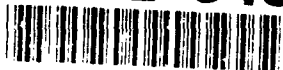


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TECHNOLOGY, FUNDING AND MODERNIZATION

A MAJOR PAPER SUBMITTED TO THE GRADUATE DIVISION OF THE
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REQUIREMENTS FOR THE DEGREE OF

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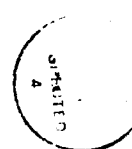
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ABSTRACT

The Chinese aviation industry is presently undergoing a critical crisis in its development process. The early PRC air force was dominated by the Soviet Union, in both aircraft and production methods. After the Soviet break in 1960 the Chinese went through a period of isolation. Upon emergence from that isolation, the defense industry began programs of acquiring foreign technology. Early programs included such things as the Rolls-Royce Spey aircraft engine. The Chinese air force's Soviet-designed aircraft eventually were highly modified by the Chinese. The process of repeatedly modifying these aircraft is presently outliving its usefulness. In order to modernize its aerospace industry, there are a few paths the Chinese could take. The practice of producing missiles for sales abroad has earned a high profit margin but is politically risky. Returning to economical production of aircraft is not possible since there is no requirement for that many aircraft. The last possibility is to focus on sub-contracting aircraft and engine parts for western companies. This practice has increased the industry's technological base, earned it foreign currency, and given it foreign credibility. The direction of China's aerospace industry is now hinged on the outcomes of the path it takes. It will depend on the effects of that path and the ability of the industry to unify its efforts in order to avoid confusion.



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APRIL 1992

BY

Bret D. Johnson

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China's Aerospace Industry: Technology, Funding and Modernization

Modernization in China's military industry is a vast subject. This paper will seek to understand the method of modernization by looking at one portion of that industry, the aviation branch. The aviation industry has undergone some critical changes within the last decade which make it a critical element in China's overall modernization plans. The importation of technology has taken on many different forms and has been driven by different forces. The aviation industry's actions determine the direction and technological level of both the military and economic sectors in China. Aviation, as is the case in most other countries, is a booming business.

MECHANISMS OF ARMS TECHNOLOGY TRANSFER

The subject of technology transfers in and out of China cannot fully be understood unless one understands the methods in which China has acquired technology since the establishment of the PRC. The mechanisms include: indigenous R&D and production, co-production with the USSR, modifications to Chinese or foreign systems, reverse engineering, co-production with other countries, and captured systems. These mechanisms for obtaining military technology can be a guideline to understanding the different periods of Chinese technology transfer and the motives of the government with regards to technology transfer at those certain periods of time in history. Although formulated and named by several different analysts, the summary contained in this paper will be

taken from a list compiled by Wendy Frieman.¹ Repeated reference will be made to this list throughout the paper in hopes that the reader will enjoy a more extensive conceptual view of the materiel.

Indigenous R&D and Production

The Chinese have had success at producing several types of weapons without appreciable outside help. Their submarine and space capability has fared well, but the best example of this indigenous production has been the development of their nuclear industry. Since the Soviet refusal to give China a nuclear bomb or any sort of technical plans for it in 1958, China was forced to develop the technology on its own.² One reason that this program did succeed was the priority with which it was awarded. "Foreign Minister Chen Yi was reported to have said that China would acquire nuclear weapons even if the Chinese common man had to go without his pair of trousers."³ Many indigenous programs did not receive this degree of support. In contrast to the nuclear program, the general reason for obtaining technology through the other five mechanisms was the failure of indigenous R&D and production on a general scale.

Co-production With the USSR

Cooperation with the USSR represents an entire period, from 1949 till 1960, of technology transfer in the history of the People's Republic of China. From the founding of the PRC until 1960 the USSR participated

¹Wendy Frieman, "Foreign Technology and Chinese Modernization" *China's Military Reforms: International and Domestic Implications*, Ed. Charles D. Lovejoy, Sr. and Bruce W. Watson, (Boulder: Westview Press, 1986) 52-60.

²S.K. Ghosh, "China's Advanced Weapons Development Programme" *IDSA Journal* 3 (1970) 25.

³Ghosh, 24.

"in the construction of over 200 large capital projects for civilian as well as military industries."⁴ The Chinese army became equipped almost entirely with equipment of Soviet origins. This jump-started China's military, as well as the civilian industrial capability, even if it was detrimental in some cases.

Modifications to Chinese or Foreign Systems

After the departure of the Soviets in the early 1960s the Chinese were faced with a new problem as to upgrading their defense capability. Through practice in modifying their existing systems the Chinese became experts in modification. They are now able to take a system and upgrade its capabilities several times in order to obtain a many-fold increase in its performance. This modification process is used on indigenous as well as foreign systems, where many of the foreign systems are bought and then modified in order to sell at a profit. The modified systems may not even be used in their own armed forces but are used as a method of importing technology and making money.

Reverse Engineering

Since COCOM (Coordination Committee for Controlling Export of Strategic Materials to Communist Countries) has put restrictions on the importation of certain technologies into China, the government cannot overtly import some of the technology that it needs. It has resorted to covertly obtaining samples of the systems that it is interested in. The process then is to take the system apart, analyze it, and try and copy it. In certain instances this has been successful but the major drawback is

⁴Frieman, 55.

that in so doing, a major time lag in technology is experienced because of the time needed to complete the process. A jump in capability may occur but then the other countries are then also advancing their own technology.

Co-production With Other Countries

China has experimented many times with co-production programs but is very leery due to their experience with the Soviets. The Soviet break and abrupt pullout left China with unfinished assembly lines and very little complete knowledge about the design and manufacture of any one complete system. In attempting co-production of a system China is careful not to be left with any lack of design and manufacture knowledge. For this reason very few deals are made for the outright buying of a weapons system; the design and related technological capabilities are often requested. This is a beneficial mechanism for technology transfer but China is afraid to use it as much as it can for chance of being left in a lacking situation. At the present time China has achieved success in co-production of certain aircraft components and in licensed production of foreign aircraft. These two methods have both increased China's level of technology and gained important foreign revenues.

Captured Systems

Captured systems have been used in China when the need has arisen. Specifically, three situations have seen the use of captured systems. The parade of Communist forces into Beijing in 1949 was said "to have been the most extensive public display of US. military hardware

in over a decade."⁵ Most of those weapons were sent to help defend the Nationalist troops before their defeat. Weapons captured during the Korean War were said to have been used in that same war. The Chinese were also reported to have pilfered some of the arms shipments passing through on rail from the Soviet Union to support North Vietnam's war against the US.

EARLY EXPERIENCES - THE SOVIET HONEYMOON

The Soviet honeymoon, or period of full Soviet cooperation from the establishment of the PRC until 1959, was one to be envied by any country seeking development aid. The aid given by the Soviets became the largest technology transfer experiment in history.⁶ As mentioned earlier, some 200 large capital projects for both civilian and military industry were begun. Whole industries were set up by Soviet personnel and those personnel began operation while training the Chinese workers. This entire production was the result of a Sino-Soviet agreement signed on 15 October 1957, concerning "new technology for national defense."⁷

However, the total support of the Soviets showed many limitations, especially when the break occurred between the two countries in 1959-60. The Soviets had shown concern in 1958 over China's wish to obtain the plans for, and a sample of, a nuclear bomb to be used against Taiwan. The request was refused and in 1959 the (1957) agreement was torn up.⁸ When the USSR decided to pull out of China, it left quickly. Technicians left their production lines in mid-construction and took

⁵Frieman, 60.

⁶Frieman, 55.

⁷Ghosh, "Advanced Weapons," 24.

⁸Ghosh, "Advanced Weapons," 25.

anything of technical value, which included plans and data. Since the Soviet technicians had been in charge of the entirety of the projects, the Chinese were not capable of continuing construction of the half-completed factories in an ordinary fashion. Modifications were made in order to 'fit' in with the level of the Chinese technical expertise. This situation of restricted technical transfer expressed the attitude of the Soviets in giving aid to China during that period. There was a reluctance to give any vital production technology. "They believed in supplying entire systems instead of providing the production technology to help the Chinese build their own facilities."⁹ What this meant was that the Chinese had no chance of setting up a military industrial base that they could truly call their own. A major amount of those unfinished factories never were completed. For the weapons systems that were obtained, such as MiG-19 fighter planes and T-55 tanks, the Chinese had to spend time understanding how the production lines were to work, complete the construction of those lines, and then try to understand the technology used in the weapons system.

From these experiences the Chinese learned some lessons that would influence their arms development and technology procurement until the present time. First, self reliance would be the best course of action for the Chinese. Expressed in the over-reaction a decade-or-so following the Soviet breakup, the Chinese would indigenously produce and develop as many different systems as they could. Playing the two super-powers off against each other would also become a trait of Chinese foreign policy in the 1980s. Secondly, they would not rely solely upon one country for aid in development when they again chose to obtain

⁹S.K. Ghosh, "Transfer of Military Technology to China" *IDSJ Journal* 9 (1977), 221.

assistance. This has led to co-production agreements with many different countries, irrespective of ideology or political leaning. Thirdly, the Chinese have stressed the co-production aspect of technology, with complete transfer of all technical details for the specific system. They have refused buying systems if the complete production technology could not be included in the deal. With this, China has tried to avoid the same problems that came with the Soviet break.

During this period of isolation, the military aid that the Chinese offered to the world was commensurate with the level of technology that it had obtained. Since Chinese weapons factories were almost entirely built by the Soviets during their period of aid to China, only the 1950s-era weapons were able to be produced. In fact, a major obstacle to obtaining modernization in the aircraft industry since then has been obtaining the capital necessary to replace the 1950s-era equipment in the factories. On a 1989 tour of the Shenyang aircraft plant, *Aviation Week & Space Technology* reported that, "most of Shenyang's aerospace manufacturing equipment was 1950's-vintage, based on Russian copies of German technology captured in W.W.II."¹⁰ China's aid up till the 1970s consisted of grants and loans of small arms to other communist and third world countries. In the period from 1967-76 China ranked fifth in the world in major arms transfers, most of it due to its aid to developing and communist countries. From 1978-82, the period where that free aid was being phased out, it fell to tenth in the world rankings.¹¹ China began to realize that the free aid of mainly small arms was not allowing their arms industry to grow, and thereby hurting the

¹⁰Donald E. Fink and Paul Proctor, "China Aviation: At a Critical Crossroads" *Aviation Week & Space Technology*, 11 December 1989, 74.

¹¹Anne Gilks and Gerald Segal, *China and the Arms Trade* (London: Croom Helm, 1985), 194.

modernization of their own armed forces. With that change in thought and attitude in the early and mid 1970s, the Chinese arms industry began to slowly open up to the idea of again importing foreign technology to aid in its modernization process.

RE-EMERGENCE ON THE WORLD SCENE

Upon deciding that going it alone would not develop the necessary technology needed for an adequate defense, the Chinese began a few programs of foreign procurement to 'test the waters'. Even though China had been probing throughout the Cultural Revolution, these programs had a great deal of impact upon the way that China would deal with the rest of the world for the next decade-and-a-half in terms of arms technology transfers. Looking at these will help one to understand the reasons why China deals in certain ways with certain countries at the present time, and to understand the technology it now possesses.

The Spey Engine

Before the signing of the *Spey* engine contract with Rolls-Royce on 13 December 1975, China had been looking at foreign equipment for quite some time.¹² In 1964, serious attempts were made to obtain the SAAB J-35B *Draken* and the AFA P-16 Mark III *Strike Fighter*. These deals did not materialize because of pressure by the US through COCOM. Later, after the normalization of relations with most of the West (mid-70's), the first major breakthroughs would be with the two countries that had established relations with China before the Cultural Revolution, Britain and France. Britain's *Spey* deal is considered by

¹²Ghosh, "Transfer," 226.

most to be the beginning of an era of Chinese cooperation with the outside world.

The sale of the *Spey* engine was one that was considered in the category of a dual-use technology. It was purchased to be used in the *Trident* jetliners that China was also purchasing from Britain. Fifty of these engines were purchased with an agreement to continue manufacture of the engine in Xian with initial assistance of British technicians.¹³ But the critical part of the deal was that China had purchased all of the rights to produce the engine with full afterburning capability. Afterburning capability is primarily for use with fighter planes, as the *Spey* had been previously used on British F-4's and US A-7's. The deal essentially advanced the propulsion technology in China by 5 to 6 years and was probably intended to be placed in a new fighter aircraft being developed within China.¹⁴

Development of this engine is an interesting factor to consider. It was used in all of the *Trident* jetliners that were operated by China. However, it was never deployed on a production fighter aircraft. The only incidence of it being used in a fighter was the F-12. This plane was developed in the late 1970s and test flown in 1980, being a derivative of a MiG-23 given to China by Egypt and equipped with *Spey* engines.¹⁵ The Chinese press reported the F-12 to be in full production but none were ever deployed in regular flying units in China or sold abroad. Other planes have not used this engine.

¹³Streedhar, "Modernization of China's Armed Forces: The Economic Factors" *ISDA Journal* 10 (1978) 250.

¹⁴Ghosh, "Transfer," 228.

¹⁵Gilks, 64.

The failure of this engine to infuse itself in the insides of some Chinese fighter aircraft may have its origins in the engines, the airframes or lack of investment capital. Presently, the Chinese aircraft engine industry is capable of producing a wide variety of aircraft and industrial turbine engines. In most cases there has not been enough orders to facilitate the full scale development of engine technology. In late 1989 the production rate for both the Wopen WP-6 and WP-7 aircraft engine at the Liming Engine Manufacturing Corporation in Shenyang was almost zero.¹⁶ Production of the larger WP-13 at the plant had been suspended but continued at the Chengdu Engine Company. This was largely due to the downturn in work due to government austerity measures in ordering new military aircraft.

Another critical factor might be the fact that China has been having problems producing capable airframes. Over half of the prototypes seen flying, mostly the indigenously developed models such as the F-12, F-10 and F-9, have never made it to the production line. Instead, the simpler models have been the ones to succeed, such as the J-7, J-6, and Q-5. These are also the models that have been exported to other countries. This phenomenon may be in part due to three other factors: the Chinese inability to develop an economically producible aircraft; the foreign buyer's wishes for cheaper and simpler aircraft; and/or developmental and prototype deficiencies. In the latest upgrade models of fighter and attack aircraft, and also in the new civilian aircraft coming out of China, the trend has been to use indigenously produced engines on domestic aircraft while putting foreign engines on the aircraft sold abroad. This again reveals the limitations in the Chinese aircraft

¹⁶Fink, 87.

engine industry. Today, some of those foreign turbofan engines are from Rolls-Royce, and some are later versions of the *Spey*. The *Spey* engine may not have played a large physical role in the Chinese military aircraft industry but it did succeed in initiating an era of technical cooperation with other countries.

Other Programs of Importance

Even though the Chinese were looking at sophisticated systems during the Cultural Revolution they did not begin any significant deals for technology transfer until the 1970s, and even then it started with simple systems and eventually became more complicated. Along with the *Spey* engine and its companion, the *Trident* jetliner, the Boeing company sold ten Boeing-707 aircraft in 1972. From those Boeing aircraft the Chinese successfully developed their own four engine transport, the Y-10. They successfully tested the prototypes but eventually decided against production of the aircraft for unknown reasons.

Other aircraft systems that were sold included several different types of helicopters, *Super Frelons* from France, BO-105 *Messerschmidts* from West Germany, *Allison-250* helicopter turbine engines, and eventually Bell helicopters from the US. The past decade has seen the completion of a major licensed production of fifty AS365 Dauphin (Z-9) helicopters at the Harbin Aircraft Manufacturing Corporation.¹⁷ In 1980 the Harbin factory signed the agreement to produce the helicopter and is presently trying to obtain the rights to produce twenty more. That program has made the Harbin factory the top helicopter producer in

¹⁷John W.R. Taylor and Kenneth Munson, "Gallery of Asian and Pacific Airpower," *Air Force Magazine*, July 1991, 81.

China and led it into competition for other programs such as a production share in the P-120 light helicopter project with Aerospatiale.¹⁸ Other programs continue in both the civilian and military sectors.

GROWTH OF THE CHINESE ARMS INDUSTRY

The growth of the military and civilian industry, in order to cope with this importation of technology, has necessitated some changes. Some of the major changes have come about because of the increased need to deal with the importation of technology.

In August of 1982, the People's Liberation Army's (PLA) Science and Technology Commission for National Defense (NDSTC), National Defense Industry Office (NDIO), and the Science and Technology Equipment Commission Office (STECO) were combined to form the Commission in Charge of Science, Technology and Industry for National Defense (COSTIND).¹⁹ This merger would accomplish three goals: first, to unify the management of national defense R&D and production under one organizational umbrella; second, to transform the military factories and technology to civil use; and third, to promote the development of new weapons and military technologies.²⁰ The structuring of the Chinese defense industry as it stands today led to the ability to obtain technology and build weapons that it could sell abroad. However, that same organization has again become, by other means, decentralized.

¹⁸Paul Proctor, "Harbin Uses New Helicopter Program to Advance Global Manufacturing Role," *Aviation Week & Space Technology*, 3 February 1992, 48.

¹⁹"Reforming China's National Defence Science and Technology Organs," *China News Analysis*, no. 1410, 15 May 1990, 1.

²⁰"Reforming," 1-2.

Structure of the Defense Industry²¹

The Chinese defense industries enjoy dual leadership from both the State Council and the Military Commission. Most industries are coordinated in their efforts by COSTIND and are advised by separate corporations. Table 1 gives a graphic representation of the relationships between the different government agencies and arms industries that are described here. The military control over trading and importation of technology is run by Poly Technologies Inc. and Ping He Electronics Co. which lie under the jurisdiction of the PLA General Staff Department. They don't actually produce anything but sell weapons straight from the government industries to outside sources.²² Although Poly Technologies was the official seller of the CSS-2 ballistic missiles to Saudi Arabia, the actual builder was the China Precision Machinery Import & Export Corp. In addition to the PLA General Staff Department, the other PLA departments containing corporations include the PLA General Political Department, the PLA General Logistics Department and the People's Armed Police.

The State Council directly controls the different ministries within the government. These include the Ministry of Machine Building and Electronics Industry, the Ministry of Energy Resources and the Ministry of Aerospace Industry. The industries under the direction of these ministries, although not under direct control of the Military Commission, produce the equipment for military uses. Military control comes through the ministries from COSTIND, which is a military corporation set up to

²¹Tai Ming Cheung, "On Civvy Street," *Far Eastern Economic Review*, 6 February 1992, 41.

²²Russell Watson, "Merchants of Death," *Newsweek*, 18 November 1991, Lexis, 38.

manage and coordinate the affairs of those civilian industries which produce civilian goods.

Direct military control over the individual industries comes through COSTIND's two individual corporations, the China New Era Corp. and the Xiaofeng Technology and Equipment Corp. The New Era Corp. is the newest Chinese military corporation, set up in 1980 to arrange scientific cooperation, exhibitions and the procurement of advanced technology. It is essentially the scouting arm of China's defense industries and obtains high technology from abroad. It deals with the industries directly, being COSTIND's method of bypassing the ministries. Xiaofeng Technology and Equipment Corp. deals in the development of computers, testing equipment and robotics. Its developments are of benefit to all of the industries.

Leadership of the different defense industries consists of many people who have family connections with government and military leaders. The head of COSTIND is Lieut.-Gen. Ding Hengao, the son-in-law of Marshal Nei Rongzhen. Poly Technologies is headed by He Ping, the son-in-law of Deng Xiaoping while one of the vice-presidents is Yang Li, daughter of Yang Shangkun.²³ This type of family influence in the ministries and industries has been prevalent in the past ten years, however, since the June 4th incident some of the positions have been

²³Cheung, 41.

Table 1: China's Military Industry²⁴

Military Commission		State Council
Has direct control over COSTIND	Commission for Science, Technology and Industry for National Defense	Ministries are under the military control of COSTIND

PLA General Staff Dept.	China New Era Corp.	Ministry of Machine Building and Electronics Industry
Equipment Poly Tech Armaments Trading Ping He Electronics Military Technology	Advanced technology; Scientific cooperation; Exhibitions	China National Electronics Import & Export Corp. Mine detection equip.; Fiber and laser optics; Comm. technology; Radar
PLA General Political Dept.	<u>New Era Works directly with the individual industries under State Council control.</u>	China Shipbuilding Trading Co. Naval Ships and Craft China National Machinery & Equip. Import & Export Corp. Armored vehicles; Trucks; Special use vehicles China North Industries Corp. Armored vehicles; Artillery; Small arms; Radar; Household goods; Motor cycles; vehicles
Kaili Corp. (Carrie Enterprises) Communication Equip. Publications		
PLA General Logistics Dept.		Ministry of Energy Resources
China Xinxing Corp. Food; Clothing; Materials; Fuels; Vehicles; Boats		China Nuclear Energy Industry Corp. Nuclear technology Rainbow Development Corp. Nuclear power development
People's Armed Police	Xiaofeng Tech. and Equipment corp.	Ministry of Aerospace Industry
Jingan Equipment Import & Export Corp. Riot, security, and fire fighting equipment; Small arms	Computers; Testing equipment; Robotics	China National Aero-Tech Import and Export Corp. Aircraft; Engines; RPVs China Precision Machinery Import and Export Corp. Machinery; missiles; Rockets; Radar; Medical and electrical goods China Great Wall Industry Corp. Space launch services and equip. Beijing Wan Yuan Industry Corp. Space launch vehicles

²⁴Cheung, 41.

changed. The new leaders all tend to be people with family ties and other close friends.

What this does for the industries is to set up some special operating circumstances. First of all, these industries have personal ties to the government, giving them an inside source of funds and an influence with government policy making that will lend to their favor if they wish. Second of all, since the personal ties become as great or greater than the government connections, the government and officiating organs lose control of what is happening. That loss of control is the reason why COSTIND was set up in 1983, to give the military better control over the industrial complex. Thirdly, that loss of control leads to a lack of coordination between the different ministries and industries. This happens on the civilian as well as the military side. When a factory decides to produce a certain civilian product, the factory alone makes the decision on what to produce. On the military side, the industries have the military product that they produce and that does not change much. Beyond this, however, the factory can decide on its own special product to produce and find its own means of selling it. This means a lack of government control in some of the arms sales.

Production in the Defense Industries

Initially the defense industries were set up to exclusively produce defense products. Since the implementation of government austerity measures in the late 1980s, orders for military production have been drastically reduced. "More than two thirds of (the military industrial) capacity is estimated to be standing idle."²⁵ "The country's aircraft

²⁵Cheung, 41.

plants can turn out 1,000 fighter aircraft annually, but there are orders for only 100 aircraft a year."²⁶ The aircraft engine factories complete their orders two thirds of the way through the year and then the production lines stand idle for the other one third of the year.

This predicament has changed the focus of China's production from military hardware to civilian goods and the sub-contracting of foreign goods. The sub-contracting work for Western industrial firms will be discussed later. The construction of civilian goods has become an integral part of each industry. From around 10 percent in 1979, the percentage of civilian output of China's military industries has grown steadily to more than 60 percent.²⁷ The civilian output rate had been increasing at an annual rate of about 25 percent in the late 1980s. That increase was exceeded by a 1990 government cut in arms production of 45 percent.²⁸ Because of this, the production of civilian goods is necessary to support the large overhead inherent in the Chinese factory system. The factory must provide services such as schools, hospitals, public works and also support the factory retirees.²⁹ Planners must now resort to a form of capitalism in order to decide what products to produce, and in what quantity. The government will no longer guarantee them the work to fill their production lines.

The decline of orders for military goods has also led to a type of chaos in the defense industries. Many factories are making deals with foreign sources without any government consultation. The most obvious of these has been the high money earning arms sales. "The Foreign

²⁶Cheung, 41-42.

²⁷Cheung, 42.

²⁸"China," *Pacific Defense Reporter*, April 1990, 24.

²⁹Proctor, "Harbin," 50.

Ministry has no say in what they sell, or where, and it is impossible to track what they do."³⁰ What this does for the defense modernization is to nullify any planning and destroy any efforts at cooperation between industries. "The Defense modernization program is virtually at a standstill due to the fact that all weapons and defense equipment manufactured in China has been exported to raise much needed foreign currency."³¹ This may be a way to raise the foreign currency, but in what sense is it helping the Chinese military? The Chinese military industry has many factors affecting it but many of the tactics of the Chinese, such as extensive arms sales, are actually hurting the military. The direction of growth of the military industry may depend on how much control the Chinese government can exert over the present-day practices. Only if they can convert that foreign currency to gains in the industry can they come out ahead in the future.

FINANCING FOREIGN TECHNOLOGY

The financing of this importation of technology into China has led the Chinese arms industry in several different directions. The initiation of sub-contracting for Western aerospace firms began in the late 1980s and has proved worthwhile for the Chinese. It has been the latest direction of the Chinese military industry and will be discussed later in this paper. The late 1970s and 1980's saw the emergence of China as an arms dealer, which became the main source of foreign capital for the military industry during that time period. They supplied an average of three percent of the arms deliveries to the third world during most of the

³⁰Watson, 38.

³¹"China," 23.

1980s, and reached a peak of supplying over twelve percent of Third World arms in 1987.³² That amounted to \$4.8 billion dollars. Presently, China ranks fourth in the world in arms deliveries to the Third World. The amount of activity is best exemplified in the supply of arms to both sides during the Iran-Iraq war. During the period of 1981-1988, 61.3 percent of China's entire arms transfers to the Third World were to Iran and Iraq.³³ That comprised 15 percent of all arms transfer agreements with Iran and Iraq during that period.

In addition to the business of supplying a war, China also entered into the missile business. Some missiles, like the much publicized *Silkworm*, were sold to Iran. Many others were developed for customers like Pakistan, Syria, and Saudi Arabia. These deals, although very controversial, attained a large profit margin for the Chinese. The sale of CSS-2 ballistic missiles to Saudi Arabia was reported to have made a net profit of over \$2 billion dollars.³⁴ That is enough to reinvest in better equipment and also give the government leaders a nice salary. While the profits made from the missile deals go back into the aerospace industry, profits made from sales of airplanes have also proven to be worthwhile. The Chinese aerospace industry has grown in a manner to achieve a dual purpose, to modernize its own air force and to sell aircraft abroad in order to finance that technical modernization.

³²Richard F. Grimmett, "Trends in Conventional Arms Transfers to the Third World by Major Suppliers, 1981-1988," Congressional Research Service, Library of Congress, (Washington D.C.: GPO, 1989) 68.

³³Grimmett, 66.

³⁴William C. Triplett II, "China's Weapons Mafia," *Washington Post*, 27 October 1991, Lexis, C3.

FIGHTER AIRCRAFT DEVELOPMENT

The development of fighter aircraft and procurement of aircraft technology from outside sources is one area that displays a fairly accurate representation of the Chinese defense industry as a whole. Since the end of the Gulf war between the coalition forces and Iraq, Chinese government planners have placed high emphasis upon, "first, the air force; second, telecommunications; and third, the navy."³⁵ This focus exemplifies their needs and perceived deficiencies. The high level of concern over the air force is due to: 1) the failure and destruction of the, largely Chinese-supplied, Iraqi air defense network when under attack by highly sophisticated aircraft; and 2) the total domination of the coalition aircraft in determining the outcome of the war.³⁶ Another reason why the aircraft industry is such a critical indicator of China's military industry as a whole is because of its potential extensions to the outside world. Within the past decade or so the Chinese aircraft industry has earned critical foreign capital through aircraft sales. This concerns both the civilian and military sectors. When the aircraft industry is down, foreign trade generally is down also, as is the rest of the defense industry. Successes in the aircraft industry have carry-over into the rest of the industrial sector.

The Chinese Air Force began, as did most of the Chinese military, with the majority of the systems coming from the Soviet Union. Early aircraft, such as the MiG-15 and MiG-17, came directly from the Soviet Union. The Soviets initiated the building of the MiG-17 in China by

³⁵Lo Ping, "Old Generals Complain About Deng Delaying Improvement of Weapons, Equipment," *Cheng Ming*, 1 May 1991, FBIS-CHI-91-088, 7 May 1991, 54.

³⁶Lo Ping, 51.

providing "all necessary design drawings and technology transfer, plus two sample MiG-17F aircraft, 15 knocked-down kits, forgings and raw materials for ten aircraft, and parts for 15 more."³⁷ When the break with the Soviet Union occurred in 1960, the Soviet-built MiG-19 production lines were left uncompleted with a few original Soviet copies of the aircraft in the country. The Soviet engineers and workers left quickly, taking all of the factory blueprints and technical information. Due to the end of Soviet assistance, the MiG-19 became one of the first aircraft to become produced under entire Chinese control, and started the legacy of the Chinese ability to upgrade aircraft. It obtained its own designation, as the J(F)-6 and later the Q(A)-5, as did the other Soviet aircraft used by the Chinese: the MiG-15 as the J-2, the MiG-17 as the J-4 and J-5, and the MiG-21 as the J-7 and J-8.³⁸

Chinese aircraft modifications have created almost entirely new aircraft, with several times the capabilities of the originals. Early Chinese models of the MiG-15 (J-2) and MiG-17 (J-4) were not modified much but were sold extensively abroad. The J-6, being one of the first models extensively experimented with, has been updated several times and widely exported. Sometimes the modifications are meant solely for export versions. Table 2 lists those Chinese aircraft being used by Asian nations. In addition to those Asian countries mentioned below, the Chinese have either given or sold significant amounts of aircraft (a squadron or more) to North Vietnam, Sudan, Tanzania, Albania, Zambia, Egypt, Somalia, Zimbabwe, and Iran.³⁹ A total of around 700 J-6 aircraft

³⁷Taylor, 75.

³⁸The Chinese use different alpha designations to distinguish the native and export versions of their aircraft. The A-5 is the export version of the Q-5, while the F-7 is the export version of the J-7. The 'J', 'Q' and 'H' designations are equivalent to the 'F' and 'A' and 'B' designations respectively in western nomenclature.

³⁹Gilks, 204-205.

were sold abroad or given away globally.⁴⁰ The J-7 and its family of aircraft has been used extensively for export, with over 500 either sold or given to other countries.⁴¹ Presently China is looking at co-development with other countries to satisfy its need to increase technology and ensure markets for aircraft.

Table 2: Chinese Fighter Aircraft in Asian Countries⁴²

Country	J-5	J-6	J-7	Q-5	J-8
China	767	2800	250	600	150
Pakistan	26	125	95	54	0
N. Korea	300	100	0	40	0
Bang.	0	30	16	20	0
Camb.	6	5	0	0	0

An overview of the development of some of the present and future Chinese aircraft, along with their co-developing countries, is useful to understand the thinking of the defense industry planners.

Force Modernization Plans

The Chinese plan to focus on two areas of its air force inventory to meet its modernization goals. They will focus on the development of two types of aircraft, the first being a ground attack aircraft, and the second being a high-altitude fighter.⁴³ The H-7 attack aircraft will be produced first, as an all weather day/night attack aircraft. They hope to equip it with an indigenous engine, an improved version of the WP-7. The flying prototype of this plane was developed by Xian Aircraft Company and

⁴⁰Gilks, 204.

⁴¹Fink, 83.

⁴²Taylor, 72-77.

⁴³Fink, 59.

began flight tests in 1989.⁴⁴ It was a totally new indigenous design and not a modified version of another aircraft. However, in an early 1992 *Aviation Week & Space Technology* tour of the Xian factory none of the H-7 aircraft were seen.⁴⁵ Defense analysts say that the program is still proceeding, but at a slower pace due to a lack of an adequate powerplant and competition for funds with the new fighter.

The new fighter is planned to also be a totally indigenous design and come about four years behind the H-7. The designation for it will be the J-9, but due to the early developmental nature of the program, not much is known about it yet.

The aircraft program nearest to completion at the present time is the joint Pakistani-Sino development of the K-8 light jet trainer. The K-8 is intended to bridge the gap between the Chinese basic piston trainers and the high-performance fighters, where the Chinese usually lose most of their pilots. The program was initially funded by the China National Aero-Technology Import and Export Corp. (CATIC) but since has grown to be a venture solely between the Nanchang Aircraft Manufacturing Company and the Pakistan Aeronautical Complex.⁴⁶ Development was hindered by the US sanctions imposed in 1989 because the engine chosen to power the aircraft came from Garrett of the US. After a year of delay the sale of Garrett engines was again approved.⁴⁷

The aircraft prototype flew first in November, 1990 and, since then, four prototypes have been undergoing flight tests. As a show of confidence in the program, the Nanchang factory sent the fourth

⁴⁴Fink, 58.

⁴⁵Paul Proctor, "China's Xian Aircraft Corp. Emphasizes Y-7 Production, Foreign Subcontracts," *Aviation Week & Space Technology*, 24 February 1992, 117.

⁴⁶Fink, 78.

⁴⁷Michael A. Dornheim, "Karakoram K-8 Trainer Makes Air Show Debut," *Aviation Week & Space Technology*, 9 March 1992, 43.

prototype to the Asian Aerospace '92 air show and exhibition at Singapore's Changi airport, held in February, 1992.⁴⁸ It flew daily despite its low flight hours and restricted maneuvering range.

The Chinese air force has not decided as yet on whether they will purchase the aircraft since it is being developed to meet Pakistani standards but probable customers are the Pakistani and Chinese air forces. The producers also want to enter the aircraft in the competition for the next US Air Force trainer, the JPATS. The program shows forth the initiative of the Nanchang Aircraft Co. and its willingness to invest in joint ventures to earn foreign currency. This saves them as an aviation complex due to the lack of aircraft orders generated by the austerity measures imposed by the Chinese military. Other programs such as the Q-5 and the J-7 show the growth of co-development in fighter aircraft.

The Q-5 Family

The Q-5 originally came into being in August 1958 as a much re-designed version of the J-6 aircraft. After cancellation of the program at the Shenyang factory in 1961, the program was reborn at Nanchang in 1963, with the first prototype flying in June of 1965.⁴⁹ The Q-5C version flown by the Chinese air force today flew for the first time in the early 1980s. The 'C' version, along with its derivatives, have become a significant money earner as export aircraft. One hundred and sixty have been sold to Pakistan, forty to North Korea, and around twenty to Bangladesh.⁵⁰ It has also allowed the Chinese to experiment with many

⁴⁸Paul Proctor, "New Aircraft Sales Slow at Asian Aerospace Expo," *Aviation Week & Space Technology*, 2 March 1992, 18.

⁴⁹Taylor, 76.

⁵⁰Fink, 81.

types of foreign co-production agreements. The standard model A-5C was produced in cooperation with the Pakistani government to meet their own needs. Presently, Nanchang Aircraft Manufacturing Company is working with Aeritalia of Italy to produce an upgraded version of the A-5-2 which will be designated the A-5M. The A-5C is a day/fair-weather fighter while the A-5M and A-5-2 are all-weather capable aircraft. The A-5M is fitted with avionics from Italy's AMX fighter program. The A-5M conversion package can be bought and used on existing Q-5 aircraft, thus increasing the market for sales of the modification.⁵¹ Its prototype first flew in June of 1991.⁵² The French were also helping China develop the A-5K version, but that plan has fallen through. The A-5M will have an enhanced all-weather and fire control capability and be powered by an improved version of the WP-6A engine.⁵³ The Chinese hope to earn more foreign sales through this kind of cooperation.

The J-7 Family

The J-7 aircraft has become one of the most widely modified aircraft in the Chinese inventory. Originally of the MiG-21 design, the first successful production version made its maiden flight in December of 1978.⁵⁴ The production of this aircraft has taken place at the Guizhou and Chengdu aircraft factories. The Chengdu Aircraft Corporation's F-7M *Airguard* is meant for export abroad (it has been exported to Bangladesh) while the F-7P was modified especially for sales to Pakistan. Up to one hundred of these were to be exported to Pakistan, again giving

⁵¹Fink, 81.

⁵²"Flight Demonstration of the A-5M Aircraft," *Asian Defense Journal*, July 1991, 135.

⁵³Fink, 81

⁵⁴Taylor, 72.

the Chinese a significant sale, but the deal was canceled by Pakistan. They claimed the development costs to be too high and that the plane would not match to the new, Soviet supplied, MiG-29 fighters.⁵⁵ After cancellation due to the June 4th incident, the British Foreign Office again permitted GEC to go through with its sale of avionics in December of 1989, which was closely related with "Pakistan's order earlier in the year for 75 Chinese F-7P fighters."⁵⁶ The latest sale of the F-7s was to Iran in early 1992. Other extensive modification plans call for Grumman to help develop the all-weather J-7-3 into the 'Super 7' for export. This would be the most significant modification of the aircraft yet, transforming the single forward air intake into two side intakes in order to put a more powerful radar and western avionics suite into the nose. It was also planned to adopt western GE F404 engines that were destined for use in the F-20 *Tigershark*, and also western avionics. That deal, as well as other co-production agreements with US companies, was abandoned when the US imposed sanctions after the June Fourth incident in Tiananmen square. The future of the Chengdu aircraft factory as an aviation enterprise was seriously hurt by the cancellation of that deal.

The Chinese Aircraft Engine Industry

The Chinese aircraft engine industry started in much the same way as the aircraft industry, entirely set up and supplied by the Soviet Union. Early aircraft, such as the J-2, J-4 and J-5 were powered by Soviet engines. Later, the aircraft industry imported the Rolls-Royce

⁵⁵"China, Grumman Cooperate on F-7M-based Fighter," *Strategic Digest*, February 1989, 191.

⁵⁶"Britain Allows Chinese Avionics Buy Despite Export Embargo," *Strategic Digest*, December 1989, 1671.

Spey engine to boost its capabilities. The five or six year boost in technology ran out due to the Chinese inability to continue from that point in developing their engines. At present there are three main engines for Chinese fighter aircraft. The WP-6, at 7,165 lbs of thrust, powers the J-6 and the Q-5.⁵⁷ The WP-7, at 12,000 lbs of thrust, powers the early versions of the F-7 fighters. The more powerful WP-13, at 14,815 lbs of thrust, powers the F-8 II and the F-7-3 fighters.⁵⁸ These engines have been upgraded and new ones will have to be developed if the Chinese want to put indigenous engines on its aircraft. Table 3 shows a basic comparison between the engines of the US and China along with their respective aircraft.

Table 3: Jet Engine Development Comparison (Approximate)

Approx. Year	1960	1980	1995
PRC Aircraft	J-6	J-8	H-7
Engine	WP-6	WP-13	WS9 (RR Spey)
Thrust (lb)	7,165	14,815	20,515
US Aircraft	F-4	F-15C	F-23
Engine	J79	F100-PW-220	F119
Thrust (lb)	15,800	23,450	35,000

The time required to boost the thrust in Chinese engines sufficiently may be prohibitive for the industry. The latest attempts at building new fighter aircraft have all stalled with a major reason being the lack of a sufficient power-plant. Two reasons for this lack are the sanctions on

⁵⁷Taylor, 75-76.

⁵⁸Fink, 89.

importation of foreign technology and the inability of the Chinese industry to economically produce engines.

The Chinese have tried to put foreign engines on many of their fighter aircraft. The K-8 was to be supplied with a Garrett turbofan but that had to be canceled due to sanctions imposed after June, 1989. The Chinese then were looking to Czechoslovakia for a suitable engine.⁵⁹ After a year's delay, the Garrett engine was approved. The proposed *Super 7* was to use a General Electric F404 engine (from the F-20 *Tigershark*) along with other foreign engines as candidates but that program was again canceled due to sanctions.⁶⁰ The F-12, a Chinese model of the MiG-23, began test flights but never made it to production, probably due to the lack of a sufficient engine. Also, the H-7 attack aircraft and the F-9 fighter aircraft are being delayed, probably due to the lack of a sufficiently reliable and powerful engine.

The inability of the Chinese engine industry to produce a capable engine is largely due to economies of scale. The two basic aircraft engine plants, at Chengdu and Linming, have produced the majority of Chinese WP-6, WP-7 and WP-13 engines. Due to austerity measures in ordering new aircraft since the latter 1980s, engine production has slowed dramatically. Production of the WP-6 and WP-7 at Chengdu is almost zero, and production of the WP-13 has been suspended at Shenyang.⁶¹ Even when production does occur, the production quota is fulfilled within the first two-thirds of the year in order to make the production process economical. This practice has led to great amounts of dead time at the engine factories. Other work has been found by sub-contracting

⁵⁹Fink, 80.

⁶⁰Fink, 82.

⁶¹Fink, 87.

production of turbine disks and other engine parts to western engine firms like General Electric and Pratt & Whitney. As the Chinese engine industry gets more behind, more foreign engines are chosen, and the factories have more time to sub-contract foreign parts.

The situation in the engine industry is also affecting the civilian aircraft industry. The prime example of this is the differences in engine selection for aircraft used for domestic purpose and those sold abroad. At the Xian aircraft factory, Y-7 transports are equipped with the Chinese-built WJ5E engines if they are to be used domestically. Those being sold on the international market are equipped with the Pratt & Whitney Canada PW127 turboprops, which are more powerful and more reliable.⁶² The Y-8 and STOL Y-12 are also equipped with Pratt & Whitney turboprops because of their power and reliability.⁶³

The larger jet transport industry in China is also looking to foreign sources for engines. By assembling MD-82 aircraft in Shanghai, the aircraft industry is obtaining valuable experience in the area of jet transports and also in jet engines. The possession of foreign aircraft in the Chinese airlines, such as the Boeing 757, is also helping the Chinese gain experience with maintaining and supporting large turbofans. Rolls-Royce and the Civil Aviation Administration of China are participating in a joint training program that focuses on engines used for the 757 and other large transports.⁶⁴ The new program being undertaken by the Chinese, assembly of the McDonnell Douglas MD-95, will incorporate the new version of the Pratt and Whitney JT80-200 series turbofans.⁶⁵

⁶²Proctor, "Xian," 112.

⁶³Proctor, "Harbin," 49.

⁶⁴Takayoshi Sogo, "Rolls-Royce to Train Chinese," *Asian Defense Journal*, November 1990, 124.

⁶⁵Takayoshi Sogo, "US Aircraft Maker to Assemble Jets in China," *Asian Defense Journal*, October 1991,

These experiences in the realm of engine technology will help the Chinese in maintaining and using modern engines but will reduce their capability in making competitive indigenous engines.

Procurement of Foreign Fighter Aircraft

Since China's break from the Soviet alliance, they have actively searched for foreign fighter aircraft but have bought entire systems only in the past year. During the 1960s they took concerted looks at the Swedish *Viggen* and the Swiss *Strike Fighter*. Other aircraft that were seriously considered include the Harrier VSTOL aircraft from Great Britain, the Mirage 2000 fighter from France, the Lockheed C-130, C-131, and C-140, the F-5, F-16, and Grumman E-2 early warning aircraft from the US.⁶⁶ These represent those that were seriously considered and not just looked at. None of the fighters were bought and the few aircraft that were bought include a couple types of airliners and helicopters.

Only lately have the Chinese actually bought a complete fighter aircraft. In the late 1980s China began looking at the Soviet MiG-29, MiG-25, SU-25 and SU-27 *Flanker*. At this time it has been confirmed that 24 of the SU-27s have been bought for \$25 million a piece for a total of \$600 million.⁶⁷ Some have been seen in late 1991 in Shenyang and after initial training they will probably be based on Hainan Island.⁶⁸ This change in China's position on buying complete fighter aircraft systems

⁶⁶David L. Shambaugh, "China's Defense Industries: Indigenous and Foreign Procurement" *The Chinese Defense Establishment: Continuity and Change in the 1980s*, ed. Paul H.B. Godwin, Boulder: Westview Press, 1983, 71-73.

⁶⁷"Soviets, China Carry Over Fighter Deal" *Center for the Soviet Union in the Pacific and Asian Region (SUPAR)*, No. 11, July 1991, 33.

⁶⁸"First SU-27s Arrive in China" *Aviation Week & Space Technology*, 23 September 1991, 11.

signals a need that China wants to fulfill. Soviet officials said that, "the SU-27 is designed to defend territorial airspace."⁶⁹ This deal gives China a fighter/interceptor with a range capable of patrolling the disputed Spratley Islands and will also give China a sample of the latest Soviet avionics and radar capability, to include an effective look down/shoot down radar. This could replace the Peace Pearl avionics modifications for the J-8-II that were under co-development by the US Air Force and halted by the Tiananmen sanctions. The responsibility lies with the Chinese avionics industry as to whether they will be able to analyze and produce a system in a quick enough time to advance their avionics technology an adequate amount. It is uncertain whether the SU-25 deal has gone through. China is also trying to obtain some MiG-25s and MiG-29s that were flown by Iraqi pilots to Iran during the Gulf war.

LIMITATIONS ON FOREIGN ASSISTANCE AND REDIRECTION

There are three critical events that have had a major effect in pointing and focusing the direction of the Chinese aircraft industry, both civilian and military. They are the Gulf war, the sanctions on technology transfer due to the Tiananmen incident, and the emergence of sub-contractual construction for Western aircraft companies. They are, in some ways, independent factors and in other ways dependent on each other. They all have been pushing the aircraft industry in a new direction.

⁶⁹"Fighter Deal," 33.

Tiananmen Sanctions

The sanctions on high-technology imports imposed by the US after the Tiananmen incident on June 4, 1989, forced China to cancel and delay many of its aircraft production and modification programs. Many of those programs were being conducted with other countries and had the potential to produce a sizable amount of revenue for the Chinese companies.

Nanchang Aircraft Manufacturing Company is producing a new L-8 light jet trainer with the Pakistan Aeronautical Complex to replace lost business due to dwindling PLAAF orders.⁷⁰ This is a benefit for the Chinese aircraft industry in several ways. First, it assures a buyer for the aircraft which is not related to the domestic market. Second, it allows them to use the expertise of the Pakistanis, who have experience maintaining and flying sophisticated American F-16s, and can incorporate that knowledge into their own industry. Thirdly, it gives them greater potential to upgrade their own aircraft industry in order to be recognized and certified for sales of aircraft abroad. Originally, Garrett of the US was chosen to be the supplier of the powerplant. One of their turboprops was judged to be the most efficient and reliable of the engines considered. However, due to the sanctions stemming from the Tiananmen incident, the ability of Garrett to supply those engines was in question for about a year and the Chinese turned their attention to other sources. One engine they were looking at was Czechoslovakian, but since the sale of Garrett engines was approved a year later, that was not

⁷⁰Fink, 78.

necessary.⁷¹ Most of the construction is occurring in China with some parts being made in Pakistan. Pakistan mainly supplied the financing and market.

Two other programs that have been jeopardized by the Tiananmen sanctions are the *Peace Pearl* program with the US Air Force and the projected 'Super 7' upgrade deal with Grumman. Both of these programs consist mainly of avionics upgrades but represent two distinctly different kinds of programs.

The *Peace Pearl* program was conducted by the US Government and the US Air Force, and consisted of major avionics upgrades for China's J-8 fighter. This program was embarked upon under consideration of four policy goals regarding military assistance: strengthening of China's self-defense capabilities; expanding interests in mutual opposition of Soviet expansionism in Asia; supporting a foreign policy which is non-threatening to allies in the region; and to support China's economic modernization program.⁷² The program was canceled by the US Government as soon as events unfolded at Tiananmen Square. Several of the policy goals were no longer valid or applicable to the situation. The Chinese officially canceled their part of the program approximately a year later. The program cancellation represents another setback to China's already lagging military electronics industry. It may have increased incentive in obtaining the Soviet SU-27's, with their advanced avionics and superior air control capabilities.

The 'Super 7' program was not conducted with the US Government, but rather, was entirely a private agreement between

⁷¹Fink, 80.

⁷²United States Congress, *Congressional Presentation for Security Assistance Programs*, Washington D.C.: GPO, 1988, 273.

Chengdu Aircraft Corporation and the Grumman Corporation. It also was different in the fact that it included re-engining, avionics upgrades, and airframe re-structuring. The Chinese were intending to sell the 'Super 7' as a replacement for the MiG-21 or Northrop F-5 fighter.⁷³ Both aircraft have been sold widely around the world and are used by many countries. With the cancellation of that program, the Chinese lost the opportunity for a significant market. It was also a setback for the engine industry in that the intended engine, the GE F404, would have been a significant boost to the level of technology possessed.

The Tiananmen incident also caused restrictions from other countries. These suspensions included "military electronics, missile technologies, naval guns, and automotive technologies from Switzerland and many NATO countries."⁷⁴ Most notable among these were the GEC heads-up displays and weapon computers that China was placing in its F-7M *Airguard* export fighter. In December of 1989 the shipments of those GEC components was resumed, but the delay of six months caused a significant stoppage in the program. The sanctions from Tiananmen caused an immense loss in revenue for the Chinese.

Gulf War Effects

The effects of the Gulf war on China's military industry may not have been so overtly obvious as were the effects from Tiananmen, however it has had a large indirect effect. It has directly influenced China's allocation priorities since the war. China has learned that its air defenses could not stand up to an air attack by any of the major powers.

⁷³Fink, 82.

⁷⁴Harlan W. Jencks, "The Losses in Tiananmen Square" *Air Force Magazine*, November 1989, 66.

"Iraq's air defense weapons and systems (were) basically supplied by China."⁷⁵ The Chinese are now putting more investment into the air force, telecommunications, and the navy respectively.

Due to the high-tech nature of the war, China's foreign sales have also been suffering. "Since the backwardness of China's weapons was completely revealed in the Gulf war, Israel, Egypt and some other countries have asked China to cancel some arms supply contracts. Pakistan has asked for revision of some contracts."⁷⁶ This loss of contracts represents a loss in foreign currency, which the factories can then directly invest into buying foreign manufacturing technology. The lower amount of capital also means that China has less to invest in upgrading their export aircraft to meet the world standard. China's greatest need now is for foreign currency to improve its technological base across the board.

Contracting for Western Companies

Since the latter half of the 1980s, a new trend has arisen among Chinese aircraft manufacturers that enables them to both earn hard currency and also increase their technological base. It allows those companies to compensate for the downturn in orders for military aircraft. This is the trend of manufacturing aircraft parts and components for Western aircraft firms. Presently, the biggest single US-China business venture is the manufacture of McDonnell Douglas MD-82 passenger jets in Shanghai, which began in 1988. It is estimated to be worth \$1 billion.⁷⁷ Some parts for the aircraft are manufactured in different

⁷⁵Lo Ping, 51.

⁷⁶Lo Ping, 52.

⁷⁷Fink, 68.

Chinese aircraft factories, most parts are shipped from the US, and the whole plane is assembled in Shanghai.

This practice of manufacturing foreign aircraft components in China is growing more popular at other factories also. In early 1992, Chengdu Aircraft Corporation shipped its first MD-80 nose section, of which it is contracted to produce one hundred.⁷⁸ Some of the other aircraft components that are being produced include one hundred pairs of Boeing 757 cargo doors, one hundred British Aerospace ATP rudders, deHavelland Dash 8 cargo doors, and emergency exit hatches for the Airbus A320 at the Shenyang Aircraft Corporation alone.⁷⁹ In October of 1991, McDonnell Douglas Corporation signed a new agreement to produce MD-95 airliners in China.⁸⁰

The aircraft engine industry is also taking the opportunity to compensate for the loss in military orders. Xian Aero Engine Corporation has delivered \$10 million worth of turbine disks and other components to General Electric since 1984.⁸¹ Liming Engine Plant makes compressor disks and turbine disks for GE and turbine disks for Pratt & Whitney while the Chengdu Engine Company has a contract with P & W worth \$40 million that runs through 1993.⁸²

Another type of program related to parts sub-contracting is the licensed production of aircraft and engines. One of the most successful programs has been the licensed production of the Aerospatiale AS365D Dauphin helicopter. In 1992 the last of fifty of the Chinese designated Z-

⁷⁸"First Shipment," *Aviation Week & Space Technology*, 10 February 1992, 11.

⁷⁹Fink, 89.

⁸⁰Takayoshi Sogo, "US Aircraft Maker to Assemble Jets in China," *Asian Defense Journal*, October 1991, 101.

⁸¹"Unusual Arrangement," *Aviation Week & Space Technology*, 10 February 1992, 11.

⁸²Fink, 88.

9As will be completed.⁸³ After initiation in 1983, the program has grown to be an almost entirely Chinese-supported operation. Every part of the helicopter is now made in China except for certain cockpit instruments and raw materials. Many of these helicopters go into service with the military, with other government companies such as forestry and off-shore oil production taking most of the rest. As a follow on to the large success achieved with the program the Harbin factory is now pursuing a licensed production contract for improved Dauphins, a share in the Aerospatiale P-120 light helicopter project, and an improvement in its \$3.2 million a year production of sub-contracted foreign parts.⁸⁴ The profits made by the company are then used to invest in purchasing "new instruments, computers, CAD/CAM design capability, and bonuses."⁸⁵

These foreign contracts generate foreign currency which can be directly invested into foreign technology, but the Chinese still have some obstacles in their industry to overcome. The materiel used to produce components and aircraft for foreign sale cannot be obtained in China until they receive foreign certification. All parts for the MD-82, including such small things as rivets and joints, must be shipped from the United States in order to be used. The parts produced for US aircraft must be produced in FAA approved factories. Since 1988 Chengdu Aircraft Corporation "has invested almost \$19 million in upgrading its 21 assembly lines and 12 workshops to meet US Federal Aviation Administration requirements."⁸⁶ Material certification is especially critical for manufacture of engine components. After the initial one year

⁸³Proctor, "Harbin," 49.

⁸⁴Proctor, "Harbin," 48-50.

⁸⁵Proctor, "Harbin," 50.

⁸⁶"First Shipment," 11.

delay of Garrett engines for the K-8 trainer, another six month delay was experienced due to bad materials in some engine core components.

If the Chinese companies are able to become certified by the FAA for production of components and use of domestic materials, then the aircraft manufacturing business can become a big money earner for them. The manufacture of foreign parts does several things for China's aircraft industry. First, it earns the foreign currency necessary to reinvest in foreign technology. Second, it is paving the way for certification of Chinese factories and materials by the FAA. Third, it allows the Chinese factories to import the technology necessary for the building of those components and then gives the Chinese experience in producing quality aircraft and aircraft components.

FUTURE POSSIBILITIES

There are several directions that the Chinese military industry could take in the future. These will depend on the purpose of the Chinese and leadership given the industries by the government.

The first of the scenarios is the possibility of continuing to focus the industry on production with the goal of making foreign military sales. The Chinese have been increasing in this area, with partners such as Pakistan, the US and Italy in producing aircraft. However, it is a very volatile business, as witnessed by the cancellations due to the June 4th sanctions and repercussions from the Gulf war. If the Chinese continue to rely on this method, a downturn or stoppage in sales could lead to a complete breakdown of their aircraft-making capability. Added to this is the fact that focusing on production of missiles and other sensitive

weapons could lead to even greater political repercussions and a greater loss for the aircraft industry.

The second scenario constitutes focusing more on the sub-contracting of foreign aircraft parts and licensed production of aircraft. This method is relatively safe in the political realm, due to the necessary cooperation and work with other companies and countries. This also keeps the aviation industry alive to an extent. It has the multiple purposes of bringing in the necessary production technology, earning foreign capital, and bringing the factories up to international standards. If the complete aircraft production capability is lost in one area, the basic production methods will be kept alive in the production of sub-contracted parts and licensed production.

The last scenario consists of extremes. The aviation industry will either turn entirely to the production of civilian products, or return to entirely producing aircraft and aircraft components. China does not have the need for all of the aircraft that the industry could produce. It is evident in the present situation that China could not support full capacity construction in the industry. A full or major turn to civilian production would have the effect of losing the capability to produce aircraft. These two extremes are not very likely.

The most probable scenario is that there will be no definite direction in the arms industry. All of the above scenarios will play a part but the direction of the industry will be determined by forces not under the control of China. The lack of focus and leadership will force the individual industries to focus on whatever area that will help them support themselves. Some individual companies may prosper but the

industry as a whole will lose more of its ability to produce effective aircraft.

SUMMARY

Procurement of foreign technology in China's military industries has changed quite a bit from the early days of Soviet dependence. After realizing that they could not really 'go it alone,' as they tried to do so during the Cultural Revolution, the Chinese began procuring foreign technology and systems. This procurement started in bits-and-pieces but then grew on through the 1980s. Financing the importation of the technology became a prime concern as it became a more prevalent practice. The emerging trend in the 1980s showed that the technology gained could be invested in simpler, cheaper aircraft to be sold abroad, thus supporting the upkeep of the industry. Foreign sales became a profitable source of capital for the aircraft industry. Sales of other types of weapons also showed large returns. The industrial complex developed exportable guided missiles, ballistic missiles, and anti-aircraft missiles in addition to the usual weapons. These brought in foreign currency but also brought in much international concern and criticism.

At the turn of the decade, the events of Tiananmen and the Gulf war changed the way that China's aircraft industry would direct their efforts. With the downturn in fighter sales and government orders of fighter aircraft, there was an increased incentive to turn to component sub-contracting and manufacture for western firms. The benefits seen from this redirection show promise in earning foreign currency for the Chinese, in obtaining certification and endorsement for its factories, and for obtaining experience in producing quality aircraft. The sales of the

profitable missiles and other military armaments remains a complex and potentially damaging practice. If the Chinese choose to stay on this course it may lead to undue political consequences and trouble. However, the outcome may be determined by the ability of the government to influence and plan for the industries' future.

The future direction of the defense industry will consist of a balance between the production of civilian goods, the international sales of weapons, and the production of sub-contracted parts for foreign companies. That balance will be driven by the need to obtain foreign currency, the ability to invest that currency into foreign technology and the ability to control and direct the modernization of China's factories. If the Chinese take the right road, they may retain a viable aircraft industry. The wrong road may lead to an industrial complex too heavily reliant on the political situation and much too brittle for a changing world.

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