The Japanese Aviation Industry

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Mr. Hidemasa Kimura, born in 1904, is a well-known aircraft engineer. Graduate of the Department of Technology of the University of Tokyo, he engaged in the development of various long-range planes before and during World War II. An A-26 plane designed by him established a world non-stop flying record in 1940. After the war he served as professor of the Department of Technology of Nihon University and supervised the development of human-powered planes.

Japan's aviation technology is at the highest of international standards, but its scale of industry falls far behind.

As a result of Japan's defeat in World War II, the aviation industry here came to a complete halt for a period of nearly seven years. Unfortunately for Japan, this was a period of great transition in the international aviation industry, involving a shift from propeller to jet aircraft as well as the rapid introduction of numerous technological innovations. It was only in the spring of 1952, with the signing of the San Francisco Peace Treaty, that Japan began the process of rebuilding her aviation industry.

Over the past 30 years Japan has been engaged in the licence production of various types of high-performance jet aircraft, including supersonic jet aircraft, as well as helicopters, jet engines and turboprop engines. At the same time, utilizing advanced technology adopted from the United States, Britain and other nations, Japan has also been involved in the independent development and production of jet engines and a wide variety of aircraft such as jet passenger aircraft, turboprop and jet transport carriers, patrol planes, and supersonic air-to-ground support fighter planes. The international respect accorded these aircraft and engine performance and operation indicates that Japanese aviation technology has now reached the highest of international standards.

However, in terms of the scale of industry, Japan falls far behind in the international aviation sector. A comparison of sales for the year 1979 shows the United States in the lead by a wide margin, followed by France, Britain and West Germany, which may be classified together into group B. Japan belongs to group C, along with Italy and Canada. Ratios of aerospace industry sales to GNP are revealing: United States 1.9%, Britain 1.6%, France 1.1% and West Germany 0.4%. Japan's ratio is a mere 0.14%.

Of course the seven-year hiatus in Japan's aviation industry was a major factor contributing to the small scale of the industry. It was this very period at the end of World War II which witnessed the rapid increase in aircraft use and popularization, leading to the worldwide expansion of a sales market which also came to include newly independent countries. Yet despite this expansion of the market, only a few nations such as the United States, Britain and France were able to develop, produce and supply aircraft, thereby allowing these countries to monopolize the market. It was no simple matter for Japan, a relative newcomer to the industry, to make inroads into the international market.

Here, a comparison with West Germany may be appropriate, for, like Japan, West Germany's aviation industry was also dealt a severe blow by the defeat in the war and forced to start from scratch. Around 1960 I visited the German company Messerschmitt and was quite impressed with its modern production facilities. The engineer who guided me around the plant smiled and said, "All this is thanks to the Allied forces who destroyed our old plants. It's the same in Japan, isn't it?" Certainly, for both Japan and West Germany, reconstruction of the industry was total and involved the building of completely modern facilities. But while the starting points were the same, West Germany has since outpaced Japan, at the very least in terms of volume. Although the production outputs of both countries were about the same in the 1960s, today West Germany's output is three times that of Japan. This is a critical problem which the aviation industry in Japan must address.

One reason for the differences in production outputs can be seen in the defense expenditures of the two countries. Ratios of defense expenditures to GNP since 1965 reveal striking gaps, with West Germany at around 3.5% and Japan at 1%. From 1975 to 1978 West German defense expenditures have been 3.5, 3.0, 2.8 and 2.5 times, respectively, the equivalent Japanese figures.

Differences in defense outlays and industrial structure are two factors accounting for the different performance of the Japanese and West German aviation industries.

The aviation industry has long been heavily dependent on demand from the military sector, a situation which held true especially in Japan. Although the degree of dependency fell as low as 57% at the peak of YS11 turboprop transport aircraft production here, it rose sharply to 86% in 1979 as YS11 production came to an end. In West Germany the dependence on military sector demand is also high at 82%, while for countries like the United States, Britain and France the figure is only around 60%. Thus, for both Japan and West Germany differences in defense outlays are sharply reflected in aviation sales.

Industrial structure is another factor accounting for the different performances of the Japanese and West German aviation industries. When Japan began reconstruction of her aviation industry in 1952, development and production systems were established only gradually, starting first with the repair and overhaul of aircraft and engines for the American forces in Japan and then moving on to licence production of Self-Defense Forces aircraft. Because of the gradual

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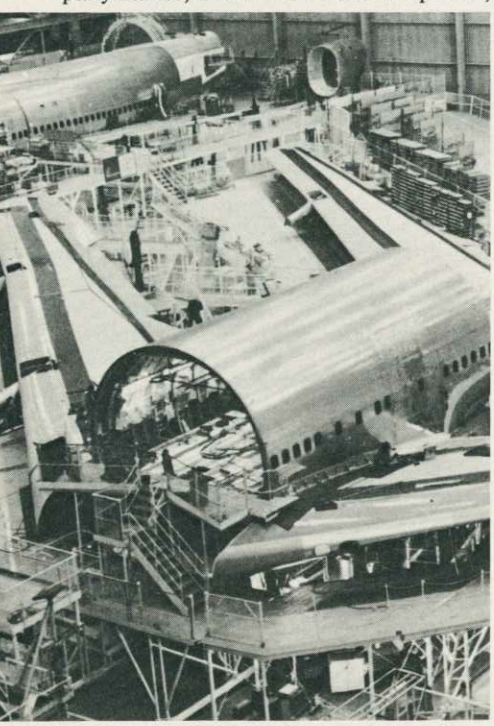
pace of reconstruction, by 1956 production output was still low, having reached only ¥4.25 billion.

The emergence of specialized manufacturers in the aviation field was virtually impossible under these conditions. Instead, those major companies with wartime experience in the aviation industry, such as Mitsubishi Heavy Industries and Kawasaki Heavy Industries, set up internal aviation divisions. This structural organization of aircraft divisions within the heavy machinery companies continues to exist to the present day in Japan. Furthermore, these manufacturers' aviation divisions account for only about 7% of the companies' total work. Only two companies, Japan Aircraft Manufacturing Co. and Showa Aircraft Industry Co., even have the word "aircraft" in the company names, and even in these companies,



the aviation divisions do not account for a significant share of the total work undertaken. In other words, a unique situation exists in Japan where not a single aircraft manufacturer centers around its aviation division.

Although reconstruction was slower to start in West Germany than in Japan, from the beginning, established and illustrious companies such as Messerschmitt and Dornier moved into the aviation industry. After a series of mergers, MBB (Messerschmitt-Bölkow-Blohm) and Dornier have emerged as the current specialized manufacturers in West Germany's aviation industry.

The postwar period saw great improvements in aircraft performance, as well as increasing complexity and sophistication in structural and operational features. As a result, longer time periods—sometimes amounting to years—and great expenditures became necessary for aircraft development and production. Plant and equipment investment, too, increased as engineering techniques became more and more complex. Moreover, there have been a number of cases of civilian aircraft production in which the aircraft has failed to find a market and production was forced to a halt after only a few dozen aircraft had been manufactured—this despite the large investment. On the other hand, poor capital management has sent some manufacturers into bankruptcy when their products proved too popular.

During the three decades following World War II, the names of many famous aviation companies have disappeared either through bankruptcy or merger. Today, various companies that had once existed independently are now integrated into such manufacturers as British Aerospace, Westland (helicopters) and Rolls-Royce (engines) in Britain and Aerospatiale, Dassault-Breguet and SNECMA (engines) in France.

An idealistic solution would be to amalgamate all the aviation divisions of Japan's aircraft manufacturers.

In Japan, however, bankruptcy did not pose the same kind of threat because the manufacturing divisions were protected by their parent companies and thus able to weather changes. But does not their very security raise doubts about their aggressiveness in the field? Here again is another point of contrast with West Germany, where manufacturers had to fight tooth and nail in order to survive.

One possible, although admittedly somewhat idealistic, solution would be to amalgamate all the aviation divisions of Japan's many aircraft manufacturers into one specialized manufacturer, severing the existing ties with the parent companies. Such a move would be a major step forward for the Japanese aviation industry. One manufacturer would be sufficient to handle the present volume of demand. Such an arrangement would make it possible to tackle larger projects such as the manufacture of jet transport carriers on an independent basis. Joint development projects with foreign manufacturers could be carried out more smoothly than at present, and the arrangement of government subsidies would also be much simpler.

Precisely because of the current situation in which a large number of manufacturers must compete with each other, in 1959 NAMC (Nippon Aircraft Manufacturing Co.) was set up with 54% government investment. It was to serve as a coordinating body for the first postwar domestic development and production of the turboprop transport aircraft YS11. NAMC had no production facilities of its own and distributed work among the various manufacturers in the following way: Mitsubishi Heavy Industries, the front and central fuselage and assembly; Kawasaki Heavy Industries, the main wings and nacelle; Fuji Heavy Industries, the tail wing; Shin Meiwa Industry, the rear fuselage; Japan Aircraft Manufacturing, the aileron and flaps; and Showa Aircraft Industry, the honeycomb construction. This distribution of responsibilities applied throughout the entire project, from the development stage to the final production stage.

YS11 represents a challenge never faced before by the Japanese aviation industry.

The first and most critical matter faced in the development of the YS11 was that of its specifications, such as seating capacity, cruising speed, range, and takeoff and landing field length. Aircraft production in the prewar period had focussed on military aircraft where specifications had already been determined by the military. Manufacturers had only to "produce to order."

Development and production of the YS11, then, posed a number of new problems. The manufacturers were required to meet not only domestic demand but also international demand. Market research on a worldwide scale was undertaken to ensure the export potential of the YS11. Finally, the YS11 also had to be within the handling capacity of the aviation industry in Japan. Thus, the YS11 represented a challenge never faced before by the Japanese aviation industry: the creation of an aircraft with specifications determined by the manufacturers themselves and whose sales depended solely on the accuracy of those judgments.

The YS11 has a seating capacity of 60 to 64 and a takeoff and landing field length of less than 1,200 meters. With efforts aimed at minimizing operating costs, the YS11 made a successful debut into the twin-engine turboprop transport aircraft market, long dominated by the Dutch Fokker Friendship and the British HS 748. A total of 182 YS11s have been manufactured, and since 1965 they have been servicing domestic airline routes in Japan and elsewhere.

Japan's first venture into the international aviation market was a success, but lack of experience led to some inefficiency.

Japan ranks third after the United States and the Soviet Union in the number of domestic airline passengers and first in the ratio of flights to land area. Yet because of the restrictions on runway length, jet aircraft cannot be used at 48 out of 77 (or 62%) airports in Japan. It is here that the advantage of the YS11 becomes strikingly clear. Furthermore, the number of

Boeing 767

YS11s either exported or leased to the United States and other nations totals 87, of which 21 have been repurchased by Japan. Thus Japan's first venture into the international aviation market can certainly be termed a success.

However, lack of experience did lead to some inefficiency in the areas of sales and services provided to the purchasing companies, giving way to criticism that the YS11 program had failed economically despite its technological success. Exports of the YS11 reached their peak between 1967 and 1969, but 1971 was marked by the so-called "Nixon shock," followed by the Smithsonian agreement in which the exchange rate dropped from ¥360 to ¥308 to the dollar. NAMC's deficits were drastically increased by the exchange loss.

While the Japanese aviation industry is heavily dependent on demand from the military sector, self-imposed restrictions on the expansion and strengthening of defense capabilities mean that substantial increases in the budget allotted to the development and production of aircraft for the Self-Defense Forces are unlikely. Moreover, specification changes in military aircraft may even trigger a halt or decline in production. Further growth in the Japanese aviation industry requires an increase in the degree of dependency on demand from the civilian sector. Particularly essential is the development and production of large-scale and technically superior civilian transport aircraft.

International joint development programs are invaluable experiences for Japan.

Towards this end, OR work on the YX transport aircraft was begun in 1967, two years after the YS11 was put on the market. In 1973, the CTDC (Civil Transport Development Corporation) was established for the promotion of the YX project. In 1978 CTDC joined the Boeing Corporation of the United States and Aeritalia of Italy in a joint research and development enterprise for the production of a 200-passenger twin-engine transport aircraft, the Boeing 767, with investment ratios of 15% for Japan, 70% for the United States and 15% for Italy. Japan was responsible for the central and rear fuselage, the main wing fairing and the main wing ribs. Of Japan's total ¥33.6 billion development fund, 50% was provided by a government subsidy.

The first Boeing 767 had its test flight in September 1981. Others are currently undergoing test flights, and delivery to the airlines is expected to take place on schedule in the summer of 1982. Upon the initial test flight, firm orders for 173 Boeing 767 came in from airlines around the world, with further options to purchase numbering 138. The future outlook is promising.

Parts manufactured in Japan, Italy and the United States are sent to the Boeing assembly plant in Everette, Washington. After assembly there, the Boeing Corporation takes full responsibility for the sales and future servicing of the aircraft. It is regrettable that Japan cannot participate in the sales aspect of the Boeing 767, for the YS11 experience has been a bitter one. Nonetheless, from a technological point of view, the production experience has been invaluable.

For the West, the Boeing 767 marks the first transport aircraft to go into operation after the Airbus A-300 in 1974, eight years ago. Hence it is replete with a new level of technology not found in the transport aircraft of former generations. For Japan, participation in this project afforded unlimited opportunities to acquire expertise in the areas of detail-planning, strength estimation, tooling, NC process work and data processing. The Japanese manufacturers were in direct contact with the Boeing Corporation via undersea cable, and the consolidation of this centrally-controlled computer system is significant, for it paves the way for future international joint research and development programs.

Just as the independent development of the YS11 led to participation in the YX international joint development program, so too did the FJR engine development program open the way for international joint research and development programs in the field of engines.

The FJR engine development program was a project of significant scale in the area of jet engine production carried out by the Industrial Science and Technology Institute. It began in 1971 with the cooperation of three major firms: Ishikawajima-Harima Heavy Industries, Kawasaki Heavy Industries and Mitsubishi Heavy Industries under the auspices of the Research Institute for Aerospace Technology. By 1981 actual performance tests were completed on a turbofan engine with a stationary thrust of 6.5 tons. Research expenditures over the 11-year period were approximately ¥20 billion.

Success in this project provided further valuable experience for the Japanese aviation industry, but more importantly, it won the industry new international respect. The result was a joint development project with the Rolls-Royce Corporation for the production of turbofan engines for civilian transport aircraft. The engine, called RJ-500, is in the 9- to 10-ton thrust class, and advanced technology makes it both fuel-efficient and low in noise. Its market is for the 150-passenger class transport aircraft, a new generation of aircraft for which huge demand is anticipated in the 1980s. Development began in 1980 with a Japanese-British 50:50 investment ratio. Test operation of the prototype is slated to begin in the spring of 1982 in both Britain and Japan, with actual commercialization to start around 1986.

This project marks the Japanese aviation industry's entry into the area of engine development for civilian transport aircraft, and it is expected that much will be learned through this cooperative effort with the Rolls-Royce Corporation, a company with a long and rich history in this field of technology.

The importance of these international joint development programs—the Boeing 767, the RJ-500 and the YXX transport aircraft project scheduled to begin soon—does not stop with the acquisition of technological knowledge and expertise. Of even greater significance is the expansion of demand in the civilian sector, long a goal of the Japanese aviation industry. This, in turn, will lead to the expansion of scale and volume and hence toward substantial progress for the industry as a whole. ●