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FORUM

COLLEGIATE AVIATION IN CHINA: OPPORTUNITIES AND CHALLENGES

Richard O. Fanjoy and Yi Gao

Abstract

The rapid growth of the aviation industry in China over the last ten years has led to a dramatic shortfall in supporting personnel and infrastructure. By 2010, the need for commercial pilots, in particular, is predicted to far outstrip current levels of production. Chinese officials have focused on collegiate aviation programs as a primary source of new pilots for their evolving aviation industry, but those institutions are already hard pressed to meet the demand. This paper examines the current structure of collegiate aviation in China as well as challenges for production growth that include the absence of a general aviation culture, insufficient national aviation infrastructure, and endemic airspace constraints.

Introduction

In the past decade, the rapid economic development of China has drawn significant western attention and provided great opportunity for providers of technical and managerial expertise. This opportunity is especially significant within the commercial aviation sector. Currently, there are approximately 11,000 Chinese pilots flying more than 800 aircraft in commercial service (Hartman, 2006). Industry forecasts predict that the number of commercial aircraft in China will grow to more than 1600 in the next five years, with a corresponding need for additional flight personnel (Wu & Sun, 2005). Boeing and Airbus have become particularly interested in the Chinese market and are working to assist in the development of aviation infrastructure. The current five year plan for airport construction includes 71 airport expansions, 49 new airports, and 11 airport relocations ("China has," 2006). Although air transportation in China has significantly improved in the last 25 years with the implementation of a hub and spoke system, rapidly expanding aircraft inventories and a "free flight" structure have had particular impact in eastern China where the air traffic has increased by 30 percent in 2005 alone ("Eastern China," 2006). Although much of Chinese airspace is controlled by the military (who have also previously supplied the bulk of pilots for commercial aviation), the rapid increase in commercial aircraft inventories and operations is already taxing both the air traffic control structure and commercial pilot production capability. During the first quarter of 2007, 17 domestic Chinese airlines planned to fly more than 26,000 flights per week (Airbus, 2006). To support this level of activity, Boeing predicts that China will need approximately 6,500

new commercial pilots within the next six years (Chao, 2006). Chinese forecasts for the same period show the need for an additional 12,000 pilots, 6,400 aviation maintenance personnel, and 1,700 ATC personnel (Wu & Sun, 2005).

Since the reform and open-door policy adopted by Chinese government in the late 1970s, the Chinese Gross Domestic Product (GDP) has experienced strong growth, from 362.4 billion RMB in 1978 to 2076.8 billion RMB (\$251 billion US) in 2004 (National Bureau of Statistics of China, 2006). During this process of industrialization, the structure of Chinese society also has undergone tremendous change. About 98 million peasants were leaving their fields in the countryside to seek traditional employment in cities in 2004, compared with only 15 million doing so in 1990 (Information Office of the State Council of the People's Republic of China, 2004). Such societal change has given rise to a seasonal nationwide migration pattern, the peak of which normally coincides with national holidays and has had a significant impact on the whole transportation industry, including railway, highway, waterway and commercial aviation. One result of this change is that commercial aviation in activity in China increased nearly six fold from 1991 to 2004 (see Table 1), highlighting future challenges for this industry.

Collegiate Aviation in China

Table 1

Comparison of Commercial Aviation Industry in China between 1991 and 2004

Year	Total Passenger Traffic (million persons)	Turnover Volume of Passenger Traffic (billion person-km)	Total Freight Traffic (thousand tons)	Turnover Volume of Freight Traffic (billion ton-km)	Number of Civil Aircraft (unit)
1991*	21.8	30.1	452	1.0	499
2004**	121.2	178.2	2767	7.2	1245

Note. From *National Bureau of Statistics of China*, *1997, **2005

During the last two decades, the Chinese political environment has become less restrictive, presenting increased opportunity for interaction with western markets. During the same period, the country has changed from a planned economy to a free market economy system, capped by China's entry into the World Trade Organization in 2001. The impact of these changes has had a remarkable impact on the Chinese aviation industry as a whole and on aviation education and training in particular. In 2003, China Southern Airlines and CAE, a Canada based civil aviation training service provider, established the first Sino-foreign joint flight training center in China (Zhuhai Flight, 2003). In 2006, United Airlines became the first western training provider to receive certification to train pilots for Chinese airlines. This certification was followed with an agreement for United to train Chinese pilots on Boeing 757 and Airbus 320 aircraft at the Denver Flight Training Center (United Services, 2006). Such activity clearly reflects the potential for additional western participation in the Chinese aviation training market. As previously mentioned, the need for Chinese flight personnel is far exceeding domestic pilot production (Wu & Sun, 2005). Unlike western nations which have established a tradition of civil aviation, the aviation culture in China has yet to become institutionalized as part of their society. This shortcoming limits a traditional source of aviators found in western nations. In response to the need for pilots, new university aviation education programs are being developed in China to address the growing shortfall. Much like their western counterparts, these aviation schools provide a collegiate education, coupled with flight training, to prepare pilots who will become the future leaders of their aviation industry. Unlike their western counterparts, most of their students' actual flight training is completed in distant nations due to a lack of aviation infrastructure. The differences between aviation education in China and that in western nations provide

insight to aviation education needs in other rapidly expanding aviation environments. This insight is essential to future growth and safety within the international aviation community.

Pilot Production in China

Commercial pilot production in China has recently been reported at approximately 500 graduates per year (Gluckman, 2006). In 2006, the five primary flight training institutions in China reported an admission of approximately 2,400 students including: Civil Aviation Flight University of China (1,600), Flight College of the Civil Aviation University of China (230), Beihang University (200), Nanjing University of Aeronautics and Astronautics (NUAA) (200), and Beijing PanAm International Aviation Academy (180) (ChinaHR, 2006). Established in 1956, the Civil Aviation Flight University of China (CAFUC), located in Guanghan, is the oldest college in China that provides flight education. It is estimated that over 90 percent of Chinese commercial pilots are trained here. CAFUC has a fleet of over 100 aircraft operating from five nearby airports (CAFUC, 2006). This university is also supported by the Boeing Company with instructor pilot training, two B737 flight simulators, a senior management development course, and a safety and accident investigation course (Boeing, 2006). Beihang University established a flying college in 1993 with support from China Southern Airlines. Flight students complete ground training at Beihang and then travel to Australia to finish their flight training in Grob G115 single-engine aircraft, Piper Senacas, and Cessna Citations (Flight College of Beihang, 2006). The College of Civil Aviation at Nanjing University of Aeronautics and Astronautics was also established in 1993 and sends its students abroad for flight training. The Flight College of the Civil Aviation University of China (CAUC) at Tianjin was established in 2001. Like the other programs described above, ground training is completed onsite. Students who

have completed ground training at CAUC are sent to the United States where they complete flight training towards their air transport pilot certificate (Flight College OF CAUC, 2007). Program format at the institutions described above includes a four or five year traditional college degree program that is completed in concert with ground training activity. The Beijing PanAm International Aviation Academy was established in 2003 in Shijiazhuang. Training at this school is limited to ground and flight training in Diamond DA-40 and DA-42 aircraft (PanAmAviation.com, 2004). Students who attend flight aviation programs at CAUC, Beihang University, and NUAU complete their inflight training, ab initio (from the beginning), in western nations. CAFUC and PanAm Academy students complete flight training at airports near the academic institution.

Flight Program Admission

In recognition of the need to optimize available resources, provisions are made for students to enter university flight programs as freshmen, juniors or college graduates.

Academic and physical fitness levels for entry to these programs are much more rigidly screened than at similar college programs in the West. In addition to academic and physical requirements, applicants are screened for criminal or misdemeanor records, psychological factors, relatives who may be imprisoned, participation in "wicked" religions, and sound moral fiber (Flight College of CAUC, 2006). In addition, most applicants must be first hired by an airline that will fund their education program and consent to be their employer upon graduation. The program charge paid by the airline, for each student, amounts to around \$70,000 U.S. (Gluckman, 2006).

The process of application for collegiate aviation programs in China is very structured. An applicant must first complete a physical and psychological examination. Applicants are then interviewed by an airline for prospective employment. Next, a background investigation is completed and a college entrance examination is taken. If these steps are all successful, the applicant is admitted to the university (Flight College of CAUC, 2006). Over the course of the first two or three years of the program, the student completes all college class work and aviation ground training before beginning flight training. In the past, only men were allowed to apply for this program. However, five women were accepted last year for flight training at CAFUC, perhaps in response to the success of female aviators in western nations and the huge shortfall of eligible pilot applicants expected in the next few years (Gluckman, 2006).

College Flight Program Format

Students admitted to collegiate flight programs in China complete an academic curriculum similar to that in western aviation colleges. Required general education courses include higher mathematics, college physics, college English, physical education, and computer software foundations. A few elective courses are also available in the curriculum. The aviation portion of academic work typically includes: basic flight principles, air navigation, aviation meteorology, instrument flight procedures, aviation human factors, crew resource management, aviation regulations, flight communications, professional English, private pilot lectures, commercial pilot lectures, and transition training. Jeppesen flight materials are used for much of the ground school activity. Graduates earn a bachelor of engineering degree, a commercial multi-engine pilot license, and a transportation pilot theory license. Students with a poor academic record or physical disability are eliminated from the program when identified (Flight College of CAUC, 2007).

Students in this college program attend classes for two 20-week semesters per year. The last two weeks each term are reserved for examinations. Students in a particular year group are divided into 30 to 40 student sections who attend the same sequence of required classes throughout their baccalaureate program. Lecture format is very similar to that of western nations, although cultural influence dictates a lower level of classroom interaction between students and instructors. Teaching and research assistants are rarely employed in Chinese aviation departments, and when they are, it is only for grading or assisting with research projects. Examinations are similar to those found in western cultures; however the grading scale is based on 100 points rather than a 4-point system. During the summer months, students work for their future airline employers as interns.

All undergraduate students are required to live on campus. Two to four persons share a dormitory room with cable TV, telephone, and internet access. A wide variety of extra curricular activities are available for flight students, but it is suggested that they not participate in contact sports, in recognition of the physical well-being that is required for flight training. Most college students receive funding from their parents, and loans are difficult to get because there is not a well-established system of credit in China. Airlines must pay tuition for flight students they will employ and some even pay student living expenses. If a student is selected as a military pilot trainee, then tuition and fees are waived.

Collegiate Aviation in China**Challenges to Pilot Production in China****Lack of Aviation Culture**

General aviation cultures in the west are well established. There were 219,246 general aviation aircraft and 19,820 airports in the United States by the end of 2004 (BTS, 2006). This infrastructure is utilized by 629,539 licensed pilots, including 236,147 who are licensed at the private pilot level (AOPA online, 2007). As this large pool of primarily younger pilots gains experience within the general aviation infrastructure, many will elect to enter the commercial aviation career field. In this way, general aviation in the United States provides a continuing supply of pilots to meet commercial aviation needs.

In contrast, China had only 365 general aviation aircraft, 133 airports for civil aviation and less than 11,000 pilots in 2005 (National Bureau of Statistics of China, 2006). Although private aircraft are gaining increasing favor among Chinese executives and entrepreneurs, there

was only one privately owned jet in China as of 2002 (Pilot Journal, 2004). Since that time, a few Chinese companies have begun business jet service to increase the efficiency of their executives as well as promote their company image (see Table 2). However, only a handful of business jets are now in service in China, while on a given day in the US, hundreds are in the air at any given time. Manufacturers like Diamond Aircraft believe China will eventually become one of the most important markets for private and business aircraft, which will further increase the demand for pilots and expanded aviation training (Xinhuanews.net, 2006). However, a number of barriers currently exist that prevent expansion of business jet operations, including high initial outlay and operating costs of such aircraft, inconvenient airport locations, shortage of experienced pilots, and restrictive airspace environment. Most of these limitations also impact the purchase and use of privately owned aircraft.

Table 2
Business Jet Operations in China

Operator	Total Jets	Model of Jet	Number	Base Location
Deer Jet	8	Jet Stream G4	1	Beijing
		Hawker 800XP	4	Beijing/Shanghai/Shenzhen
		Premier I RA390	1	Hangzhou
		Boeing 737-300	2	Beijing
Air China Business Jet	2	Jet Stream G4	1	Beijing
		Learjet 45	1	Beijing
Shanghai Airlines Business Jet	1	Hawker 800XP	1	Shanghai
Rainbow Jet	2	Challenger 601	1	Beijing/Jinan/Shanghai
		Challenger 604	1	
Broad Air Conditioning	2	CE 525	1	Changsha
		CE 560	1	

Note: from China General Aviation Net, 2007.

Insufficient Infrastructure

While the fast-developing aviation industry is demanding more and more professional pilots, the limited infrastructure of Chinese aviation education greatly restricts production. Currently, only five aviation institutions operate in China and each of these have a limited annual output. Three of them are located in large, congested cities without access to runways for flight operations. For this reason, they can only provide ground or simulation training, and must rely on overseas cooperation to finish flight training. The Civil Aviation Flight University of China (CAFUC) has produced 90% of the pilots employed by Chinese airlines over the last fifty years. Before 2000, CAFUC had sufficient

resources to annually complete 40,000 hours of flight training. Recently, due to the growing market demand for commercial pilots, CAFUC increased the number of students admitted for flight training. The result was a large increase in total flight hours required beyond the school's actual capacity. In 2006, CAFUC planned to complete 140,000 hours of flight training; however, only 110,000 hours were actually accomplished due to insufficient training aircraft and instructors (CAAC Journal, 2007). All the other Chinese aviation institutions, like CAFUC, fully exploit their available flight resources, but are still unable to meet pilot production demands.

Airspace Constraint

The lack of unrestricted airspace in China further delays the development of general aviation and hinders flight training activity. Unlike the United States, where uncontrolled Class G airspace is commonly used for general aviation operations, there is currently no uncontrolled airspace in China. Airspace in China has been divided into four classes: Class A is the Upper Control Area, Class B, is the Mid to Low Altitude Control Area, Class C is the Terminal/Approach Control Area, and Class D is the Tower Control Area (CAAC, 2004). Class A airspace is for IFR operations only. All VFR flight is controlled and receives ATC services. Most of Chinese airspace is strictly controlled by the military except for a few routes used in commercial flight operations. In addition to rigid airspace control, a number of government regulations further restrict general aviation. According to Regulations for General Aviation Flight Control of the People's Republic of China, "Units and individuals engaging in general aviation activities must apply to the relevant flight control department for permission of temporary airspace to conduct private flight." (Military Commission of the Central Committee, 2003) The application must include details such as the planned route of flight, the aircraft model, boundaries, flight altitude, date, time, and nature of the flight, and "must be submitted to the relevant flight control department at least 7 working days before the planned use of the temporary flight airspace." (Military Commission of the Central Committee, 2003) In addition, upon receiving permission to use the airspace, the actual flight plan must be submitted the day before the flight (Military Commission of the Central Committee, 2003). Such requirements severely limit the flexibility required for routine and periodic general aviation flight. Automated traffic separation is still in the development stage and has not been practically applied; however, significant steps have been taken to modernize the national air traffic control system. In 2005, Thales Communications Inc. was contracted to develop a third major Air Traffic Route Control Center in eastern China, a development in response to a 30 per cent air traffic increase that year ("Eastern China." 2005). Further ATC initiatives will be needed to convert the predominant "free flight" environment of commercial air travel to one that is more effectively managed.

Discussion and Conclusions

Although the lack of aviation culture and insufficient infrastructure for flight training challenge current Chinese flight education and training needs, the Civil Aviation Administration of China, has begun steps to meet market demand. In November 2003, the first

commercial flight training institution in China, Beijing PanAm International Aviation Academy, was founded to assist the traditional state-owned aviation education system universities. The recent addition of the Zhuhai Flight Training Center and ongoing cooperation with United Airlines further highlight the government's resolution to utilize all possible resources to reform existing aviation education assets and to relieve the pilot shortfall. Contracts to provide modern light training aircraft for flight training at aviation education locations in China and the establishment of a flight training college in Australia to support Beihang University's flight program have been other important steps towards production growth. In addition, Chinese aviation education programs have begun preliminary interaction with several American aviation universities to explore common aviation interests and opportunities. As Chinese aviation education institutions continue to ramp up their programs, future partnerships and collaborative agreements with western aircraft manufacturers and flight education providers will be essential to meeting their infrastructure needs.

Additional initiatives are needed to address flight college staff inexperience. While modern training aircraft and materials are being acquired from western sources, there is also a need to develop experienced "home grown" faculty. Current faculty members at Chinese aviation colleges are selected upon completion of their degree programs and many of them do not typically have industry experience that is so essential to proper student preparation. Initiatives such as faculty fellowships and internships within the aviation industry, both domestic and international, must be expanded to improve staff member levels of practical experience. In western nations, such cross flow between academia and industry is a proven model and the benefit to both entities has been substantial.

At present, a general aviation culture does not exist in China. In concert with initiatives to expand pilot production at flight education universities, the general aviation infrastructure and aviation culture in China must also receive significant attention to insure an ongoing and sufficient interest in pilot careers. Dr. Wu, President of Civil Aviation University of China (CAUC), believes that the demand for commercial pilots in China over the next five years cannot be met without a major increase in the domestic population of general aviation pilots (Tom.com, 2006). To foster a climate of general aviation, access to relatively inexpensive aircraft training and operation, a movement towards more unrestricted airspace, and activities that showcase sport flying would be helpful. Initiatives that provide an orientation to aviation in secondary schools

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would also promote expanded general aviation opportunities and an interest in aviation careers. These suggestions are derived from lessons learned through the western flight experience. In concept with steps to adopt a successful

aviation structure, actions to forge new aviation partnerships will set the stage for China's entry as a full-fledged member of the international aviation community. →

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