Lux Esto Law Review

COMMERCIAL AIRCRAFT INDUSTRY

Sam Sedaei

Lux Esto Law Review, Vol. 2, Issue 1 (March 2006)

COMMERCIAL AIRCRAFT INDUSTRY

Sam Sedaei

In 1903, Wilbur and Orville Wright of Dayton, Ohio, made the first successful flights, and manufactured well-controlled aircraft two years later (Heppenheimer). This initial success in the centuries-long dream of flight marked the beginning of the road to the emergence of the aircraft industry, the United States' number one industry, having realized close to 140 billion dollars in sales in 1999, including 62 billion dollars in exports to other countries (ICAF). An important segment of this industry consists of commercial aircraft producers. Therefore, it is imperative to review the components and history of this industry in order to analyze the effects various public policies could have on the manufacturers as well as the buyers of aircrafts.

A Brief History

In 1903, the Wright brothers succeeded in flying the first plane named "Kitty Hawk" in Carolina, marking the beginning of the aviation industry (Boyd 2000). Initially, the public did not embrace aircraft as a trustable means of transportation due to the perception that it was dangerous. However, this perception was changed when in 1927, Charles Lindbergh successfully flied across the Atlantic Ocean, creating a massive interest in flying (Boyd 2000).

The Wright brothers set up the Wright Company in 1909, which started by building airplanes before it lost in a bitter rivalry to another airplane manufacturer named Glenn Curtiss of New York (Heppenheimer). Curtiss's firm which Curtiss Aeroplane Company built such high quality planes that the Wright Company could not compete, leading it to change its
name to Wright Aeronautical Company and turning to building aircraft engines.

The industry suffered a decrease in demand with the break out of World War I, and this low demand continued throughout some years following the war. But one of the biggest factors in the growth of the air transportation industry in the post-war period was the development of the mail transport system by the U.S. Postal Service (Boyd 2000). The Kelly Airmail Act of 1925 allowed private airlines to function as mail carriers through competitive bids. The airmail revenue helped private carriers to expand into carrying other forms of cargo, including passengers. Prospects for new profits also led to the growth of already new manufacturers such as Donald Douglas, William Boeing and Alan Loughead to go into business (Boyd 2000).

A holding company by Boeing, United Aircraft and Transportation Corporation, gained a significant advantage over other manufacturers in 1926 by building a single-engine plane that was capable of carrying mail and passengers over the Rocky Mountains (Heppenheimer). Following this success, both airline companies and aircraft manufacturers targeted passengers to expand the income from the airmail system (Boyd 2000). The demand for commercial planes continued to increase steadily throughout the 1930s, but suffered another decrease in demand when World War II broke out. But the war helped generate support for military aircraft research and development, which extended to commercial aviation (Boyd 2000).

The end of war brought a collapse to the aircraft industry as a substantial number of army orders were cancelled (Heppenheimer). But the capacity and comfort of commercial aircrafts improved substantially in the 1950s as planes were modernized, and

in 1959 jet service was introduced, enabling faster cross-country flight service. During this period, Boeing introduced Boeing 707 while Douglas produced its DC models, DC-8 being the latest model in that decade (Heppenheimer).

In the following years, Boeing and Douglas competed heavily to sell their planes by offering custom variations of a basic design that would serve airlines' specific needs such as larger wing for long range. These customizations were costly, which helped Boeing win an important advantage over Douglas since the former was capable of making larger investment for it was selling planes to the Air Force in large numbers. In the 1960s, Boeing introduced 727 while Douglas also stayed in the game by bringing its DC-9 to the market. As the Vietnam War began reaching its conclusion, Boeing, Douglas and Loughead all suffered economic troubles (Heppenheimer).

Slowly recovering from post-war economic conditions, Boeing introduced airliner 747. However, this model was too large, which gave Loughead and Douglas the opportunity to produce a smaller airliner. Loughead produced L-1011 while McDonnell Douglas offered DC-10. However, this was a mistake since there was only room for one model of small airliner in the market (Heppenheimer). This resulted in both companies losing money and pushed Loughead to leave the commercial aircraft manufacturing, becoming a purely military builder. Douglas stayed in the industry but was financially weak from rivalry with Loughead and could not fund the research and development of new planes.

These developments raised the possibility of Boeing to become a near monopoly in the aircraft industry. Although this prospect made Airline executives temporarily worried, during the late 1970s, European plane manufacturers completely changed the nature of the industry. France and Great Britain, which had a strong aviation industry, had built the Concorde, the world's only supersonic airliner (Boyd 2000). These countries combined with West Germany to create Airbus Industrie. During the 1980s, Airbus competed vigorously with Boeing, winning a large number of orders and becoming a powerful competitor to Boeing in the industry.

Some mergers made the aircraft industry even more concentrated. Boeing eventually bought McDonnell Douglas and another aircraft manufacturer, Rockwell International, becoming the only major commercial aircraft manufacturer in the United States. Today, the Boeing Commercial Aircraft Company and Airbus Industrie dominate the commercial aircraft industry, followed by McDonnell Douglas as a distant third (Shokralla 1997).

Costs in the Commercial Aircraft Industry

As the historical as well as current data on the commercial aircraft industry demonstrate, the entire industry is dominated by two major firms: Boeing, which owned 55% of the dollar value of the market in 2005, and Airbus owning slightly over 40% (Landler 2006). Based on this data, it is apparent that this industry is a very tight and highly concentrated oligopoly. Therefore, like most oligopolies, the industry is expected to have high financial and logistic costs associated with it that make entry of new firms rather difficult. Hence, it is important to analyze some of the costs associated with this industry in order to explain the high concentration in this market.

One of the factors which make entry to the commercial aircraft industry very difficult is the high set-up costs. Production of commercial aircrafts requires a great amount of initial investment in equipment, staff, labor, training and legal procedures. In

addition to these preliminary set-up costs, a great amount of research and development is required to develop the aircrafts before any product could be produced and sold. A British aircraft producer reported that the research and development costs of a model of aircraft could amount to about twenty times the price of the completed aircraft (Sturmey 1964). A similar figure has been used to estimate the costs of research and development for a commercial airliner. These high set-up costs make entry to the industry rather difficult as few individuals or firms are financially able to make such large investment before being able to produce any revenue. Hence, high set-up costs result in an industry with a few large firms, such as Boeing.

Another reason which makes it more efficient to have larger firms in this industry is the idea of specialization. As Adam Smith demonstrated, specialization in production substantially increases the efficiency of production. But in order to have specialization, the producer needs to reach a minimum size required. For instance, a Boeing 777 contains about132,500 engineered, unique parts and 3,000,000 fasteners (Shokralla 1997). Therefore, based on Adam Smith's specialization theory, a very large production facility is required in order to create efficiency through specialization in the production of a product that contains such high number of highly-specialized engineered parts. Hence, this is another reason that explains why the commercial aircraft industry consists of only two major players.

The theory of learning curve is used to explain why it is more efficient for an aircraft manufacturer to produce at high volumes. The theory in the aircraft industry states that direct labor learns as it works, and the more a worker repeats a given task, the more efficient the worker will become (Hartley 1965). The first time, the learning theory was applied to the aircraft industry when it was discovered that the rate of output of a given type of aircraft was increased, direct labor per unit declined. Therefore, based on the aircraft learning theory, the time required to complete each task in the chain of production of an airplane decreases each time a task is repeated. In 1965, Hartley developed a learning curve for the British aircraft industry. He demonstrated the relationship between worker hours – "man hours" – and cumulative aircraft output with the following graph.

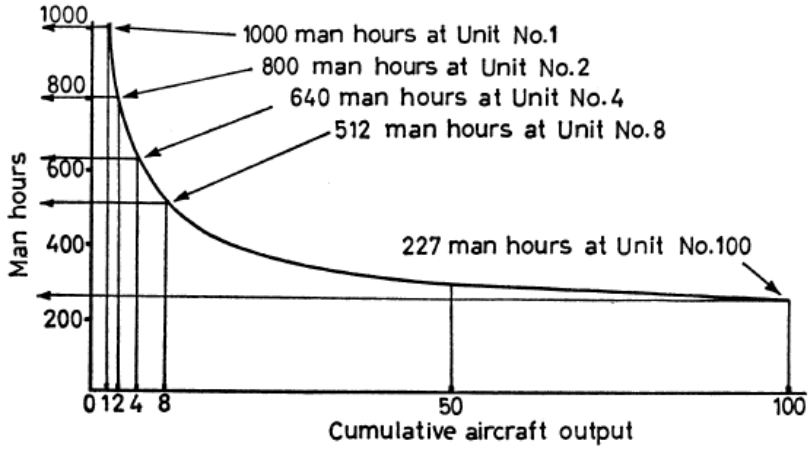

Figure 1

As the graph demonstrates, 1,000 worker hours are needed to build the first aircraft. But at unit two, the number decreases to 800 hours. Consequently, the one hundredth unit is expected to take one fourth of the labor hours that were required to build the first unit.

Therefore, as this graph demonstrates, there is a very strong learning curve in the industry which makes it much more efficient for the manufacturer to produce at high volumes.

Finally, the theory of economies of scale is another factor which explains why firms that produce commercial aircrafts tend to be very large. Based on this theory, large firms could be more efficient if with the increase of production, their average total costs decrease dramatically. The aircraft industry has very large economies of scale due to very high set-up costs for plants, research and development and specialization. Furthermore, leaning curves make it more efficient for a single manufacturer to produce at a high enough volume to reach the peak of learning and production-per-worker. Due to all these factors, the commercial aircraft industry has very high economies of scale, which is the main factor in explaining the high market concentration in the industry.

Public Policies and Their Effects on Oligopolistic Competition

As most other monopolies and oligopolies, public policies have a major role in the performance of the manufacturers of commercial aircrafts. Especially, some of the policies that the European countries have undertaken toward Airbus have affected the nature of the competition between Boeing and Airbus. Therefore, it is imperative to review some of these policies in order to understand their impact on this industry.

One of the main factors which have helped Airbus, the European aircraft manufacturer, in competition with Boeing is the great amount of technological collaboration which has taken place among the European countries (Hayward 1988). Over the years following World War II, technological collaboration increased dramatically among European countries to accommodate important national interests of several states. Although such collaborations have not been perfect and competitive and cooperative forces coexist, collaboration has become a routine for most European firms. Collaboration has been practiced as a natural industrial strategy to help European countries deal with large development costs for products and endure international market pressure. This has especially been true in the aerospace industry where key technologies are very closely linked to military and economic security. At times, such collaborations have sparked criticisms that countries were sacrificing efficiency in certain cases for the sake of working in a certain program with other Europeans. For instance, France received one such criticism when it insisted on the development of two versions of Concorde and the allocation of Tornado equipment contracts to German companies despite their inadequate experience (Hayward 1988). However, European economists have responded by asserting that just like the production of aircrafts, learning curves are also applicable to collaboration; in other words, by "practicing" collaborations, countries are capable of gradually moving toward more efficient collaborative projects. Airbus Industrie has been considered the European organization that has come closest to this integrated approach to collaborative programs. The Airbus collaboration is unique in that it has united the three major European countries in the aerospace industry, France, Germany and Great Britain, to a significant degree on a large-scale program. This integrated collaboration is one of the reasons why the relatively young European aircraft manufacturer quickly became a major competitor to Boeing.

Another factor which has had a major impact on the nature of the competition between Boeing and Airbus has been European government subsidies which have allowed Airbus to develop new technologies (Shokralla 1997). The Airbus Industrie came into being with the generous financial help of EU governments (Pavcnik 2002).

Europeans justified the subsidies that covered the launching costs of the first Airbus model, the A-300, by relying on the "infant industry" argument and the monopoly of the United States in the industry. However, while Airbus has grown from a small firm into a powerful manufacturer effectively competing with Boeing, subsidies have continued. These subsidies have caused Airbus to enjoy from a long-term competitive advantage which enables them to afford research and development without having to pass on the costs to the customers.

Trade Disputes in the Aircraft Industry

Major European countries' constant subsidization of Airbus has been a major factor that has put Boeing at a disadvantage to compete in the world market. Often in cases of disputes involving major firms in a concentrated industry in the same country, the government may have a small interest in the outcome of the disputes. But the commercial aircraft industry is an international industry with its two major firms located in two different continents. In this context, international trade plays a major role in this industry (Pavcnik 2002). Large economies of scale as well as the learning curves in the industry require producers to look beyond domestic markets, relying on export markets to lower their average production costs. However, the world demand for aircrafts is rather limited, making the competition in the industry very difficult. In such circumstances, the U.S. and the E.U. have an active interest in putting their forces behind their national aircraft manufacturers to capture or win over the world market. Such incentives have resulted in trade disputes that have involved American and European governments.

U.S. and E.U. governments have often affected competition in the aircraft industry between Airbus and Boeing through domestic and trade policies. Through such efforts, governments have tried to alter the strategic interaction between domestic firm and foreign rivals to shift the market share from a foreign to a domestic producer (Pavcnik 2002). When European subsidies to Airbus became more permanent, Boeing threatened to file a complaint to WTO. However, the American manufacturer has avoided retaliation because it fears that it may lose most of the European market. Instead the two sides have attempted to resolve conflicts through negotiations (Pavcnik 2002). Sometimes these efforts, such as the 1979 GATT agreement on trade in civil aircraft have failed to put at end to European subsidies. But other efforts such as the US-EU agreement on trade in civil aircrafts that limits government subsidies and financing have been relatively more effective in settling disputes.

Common Challenges in the Industry

While European and American commercial aircraft manufacturers have endured many disputes and disagreements in their competition to maximize their international market share, there are some challenges which they both have to overcome in order to remain successful in
the industry. Therefore, it is important to review some of these challenges in order to understand the direction in which this industry is headed.

The first major challenge which the industry faces is creating profits. Boeing has to compete with a manufacturer that receives government subsidies while Airbus has to struggle against a firm that owns 55% of the market share. These conditions have resulted in ultra-competition which has made profit making rather difficult. Despite lower anticipated revenues, Boeing is striving to create larger operating margins and greater

profits (ICAF). It continues to increase productivity by reducing square footage and overhead costs. Both firms need to continue increasing efficiency and promotion of their products to increase profitability.

Another challenge facing all aircraft manufacturers is large-scale strikes which can jeopardize stability in the industry. An example of how such strikes could have a lasting impact on the industry is the strike against Boeing by the Society of Professional Engineering Employees in Aerospace (SPEEA) in 2005 (Bailey 2005). This forty-day walk-out by 18,000 SPEEA members substantially slowed down aircraft production. But strikes are more damaging to the society when they occur in monopolistic or oligopolistic industries, because they could have a significant impact on the total supply of a specific product in the market. Hence, the CEOs and boards of directors of these firms need to constantly work with union leaders to ensure that production would continue without jeopardizing revenue or employees' working conditions.

Finally, increasing jet fuel costs and inadequate infrastructure development in less-developed countries are serious obstacles to continued growth (ICAF). World markets are critical to both Boeing and Airbus, and aircraft manufacturers need to penetrate these markets
in order to increase sales as well as making air travel more accessible to a larger population. Furthermore, governments as well as aircraft manufacturers need to throw their weight behind the research and development of alternative fuel, such as the production of jet fuel from agricultural products or through clean coal technology in order to reduce fuel costs. These investments will not only benefit the firms in the industry, making aircrafts more attractive in the market, but their investments will also be beneficial in other sectors such as automotive industry. Accordingly, both companies will continue to pursue emerging technologies that provide cost savings and greater operational efficiency. Development of aircrafts that use cheaper fuel is expected to instantly gain substantial favor in the world market due to high worldwide oil prices. Hence, aircraft manufacturers have a real incentive in the development of alternative fuel and aircrafts with the technology to use such fuel.

Commercial aircraft industry has become one of the major international industries over the decades after World War II. Its high concentration is an indication of the economies of scale involved in the industry. As Boeing and Airbus continue their vigorous competition to dominate the world market, they have challenges that they need to overcome, both in terms of competition with one another, but also in terms of common problems. Governments also need to work together in making policies that would help the growth of the industry as a whole and promote competition. Only by overcoming these challenges will the industry have sustained growth and increased demands for their products in the world market.

BIBLIOGRAPHY

Col, William F. 2005. "Industry Studies: Aircraft." *The Industrial College of the Armed Forces.* http://www.ndu.edu/icaf/industry/2000/aircraft/aircraft.htm.

Gillett, Dave. 1994. "Strategy in the Commercial Aircraft Industry in the United States: A Comparison of Decisionmaking and McDonnell-Douglas and Boeing Aircraft Companies from 1977-1983." *The Industrial College of the Armed Forces.*

Golbe, Devra L. 1986. "Safety and Profits in the Airline Industry." *The Journal of Industrial Economics,* 34 (3): 305-318.

Golich, Vicki L. 1992. "From Competition to Collaboration: The Challenge of Commercial-Class Aircraft Manufacturing." *International Organization,* 46 (4): 899-934.

Hartley, K. 1965. "The Learning Curve and Its Application to the Aircraft Industry." *The Journal of Industrial Economics,* 13 (2): 122-128.

Hayward, Keith. 1988. "Airbus: Twenty Years of European Collaboration." *International Affairs,* 64 (1): 11-26.

Heppenheimer, T. A. "The U.S. Aircraft Industry – An Overview." *U.S. Centennial of Flight Commission.* http://www.centennialofflight.gov/essay/Aerospace/AeroOV1.htm.

Landler, Mark. 2006. "Airbus Edge in '05 Sales Comes With an Asterisk." *The New York Times.* January 18.

Milner, Helen V., and Yoffie, David B. 1989. "Between free trade and protectionism: strategic trade policy and the theory of corporate trade demands." *International Organization,* 43 (2): 239-272.

No Author. 2005. "Current Market Outlook." *Boeing Corporation.* http://www.boeing.com/commercial/cmo/pdf/cmo2005_OutlookReport.pdf.

Pavcnik, Nina. 2002. "Trade Disputes in the Commercial Aircraft Industry." *Blackwell Publishers.* United Kingdom.

Shokralla, Shad H. 1997. "Boeing 777 Case Study." *Synthesis Coalition.* http://bits.me.berkeley.edu/mmcs/b777/main.html.

Simonson, G. R. 1960. "The Demand for Aircraft and Aircraft Industry, 1907-1958." *The Journal of Economic History,* 20 (3): 361-382.

Sturmey, S. G. 1964. "Cost Curves and Pricing in Aircraft Production." *The Economic Journal,* 74 (296): 954-982.