

## 航空經營論文

## 에어버스와 보잉사의 대형민간항공기 개발 및 마케팅 전략 비교 연구

송춘영\*, 허희영\*\*

Comparison of Development and Marketing Strategies  
of Airbus and Boeing

Choon Young Song\* and Hee young Hurr\*\*

## ABSTRACT

For the next two decades the civil aviation industry is expected to grow. Both Airbus and Boeing predict a delivery of almost 20,000 new Large Civil Aircraft (LCA). LCA is defined as a large civil jet aircraft with 100 seats or more. Airbus offers the Superjumbo, A380 (>555 seats), while Boeing presents the Dreamliner, B787 (200 - 300 seats). Their philosophies are very different. In the wake of B787, Airbus intends to offer a new aircraft, A350, as the competitor against B787, with the same engines developed for B787. The U.S. government pushed by Boeing, on the day of October 6, 2004, filed a suit against Airbus for wrongful subsidy to the World Trade Organization (WTO). A brief overview is given on the LCA development status in the world commercial aircraft market. Since there have been little changes in engine and avionics manufacturers in the LCA industry, the airframe area only is the object of this study. An analysis is carried out to find out the differences in development and marketing strategies of two major LCA manufacturers, Airbus and Boeing. The authors predict that Boeing will recapture its No. 1 position soon, while the leading edge in technology may be slipped away from Boeing.

## 초 록

향후 20년간 민간항공업계는 성장할 것이다. 에어버스와 보잉은 모두 약 2만대의 신규 대형민간항공기 (LCA) 가 인도될 것으로 예측하고 있다. 대형민간항공기 (LCA)란 100인승 이상의 민간제트항공기를 말한다. 에어버스는 555석 이상의 A380 (슈퍼점보)을 내 놓고 있고, 보잉은 250석 가량의 B787 (드림라이너)을 제공하고 있다. 양사의 철학은 대단히 상이하다. B787 소개 후 에어버스는 A350이라는 신형 항공기를 B787의 직접적 경쟁기종으로 내 놓으려 하는데, 이 항공기는 B787을 위하여 개발된 엔진을 사용할 것이다. 보잉사가 요구하여 2004년 10월 6일 미국 정부는 잘못된 지원금 (subsidies)을 이유로 에어버스사를 세계무역기구 (WTO)에 제소하였다. 전 세계의 민간항공기 시장에서의 LCA 개발 현황이 간략하게 살펴져 있다. LCA 업계에서는 엔진과 항공전자 (avionics) 업체들 사이에 변화가 거의 없기 때문에, 본 연구에서는 기체 부분만이 다루어져 있다. 양대 LCA 제작사인 에어버스와 보잉의 개발 및 마케팅 전략 상 상이점들을 분석하여 보았다. 보잉은 조만간 1위의 자리를 탈환하겠지만, 기술상의 선진 위치는 보잉으로부터 멀어질 수도 있겠다는 것이 저자들의 예측이다.

**Key Words** : LCA(대형민간항공기), A380(슈퍼점보), B787(드림라이너), A350,subsidies (지원금), WTO(세계무역기구), Airbus(에어버스사), Boeing(보잉사)

† 2006년 3월 9일 접수 ~ 2006년 5월 11일 심사완료

\* 정회원, 한국항공대학교 대학원 경영학과

연락처, E-mail : songcy237@hanmail.net

경기도 고양시 덕양구 화전동 200-1

\*\* 정회원, 한국항공대학교 경영학과

## I. Overview of World LCA Development

### 1.1 Current Major Development Status of LCA

At present time, Airbus and Boeing are developing three brand-new large civil aircraft: A380 and B787 along with A350. Several important factors are listed in Tables 1 and 2.

Table 1. Comparison of A380 and B787

Item	A380	B787
Passenger	555 - 844	223 - 296
Length (m)	73	57 - 63
Height (m)	24	17
Wing Span(m)	80	52 - 60
MTOW (ton)	560	163 - 218
Range (km)	15,000	6,500 - 15,700
Speed (Mach)	0.89	0.85
Total Order	132	174
EIS	Dec-06	2008
Development Cost	\$12B	\$8B
List Price	\$330M	\$130M

Table 2. Comparison of A350 and B787

Item	A350-800	A350-900	B787-8	B787-9
Passenger	253	300	223	259
No of Class	3	3	3	3
Range(km)	16,300	13,890	15,700	15,400
Length (m)	59	65	57	63
Height (m)	17	17	17	17
Wing Span(m)	61	61	60	60
Speed (Mach)	0.86	0.86	0.85	0.85
MTOW(Ton)	245	245	218	227
Development Cost	\$5.3B	\$5.3B	\$8B	\$8B
List Price	\$159M	\$159M	\$130M	\$130M

Table 2 clearly shows that A350 is designed for a head-on competition with B787. One strange thing is that the development cost of A350 is 33% less than that of B787 while the price of A350 is 22% higher than that of B787. Then, Airbus should allure airlines with a lower price. The authors think this may be one of reasons why A350 has not been received by the market well, yet.

### 1.2 Market Share Trend and Current Issues

#### Market Share Trend

The reversal of the market share is dramatically presented in Table 3, the data of which is from the presentation of J. Douglas, President of AIAA.<sup>1)</sup> In 1993 Airbus was behind Boeing in every aspect. However, in 2004, Airbus exceeds Boeing in almost every aspect. Airbus is no longer in a position to be provided with any favor from the standpoint of an infant company.

Table 3. Comparison of Performance of Airbus and Boeing in 1993 and 2004

	Aircraft Deliveries	Product Lines	Revenue	Employees
1993 Airbus	138	4	\$8.8 billion	38,000
1993 Boeing	330	4	\$20.6 billion	75,000
2004 Airbus	320	12	\$25.1 billion	51,959
2004 Boeing	283	7	\$21 billion	52,669

#### Issues of Subsidies and WTO Litigation

Boeing has been concerned at reports that Airbus might seek government loans to develop the A350 to compete directly with the 787. Boeing needs to block or at least deter the A350 program and to regain the No.1 position in the civil aviation industry.

Boeing lost ground to Europe's Airbus and subsequently lost its leadership of the market in 2003 and 2004. Boeing hopes that the new B787 helps it to regain the #1 position just ahead of Airbus.

In October 2004, Boeing filed a complaint at the World Trade Organization, claiming that Airbus had violated a 1992 bilateral accord when it received what Boeing deems as "unfair" subsidies from the European Union. Airbus retaliated by filing another complaint,

1) Hearing on "The U.S. Jet Transport Industry: Global Market Factors Affecting U.S. Producers" by John W. Douglas, President, Aerospace Industries Association of America, May 25, 2005.

contesting that Boeing had also violated the accord when it received tax breaks from the U.S. Government.

The latest scramble involving Airbus and Boeing surround the American company's latest offering, the B787 Dreamliner. EU trade officials are questioning the funding provided by the Japanese Government and Japanese companies for the launch of the B787.

Boeing knows very well that it is too late for Boeing to offer A380-like new aircraft. Hence, Boeing had no choice to find a way so that Boeing may be able to grab the market as much as possible. That is why Boeing presented B787, which aims a totally different market segment where B787 does not need to compete with A380.

It seems that US and Boeing have absolutely become desperate and felt fretted. And they want to restore the golden days when US and Boeing dominated for almost four decades. They know Boeing violated the 1992 Agreement like Airbus. Thus, their aim to go for the WTO litigation is to nullify the 1992 Agreement and pour the national support to Boeing. This is the authors' view on the primary purpose of US WTO litigation.

One important possibility is that any other WTO member can raise question to the legality of a settlement. Then, a settlement may be a beginning of a new dispute, not the end. The authors predict that not only an exhausting, long, dog-fighting at WTO and a furious sales battle for the 250-seater market will be surely inevitable. However, some experts in the aerospace industry take this WTO litigation as

Table 4. Claims from US and EU

Item	US Claim	EU Claim
Infant Industry	Airbus is no more an infant.	
Launch Aid	For 35 years Airbus received from EU nations \$32B.	Boeing received from US government \$23B
Subsidies	A380 subsidies is \$6.5B	B787 subsidies is \$6B.
Foreign Support		Japanese support is another subsidy

an empty threat. It is to be seen how the outcome turns out.

Arguing points from US and EU are summarized in Table 4.

### 1.3 Forecast of World LCA Market

The forecast from Airbus, Boeing and JADC(Japan Aircraft Development Corporation) is given in Table 5.

Table 5. Comparison on Three Forecasts

Item	Airbus	Boeing	JADC
Passenger traffic growth rate	5.30%	4.80%	4.60%
Passenger preference	hub-and-spoke	point-to-point	unspecified
New Deliveries (US\$billion)			
Single-aisle	10,902(761)	15,249(810)	12,317(410)
Small twin-aisle	1,799(250)	3,005(945)	2,764(252)
Intermediate twin-aisle	2,650(476)	2,234(*)	2,725(343)
Large aircraft	1,250(416)	591(231)	534(97)
Total	16,601(1,903)	21,079(1,995)	18,340(1,102)

\* means that the number is included in small twin-aisle number, 945.

A dramatic difference in the number of new delivery for the large aircraft is clear: Airbus predicts 1,250 aircraft delivery, but Boeing shows a mere number of 591 for this category. After reviewing three forecasts, a simplified prediction may be suggested. For the coming two decades, the total number of new delivery is on the order of 20,000 at \$1.9 trillion and the largest market is the single-aisle aircraft market grabbing approximately 70% of new delivery.

## II. Analysis of Development and Marketing Strategies

### 2.1 Organization

#### Airbus S.A.S. (Airbus)

In 1960s a need was generated for a high-performance, low-cost, medium-range

aircraft which was suitable for passenger transport among European countries. The demand concept was different from large aircraft which was widely used in US. Thus, European aerospace manufacturers began to study the medium as well as short-range aircraft market requirements.<sup>2)</sup>

In December 1970 the Airbus company was established by Sud Aviation of France and Deutsche Airbus of Germany. In 1971 Constructions Aeronautics S.A. (CASA) of Spain joined and BAE of UK also participated in 1979.

Later on Sud Aviation was absorbed into Aerospatiale Matra and Deutsche Airbus into Daimler Chrysler. Then, Aerospatiale Matra, Daimler Chrysler and CASA merged into one mammoth company, European Aeronautic Defense and Space company (EADS) on July 10, 2000. Thus, at present time, two leading European aerospace companies own Airbus. (EADS:80%, BAE:20%). So, one can say that Airbus is under the umbrella of European Union.

Airbus was incorporated in 2001 under French law as a simplified joint stock company or Airbus Societe par Actions Simplifiee (S.A.S.). Manufacturing, production and sub-assembly of parts for Airbus aircraft are distributed around 16 sites in Europe, with final assembly in Toulouse, France and Hamburg, Germany.

**Boeing**

In 1952 Boeing invested \$16 million into a jet transport, the Dash 80, which later became B707. Jet transports soon proved their efficiency and reliability. As the decades passed, jetliners had to be faster, quieter and more energy efficient. To meet these goals, Boeing produced the standard-body B757, the larger B767 and upgraded versions of the B737.

In 1996, Boeing merged with Rockwell International and, in 1997, with McDonnell Douglas. Then, Boeing purchased six companies between 2000 and 2002. (See Table 6). An interesting fact is that all of them have business activities in software services and that none of them is a hard- ware manufacturer.

2) Hurr, H.Y. "Boeing, Airbus", Gilbut March 1996

**Table 6. Subsidiaries Boeing Recently Purchased**

Name	Main Product	Purchasing Time
Aeroinfo Systems	Maintenance software	Sep-00
Airspace Safety Analysis Corp.	Regulatory Compliance Services	Oct-00
Alteon Training	Flight and Maintenance Training	Sep-02
Continental Datagraphics	Parts-related Information Management Services	Sep-00
Jeppesen Sanderson	Flight Information Services	Oct-00
SBS International	Crew-scheduling software	Jul-01

**Summary**

Even though the content is rather brief, it seems obvious that the evolution pattern of Airbus and Boeing is very different. Airbus can be called as a consolidation through group participation despite stages of difficulties, while Boeing seems to diversify its business lines for profit and easiness only. The differences in the organization strategies are summarized in Table 7.

**Table 7. Differences in the Organization Strategies of Airbus and Boeing**

Organization Method	Airbus	Boeing
Business Direction	Consolidation	Diversification
Number of Identities	European nations	US citizens
Primary Target Market	LCA market	Military/space market
Secondary Target Market	None	LCA-related services market
Tertiary Target Market	None	LCA market
Government Influence	Direct	Indirect
Political Backup	European Union	US and Japan
2004 Turnover (\$B)	23.4	21
2004 Employees	52,000	52,700

## 2.2 Market Forecast

It is very interesting to notice that Airbus and Boeing seem to get engaged in an all-in gamble, for their new aircraft, A380 and B787, are targeting two totally different market sectors. The background rationales are reviewed.

### Market Forecast – Airbus standpoint<sup>3)</sup>

Until recently, air travel demand has been driven largely by convenience. But now, travel decisions are primarily based on price. And airlines try to increase their capacity to absorb the increasing number of passengers. Airbus claims that the hub system drastically reduces congestion and costs as well as expanding service choices, and that the global number of non-stop services has reached a saturation point and need more of large aircraft such as A380.

To cope with passenger growth, the choices are: (1) adaptation to bigger aircraft, (2) New runways and terminals where airport space is available for both, and (3) Additional airport where airport space is not available. When frequency/slot limit is reached, airport duplication or aircraft size increase is the only solution.

### Market Forecast – Boeing Standpoint<sup>4)</sup>

Passengers want the freedom to go where they want to go, when they want to go. In a competitive market, airlines will continue to meet passengers' demands for more nonstop with more point-to-point flights and increased frequency choice, which doesn't rely on larger aircraft. The same pattern will be true for the Japan domestic market where aircraft size decreased after deregulation in 1996. This resulted in an increase in frequencies and nonstop markets to accommodate the air travel growth and reduction in aircraft capacity to the benefit of the passenger.

Boeing argues that VLA (Very Large Aircraft) will not reduce airport congestion, that nonstop service continues to bypass mega-hubs, that mega cities are not driving

aircraft size, and that airlines need the right fleet mix to maximize profit.

### Analysis

It is absolutely true that both hub-and-spoke routes and point-to-point routes will continue to exist. Airbus says that the major motivation is the lower fare. Business people are not necessarily motivated by the lower fare. Passengers who do not fly frequently are prone to choose crowded flights with lower fare. It seems that we see this kind of passengers in countries such as China and India.

When a travel pattern is analyzed, there are many factors to be considered. Definitely the number of passengers is one of the most important. However, the characteristics of passengers are important at the same time. For example, the travel frequency of each passenger per year, the income level, and the purpose of travel play important role. No data is available for the passengers Airbus notes. Nevertheless, some interpretation can be possible.

US and European continents can be called as well-advanced or stabilized from the standpoint of travel pattern. In other words, there are many established hubs. And this is the reason why Airbus argues that non-stop routes are saturated. China is rather far from being in this kind of category. China is fiercely and actively developing, but the economic development is still concentrated at certain strategic locations only. This is the reason why most of passengers in China utilize the said, only three major airports.

There is no doubt that, as the economy in China improves, many passengers will prefer direct flights connecting city pairs of their final origins. Korean economy has remarkably improved for last 30 years, but still there is no direct flight between big cities other than Incheon connecting to and from foreign major airports. Most of Koreans have a relationship with handful number of foreign Megacities such as Los Angeles, New York, and Atlanta. But, there are not a sufficient number of passengers to justify a direct flight with VLA

3) Airbus Global Market Forecast (GMF) 2004-2023

4) Boeing Current Market Outlook 2005-2024

for Busan and New York, for such flight needs to operate at least once a day. Thus, Airbus example of China explains very well the necessity of the hub-and-spoke concept for countries where megacities do not represent sufficient number of passengers.

However, it does not represent other possibilities. Airlines such as Singapore Airlines and Qantas want to serve more non-stop flights between Southeast Asia and North America as well as Europe. The reason seems that megacities in Southeast Asia are more evenly developed with justifying passengers than China and Korea. Other airlines also place orders for LCA's which can provide economic long-range, non-stop flight that used to be served by B747. More medium, twin-aisle LCA such as B777 and A340 takes over B747. The recent history of B777 orders shows this trend (13 in 2003, 42 in 2004 and 106 in 2005.) Therefore, Boeing's argument of point-to-point concept seems to have an acceptable reason as well.

Ever-expanding low cost carriers such as South West Airlines, JetBlue and Ryanair clearly show that more non-top services will continue to grow. They have expanding the size of their aircraft fleet and the number of point-to-point pairs. They are making the most out of single-aisle aircraft such as A320 and B737 for mostly one-hour flight distance.

It is the authors' conjecture that the point-to-point method will be picked up more due to several reasons: the point-to-point traveling offers less check-in and check-out time, probably less travel fare, less travel congestion and others, for passengers would prefer more comfort to low fare. This feature should be especially clear in air-transport-advanced countries such as US and European nations.

### 2.3 Market Penetration with Offset Demand

The offset requirement has been widely exercised in numerous ways. These days it can be argued that there is almost no big sale without the offset. The offset is a demand from the buyer which the seller should satisfy

for sales. There are basically two types of offset; direct and indirect. The direct offset is such that the seller purchases a portion of the product which the seller wants to sell. The indirect offset includes any kind of gift offer to the buyer which is not necessarily directly related with the sales under consideration.

Most of world airlines are either government-owned or government-controlled. For example, all airlines providing full service in China are totally under the control of Chinese government. Thus, when Airbus or Boeing wants to sell their LCA to airlines under their government influence, LCA manufacturers are facing the strong demand for either direct or indirect offset requirement. The size of the offset demand is known to be up to 100% of the total sales volume of LCA under procurement consideration. Therefore, the sales of LCA has become not a mere marketing activity of a LCA manufacturer but a government-to-government big deal.

This trend can be illustrated very well by the purchase diplomatic activity of Chinese government.<sup>5)</sup> (Table 8)

**Table 8. Recent Procurement History of LCA by China**

Date	Diplomatic Visit	Procurement
04-Dec-05	Wonjabao → France	150 A320
20-Nov-05	Bush → China	70 B737 with 80 option
06-Dec-04	Schroeder → China	23 Airbus aircraft
09-Oct-04	Chirac → China	26 Airbus aircraft
27-Jan-04	Hujintao → France	21 Airbus aircraft
Dec-03	Wonjabao → US	30 Boeing aircraft

China wants to build up its LCA manufacturing capability. China orders aircraft from both Airbus and Boeing. In return, China demands work share from them. And China has grabbed several works through which China can obtain new capital manufacturing equipment with advanced technology and new manufacturing facilities in order to supply parts and assemblies to Airbus and Boeing.

5) www.chosun.com, December 06, 2005

One interesting fact can be seen in Table 8 is that China plays a balance game between EU and US.

In the world LCA market, Boeing has mostly exercised the direct offset, while Airbus the indirect offset. When Boeing sells an aircraft, Boeing gives some parts or assemblies of the aircraft so that the buyer or the buying country can work on. McDonnell Douglas was the frontier with MD 80/90 aircraft in the direct offset. They established the Trunk-liner program so that Chinese workers could work on fuselages, while Chinese airlines purchased the final aircraft in return. The offset demand is both necessary and sufficient condition for sales and market penetration.

Traditionally, Airbus has tried to offer the buyers in-direct offset packages. For example, in return for the purchase of Airbus aircraft, Airbus or European countries provided the slot for European airports to foreign airlines, especially US airlines. One major difference between the direct and indirect offset is that the direct offset results in the leakage of technology transfer, while the in-direct does not. This can be traced as one of the most important reasons why Boeing has become behind Airbus in the technology area these days.

## 2.4 Work Share Philosophy and Technology Transfer

### Airbus - Vertical Integration

When Airbus consortium was established in the early 1970s, one of the agreements between partners was that each partner works on specific parts and assemblies. In this way, partner companies have been able to develop individual skills and technologies among them. This kind of manufacturing arrangement is called as the vertical integration. Table 9 show examples of dedicated manufacturing facilities for Airbus aircraft.<sup>6)</sup>

Airbus farms out, when meeting the offset requirement is needed, non-critical parts only. Even when Airbus receives a favorable contract offer, mostly at a price far below Airbus

Table 9. Airbus Manufacturing Facilities

Facility	Country	Major Production	Aircraft
Broughton	UK	Wingbox	All models
Madrid	Spain	Horizontal stabilizer	All models
Meaulte	France	Cockpit	All models
Saint Nazaire	France	Forward fuselage	All models
Stade	Germany	Vertical stabilizer	All models
Tablada	Spain	Passenger doors	All models

hourly rates, Airbus sources out parts for older models. Clearly, the vertical integration has a specific advantage as described above. However, it gives a malignant image to other countries who want to participate in new programs of Airbus.

Recently, Airbus has mellowed down their original stance and shown a changed policy. For example, Airbus is pursuing risk-sharing agreements with Korean companies. But, one thing to be noticed is that the contracts with Korean companies such as Korean Aerospace Industries (KAI) may contain very, very low rates. The low hourly rates can be a keen interest for Airbus, but it is to be seen whether KAI can accumulate applicable technology through the risk-sharing contract with Airbus. Korean Airlines is somewhat at different situation. Korean Airlines is one of important buyers of Airbus. Thus, the work share to be allocated to Korean Airlines can be more desirable at better rates.

### Boeing - System Integration

The domestic manufacturing work share portion of the Boeing family of aircraft has diminished as the newer models of aircraft have been introduced during the past 30 years. In comparing B727 that was introduced in the 1960s with US launch customers with B777 in the 1990s that included foreign customers, the percentage of foreign content rose from 2% to almost 30%.

International carriers who are typically

6) <http://encyclopedia.thefreedictionary.com/airbus>

state-owned dominate the purchasing of Boeing twin aisle aircraft. In 1978, the launch customers for the twin aisle B767 were the Canadian and Japanese carriers. In response to the purchase of B767, Canadair in Montreal received Section 48 of the rear fuselage of the aircraft to produce. Additionally, Japanese Airlines purchased B767, and in return, three Japanese manufacturers received subcontracts to produce the majority of B767 fuselage and cargo doors.

The Japanese carriers were also the launch customers for B777 aircraft and received the fuselage to produce. The original concept on the B777 program was for the Japanese to be a 25% equity stake partner, which would have cost them a \$1 billion investment, but they ended up as subcontractors making fuselage panels, floor beams and doors. This put their investment at about 10% of the \$5 billion launch cost for B777. The companies of Mitsubishi, Kawasaki and Fuji were contracted to make over 25% of B777 aircraft between them.<sup>7)</sup>

**Analysis**

When Airbus and Boeing want to launch new LCA programs, they apply totally different types of work share policy. Boeing selects partners in such a way that the partner companies join as risk-sharers or subcontractors through transferring new technologies and manufacturing processes. Boeing's method results in the leaking of technology, decreasing the manufacturing capability inside Boeing and US, and the lack of new capital equipment in Boeing. Airbus case is such that most of new technologies are kept inside, that is, among the partners inside the Airbus company structure.

**2.5 Financial Structure of Airbus and Boeing**

A brief comparison on the financial structures of Airbus and Boeing is given in

7) Pritchard, D. (2002). The Global Decentralization of Commercial Aircraft Production: Implications for U.S. Based Manufacturing Activity. PhD Dissertation, Department of Geography, University at Buffalo, Buffalo NY 14261, USA.

Table 10. The Boeing revenue shows a 21% decrease from \$28.4 billion in 2002 to \$22.4 billion in 2003, while the Airbus revenue shows a 17% decrease from \$18.2 billion in 2002 to \$15.1 billion in 2003. This is an indication of the overall downward spiral of the world aviation industry. The operating income of Boeing shows a dramatic decrease from \$2.0 billion in 2002 down to \$0.7 billion in 2003.<sup>8)</sup>

**Table 10. Financial Structure of Airbus and Boeing (unit: \$M)**

Item	BOEING <sup>9)</sup>		AIRBUS <sup>10)</sup>	
	2003	2002	2003	2002
Revenues	22,408	28,387	15,132	18,193
Operating Income	707	2,017	643	773
Identifiable segment assets (including goodwill)	22,439	22,447	24,595	29,570
Goodwill	282	627	5,038	6,057
Capital expenditures	218	135	1,610	1,599
Segment liabilities	5,536	6,075	16,511	19,851
Depreciation, amortization	455	463	1,293	1,555
Research and development expense	676	768	1,445	1,737
R&D ratio	3.02%	2.71%	9.55%	9.55%
Profitability ratio	3.16%	7.11%	4.25%	4.25%
Activity	99.86%	126.46%	61.52%	61.52%

Two interesting points can be identified. Airbus report shows capital expenditures as a level of \$1.6 billion, while Boeing reports capital expenditures as a level of mere \$0.2 billion. Also, for the research and development, Boeing spent less than 50% of Airbus

8) Exchange rate: (based on data from Korean Exchange Bank) 2002: USD 1= EUR 0.955, 2003: USD 1= EUR 0.794

9) Boeing has both commercial and military business. Here, the outcome of commercial business only is shown for direct comparison

10) Revenues of AIRBUS exclude the internal revenues



investment. These two items clearly shows that Boeing does not want to invest on the capital equipment and new technologies.

## 2.6 Financing

### Types of Financing for LCA Development

In order to launch a new LCA program, both Airbus and Boeing rely on various financing channels. First of all the internal investment generally comprises the largest portion of the total launching cost. It may be a withdrawal from their bank account or can be a loan from financing organizations.

Second type of the launching fund is the launching deposit which comes from the launching customers. The commitment of the launching customers is very important, for it means that the new LCA program is well accepted in the aviation market with a firm support. This is the reason why LCA manufacturers always make a big noise about the accumulated list of launching customers and commitment orders. It is a rule of thumb that a production of 250 aircraft can make the break-even point. And it is generally accepted as a stable start when the firm order from the launching customers is more than 50. A380 program was launched with an order of 100, while B787 with an order of 52.<sup>11)</sup>

The portion of the launching commitment varies but is considered to be reasonable if it is 10 to 20%, after hefty discounts considered, of the total launching fund. The discount for launching customers is generally known to be up to 50% of the list price. Third type of the launching fund is the financial take-over from the suppliers of the new LCA program through the risk-sharing. Airbus does not adopt the risk-sharing philosophy with suppliers outside of the partner companies. Hence, only Boeing case is considered here.

Basically, the total launching fund includes investment on new technology, testing, new

facilities, new manufacturing and fabrication equipment, salaries, marketing cost, etc. When a supplier participates in the new LCA launching program, Boeing can save the amount of investment to betaken over by the suppliers. In return for this investment, suppliers obtain the work share of the new program. One of the best examples on this type is the involvement of Japanese companies in the B787 program. They intend to pour \$3 billion in order to design, manufacture, test and produce wing, fuselage sections and other important parts of B787.(See Table 11)

Table 11. Japan Investments for B787

Company	Parts	\$ million
MHI	Wing, Engine	900
FHI	Airframe	400
KHI	Airframe, Engine	650
IHI	Engine	350
Toray	Composite material	250
Others	Equipment, Systems	450
	Total	3,000

Fourth type of the launching fund is the loan from the national governments. This government loan is called a subsidy and can take various forms such as direct loan to LCA manufacturers and indirect support through research and development activities. The direct loan from the government is limited up to 33% of total development cost and usually comprises the largest portion of all financing fund. Government subsidies have played a very critical role in successful launching programs and have been at the center of argument from both EU and US for at least two decades.

Even though the cooperative or negotiation-friendly atmosphere in 1992 resulted in an agreement on the definition of subsidies and countervailing measures, the fierce battle between Airbus and Boeing has become too deadly to maintain a friendly or fair competition in the world LCA market. In 2004, US filed litigation to the World Trade

11) It is a rule of thumb that a production of 250 aircraft can make the break-even point. And it is generally accepted as a stable start when the firm order from the launching customers is more than 50.

Organization (WTO) for their judgment in regards to subsidies. A brief description on issues of subsidies is provided in Section 2.2.

Five types of launching fund are summarized in Table 12.

**Table 12. Types of LCA Launching Funds**

Item	Source	Content
Direct Investment	LCA manufacturer	Out of manufacturer's bank account
Bank Loans	Financing companies	Long-term loan which must be repaid
Order Commitment	Launching customers	Monetary deposit associated with firm order
Investment through Risk-Sharing	Suppliers	Investment on R&D, manufacturing and production in compensation for work share
Government Loan and Indirect supports	National Governments	Called as subsidies. Refer to Section 4.2.7.2

### III. Conclusion

An overall review on the world LCA market trend is touched in this paper. The organization, technology transfer policy, market penetration methodology, financing methods of Airbus and Boeing are compared. A special attention is given to the subsidies issue, for it has caused the largest trade dispute at the World Trade Organization. The WTO litigation will be a very bloody and fierce battle. However, it is anticipated that, no matter what will be the result next year, both sides will have found sufficient amount of fund for A350 and B787, by then.

Both Airbus and Boeing used to provide raw material to suppliers, for it could save the overall cost of their aircraft production. These days the policy has been changed and each supplier is responsible for securing the raw material needed. When there is a risk or a

difficulty, it can be declared that there is an opportunity. The authors strongly claim that this is the time for Korean aerospace industry to find a way to ride along this world wave and that Korean aerospace industry holds a stronger tie with the duopolic giants. It can be said a relief that KA and KAI has been aggressive in pursuing the business chances.

One of the future research areas is the LCA subsidies issue. The bloody game between Airbus-European Union and Boeing-United States-Japan will continue with many arguments, disputes and media campaigns. The authors predict that the game may go for several years until it settles down, if it does, due to the intrinsic process structure of WTO litigation arbitration. One settlement will surely call for another dispute. The authors feel that the research on the LCA subsidies issue is very important not only for LCA market but other industries, for it represents the global battle game between two giant mountains with a power of worldly influence.

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