows the same funding categories valued at their worth to an enterprise operating on a commercial basis. The cost to a commercial enterprise in West Germany of these funds is DM14.5 billion ($7.6 billion).

The other aid to Deutsche Airbus committed by the West German Government are funds yet to be disbursed for the development of the A330 and A340 as well as government-guaranteed production supports and exchange rate guarantees-for the A300/A310 and A320 programs which have been committed for the 1990's.

Table B-22

WEST GERMAN GOVERNMENT CUMULATIVE SUPPORT FOR AIRBUS VALUED AT THE PRIVATE RATE OF BORROWING

(DM MILLIONS)

	Net A-300/310	A-320	A-330/340	Production	Exchange Rate	Cum. Total
1967	10.6	0.0	0.0	0.0	0.0	10.6
1968	49.0	0.0	0.0	0.0	0.0	49.0
1969	53.0	0.0	0.0	0.0	0.0	53.0
1970	200.0	0.0	0.0	0.0	0.0	200.0
1971	430.1	0.0	0.0	0.0	0.0	430.1
1972	693.4	0.0	0.0	0.0	0.0	693.4
1973	1,040.1	0.0	0.0	0.0	0.0	1,040.1
1974	1,468.6	0.0	0.0	29.4	0.0	1,498.0
1975	1,842.4	0.0	0.0	101.6	0.0	1,944.0
1976	2,127.5	0.0	0.0	217.7	0.0	2,345.1
1977	2,358.9	0.0	0.0	378.9	0.0	2,737.8
1978	2,469.6	0.0	0.0	443.2	0.0	2,912.8
1979	2,747.8	0.0	0.0	629.5	0.0	3,377.3
1980	3,177.4	0.0	0.0	893.2	0.0	4,070.7
1981	3,907.6	0.0	0.0	1,091.2	0.0	4,998.8
1982	4,629.4	0.0	0.0	1,238.5	0.0	5,867.9
1983	5,190.8	0.0	0.0	1,363.6	0.0	6,554.4
1984	5,792.2	0.0	0.0	1,497.3	0.0	7,289.4
1985	6,450.8	485.1	0.0	1,639.5	0.0	8,575.4
1986	7,055.5	883.1	0.0	1,783.0	0.0	9,721.6
1987	7,645.3	1,471.7	0.0	1,932.0	0.0	11,049.0
1988	8,282.2	1,870.5	216.7	2,271.7	216.7	12,641.1
1989	9,053.3	2,044.7	669.2	2,707.3	498.1	14,479.3
Cumulative Support (1989 $)						
	$4,769.9	$1,077.3	$352.6	$1,426.4	$262.4	$7,628.7

Source: Data from Tables B-2, B-16, and B-17.

B.4 United Kingdom Support of Airbus

British Aerospace of the United Kingdom began originally as a non-risk-sharing sub-contractor to the Airbus consortium for the A300 aircraft. In 1978, British Aerospace (at that time a nationalized company) became a partner in the Airbus consortium with a one-time payment of 50 million pounds provided by the UK Department of Industry. Apparently there was no requirement for these funds to be repaid. BAe's partnership participation in Airbus Industrie began with the A310, and it has a 20 percent ownership of all subsequent Airbus programs.

Government support of British Aerospace's participation in Airbus principally takes the form of repayable development grants, although it did provide a one-time grant for BAe's entry into the Airbus program as a risk-sharing partner. There also have been significant equity infusions by the government through company stock sales which accompanied the government's sale of shares at the time of privatization.

The total support provided to BAe for its Airbus-related activities is shown in Table B-23. On a current basis the UK Government has provided 1.1 billion pounds ($1.8 billion) net of repayments. It also has committed to provide 196 million pounds ($325 million) to complete development of the A330/A340. The opportunity cost of these funds to the government was 2.3 billion pounds ($3.8 billion), using the rate at which it could borrow the unrepaid funds. To a creditworthy firm which had to borrow the aid, the support is worth 2.4 billion pounds or $4 billion.

Section B.4.1 discusses in detail the government-provided development grants. Section B.4.2 covers repayment of the development aid. Section B.4.3 discusses other forms of government support to BAe for Airbus.

B.4.1 Government Support for Aircraft Development

The UK Department of Industry provides launch aid for aircraft and aeroengine programs at a level of 60 percent of total development costs. Such aid is generally repaid from levy on sales; however, in the case of the A320 there is a fixed repayment schedule for a portion of the funds.

The British Government support for the A300/A310 during the 1978 to 1987 time period is shown in Table B-24. It can be seen that the 50 million pounds ($96.0 million in 1978 terms) was the only government support explicitly advanced for the A300/A310 program. However, Hayward notes that the 100 million pound write-off ($156.8 million) taken in 1982 and 1983 was related to British Aerospace participation in Airbus programs,[9] and GRA's information also shows that BAe put between 200 and 250 million pounds into development of the A310.[10] For the A320 (see Table B-25), a total of 250 million pounds was advanced as launch aid. After repayment of 12.5 million pounds in 1989, 237.5 million pounds ($319.5 million) remains outstanding.

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9. Sources: Hayward, op cit, p. 164 and British Aerospace Public Limited Company Offer of Ordinary Shares, May 1985, p. 16.

10. British Aerospace Offer for Sale of Ordinary Shares, 1981, p. 9.

Table B-23

SUMMARY OF UNITED KINGDOM SUPPORT TO THE AIRBUS PROGRAM 1978-1989

		Pounds, millions	Dollars,millions
Current Basis			
Development Aid:			
A300/310		50.0	$82.9
A320		250.0	$414.6
A330/340		254.0	$421.2
Capital Infusions		533.0	$883.9
TOTAL		1,087.0	$1,802.7
Less Repayments		12.5	$20.7
Net Support		1,074.5	$1,781.9
To be Disbursed:	A330/340	196.0	$325.0
Total Net Support		1,270.5	$2,107.0
At Government Opportunity Cost (as of 1989)			
Development Aid:			
A300/310		174.3	$289.0
A320		386.6	$641.1
A330/340		291.5	$483.4
Capital Infusions		1,309.0	$2,170.8
TOTAL		2,161.4	$3,584.3
Less Repayments		12.5	$20.7
Net Support		2,148.9	$3,563.6
To be Disbursed:	A330/340	156.6	$259.7
Total Net Support		2,305.5	$3,823.3
At Private Borrowing Rate (as of 1989)			
Development Aid			
A300/310		187.5	$310.9
A320		402.5	$667.5
A330/340		299.3	$496.4
Capital Infusions		1,383.6	$2,294.5
TOTAL		2,272.9	$3,769.3
Less Repayments		12.5	$20.7
Net Support		2,260.4	$3,748.6
Committed Support	A330/340	147.8	$245.1
Total Net Support		2,408.2	$3,993.6

Fifty million pounds of the launch aid for A320 will be repaid by BAe during three years starting in 1990 (1990: 10 million, 1991: 20 million and 1992: 20 million). The remaining 200 million pounds will be repaid from levies on future deliveries.[11]

The value of aid provided to BAe for the A300/A310 programs is shown in Table B-24 using an opportunity cost of funds approach. It can be seen that the opportunity cost of this infusion to the government was 174.3 million pounds ($289 million) in 1989. For a company operating on a commercial basis, the value is 187.5 million pounds ($310.9 million) in 1989.

Table B-24

BRITISH GOVERNMENT SUPPORT OF THE A300/A310 (MILLIONS)

	Annual Funding		Cumulative Funding (Pounds)		
	Pounds	Dollars	Current	Gov't Rate	Private Rate
1978	50.0	$96.0	50.0	54.3	54.4
1979	-	-	50.0	61.3	62.0
1980	-	-	50.0	70.6	72.0
1981	-	-	50.0	79.8	81.5
1982	-	-	50.0	88.9	91.1
1983	-	-	50.0	97.4	100.1
1984	-	-	50.0	106.5	109.7
1985	-	-	50.0	118.8	123.2
1986	-	-	50.0	131.1	136.5
1987	-	-	50.0	143.8	149.7
1988	-	-	50.0	157.6	165.1
1989	-	-	50.0	174.3	187.5
Total	50.0	$96.0	Cumulative Funding (1989 Dollars)		
			$82.9	$289.0	$310.9

Funds converted using data from Table B-3.

For the A320 program (see Table B-25) the opportunity cost of the launch aid net of repayment is 374.1 million pounds ($620.4 million) as of 1989. For a company operating on a commercial basis, the value is 389.6 million pounds ($646.2 million) in 1989. Table B-26 shows the government share of the A330/A340 launch aid which will be distributed over the 1988 to 1996 time period. The value in 1989 terms of the aid committed to BAe is 450 million pounds ($746.3 million).

11. British Aerospace Offer of Ordinary Shares, 1985, p. 7.

Table B-25

BRITISH GOVERNMENT SUPPORT OF THE A320
(MILLIONS)

	Annual Funding		Cumulative Funding (Pounds)		
	Pounds	Dollars	Current	Gov't Rate	Private Rate
1978					
1979					
1980					
1981					
1982					
1983					
1984	46.5	$61.9	46.5	50.8	51.0
1985	73.0	$93.7	119.5	138.1	139.2
1986	86.0	$126.1	205.5	247.4	249.6
1987	44.5	$58.6	250.0	320.1	322.4
1988		$0.0	250.0	350.8	355.6
1989	(12.5)	($20.7)	237.5	374.1	389.6
Total	237.5	$319.5	Cumulative Funding (1989 Dollars)		
			$393.9	$620.4	$646.2

Source: Supply Estimates', various years.
Exchange and interest rates data from Table B-3.

Table B-26

BRITISH SUPPORT FOR DEVELOPMENT OF A330/A340
(MILLIONS, CURRENT)

	Pounds	Dollars(1)
1988	100.0	$165.8
1989	154.0	$255.4
1990	100.0	$165.8
1991	48.0	$79.6
1992	48.0	$79.6
TOTALS	450.0	$746.3

1 Converted to dollars using 1989 exchange rate from table B-3

Sources: "The Government's Expenditure Plans, 1987-88 to 1989-90, Volume II"
Her Majesty's Stationary Office, London.
1991, 1992 Spending assumed by GRA based on total allocated funds.

The British Government has agreed to provide 60 percent of the British Aerospace launch funds for the A330 and A340.[12] There is no fixed repayment schedule as there was for part of the A320 launch aid, and repayments will be made from levies on aircraft deliveries. The government portion of funds will be used for the initial part of the development funds; BAe will use internal funds for the latter part of the development.[13]

The total value in 1989 of the launch aid provided directly by the UK Government to BAe is shown in Table B-27. It includes only direct government advances of launch aid for the A300/A310, A320, and A330/A340 programs and is net of repayments for the A320. In total, these advances have had an opportunity cost to the government of 840 million pounds ($1.4 billion). To a company operating in commercial markets, they are valued at 876 million pounds ($1.5 billion).

Table B-27

BRITISH GOVERNMENT NET LAUNCH AID SUPPORT VALUED AT GOVERNMENT AND PRIVATE BORROWING RATES (MILLIONS)

	Government Rate		Private Rate	
	Pounds	Dollars	Pounds	Dollars
A300/A310	174.3	$289.0	187.5	$310.9
A320	374.1	$620.4	389.6	$646.2
A330/A340	291.5	$483.4	299.3	$496.4
TOTAL	839.8	$1,392.8	876.5	$1,453.5

Source: Data from Tables B-3, B-24, B-25, B-26

B.4.2 Repayment of Government Aid

To date there has been no identifiable repayment of the government aid provided to BAe for A300/A310 programs; the 50 million pounds provided in 1978 was a non-repayable grant. Other development funds for the A310 were nominally provided by BAe, but a series of capital infusions by the government in the late 1970's and early 1980's likely provided the resources to the company for this development program (see below). Repayment of A320 launch aid began in 1989. There is a portion (50 million pounds) which, as noted above, will be repaid from 1990 to 1992.[14]

B.4.3 Other Support

12. Wall Street Journal, May 15, 1987. Aviation Week and Space Technology, May 18, 1987, p. 33.

13. Ibid.

14. British Aerospace PLC Offer of Ordinary Shares (1985), p. 14.

The proceeds of BAe shares sold along with public offerings represent government aid to British Aerospace in the sense that the UK Government was selling a nationalized company. If the government received full value for its ownership, all receipts normally would go to the national treasury. To the extent that BAe sold shares and retained the proceeds, this represents government aid to the company. While some may argue that these capital infusions are not solely related to Airbus, they made it possible for BAe to pay its share of A300/A310 development and production costs. They also provided a capital base for BAe to write off losses related to Airbus. (BAe, in its annual reports, detailed the poor financial performance of its AI-related activities.)

Table B-28 shows the level of capital infusions to BAe during the 1979 to 1981 time period. Table B-29 values the other support provided to BAe by the UK Government in the form of capital (equity) infusions. On a current basis, these amounted to 533 million pounds ($965.5 million).

Table B-28

BRITISH GOVERNMENT SUPPORT TO AIRBUS-- LOANS TO BRITISH AEROSPACE AND PUBLIC DIVIDEND CAPITAL
(MILLIONS OF POUNDS)

	1979	1980	1981
Loans (balance)	20.2	36.0	32.6 [2]
Extinguished Loan			30.0 [1]
Public Dividend Capital	27.0	60.0	188.7 [1]
Total	47.2	96.0	251.3
Increases (Decreases)	47.2	48.8	158.7 [3]
Increases in Dollars	$100.2	$113.5	$320.0

1) Loans of 30 million pounds and public dividend capital of 188.7 million pounds extinguished as part of privatization of British Aerospace ($440.9 million of 1981 dollars).

2) Transferred to British Aerospace, PLC as commencing debt.

3) Change in Public Dividend Capital from 1980 and loan of 30.0 million pounds.

SOURCES: "Accounts Relating to Issues from the National Loan Fund," Aircraft and Shipbuilding Industries Act 1977, various years.

Offer for Sale of Ordinary Shares British Aerospace Public Limited Company, February 1981, pp. 28, 33, 47.

It is likely that these funds supported the 200 million to 250 million pounds put forth by British Aerospace to fund A310 development costs. Therefore, GRA assumes that such support allowed BAe to participate in Airbus. It is not likely that BAe could have borrowed on commercial terms to fund losses on Airbus production.

Table B-29 also provides an estimate of the cumulative value of such aid. The opportunity cost of such funds in 1989 to the government was 1.3 billion pounds ($2.2 billion). For a firm operating on a commercial basis in the UK, the total of these capital infusions has a value of 1.4 billion pounds ($2.3 billion) in 1989.

Table B-29

OTHER GOVERNMENT SUPPORT TO BRITISH AEROSPACE (MILLIONS)

	Annual Support		Cumulative Support (Pounds)		
	Pounds	Dollars	Current	Gov't Rate	Private Rate
1979 (1)	47.2	$100.2	47.2	53.3	53.8
1980 (1)	48.8	$113.5	96.0	117.6	119.1
1981a (1)	158.7	$320.0	254.7	312.3	314.6
1981b (2)	98.9	$201.8	353.6	464.7	468.3
1982	0.0	$0.0	353.6	518.0	523.6
1983	0.0	$0.0	353.6	567.7	574.8
1984	0.0	$0.0	353.6	620.5	630.3
1985 (2)	179.4	$230.0	533.0	892.4	909.2
1986			533.0	984.9	1,007.7
1987			533.0	1,080.1	1,104.7
1988			533.0	1,183.7	1,218.4
1989			533.0	1,309.0	1,383.6
Total	533.0	$965.5	Cumulative Support (1989 Dollars)		
			$883.9	$2,170.8	$2,294.5

[1] Table B-28

[2] Text B-43

Exchange and borrowing rates from Table B-3.

Appendix C

THE DISCOUNTED CASH FLOW MODEL

C.1 Introduction

An overview of the discounted cash flow (DCF) model is illustrated in Figure C-1. First, the net cash flow for a given Airbus project is computed for each time period over the evaluation horizon.[1] From the perspective of Airbus, cash inflows include government loans/grants and revenues from the sales of aircraft. Cash outflows include non-recurring costs (e.g., development costs), recurring costs (e.g., production costs), and repayments of government loans.

Net cash flows for government participants in the Airbus project are defined in a complementary fashion (not shown in Figure C-1). Specifically, cash inflows for government participants are defined as the receipt of repayments of grants or loans. Cash outflows for government participants are defined as loans/grants to Airbus.

Next, discounted cash flow analysis is performed to compute the present value of the net cash flows. Briefly, this procedure adjusts the net cash flows received in different years to a common basis by accounting for (i.e., discounting) the time value of money.

The DCF model is capable of performing several types of economic evaluations of various Airbus projects. As was noted earlier, the model generates estimates of the net present value (NPV) of projects from the perspective of Airbus as a commercial concern, and from the view of government participants. The model also provides estimates of the value of government subsidy in projects. Briefly, this is done by comparing the net present value of a project to Airbus with government participation. Finally, the DCF model also can provide estimates of "breakeven" prices. The breakeven price of an aircraft is defined as the per unit price that would have to be received to generate a project NPV of zero.

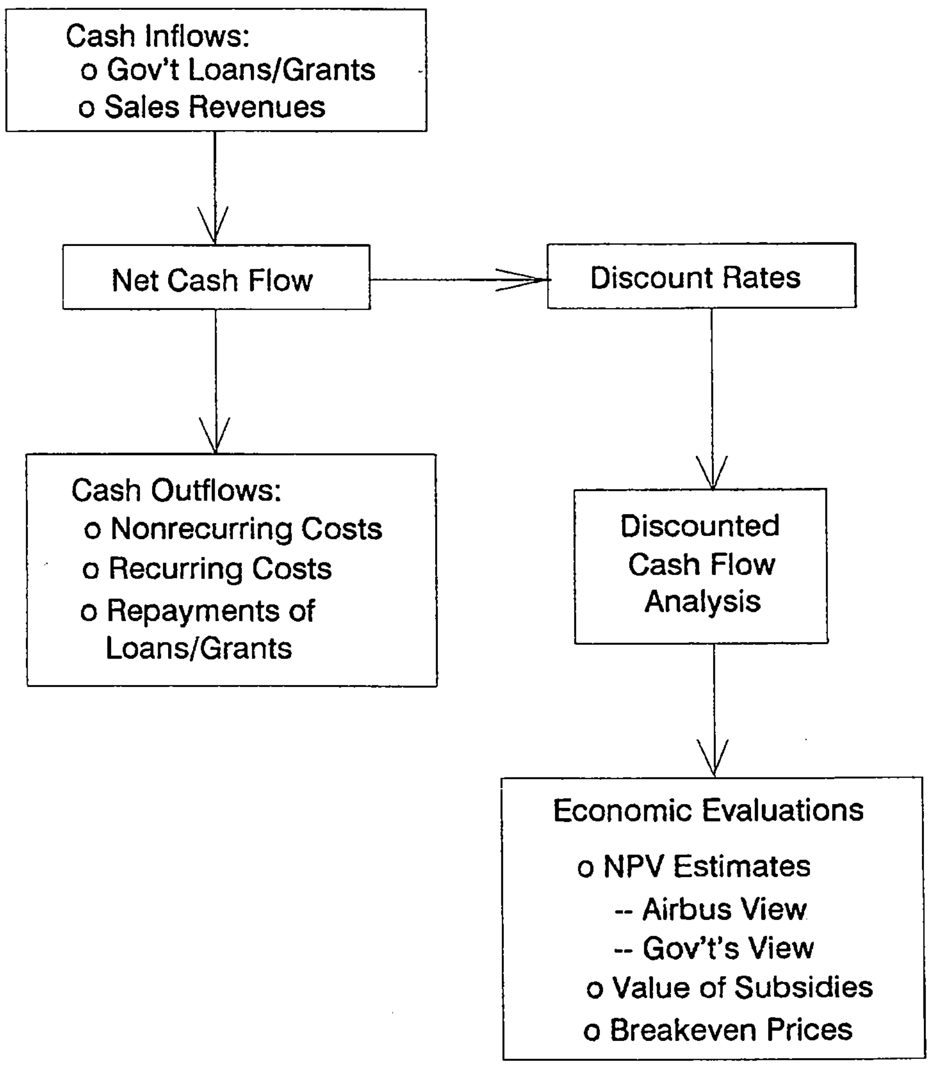
C.2 Estimating Net Cash Flows

Some aspects of the estimates of net cash flow warrant further discussion. As was noted earlier, cash inflows--from the perspective of Airbus--include the receipt of government loans/grants and revenues from aircraft sales. For current and past years, cash inflows attributable to government loans/grants are taken, for each given Airbus project, as the sum of reported government contributions, as they have been distributed over each year of the project life. Estimates of current and past government contributions have been reported earlier, both by project and by year, in Appendix B of this report. Future government loans/grants are based on reported government commitments, and are allocated over time according to GRA projections.

1. The evaluation horizon is defined as the period spanning the time at which costs are first incurred and ending at the time at which the last sales of aircraft are made or 2008, whichever is earlier.

Figure C-1

OVERVIEW OF DISCOUNTED CASH FLOW MODEL



Cash inflows attributable to sales revenues--for a given time period and for a given project--depend on both the price of the aircraft and the number of aircraft delivered. The DCF model can be operated under a number of different assumptions regarding aircraft prices and delivery schedules.

It is common industry practice that progress payments are made on aircraft purchase commitments. As a result, some revenue is received prior to the year in which an aircraft is actually delivered. Estimates of cash inflows attributable to aircraft sales are based on the following progress payment schedule:

- Two percent received two years in advance of delivery;
- Twenty-one percent received one year in advance of delivery;
- The remaining 77 percent received upon delivery.

Cash outflows, from the perspective of Airbus, include both non-recurring and recurring costs, as well as the repayment of government loans. All recurring production costs are assigned to the year of delivery. Cash outflows associated with the repayment of government loans are based on fixed payment schedules, per aircraft delivered, over a given number of delivered aircraft.

C.3 Discount Rates

Discount rates are specified in the DCF model as "real" rates. A real discount rate measures the time value of money in the absence of any price inflation. A real discount rate of 8.7 percent is used in the DCF analyses. Real discount rates are required because all cash flows are defined in constant 1990 dollars.

The real discount rate was estimated as follows. The real commercial lending rate in West Germany, Great Britain, and France was estimated by taking the nominal lending rate and subtracting from it the change in consumer prices for the years 1983 to 1986. A weighted real discount rate for each year was then developed by weighting the result for each country by its share of the relevant Airbus programs. The average real discount rate for the period 1983 through 1986 was estimated for each Airbus aircraft program. These ranged between 8.6 percent and 8.8 percent. An average figure of 8.7 percent was used for the analysis.

C.4 Economic Evaluations

Estimates of project net present values can be used to evaluate the economic feasibility of various Airbus projects. Under the NPV criterion, a project is said to be economically viable if its NPV is non-negative. As was noted earlier, the DCF model calculates NPV estimates from the perspectives of both Airbus and participating governments under a variety of scenarios.

Estimates of NPV, from the perspective of Airbus, are estimated for the following two scenarios:

- No Government Participation--Under this scenario, an Airbus project is evaluated as a purely commercial concern, and it is assumed that no government funding whatsoever is received for the project;

- Scheduled Repayments--Under this scenario, it is assumed that Airbus is obligated to make repayments for government funding, as stipulated by a fixed (per aircraft) payment schedule.

It should be noted that the second scenario does not necessarily imply that all government funding is fully repaid. Since payments under this scenario are made on delivered aircraft, the government will not receive full reimbursement if an insufficient number of aircraft are actually delivered. Moreover, because government support typically is provided a number of years before deliveries occur, it may be the case that the government is not fully reimbursed on a net present value basis.

Net present values of various projects are estimated, from the perspective of participating governments, under a scheduled repayment scenario. This evaluation forms the complement of the latter of the two evaluations of the Airbus position.

These various evaluations of the various Airbus projects are convenient in that they provide a measure of the economic value of government participation as a subsidy to Airbus. Specifically, the difference in the net present value--from the perspective of Airbus--between the first and third scenarios yields a direct estimate of the lump sum present value of government participation in a project to Airbus. The subsidy will also equal, by definition, the opposite of the net present value of the project to the government under the fixed repayment schedule scenario. This follows because any gain in the net present value of the project to Airbus--because of government funding--must be offset exactly as a cost to government participants.

Finally, the DCF model computes "breakeven" prices under the "No Government Participation" scenario described above for Airbus. The breakeven price is defined as the per unit revenue that Airbus would have to receive for its aircraft in order to generate a zero net present value for the project. Breakeven prices for nominal (or discounted) cash flows can be estimated.