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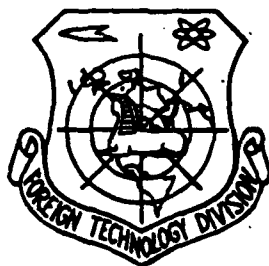
FOREIGN TECHNOLOGY DIVISION



CHINESE AVIATION IN THE EYES OF AMERICAN EXPERTS

by

Charlie Garroy



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CHINESE AVIATION IN THE EYES OF AMERICAN EXPERTS

Charlie Garroy*

Selective Translation by Yi Xing Ching

The delegation of the American Institute of Aeronautics and Astronautics (AIAA) paid China a visit last September, in response to China's invitation. Members from the delegation were professionals and professors in universities or the aeronautical industry in the United States of America. In February of this year, the American magazine "Aeronautics and Astronautics" published their impression of the China trip which is selectively translated here for our readers' reference. Our purpose in publishing the translation is merely to provide readers with some commentary materials on our country's aeronautical and astronautical areas by foreigners whose opinions and report are not necessarily agreed to or verified by our magazine.

Old China virtually had no aeronautical industry before 1949. During that period airplanes were merely assembled and repaired using foreign parts, and even the original raw materials had to be imported from foreign countries. There were eleven universities that had aeronautical engineering departments or courses with four major areas: air dynamics, structural statics, instrumentation and materials. There were only two to ten graduates from each school each year, and even so, those graduates had a hard time finding jobs in the aeronautic field, and many of them went to the United States for work and subsequently stayed in America.

*Translator's note: Phonetic transliteration from Chinese to the original language.

In 1949, the eight aeronautical departments from the eleven universities were combined to form the Peking Institute of Aeronautics, and the three remaining aeronautical departments formed the North West Industry University in Sian. Aeronautical courses had tremendous development after the reorganization. After 1956, in order to accelerate the education of aeronautic specialists, the Nanking Institute of Aeronautics was founded. Nevertheless as of 1960 there were only 10,000 college educated aeronautical engineers in new China. In order to train and educate managerial and technical personnel in the factories, several advanced aeronautical colleges were founded in 1978.

The Chinese government obtained from the Soviet Union a shipment of airplanes in 1949 for the purpose of strengthening the national defense. A number of maintenance factories were built for the repair and maintenance of such airplanes. Starting in the mid 50's, with Russian aid, China was building airplane factories from Russian models.

The first airplanes made in China (a trainer designed by the Soviet Union) were produced in 1954. Until the end of the 50's, from parts to original materials, raw materials had to be imported from Russia. Due to political discord in 1960, Russia withdrew all her specialists working in China, and discontinued the supply of airplane parts and raw materials.

In 1966, China established several experimental aeronautical bases, and started her own work of technological development. The young aeronautical industry in China again suffered another setback - the Cultural Revolution from 1966 to 1976, which eventually made the aeronautical development in China come to a near complete halt.

Even in the mid 50's, the Chinese leaders were aware of the need for systematic research and development in aeronautical science; however, nothing much was done to solve this problem after the withdrawal of the Russian specialists. In the late 50's some universities designed and implemented

several new airplanes. 'Peking-1' seen by the delegation of AIAA in the Peking Institute of Aeronautics was one of them. The department of mechanics in the China Scientific Institute has been continuously and efficiently engaging in scientific research since its founding in 1959. In order to lay a concrete foundation for the aeronautical research development in China, large scale new facilities were yet to be built such as the gas turbine engine research center in Jiang You in Sichuan, air dynamics research and development center in Jin Yang and the aviation test center in Yien Lian in Shaanxi province. The construction of all these large scale facilities started in the sixties; however, they have not been completed because of the ten-year break due to the Cultural Revolution.

In the mid seventies, the majority of these large scale facilities were put under the leadership of C.A.E. which has a function equivalent to NACA in America.

Nowadays China possesses a manufacturing base capable of efficiently producing a large quantity of airplanes. She also has a group of well trained specialists who demonstrated their abilities and skills in the area of fundamental theory research. However there are certain limitations in the areas of applications research, development, design and the inufication of systems.

PRODUCTION OF AIRPLANES

China's aeronautic industry is under the Third Ministry of Machine Building. In addition to 200,000 employees, it embodies personnel of other departments or groups relevant to the aeronautical industry. There are 40,000 lathes in the factories under the Third Ministr of Machine Building.

China has manufactured a self-designed transportation plane with four turbofan (C-10) engines and a prototype fighter (F-8). The AIAA delegation viewed the C-10 in the Shanghai Airplane Factory (designed by this factory), but did not see the F-8 which was probably produced in Shenyang.

Fighter: Various airplane factories in China can manufacture three types of fighters: F-5 (Mig-17), F-6 (Mig-19) and F-7 (Mig-21). The subsonic A-5 is a ground attacker which is actually a new fighter bomber or light attacker. The F-6, with fighter, reconnaissance and trainer versions, is equipped with two J-6 engines, basically of the Russian model but manufactured in China with some improvements. The F-7 which has a cruising speed of 2.05 M is a plane with a production volume far below demand.

Bombers: Bomber factories produce B-5 (Soviet Y-28) and B-6 (Soviet Tu-16) - both are subsonic planes. The Chinese do not think that these two types of planes meet their requirements and are in the process of designing and implementing a new bomber.

Helicopters: At the present time the Chinese have just stopped the production of the single rotor H-5 (Soviet Mig-4). The maximum takeoff load of this helicopter is 7.5 ton and it is used in transportation, rescue and forest operations. The Chinese need helicopters and they may attempt to design and implement several kinds of helicopters. Not long ago, China obtained the license to manufacture the CAF 'Dauphin' helicopter.

Transport planes: In addition to the C-10, China also produced several transport planes: the C-5 which is equivalent to the Soviet An-2 in 1955; the C-11 is designed by the Chinese themselves and resembles the 'Drifter' of Australia, and can be used in forming operations. The C-10 is the only one that is in the current modernization project; however, it has not yet been decided to put it into production.

Trainers: There are four types of trainers that are in production: two piston engined light trainers Tr-5 and Tr-6; and two jet trainers Ft-6 and Bt-5. The Tr-6 is designed by the Chinese and is used in beginner training for pilots. The two jet trainers are F-6 and B-6 trainer models. The Chinese are manufacturing a large scale anti-submarine hydroplane in Harbin.

Airplanes and engines are primarily produced in several major factories in Shenyang, Chengdu, Nanchang, Xian and Harbin. According to the Chinese, there are around 100,000 personnel in each of those factories. They manufacture a good part of the tools they need. Auxiliary equipment is manufactured in smaller shops, and electronic equipment is made in the factories of the Fourth Ministry of Machine Building. All original and raw materials are supplied by the Ministry of Metallurgy and other materials come from the Ministry of Chemical Engineering.

It is confessed by the Chinese and observed by the AIAA delegation that the major problem of the Chinese aeronautical industry is the lack of capability in design and development. In the past four years, the Chinese have been paying close attention to introducing technology from advanced nations, and one of the examples is learning from the British production experience, especially badly needed management and systems engineering. This contact between the Aeronautics Institute of China and the American Institute of Aeronautics and Astronautics also reflects the new Chinese policy of promoting scientific and technological development.

THE PRODUCTION OF AERONAUTICAL ENGINES

China provides all her aircraft (mentioned above with the exception of the C-10 which has not yet been put into production) with all engines. The AIAA delegation visited engine factories in Shenyang, Harbin and Xian. Just as the situation seen at the airplane factories, each of these engine factories produces its own tools, screws and so on, has its own casting shop, forging shop and production facilities, all of which have a low utilization. It was not until lately that 'planning production' turned toward 'facing the market.' The majority of the lathes are old but well maintained, and they are from all over the world - U.S.A., Germany, France, Japan, U.S.S.R., Switzerland, Great Britain and so on.

Some of the AIAA delegation members discovered that in the area of gas turbine manufacturing, the Chinese are much more advanced than what is imagined. As far as the technical understanding on jet engines is concerned,

the Chinese are on par with American engineers; however, the Chinese are not yet capable of applying their comprehension to product improvement. Technical renovation in aeronautical engine design, developments, unification of management system has to be given as much attention as the cost of the engines.

Nevertheless the AIAA delegation was deeply impressed by the devotion, working spirit and morale manifested by the Chinese in all the units they visited.

THE RESEARCH, DEVELOPMENT AND TESTING OF AERONAUTICAL THEORIES

As viewed from the history of aeronautical development in China, China is strongest in theoretical research such as air dynamics. For example, the AIAA delegation is aware that the papers presented at the second annual meeting of the China Institute of Aeronautics are of the highest standard in the relevant sciences; however, almost all are of an analytical nature.

There is an array of wind tunnel facilities in China which are either in the universities or various research centers. There is a great difference in the capacity of these wind tunnels, ranging from the very primitive manually controlled and manually recorded low speed tunnel to the transonic wind tunnel of substantial capability with an automatic data processing system and real time air dynamic coefficient curve read out. It is in such a domain that the delegation seems to be able to see the real model that reflects the research capability of China.

In the area of computation in air dynamics, Chinese scientists and engineers demonstrated their skills and abilities. Nevertheless their performance is limited by what the facilities can offer, even the best laboratory visited by the delegation. The capability of the computers is generally adequate for the current work load, but might become an obstacle when viewed from the angle of development. Measuring instruments are another limiting factor on research work.

There is another important factor which often limits the development of research and laboratory equipment - solving a practical problem is overly stressed while research and development on new ideas and new technology is neglected. The majority of the units visited by the delegation were all engaged in the improvement of the existing or planned airplanes, missiles and propelling systems, failing to develop new ideas and technology.

Finally, as in the case of airplane production, the Chinese in the area of aeronautics lack the ability to effectively combine the stages of research, development, design and implementation. For instance, in the research and testing of air dynamics, they lack the ability to test a full scale flight model enlarged from the wind tunnel scale.

THE RESEARCH, DEVELOPMENT AND TESTING OF AERONAUTICAL ENGINES

In visiting engine research units and testing units, the AIAA delegation discovered a situation similar to that in the air dynamics laboratory - a high standard in theoretical analysis but relative backwardness in the testing facility, data recording and data analysis. China has a more urgent need in engine development and design capability than in air dynamics and structure. There is a big gap between the manufacturing and fundamental research in engines. Analytical and testing capability on compressors is generally more advanced than that on combustion and turbines. Especially the Chinese have to start working on the technology of the high temperature turbine.

The engine laboratories in every university in China are comparable with those in American universities; however, there is a great lag in terms of testing instruments and data processing. The AIAA delegation visited two research units on engines - the gas turbine laboratory center in Jiang You in Sichuan that belongs to the China Institute of Aeronautics under the Third Ministry of Machine Building, and the engine research laboratory of Peking Research Institute that belongs to the China Precision Instrument Company. Generally speaking, these two units are well equipped and of high standard, nevertheless their utilization is not that high.

CONCLUSION

In summary, the AIAA delegation witnesses that the aeronautical circle in China is aware of the problems it faces in the development of modern aeronautical endeavors. In order to fulfill the modernization project, the Chinese are concentrating with all their heart and mind to work hard, to overcome the bondage exerted on them during the Cultural Revolution, to take each and every possible path. The AIAA delegation believes that they will succeed.

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-8