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An examination of the growth of the Japanese aerospace industry with emphasis on current capabilities and the development of growth potential.

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AN EXAMINATION OF THE GROWTH OF THE JAPANESE AEROSPACE INDUSTRY WITH EMPHASIS ON CURRENT CAPABILITIES AND THE DEVELOPMENT OF GROWTH POTENTIAL

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CHAPTER I

INTRODUCTION

Background

Since the end of the Allied occupation in April, 1952, Japan has grown economically to take a current position as the world's third largest producer (the United States, Soviet Union, and Japan, in that order). Its continuous real economic growth rate of greater than 10 per cent per year makes Japan not only a formidable economic and industrial competitor but also a powerful political force in Asia now, with an even more powerful potential for the future.[1] The objective of this study will be to examine one segment of Japan's growing industrial potential, the aerospace industry.

About 25,000 persons are presently engaged in Japan's aircraft industry, which covers factory floor space of more than 900,000 square meters. Average annual income per employee is $2,550, about double that of the national average.[2] Japan's aircraft industry, which began the

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[1] Herman Kahn, The Emerging Japanese Superstate: Challenge and Response (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1970), p. 4.

[2] Cecil Brownlow, "Direction of Aerospace Industry Studied by Japan," Aviation Week & Space Technology, January 19, 1970, p. 22.

manufacture of aircraft in the latter part of 1910, with the assistance of foreign technology, made much progress toward independent development, producing the "Kamikaze," which made a record long-distance flight between Tokyo and London in 1937, and the "Nippon," which successfully completed a round-the-world flight in 1939.[1]

World War II witnessed a great development in various types of military aircraft; by 1944, the Japanese aircraft industry had produced approximately 24,000 aircraft, with its industry work force reaching close to one million. Japan's defeat was a mortal blow to the industry as the production and research activities were totally prohibited for a period of seven years, by order of the Supreme Commander of the Allied Occupation Forces, until resumption in 1952. Japan's aviation industry has been struggling ever since to overcome the technological gap that resulted from its seven-year period of suspension. The impact of that period of inactivity was significant, since both military and civil aviation advanced from piston engines to jet turbines during the period. In 1952, only twenty-six aircraft were produced, and twenty-five of these were gliders.[2]

The reconstituted aviation industry initially resumed its activities in 1952 by undertaking the overhauling

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[1] Mitsubishi Aircraft Before 1945 (Tokyo, 1968), p. 1.

[2] Ibid., p. 3.

of United States military aircraft, ultimately developing the capability to produce small and medium aircraft. From 1954, after establishment of the Defense Agency, the emphasis gradually began to change from overhauling of United States military aircraft to manufacturing, mainly under license agreements with the United States, of aircraft for the Japanese Self-Defense Forces. For example, between 1955 and 1960, the government of Japan and the United States signed agreements to manufacture jointly 210 Lockheed T-33A jet trainers, 300 North American F-86F jet fighters, 42 Lockheed P2V-7 anti-submarine patrol aircraft, and 200 Lockheed F-104 jet fighters. In 1969, an agreement was signed to produce in Japan one of the most advanced fighter-interceptor weapon systems developed in the United States, the McDonnell Douglas F-4EJ.[1] Thus, the Japanese aviation industry has manufactured under license some of the more advanced Western (mainly United States) military aircraft and has the demonstrated capability to design and produce high performance aircraft.

Research Questions

Given a background of the successful post-World War II growth of the Japanese aerospace-aviation industry,

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[1]The agreement, signed in Tokyo on April 4, 1969, authorized a program for the acquisition and production in Japan of 104 F-4EJ aircraft and related materials and equipment.

the research question evolved is: "What is the status of the Japanese aerospace-aviation industry, its current capabilities, production, plans, and growth potential?" In developing an answer to the research question, other questions which have materialized are:

1. What has been the role of the government of Japan in the development of the aviation industry?
2. Who are the major aircraft manufacturers, airlines repair, and aircraft overhauling facilities?
3. What is the structure of the major Japanese aircraft corporations?
4. What are the potential markets for United States aerospace products in Japan?
5. What are the plans for the development of follow-on aircraft and terminal facilities in Japan?
6. To what extent is the Japanese aviation industry dependent on production for the Japanese Self-Defense Force?
7. Has the Japanese aerospace industry been characterized by production and technological sharing with other nations?
8. What are plans for expansion of existing aircraft and terminal facilities and development of additional facilities?

It is suggested that the process of deriving the answers to these questions will obtain an insight into the financial management structure of Japanese aerospace industries and that the role of the government of Japan in the development of this growing industry will be perceived. In addition, an indication of the United States market potential for aerospace-related support products for export to Japan should be gained.

Scope and Limitations

The scope of research for this thesis is limited to an analysis of the Japanese aerospace industry.

One limitation of this thesis is the inconsistency found in Japanese financial data. For many years, Japanese business concerns either were not interested in releasing financial information or were reluctant to do so. Not until the late 1950's or early 1960's were data published from which valid comparisons with Western businesses could be drawn. However, since the Japanese still do not subscribe to full disclosure or other accounting conventions in use in the United States, the majority of the recently published material must be viewed as an approximation by United States standards. Because a comparative analysis of derived data was not accomplished, Japanese financial and other data, as presented by various sources, have been accepted without dispute.

Organization of the Study

The major Japanese domestic and international airlines operations and aerospace manufacturing firms will be discussed individually on a chronological and historical basis along with Japan's capacity for rocket and missile development.

Separate sections will address the role of the government of Japan in the development of the Japanese

airline-aerospace industry, Japanese Self Defense Force planning and operations, the third Five Year Plan, and existing, planned, and proposed new aircraft programs.

Plans for aerospace research and development, as well as the programmed expansion of airports and terminal facilities, will be discussed with a view toward deriving the position of the Japanese aerospace industry in Japan's total industrial potential as well as suggesting her world and United States aerospace product market potential.

As a basis for understanding the extent of participation of the government of Japan in promoting the development of the aerospace industry, subsequent sections will detail the light aircraft import procedure regulations, the Aircraft Manufacturing Industry Law, and the Aircraft Industry Promotion Law, as well as the industry's own body, the "Aircraft Industry Council," developed for coordination and representation of its views to the government.

CHAPTER II

BRIEF PROFILE OF JAPANESE AVIATION INDUSTRY

Role of Air Transportation

Civil aviation in Japan has developed remarkably since its resumption in 1952. Domestically, it is in competition with a highly developed rail transportation network and an ever-expanding road system. The country's transportation system is exemplified by the high speed trains and the world's most sophisticated subway system. The new Tokaido Line and many others carry passengers in greater comfort than some contemporary passenger aircraft, and at city-center to city-center speeds that provide competition and challenge to the also highly efficient and inexpensive Japanese domestic air services. When the modern high-speed National Railways Tokaido Line began service between Tokyo and Osaka in the fall of 1964, the load factor of All Nippon Airways (ANA) and Japan Airlines (JAL) was cut in half on this route.[1]

Despite the domestic competition from Japan's highly efficient National Railway system, domestic airlines are operating at full capacity between major cities, and the

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[1]Max Nibloe, "Japan--A Coming Power in Aerospace," Interavia, August, 1970, p. 7.

Tokyo and Osaka international airports are saturated from the heavy volume of international traffic. During 1968, total Japanese airline passenger kilometers reached about 9,300, including 4,800 million passenger kilometers for local domestic lines. The total for local and international lines combined showed an increase of nearly thirteen times that of ten years ago, or an average yearly growth ratio of about 30 per cent.[1] Of special significance is that the number of local passengers totaled 800,000 persons, ranking second in the world after the United States. In air cargo there was also an increase. Air cargo increased about twenty-five times during the past ten years, which equates to an extremely high growth rate of 40 per cent annually.[2]

On the basis of an interim report of the Ministry of International Trade and Industry (MITI), the number of domestic air travelers is expected to reach 120,000,000 annually in 1985, as compared with 10,800,000 in 1969.[3] The number of passengers flying to and from Japan in 1985 will be approximately 40,000,000, with Japanese nationals accounting for more than half of the total. The report

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[1] "Aircraft," Industrial Japan, 1971, p. 150.

[2] "Local Airline Passengers Increased 30.7% in FY 68," Nihon Keizai Shimbun, May 6, 1969, p. 12.

[3] "Japan Braces for Boom in Commercial Aviation," Aviation Week and Space Technology, June, 1970, p. 15.

indicated that air passenger traffic is growing by an average of 30 per cent annually. The Japanese Civil Aviation Bureau estimates that 60 per cent of the airline traffic to and from Japan is composed of tourists. Businessmen account for the remaining 40 per cent. Air traffic growth has far exceeded the facilities to handle it--a situation not peculiar to Japan.[1]

The ad hoc subcommittee of the Transport Policy Council, advisory body to the Transport Minister in mid-1971, amplified the interim policy report which is to become the basis for the nation's long-range transport improvement program.[2] This report typifies the active role of the government of Japan in planning the future of air transportation. According to the report, the nation's gross national product in the target year of 1985 will reach 200 trillion, with an annual growth rate averaging 8.6 per cent. The number of passengers to be carried in the target year will be 94,000 million, or 2.5 times that of 1969. The number of domestic air passengers is to increase 8.3 times to over 100 million; railway passengers 1.9 times, to 30,480 million; auto passengers 2.9 times, to 63,090 million; and ship passengers to 330 million. A comprehensive air network is proposed to link principal

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[1]Cecil Brownlow, "Japan Spurs Asian Aviation Surge," Aviation Week and Space Technology, June, 1968, p. 31.

[2]"Long-Range Transport Blueprint Drawn Up," Japan Times, July 1, 1971, p. 7.

cities with either Tokyo or Osaka. Construction of a nationwide network of bullet trains is also called for. Of particular interest is a new high-speed railway using linear motor and magnetic suspension envisioned between Tokyo and Osaka.

A total of ¥100 trillion will be required to complete the project by target year 1985.[1] For the purpose, an average of 4 per cent of yearly GNP should be spent rather than the present 3 per cent. Funding of the project is to be primarily by government bonds. The report stated further that special government subsidies should be provided for construction of the nationwide bullet train network, but that funds for improvement of harbors and airport facilities should come largely from beneficiaries of the project.

The MITI transportation report projects huge increases in air transportation which are attributed to an expansion of the nation's economic growth scale. The programmed growth of air transportation and popularization of air travel is forcing the transportation industry to plan for a future in which the amount of travel by airplane will greatly increase. Under these projections, the hopes placed on the Japanese aircraft industry, which has not fully emerged from its infancy, and the problems it must solve will probably loom larger year after year.

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[1] Ibid.

The aviation industry has been characterized by a high degree of dependence on military orders, which still comprise the majority of its business. However, the civil sector of aircraft manufacturing and servicing is assuming increasing importance. Between 1952 and 1967, of a total production value of aircraft engines and components of $1,170.2 million, $81.66 million was for United States procurement and $855.08 million was for the Japanese Self Defense Agency; only $180.45 million was for domestic civil demand.[1] Production value of the aircraft industry has been steadily responding to increasing demands. The Japanese Economic Journal reports "that domestic production of aircraft will exceed ¥100 billion (approx. $278 million) for the first time in fiscal 1969, according to figures compiled by the Society of Japanese Aircraft Constructors."[2] It was also reported by the association that aircraft production in fiscal 1970 will reach about $322 million, up over 13 per cent over fiscal 1969. Initially, the major activity of the Japanese aircraft industry was the overhauling of United States military aircraft. Since 1954, the manufacture under license of United States aircraft--T-33A jet trainers, F-86 fighters, P-2H anti-submarine warfare (ASW) aircraft, F-104 jet fighters, and numerous

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[1] "Civil Aviation," Department of State Airgram A-730, July 15, 1970.

[2] "Plane Output Set Record during 1969," Nihon Keizai Shimbun, March 3, 1970, p. 12.

helicopters--has been the mainstay of the industry. The civilian output is rising, however; in July 1969, defense orders were, by value, 49 per cent of new aircraft and almost 60 per cent of repairs, and civil orders were 40 per cent for domestic and 10.5 per cent for export of new aircraft.[1]

In fiscal 1969, the total production of airframes, engines, systems, and components was only $285 million, compared with a total manufacturing production output of $36,600 million. Additionally, in the same year Japan spent about $143.5 million on aircraft imports, primarily for large civil aircraft (Boeing 727 and 737) of United States origin for international and domestic trunk lines. The industry is therefore a relatively small, though growing, faction of the Japanese economy.

Continuous improvements are scheduled for communications and electronic air navigational air facilities. As of April 1, 1967, the Japanese Civil Aviation Bureau assumed from the United States Federal Aviation Administration the entire responsibility for flight check of its own facilities.

The expansion of pilot training capability, urged in past years, commenced in 1967 under a four-year plan. The facilities of the Civil Aviation College at Miyazaki were expanded to accommodate a total of ninety candidates beginning in fiscal year 1968.

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[1]"Civil Aviation," Airgram, July 15, 1970.

A discussion of the status and plans for airport expansion and modernization will follow later in this chapter. The Ministry of Transportation has plans for a new aviation policy for the six-year period 1970 to 1975 to meet the sharply increasing air traffic.

Governmental Organizations Concerned with Japanese Aircraft Industry

The Japan Civil Aviation Bureau (JCAB) in the Ministry of Transportation (MOT) is responsible for the administration and regulation of air commerce, including aircraft and air safety, airways, airports, air navigational aids, aircraft operations, airlines, and investigation of air accidents. Local offices of the JCAB include area flight control centers and aeronautical aids offices. The MOT presently operates the Civil Aviation College for the training of pilots, providing trainees with 210 hours of flight experience. Student pilots at the institute receive one year of training in the Beechcraft and six months of additional training in the Boeing 727's.[1]

Other governmental agencies concerned with civil aviation include the Maritime Safety Agency, which is responsible for air rescue operations; the Meteorological Agency, which compiles weather information; and the Transportation Technical Research Institute, which is responsible for

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[1]U.S., Department of Commerce, World Survey of Aviation: Japan 1968 (June, 1968).

design, experimentation, investigation and research on transportation vehicles (including aircraft), aircraft engines, aeronautical equipment, and airport facilities.[1]

In addition to these administrative agencies, there are two advisory bodies which report directly to the Minister of Transportation. The Transportation Council advises on important transportation policies, including the granting of franchises and the approval of fares and rates for domestic air scheduled services. The Aviation Council advises on basic air transportation policies, including the expansion of air routes and the improvement of airports.[2] A partial listing of government agencies concerned with the aircraft industry follows; their importance will be illustrated during subsequent chapters.

Ministry of International Trade and Industry

Agency of Industrial Science and Technology

Aircraft Industry Council

Japanese Industrial Standards Committee; Aircraft Subcommittee

Ministry of Transport

Aviation Council

Defense Agency

Technical Research and Development Council

Research and Development Institute

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[1] Ibid.

[2] Nibloe, "Japan, A Coming Power," p. 9.

Science and Technology Agency

National Space Development Center

National Aeronautical Council

Space Activities Commission

National Aerospace Laboratory

Institute of Space and Aeronautical Science, University of Tokyo

Although all manufacture is in the hands of private industry, the Ministry of International Trade and Industry is able to control the industry through the following legislation:

Aircraft Manufacturing Industry Law.--The aircraft industry was officially restored on April 9, 1952 by authority of the Aircraft Industry Law, which regulates all aircraft and engine production and overhaul. Under this law all enterprises undertaking the manufacture, repair, or overhaul of aircraft, or the manufacture of aircraft parts and accessories, must be licensed by MITI. Currently, six major airframe makers, four engine plants, eleven overhaul factories, and thirty-five principal accessory manufacturers are licensed. A total of about 700 firms participate to some degree in the industry.

Aircraft Industry Promotion Law.--The object of this law is to promote the aircraft industry by administrative action, loan subsidies, customs exemptions, and direct investment. The most significant example of the operation

of this law was the establishment in 1959 of the Nihon Aeroplane Manufacturing Company (NAMC). The government directly invested $10.5 million in NAMC and underwrote debentures up to $66.4 million. The government has also provided $15.7 million for machine tools in the industry and $15.77 million for research. Under the provisions of the Aircraft Industry Promotion Law, the government has been guaranteeing NAMC debts since fiscal year 1961. Guarantees totaled $33.06 million through 1965.[1]

Loans

Government loans for the purchase of machinery and equipment for aircraft manufacture and repair have been extended to companies chiefly from Economic Assistance funds and partly from the Japan Development Bank. These loans amounted to $14.68 million in 1966.[2]

Subsidies

Subsidies have been extended by the Ministries of International Trade and Industry and the National Research Institute to companies and laboratories engaged in aerospace research. These subsidies have amounted to $5.68 million, including $0.64 million for developing the YS-11.[3]

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[1] "Civil Aviation," Airgram, July 15, 1970.

[2] "The Japanese Aircraft Industry," Department of State Airgram A-10, November, 1966.

[3] Ibid.

Special rates for national laboratories

Private aircraft firms can use national laboratories for research and experimentation at fees 50 per cent lower than those charged other users.[1]

Customs exemptions

Specific machinery, aircraft operational safety equipment, and parts are exempted from import duties under provisions of the Tariff Law. Testing equipment, aircraft and parts, and raw materials for aircraft manufacturing when domestic production of such items is considered to be uneconomical, are also exempt from customs.[2]

Depreciation of machinery and equipment

Depreciation schedules for machinery and equipment used for the manufacture and repair of airframes, engines, propellers, cabin air conditioning systems, landing equipment, and hydraulic equipment are generally set at 10 per cent, a higher rate than that allowed other industries.[3]

Currently, the MITI is sponsoring government-backed research and development for aircraft jet engine development. This project is on the national development program of industrial technology and is regarded as essential to

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[1] Ibid.

[2] Ibid.

[3] Ibid.

future national economy.[1] The five-year (fiscal 1971 through fiscal 1975) program on the jet engine is devoted to the development of an engine that will be installed in the third generation of Japan's domestically produced non-military planes, code named YX, at a cost of ¥6.7 billion, approximately $18.6 million.

Light Aircraft Import Procedures

The role of the governmental agencies and the civil aviation agency of Japan, in protecting, supporting, and planning for the growing Japanese aircraft industry, takes many forms. The present procedure of having the Japan Civil Aviation Bureau (JCAB) certify and make favorable recommendations for each aircraft to be operated (sold) in Japan before the Ministry of International Trade and Industry (MITI) will issue an import license has an adverse commercial effect on imports of light aircraft to Japan. This restriction is in addition to the basic 15 per cent duty on foreign imported light aircraft. These policies severely restrict import of United States aircraft since the JCAB check requires that the individuals who operate the aircraft process the application.[2] The effect of this policy is to

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[1] "MITI Decides Two Big Projects," Nihon Keizai Shimbun, July 27, 1971, p. 13.

[2] U.S., Department of Commerce, Bureau of International Commerce, Transportation Products Division, Letter to Hughes Tool Company, Aircraft Division. "On April 6, 1970 Japanese press report stated that the Government of

prevent the sale of aircraft from inventory. In order to maintain inventories, United States light aircraft sales agents in Japan would have to be allowed to import on their own accounts without having to designate a specific end user at the time of importation.[1]

Despite these restrictions, Japanese import procedures for American light aircraft imports, although subject to normal import quotas, have been actually receiving "liberal licensing" treatment. If the Japanese could be convinced, it would be possible for the JCAB to perform its review and inspection of aircraft after their importation, thereby eliminating the commercial restraint effect of its check while still maintaining its high standards of aviation safety.[2]

Japanese Airfields and Airport Expansion

There are over 150 airports available for civil and military aviation in Japan. These include international

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Japan plans to liberalize imports of light aircraft and helicopters in January, 1972. Ikuta (head, MITI's first overseas market division) reported later this was 'groundless' and the October 1969 liberalization offer to the United States still stands, i.e., full liberalization or liberal licensing for single engine light aircraft and helicopters in January 1971 with 25 percent yearly increase in global quota in interim: with full liberalization of twin engine light aircraft within three years with liberal licensing to United States in interim." (Industry reports appear to substantiate that the policy described above was actually implemented.)

[1] "New Tariff Barriers, Light Aircraft," Department of State Airgram A-241, April 2, 1971, p. 1.

[2] Ibid., p. 3.

airports, major domestic airports, local airports, airports for non-public use, and airports for joint use with Japanese and United States forces. There are also three heliports for public use and twenty-two for non-public use.[1]

The international (Class 1) airports are administered and financed by the national government. Major domestic (Class 2) airports are administered by the national government with three-fourths of the financing provided by the national government and one-fourth by the local governments. Local (Class 3) airports are administered by the local governments, and financing is equally shared by national and local governments. Construction of several new airports is being planned or considered, including international airports at Tokyo, Hokkaido, and Osaka.[2]

Expansion and modernization of ground facilities are underway throughout the country. The Transport Ministry has initiated a multi-million-dollar, five-year airport improvement program, to commence in fiscal year 1970, which will follow up the current five-year plan. A total of $170 million is allotted for the New Tokyo International Airport, and $180 million for the New Kansai International Airport to be built near Japan's second-largest city, Osaka.[3]

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[1] Department of Commerce, World Survey (1968), p. 3.

[2] Ibid.

[3] "Japan Braces for Boom in Commercial Aviation," Aviation Week and Space Technology, June, 1970, p. 23.

The littoral zone off Osaka is to be chosen for the site of the New Kansai Airport. Indications are that Osaka Bay, particularly an area to be reclaimed off the Hanshin (Osaka-Kobe) coast will be selected as the site for the second international airport. Flight operations totaling 175,000 per year are said to be the capacity of the present Osaka International Airport. Predicted growth is anticipated to surpass its capacity within a few years. Further expansion of the present Osaka International Airport is not feasible since the area is densely populated and the population is making strong complaints against the jet aircraft noise. The Kansai site was selected with consideration given to making aircraft fly over nonresidential areas to prevent the noise problem of takeoff and landing. Another factor was that the site should be within an hour's access of the heart of Osaka by car or train.[1]

Under the five-year program, which began in fiscal year 1967, a total of $319 million is to be spent to improve major domestic and international airports in Japan, excluding the new Tokyo International Airport, which is to be developed under a separate program. Both the existing Tokyo International Airport and Osaka airport will have a new 3,000-meter runway, and the Haneda runway will be extended to 2,500 meters, permitting large jets to land on westbound

[1] "Littoral Zone Off Osaka, Kobe Likely to Be Chosen," Mainichi Daily News, January 4, 1971, p. 1.

trips. In addition, electronic navigation aids are expected to be improved considerably.

To provide a part of the funds needed for airport improvement, measures will be taken to fix the rate of airplane passenger transportation tariff at 10 per cent, and to raise landing charges by 20 per cent.

When the New Tokyo International Airport has been completed at Narita, Chiba Prefecture, in 1978,[1] it will cover an area three times that of Tokyo International Airport at Haneda and will be as big as Heathrow Airport in London. The successful clearance of anti-airport farmers and students on September 15 is believed to have paved the way for opening of the airport's 4,000-meter main runway in mid-1971, thus completing phase one. The new airport, when completed, will have two additional runways 2,500 and 3,200 meters long. The aircraft parking areas will be able to accommodate 230 of the DC8 class aircraft, and the car parking area will have the capacity for 12,000 cars. These facilities were designed to meet the expected increase in the airport's air traffic, which by 1976, it is estimated, will include 5,400,000 passengers and 410,000 tons of cargo. The second phase of the project is scheduled to start next fiscal year with expansion of the terminal area. Completion date has tentatively been set for fiscal 1978. However, there remain

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[1] "Statistics on New Airport Revealed," The Japan Times Weekly, September 25, 1971, p. 2.

more than thirty farmhouses whose plots are yet to be purchased by the airport corporation.[1]

The area of Sarizuka of Narita was officially decided as the airport site by the Japanese Cabinet on July 4, 1966, and the New Tokyo International Airport Corporation was established that month. The corporation started negotiations with landowners in September, 1966, to buy plots measuring a total of 670 hectares.

The airport corporation asked for and obtained authority from the Construction Ministry and the Chiba Prefectural Eminent Domain Commission to employ the Eminent Domain Law to expropriate the remaining plots of land in December, 1969.[2]

The Ministry of Transport has planned for a major buildup of airports over a six-year period, which commenced in fiscal 1970, to meet the projected increase in civil air transport demand. The MOT intends to spend ¥660,000 million (approximately $1,833 million) for the programmed modernization and airport expansion and envisages establishment of a special account for carrying its plans through.

The program, aside from establishment of the New Airport in Kansai (Osaka-Kobe) area and a pilot training field, aims at revamping the existing airport facilities to enable them to cope with the advent of the era of jumbo jet

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[1] Ibid.

[2] Ibid.

planes. To provide revenues for its projected new special account for funding airport improvements, MOT suggests imposing on next year's budget a transit tax. Along with this, it hopes to acquire funds from the General Account to partially fund projects of a public character concerned with a civil air transport, such as relating to air traffic control and noise abatement.

According to the Ministry, the number of passengers utilizing international and domestic airlines in and after 1968 is due to increase by an average of 22 per cent yearly to reach 153 million in fiscal 1975.[1] At this rate, the number of landings and departures from Tokyo International Airport at Haneda will quadruple by fiscal 1975.

Its six-year program is thus designed to cope with such a projection. By 1975, Japan's international airports will efficiently handle the predicted numbers of supersonic transports and provide complete instrument landing approach systems for their operations. The airport improvements will also facilitate operation of the so-called airbuses, such as DC-10's and L-1011's, which will carry up to 330 passengers.[2] The improvements will also enable provincial airports, such as those in Kagoshima, to accept operation of airbuses.

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[1] "MOT Hopes to Enlarge Airports for Coping with Rising Demand," Nihon Keizai Shimbun, December 2, 1969, p. 12.

[2] Ibid.

To keep pace with the projected passenger and cargo volume, Japan Airlines programmed the establishment of a computer-operated coordinated cargo handling system at the New Tokyo International Airport under construction at Narita, Chiba Prefecture. The computerized cargo handling system is being installed by Tokyo Shibaura Electric and is designed to be capable of simultaneously processing enough air freight to fill three jumbo jet cargo liners and one ordinary one. Utilization of the computerized cargo handling system will reduce cost-per-ton handling costs to one-fifth, limit personnel requirement to 1.8 times, and raise labor productivity 450 per cent as compared with the initial operating year.[1]

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[1]"JAL to Construct Terminal for Cargo at New Airport," Nihon Keizai Shimbun, June 17, 1969, p. 22.

CHAPTER III

JAPANESE CIVIL AVIATION

The Japanese Civil Aircraft Industry, General

The Japanese civil aviation industry currently faces a major policy decision. The government-industry establishment has planned that the Japanese civil aircraft industry, headed by the Nihon Aeroplane Manufacturing Company (NAMCO has no production facilities and is limited to a development, design, and sales role), will build a pure jet transport successor to the turbo jet YS-11.[1] The questions of what type of jet to produce and whether to produce the aircraft and its engines in cooperation with foreign manufacturers are still undecided. After a series of go-it-alone endeavors and equally unsuccessful discussions with European manufacturers, NAMCO is considering an offer by Boeing for a joint effort to build a medium-sized short-range jet. The ultimate decision on this proposal could have major implications for United States aircraft and engine sales.

The fact that Japanese air transport has recorded a phenomenal increase in the past ten years attests the

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[1] "Future Course of Japanese Civil Aviation Production," Department of State Airgram A-1246, April 10, 1970, p. 2.

potential for the industry. The passengers on both domestic and international lines have increased to thirteen times those of ten years ago. As for domestic air cargo, a tremendous increase of twenty-three times, and international cargo of 276 times, was recorded. The Transportation Policy Council predicts that in 1985 passengers on domestic lines will reach 120 million, and those on international lines will increase by nineteen times, to 40 million.[1] The following is a breakdown of domestic passengers carried by domestic carriers during calendar year 1970:

TABLE 1

DOMESTIC PASSENGERS CARRIED BY DOMESTIC CARRIERS
1970

Airline	Passengers (in thousands)	Percent of Increase[a]
All Nippon Airways	7,608 (50%)	41%
Japan Air Lines	4,773 (31%)	33
Japan Domestic Airlines	1,701 (11%)	43
Toa Airways	1,126 (8%)	17
Total	15,208 (100%)	37

[a]Increase over calendar year 1969.

Source: "Civil Aviation: All Nippon Airways Annual Report and Proposed Five Year Program for JFY 1971-75," Department of State Airgram A-210, March 23, 1971, p. 1.

[1]"Aircraft Industry at the Crossroads," MERI's Monthly Circular, June, 1970, p. 5.

Expansion of air transport has prompted an increase in demand for aircraft, and changes in specifications of aircraft have been brought about as a result of this phenomenal expansion. Currently, advancements in the size and speed of aircraft constitute the main trend. Jumbo jet (500-passenger configuration) and airbus (350-passenger) represent the large size of aircraft which are contemplated to be employed even on local shuttles. SST, supersonic transports, which are now under trial production, represent the ultimate in high-speed aircraft. The all-jet liner has been advancing into the local lines, which formerly were the market for turboprops.

The changing of markets and the rapid development in the aircraft industry concerning the size and speed of jet transports should permit Japan to insert herself in the world market. For example, by mid-1965 the Japanese had developed the YS-11 passenger plane, and 151 of these modern turboprop STOL (short takeoff and landing) aircraft have been sold at home and to such foreign countries as the United States, Canada, Brazil, Argentina, Chile, Greece, South Korea, and Nationalist China.[1] Development of the next transport, tentatively called the YX, was commenced in 1967 by NAMCO.[2] Japan's aircraft industry

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[1] Ibid.

[2] Additional details concerning the YS-11 and other future aircraft to be developed by NAMCO and the role of government in the aerospace industry are found in Chapter IV.

could become prosperous depending on the successful development and marketing of this aircraft.

When civil aviation was reinstated in Japan in 1951, many small carriers were established. In 1953, the Government of Japan took over 58 per cent of Japan Airlines (JAL) and gave JAL the sole right to international and domestic trunk service. The trunk route, which connects Sapporo, Tokyo, Osaka, and Fukuoka, encompasses 70 per cent of Japan's domestic air traffic.[1]

Over the years the number of local private carriers gradually decreased because of mergers and absorptions. The Japanese government encouraged these consolidations and gave the largest carriers that emerged the right to serve the trunk routes. In 1958, several private airlines merged to form All Nippon Airways (ANA), and ANA was given the right to provide trunk route as well as local service. In 1964, three of the remaining local carriers merged to form Japan Domestic Airways (JDA), and in March, 1965, JDA also was given limited participation in the trunk-route service.

Prior to the latest mergers, there were four major airline companies in Japan.[2] They were Japan Airlines (JAL), All Nippon Airways (ANA), Japan Domestic Airlines

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[1]Department of Commerce, World Survey (1968), p. 5.

[2]"Civil Aviation," Industrial Review of Japan, 1971, p. 86.

(JDA), and Toa Airways. Of these four firms, only JAL operates international routes in addition to domestic trunk lines linking Sapporo, Tokyo, Osaka, and Fukuoka. ANA operates domestic trunk lines and a wide network of local routes.

JDA and Toa Airways operate only local lines with JDA operating primarily in eastern Japan, while Toa concentrates its operations in the western part of the country.

In June 1966, JDA and JAL signed an agreement calling for the merger of the two airlines by April 1971. JAL agreed to take over JDA's domestic trunk route service as of July 1966, and help JDA rationalize its local route structure and improve its financial structure. Subsequently, ANA and Toa Airways, the largest of the remaining feeder carriers, reported they would merge. It is expected that Nagasaki, the only other scheduled carrier, will eventually merge with ANA.

In the following sections of this chapter each major airline will be individually examined, with the final chapter addressing the Japanese Air Self Defense Force (JASDF).

Nonscheduled services and general aviation are not extensive in Japan. There are less than fifty nonscheduled service and general aviation operators in Japan.[1] These

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[1] Ibid., p. 87.

operators do not receive a government subsidy. Industrial and nonindustrial aerial services, particularly agricultural spraying, constitute the major activities of general aviation in Japan. There are approximately 360 airplanes and helicopters engaged in such services. It is estimated that the demand for such services will increase at a rate of 15 per cent per year.[1] Private flying is extremely limited in Japan. The government, which has done little to promote general aviation in the past, recently announced plans to build Japan's first general aviation airport in Chofu. At present, general aviation is discouraged from using the larger airports and is largely restricted to the small local airports. The government provides encouragement but no subsidies to the twelve aero clubs that are active in Japan. The government does subsidize the training of commercial airline pilots; however, it does not subsidize the training of general aviation pilots.[2]

Japan Air Lines

The original (post-World War II) Japan Air Lines (JAL) was organized by private interests in 1951 with equipment leased from Northwest Orient Airlines. The new JAL was reorganized in 1953[3] after signing a bilateral air

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[1]Department of Commerce, World Survey (1968), p. 5.

[2]Ibid., p. 6.

[3]Enclosure to "Civil Aviation, Japan Airlines Annual Report and Proposed Five Year Plan," Department of State Airgram A-84, February 8, 1971, p. 68.

transport agreement with the United States. The new company was awarded a trans-Pacific route and took over the domestic services of its predecessor, with the government holding a 50 per cent ownership of its stock. JAL received its first jet equipment in 1960 by acquiring four DC-8's. A second order, for six additional DC-8's and four CV-880's (Convair), was placed at year-end 1963, and, to meet the associated financial requirements, the government increased its holdings to 55 per cent, ultimately increasing them to 58 per cent.[1]

Japan Air Lines is now flying into all the major countries of the world. JAL serves Southeastern Asia, Australia, the Middle East, Europe via polar and southern routes, and the United States. JAL began service to New York, via San Francisco, in November 1967, thus becoming the fourth airline in the world to provide round-the-world service. The company ranks eighth among all the world aviation companies in terms of total revenue.[2] JAL estimates that the numbers of international and domestic passengers carried on its scheduled flights during calendar year 1970 increased by 28 and 33 per cent respectively over the preceding year, while cargo tonnage increased by 19 per cent. New services inaugurated during 1970 included an independent Tokyo-Paris-London service via Moscow, terminating the joint Aeroflot/JAL trans-Siberian operation between Tokyo

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[1] Ibid.

[2] "Civil Aviation," Industrial Review of Japan, 1971, p. 86.

and Moscow. This independent JAL flight operates twice a week and reduces the flight time between Tokyo and London to thirteen hours. Most of JAL's world competition operates the polar route between Japan and Europe and thus is at a disadvantage with JAL's Tokyo-Paris-London via Moscow route.[1] A Tokyo-Guam service began in October 1970, and all-cargo services to Europe (via India), Hong Kong and Seoul were also inaugurated in 1970. By the end of 1970, JAL was operating a total of forty-seven weekly round-trip trans-Pacific flights (including all-cargo flights).

To meet continued strong domestic traffic growth, JAL introduced 234 passenger DC8-61's on its domestic trunk service (Fukuoka-Osaka-Tokyo-Sapporo) in 1970.[2] Within the next few years, air buses will be introduced to meet the growing demand, and at the same time alleviate airport congestion problems. Japan Air Lines plans the introduction of airbuses into its domestic trunk lines prior to its short-distance international services. JAL has changed its original plan to transfer the surplus part of its growing fleet of jumbo jets to its domestic flights next year. The jumbo jets are now used for international flights or their shorter-range versions. JAL has changed the plan in favor of adoption of larger short-range jets of the

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[1] "JAL Plans Extension of Moscow Flights to London and Paris," Nihon Keizai Shimbun, June 24, 1969, p. 14.

[2] "Civil Aviation, JAL Annual Report," Airgram, February 8, 1971, p. 2.

airbus type to avoid the possibility of serious environmental noise problems caused by jumbos in and around domestic airports. It has taken into account the fact that All Nippon Airways Company, a domestic airline, has already decided to introduce airbuses.

JAL's fleet of jumbo 747's will increase to eight this year, part of which were to have been commissioned into its Tokyo-Sapporo and Tokyo-Fukuoka trunk flights.[1] There are several airbus choices for JAL, including the DC-10, Lockheed 1011 of the United States, and a rival British aircraft (BAC). JAL's present mainstay liners are DC-8's.

In its five-year program, JAL estimates that international passengers and air cargo will increase at annual rates of 22 and 32 per cent respectively during fiscal years 1971-75. International passengers are expected to increase from 3.4 million in fiscal year 1970 to 9.2 million in fiscal year 1975, and air cargo from 120,000 metric tons to 450,000 metric tons. To meet this demand, JAL proposed to enlarge its fleet from the current sixty-one aircraft (including three jumbo B747's) to eighty-seven, including forty-seven jumbo type aircraft (which include air buses) and two Concord SST's in fiscal year 1975.[2] During the

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[1]"Airbus Use Eyed by JAL," Nihon Keizai Shimbun, December 15, 1970, p. 20.

[2]"Civil Aviation, JAL Annual Report," Airgram, February 8, 1971, p. 2.

coming five-year period JAL will also seek the following new routes: Tokyo-Great Circle-Chicago-New York; Tokyo-Djakarta service extended to Bali Island; Tokyo-Guam service via Saipan; service to Nairobi; and increased South Pacific service.[1]

Although JAL's five-year plan does not detail how its expansion (estimated to require some $1.31 billion) is to be financed, shortly after the issuance of the report the press in Tokyo reported that JAL will raise some fifteen billion yen (approximately $42 million) through sales of convertible bonds during fiscal year 1971. JAL reportedly sought additional government investment (the government of Japan currently has a 50 per cent equity in JAL), but this approach was rejected by the Ministry of Finance, as the government of Japan reportedly does not intend to subscribe to the bond issue. If convertible bonds totaling fifteen billion yen are issued and converted to common stock, the share of the government of Japan in JAL would decline to approximately 36 per cent.[2]

During late 1969, the government of Japan released over two million shares of JAL stock to the public, thereby reducing its then 53.3 per cent ownership to 50 per cent. That was the second time within a year that the government of Japan had sold a portion of its JAL stock ownership.

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[1] Ibid., p. 6.

[2] Ibid., p. 2.

The release was apparently intended to provide for subscribing to JAL's capital increase with the least possible budgetary burden. The shares, when released, were sold at a price of ¥1,430 (approximately $3.97) each. The released shares adjusted the balance of shares of stock of the government of Japan so that the government's new total was 50 per cent of JAL's outstanding stock.[1] The government obtained approximately ¥3,010 million $8.3 million) from the release, but it had to pay approximately $8.9 million to subscribe to a 20 per cent increase in JAL capital. The shortage was covered with a budgetary disbursement. JAL paid-up capital now stands at $104.9 million.[2]

During Japan's fiscal year 1970, JAL leased four DC-8-33-type aircraft with crew (wet charter), two from British World Airways and two from Trans-International of Honolulu. The mounting costs of fleet expansion coupled with Japan's pilot shortage were the primary reasons for this leasing action.[3]

The high demand for Japanese air transport service has been continuous since 1967, and the annual

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[1] "Government Releases to Public Over Two Million Shares of JAL Stock," Nihon Keizai Shimbun, September 16, 1969, p. 13.

[2] "Government Ministries in Opposition to Boosting Japan Air Line Capital," Nihon Keizai Shimbun, November 25, 1969, p. 14.

[3] "JAL to Lease British and U.S. Jets, Crews," Nihon Keizai Shimbun, December 2, 1969, p. 13.

growth rate has been 32 per cent in recent years. Thus the passenger and air cargo demand has assured the feasibility of JAL's jumbo B-747 operations. B-747's were first introduced in the Tokyo-Honolulu and Tokyo-Los Angeles via Honolulu service in fiscal year 1970 with three of the jumbo B-747's.[1] During the next year, five additional B-747's were obtained from Boeing in the United States.

JAL plans to expand its B-747 service during fiscal year 1971 in the Tokyo-San Francisco via Honolulu service and in some sections of the Southeast Asian service; in fiscal year 1972, in the Tokyo-New York service via Honolulu and San Francisco; in fiscal year 1973, in the Europe and Trans-Atlantic services; in fiscal year 1974, in the Okinawa service and other Southeast Asian services; and in fiscal year 1975, in the Tokyo-Sidney-Auckland service.[2] By the time this expansion plan is completely attained, JAL will be operating eighty-one weekly both-way flights across the Pacific, about double the current fiscal-year level of forty-two.[3]

JAL and Japan's other airlines all have the mutual problem of pilot shortages. Included in JAL's operations is the training of pilots who will fly its B-747 jetliners

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[1] "Civil Aviation, JAL Annual Report," Airgram, February 8, 1971, p. 6.

[2] Ibid.

[3] "JAL Discloses 5-Year Plan for Jumbo Jets," Nihon Keizai Shimbun, January 7, 1971, p. 11.

on a computer-controlled flight simulator. The simulator, controlled by the most modern third-generation digital computer, is equipped with an advanced motion system that reproduces the experience of actual flight.[1]

Valued at ¥850 million, the simulator was produced by Conduction, Incorporated, of St. Charles, Missouri. It has been installed in the JAL Flight Training Center at the Tokyo International Airport. Although the flight simulator cost JAL ¥900 million to set up, the simulator will eventually save training expenses, as the simulator costs only one-fifth as much as flight training on the aircraft. (Actual B-747 flight training costs as much as ¥3,000 million.) Simulator training will ultimately account for 80 per cent of flight training for Japan Air Lines.[2]

On the basis of the plans announced by the Ministry of Transport in 1966, Japan's airlines would be reduced to four: Japan Air Lines, All Nippon Airways, Japan Domestic Airlines, and Toa Airways.[3] It has since been approved by the Cabinet that All Nippon Airways would eventually merge with Toa Airways, and Japan Air Lines would merge with Japan Domestic Airlines. This would mean that only two aviation firms would then be in operation, with JAL engaged

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[1] "JAL Begins Training of Pilots Using Jumbo Flight Simulator," Japan Economic Review, May 15, 1971, p. 13

[2] Ibid.

[3] "Civil Aviation," Industrial Review of Japan, 1971, p. 86.

in only domestic services. Recently, however, a new plan has been advanced by leaders in the government and aviation industry to set the number of domestic airline operators at three instead of two. Accordingly, JAL and ANA would be left as they are, while Toa and JDA would be merged to operate the same domestic route as ANA.[1] This proposal now has wide acceptance, and JDA and Toa are now in merger negotiation. It is anticipated that these two firms will merge by 1972, and the Japanese sky will be divided by three aviation firms: JAL, ANA, and the newly merged firm, to be called Toa Domestic Airlines (TDA).

On the basis of JAL's study and proposed five-year plan (Japan's fiscal years 1971-75), JAL's share of international passengers and cargo to and from Japan is estimated to increase as follows:[2]

	FY 71	FY 72	FY 73	FY 74	FY 75
Passengers	37%	28%	28%	25%	26%
Cargo Tonnage	51%	38%	34%	33%	33%

(Figures are percentage increases over previous year.)

JAL estimates that domestic passengers will increase at an annual rate of 24 per cent. Because of airport congestion, larger passenger capacity aircraft will be introduced. All B-727's will be retired from service in

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[1] Ibid.

[2] "Civil Aviation, JAL's Annual Report," Airgram, February 8, 1971, pp. 6, 7.

fiscal year 1972 and replaced by 234-passenger DC-8-61's. In addition, air buses will be introduced in fiscal year 1972.

JAL expects, during the five-year period, to operate the fleet shown in Table 2, including leased aircraft but excluding aircraft used solely for training.

TABLE 2

JAPAN AIR LINES' ANTICIPATED FLEET, 1971-75

	Fiscal Year				
	1971	1972	1973	1974	1975
Boeing 747	6	14[a]	23[a]	33[a]	42[a]
Boeing 747F	-	-	-	3	5
DC-8-30	4	3	-	-	-
DC-8-50	11	11	8	6	5
DC-8-62	10	10	10	10	10
DC-8-61	16	16	16	13	13
DC-8-50F	4	3	5	3	3
DC-8-62F	2	5	5	5	5
Boeing 727	8	8	-	-	-
YS-11	2	2	2	2	2
Concord SST	-	-	-	-	2
Total	63	72	69	75	87

[a]Includes airbuses.

Source: "Civil Aviation, JAL Annual Report and Proposed Five-Year Program for JFY 1971-1975," Department of State Airgram A-84, February 8, 1971, p. 9.

The number of pilots and co-pilots flying for Japan Air Lines is expected to increase from 800, including 200 foreigners, in fiscal year 1971 to 1,300, including 250 foreigners, in fiscal year 1975.

JAL's revenue is expected to increase from 210 billion yen ($590 million) in fiscal year 1971 to 530 billion yen ($1,480 million) in fiscal year 1975 if the proposed plans are realized.[1]

All Nippon Airways

The privately owned All Nippon Airways Company Limited (ANA) has become the largest domestic carrier in terms of passengers carried, through the amalgamation of several small carriers. All Nippon Airways was organized in 1958 after the merger of Far East Airlines and Japan Helicopter and Aeroplane Transport Company. The latter two companies had been founded to provide local feeder service after the 1952 Japanese Peace Treaty. In 1958, ANA carried less than half the number of passengers that JAL carried on its domestic routes. However, by 1962, ANA with improved fleets of F-27 and Viscount aircraft and new services had begun to catch up with JAL domestic traffic.[2] All Nippon Airways took over Fujita Airlines in 1963 and Central Japan Airlines in 1965. Negotiations have been underway since

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[1] Ibid., p. 9.

[2] Department of Commerce, World Survey (1968), p. 7.

1966 regarding a merger with Toa Airlines and Nagasaki Airlines. However, operations in 1966 diminished, with a 13 per cent drop in passengers carried and an 18 per cent drop in load factor. Stiff competition from railroads on the Tokyo-Osaka line and two serious accidents involving the loss of one YS-11 and one B-727 were cited as contributing to the decreased demand for ANA service. In the light of this temporary setback, merger negotiations were broken off and a new organization and management evolved. In mid-1967, ANA initiated plans for medium-haul international service proposed for early 1968. By year-end 1967, ANA reported improved monthly traffic figures but continuing stiff competition from the railroads.

The Ministry of Transport, in mid-1969, announced major portions of a six-year aviation policy which included approval for All Nippon to begin operation of short distance international air routes.[1]

ANA announced a record year during fiscal year 1970, ending March 31, when it reported having carried a total of 8,030,000 passengers, an increase of 35 per cent over the previous year.[2] It was the first time the leading domestic airline had carried more than eight million people in a twelve-month period. The announcement noted that the sharp

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[1] "Aviation Policy Covering 6 Years Drawn Up by MOT," Nihon Keizai Shimbun, June 10, 1969, p. 15.

[2] "ANA Carried 8,030,000 in Fiscal '70," Japan Times, April 4, 1971, p. 12.

rise in the number of passengers carried was due chiefly to the world exposition held in Osaka in March through September, 1970.

ANA operated a total of seventy-seven aircraft as of December 1970, as compared with sixty-four the previous year. Of the 1970 total, twenty-two were jet aircraft. The ANA jet fleet will be increased to thirty-three aircraft by December 1971; the new jets to be added include eight 178-passenger B-727-200's for trunk service and three 115-passenger B-737's for feeder service. Seven F-27's will be retired from service upon introduction of the B-737's. The ANA purchase of eleven jet liners from Boeing totaled ¥30 billion (approximately $83.3 million) in fiscal year 1971. It was the first such large purchase by ANA and constituted a rare case for airlines throughout the world.[1] Some air industry spokesmen were critical of ANA's latest purchase. They pointed out that the purchase is going to cause a heavy financial burden to the company, since the down payment alone requires six billion yen (approximately $16.4 million). There is also the problem of obtaining the additional pilots because of the industrywide shortage. ANA's immediate financial position was alleviated when the Export-Import Bank of the United States signed a $24 million

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[1]"All Nippon Airways Buys Boeings," Nihon Keizai Shimbun, July 14, 1970, p. 7.

letter of credit to finance the proposed purchase of six 737 jets from Boeing.[1]

As a first step into the international field, agreement on joint charter services to Hong Kong was reached between ANA and JAL on January 18, 1971. Flights commenced in February 1971, and initially will be limited to twenty-four round-trip flights during a six-month period utilizing wet-lease Boeing 727's from JAL for the charter flights between Japan and Hong Kong.[2]

All Nippon plans to acquire ninety jet airliners by 1975 under its new five-year plan, to commence in fiscal 1971,[3] which will require an estimated ¥300 billion (approximately $833 million). During the five-year period, ANA intends to increase the number of jet planes, now thirty-three, by more than ten planes annually so as to have a total of ninety, including eighteen air buses, by 1975. In the latter part of fiscal year 1972, it is planned to receive the first three airbuses. The decision regarding which type of airbus is to be introduced should be made in the near future. At present, the B-747-SR (maximum capacity 537 seats), DC-10 (maximum capacity 345 seats), and the Lockheed L-1011

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[1] "ANA Secures U.S. Credit," Nihon Keizai Shimbun, March 10, 1970, p. 11.

[2] "All Nippon Airways and Japan Airline Agree on Charter Service to Hong Kong," Department of State Airgram A-49, January 22, 1971, p. 1.

[3] "ANA Target for 1975 is 90 Jet Airliners," Nihon Keizai Shimbun, March 3, 1971, p. 12.

(maximum capacity of 345 seats) are being considered.

Of its planned outlay, ANA intends to earmark roughly ¥200 billion[1] (approximately $556 million) for purchasing the airliners and spend the remaining on airport improvement and pilot training. ANA plans to buy twenty-five more 727-200 series jets during the five-year period, bringing the total of 737's to thirty-seven. The present fleet of F-27's and YS-11A-200 medium turboprops will be phased out of service and converted into cargo aircraft.[2] ANA estimates that cargo traffic will reach 150,000 tons on its domestic network in Japan by 1975, and forecasts that the number of domestic air passengers will reach forty million in 1975.

For financing such an extensive program, ANA is expected to double its capitalization at least twice and to rely heavily on loans from foreign commercial banks. ANA estimates its revenue will reach ¥22,000 million in the final year of the five-year plan.

ANA will be operating a total of 109 aircraft, including eighteen airbuses in fiscal year 1975; 97 per cent of ANA's total services will be operated by jet in that year, and local cities will be within an hour's range of

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[1] Ibid.

[2] "ANA to Fleet Up Under 5-Year Plan," Japan Times, January 4, 1971, p. 11.

either Tokyo or Osaka.[1] It is projected that in fiscal year 1975, ANA will be carrying 26 million passengers, or 3.3 times that of fiscal year 1970, equating to 65 per cent of Japan's total domestic passenger demand.[2] ANA's annual passenger growth rate is estimated at 27 per cent during the five-year period. The growth rate beyond 1975 is likely to decline because of the construction of the Sanyo high-speed train to Fukuoka, a bridge to Shikoku, a tunnel to Hokkaido, and a national motor throughway-expressway will be completed around that year.

On the basis of the current five-year plan, ANA expects to operate the fleet shown in Table 3.

TABLE 3

ALL NIPPON AIRWAYS' ANTICIPATED FLEET, 1971-1975

	1971	1972	1973	1974	1975
Air Bus	0	3	6	10	18
B-727-200	13	20	27	31	33
B-727-100	7	4	4	4	4
B-737	13	18	24	31	35
Total jets	33	45	61	76	90
YS-11	30	30	30	25	19
F-27	18	7	0	-	-
Total aircraft[a]	81	82	91	101	109

[a]Does not include about 30 helicopters.

Source: "All Nippon Airways Annual Report and Proposed Five Year Plan," Department of State Airgram A-210, March 23, 1971, p. 7.

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[1]"All Nippon Airways Annual Report and Five Year Plan," Department of State Airgram A-210, March 23, 1971, p. 6.

[2]Ibid.

ANA's trunk service will be operated mainly by 178 passenger B-727-200's and air buses in fiscal year 1975. Three air buses with a capacity of 350 to 500 seats each will be introduced for the first time in the latter part of fiscal year 1972. In an effort to reduce airport congestion, larger jets carrying maximum numbers of passengers will be operated at less frequent intervals. Eighteen airbuses (assuming each aircraft carries 350 passengers) are expected to be required in ANA's trunk service in fiscal year 1975. At that time it is expected that a total of 19 additional feeder airports will be available for jet service. The feeder services will be operated mainly by B-727-200's and 115-passenger B-737's. Air buses will be introduced for service to Kagoshima, Miyazaki, and Kumamoto during the 1974-1975 fiscal period.

When the five-year program is completed in fiscal year 1975, ANA will be operating on sixty-nine routes, in contrast to fifty at present. The average annual load factor[1] is anticipated to decline from 72 per cent in fiscal year 1970 to 63 per cent in fiscal year 1975. The number of ANA pilots will be increased from the current 543 to 1,085 in fiscal year 1975.

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[1] Ibid., p. 9.

Japan Domestic Airlines

Japan Domestic Airlines Company Limited (JDA) was formed in March, 1964, out of the merger of North Japan Airlines (NJA), Nitto Air Lines, and Fuji Airlines.[1] NJA had provided regular air service on Hokkaido, the northernmost island of Japan. Nitto provided feeder service between Osaka and small local airports, and Fuji operated irregular routes out of Tokyo to the south and north. As a result of the merger, JDA concentrated on services within Hokkaido and from Osaka and Tokyo to smaller towns.

Japanese Domestic Airlines, although granted limited frequency trunk routes, consistently lost money and, as a result of competitive factors and an overly optimistic fleet expansion program, found itself in financial difficulties by year-end 1965. The Japanese government subsequently ordered JDA to withdraw from domestic trunk routes by mid-1966. JDA then made plans to standardize its fleet with YS-11 aircraft; this fleet rationalization was completed in 1969. JDA operated at the time of its merger with Toa the following aircraft:

Turboprop YS-11	17
Helicopters:	
Bell 47	16
Bell 204	2
Total	35

[1]Department of Commerce, World Survey (1968), p. 8.

Japan Domestic Airlines and Toa Airways merged on May 25, 1971, to become known as Toa Domestic Airlines (TDA). Details of the merger are discussed in the section addressing Toa Domestic Airlines.

Toa Airways

Toa Airways, based in Hiroshima, provided local scheduled and chartered services.[1] It was formed through amalgamation of several smaller carriers and sought merger with ANA. The main routes served by Toa were between Hiroshima and Osaka and between Osaka and Yonaga. Prior to Toa's ultimate merger with JDA, her fleet consisted of twenty aircraft: eight YS-11, five Convair 240, five DH Heron, and two Beechcraft. Toa had not been operating at a profit subsequent to 1965.

Toa Domestic Airlines

Toa Domestic Airlines (TDA), Japan's third largest scheduled carrier, started business officially on May 15, 1971, with a combined capital of ¥9,570 million ($26 million).[2] The airline was formed by a merger between Japan Domestic Airlines and Toa Airways, third- and fourth-ranking respectively among Japan's four airlines, following JAL and ANA. During fiscal year 1970, the two airlines had carried a total of 2,827,000 passengers.

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[1] Ibid., p. 8.

[2] "Toa Domestic Airlines," Department of State Airgram A-393, May 21, 1971, p. 1.

The new airline is headed by Goro Tominaga, currently senior managing director of JAL.[1] The current president of Toa, Yaichi Shimomura, is chairman of the board of TDA. Members of the board include the president of Tokyu Railways (a leading private railway and department store enterprise) and the president of Fuji Sash Manufacturing Company (the latter two companies being major shareholders in JDA and TDA respectively). Under the merger agreement, Tokyu Railways will be the largest individual shareholder in the new airline (with 26 per cent interest), followed by JAL (9 per cent), Kinki Railways (8 per cent), Hanku Railways (6 per cent), Fuji Sash Manufacturing (5 per cent), Sankei Newspaper (4 per cent), and various financial institutions.

TDA, with a total fleet of twenty-nine YS-11's and two Herons, operates on fifty-three scheduled routes nationwide.[2] It also engages in general aviation activities with seventeen helicopters. Three Boeing 727's, which had been owned by JDA and leased to JAL, will continue to be leased to JAL since TDA is authorized to provide limited service only on trunk routes.

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[1] "Japan Domestic Airlines (JDA) and Toa Airways (TOA) Agree on Merger," Department of State Airgram A-8, January 7, 1971, p. 1.

[2] "Toa Domestic Airlines," Airgram, May 21, 1971, p. 1.

Helicopter Services and Brief Summary of Domestic Production

There are presently eighteen helicopter operators in Japan, with a combined fleet of over 160 aircraft.[1] Four firms--All Nippon Airways, Asahi Helicopter Company, Nippon Agricultural Helicopters Company, and Toa Domestic Airlines--operate more than twenty helicopters each and dominate the industry.

Helicopter airframe production in Japan is limited to three major prime manufacturers: the aircraft divisions of Fuji, Kawasaki, and Mitsubishi Heavy Industries. While a number of domestically-designed aircraft have been produced, or are in development, since the industry began its revival in 1952, the nation's helicopter program is limited primarily to the licensed production of basic United States designs. Production rates are minimal--one a month in some instances. The limited production has included the following:[2]

Fuji-Bell 204-B/UH-1B.--Fuji is manufacturing Bell model 204-B and UH-1B helicopters under sub-license to Mitsui and Company Limited (Bell's legal licensee). The first two Fuji-built 204-B's were placed in service with Asahi Helicopter Company and All Nippon Airways in the spring of 1966. In addition, the Japan Ground Self Defense Force placed

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[1]Department of Commerce, World Survey (1968), p. 9.

[2]Cecil Brownlow, "Japan Lags in Helicopter Design," Aviation Week and Space Technology, January 19, 1970, p. 11.

orders for thirty-six of the Fuji-built UH-1B's in 1966, of which twenty-six had been delivered by October of that year. The Third National Defense Program includes orders for fifty-three more for a total of eighty-nine to be delivered by 1971. The Fuji-Bell 204-B and UH-1B are identical with the versions of these aircraft built by Bell Helicopter Company.

Mitsubishi Heavy Industries, Ltd. (MHI) (Sikorsky) S-55, S-61, S-62.--Mitsubishi (MHI) has been producing Sikorsky S-55 helicopters in Japan under a licensing agreement since 1955, and it has produced about fifty-five. Mitsubishi also holds license agreements to manufacture the Sikorsky S-61, Sh-3A, and S-62 helicopters. By April 1967, eighteen S-62's had been delivered for civil and military use. Two S-61's have been delivered for civil use, and delivery of the first fifty-five SH-3A's for the JMSDF commenced in March 1964, with the remainder scheduled to follow into service by 1972.[1]

Kawasaki - Vertol 107 Model II and Kawasaki KH-4.--Kawasaki has exclusive rights to manufacture and sell the Boeing-Vertol 107 Model II helicopter in Japan. The first KV-107 was produced by Kawasaki under this license in 1963 and was delivered to Kanki Airlines in February. Subsequent deliveries have included one more for Kanki Airlines, forty-seven for Thailand, two for the JMSDF, one for New York

[1] Ibid.

Airways, and two for Pan American for operation by New York Airways. Six were delivered to the JGSDF and another six ordered in 1966. Four were ordered for the JASDF during 1966. Another forty-five KV-107's were included in the Japanese Defense Agency's five-year program covering 1967-1971.

In addition, Kawasaki has developed from the three-seat Bell Model 47G-3B the KH-4, a four-seat, light general-purpose helicopter. The prototype flew in 1962, and a total of 110 KH-4's had been built by May 1967.[1]

At least 50 per cent of Japan's commercial helicopter market has been for agricultural applications, with variants of Kawasaki-produced Bell 47's accounting for the majority of sales. The eighteen private operators bid among individual farmer cooperatives for agricultural helicopter spray work. Their charges are determined by the Association for Aerial Agricultural Operations, within the Ministry of Agriculture, after negotiations between the contractor and the farmer customer. The peak season for such work in Japan is July and August, when about 160 commercial helicopters are engaged in dusting the country's rice crop as it begins to mature after a June planting.

A discussion in Chapter IV of each major aviation licensee will include additional details concerning Japanese helicopter airframe production.

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[1] Ibid.

Aerospace-Related Activities of the Japanese Self Defense Force

The concluding section of this chapter will detail briefly the aerospace activities related to the Japanese Self Defense Force (JSDF). Fortunately, the Japanese aircraft industry has made significant progress while supported by the national defense procurement. The JSDF provided the impetus for the new aviation industry by initially providing overhaul contracts for United States military aircraft and the subsequent manufacture under license agreement of military and civil versions of United States designed aircraft; namely, the T-33, F-86, P2H, F-104, and Sikorsky, Vertol, and Bell helicopters.[1]

As recently as 1969 it was noted that Japan's aircraft industry was beginning to change its interest again to the defense phase. This was because demand for various types of aircraft were beginning to increase under the nation's defense build-up programs and the production peak of Japan's first postwar airliner (the YS-11) for private use appeared to have passed. This trend appears to be continuing as the Japan Economic Journal reported: ". . . with postponement of the YX next-generation civilian jet plane plan decided, the aircraft industry is going to raise rapidly its dependency on defense production."[2]

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[1] "Aircraft Industry at Crossroads," p. 5.

[2] "Aircraft Industry's Steep Inclining Toward Dependency on Defense; As Much as Even 80% of Sales; Manufacture of YX Postponed; Successive Orders for SDF Planes," Japan Economic Journal, January 7, 1971, p. 7.

Under the third and fourth defense build-up programs the government is funding the development of a supersonic, advanced jet trainer, the XT-2; an all-jet STOL military transport, the XC-1; the PIX-L anti-submarine patrol plane; and domestic productions of the F-4E jet fighter.[1] The government's fourth defense build-up program, fiscal years 1972-1976, calls for spending of ¥5,195 billion ($14.4 billion). The plan stresses that Japan's self-defense structure should be strengthened because of the change in the Far East situation and the phased withdrawal of United States forces. Under the program, the Japanese air force will have a total of 920 aircraft including modern high-performance F-4Ej fighter interceptors and T-2 advanced jet trainers. The new program was welcomed by the defense industries, as the amount of spending will about triple that for the third defense build-up program.[2]

The heavy industry companies concerned with aero-space, such as Mitsubishi, Kawasaki, and Fuji, project that the forthcoming defense orders will permit increased sales in the aircraft divisions by two and a half to three times by fiscal year 1975. Mitsubishi foresees aircraft sales of 100 billion yen ($278 million) in fiscal 1974, and Kawasaki 60 billion yen ($167 million) in fiscal 1975.

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[1] "Aircraft Industry Switching Interest to Defense Orders," Nihon Keizai Shimbun, October 21, 1969, p. 9.

[2] "Stronger Air and Sea Defenses Sought," Nihon Keizai Shimbun, May 4, 1971, p. 6.

Mitsubishi is the prime contractor for the agency's planned XT-2 trainer and Phantom F-4Ej fighters. It plans to spend approximately $28 million on plant and equipment during the five years of the build-up program. Kawasaki is the subcontractor (40 per cent) for the F-4EJ's and the prime contractor for the XC-1 transport,[1] and is planning to invest $39 million during the fiscal 1971-1975 period. Fuji Industries, subcontractor for both the XT-2 Trainer (50 per cent) and the XC-1 transport, plans capital expenditures of 5.5 billion yen ($15 million) during the same period to increase its aircraft sales.

It has been noted that the Japanese aerospace industry is dependent to a large degree on the defense programs of Japan's defense agency. In Japan the current defense budget totals $1.35 billion, less than 1 per cent of the GNP (.84 per cent).[2] However, Japan's military build-up rate is much faster than that of the United States and of the European countries. For example, the budget of the third five-year defense build-up program (1967-1971), just concluded, was $6.5 billion. This is twice as much as that of the second five-year defense build-up program, and in the fourth the budget is expected to double. There is little doubt that a major portion of the budget will

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[1] "More Plane Orders Seen in New Defense Plan," Nihon Keizai Shimbun, May 4, 1971, p. 11.

[2] Kahn, The Emerging Japanese Superstate, p. 163.

be spent for aircraft and electronics since Japan lags other modernized nations in these areas.[1]

To portray the many defense agency aerospace programs planned or already in effect in Japan, the following are categorized by the defense agency concerned and chronologically by third or fourth five-year defense build-up program.

ASDF (Air Self Defense Force)

XC-1 Medium Range Military Transport.--The flight prototype and static test aircraft were constructed at Kawasaki plant during fiscal year 1970. Powered by two Pratt and Whitney JT8D-9 engines, the XC-1 features advanced design high-lift devices and will be short takeoff and landing capable (STOL). The aircraft are to replace the obsolete C-46's. The defense agency has proposed procurement of forty-four XC-1's in fiscal years 1972 and 1973.

F-4EJ McDonnell Phantom.--Present fighter aircraft are about 300 F-86D/F and 196 F-104D/J, both built in Japan under United States license. All F-86's will ultimately be replaced by F4-EJ's, which are scheduled to be operational with the ASDF in 1973. The current F4-EJ force includes 104 aircraft to equip four squadrons. Japanese fighter pilots average 2,000 hours of flying time and are backed by the BADGE system (Base Air Defense Ground

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[1] Summary of Japanese Aircraft Industry (a study by Niisho-Iwai American Corp., April, 1971), p. 2.

Environment), a computerized air warning and interception control system involving twenty-four radar systems.[1] Beyond the F4-EJ, which is planned to have a ten-year operating life, the ASDF hopes to have its own Japanese designed and built supersonic fighter complementing the XT-2 advanced trainer, already entering the evaluation phase. The XT-2 will be the first domestically designed and developed supersonic aircraft. The production total of fifty of the XT-2 advanced trainers will be assembled by Mitsubishi.

Five YS-11 turboprop transports and five MU-2 executive transports procured during the third defense plan will continue to be added to the JASDF in limited numbers to offset retiring C-46's and to act as an interim stop-gap between the C-46 and the ultimate XC-1.

MSDF (Maritime Self Defense Force)

P-2V, P-2J Anti sub-patrol aircraft.--The air arm of the MSDF is geared primarily to anti-submarine warfare (ASW) operations, using the Lockheed P2V-7 and the Kawasaki P-2J. The first volume production model of the twin engine turboprop P-2J anti-submarine patrol plane (improved version of P-2V Neptune), developed and assembled by Kawasaki Aircraft in 1969, was delivered in September, 1969. During fiscal year 1970, eleven P-2J's were

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[1]Shunji Taoka,"Defense Becomes an Issue," in This Is Japan, No. 18 (Tokyo: Asahi Shimbun, 1970), p. 269.

were delivered to the MSDF. A total of forty P-2J's will be purchased by the defense agency under the third and proposed fourth build-up programs (fiscal years 1972-1976).[1] Main engines utilized by the aircraft are GE's T-64 turbo-prop produced under license by Ishikawajima-Harima Heavy Industries (IHI). The aircraft is equipped with auxiliary J-3 jet engines developed by IHI.

Currently, the MSDF operates some 230 aircraft,[2] fifteen types of helicopters, and seven types of fixed-wing aircraft.

PS-1 STOL Amphibian Seaplane.--A major MSDF fiscal 1970 acquisition was five multi-engine Shin Meiwa PS-1 amphibian flying boats at a unit price of about $3.1 million each.[3] The aircraft are suitable for air sea-rescue as well as ASW.

In January 1966, after seven years of basic study and research, Shin Meiwa was awarded the contract to develop a new anti-submarine amphibian sea boat for the MSDF. The first prototype was completed in August 1967 and flew for the first time on October 6, 1967. The first and second prototypes, which flew in June 1968, have already been

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[1] "Voluntary Special Report on Japanese Aeronautical Manufacturing," Department of State Airgram A-449, April 30, 1970, p. 4.

[2] Frank Burnham, "Japan's Self Defense 16 Years Later," Armed Forces Management, March, 1970, p. 49.

[3] Cecil Brownlow, "New Variants of PS-1 Considered," Aviation Week and Space Technology, January 19, 1970, p. 7.

delivered to MSDF.[1] The basic PS-1 employs two innovative design concepts--patented in Japan as well as in the United States, Great Britain, and Canada--that make it the world's most advanced seaplane. They provide the airplane with three basic advantages over former seaplane designs--stability in high-seas states, STOL capability, and elimination of the threat of water spray engulfing the engines during takeoff and landing. These Shin Meiwa designed systems are:

1. Spray suppressor, a filleted and slatted aerodynamic groove has been built around the bow of the seaplane's low-shock hull as a spray suppressor.

2. Boundary layer control (BLC) and deflected slipstream for STOL performance and greater stability in high-seas states.

The main PS-1 powerplants are four GE T-64-10 axial flow turboprop engines. Both the T-58 BLC compressor and the T-64 engines are being built in Japan under license by the Ishikawajima-Harima Heavy Industries Company Limited. Empty weight of the aircraft is 52,770 pounds; maximum ramp weight is 99,000 pounds.

Production of the first fourteen PS-1's was approved during fiscal year 1971 to form the basis for two ASW patrol squadrons. Current planning calls for the JMSDF

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[1] Ibid.

to place orders for forty to fifty of the aircraft to be delivered during the fourth five-year defense build-up program.[1]

GSDF (Ground Self Defense Force)

OH-6, HU-1, V-107, H-X Helicopters.--The GSDF third defense plan produced a considerable amount of basic helicopter study in preparation for the fourth defense plan, during which Japan will assume almost all of the responsibility for meeting its own helicopter requirements.[2]

One of the principal additions to the JGSDF is the fifty-five OH-6A light observation helicopters to be procured in the third defense plan. These aircraft are manufactured by Kawasaki Aircraft Company, which is a licensee of OH-6 helicopters by Hughes Tool Manufacturing Company. Eight MU-2 twin-engine turboprop STOL utility transport-type aircraft are to be delivered under the third defense plan. The aircraft are built by Mitsubishi, both in Japan and in a plant in San Angelo, Texas, owned by Mitsubishi. Mitsubishi is also producing under license Allison T-63 turbine engines to power the Hughes OH-6A helicopters being manufactured by Kawasaki for the JGSDF.[3]

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[1] Summary of Japanese Aircraft Industry, p. 6.

[2] Ibid., p. 19.

[3] Eiichiro Sekikawa, "Aeroplanes for World Markets," This Is Japan, No. 13 (Tokyo: Asahi Shimbun, 1966), p. 312.

An important acquisition by the JGSDF in the third defense plan involved increasing its force of Bell HU-1's, built by Fuji, to fifty-three, to serve the dual function of armed escort and ground support. At this time, the H-X project calls for the development of a medium-to-large ASW helicopter to be developed and produced in the fourth defense build-up program. This aircraft is to be developed basically in Japan and will probably incorporate a rigid rotor system. It is assumed that the new H-X will be essentially an updated HSS-2 with a higher degree of sophistication in installed equipment.

Toward the end of the third defense build-up program and as the Nike and Hawk missile units become operational (one in the Tokyo area and the other in the northern part of Kyushu), a third group is to be located in Hokkaido by the end of 1971.[1] The defense agency foresees a need for a heavy-lift helicopter to support such operations. It is also believed that there will also be a valid alternative use in civil transport operations.

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[1]Burnham,"Japan's Self Defense," p. 49.

CHAPTER IV

THE JAPANESE AEROSPACE MANUFACTURING INDUSTRY

Introduction

During the twenty-year period from the early stage of the Showa Era (1926) until the end of World War II, the Japanese aircraft industry manufactured about 110,000 airframes and 150,000 engines. Aircraft production reached its highest level during World War II, when more than one million workers manufactured an average of 25,000 planes annually. Among them were more than ten outstanding machines ranked with the leading aircraft in the world at the time.[1]

Nineteen years have elapsed since the Japanese aircraft industry, which was almost completely destroyed during World War II, began to reorganize by commencing the repair of United States military aircraft based in Japan as well as the manufacture under license of United States military aircraft. Its steady development during this period can be attributed in large part to a vigorous policy of importing United States technical knowledge and to the

[1]Kiyoshi Nada,"The Japanese Aircraft Industry," The Oriental Economist, April, 1966, p. 221.

nation's defense demands, which equated to about 70 per cent of total production.[1] Although the industry has been characterized by a high degree of dependence on military orders, which still comprise the bulk of its activity, the civil side of aircraft manufacture and servicing is assuming increasing importance. For example, between 1952 and 1967, of a total production value of aircraft, engines, and components of $1,170.2 million, $81.66 million was for United States procurement and $855.08 million was for the Japanese Defense Agency; only $180.45 million was for domestic civil demand and $44.8 million for export and reparations.[2] The fifteen-year production figure breaks down as follows: 73 per cent was defense agency orders, 7 per cent was orders from the United States military, 16 per cent was from domestic customers, and 3.9 per cent was export and reparations.

Thus, the industry potential developed during the postwar years enabled the Japanese to produce, during the 1960's, the nation's first postwar passenger planes developed entirely by Japanese engineers, the YS-11, the MU-2, and the FA-200--all aircraft of excellence by world standards. Since the industry started its postwar comeback these were the first aircraft designed in Japan that had

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[1] "Aircraft," Industrial Japan 1971, p. 150.

[2] Ronald C. Golden, "A Phoenix with a Future: Rebirth of Japan's Aircraft Industry," Oriental Economist, April, 1970, p. 22.

reached the commercial production stage.[1]

The recent growth trend of the Japanese aircraft manufacturing industry has been strong, particularly during the period of the Third Defense Equipment Plan (1966-1971). The production value of the Japanese aircraft industry in 1969 was $209 million, following $159.9 in 1967 and $190.8 in 1968, breaking all records for three years in succession. In 1970 it reached $274 million, exceeding its projected $230 million. The aircraft repair work, exceeding $50 million in 1967, also progressed at a good rate and earned $58 million in 1969 and $60 million in 1970, despite a decreasing demand for repairs to American military aircraft.[2] Total production value for aircraft production and aircraft repairs combined was $274 million in 1969 and over $300 million in 1970. (See Table 4.)

Recent production records show great dependence still on the Self Defense Agency's demand, but, unlike during the previous years between 1952 and 1969 when 70 per cent of total production depended on the Defense Agency, this ratio has dropped to 60 per cent in the past three years. This drop was due to an increase in civilian demands and to exports of Japan's own domestically produced aircraft. The most notable examples are Mitsubishi's MU-2 and the Nihon Aeroplane Manufacturing Company's (NAMCO) YS-11. The MU-2 is a twin turboprop business transport marketed

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[1]Sekikawa, "Aeroplanes for World Markets," p. 313.

TABLE 4

PRODUCTION VALUE OF THE JAPANESE AIRCRAFT INDUSTRY
(in millions of dollars)

Year	Amount
1952	$ .08
1953	6.81
1954	6.69
1955	8.33
1956	11.8
1957	27.94
1958	52.31
1959	51.83
1960	69.01
1961	75.51
1962	101.42
1963	169.38
1964	202.29
1965	152.91
1966	147.36
1967	219.09
1968	256.18
1969	273.87
1970	306.39
Total	$ 2,139.25

Source: Directory of Aerospace Industry in Japan (Society of Japanese Aircraft Constructors, September 1, 1971), p. 5.

in the United States by Mitsubishi in cooperation with Mooney Aircraft, Incorporated. In 1969, 126 of the 162 orders placed for MU-2's were for delivery in the United States; Nihon's YS-11, a short-haul turboprop, is now in service with fifteen airlines in 11 nations, including Piedmont in the United States. As of January 1970, more than sixty YS-11's had been sold on the export market. NAMCO also has plans for a YS-33 trijet to make its maiden flight in 1974 and to be in service in 1975.[1]

A breakdown of the total number of aircraft built after resumption of activity in 1952 to the end of fiscal year 1970 shows 2,284, including 1,411 for the Defense Agency, 482 for the domestic civil market, 364 for export and reparation, and 27 for the United States armed forces.[2]

The Japanese aircraft industry's total production of $300 million in 1970, including airframes, engines, systems, and components is not impressive when compared to the United States or other major aerospace manufacturing nations, or even in the context of Japan's total industrial activity, but it does show steady growth when compared with figures of earlier years and positive growth potential. According to the Society of Japanese Aircraft Constructors (SJAC), the

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[1] "Trade Council Sees Continuing High Japanese Demand for U.S. Aviation Products," United States-Japan Trade Council News, August 24, 1970, p. 3.

[2] Directory of Aerospace Industry in Japan (Society of Japanese Aircraft Constructors, September 1, 1971), p. 3.

upward trend will continue, and fiscal year 1972 output is forecast to total $400 billion.

Governmental Support of Aircraft Manufacturing Industry

In order to examine the manner in which the Japanese government encourages joint efforts, mergers, and industry cooperation, and actively participates in developing and planning for the aviation industry, the development of NAMCO (Nihon Aeroplane Manufacturing Company Limited) and the YS-11 will serve as an excellent example. NAMCO has no manufacturing facilities; rather, it is a management coordinating, design, and marketing group evolved from the TADA (Transport Aircraft Development Association) established in 1957.[1] NAMCO is composed of management personnel of other Japanese aircraft manufacturers under the general supervision of the MITI (Ministry of Trade and Industry). Manufacturing facilities of existing manufacturers are utilized on an agreed basis. Present projects are the YS-11, YS-33/YX and X-2.

The manufacture of a medium-sized passenger airliner of Japanese design was first advocated by MITI in 1956. The major aircraft manufacturing firms cooperated on design studies, and when the government decided to grant a subsidy to assist the project in 1957, the basic design work was

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[1] "YS-11 Japanese Produced Turboprop Goes into Operation," Department of State Airgram A-1280, March 28, 1965, pp. 2, 3.

started as a joint effort by six companies: Mitsubishi Heavy Industries Limited, Kawasaki Aircraft Company, Fuji Heavy Industries Limited, Shin Meiwa Industry Company, Japan Aircraft Manufacturing Company Limited, and Showa Aircraft Industry Company.[1]

In June 1959, following an amendment to the Aircraft Industry Promotion Law, NAMCO was established with financing provided jointly by the government and private business. NAMCO was capitalized at 5.5 billion yen ($15.3 million) with about 53 per cent of the stock controlled by the government and the remainder by a large number of private holders, including the six manufacturing partners. The government invested about $11.66 million[2] in the company and underwrote debentures up to $74.1 million. In addition, the government provided $17.5 million as part of a fund to purchase machine tools for the industry and subsidized research to the amount of $17.59 million. (See Table 5.)

Thus, the YS-11 project began under government encouragement in 1957 with the Transport Aircraft Development Association. In 1959 the early development work of this group was taken over by NAMCO, which was ultimately responsible for the development and production of Japan's first domestically designed and produced aircraft, designated

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[1] Ibid.

[2] Directory of Aerospace Industry in Japan, p. 975.

TABLE 5

JAPANESE GOVERNMENT FINANCING SUBSIDY AND INVESTMENT IN AIRCRAFT INDUSTRY[a]
(in millions of dollars)

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Financing	$3.14	$ -	$ -	$1.67	$ .89	$ .29	$ -	$ -	$ .09	$ -	$ .28	$ .56	$ .56
Subsidy	.41	.27	.21	.33	.65	.85	1.05	.76	1.11	2.89	5.73	2.51	1.88
Individual	-	.83	2.08	2.78	1.53	-	1.11	-	-	3.33	-	-	-

[a]The government of Japan has financed about $17.55 million as part of a purchasing fund for machinery for the aviation industry and subsidized about $19.8 million for research funds for aerospace engineering by the industry and by scholars.

Source: Directory of Aerospace Industry in Japan (Society of Japanese Aircraft Constructors, September 1, 1971), p. 1.

the YS-11. The production contribution of the six major firms manufacturing the YS-11 are as follows:

Mitsubishi Heavy Industries	- Fuselage and final assembly
Kawasaki Aircraft Company	- Wings and engine nacelles
Fuji Heavy Industries Co.	- Empennage
Japan Aircraft Mfg. Co.	- Ailerons and flaps
Showa Aircraft Industry Co.	- Honeycomb structural components
Shin Meiwa Industry Company	- Rear fuselage

Foreign manufacturers provide other major components, such as the engines (two Rolls-Royce Dart MK 542.10 turboprop engines of 3,060 hp each) propellors, pressurization and air conditioning, wheels and brakes, electronic equipment, and many engine and flight instruments.[1] The foreign contribution, chiefly British and American, is estimated to account for 30 to 45 per cent of the value of the aircraft.

NAMCO as a separate corporate entity retains the functions of design, production, quality control, and sales for the YS-11, having obtained its type certificate from the JCAB on August 25, 1964,[2] and from the United States Federal Aviation Agency the following year.

There is no similar United States-produced aircraft to compare with the YS-11, and NAMCO sees it as a modern

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[1] "YS-11 Economical, Short Take-off Turboprop Airplane," Aviation Week and Space Technology, June, 1968, p. 21.

[2] "Japanese-Produced Turboprop Airliner," Airgram (March 28, 1965), p. 3.

replacement for the Douglas DC-3, in service around the world. Many airlines are interested because they operate from unimproved landing strips and short runways, and the YS-11 has much better takeoff and landing characteristics than the DC-3, can carry twice the payload, and can be operated most economically between the short-range lengths of 300 and 700 miles, and at a cruising speed of 300 miles per hour.

Through government financial and industry cooperation the first prototype of the YS-11 made its initial flight in August 1962. The first production model was fitted with electronic equipment for flight check of aerial navigation aids and was formally delivered to the Japanese Civil Aviation Bureau on March 30, 1965.[1] On the same day, a second production model was delivered to the Japanese Air Self Defense Force. Japan Domestic Airlines placed the first YS-11 in commercial operation in April 1965, and continues to provide crew training for airlines purchasing the turboprop. NAMCO anticipated that by fiscal year 1970 the YS-11 production run would reach a total of 150.

Hawaiian Airlines became the first American carrier to operate the YS-11 in late 1966. NAMCO developed the YS-11A, a more powerful version, specifically for the American market with the help of United States advisors,

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[1] Ibid., p. 4.

[2] Ibid.

and the advice was profitable. During a coast-to-coast tour of the United States by top NAMCO executives aboard the YS-11A demonstration model, Piedmont Airlines became interested in the aircraft. The heavy-duty plane features a 2,000-pound payload increase over the standard models and strengthened wing structures. Three configurations are available: all-passenger, with standard seating for sixty; mixed cargo and passenger; and all-cargo. Ultimately, Piedmont Airlines, a North Carolina-based feeder airline, purchased ten YS-11A's with an option for ten more, signing the agreement in 1966 for delivery in 1968.[1]

The Japan Economic Journal of March 24, 1970, reported that NAMCO intended to request the Japanese government's approval for inclusion of YS-11 aircraft in Japan's foreign aid to Southeast Asia.[2] Two YS-11's have been sold to the Republic of China under the aid program as an exception to the general policy. Unless the Japanese government permits the YS-11 to be sold under more liberal credit terms, NAMCO considers the prospects of further sales to Southeast Asia to be poor. The company feels that the Japanese government would not permit YS-11's to be sold to the Republic of Vietnam because this action might

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[1]"U.S. Airline Puts YS-11 into Service," Japan Times, March 5, 1968, p. 13.

[2]"Nihon Aeroplane Mfg. Desirous of Offering YS-11 as Economic Aid," Japan Economic Journal, March 24, 1970, p. 6.

be construed as exporting military equipment to a beligerent.[1]

Early in 1971 the Nihon Manufacturing Company (NAMCO) announced the sale of the 157th production model of its YS11A-200 to Japan Domestic Airlines for delivery in May. Additionally, All Nippon Airways has also expressed intent to purchase another two or three YS11A-200's from NAMCO.

Korean Airlines have also signed an agreement with NAMCO for the lease of an additional Japanese made turboprop liner. This will be the seventh YS11A-200 to be leased from NAMCO by Korean Airlines.[2]

In March 1971 the Japan Economic Journal announced NAMCO's plans to manufacture fifteen more YS-11 turboprop airliners, to bring its total output to 195 because it has received assurance from Rolls-Royce Limited that Dart engines for the aircraft will be made available.[3]

NAMCO anticipates that the fifteen YS-11's will be manufactured after fiscal year 1972, starting April, 1972. As of March 1, the 166th YS-11 was being produced. Total production is expected to reach 180 by March 1972.

The Nihon Aeroplane Company (NAMCO) plans to cease manufacturing the YS-11 in fiscal year 1972, when a total

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[1]"YS-11's to Be Offered as Economic Aid," Department of State Airgram A-361, April 1, 1970, p. 1.

[2]"YS11A Sales," Japan Times, April 26, 1971, p. 11.

[3]"Nihon Aeroplane Secures Rolls-Royce Assurance on More Engines," Japan Economic Journal, March 9, 1971, p. 5.

of 180 planes will have been produced, in an effort to stop the growing deficit of more than 14,000 million yen.[1] This has been confirmed by the Aviation Industry Council, an advisory body to the MITI. With this policy confirmed, NAMCO will manufacture the remaining twenty-nine of the planned 180 YS-11's in fiscal year 1971-72.

Shoichi Akazawa, director of MITI's Heavy Industry Bureau, issued a statement that a plan for the government to bear part of the losses incurred by NAMCO would be worked out promptly. His report also noted that all the participating manufacturers and other firms associated would also share a considerable portion of the deficits. Of the twenty-nine YS-11's to be built in fiscal year 1971-72, contracts have already been made on the sales of ten aircraft to Japanese and foreign users. NAMCO will continue until 1983 to sell spare parts and offer maintenance services after it has stopped manufacturing the YS-11. The Aviation Industry Council had rejected a NAMCO plan to make more YS-11's on the basis that additional production would result in additional loss because aircraft prices could not be increased to offset the increased production cost (estimated at $278,000 per aircraft).[2]

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[1] "Deficit Plagued NAMC to End YS-11 Production," Japan Times, April 28, 1971, p. 15.

[2] Ibid.

A study mission headed by Professor Kimura, of Nihon University, was sent to the United States, France, Netherlands, and Britain in mid-1971 to study the situation of aircraft industries over the world in connection with the proposed YX development. The mission was made up of members of the Aviation Industry Council, representatives of the domestic aircraft industry--Mitsubishi, Kawasaki, Fuji, and Ishikawajima-Harima as well as NAMCO--and MITI officials.[1] In its contacts, the mission presented Japan's basic position on joint development of the YX as: (1) Japan and its partner will reserve equal rights in designing the aircraft, (2) Japan will have its own marketing territories, (3) the name of the aircraft to be jointly developed should be indicative that Japan has participated in its development, and (4) the part the Japanese play in its actual production should consist of assembly of main wings or body and/or more essential stages.[2]

In the fall of 1970, Boeing Aircraft proposed joint development of a jet passenger plane seating 200 to 250 passengers by 1974. This aircraft would use a CF-6 engine developed by McDonnell Douglas Aircraft Corporation, which is also used on Boeing's DC-10's.[3] The Aircraft Industry Council,

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[1] "YX Jet Transport Plane Plans Mulled in Japan," Journal of Commerce, August 10, 1971.

[2] "Special Corp. to Take Charge of YX Plane," Nihon Keizai Shimbun, June 8, 1971, p. 6.

[3] "Airliner Development Discussed by Two Firms," Nihon Keizai Shimbun, December 8, 1970, p. 6.

in the process of drafting the development plan to replace the YS-11, has recommended collaboration with top-rated American and European manufacturers for the new plane.

Regarding NAMCO's deficits, which reached $40.5 million by the end of fiscal year 1970, the Council proposes to write them off by the end of next fiscal year by the company's capital decrease, or have the government and private firms taking part in the YS-11 business shoulder them.

To clarify any confusion, the aircraft to be developed to replace the YS-11 has been termed the YS-33; however, the YS-33 has so far been called the YX but the designation of YS is to be retained because the YS-11 is popular and has become known throughout the world.[1]

Most aircraft manufacturers visualize the YS-33 as being produced by a new public corporation established with government funds but with private Japanese companies responsible for actual production and sales. The estimated cost of the development of the aircraft would be between $550 and $600 million, thus requiring that a foreign partner be asked to join in the development and cost.[2]

When NAMCO first proposed that the triple jet YX be developed and built in Japan in July 1969, it was then

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[1]"MITI to Increase YS-33 Development Expenses to 27.5 Billion Yen," Sankei, August 29, 1969, p. 11.

[2]"YX Jet Transport Plane Plans Mulled in Japan," Journal of Commerce, August 10, 1971, p. 25.

obvious that the YS-11 was more or less a commercial failure. Aviation experts had known long in advance that the YS-11 was not to be a major success commercially, merely because of its obsolescence; it was nearly obsolescent when the first production model came off the assembly line. Essentially, the design and construction of the YS-11 was intended to assist Japan's aircraft industry in closing the technological gap between this country and the West. Mitsubishi Heavy Industries, one of the six companies included in NAMCO, pointed out that the YX project would involve such tremendous expenditures before the first plane appeared on the market that participation by private industry without massive government funding was out of the question.[1]

However, MITI has been stressing that the YX project is necessary to complete the closure of the technological gap. MITI officials also contend that in the 1970's Japan's aircraft industry will play a key role in earning foreign exchange. The ministry also suggests that the project would also provide technological spinoffs which would contribute enormously to the sophisticated progress required of the country's industrial structure.

Japan and the MITI have gained an awareness of the problems of developing new aircraft by observing problems caused by suspension of the SST in the United States and their own deficit occasioned by the YS-11 production, and

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[1] Ibid.

have formulated a basic plan which includes the recommendation that Japanese industry develop both aircraft bodies and jet engines. Further, the industry should concentrate on large jet aircraft, avoiding the supersonic transport and jumbo jets and the manufacture of vertical and short takeoff and landing aircraft.

The MITI has derived its basic plan for the YX, which includes the following: (1) to set up a public corporation (tentative name) which is to settle the financial losses caused by the development and sale of YS-11's and develop the YX at the same time; (2) to develop the YX by international cooperation, and obtain one-half of the funds necessary for development from the cooperating foreign manufacturers; and (3) to obtain a commitment from the Japanese government for the annual release of 25 billion yen for four years from fiscal 1972 for development of the YX, separate from the regular budgetary requirements of MITI.[1]

MITI favors development of the YX by international cooperation because it is not possible for Japan to fund this entire project alone, and also because international cooperation for such a purpose has become an established practice recently. The joint development is expected to result in greatly increasing the technological level of the Japanese aircraft industry. Since the development cost is anticipated

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[1] "MITI Planning to Establish Public Corporation for Development of YX," Nihon Keizai Shimbun, April 11, 1971, p. 26.

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to be very high, joint development would ease the financial burden of each government and each contractor concerned. Additionally, through joint development, it is possible to sell the planes in a coordinated manner in the world market to avoid sales competition.[1]

According to the basic policy, the development of the YX jetliner will be carried out by a public corporation to be set up wholly with government funds. MITI proposes revision of the Aircraft Industry Promotion Law to create such a corporation.[2] For production and sale of the projected jetliners, MITI plans to adopt the "prime system," in which private companies will be entirely responsible for their production and sale.

Of foreign manufacturers concerned, Boeing Company and McDonnell Douglas Aircraft Company of the United States and the British Aircraft Corporation (BAC) have announced their intention to cooperate in the development of the YX. When Boeing made its proposal, the Japanese feared that leadership of the project might be taken over by the foreign partner; however, Boeing has indicated its willingness to carry out the project on an equal footing with the Japanese. At present, Boeing and McDonnell Douglas appear to have the best chance to be selected for participation in development

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[1] Ibid., p. 2.

[2] "YX Jet to Be Developed by Government Corporation," Japan Times, May 12, 1971, p. 2.

of the YX. Lockheed Aircraft Corporation appears to have been eliminated as it is asking Japan to take full responsibility for any loss that might be incurred in the project.[1]

MITI desires to start efforts for development of the YX in fiscal year 1972 and is expected to make public its policy for reorganization of the country's aircraft industry after receiving recommendations from the Aircraft Industry Deliberation Council. The ministry's policy is expected to include guidelines for strengthening NAMCO, selection of the partner for joint development, and the extent of government financial assistance to the project.[2]

As previously discussed, the greatest amount of the aviation industry's recent activity has been in the manufacture of military jets and military and civilian helicopters under technical and licensing agreements with American firms. Aircraft produced in Japan under foreign license include seventeen different airplanes and eight helicopters.

The history and structure of NAMCO and the joint venture between the government of Japan and six major aircraft manufacturers has already been examined. The major corporate firms most active in Japan's aerospace industries will be discussed in the following section. Since it is not

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[1]"Special Body for YX Plane," Nihon Keizai Shimbun, August 2, 1971, p. 9.

[2]"Japan's Aircraft Industry at a Crossroad: New Type Passenger Plane to Be Developed," Japan Economic Journal, May 15, 1971, p. 11.

possible to determine which of the nearly 700 companies that participate in Japan's aerospace industry will emerge as leaders in the industry, the order in which they are addressed is completely random. Also, the extent of diversification of the companies is such that aerospace activity is often a small segment of their total industrial activity.

Japan's Major Aerospace Firms

Fuji Heavy Industries

Fuji Heavy Industries, Limited was established on July 15, 1953, as successor to the Nakajima Aircraft Company. This company was established in 1914 and built 30,000 aircraft by the end of World War II.

Under license and a technical assistance agreement with Beech Aircraft Corporation, concluded in 1953, Fuji built the Beechcraft Mentor at its Utsunomiya plant. Deliveries began in August 1954, and Fuji supplied a total of 124 Mentors to the Japanese government; an additional thirty-six, with spares were sold to the Philippine Air Force.[1] A modified version of the Mentor, developed as the LM-1 Nikko, and twenty-seven of these aircraft were supplied as the standard multipurpose liaison aircraft of the Japan Ground Self Defense Force.

Under another major agreement, Fuji has been producing in Japan since 1963 the Bell Model 204B helicopter

[1]Department of Commerce, World Survey (1968), p. 16.

under sublicense to Mitsui Company, Bell's Japanese licensee. The Japan Ground Self Defense Force has purchased a total of eighty-nine UH-1B's (military version) for delivery by 1971. The first aircraft of entirely original design produced by Fuji was the T1-F two-seat jet trainer, the prototype of which flew for the first time on January 19, 1958.[1] This aircraft, designed to meet a defense agency requirement for a jet trainer, was produced in modest quantities for the JASDF, and is no longer in production.

Following the successful design of the T1-F jet trainer, Fuji began design work on the FA-200 series light aircraft in 1964, and the prototype flew in August 1965. Fuji's FA-200 qualified for a certificate from the JCAB in March 1966, and was certified in the utility category in 1967.[2] The FA-200 Aero Subaru is a lightweight monoplane, piston engine, low wing type, first produced in 1968, of which seventy-four were produced by January 1970.[3] The FA-200 is not only a business and training plane, but also has excellent qualities as a sports plane suitable for stunt flying. Production of the FA-200 was initially six per month in 1969, but demand, both foreign and domestic, greatly exceeded company estimates and production was

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[1] "The First Japanese Lights Are Here," Aircraft, June, 1968, p. 30.

[2] Ibid.

[3] "Aircraft," Industrial Japan, 1971, p. 153.

increased to eight per month by the end of 1969. Fuji also revised upward its FA-200 production target for 1975 from the original level of 530 to 800 units.[1]

The Subaru is currently produced in two versions: the FA-200, which is powered by a 160-hp Lycoming O-320-D2A engine driving a fixed-pitch propellor, and the FA-200-180, which is powered by a Lycoming IO-360-B1B engine driving a constant-speed propellor. The airframes of both models are identical.[2]

Fuji has undertaken the development of a twin-engine light aircraft to be designated the FA-300. The FA-300 will be a multipurpose aircraft with accommodations for about eight passengers. Research on the basic design is underway, and production is scheduled for 1972.[3]

Fuji has also decided to develop an additional jet trainer aircraft, to be designated the T-3. This trainer will replace the present T-33 and T-1 jet trainers now in use. Fuji plans to achieve complete domestic production of the T-3, both as to engine and as to airframe. Fuji has already begun negotiations with Ishikawajima-Harima to develop the engines for the new jet. Ishikawajima-Harima

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[1] "Fuji Heavy Industries to Develop Twin Engine Light Plane," Department of State Airgram A-821, August 27, 1969.

[2] "Aircraft," Industrial Japan, p. 153.

[3] "Fuji Heavy Industries to Develop Plane," Airgram (August 27, 1969).

is Japan's first developer-manufacturer of a jet engine, the J-3, which is installed on the T-1.[1]

Fuji also produces Ryan Forebee aerial target drone systems under an agreement with Ryan Aeronautical Company, of San Diego, California, the developer of the system. Fuji plans to make the system for both the Maritime Self Defense Force and the Ground Self Defense Force, and hopes to sell seventy to eighty units of the system to the defense agency commencing in fiscal year 1971. Fuji will make a down payment of $200,000 to Ryan and offer a royalty of 8 per cent for use of the technology.[2]

Ishikawajima-Harima
Heavy Industries

Ishikawajima Harima Heavy Industries (IHI) is primarily devoted to shipbuilding and heavy industry. The aircraft engine division is one of seven divisions of IHI. The other divisions are: Industrial Machinery, Transportation Equipments and Steel Structures, Powers (diesels, marine turbines, and atomic power machinery), Chemical Plants, Ships, and Mass-Produced Machinery.[3] The Aircraft-Engine Division at Tanashi, twenty miles west of Tokyo, is the main producer of aircraft engines in Japan. Most of

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[1]"Fuji Heavy Industries to Build T-2 Trainers," Nihon Keizai Shimbun, September 30, 1969, p. 9.

[2]"Fuji HI Will Produce Ryan Firebee System," Nihon Keizai Shimbun, March 10, 1970, p. 7.

[3]"Aircraft," Industrial Japan, p. 153.

these engines are made under license from the world's leading aero-engine makers--Rolls Royce, General Electric, and Pratt and Whitney.

IHI produces the J-79 turbojet, the T-58 turboshaft, and the T-64 turboprop and shaft under license from General Electric, and the AVCo Lycoming T-53 gas turbine under license. IHI also overhauls Turbomeca, General Electric, and Pratt and Whitney engines. Under a license agreement concluded in 1960, IHI has produced all J-79 engines used by the JSDF for its F-104 Starfighters.[1] Japanese production of the T-58, a lightweight, compact, 1,250 horsepower, shaft-powered gas turbine designed primarily for helicopters, began in 1961. Since then, IHI has delivered T-58 turbine engines to the Japanese Defense Agency for use in its V-107 S-62, and HSS-1 helicopters (in use by commercial operators), and has exported them to Thailand. IHI has also designed the IHI-3 and the IHI-7, which are auxiliary engines for the P-2J and power the T-1 jet trainers made by Fuji Industries.[2]

In 1964, IHI received the license to produce the T-64, a free turbine power plant for the JMSDF's new PX-S flying boat and the Kawasaki P2-J maritime patrol boat. The T-53 is being produced in Japan for use in helicopters, hydrofoil boats, and other aircraft.

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[1] "Civil Aviation: Special Report on Japanese Aeronautical Manufacturing," Department of State Airgram A-449, April 30, 1970, p. 3.

[2] Ibid.

IHI recently concluded a license agreement to manufacture the latest Rolls Royce Adour jet engines to be mounted on the Defense Agency's future XT-2 advanced jet trainer aircraft. After approval by the government of Japan, IHI plans to begin making 150 units of the engine. It is to pay $900,000 down and a 7 per cent royalty to the Anglo-French engine developer. Each of the fifty XT-2 jet trainers, which will commence production in 1974, will have two Adour jet engines, and fifty engines will be held as spares.[1]

Itoh Aircraft Maintenance and Engineering Company

The Itoh Aircraft Maintenance and Engineering Company, located in Tokyo, with the help of Nihon University developed the N-62 Eaglet STOL four-seat, light plane, the first Japanese-designed light plane built since World War II.[2] The Eaglet, designed as a trainer for flying clubs and as a transport for business executives, is powered by one Lycoming 160 horsepower engine. The designer of the N-62 Eaglet was Professor Hidemasa Kimura, of the Nihon University's Engineering Department. Professor Kimura led the Japanese Aircraft Industrial Study Mission to the United States and Europe in mid-1971 to discuss and obtain views on a proposed Japanese short- or medium-range jet airliner as a joint

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[1] "IHI to Make Adour Jet Engines," Nihon Keizai Shimbun, May 11, 1971, p. 7.

[2] Sekikawa, "Aeroplanes for World Markets," p. 313.

Japanese-foreign (United States) cooperative venture.[1] The N-62 obtained certification in 1962, and production began in 1967. Itoh also repairs and overhauls a large number of small planes.

Mitsubishi Heavy Industries

Mitsubishi Heavy Industries, Limited (MHI) is Japan's fourth largest major industrial firm, with more than 90,000 employees; its aircraft division employs about 7,000 persons.[2] MHI is the leader in the Japanese aircraft industry in both volume and diversification of products. It has three plants in the Nagoya area. Mitsubishi began the production of aircraft in the present Oye plant of its Nagoya Engineering Works in 1920, and manufactured a total of 80,000 aircraft of approximately 100 different types during the twenty-five years prior to the termination of World War II. The company was also one of the leading aero-engine manufacturers, producing a large number of engines in the 1,000 to 2,500 horsepower range. The conclusion of the Peace Treaty in 1952 permitted the aircraft industry in Japan to re-commence, and in December the company constructed its present Komaki aircraft plant. This factory, together with Mitsubishi's Oye and Daiko plants,[3] has since been separated from the

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[1] "Future Course of Japanese Aviation Production," Department of State Airgram A-404, May 26, 1971, p. 2.

[2] "Japanese Aircraft Industry, Mitsubishi Heavy Industry," Department of State Airgram A-865, October 7, 1965, pp. 2-6.

[3] Ibid.

original Nagoya Engineering works and consolidated as the Nagoya Aircraft Works, with a combined floor space of 1,765,000 square feet.

The Oye plant is mainly a testing and research installation, with extensive wind tunnel, structure testing, and related equipment and research facilities for the design, development, and application of specific techniques (e.g., chemical milling and explosive forming). The Oye wind tunnels were of primary importance in the development of Japan's two main commercial aircraft, the YS-11 cargo-liner and the MU-2 executive turboprop. The main assembly plant is at Komaki, where many of Japan's principal aircraft are finally assembled from parts made at other plants. The Komaki plant is currently assembling the YS-11 and the MU-2, as well as the Sirkorsky helicopters; F-86 and F-104 fighters were assembled there. It is expected that the F-4EJ final assembly will also be at Komaki. The Daiko plant is largely a maker of components, particularly hydraulics and engine parts, and an engine-overhauling facility.[1]

Like many other Japanese companies, Mitsubishi resumed postwar activity with overhaul work for the United States forces. Contracts to overhaul F-86 Sabre fighters led, in June 1955, to the selection of Mitsubishi as the company to manufacture 300 F-86F fighters for the JASDF

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[1] Ibid.

under a license agreement with North American Aviation, Incorporated. MHI subsequently produced a total of 230 Lockheed F-104J and F-L04DJ Starfighters, in cooperation with Kawasaki.[1]

Similarly, overhaul work on Sikorsky S-55 helicopters started in 1954 and led, in December 1958, to a license agreement for the manufacture of S-55-type helicopters in the Oye and Komaki plants when forty-four were ordered for military and civil use. In addition, Mitsubishi holds license agreements to manufacture the Sikorsky S-61, SH-3, and S-62 helicopters. By 1967, twenty-five S-62's had been assembled for civil and military use, and the first of fifty-five SH-3A's for the JMSDF were delivered in March 1964.

Presently, Mitsubishi is responsible for producing the front and center fuselage sections of the YS-11 transport and for final assembly of this aircraft, and is also engaged in the development of guided weapons. Current activities at the Daiko plant include the manufacture of components for piston engines and jet engines, the overhaul of jet and piston-type engines for domestic and foreign airlines, and production and repair of the Mitsubishi 1 (GGM-1) gas turbine compressor for the air starter of the F-104J. Mitsubishi is also producing under license

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[1]Personal interviews with Lt. Col. Ohkuma, JASDF (Retired) (F-104 Project Officer), Representative for Marubeni-Iida (America) Inc. Mitsubishi, Washington, D.C., October, 1971.

Allison T-63 shaft turbine engines to power the Hughes OH-6A helicopters being manufactured by Kawasaki for the JGSDF.[1]

Within the framework of Japan's national space program, Mitsubishi is collaborating with the Science and Technology Agency and the Institute of Space and Aeronautical Science, University of Tokyo. It has manufactured the rocket chambers of the Kappa, Lambda, and Mu series rockets, the attitude control motors.

Mitsubishi's successful turboprop business executive transport designed for the world export market, the MU-2, is proving to be an effective competitor in the United States corporate plane market. The MU-2, costing about $450,000, is a high wing, economical, high performance Japanese aircraft, made partly in Japan and partly in San Angelo, Texas.[2] Mitsubishi Aircraft International, located in San Angelo, Texas, is owned 80 per cent by Mitsubishi Heavy Industries and 20 per cent by the Mitsubishi company.[3]

In a unique marketing effort, the fuselage, wings, and other components of the airframe are made at Mitsubishi's plant at Nagoya, Japan. The twin turboprop engines are made in the United States by the Garrett Corporation. The propellers, most of the cockpit instrumentation, radio

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[1] Ibid.

[2] "Aircraft, Culture Shoku in Texas," Time, November 22, 1971, p. 103.

[3] Robert Lindsey, "Mitsubishi's Turboprop," New York Times, June 13, 1971.

equipment and some other components are also made in the United States.

The various components are shipped to the Texas plant and assembled, test flown, and delivered. Two versions are sold: the "F" model, which carries a crew of two and five passengers, and the "G" model, which is six feet longer and has places for eight passengers although it can be configured to carry as many as fourteen. The range of both models is 1,500 miles and the cruising speed is 340 miles per hour.

About 100 MU-2's have been sold in the United States in the past three years, accounting for almost 25 per cent of the United States market for turboprop aircraft. An additional twenty-five have been built at San Angelo for export.[1] Although its basic price is $450,000, the stretched MU-2 sells for about $550,000 with standard electronic equipment. At this price it has been able to compete very well with the turboprop Beech King Air, its closest competitor in terms of operating performance.

Mitsubishi's latest example of technology and versatility was illustrated when the XT-2, Japan's first domestically designed supersonic aircraft, successfully completed its first test flight in July 1971.[2] The X-2

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[1] Ibid.

[2] "XT-2 Supersonic Plane Ends First Test Flight," Japan Times, July 21, 1971, p. 4.

was developed by Mitsubishi as part of the fourth defense build-up brogram. It is equipped with two turbofan jet engines jointly developed by Rolls Royce of Britain and Turbomeca of France. About 210 of the supersonic XT-2's will be assigned to the JASDF in the future. The defense agency has reported that the price of the XT-2 was originally estimated at 700 million yen but has risen to about 1,700 million yen, resulting mainly from the bankruptcy of Rolls Royce.[1]

Shin Meiwa Industry Company

The former Kawanishi Aircraft Company became Shin Meiwa in 1949 and has established itself as a major overhauling center for Japanese and United States military and commercial aircraft and engines.[2] Shin Meiwa is divided into four major divisions: Aircraft, Machinery, Motor Service, and Automotive Maintenance. Shin Meiwa Aircraft Itami plant at Osaka has the capability to overhaul or repair nearly any aircraft piston engine ever built, and has overhauled at least thirty-five different engines including nearly all the types of United States military fixed wing transport and helicopter engines. The Itami plant also has an extensive repair and overhaul capability which extends to at least fifty-two different types of jet, transport,

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[1] Ibid.

[2] Department of Commerce, World Survey (1968), p. 20.

and helicopter airframes and includes virtually every United States military aircraft produced during the 1960's.[1]

Shin Miewa is also engaged in the manufacture of components for helicopters and fixed-wing aircraft. It produces fuselage and tail assemblies for the P-2J (Neptune) maritime patrol aircraft built in Japan by Kawasaki, and it is one of the companies collaborating in the manufacture of the NAMCO YS-11 aircraft.

Shin Meiwa, in its Konan plant near Kobe, designed and produced the PS-1, the world's most advanced ASW flying boat.[2] This amphibian STOL aircraft has market potential for ASW, Air Sea Rescue, and commercial application as a medium-range passenger transport. Fourteen PS-1's have been procured for the JMSDF for delivery by fiscal year 1972 under the third defense build-up program. This superior aircraft features a sea-spray suppressor design and a special boundary layer control that permits the aircraft to land and take off at sea at speeds as low as forty-five knots, and to operate in wave heights up to twelve feet. To make possible the very low landing and takeoff speeds, the PS-1 has both a boundary layer control system and extensive flaps for propellor slipstream deflection. Improved seaworthiness results from the use of a high-length beam ratio hull, with

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[1] "Civil Aviation: Special Report on Japanese Aeronautical Manufacturing," Airgram (April 30, 1970), p. 3.

[2] Brownlow, "New Variants," p. 21.

specially developed spray-suppression strakes on the nose. Control and stability in low-speed flight are obtained by aerodynamically "blowing" the rudder, flap elevators, and ailerons, and by the use of an automatic stabilization system.

The PS-1 is powered by four 2,850 shaft horsepower General Electric T64-IHI-10 turboprop engines built under license in Japan by Ishikawajima HI. The boundary layer control uses a 1,250 shaft horsepower General Electric T58-IHI-8B shaft turbine engine, also built by IHI.

The excellent design characteristics of the PS-1 have been recognized by Grumman Aircraft Corporation of the United States, which plans to develop jointly with Shin Meiwa a passenger STOL version with 100- to 150-seat capacity by modifying the ASW model PS-1. Shin Meiwa has stated that it will export the technology for the boundary layer control system to Grumman.[1] Shin Meiwa also expects to export to its United States partner the technology for the automatic flight stabilization control system which helps to increase stability in low-speed flight. The program is initially estimated to cost 30 million yen. Grumman plans to manufacture the mock-up and the first to third test aircraft.[2]

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[1] "Japan, U.S. Firms Plan STOL Plane," Japan Times, August 10, 1971, p. 7.

[2] Ibid.

Kawasaki Aircraft Company

The Kawasaki Aircraft Company, Limited is a member of the Kawasaki group comprised of seven companies with twenty-five manufacturing works. The group's wide variety of products and services include: primary steel products; machinery and equipment for air, sea, and land transportation; electrical machinery; industrial equipment; and worldwide shipping services.

The aircraft division of Kawasaki has its main plant at Gifu, where it makes the P-2J maritime reconnaissance patrol aircraft, Vertol 107, Bell and Hughes helicopters, and the main wing for the YS-11. The Gifu plant carries out the final assembly of the twin-jet CX-1 military jet cargo aircraft, as Kawasaki is the prime contractor on the XC-1, whose first prototype test flight was in 1970. A defense agency purchase of forty-four XC-1's (approximately $39 million during fiscal 1971-1975)[1] is expected to commence production in fiscal year 1972 to replace the aging C-46 transports of the JASDF.[2]

Kawasaki has gained much of its technology through its extensive overhauling work; additionally, it has built many United States aircraft under license since 1955. It began by building 210 Lockheed T-33A jet trainers under

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[1] "More Planes Orders Seen in New Defense Plan," Nihon Keizai Shimbun, May 4, 1971, p. 4.

[2] "Special Report on Japanese Aeronautical Manufacturing," Airgram (April 30, 1970), p. 4.

license for delivery to JASDF in 1955-59. In 1959, Kawasaki received a contract to manufacture forty-eight Lockheed P2V-7 Neptune ASW aircraft for the JMSDF. The first was completed in September 1959, and the last six were delivered in 1965.

Kawasaki has been producing the Bell Model 47 helicopter (four-passenger plus crew) under license since 1953 and had built a total of 300 by May 1966. Of this total, 102 helicopters were delivered to the Japanese government, 173 to civil operators, 13 to Burma, 8 to Thailand, and 2 each to Formosa and Brazil. Current rate of production is two to three per month.

In May 1967, Kawasaki received production rights for the Hughes OH-6A light observation helicopter,[1] of which fifty-five were manufactured for the JGSDF. In the same year, Kawasaki acquired license rights for the AVCo Lycoming T-53 shaft turbine engine, which is used in the UH-1B helicopter manufactured in Japan by Fuji.

Kawasaki also has exclusive rights to manufacture and sell the large Boeing Vertol 107 Model II helicopter in Japan. In 1965, Kawasaki obtained worldwide sales rights to the KV-107 from the Boeing Company's Vertol Division. In November 1965, it was awarded a type certificate for the KV-107 by the FAA. To meet the various demands, it

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[1]Department of Commerce, World Survey (1968), p. 18.

manufactures the helicopter in eight versions as follows:[1]

KV-107/II-1	Basic utility helicopter
KV-107/II-2	Basic airline helicopter
KV-107/II-3	Naval mine countermeasures series
KV-107/II-4	(Ch-46 series) Army-Marine tactical troop transport
KV-107/II-5	Air Force long range search and rescue helicopter
KV-107/II-7	Executive type VIP transport
KV-107/II-8	Executive type VIP transport
KV-107/II-9	Ambulance helicopter

The KV-107 series helicopter is powered by two 1,250 shaft horsepower CT58-110 shaft turbine engines built by either General Electric in the United States or Ishikawa-jima-Harima in Japan.

In April 1971, Kawasaki began producing the KV-107 models with entirely domestic material.[2] The company had been producing the helicopter by importing some parts under license from Boeing. The completely independent production is necessary to cope with the scheduled halt of production of the Ch-46 by the Vertol Division of Boeing in the United States. Kawasaki has produced about sixty of the KV-107 series helicopters since its initial agreement with Boeing in 1960.[3]

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[1] "Special Report on Aeronautical Manufacturing," Airgram (April 30, 1970), p. 4.

[2] "Kawasaki Helicopter Products," Nihon Keizai Shimbun, April 1, 1971, p. 7.

[3] Ibid.

Kawasaki is also a subcontractor for the Phantom F-4Ej and a leading member of the First Aerospace Organization, formed in 1959 to study and develop a long-range surface-to-air missile with the technical assistance of Boeing. Kawasaki Aircraft has responsibility for the system design, fuselage, and engine; Fuji is responsible for the communication and electronic equipment.

Japan Aircraft Manufacturing Company and Showa Aircraft Industry

Japan Aircraft Manufacturing Company, Limited produces ailerons and flaps for the YS-11, and Show Aircraft Industry, Limited, located in Tokyo, produces honeycomb structural components for the YS-11. Both firms produce various aircraft parts, jigs, tools, systems, and aircraft furnishings; they also undertake small aircraft overhauls.

Japanese Missile Production and Space Satellite Development

Japan has an adequate capacity for missile production, but most of her operational missiles are of United States origin or design, such as the Sidewinder air-to-air missile (AAM). From March 1972 the JASDF will be provided with the Japanese designed AAM-1 infra-red homing missile, which will be built by Mitsubishi HI as prime contractor.[1]

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[1] "Rocket and Space Development," Aviation Week and Space Technology, May 5, 1970, p. 14.

The United States Nike-J surface-to-air missile (SAM) is built by Mitsubishi under license, with a contract commencing with a fifty-missile order in 1968. Several other Japanese companies are involved in the production: Nippon Electric for guidance systems, Asahi Chemical and Nippon Oils and Fats for propellants, and Daicel for warheads.

Japan also produces parts of the United States Hawk missile system, a short-range SAM to fill the gap between antiaircraft artillery and air-to-air intercept. A short-range SAM will be developed by Toshiba starting in fiscal year 1971. Prototypes of the GSDF surface-to-surface rocket have been made, but production by Nissan Motor Company, the prime contractor, will not commence until the middle of the fourth defense build-up program (1972-1976).

From the beginning of Japan's space program in 1955, both the University of Tokyo's Institute of Space and Aeronautical Science and the government's National Space Development Agency have stressed that "originality" should be one of its primary objectives, but have also recognized the big-nation prestige to be gained from an impressive showing in this field. To obtain the necessary technology, a number of industry-to-industry agreements with United States firms have already been negotiated, some of which are discussed below.

Toyo Bearing Company, a large Japanese bearing manufacturer, has signed a blanket contract with Fafnir Bearing

Company (a division of Textron, Incorporated) to import all of the latter's technologies and know-how to produce bearings for aircraft, rocket, and missile equipment. Toyo has also concluded a contract with Fafnir to import and sell various kinds of bearing products. For the technology, Toyo will make a down payment of $500,000 and royalties equivalent to 6 per cent of each sale under contract for a fifteen-year period.[1]

Mitsubishi, in 1969, reached basic agreement with McDonnell Douglas to secure technology for developing Japan's "Q" rocket, with the approval of the Science and Technology Agency. Mitsubishi HI also reached basic agreement with North American Rockwell Corporation to use its technology for manufacturing liquid rocket fuel.[2]

Nissan has agreed to obtain technology from Aerojet-General relative to development of liquid fuel rockets. While Nissan had earlier advocated development of rockets entirely with Japanese technology, it decided to enter into a technological agreement with Aerojet from concern that development of original Japanese technology might not be attained in time for scheduled use of the Q rocket in 1972. The government, after setting up a new National Space Development Agency in October 1969, plans development of

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[1] "Toyo Bearing Co. to Purchase Rocket and Missile Technology," Nihon Keizai Shimbun, May 5, 1970, p. 8.

[2] "MHI and Nissan to Get U.S. Rocket Technology," Nihon Keizai Shimbun, November 25, 1969, p. 1.

the Q rocket for getting its first satellite into orbit for making observations of the ionosphere in 1972.[1] (The Q rocket is a more sophisticated version of the Mu-type rocket, as it requires guidance systems and a high degree of technology.)

The Q rocket booster, developed by the governmental Science and Technology Agency's National Space Development Agency, is planned for one of the four stages required to launch one of the ionosphere observation satellites. The "Q" series is scheduled to be followed in 1974 by the "N" series, with a boost three times that of its predecessor.[2]

Under a contract with the National Space Development Agency, Mitsubishi, Nissan Motors Company, and Ishikawajima-Harima are currently developing Japan's proposed Q-type rockets for launching an ionosphere observation satellite and various application satellites. Mitsubishi is coordinating the development of the third liquid fuel stage and the fourth solid fuel stage of the proposed rocket.[3] The national space program received a strong boost from the February 11, 1970, success of the University of Tokyo in orbiting Japan's first artificial satellite of experimental type.

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[1] Ibid.

[2] Cecil Brownlow, "Japan Sets Ambitious Space Goals," Aviation Week and Space Technology, May, 1969, pp. 32-35.

[3] "Rocket Technique," Nihon Keizai Shimbun, March 3, 1970, p. 12.

The Q rocket is regarded primarily as a technological stepping stone to the N series rocket, and, as such, top level government approval has been received for only a single launch, to place an ionosphere observation satellite into circular orbit. However, some officials of the Science and Technology Agency hope that several other "Q" satellite launches will be possible.[1]

Guidance system planned for the Q rocket series will be a combination of inertial guidance and gas jet directional control engines, pre-set prior to launch on all four stages. The third stage is designed to boost the satellite to orbital altitude. After third-stage separations, the fourth will then cut in to give the payload the necessary speed to attain and maintain a true orbit.

The N series rockets must be capable of delivering a 264-pound telecommunications satellite payload into a geostationary equitorial orbit after a launch from a yet unbuilt site on Tanegashima (an island located off the southern Japanese mainland). After achieving initial orbit, the satellite package will be directed into a stationary orbit over the equator by telemetered directional commands from the ground. Responsibility for continued development of the communications satellite recently was shifted to the National Space Development Agency from the Japanese Postal Ministry.[2]

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[1] Brownlow, "Japan Sets Space Goals," p. 34.

[2] Ibid.

The first stage of the N series rocket is programmed to have a booster thrust of over 700,000 pounds, more than twice that of any currently under active development in western Europe. Second-stage design thrust is 310,000 pounds, the liquid third-stage 40,000 pounds, and the solid fourth-stage 10,000 pounds. Final design specifications are still under study.

The government's Space Development Committee revised Japan's space development programpplans in late 1970;[1] the change featured switching from solid- to liquid-type fuel and a three-year delay in the launching of the proposed application satellite. The revised program calls for modification of the follow-on "N" type four-stage rocket development project for launching an experimental stationary orbit communication satellite in fiscal 1973 by switching its fuel from primarily a solid type to chiefly a liquid type. This change will take advantage of American liquid rocket fuel technology to be imported.

The revised program estimates a total of 200 billion yen $555.5 million) in development and preparation expenses for launching the communication satellite, and another $55.5 million for orbiting the scientific satellite. (See Table 6.)

The National Space Development Agency has also begun to study the possibility of developing a modified N series

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[1]"Japan's Space Program Is Due to Be Drastically Revised from FY 1971," Nihon Keizai Shimbun, November 3, 1970, p. 7.

TABLE 6

GOVERNMENT EXPENDITURE FOR SPACE DEVELOPMENT
(in millions of dollars)

Fiscal Year	Expenditure
Up to 1963	$ 9,301
1964	7,351
1965	9,803
1966	12,650
1967	16,367
1968	21,920
1969	25,658
1970	41,375
Total	$ 144,425

Source: Directory of Aerospace Industry in Japan (Society of Japanese Aircraft Constructors, September 1, 1971), p. 6.

rocket which can be used as a booster for the first stage of the N rocket to be used in satellite launchings around 1979. Nissan Motor Company has already informally stated a desire to develop the booster rocket. Under the space development program decided by the government in late 1970, Japan hopes to secure technology on America's Thor Delta rocket for developing the N rocket. Plans call for launching seven of these rockets during the period from fiscal 1976 to fiscal 1978, with the objective of pinpointing

in space an experimental communications satellite.[1]

A Japanese-made rocket (regarded as a very significant achievement by Western observers) sent Japan's first scientific observation satellite into orbit on September 28, 1971.[2] A forty-four-ton, seventy-five-foot MU-series rocket successfully launched the 145-pound satellite, which circled the earth for three months.

Japan became the fourth country to orbit a satellite in February 1970, with its earth satellite "Ohsumi," climaxing a sixteen-year Tokyo University space program carried out on a "shoestring" budget averaging only $9.5 million a year. This contrasts with an average of $4.5 billion spent annually by the United States on its space effort in its peak years.

Like the previous Japanese launches, the successful launch of September 28, 1971, utilized an unsophisticated "gravity turn" device in lieu of conventional guidance and control techniques and the satellite did not follow its programmed orbit. The Japanese had deliberately barred research on guidance and control techniques in its early days on the grounds that this might inadvertently feed into military rocketry programs at some future time. However, it appears that the gravity turn system is too haphazard

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[1]"Space Agency Studies Development of Booster Rocket for Satellite," Nihon Keizai Shimbun, May 11, 1971, p. 5.

[2]Selig S. Harrison, "Japan Puts Satellite into Orbit," Washington Post, September 29, 1971, p. 1.

for a significant scientific effort, and this conclusion has led to the quiet beginnings of guidance and control research in the Tokyo University program.[1]

Japan has been requested by the United Nations World Meteorological Organization to orbit an international meteorological satellite by about 1975.[2] Presently, Japan does not have the rocket technology necessary to orbit the proposed weather satellite, and two United States firms (Martin Marietta Corporation and General Dynamics Corporation) have offered to undertake the job of the proposed orbit. The United States space cooperation program is designed to help the United States balance of payments and permit the transfer of carefully screened guidance technology deemed justifiable for the development of communications and scientific satellites. (Technology primarily relevant for military purposes is barred by an interagency screening body.) The problem of whether to accept the American offer or proceed alone is arousing domestic controversy in Japan. Mitsubishi HI and other domestic rocket and satellite manufacturers are strongly opposed to accepting such American offers, proposing instead to rely on the use of an improved version of Japan's own N series rocket. These firms believe that rapid technological

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[1] Ibid.

[2] "Two U.S. Firms Propose Undertaking Jobs for Launching Satellite," Nihon Keizai Shimbun, November 17, 1970, p. 14.

development will make it possible for Japan to orbit a weather satellite utilizing its own improved N series rocket.[1]

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[1] Ibid.

CHAPTER V

MARKET POTENTIAL FOR UNITED STATES AEROSPACE PRODUCTION IN JAPAN

Despite the fact that the Japanese aerospace industry has grown rapidly since it was reestablished in 1953, Japan can be expected to continue to import many American aerospace products. The only Japanese civilian aircraft programs of any significance continue to be the MU-2, the YS-11, and possibly the YX (YS-33) and civilian versions of the C-X military cargo transport and a joint United States-Japanese commercial version of Shin Meiwa's PS-1 STOL flying boat.

The development of the medium-range tri-jet YS-33 is financially questionable. During the coming months the Japanese aviation industry must decide whether to go ahead with its YS-33 or begin design cooperation with Boeing and/or European manufacturers.[1] There will be considerable commercial implications for the United States balance of payments, regardless of the Japanese decision. If the Japanese decide to work independently with a YS-33, with or without Rolls Royce engines, this aircraft will dominate

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[1] "Future Course of Japanese Aircraft Production," Department of State Airgram A-1246, December 31, 1970, p. 5.

the domestic Japanese market, and foreign manufacturers will find the market limited to larger, longer-range jets. If a United States partnership is established, the United States partner will have access to the Japanese market, but large sales will probably take place in the United States as well. More important, Japan's new aviation industry will have been made more competitive.

There has been little competition from other countries for United States aerospace equipment sales on the Japanese market. Eighty-nine per cent of Japan's 1966 aeronautical imports came from the United States, as compared with 92 per cent in 1965 and 87 per cent in 1967. (See Table 7.) More than 75 per cent of the civil fixed-wing air carriers operate aircraft of United States manufacture. For example, JAL's projected 1972 fleet contains sixty-five jet airliners, of which sixty-three are United States manufactured.[1] The great majority of helicopters in Japan (82 per cent) were produced locally under United States license.

American products are preferred because the Japanese aircraft industry and the Japanese Defense Agency are oriented to the use of American equipment, which has influenced the civilian users who tend to regard the quality of American products as the best in the world. However,

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[1]Department of Commerce, World Survey (1968), p. 10.

TABLE 7

IMPORT VALUE BY YEAR OF AIRCRAFT AND PARTS
(in millions of dollars)

Year	Dollar Value of Import
1952	$ 6.8
1953	20.9
1954	7.9
1955	4.4
1956	50.2
1957	16.4
1958	14.8
1959	21.6
1960	88.2
1961	110.3
1962	105.0
1963	94.6
1964	128.1
1965	166.5
1966	104.2
1967	331.3
1968	265.7
1969	151.5
1970	542.2
Total	$2,230.7

Source: Directory of Aerospace Industry in Japan (Society of Japanese Aircraft Constructors, September 1, 1971), p. 7.

increasing competition can be expected from European manufacturers, particularly in the field of aircraft engines.

Major military programs introduced during the third National Defense Program also offer great opportunity for United States manufacturers.

JAL has begun an extensive purchasing program to acquire a total of thirty-six aircraft (DC-8's, Boeing 727's, and Boeing 747's); also, All Nippon Airways has plans for acquiring additional United States manufactured jetliners.

United States Product Potential

United States products currently account for well over 90 per cent of Japan's aerospace imports, and this favorable trend is expected to continue for the forthcoming immediate years. In view of the Japanese market circumstances, promotion efforts should continue to prove effective when directed toward the scheduled air carriers and the airframe manufacturers and overhauling facilities. Japan's airlines have historically relied on United States production for their airframes and engines, and regard United States aerospace products as the utmost in performance, reliability, and safety. Although the Japanese airframe makers are actively engaged in developing new aircraft, they are expected to rely heavily on United States

producers for high quality aircraft engines and aircraft instruments not available from domestic manufacturers.[1]

Analysis of Individual Product Potential

VHF transmitters, receivers, transceivers

VHF radio is the primary air-to-air and ground-to-air communication equipment utilized by civil aircraft in Japan. The leading domestic makers in this line are Toshiba and Mitsubishi Electric Companies; their market share of VHF aircraft radio equipment is 15 to 20 per cent.[2] Domestic products are generally used only on small-sized aircraft. Civil air carriers and JAL's international fleet rely entirely on United States manufactured VHF equipment produced by such companies as Collins Radio and Aircraft Radio Corporation. In view of the growing demand for air service in Japan, it is estimated that the demand for VHF equipment will grow at an annual rate of 20 per cent. The civil air transport airlines, the prime users of VHF, are continuing to show preference for United States products.

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[1] In substantiation of the foregoing comments and the majority of the marketing data which has been referenced in the aerospace product analysis in the section to follow, the author's primary source has been the marketing studies by the U.S. Department of Commerce, Bureau of Domestic Commerce, Transportation Division, and a current report by a Tokyo-based marketing research firm, the Coral Company, dated February 1971 (available at the Department of Commerce, Aerospace Equipment Branch).

[2] Ibid.

Therefore, the current market share of 75 to 80 per cent is controlled by the United States.

UHF transceivers

In contrast to VHF equipment, which is utilized primarily by the civil aviation sector, UHF communication equipment is used almost exclusively by the JASDF, the JMSDF, and the United States military forces in Japan. For example, UHF transceivers are used by all F-86 and F-104 JASDF fighters. UHF equipment for these aircraft are made by Mitsubishi Electric Corporation under a license agreement with Collins Radio. A 20 per cent growth in UHF demand is projected, on the basis of growing requirements of the JSDF.[1] However, since the Defense Agency has adopted the policy of preferring domestically produced UHF equipment, little potential is seen for United States produced UHF equipment.

VHF, VOR/DME navigation receivers

VHF navigation receivers utilized in civil and military aircraft in Japan are a part of the air control/airways navigation system, which has been imported primarily from the United States. VHF/VOR receivers are being produced by Toshiba and Mitsubishi Electric, and DME by Furuno Electric; however, these products are inferior in

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[1] Ibid.

performance to United States products. Since domestic receivers are not competitive in cost to United States receivers and lag in reliability, their sales are poor.[1] Civil air carriers continue to show preference for United States imported navigation receivers made by Collins, Bendix, and Sperry Rand Corporation. High United States sales potential is projected to continue for this air navigation equipment.

Transponders (airborne radar identification transponder)

The single domestic producer engaged in this product is Toyo Communications Company, which supplies mainly to the Defense Agency (with about 40 per cent of the market). Jppanese civil and international air carriers use only United States imported transponder equipment made by Collins, Bendix, Loral and Hazeltine Corporation. With an estimated future annual growth of 15 to 20 per cent, the continued strong preference for United States products among JAL and civil air carriers suggest continued high sales potential.

Automatic direction finders (ADF - aircraft radio direction finders)

Mitsubishi is the only domestic manufacturer of ADF equipment through a technical agreement with Aircraft Radio Corporation, and supplies primarily the Defense Agency.

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[1] Ibid.

Although technically equivalent to United States products, some are 10 to 20 per cent higher in cost compared with United States ADF equipment. JAL and all civil air carriers continue to prefer United States ADF products made by Collins, Bendix and Aircraft Radio Corporation. Future demand is estimated to continue at an annual 15 to 20 per cent growth.[1]

Airborne doppler and inertial navigation systems

Two domestic manufacturers are engaged in the field: Mitsubishi Precision, a joint venture established by Singer General Precision of the United States, and Toshiba, producing through a technical relationship with Litton Systems, Incorporated in the United States. Both domestic makers are supplying the Defense Agency. By comparison, domestic air navigation systems are equal in terms of technical standards to United States systems; the latter have an advantage in terms of cost. United States air navigation systems are used partially by the Defense Agency but mainly by Japan's civil air carriers, constituting 80 per cent of the market.[2]

Airborne weather radar

The domestic producers in this field are Toshiba and Japan Radio Company, which control 15 per cent of the total

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[1] Ibid.

[2] Ibid.

domestic market. Although Toshiba is considered Japan's most sophisticated producer in the radar field, a technical gap of five to six years[1] exists in airborne weather radar equipment, as compared with United States imported equipment.

Loran

The major domestic manufacturer in this field is Furuno Electric. Domestic products control the entire market for ship use. However, because of the high cost of domestic airborne radar, domestic products account for only about 20 per cent of the airborne loran market.

Principal imported loran equipment is from Collins, Bendix, and Sperry Rand Corporation of the United States. In view of the recent trend of long distance jet liners switching to dual inertial navigation systems, the future growth demand is estimated at 10 per cent. United States imported loran systems continue to have a cost advantage over domestic equipment, and consequently the highest sales potential.

Radio and radar altimeters

Domestic producers engaged in making radio and radar altimeters are: Japan Aviation, the top domestic maker, which has a technical agreement with Honeywell, Incorporated of the United States; and Tokyo Aircraft Instrument Company,

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[1] Ibid.

also with a technical agreement. Forty per cent of the market,[1] primarily for civil aircraft, is served by imported United States equipment manufactured by Bendix and Collins in the United States. Since domestic manufacturers are concerned mainly with supplying equipment to the Defense Agency, and domestic radio and radar altimeters are more costly than United States products, the market for United States equipment is seen to continue with the Japanese civil air carriers.

Autopilots

The domestic producers are the Japan Aviation Electronics Industry, Limited and the Tokyo Aircraft Instrument Company, which supply primarily autopilots to the Defense Agency. Japan Aviation Electronics has a technical agreement with Honeywell, Incorporated and General Electric of the United States, while Tokyo Aircraft Instrument has a technical agreement with the Bendix Corporation. These domestic producers control 40 per cent of the Japanese market.

JAL and Japan's civil air carriers utilize almost exclusively United States autopilots of Bendix, Lear Seigler, Incorporated, and Honeywell/General Electric design and manufacture comprising about 60 per cent of the Japanese market.[2]

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[1] Ibid.

[2] Ibid.

Instrument landing systems (ILS) localizer/glide slope receivers

Takeoffs and landings are extremely critical operations in Japan because runways on most of Japan's airports are narrow and airport surroundings are densely populated and often obscured by smoke, haze, fog, or clouds. To cope with this situation, the MITI has emphasized equipping all airports with instrument landing systems (ILS). All civil and international air carriers are equipped with ILS. At present, no domestic manufacturers are in contention; Toshiba only recently began developing this system.

Since it will be at least three to five more years before domestic producers are capable of commercializing their own products, complete reliance on United States imported equipment is foreseen for the immediate years. Additionally, future demand growth is estimated at 10 to 15 per cent annually.[1]

Flight instruments such as airspeed indicators, turn and bank indicators, and altimeters

There are at present at least fifteen domestic aircraft instrument makers. They include: Tokyo Aircraft Instrument, Tokyo Keiki Seizosho, Kanto Aircraft Instrument, and Hokushin Electric. These domestic suppliers control approximately 70 per cent of the domestic market. United

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[1] Ibid.

States imported instruments represent over 90 per cent of the entire imported sector. These include aircraft instruments manufactured by Collins Radio, Colman, Sperry Rand, and Lear Seigler. Domestic products are reputedly [1] slightly inferior to United States instruments in the areas of quality, material, durability, and price. Domestic products are generally 5 to 10 per cent more costly than United States imported instruments. This is because most of the aircraft instruments have been supplied and installed on American jetliners as they were imported from the United States. Future growth of the aircraft instrument market will depend on whether follow-on jetliners continue to be imported from the United States or domestically produced, as may be the case with Japan's proposed medium-range tri-jet, the YS-33. Annual demand growth is expected to continue at 10 to 15 per cent.

Aircraft engines, including jet engines

Major domestic engine manufacturers, with heir technical collaborators, are as listed:[2]

Ishikawajima-Harima	-	General Electric
Kawasaki	-	Lycoming Division Avco Corp
Mitsubishi	-	Allison Div., General Motors

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[1] Ibid.

[2] Ibid.

Jet engines manufactured by these domestic makers are supplied almost entirely to the Defense Agency. United States manufactured engines dominate the civil aircraft market, with United States imported engines representing over 90 per cent of the total civil market for aircraft jet engines. The annual demand growth is estimated at 10 to 15 per cent. A high United States sales potential is anticipated to remain for the immediate years, but as the technical gap is closed, increasing domestic competition will be noted.

Aircraft maintenance and servicing equipment

There are at present some twenty domestic firms in this field. Included are: Shimazu Seisakujo, Kanto Aircraft Measuring Equipment Instrument Company, Tokyo Aircraft Measuring Instrument Company, Toyo Communication Company, and Fujitsu. In general, the technical standards of the products of domestic firms are equal to those of the imported products; however, Japan's civil aviation operators generally import their maintenance and service from the same United States manufacturer that supplies the engine and navigation instruments to the Japanese civil aviation market. Therefore, a continued high sales potential is expected for aircraft maintenance and servicing equipment.

Passenger and cargo terminal equipment

The major domestic makers of passenger and cargo terminal equipment are: Hitachi, Mitsubishi Electric, Toshiba, MHI, Ishikawajima-Harima HI, and Sanki Industries. Domestic equipment accounts for over 95 per cent of the equipment used in the domestic market. Construction of the JAL cargo terminal to be built with the New Tokyo International Airport in 1972 will be undertaken by the Toshiba group, while construction of the projected air cargo city terminal within Tokyo is expected to be handled by either Hitachi or Mitsubishi or the Toshiba group. Equipment, therefore, will be supplied by the domestic maker connected with these groups. Thus, in view of the almost complete control of the market by the domestic makers, no sales potential is seen for United States products.

A most significant factor to be aware of in analyzing future aerospace product potential in Japan is that there are at present at least 209 license agreements or technical collaborations between United States aerospace firms and potential Japanese producers.[1] These agreements cover the entire spectrum of the aerospace industry and serve to provide a strong economic tie between Japan and the United States.

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[1]A listing of the 209 U.S. aerospace firms and their Japanese counterparts is found in Aircraft, Instrumentation and Ground Support Equipment (Coral, Inc., Marketing Research Consultants, February, 1971), pp. 93-107.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The Japanese aerospace industry is an interdependent, loosely knit, government-private industrial consortium, which receives much of its guidance and production direction from the government in the commercial as well as the military sector. Government participation is strong at both the initial planning and the financial levels.

To maintain a strong production base, the government has insisted that all the work on an aircraft project be spread among as many firms as possible. Almost all members of the Society of Japanese Aircraft Constructors,[1] for example, are participating in the production program for the Shin Meiwa PS-1 STOL seaplane for the Japan Maritime Self Defense Force (JMSDF). More than 100 firms will be employed in support of the manufacture of the PS-1.

This strong governmental participation in and supervision of the activities of the industry have produced their share of bureaucratic red tape and delay, and this has been true in the response time for back-up spares for the YS-11.

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[1]Cecil Brownlow,"Japanese Aircraft Revival Pushed," Aviation Week and Space Technology, January 19, 1970, p. 33.

Japan's aerospace industry is yet relatively small and is mainly an offshoot of some of Japan's major industrial firms, for which aircraft manufacture and aerospace associated production represent only 4 to 6 per cent of the total activity. The current level of aerospace activity is not yet commercially self-supporting; however, it does not seem possible that the government will fail to insure that an industry so vital to Japan's defense, prestige, and technological development will be promoted.

Why is it necessary for Japan to promote such an unstable industry as aircraft manufacturing? One of the reasons is that, in order to meet the increasing demands for domestic air transportation--i.e. aircraft--they desire to manufacture their own rather than rely on imports.

The MITI has also stated that the industry is important because of its effect of stimulating technology in the associated industries of machinery, metal, and electronics. Thus, the development of the aircraft industry contributes to raising the level of Japan's entire industrial technique. Japan's domestic aviation industry, with more advanced technology, could also increase her export product potential.

There are some problems yet to be solved within the industry, such as the shortage of domestically produced marketable aircraft, trained pilots, and limited aerospace technology.

Technically, the Japanese aircraft industry is competent to design and manufacture modern high performance aircraft, both military and civil. In some areas of advanced design it lags compared with the United States and European industries, and definitely lacks experience in the design of very large aircraft. Japan, however, has wisely shown no disposition to engage actively in the immediate future in this enormously expensive business, which has been hazardous even among the giants of the United States industry.

Slow development is a problem resulting from the relatively small research and development capability and from limited funding of this activity; for example, the YS-11 market research and design studies were begun in 1957, but the first aircraft did not enter service until April 1965.

Aircraft manufacturing is the least profitable division of the production of most large diversified firms. For example, Fuji Industries accrues only 6 per cent of its total revenue from its aircraft division, which has one-sixth of its total personnel. As in other sections of Japan's aircraft industry, Fuji's aircraft factory is well below the standards of a modern Western aircraft factory, because of its having grown piecemeal rather than having been designed and built for a specific purpose. In mid-1970, the Aircraft Industry Council submitted to MITI a

report on what it thought was needed to promote the industry. Its recommendations[1] amounted to support for development and production of smaller jet aircraft for feeder line operation, international collaboration on the development of the next generation (YX) of medium airliners, and development of the industry's capability to design and produce its own military aircraft and of the capability to design and produce its own engines, through increased investment in research and development. The Council also recommended financial assistance for NAMCO and for advanced jet engine development.

MITI responded by programming into its 1971 budget proposal a $1.26 million subsidy to NAMCO and a government-backed loan of $16 million to support further YS-11 production. MITI also proposed 100 per cent government-backed financing for the research and development program for the next jet civil airliner and for advanced jet (turbo fan) engine development, estimated at about $8 million for 1971.[2]

The Japanese aircraft industry suspended production and research activities for seven years after the end of World War II and was permitted to resume activities only from April 1952. This resulted in a substantial technical lag, and, to overcome this gap, the domestic producers aggressively entered into technical relationships with United States manufacturers.

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[1] "Future of the Japanese Aircraft Manufacturing Industry," Department of State Airgram A-482, July 15, 1970.

[2] Ibid.

What cannot be overemphasized is the fact that the United States aerospace industry played a very significant role in supporting the recovery of the Japanese aircraft industry. All Japanese aircraft were produced on a licensing basis through technical collaboration with the foreign manufacturers, particularly United States manufacturers. Among these aircraft were the Mentor B-45 trainer, produced by Fuji Heavy Industries under agreement with Beechcraft Company; the Bell-type helicopters, produced by Kawasaki Heavy Industries under technical agreement with the Bell Helicopter Company; the F-86 fighters, produced by Mitsubishi Heavy Industries under technical agreement with North American Aviation; and the T-33 jet trainers, produced by Kawasaki Heavy Industries under technical agreement with Lockheed Aircraft Corporation. The jet planes in particular entailed assembly production by the Japanese under guidance by American technical engineers.

Besides such production developed through licensing, Japanese industry has also continued efforts to develop its own technology.

Fuji Heavy Industries began producing the T-1A and T-1B jet trainers, which were developed by its own staff. The commercial aircraft developed by Japanese domestic manufacturers were the medium-range turboprop YS-11 transport, and the small-sized MU-2's and FA-200's. The engines of these three domestic aircraft as well as most

of the instruments used on these aircraft were imported products. In other words, the Japanese aircraft industry has only just now recovered to the stage of being capable of developing medium- and small-sized aircraft. In view of this situation, over 90 per cent of the aircraft used by Japanese civil air carriers are United States imports. Consequently, Japanese civil airlines also rely on United States manufacturers for navigation equipment and flight instruments to be used on board their fleet aircraft. On the other hand, the Defense Agency relies primarily on the domestic manufacturers with technical relationships with United States manufacturers for the supply of aircraft required for its Self Defense Forces.

Nevertheless, the technical gap, when compared with the advancement of the Western countries, is still conspicuous. Japanese aircraft technology has just reached the stage of developing airframes with its own techniques and is still behind other countries in the development of parts, equipment, and instruments. For example, the introduction of foreign technology during the 1952-1969 period produced 209 technical and licensing agreements, of which 39 related to airframes and the remaining 170 to aircraft equipment and instruments.

As for ground support communication equipment and navigational aid equipment and airport facilities, the technical standard of domestic Japanese producers is

essentially equal to that of foreign producers, including those of the United States.

The aerospace technical gap is most conspicuous in the field of aircraft engines and communication and navigational equipment for use in flight, which require the highest level performance, reliability, and durability. At least a five-year technical gap is seen between Japanese domestic production and United States production.

The aircraft engine makers of Japan are the Ishikawajima-Harima Heavy Industries, the Mitsubishi Heavy Industries, and the Kawasaki Heavy Industries. The sole engine developed by domestic technology in postwar Japan is the turbojet engine J-3. With the exception of this J-3 jet engine, Japanese aircraft engine makers are engaged in the manufacture of aircraft engines with technical assistance from United States firms. These engines are supplied primarily to the Defense Agency.

As an example of the dependence upon foreign assistance, Ishikawajima-Harima started producing J-79-11 engines for F-104 jet fighters after having concluded a contract with General Electric Company of the United States for technical induction in 1960. Kawasaki commenced production of T-53 turbo shaft engines for HU-1B and 204B helicopter use following its technical agreement with the Lycoming Corporation. Mitsubishi began producing T-63 turbo shaft engines for the OH-6A helicopter following a

technical agreement with Allison Division of General Motors Corporation.

It then follows that Japanese aircraft engine manufacturers have not yet demonstrated their ability to carry out the unassisted development of aircraft engines. Consequently, all Japanese aircraft developed domestically are utilizing foreign engines. For example: the YS-11 utilizes Rolls Royce Dart engines made in Britain, the MU-2 uses engines manufactured by Garrett Air Research of the United States, and the FA-200 uses Lycoming engines of United States manufacture. Although Japanese aircraft engine manufacturers are presently making active research and development efforts through strong financial support from the government, it is estimated that at least five more years will be required for aircraft engines to be commercially designed and independently produced in Japan.

United States produced aerospace products, particularly aircraft engines and communication, flight, and navigation instruments, are highly regarded by Japanese civil air carriers. This attitude, coupled with the top priority of all civil carriers for the safety of their aircraft and passengers, has accustomed Japanese operators to long-time use of aircraft products of the United States. This has been a strong factor in retaining United States aviation products, even when domestic-made products have reached reputed comparability. For example, the leading domestic

airline, the only international airline in Japan, the Japan Airlines, operates under a mutual assistance agreement, concerning parts, equipment, and maintenance, with the various foreign airlines operating in Japan and abroad. When JAL needs to replace parts from abroad, it is supplied with such parts and technical assistance from the airlines operating in that country. Conversely, when a foreign airline is faced with the problem of replacements in Japan, JAL provides such service. This has meant that JAL has found it convenient to have a constant supply of aircraft products of the United States which can be exchanged with other world airlines. In other words, even if high quality products are developed domestically in Japan, there is little likelihood that JAL would use them unless these products were preferred by all the other international airlines as well.

The Japanese government, like those of other advanced nations throughout the world, has come to learn of the advantages to be attained through long-range planning. Japan has applied planning concepts to all economic-oriented functions of the government, resulting in maximum control over all aspects of economic growth. Although such planning concepts are not new, Japan's remarkable success can be explained in broad terms as: (1) oriental attention and dedication to once-established plans, and (2) economic forecasting ability relatively free of external factors and

defense budget for 1972-1976 includes some $480 million for research and development. As has been noted in Chapter IV, space research has been of some interest to the Japanese (expending $100 million over the past ten years); however, their expenditures have been slight, as compared with those of other major nations. The trend is nevertheless upward, and it is estimated that by the mid-1970's Japan will spend between $500 million and $1 billion on satellite and launch vehicle programs.[1]

An original feature of the semi-government-industrial NAMCO organization (Nihon Aeroplane Manufacturing Company, Limited), one that will probably contribute greatly to the future success of this plan for the Japanese aircraft industry, is that NAMCO's activities are restricted to the management of development, design, and sales, with no direct production activity under its control.

A final and most important feature of the structure of the Japanese aerospace industry is that the companies involved are diversified into such production fields as ships, motor vehicles, electronics, and machine tools, and aerospace activity is often a small part of its total concern.[2]

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[1] Ibid.

[2] The Society of Japanese Aircraft Constructors reported in its Directory of Aerospace Industry of Japan, of September 1, 1971, that the total assets of the aerospace divisions of all heavy industries equated to 5.4 per cent and that the aerospace sales total represented 4.5 per cent of the sales of all heavy industry.

This factor, together with production sharing and the assurance of financial support of the government, provides a strong base on which to build the industry.

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Thesis
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