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**The YS-11 Project and Japan's Aerospace Potential**  
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Richard Samuels has been making the case in the past few years that Japan has had a great deal of success in developing its aerospace industry through policies different from those of the United States. In his essay coauthored with David Friedman “How to Succeed Without Really Flying” (in Johnson, Tyson, and Zysman’s *Politics and Productivity*, 1989) and his book *Rich Nation, Strong Army* (1994), Samuels has described such Japanese practices as “spin ons” from commercial to defense technology. He also argues that Japanese defense production is “embedded” in the larger commercial economy and that technology is more broadly diffused through competitive yet cooperative industrial ties, whereby companies that lose in competition for the leading role in defense projects often participate in the projects as second-tier partners. Foreign partners are also important avenues to advanced overseas technology, which has proven especially important at times when Japan is playing catch-up with the West.

Throughout these particulars runs Samuels’s theme of techno nationalism--the idea that Japan’s governing elite has developed technology primarily to strengthen Japan against foreign threats. Coming late to industrialization in the last century and then recovering from its devastating defeat in World War II, Japan has relied much less than Britain or the United States on laissez-faire or rugged individualism.

But has Japan done all that well in playing by its own rules, particularly in such an advanced industry as aerospace? Two Japanese authors have recently published different views of Japan’s record in the nation’s postwar aerospace industry. Maema Takanori, a former engineer who worked on jet engines for some 20 years at Ishikawajima-Harima Heavy Industries (IHI), looks back at the YS-11 project as both epic adventure and fruitful endeavor. In Maema’s account, *The Men Who Built Japan’s Own Passenger Airplane [YS-11: Kokusan Ryokakuki o Tsukutta Otokotachi*, Kodansha, 1994], a visionary official of the Ministry of International Trade and Industry (MITI) launched a project by which the industry’s dedicated engineers designed, built, and exported a reliable passenger airplane. Whatever the missteps, the YS-11 project remains for him a monument to Japanese industrial policy. By contrast, veteran *Tokyo Shimbin* journalist Yamamura Takashi sees the YS-11 as a complete failure that was doomed from the beginning. In his book *The Tragedy of the YS-11: The Collapse of a Special Corporation [YS-11 no Higeiki: Aru Tokushu Hojin no Hokai*, Nihon Hyoronsha, 1995], Yamamura focuses not on the heroic efforts of the project’s participants but on the structural defects of the Nihon Airplane

Manufacturing Corporation (NAMCO), the special entity created by MITI to develop the YS-11.

### **Maema for the Defense**

Maema's tale of Japan's postwar aerospace industry departs from conventional Anglo-American economic rhetoric. Here we find no mention of factor endowments, competitive advantage, or the invisible hand. Rather, Maema shows us the clearly visible hand of Akazawa Shoichi, who directed MITI's Ordnance Division (today, the Aircraft and Ordnance Division) in the mid-1950s. Akazawa assumed his post with vivid memories of the war in the Pacific and a burning sense of mission to rebuild Japan's prewar aircraft industry. A graduate of the elite law faculty of Tokyo Imperial University (today's University of Tokyo), Akazawa's defining experience was his wartime service in the Imperial Japanese Navy (IJN) on board the battleship *Hiei*, from which he watched with pride Japan's incomparable Zero fighters fly into battle. He survived the sinking of his ship off Savo Island during the fighting for Guadalcanal.

Wartime memories were less important, however, than the drop in U.S. special procurement orders after the Korean War wound down and the ensuing internal Japanese debate over industrial policy. With little capital and a huge, inexpensive labor pool, Japan could have followed Anglo-American economic theory by eschewing capital-intensive heavy industry to concentrate on agriculture, textiles, and other labor-intensive light industries. Instead, the dominant participants in the debate devoted their energies to pushing Japan swiftly into such higher value-added sectors of heavy industry as steel and aircraft. The late Okita Saburo, a key figure in postwar industry and U.S.-Japan relations, once explained that steel's importance as a key industry outweighed the Japanese steel industry's lack of competitiveness when the government chose in the 1950s to promote its growth.

Akazawa targeted passenger aircraft for much the same reason. Aerospace was the top of the manufacturing food chain, the crowning achievement of an advanced industrial nation. Although the YS-11 was conceived primarily as a commercial aircraft, the Japanese Defense Agency (JDA) would also be able to use it. The YS-11 would thus be a "spin-on" project--transferring civilian technology to the defense sector--the opposite of a typical American military "spin-off" program.

What follows is a classic, colorful tale of Japan, Inc. Akazawa went to the mat in protracted negotiations for funding in fiscal year 1957 with the tight-fisted Ministry of Finance (MOF), enlisting the support of industry and the ruling Liberal Democratic Party (LDP). His Navy background proved a blessing, giving him connections to, among others, former Naval officer (and future prime minister) Nakasone Yasuhiro. With subsidies secured, the project began with the establishment in May 1957 of the Commercial Transport Design Research Association (or, in its Japanese abbreviation, Yuken). Yuken's executives were leaders of Japan's revived (U.S. Occupation authorities had banned airplane research, development, and manufacturing) aircraft industry. On its technical committee were legendary Zero designer Horikoshi Jiro and four other able wartime

designers. Maema offers detailed accounts of their wartime design successes and repeatedly refers to the band as the Five Samurai, evoking Kurosawa's classic film *Seven Samurai*.

This project then moved to its next level with the establishment of the special corporation NAMCO in March 1959. The Japanese government took 54% of the shares; the aircraft manufacturers, 18%; and parts/materials suppliers, 11%. Trading firms, banks, insurance companies, and stock firms constituted the remaining participants. MITI and MOF veterans (the government "Old Boys," or OBs, famous in Japan Inc. lore) took executive positions under Mitsubishi executive Soda Taizo. The engineering section chiefs were all wartime veterans in aircraft production, including Mitsubishi designer Tojo Teruo (second son of wartime Prime Minister Tojo Hideki). It was fortunate that several section chiefs hailed from Tokyo Imperial University's Class of 1941, giving cohesion to a company put together largely with executives and designers from competing companies.

The dedicated men of NAMCO then labored mightily to overcome a host of obstacles. While the wartime Japan aircraft industry had produced excellent fighters, only Nakajima Aircraft (the forerunner of today's Fuji Heavy Industries) had ever designed and built a passenger airplane, the 8-seat AT2. Worse still, the international state of the art had advanced rapidly while Japan's industry stagnated during the seven-year (1945-52) Occupation ban on aerospace R&D and manufacturing. NAMCO itself proved unwieldy, a company without its own manufacturing facilities or wholly permanent staff. Even the Five Samurai, Japan's greatest wartime designers, contributed little more than prestige in what Maema describes as a young man's game. The author's account of Horikoshi's punctuating his arguments with the younger generation of YS-11 designers by examples of how he had solved technical problems when designing the Zero (despite the obvious differences in designing a high-performance fighter and a 60-seat civilian passenger plane), is telling.

In the end, as Maema admits, the men of NAMCO built the YS-11 less by drawing on past experience than by copying, benchmarking, and incorporating foreign technology into the plane. With no Japanese experience in cabin pressurization technology, for example, the project's team simply copied American equipment. Learning from example proved the hallmark of NAMCO's approach. Japan's aerospace industry had first recovered from the war and its Occupation inactivity by repairing American planes during the Korean War, then by building foreign aircraft under license. Aircraft designers had regained access to both foreign and domestic technical journals. Japan's revived airlines, international trading firms, and diplomatic missions resumed their long-standing function of funneling foreign information to industry. Japanese furiously snapping pictures at Britain's annual Farnborough air show became a familiar sight. At one point, a designer found the solution to a key problem in controlling the YS-11 in a foreign journal article on the use of spring tabs in a plane's vertical stabilizer.

Not that benchmarking was without its own problems. The YS-11, a twin-engine turboprop plane inspired by various aircraft then in the air, was old by the time it went into full-scale production in 1965. NAMCO even followed foreign models in its legal affairs,

omitting in a foreign sales contract to write provisions covering the YS-11's propellers. The executives had simply copied a previous All Nippon Airlines (ANA) procurement contract for Boeing B-727s, the latter equipped with jet engines!

Maema also shows the determination of those involved in the YS-11 to "eat into" the international aircraft market. The project's planners first planned to place 50 aircraft in overseas markets, primarily in Southeast Asia. In an exception to its rule to use Japanese components wherever possible, the project largely relied on foreign avionics (the area where Japanese companies most trailed the West) to create a viable product. Its planners also adopted in toto America's Civil Air Regulations 4b (CAR4b), the de facto international standard, and invited informal FAA review of the project to eliminate defects before applying for formal approval. In 1965 NAMCO reached an agreement with a Philippine airline company for four aircraft. Backing the deal was the Tokyo government--which supported it as a form of war reparations to the Philippines--the Japanese Embassy in Manila, and the Tomen trading company. Among those attending the ceremony marking the first plane's delivery were NAMCO's president and the chief of MITI's Aircraft and Ordnance Division.

Particularly interesting in Maema's account are the efforts to sell the YS-11 to American airlines. Despite the initial focus on Southeast Asia, the YS-11 project's leaders could not resist the lure of the American market. The author describes the export by lease agreement to Hawaiian Air Lines in 1966 as the "first step" in NAMCO's campaign. Then, with an official send-off from Prime Minister Sato Eisaku and MITI Minister Miki Takeo, NAMCO sent a plane to the continental United States. There, NAMCO won a contract with Piedmont Airlines for 23 planes, the largest single overseas order for the YS-11. Years of hard work, as well as MITI-supervised pricing of the YS-11 to undercut the competitor Martin 404 passenger plane, had gained Japan a foothold in the world's largest, most advanced aircraft market. In all, NAMCO exported 75 YS-11 aircraft to 19 customers in 15 countries in the Americas, Asia, Europe, and Africa. But pricing and extended payment terms designed to undercut the foreign competition rather than recoup costs resulted in greater losses than anticipated. Japanese inexperience with international sales and service was also a problem. NAMCO had assumed all project risk and debt while guaranteeing Japan's airframe manufacturers a profit to build the planes, but running a commercial project like a defense contract eliminated the incentive for the companies to cut costs. MITI's Akazawa, for his part, admitted in retrospect to launching the project without giving much thought to the bottom line.

The project's end came as the Japanese economy grappled with the rising yen after President Nixon in 1971 ended the dollar's fixed exchange rate to the yen. NAMCO ceased manufacturing YS-11s after the project had produced 180 of them. The special corporation and Akazawa Shoichi, by then chief of MITI's Heavy Industries Bureau, could not sell the successor YS-33 (so named as NAMCO's third project, a three-engine aircraft) to either MOF or industry officials.

On balance, Maema judges the project to have been a success. The YS-11s manufactured in 1968, accounting then for nearly half of domestic aircraft production, helped make that

year the industry's peak for civilian orders. The project reduced the business cycles accompanying the industry's overwhelming dependence on military projects.

The project also gave its many participants valuable experience. In one case, according to Maema, a NAMCO technical staffer returned to his parent corporation, Sumitomo Precision Products, with technical knowledge that helped the company to become a current world leader in aircraft landing gear. Tojo Teruo went from managing both NAMCO's YS-11 and C-1 military transport projects to become chairman of Mitsubishi Motors. Finally, the basic testimony of the project's success, according to the author, is that 112 of the project's 180 YS-11 aircraft were still in service in 1994. Yes, there were financial deficits. On the other hand, Maema argues, in the postwar era only Boeing has managed not to lose money on new aircraft projects.

### **Yamamura for the Prosecution**

Journalist Yamamura Takashi, for his part, concentrates less on the individuals involved than on the nature of the enterprise. He notes that the YS-11's maiden flight over Nagoya in August 1962 also launched the hopes of many that the project would make Japan an international player in aircraft manufacturing. Instead, the project ultimately lost 36 billion yen--over four times NAMCO's capital of 7.8 billion yen--to produce 180 aircraft. Moreover, no Japanese airline has since voiced any enthusiasm for a second national aircraft development project. The YS-11 was simply a "tragic" failure, according to Yamamura. This tragedy came about, he argues, as a result of the project's structure. MITI and the Japanese airframe makers conceived NAMCO as a special corporation to marshal the forces of Japan's recovering aerospace industry in a key project beyond the reach of any single company. NAMCO was to issue contracts throughout the industry, thus avoiding duplicate corporate investment and overconcentration of technical knowledge in a single prime contractor. But the resulting structure produced a "paper company" with no manufacturing facilities and corporate participants with no authority. Worse, NAMCO financed production with money borrowed without collateral from the private sector but guaranteed the manufacturers a profit. NAMCO was thus running a civil aircraft project like a defense contract. Finally, the bureaucrats and industry executives remained wedded to military ways, stressing aircraft performance at the expense of cost and customers.

As a paper company, NAMCO lacked not only manufacturing plants but personnel. A full third of the corporation's employees were on rotation from other companies even as late as 1970. Japan's airframe manufacturers and other corporate participants seconded executives and designers to NAMCO at their convenience. The major participants also worked on JDA contracts, making them reluctant to part with seasoned engineers when defense contracts were flush. Many saw YS-11 as less a true project than a training opportunity. Mitsubishi in particular rotated a large number of employees through the project in quick succession. This practice led to accusations within the industry that Mitsubishi was using NAMCO as a training school for its MU-2 business aircraft, which it launched in September 1963. Mitsubishi even recalled Tojo Teruo, NAMCO's chief engineer, after a two-year rotation.

Running a civil aircraft project with a military mindset also hurt the project. The wartime designers who oversaw the project remained wedded to performance over all other considerations. The YS-11's engineers gave no thought to operating costs, fuel consumption, and maintenance costs. One anonymous airline company employee quoted by Yamamura offers what may be the most astounding example of the difficulty the project's designers had in shifting gears from warplanes to civilian passenger aircraft. Going over early rough sketches at the Yuken design consortium, the airline employee noted with disbelief the absence of toilets on the future aircraft. Yuken's reply was that the plane was already jammed full with 60 seats. Customers flying the 90 minutes between Tokyo and Osaka, a primary route anticipated for the plane, would simply have to do without toilets!

In the end, Yamamura sees the YS-11 project as the failure of a special corporation. He finds in the program signs of the "spiritualism" that drove Imperial Japan's military leaders to insist that the Japanese soldiers fighting spirit would ultimately triumph over any adversity. The author is particularly scornful that the project was launched with few firm ideas, other than a production target. Finally, he blames the YS-11's "tragic" failure under NAMCO for Japan's not taking the lead subsequently in any international passenger plane development project.

### **Tokyo's Verdict on YS-11: Not a Failure**

Nonetheless, Japan demonstrated through the YS-11 project that its aerospace industry could design and build a viable passenger aircraft. As Maema notes, 112 of the 180 venerable airplanes were still in service as of last year, 13 of them for the Defense Agency. The problem, as Yamamura underscores and even Maema admits, was that the project failed to produce a plane that came anywhere close to breaking even.

As Richard Samuels indicates in *Rich Nation, Strong Army*, the government has since continued to target aerospace as a strategic industry and to marshal industry in collaborative ventures. Tokyo has simply learned not to subsidize directly a company's mass production. Also, a quick glance at the policy landscape reveals that Japan remains committed to developing its own aerospace industry. Looking at MITI's aircraft-related auxiliary organs alone, we see not only the survival of the Society of Japanese Aerospace Companies (SJAC, an industrial association established in 1952) but the launching since the demise of the YS-11 of three foundations (*zaidan hojin*): the Japan Aircraft Development Corporation (JADC, 1973), the Japanese Aero Engines Corporation (JAEC, 1981), and the International Aircraft Development Fund (IADF, 1987). MITI has also had its Aircraft Industry Council as an advisory organ since 1987. One can find a host of other aerospace auxiliary organs, advisory councils, special corporations, and research institutes under the Science and Technology Agency, Ministry of Transport, and Ministry of Education, Science, and Culture.

In 1989, Japan launched a YS-11 successor project, called the YSX. The Japan Aircraft Development Corporation has also been negotiating with Boeing to bring that company into the project as a way to tap its advanced technology and international marketing skills.

But in mid-June the two signed a letter of understanding agreeing only to continue studying the matter for another year. Despite Japan's desire to enter the aircraft industry, the biggest obstacle at the present time is the high yen and the cost of building any aircraft in Japan.

Nonetheless, Samuels may not be wrong when he argues that Japan's domestic aircraft industry, without anything near the flow of military money the Pentagon has channeled for decades to U.S. companies, has grown from being one-thirtieth the size of the U.S. industry in 1983, to being one-fifteenth their size in 1994. Samuels, pointing to the increasing value share of components in finished aircraft, also makes the case that Japanese industry--more a components manufacturer than an integrator at this point--is well positioned for the future. Japan must be considered a player with the United States in developing not only conventional passenger aircraft but the next generation of supersonic planes and spacecraft.

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