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China's Growing Market for Large Civil Aircraft

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Abstract

China will likely become the largest market in the world for new large civil aircraft (LCA), with global LCA manufacturers expecting to sell 100 LCA per year in the Chinese market for the next twenty years, or one every three to four days, at a total value ranging up to $350 billion.

The challenge for western LCA producers in meeting this demand comes less from each other than from the regulation of China's market by its government, the lack of adequate air transport infrastructure to serve its population, and China's nascent attempt at building its own LCA. Should China continue to aggressively address governmental and infrastructure restraints, it will benefit through increased trade and tourism, both of which will spur LCA sales to satisfy air transport demand.

This paper describes China's growing market for LCA and the challenges for LCA producers in realizing China's potential market. It further discusses China's trade in LCA and parts, U.S. exports and imports with China, key infrastructure and regulatory challenges in China, and China's ambitions of building a domestic LCA by 2020.

China's Growing Market for Large Civil Aircraft

Introduction

China will likely become the largest market in the world for new large civil aircraft (LCA),[1] with global LCA manufacturers expecting to sell 100 LCA per year in the Chinese market for the next twenty years, or one every three to four days,[2] at a total value ranging up to $350 billion.[3] In addition, infrastructure updates (airports, repair facilities, flight schools, and air transport modernization) will add substantially to this estimate, making China the most essential market in which suppliers of aircraft and associated equipment and services must participate. From 1997 to 2006, China ordered 959 LCA, accounting for 9.1 percent of global orders. During this period, deliveries to China amounted to 504 LCA, representing 6.9 percent of global deliveries.

Despite this vigorous market performance and expectations, global LCA producers face several challenges in the Chinese market that ultimately limit their potential sales. Governmental control over domestic airlines (including aircraft purchases, air fares, and route structures), airports, and jet fuel restricts the growth of China's air transport system. China's limited air transport infrastructure further constrains airline growth and LCA sales. Lastly, the official state news agency Xinhua announced China's intention of building an LCA and offering it for delivery by 2020.[4] A Cabinet meeting held on February 26, 2007 approved in principle the implementation of a formal production program. If successful, global LCA producers would face new competition from a domestic Chinese manufacturer.

China is arguably the most important future market for global LCA producers, but will not reach its full market potential without assistance from outside sources in mitigating the current infrastructure shortfalls and internal efforts to overcome the existing regulatory impediments.

This paper briefly describes the Chinese market for LCA and parts, highlighting U.S. exports and imports. China's airlines are then briefly discussed, along with China's efforts to grow world-class civil transport and parts manufacturing industries. Demand factors for both China's air transport service and LCA are explored, as are barriers to further air transport market growth.

China's Market for Large Civil Aircraft

China's market for new LCA is expected to surpass those of the U.S. and Europe within the next 20 years, driven by rapidly increasing domestic passenger and freight demand for air transport services. The robust growth in the Chinese economy over the last decade has lead to increased passenger demand for air service as China's per capita disposable income has increased, and the demand for freight has grown with the need for timely delivery of certain goods to feed its economic expansion. To better understand these demand drivers, which are more fully discussed later in the paper, a discussion of China's present market, airline industry, and aircraft and part production follows.

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[1] LCA are civil aircraft seating 100 or more passengers, or civil aircraft weighing over 15,000 kg.

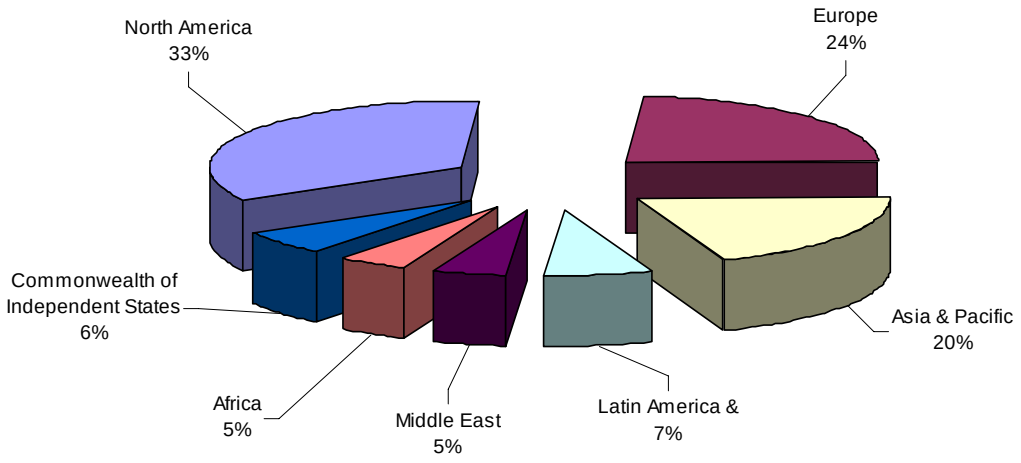
[2] Boeing, *Commercial Market Outlook 2007*, 26.

[3] Over the next twenty years, Boeing estimates China (including Hong Kong and Macau) will need 3,380 aircraft valued at $350 billion while Airbus estimates China will need 2,929 aircraft valued at $349 billion. Boeing, *Current Market Outlook, 2007*, 26 and Airbus, *Global Market Outlook, 2006*, 5.

[4] Embassy of China, "State Council gives go-ahead to develop large passenger jets." *People's Daily Online*, "Large airplane of great significance."

Asian and Pacific nations accounted for the third largest LCA fleet in the world, with 3,478 LCA at the end of 2006 (figure 1, table A-1). China, historically not a large market for LCA producers, is expected to triple its fleet of LCA over the next two decades, making it the most promising market in the world for future LCA sales. China's fleet grew from 957 registered LCA[5] in December 2005 to 1,150 by December 2006,[6] and to 1,171 as of July 2007, an indicator of China's commitment to enlarge its air transport capabilities. The size of China's fleet is expected to continually grow for the next 20 years.

Figure 1 Geographic distribution of world LCA fleet, year-end 2006



Source: World Jet Inventory Year-end 2006 Summary, table S-6, Jet Plane Inventory by Region. See app. A, table A-1 for data.

China's LCA fleet

The majority of China's LCA fleet is comprised of Western-built aircraft. As of July 2007, there were a total of 1,171 Western-built LCA registered in China,[7] while regional jets from BAe, Canadair, and Brazil's Empresa Brasileira De Aeronáutica SA (EMBRAER) accounted for 57 additional aircraft.[8] Since the demise of the BAe, Douglas, and Fokker brands, and in light of the inability of Commonwealth of Independent States' manufacturers to sell their equipment to Chinese operators in sizeable numbers, Boeing and Airbus essentially share the new equipment market. Given China's past relationships with Commonwealth of Independent States' manufacturers, there is some room in China's market for Russian- and Ukraine-built aircraft if they offer performance characteristics similar to Western aircraft, attractive pricing, and after sales support comparable to Western manufacturers. However, this window of opportunity is closing, as China's airlines invest heavily in support of infrastructure (training, parts, tools, etc.) geared towards Western models.

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[5] Jet Information Services, *World Jet Inventory Year-end 2005*.

[6] Boeing, *Current Market Outlook, 2007*, 26.

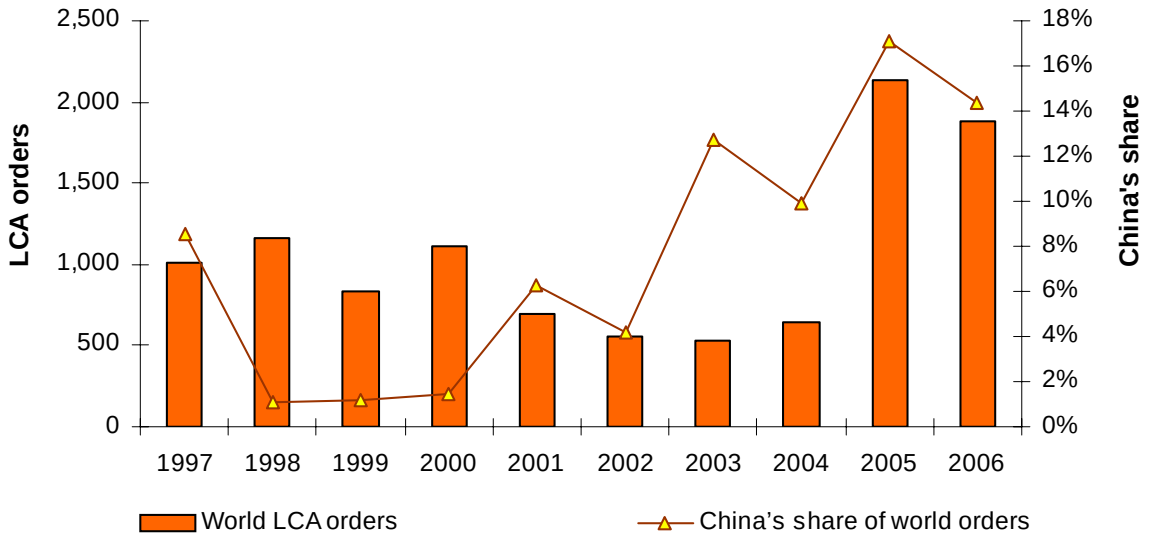
[7] Includes Fokker aircraft. Plane e-List, "Civil Aircraft By Airfleets: China." It is unknown how may CIS aircraft are currently in operation in China. LCA registered include 715 Boeing/McDonnell Douglas, 448 Airbus, six Fokker 100s, and two BAe-146/300 aircraft flying in mainland China, each with 100 seats or more. For comparison purposes, the United States had 3,938 LCA (3,376 narrowbody; 562 widebody) as of December 31, 2005. U.S. Federal Aviation Administration, *Aerospace Forecasts FY 2006–2017*.

[8] Regional jets registered in China include certain models of the BAe146 (6), Canadair's CRJ (31), and EMBRAER's 135/145/170 (20). Plane e-List, "Civil Aircraft By Airfleets: China."

Orders and deliveries

Recent record LCA orders, driven by rapidly increasing passenger and freight traffic, are expected to continue. During 1998–2006, China's LCA orders represented an increasing share of global LCA orders, growing from 1.1 percent to 14.3 percent (figure 2). China's 2005 order for 366 LCA was its largest by far in the decade, equaling 17.1 percent of total world orders for LCA. Orders in 2006 were down but still significant at 270 LCA. As growth in other major markets of the world increases, China's share of orders may diminish, but will remain high in terms of the number of aircraft for some time.

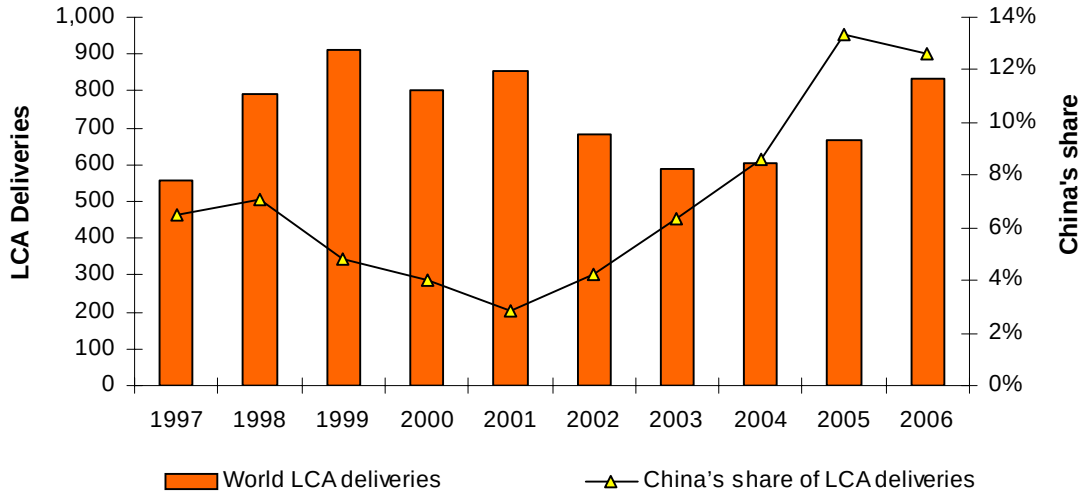
Figure 2 World LCA orders, China's share of world LCA orders, 1997-2006



Source : Boeing and Airbus corporate websites and company-provided information. See appendix A, table A-2 for data.

Deliveries of LCA to China grew more than twofold during the period (figure 3), from 36 aircraft in 1997 to 105 aircraft in 2006. China's market share of world deliveries fluctuated from 2.8 percent in 2001 to a high of 13.2 percent in 2005, before slipping modestly to 12.6 percent in 2006. LCA deliveries are likely to continue growing, given the number of aircraft China has ordered.

Figure 3 World LCA deliveries, China's share of world LCA deliveries, 1997-2006



Source : "Boeing and Airbus corporate websites, and company-provided information. See appendix A, table A-3 for data.

China's Airline Industry

Background

After a series of consolidations over the last 20 years, China's airlines have begun to thrive, profiting from the continued loosening of governmental controls. Their success has led to demand for LCAs from the world's two largest producers, who in turn have projected steady and significant growth in both orders and deliveries of their aircraft in China.

In the mid-1980s, the Civil Aviation Administration of China (CAAC) divided its airline arm into six regional carriers[9] and allowed provincial and municipal governments to begin operating airlines. A total of more than 35 airlines were consequently formed.

Through government mandates, this number was reduced to 19 airlines operating domestically by 1995.[10] In October 2002,[11] three major airline groups were formed by government fiat, further consolidating the airline industry: Air China,[12] China Eastern Air Holding Co., and China Southern Air Holding Co. Together, these three groups and their subsidiaries operated 416 LCA (passenger and freight) and regional jets, predominantly of U.S. manufacture, at their inception.

Not affected by this government fiat was Hainan Provincial Airlines Co., a regional airline founded in October 1989. It formed China's fourth major airline group, and in 2000, became a division of

[9] CAAC continued its regulatory role and its focus on aviation safety. American Chamber of Commerce, "Flying High: China's Aviation Industry."

[10] Davis, *Airlines of Asia*, 421–422.

[11] *People's Daily Online*, "Regrouping Civil Aviation Industry Aims to Fly High."

[12] Air China was a wholly state-owned air transport enterprise. As of December 31, 2006, shares of Air China were traded on exchanges in Hong Kong, London, and Shanghai. Air China, *Annual Report, 2006*. However, controlling interest lay with China National Aviation Holding Co., which also controlled China Southwest Airlines and Zhejiang Airlines. GIGA, 8.

HNA group. By 2005, Hainan had become China's fourth-largest airline prior to its association with other domestic airlines.

By December of 2006, China's airline landscape had evolved into five groups, each with several affiliated airlines (table 1), operating 723 LCA and 26 other passenger aircraft, primarily regional jets (table 2).

Table 1 China's major airlines and their associates and subsidiaries, July 2007

Airline	Associates and/or subsidiaries
Air China Ltd.	Air Macau Co., Ltd. Macau Asia Express Ltd. Cathay Pacific Airways Shandong Airlines Co., Ltd. Shenzhen Airlines Co., Ltd.
China Eastern Air Holding Co.	China Cargo Airlines Co., Ltd. China Eastern Airlines China Northwest Airlines China Yunnan Airlines Great Wall Airlines Jiangsu Co., Ltd. Wuhan Co., Ltd.
China Southern Air Holding Co.	China Postal Cargo Airlines, Ltd. China Northern Airlines China Southern Airlines China Xingjiang Airlines Fujian Airlines Guangxi Airlines Co., Ltd Guizhou Airlines Co., Ltd Sichuan Airlines Corp., Ltd. Southern Airlines Group Shantou Airlines Co., Ltd Xiamen Airlines Co., Ltd Zhongyuan Airlines Zuhai Airlines Co., Ltd
Hainan Airlines Group	Chang'an Airlines China Xinhua Airlines Hainan Airlines Shanxi Airlines
Zhongtian Aviation Holding Co.	Shandong Airlines Shanghai Airlines Shenzhen Airlines Wuhan Airlines

Source: Airline annual reports and GIGA Institute for Asian Studies, 21.

Table 2 Major airlines in China, ownership as of December 2006 and fleet composition as of July 2007

Airline	Principle owner's (share capital)[a]	Boeing[b]	Airbus	Other	Total fleet
Air China	China National Aviation Holding Company (CNAHC)(51.7%), foreign owners (31%) and Cathay Pacific (17.3%)	152	49	1	202
China Eastern Airlines	Chinese government (61.6%), publicly held H shares (32.2%) and publicly held A shares (6.2%)	70	113	14	197
Hainan Airlines	Joint stock company	42	7	0	49
China Southern Airlines	China Southern Holding Company (50.3%), private Hong Kong and non-China investors (H shareholders) (26.8%) and private China investors (A shareholders) (22.9%)	154	110	11	275
Total by manufacturer		418	279	26	723

Source: Corporate annual reports and corporate Web site (Hainan Airlines): Air China, 31; China Eastern Airlines, 38; China Southern Airlines, 19; also, Airfleets Plane e-List.

[a]As of December 2006.
[b]Includes McDonnell Douglas aircraft.

Airline Privatization

In order to serve a broader population, China sought to introduce new airlines that would operate under the global low-cost business model. This effort resulted in the formation of Tianjin-based Okay Airways, established in 2004 by a logistics company, which became China's first privately owned airline.[13] It operates out of Binhai International Airport about 125 miles southeast of Beijing in Tianjin Municipality.[14] Perhaps in anticipation of the Central Government change in rules for airline formation, Spring Airlines and United Eagle Airlines joined the list of private airlines in 2005.[15] In December 2005, CAAC liberalized its rules for industry entrants, allowing anyone with three or more aircraft to form an airline.[16] This change was intended to spur both domestic private and Sino-foreign joint-stock companies to enter the airline business to increase domestic flight frequencies via regional airlines and freight services.[17]

China's Civil Aircraft and Parts Industry

The Chinese Government is determined to develop a domestic LCA and parts industry that will be a global competitor by 2020,[18] despite the challenges presented by a constrained LCA and parts industry (box 1) and considerable technological and market entrance obstacles. By encouraging the

[13] *Interavia*, "MRO sector pursues cost, reliability goals," 21.
[14] *China Daily*, "China's Private Airlines To Take Off In 2005."
[15] Jade Cargo International, a joint venture between Shenzhen Airlines and Lufthansa, and Huaxia Airlines (Chongqing, in Gansu province) have petitioned the government to begin service. U.S. Commercial Service, *Aerospace Industry Market Briefs - China*, 4; Wikipedia, "Jade Cargo International." Jade Cargo will begin service between Amsterdam and Seoul Incheon in August 2006. *ATW Daily News*, "Jade Cargo sees August launch."
[16] Ibid.
[17] *Xinhua News Agency*, "Aviation market opens to private, joint-stock air companies."
[18] *People's Daily Online*, "China's large aircraft dream to come true by 2015."

Box 1 The evolving role of global parts suppliers

One way to begin to understand the complexity and enormity of designing and building a LCA is to begin on a smaller scale, manufacturing parts to someone's performance and quality specifications. Over time and with the purchaser's familiarity with a company's work, this may lead to more complex work being allocated to the parts supplier. This is the route China's civil aircraft industries had been following to gain acceptance in the West, prior to the industry's involvement with both China's regional jet and LCA program.

The largest, most diverse suppliers to the LCA industry are tier-1 suppliers, which account for relatively few of the thousands of companies in the world producing parts for LCA and their component assemblies. In addition to offering a combination of broad engineering skills, research and development acumen, expanded quality control capabilities, and skills managing subassembly suppliers, tier-1 suppliers may also have to finance part of the program before being considered as a program's risk-sharing partner. Risk-sharing arrangements are vehicles for aircraft companies to mitigate some of an aircraft's program risk by shifting some of the program's responsibilities to suppliers. Under risk-sharing arrangements, the supplier is essentially in a decades-long relationship with the aircraft program and its manufacturer, meaning a longer time period for suppliers to recoup initial expenses but also to share in the profit, should the program be successful. This new paradigm differs from the build-to-spec arrangement, under which suppliers were not guaranteed a long term relationship with the LCA manufacturer, which increased the pressure to recover their costs plus profit over each run of goods.

New entrants to the supplier industry wishing to compete with established tier-1 suppliers must either accept this new reliance on risk-sharing arrangements or accept a smaller role in aircraft parts production. Some suppliers, realizing they cannot offer risk-sharing, have chosen to be second- and third-tier suppliers, with less responsibility for the overall product and commensurate lower risk. Individually, smaller companies lack the abilities and financial stature to compete at the same level as larger ones, though they may develop these attributes over time.

development of a domestic industry capable of producing jet-powered transport aircraft,[18] China hopes to advance state-of-the-art technologies in subordinate industries such as machinery, electronics, metallurgy, materials, and information technology.[19] A recent unprecedented production agreement with Airbus and a pronouncement by the central government to have an indigenous LCA industry demonstrate China's resolve.

Background

On two prior occasions, China unsuccessfully attempted to produce a commercially viable LCA. The first attempt in the 1970s resulted in the "Yunshi" Y-10, a 707-style aircraft;[20] however, the aircraft was not competitive with other LCA available at the time, and the program was halted after only two were produced. The next effort was a successful joint venture with McDonnell Douglas in 1985 that produced MD-80 series aircraft exclusively for China's domestic market.[21] In 1992, a second joint venture

[18] China has successfully designed, produced, and sold turbine-powered propeller aircraft abroad. *Flight International*, "Indonesia's Merpati places largest order for Chinese Xian (sic) Aircraft MA60."

[19] Forbes.com, "China's Large Aircraft Readying for Take-Off."

[20] The maiden flight of the Y-10 occurred in 1980, about 15 years after Boeing's 707. U.S. International Trade Commission, *The Changing Structure of the Global Large Civil Aircraft Industry and Market*, 5–10.

[21] The maiden flight of the first Chinese-made MD-82 took place in 1987; 35 were produced. U.S. International Trade Commission, *The Changing Structure of the Global Large Civil Aircraft Industry and Market*, 5–9.

was formed by McDonnell Douglas and two Chinese companies to produce MD-90 aircraft.[22] This plan was amended in 1994 in favor of a plan whereby the Shanghai Aircraft Manufacturing Factory (SAMF) would produce 20 of the so-called Trunkliner aircraft independently of McDonnell Douglas. This program failed after only three aircraft were produced, in part because McDonnell Douglas stopped supplying SAMF with raw materials after its merger with Boeing.[23]

On July 1, 1999, China reorganized its aircraft manufacturing industry, establishing 10 state-owned aerospace enterprises. The largest enterprise was the Aviation Industries Corporation of China (AVIC), employing 560,000 people. AVIC was subsequently split into two companies (AVIC-I and AVIC-II) with similar capabilities to serve different markets. AVIC- I (table 3) was to concentrate on development of medium and large aircraft, while AVIC- II (table 4) focused on smaller aircraft and helicopters.[24]

Current Projects

Regional Aircraft[25]

In order to supply its domestic market while continuing to learn how to assemble a modern, complete aircraft to Western standards, two AVIC- II companies[26] teamed with EMBRAER (Brazil) in 2002 for co-production of their regional jet (ERJ-145) in Harbin.[27] EMBRAER holds a 51 percent share of this joint venture, investing $25 million to build a new factory for regional jet production. The first ERJ-145 rolled out December 16, 2003; the factory is also capable of producing other EMBRAER models.[28] On February 2, 2004, the joint venture won a contract from China Southern Airlines for five ERJs, valued at $120.6 million.[29]

[22] The two Chinese companies were the China National Aero-Technology Import and Export Corporation Group (CATIC) and the Aviation Industries Corporation of China (AVIC). CATIC is a subsidiary organization of the former AVIC which oversees the R&D, production and sale of all military and civilian aircraft in China. The CATIC Group is not a production entity but rather sells military and civilian aircraft, engines, missiles and other airborne equipment. Nuclear Threat Initiative, "China National Aero-Technology ..."

[23] U.S. International Trade Commission, *The Changing Structure of the Global Large Civil Aircraft Industry and Market*, chapter 5.

[24] For more information on AVIC see Nuclear Threat Initiative, "China National Aero-Technology ..." and The First Aircraft Institute of AVIC-I.

[25] Regional aircraft are those transport aircraft under 100 seats, typically used in feeder operations for major airlines.

[26] Harbin Aviation Industry (Group) Co., Ltd. and Hafei Aviation Industry Co., Ltd.

[27] Original contract February 2, 2004. A follow-up contract for five aircraft was signed January 19, 2006. Economist Intelligence Unit, "China industry," as found in *ViewsWire*.

[28] Jackson, *Jane's All the World's Aircraft*, 89.

[29] Economist Intelligence Unit, "China Industry," as found in ViewsWire.

Table 3 AVIC-I Companies

Aircraft	Changhe Aircraft Industries Group, Ltd Changzhou Aircraft Manufacture Company Ltd. Chengdu Aircraft Industrial Corporation China National Guizhou Aviation Industry Group Guizhou Aviation Industries Corporation (GAIC) Longyan Aircraft Manufacturing Factory of GAIC Shanghai Aviation Industry (Group) Company Shanghai Aircraft Manufacturing Factory Shenyang Aircraft Industry (Group) Corporation Shuangyang Aircraft Manufacturing Factory of GAIC Xi'an Aircraft Industrial (Group) Company Yunma Aircraft Manufacturing Factory
Engine	Changzhou Lan Xiang Machinery Works Chengdu Engine (Group) Company Guizhou Liyang Aero-engine Corporation of GAIC Honglin Machinery Corporation of GAIC Liyang Aero Engine Corporation of GAIC Shanghai Aero-Engine Corporation Shenyang Liming Aero Engine Group Corporation Xi'an Aero-engine (Group) Ltd.
Components	Anda Forging Plant of GAIC Anji Foundry of GAIC Beijing Keeven Aviation Instrument Co., Ltd. Beijing Shu Gang Electrical Machinery Factory Beijing Qingyun Aviation Instrument Company Changfeng Machinery Plant China Aviation Standard Parts Manufacturing Corporation of GAIC Chengdu Aero-Instrument Corporation Fengyang Hydraulic General Factory of GAIC Guiyang Aviation Hydraulic Component Factory of GAIC Guiyang Electrical Machinery Plant of GAIC Guiyang Huafeng Electrical Appliance Factory of GAIC Guiyang Qianjiang Machinery Factory of GAIC Guizhou Hongyang Machinery (Group) Corporation of GAIC Guizhou Leach-Tianyi Aviation Hanjiang Machinery Plant Hefei Wanan Machinery Factory Honghu Machinery Factory of GAIC Honglin Machinery Factory of GAIC Hongyuan Aviation Forging & Casting Industry Company Hongwei Machinery Factory Huanyu Machinery Factory of GAIC Huayang Electrical Factory of GAIC Huaxing Aircraft Wheel Corporation Jianghan Aviation Life-Support Industry Corporation Jianghuai Aviation Instrument Factory Jincheng Group Corporation, Ltd Luoyang Aviation Electrical Factory Luoyang Nanfeng Aviation Precision Electro-Machinery Company Luoyang Xinghua Electric Appliance Manufacturing Corporation Pingshui Machinery Factory of GAIC Pingyuan Machine Factory of GAIC Shanghai Aero-Electrical Appliance Factory Shanghai Avionics Corporation Shaanxi Qinling Aeroelectric Company Shenyang Xinhua Electric Appliance Factory Southwest Tooling General Factory of GAIC Taihang Instruments Factory Tianyi Electro-Technical Factory of GAIC Wanjiang Elecro-Mechanical Factory of GAIC Weihong Machinery Factory of GAIC Xi'an Aeronautical Machinery Corporation Xi'an Yuandong Company Xin'an Machinery Factory of GAIC Xinhang Aeronautical Machinery Corporation of GAIC Yonghong Machinery Factory of GAIC

Source: McGraw-Hill, *World Aviation Database*, AVIC-1 "Enterprises."

Table 4 AVIC-II Companies

Aircraft	China National Helicopter Corporation Hafei Aviation Industry Co., Ltd Harbin Aircraft Manufacturing Corporation Hangzhong Aviation Industry (Group) Corporation, Ltd. Harbin Dongan Engine (Group) Company, Ltd. Nanchang Aircraft Manufacturing Company Shaanxi Aircraft Company Shijiazhuang Aircraft Manufacturing Company Shuangyang Aircraft Manufacturing Factory
Engine	China National South Aeroengine Company
Components	Beijing Chankong Machinery Corporation, Ltd. Changchun Airborne Equipment Company China National Airborne Equipment Company Chuanxi Machinery Plant Shaanxi Liaoyuan Aero-Mech Corporation Xinhang Aeronautical Machinery Corporation Yubei Machine Factory Yuxin Machinery Factory Zhongnan Transmission Machinery Works

Source: McGraw-Hill, *World Aviation Database*.

At the joint venture's inception, China was projected to need about 583 regional jets seating from 50 to 110 passengers within 20 years.[30] In September 2006, these projections began to materialize when Hainan Airlines ordered 50 ERJ-145s and an additional 50 ERJ-190s. This order represents the first time EMBRAER's ERJ-190 has sold in China. All aircraft are to be produced by the joint venture in Harbin.[31]

Concurrently, China's AVIC-I Commercial Aircraft Division (ACAC) is developing a regional jet, the ARJ21. By starting with a regional jet, China will gain valuable design, engineering, and support skills for jet-powered transport aircraft while avoiding direct competition with with Boeing or Airbus. Initially designed as a 72- to 79-seat aircraft with plans for a stretched version of 90–92 seats, it is design, engineering and support skills for jet-powered transport aircraft while avoiding direct competition scheduled to enter service in 2009.[32] The aircraft is designed to meet domestic needs, though subsequent models may be considered for export as well.

The four Chinese factories that were involved in the MD-90 Trunkliner program —the Shanghai Aviation Industrial Corp., Xi'an Aircraft Co., Chengdu Aircraft Co., and Shenyang Aircraft Co.—are now partnered on the ARJ21 program. As in the case of the MD-90, the Shanghai facility has taken responsibility for the horizontal stabilizer and final assembly. Xi'an Aircraft is responsible for building the ARJ21's fuselage and wing.[33] Chengdu Aircraft, located some 400 miles southwest of Xi'an, will build the nose section, while Shenyang Aircraft will supply the tail section (empennage).[34] As of

[30] Heilongjiang Information Harbor (HLJ-Online), "JV To Produce Regional Jets."
[31] Francis, "EMBRAER's scores China coup with $2.7bn sale."
[32] *Flight International*, "Chinese Turn."
[33] *Flight International*, "Pictures: ACAC ARJ21 Chinese regional jet."
[34] AINOnline, "AVIC- 1 Commercial Aircraft."

March 15, 2007, total orders placed for the ARJ21 stood at 71 aircraft;[35] on December 21, 2007, Kunpeng Airlines added 100 to the order book.[36] Deliveries are expected to begin in the third quarter of 2009, with Shandong Airlines the launch customer.[37]

International partners have shouldered much of the cost and risk of product research and development, according to ACAC.[38] Some of the U.S. and European manufacturers participating in the ARJ21 program as suppliers include:[39]

U.S. participants:

- B/E Aerospace, Inc.: oxygen equipment
- Eaton Aerospace: integrated flight deck panel assemblies and cockpit lighting controllers
- General Electric: engines
- Goodrich Hella Aerospace: lighting equipment
- Hamilton Sundstrand: electric power system, high lift devices, auxiliary power unit
- Honeywell: primary flight control
- Kidde Aerospace: fire protection
- MPC products Corporation: auxiliary power unit door system
- Parker Aerospace: fuel, hydraulic, and flight controls
- Rockwell Collins: avionics
- Rosemount Aerospace: windshield heater control and wiper system
- Zodiac-Air Cruisers Company: emergency evacuation equipment

European participants:

- Fisher Advanced Composites: interior components
- Liebherr Aerospace, Toulouse: AMS
- Liebherr Aerospace, Hindenburg: landing gear
- Sagem, Paris: flight deck control suite
- Saint-Goban, Sully: windshields and opening windows
- Vibro-Meter SA, Fribourg: engine vibration monitoring system, engine interface control unit
- Zodiac Sicma Aero Seats: crew seats

[35] *People's Daily Online*, "Mass production of ARJ21 airplane to begin." Orders include Shandong Airlines, based in the eastern city of Jinan, ten airplanes, replacing seven Bombardier CRJ200s and two CRJ700s, Shanghai Airlines ordered five ARJ21s Shenzhen Financial Leasing Co. has ordered twenty, and state-run China Aviation Supplies Import and Export Group (CASC) ordering thirty. Xiamen Airlines signed a memorandum of understanding for six ARJ21s; a firm order may be forthcoming. Ibid; also, *Xinhua News Agency*, "China Strengthens Manufacturing of New Regional Aircraft;" and Francis, "First new customer for ARJ21 regional jet."

[36] *ATW*, "ARJ21 rolls out, Kunpeng orders 100."

[37] Li, "Lift-off for China's regional jet."

[38] China.org.cn., "Regional Aircraft Taking Off."

[39] AVIC Commercial Aircraft Company, Ltd., "Partners."

Large Civil Aircraft

The development of large aircraft is listed as one of China's 16 major development plans in the country's 11th Five-Year Program (2006–2010).[40] The goal is to produce a large transport aircraft for civil and military purposes by 2015, with entry into civilian service by 2020.[41] According to the president of AVIC- I, the first model of China's LCA, a freighter, should be ready by 2018,[42] followed by a 150-seat passenger aircraft. In March 2007, China's Premier Wen Jiabao approved a plan to form a joint-stock company that would be responsible for the production of this large civil aircraft and encouraged "concerned parties" to begin as soon as possible in the endeavor.[43] Professor Guan Zhidong (Beijing University) indicated that, while the expressed timetable is possible, it must be in conjunction with foreign assistance in the areas where China is not globally competitive.[44]

Despite the challenges, China is moving ahead in its pursuit of manufacturing an LCA. On June 8, 2006, Airbus and the Chinese Government announced an agreement to build a factory in Tianjin to produce the Airbus A320; production is scheduled for 2008. This project will give China first-hand knowledge in building another commercially-viable aircraft. Initially costing about $630 million for the production line alone, additional investments of between $375 and $630 million are being considered. A new runway may be built by the local government to accommodate the factory's needs.[45]

China's International Trade in Aircraft and Parts

China's trade in civil aircraft has been limited to turbopropeller aircraft. The twin-engined turbopropeller MA-60 seats 50-60 passengers, and has been sold to airlines and governments in Bolivia, Congo, Indonesia, Zambia, and Zimbabwe.[46]

China's global trade in aircraft and engine parts has increased substantially during the period 1997–2006, with exports growing from $280 million to $1.3 billion, which represented 1.8 percent of the global aircraft parts market in 2006.[47] Imports grew from $667 million to over $2.0 billion, giving China a 3.3 percent share of the global market in 2006.[48] The rise in exports may be largely attributable to China's growing importance as a supplier to both Airbus and Boeing, while import growth is driven by China's growing domestic fleet, the Westernization of some Chinese existing civil aircraft,[49] and their nacent domestic turbojet aircraft programs. Both exports and imports should continue to rise, given the West's interest in buying from China's suppliers, and China's interest in producing civil aircraft to Western standards, which is most easily accomplished through the use of parts from recognized Western suppliers.

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[40] *People's Daily Online*, "China's large aircraft dream to come true by 2015." Premier Wen Jiabo announced this publicly on March 12, 2006. *Xinhua News Agency*, "China Planning To Build Jumbo Jets."

[41] *Malaysian National News Service*, "China's large aircraft dream to come true by 2015."

[42] Huanxin, "China's first large civil aircraft to fly by 2018."

[43] *People's Daily Online*, "Large Airplane of Great Significance."

[44] *Xinhua News Agency*, "China Planning To Build Jumbo Jets."

[45] Bradsher, "Site Chosen in China for Airbus Assembly Plant," and "Airbus and China Select Assembly Site." Two articles on the same day by the same author conflict as to whether or not the local government will build this runway.

[46] *People's Daily Online*, "Made-in-China regional airplane sells well abroad," and Wikipedia, "Xian MA60." Customers for the MA60 also include Air Fiji, Air Zimbabwe, Lao Aviation, Merpati in Indonesia, and the Nepalese Air Force. See *Flight International* search results.

[47] See appendix D, table D-9 for data.

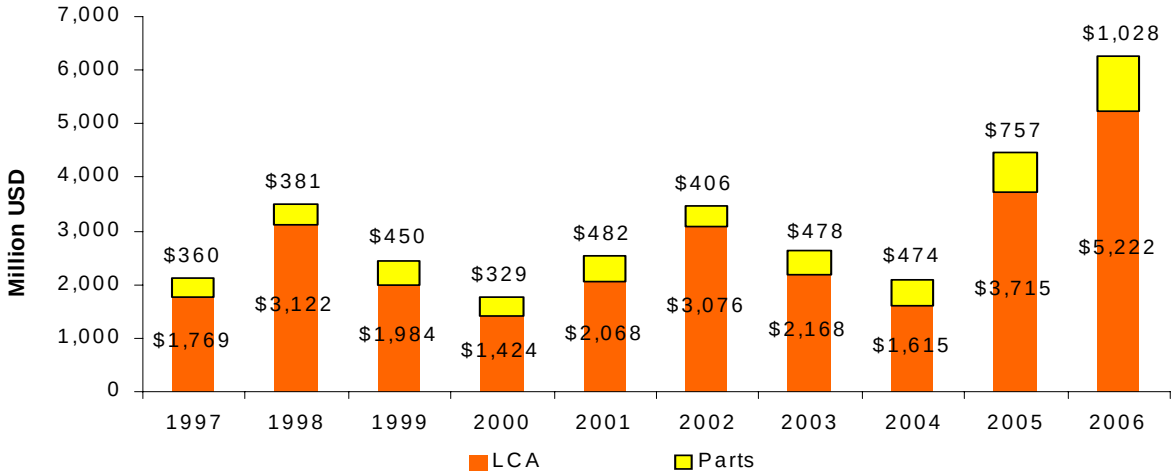
[48] See appendix D, table D-10 for data.

[49] U.S. producers are an integral source of systems for the ARJ-21.

U.S. Trade in Aircraft and Parts with China

As the Chinese demand for LCA grew, so too did the overall trade with the United States in all types of aircraft and parts. U.S. exports of LCA and parts to China during 1997–2005 fluctuated between $1.8 billion and $4.5 billion, before reaching a 10-year high of $6.3 billion in 2006 (figure 4). Orders for U.S.-built LCA by China increased from 56 to 120 aircraft (114 percent), while deliveries increased from 17 to 29 aircraft (71 percent).[50] Deliveries of LCA to China maintained their record share of total LCA exports by value, slipping modestly (by 0.7 percent) to 12.6 percent in 2006. While the United States accounted for a declining number of LCA deliveries, the value of such deliveries increased.[51]

Figure 4 U.S. exports of LCA and parts to China by value, 1997-2006



Source: U.S. Department of Commerce and U.S. International Trade Commission tariff and trade data. See appendix B, table B-2 for data, appendix C for a definition of parts.

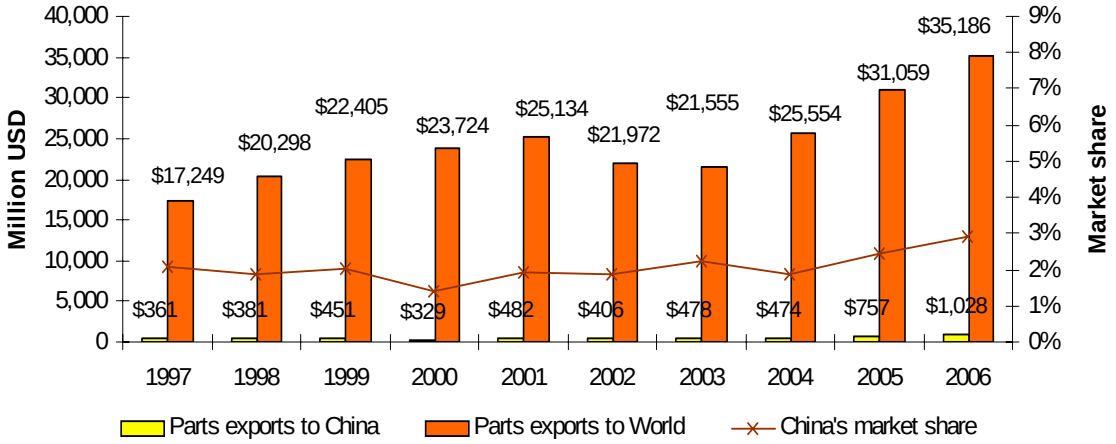
U.S. LCA exports to China accounted for more than 75 percent of the total value of civil aircraft and parts exports by the United States to China during the period, reflecting the strong demand for fleet expansion in China vis-á-vis U.S. manufacturers' total export market (appendix B, table B-1). In contrast, U.S. LCA exports to the world represented about one-half of the total U.S. export value of civil aircraft and parts.[52]

China's increased purchases of LCA highlight the strength of demand from its aviation market for transport aircraft. The increased volume of purchases indicates the pressing need perceived by China's airlines and Central Government to equip airlines for both domestic and international air travel. China is unlikely to alter its buying significantly through the midterm as it tries to satisfy the increasing domestic demand for air transport; consequently, this rate of importation is unlikely to slow.[53]

[50] See appendix A, tables A-2 and A-3.
[51] See appendix A, table A-3, and appendix B, table B-1.
[52] World total includes shipments to China.
[53] *China Daily*, "Orders for new airplanes in line with demand: official."

U.S. parts[54] exports also increased during the period, from $360 million to $1 billion (185 percent). The share of U.S. parts exports to China is relatively small, representing 2-3 percent of total U.S. civil parts exports to the world (figure 5). This is less than one-half the ratio of such exports to other areas of the world (appendix B, table B-3).

Figure 5 U.S. exports of parts to world, to China, China's market share, 1997-2006



Source: U.S. Department of Commerce and U.S. International Trade Commission tariff and trade data; Aerospace Industries Association, Inc., *Aerospace Facts and Figures 2005-2006*; *SpeedNews*, "Commercial Aircraft." See appendix B, tables B-1, B-2 and B-3 for data.

A possible explanation for this disparity is that China has a relatively young fleet that presently does not require large numbers of replacement parts when compared with more mature aviation markets that have fleets of more varied ages. As China's fleet begins to age, the absolute value of U.S. civil aircraft parts exports to China should increase, though it is likely that the ratio between the value of LCA and parts imports will remain unchanged in the short term. China also has yet to become a significant aircraft exporter, thereby limiting demand for Western-made aircraft parts imports.

Despite a large number of aircraft production facilities together employing more than 500,000 employees,[55] China has yet to impact the global market for civil aircraft or parts. Since 1997, the U.S. industry has purchased a growing number of Chinese aircraft parts, with such imports rising from $44 million to $229 million.[56] However, the growth in absolute value is small compared with U.S. imports of civil aircraft and parts from the rest of the world.[57] As a relatively new supplier, it must compete with established global suppliers with long affiliations with the U.S. industry for a place in the market. In 2006, China represented less than one percent of total U.S. imports of civil aircraft and parts from the world (figure 6).

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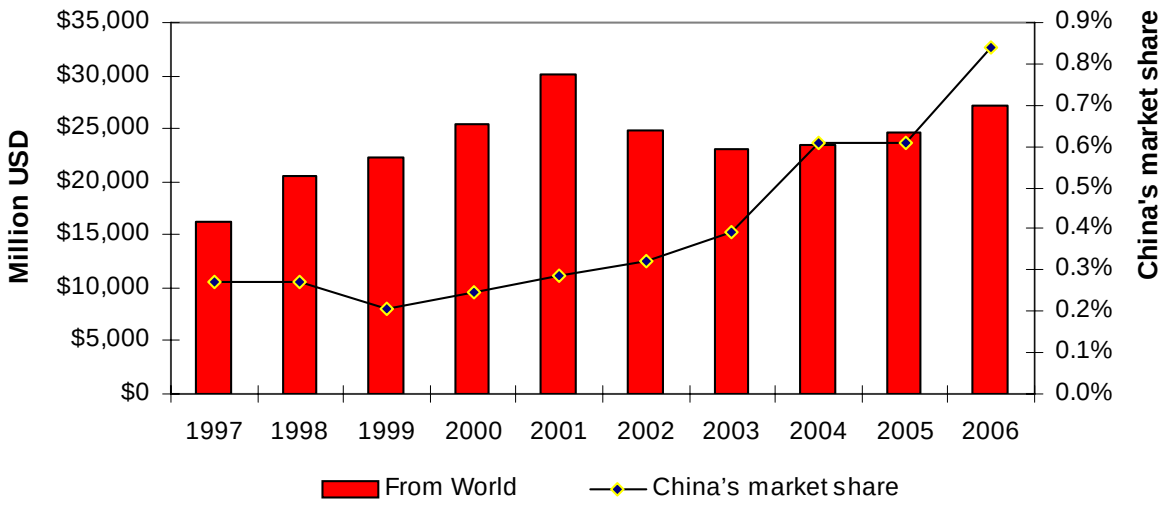
[54] Parts consist of total U.S. civil aircraft exports minus LCA exports. The remainder consists of other civil aircraft, aerostructures, engines, systems, and individual parts.

[55] See tables 3 and 4, pages 8 and 9, for Chinese production facilities. It is unclear how exact the number of aerospace workers this represents, as AVIC-I and II each produce nonaerospace goods.

[56] See appendix B, table B-4 for data.

[57] Information on China's aerospace trade with the EU (25) can be found in appendix D, as well as corresponding information on the European Union's aerospace trade with China.

Figure 6 U.S. imports of civil aircraft and parts from world, China's market share, 1997-2006



Source: U.S. Department of Commerce and U.S. International Trade Commission tariff and trade data. See appendix B, table B-4 for data, appendix C for a definition of parts.

Although the number and variety of aircraft parts manufactured in China is growing,[58] particularly with both Airbus and Boeing sourcing parts from Chinese companies,[59] no near term significant challenge to global parts producers exists. However, given China's massive orders for LCA and ever-growing technological competence, they likely will be a factor in future competitions as suppliers to international LCA programs. To date, the technology transferred by western LCA manufacturers has not led the Chinese aerospace industry to become globally competitive. If the partnership with Airbus to produce A320 aircraft in China is successful,[60] China's abilities would likely rise substantially, both in terms of parts production and final assembly of LCA.

China's government also may use its tremendous market strength for LCA to encourage more investment in domestic parts manufacturing. However, in the short-run there is a finite number of parts that either Airbus or Boeing can source successfully from China because of existing contracts with other suppliers and current indigenous manufacturing abilities. Both airframers now demand risk-sharing agreements for many of the major domestic and foreign parts producers, a form of business not common in China today.[61]

Western Assistance in China's LCA and Parts Industry

Both Boeing and Airbus have invested in China to establish themselves as learning resources for the domestic LCA and parts industry and to enhance their relationship with LCA purchasers. They have

[58] Details of EU aerospace trade with China are presented in appendix D; U.S. aerospace imports from China are detailed in appendix E.

[59] See tables 5, 6, and 7 on pages 18–20 for Western involvement in China's parts industry.

[60] See China's Civil Aircraft and Parts Industry, Large Civil Aircraft, 14.

[61] The ARJ-21 is the first major program to use this type of contractual arrangement.

also assisted in developing both China's air traffic control (ATC) system and manufacturing expertise. China has welcomed this assistance, and is hoping to incorporate their knowledge with its domestic industries.

Boeing[62]

Boeing's involvement with China's LCA industry, beginning in the 1970s, is broad and deep.[63] Boeing has assisted in developing manufacturing methods for parts production and has provided ideas for air traffic management,[64] aircraft maintenance,[65] and pilot training.[66] At present, Boeing is affiliated with several logistics, repair and training companies in China (table 5) and sources a number of assemblies and parts from Chinese suppliers (table 6). Since the 1980s, Boeing has sourced over $1 billion in parts and services from China; current and future contracts are estimated to be worth $1.6 billion for the life of their 737, 777, and 787 programs.

Table 5 Boeing-affiliated enterprises

Enterprise	Established	Provides
Aviall (purchased by Boeing in May 2006)	1959	Integrated materials managing
Boeing Alteon Flight Training Center, Kunming	1999	Flight simulator and maintenance training
Boeing Spares Service Center, Beijing	1994	Center for airline logistics, spare parts training, support and services
Taikoo Aircraft Engineering Company Ltd, Xiamen	1993	Airplane overhaul and repair
Boeing Shanghai Aviation Service Co., LTD. Pudong International Airport, Shanghai	October 2006	Maintenance, repair and overhaul of aircraft

Source: Boeing, "About us: Boeing in China."

[62] Data for this section taken principally from Boeing, "The Boeing Company in China."

[63] Historically, industrial collaboration has included: B-737 Classic vertical fins and horizontal stabilizers built in Xi'an (1982–1999); MD-80/90 nose sections, landing gear doors, horizontal stabilizers subcontracts (1979–1999); B-737, B-747 machined parts (1980–1992); and 757 horizontal stabilizers, vertical fin and tail sections built by Chengdu. Boeing, "The Boeing Company and China."

[64] A China-Boeing Joint Air Traffic Services task team was formed in 1993 to improve safety and air traffic management. In April 2002 Boeing Air Traffic Management contracted with Beijing Capital International Airport Company Limited and Civil Aviation Administration of China (CAAC) to study the Beijing Capital International Airport (BCIA) terminal maneuvering area and ground operations. Boeing Air Traffic Management also worked with the CAAC to modernize the Chinese air traffic system and prepare for the 2008 Beijing Olympics. "CAAC and Boeing are undergoing an 18-month implementation of the Required Navigation Performance/Area Navigation (RNP/RNAV) that will help airlines operate to and from Lhasa airport with greatly improved safety and efficiency." Boeing, "The Boeing Company and China."

[65] "In the 1980s, Boeing helped the CAAC establish an air plane (sic) maintenance certificate course at the Civil Aviation University of China (CAUC) in Tianjin. CAAC and airline personnel come from all over China to Guangzhou, Shanghai, Chengdu and Beijing to complete safety-management courses taught by Boeing instructors." Boeing, "The Boeing Company and China."

[66] Boeing Alteon's Kunming Training Center is an important part of China 's airline training community and is Alteon's first training facility in Asia. The Kunming Center offers flight training for pilot and crew in certain Boeing and Douglas aircraft simulators. Boeing has also assisted the CAAC in its efforts to further develop China's Civil Aviation Flying College (CAFC) by giving the college two multi-million dollar 737 simulators. Curricula and course materials, with special emphasis on basic pilot training, have also been supplied by Boeing. Under contract with Boeing, the Florida Institute of Technology has provided the CAFC advanced instructor and management skills training." Boeing, "The Boeing Company and China."

Table 6 Boeing's current parts procurement from China, April 2007

Company	Location	Parts procured
Baoji Group Ltd.	Shaanxi	titanium ingot, plate & sheet
BHA Aero Composites Company, Ltd. - joint venture between Boeing, Hexcel, and AVIC-I	Tianjin	737 composite panels and parts (flight deck, close out panels, dorsal fin, wing-to-body fairing, cover panels, wing fixed trailing edge, wing fixed leading edge, tail cone, interior parts, secondary composite structures) 747 miscellaneous composite parts and structures 767 and 777 wing fixed tailing edges and dry bay barriers; empennage panels, interior parts, secondary composite structures 777 flight deck interior panels 787 trailing edge panels for the vertical fin, interior parts, secondary composite structures
Chengdu Aircraft Industries	Chengdu	737 forward entry and over-wing exit doors (a subcontract from Vought Aerospace, USA) 747-8 ailerons and spoilers, single source; horizontal stabilizer parts and subassemblies (a subcontract from Vought Aerospace, USA) 787 rudder, single source (sole provider of this assembly)
Hafei Aircraft Industries	Harbin	787 upper and lower body panels for wing-to-body fairings, single source; vertical fin parts

Table 6 Boeing's current parts procurement from China, April 2007—*Continued*

Company	Location	Parts procured
Hong Yuan Aviation Forging & Casting Industry Company	Sanyuan	747 titanium forgings since 1984
Shanghai Aviation Industry Company	Shanghai	737 horizontal stabilizers
Shenyang Aircraft Company[a]	Shenyang	737 aft fuselage subassemblies
		787 vertical fin leading edge, single source
Southwest Aluminum	Chongquing	747 aluminum forgings
Taikoo Aircraft Engineering Company, Ltd. (TAECO) - joint venture with Boeing	Xiamen	747 parts, subassemblies
		747 Boeing Converted Freighter modification program
Quick Electronics	Beijing	print hardware, servers in support of Boeing IT hardware
Xi'an Aircraft Company	Xi'an	737 Next Generation vertical fin
		747 trailing edge ribs, floor beams, detailed parts, and subassemblies
		747-8 trailing edge flaps

Source: Boeing, "About us: Boeing in China."

[a]Shenyang has contracted metal and honeycomb leading edge panels from U.S. company PlasticFab, a division of Kaman Aerospace Corporation, Bloomfield, CT. Vandruff, "Outsourced 787 work returning to America."

Training in manufacturing methods has received the greatest attention from Boeing. Boeing has had resident teams in China since 1980 to train and provide technical assistance and support to several Chinese factories.[67]

Airbus

In addition to partnering with Chinese industry for production of its A320, Airbus is acquiring numerous parts from Chinese sources. Airbus has developed relationships with several of China's aerospace manufacturing enterprises, and it currently sources parts from six vendors (table 7).[68] In 2002, Airbus signed an agreement with the Chengdu Aircraft Aviation Co. and the Xi'an Aircraft Industrial Corp. to buy wing leading and trailing edges, worth an estimated $169 million.[69] In 2003, Airbus signed a contract with the Shenyang Aircraft Co. for the procurement of 3,000 emergency exit doors, while in 2004, a contract valued at over $100 million was signed by Airbus and AVIC-I for the procurement of more LCA parts.[70]

[67] Boeing, "The Boeing Company and China."
[68] Ibid.
[69] *Bloomberg News*, "China Wins US$169 million Airbus Contract."
[70] Airbus S.A.S., "Airbus in China."

Table 7 Airbus suppliers in China, July 2007

Company	Location	Parts procured
Chengdu Aircraft Industrial Company	Chengdu	A320 rear passenger doors
		parts of nose section
Guizhou Aviation Industrial Group	Guizhou	maintenance jigs and tools
Hafei Aviation Industry Co., Ltd.	Harbin	HTP leading edge ribs and torsion box
		CRP detail parts with monolithic structure
Hong Yuan Aviation Forging & Casting	Xi'an	titanium forging parts
		wing to engine mounts
Shenyang Aircraft Company	Shenyang	produces and assembles emergency exit doors
		manufactures: - fixed leading wing edges and ribs - A320 cargo doors - skin plates
Xi'an Aircraft Industry Company	Xi'an	access doors for wide-bodied aircraft
		wing fixed trailing edges
		medium air ducts

Source: Airbus S.A.S., "Airbus in China;" Airbus S.A.S., "Airbus in China: Milestones."

The China Aviation Supplies Import & Export Corp. and Airbus established a joint training center in 1998 with two full simulators, one for the A320 series and one for the A330/A340 series.[71] Airbus has expanded its corporate footprint by choosing Beijing as the site of its Engineering Center. Opened on July 21, 2005, Airbus announced the Engineering Center will assist China in supplying up to five percent of its upcoming A350 model, thereby aiding Airbus in its goal to procure up to $120 million in parts from China by 2010.[72]

Potential for LCA Production

In the past, China has been successful in securing some elements of aerospace technology in conjunction with aircraft orders, which has aided its aerospace industry in areas such as manufacturing and ATC. However, China's aircraft and systems design and development skills need continued development prior to any meaningful discussion of indigenous LCA production. It also lacks a history of building aircraft to Western standards and supporting aircraft globally, essential aspects to the global acceptance of their aircraft.

[71] Op cit.
[72] *People's Daily Online*, "Airbus Engineering Center Inaugurates In China."

China's ambition to produce commercially-viable LCA faces many obstacles. Competition from Airbus, Boeing, and proposed aircraft from the CIS notwithstanding, a new airframe from a new company must gain the trust of both airlines and travelers, something earned over considerable time with operational experience (e.g., aircraft reliability, maintainability, operating costs, and passenger acceptance). The performance and support of this new aircraft type must, at a minimum, match the performance and capabilities of existing foreign offerings, a formidable and complex undertaking for a new manufacturer. Even success in this area does not assure sales of the aircraft, as airlines considering aircraft purchases look for significant technological or cost-savings from new aircraft; therefore, airlines gravitate towards a manufacturer and an aircraft they are familiar with versus one without discernable advantages or a track record.

New tools must also be designed for the airline workforce to work on each new aircraft and training must be instituted for mechanics and pilots at the airlines, at additional cost for both the airlines and manufacturer. An aircraft manufacturer with global sales aspirations must also know how to support his product globally, with parts warehouses strategically located near the aircraft's home base. Taken together, the formidable monetary and design challenges may inhibit the introduction of a Chinese-designed and produced LCA.

Drivers of Demand for LCA and Air Transport Service in China[73]

China is slated to become the largest market for LCA, with passenger demand for air transport service driving the bulk of LCA purchases. This demand, in turn, is a function of population, disposable income, and the fare structure of the individual airline. As disposable income increases, so too does demand for air travel. The growing middle class in China is therefore a primary determinant of the expected exponential growth in air transport demand, with officials seeing China's middle class expanding by 22 million annually through 2020.[74]

Demand for LCA in China is also influenced by demand for air cargo service, growth in an airline route structure and/or a desire to increase frequencies on existing routes, and fleet replacement needs. Although today's airlines are essentially limited to two LCA suppliers, some augment their fleet with regional jets to provide point-to-point service on short haul and/or "thin" routes (i.e., routes with low but consistent demand where a larger aircraft would be uneconomical) and act as feeder aircraft to an airline's major hub.

China's topography is also a factor driving demand for air transport. China has a land area similar in size to that of the United States, encompassing large areas of rugged terrain. Land transport options are not as well-developed as in the West, furthering reliance on air transport.[75] This demand is expected to continue for at least the next two decades.

[73] For a more complete discussion of these factors, see U.S. International Trade Commission, *Global Competitiveness of U.S. Advanced-Technology Manufacturing Industries* and *The Changing Structure of the Global Large Civil Aircraft Industry and Market*, 6-5 through 6-7.

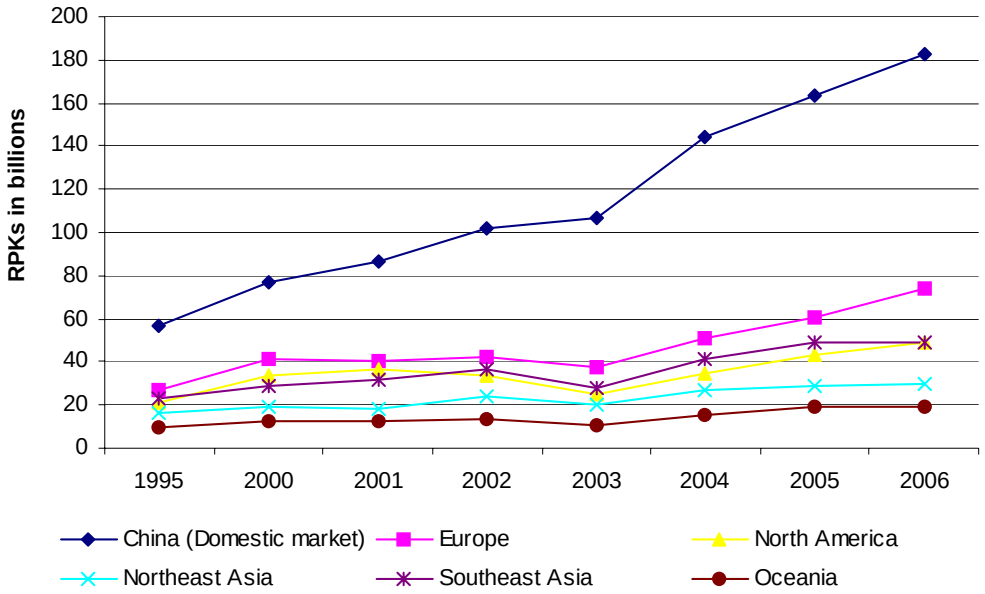
[74] Airbus S.A.S. *Global Market Forecast 2004–2023*, 24.

[75] According to the Central Intelligence Agency's *World Fact Book*, China's landmass is 9,596,960 sq. km (for comparison, the United States has 9,826,630 sq. km). See appendix G for a comparison of U.S. and China's transport infrastructure.

Passenger and Freight Market

Although the outbreak of SARS caused international traffic from China to drop from 8.4 million passengers to 6.8 million (19 percent) in 2003, China's domestic passenger traffic rose in 2003 by 1.9 percent over 2002 to 87.6 million, illustrating the strength of the domestic travel market.[76] Revenue passenger kilometers (RPKs, or one fair-paying passenger transported one kilometer), have grown substantially for the period, with the bulk of growth occurring in China's domestic market (figure 7).

Figure 7 Traffic flow - passenger traffic from China to destination, selected years



Source : Boeing, *Current Market Outlook* , 2007. See appendix F, table F-2 for data.

In 2005, China accounted for 42 percent of all eastbound air cargo traffic from Asia, 50 percent of which was comprised of high-value time-sensitive shipments such as telecommunications equipment and consumer product shipments.[77] Overall, air freight from China grew from 60,000 tons in 1978 to over 3.5 million tons in 2006. China's membership in the World Trade Organization, favorable monetary policies, and an ongoing relocation of multinational manufacturing will likely add to air cargo growth in the years to come.[78]

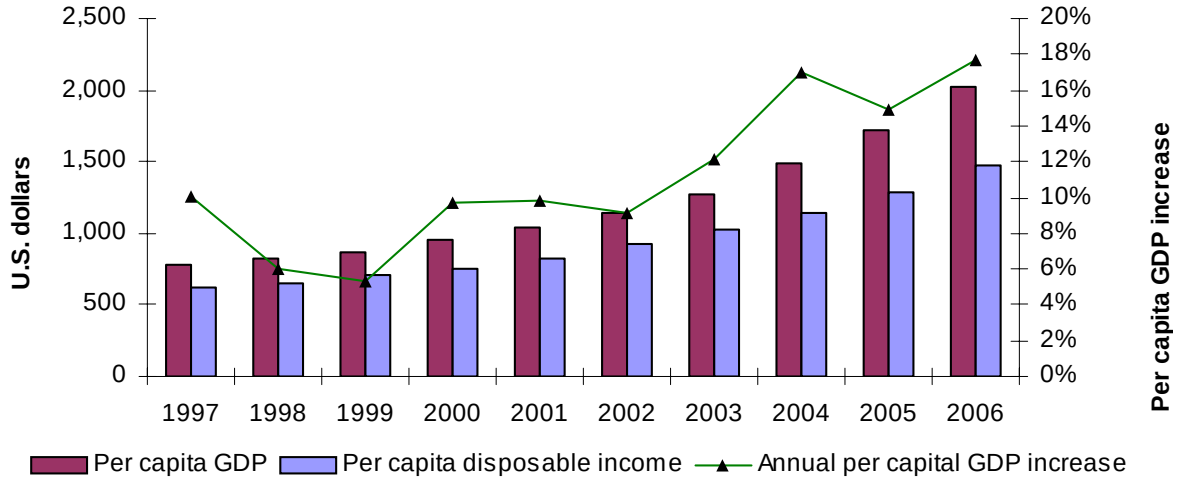
To accommodate this meteoric increase in demand, Boeing projects China will need 3,400 new aircraft over the next twenty years. Airbus has a similar projections, seeing China's market growing by 2,929 LCA over the next twenty years.

[76] *ViewsWire*, "China: Transport and communications." Also, *People's Daily Online*, "China's civil aviation ..."
[77] Graham, "Emerging Markets Drive Growth."
[78] Ibid.

Rise in Disposable Income and Population

According to Airbus, the rise in income (measured by either per capita GDP or disposable income, or both) and exports are responsible for 99 percent of the traffic variations of the last 20 years.[79] The greater the amount of per capita income, the higher the propensity for air travel (figure 8).

Figure 8 China's per capita GDP, disposable urban income, annual GDP increase, 1997-2006



Source: National Bureau of Statistics, *China Statistical Yearbook, 2006,* tables 3-1 and 10-2, 57 and 347, respectively; National Bureau of Statistics, *China Statistical Yearbook, 2007*, tables 3-1 and 10-2, 57 and 345, respectively. Disposable income: Data based on USITC calculations utilizing raw year data from CEIC Data Company, Ltd. and average exchange rate for each year found at Oanda Corporation. See appendix F, table F-3 for data.

The disposable income available to China's urban dwellers rose significantly during the period 1997–2006, increasing at an average annual increase of 10.1 percent. China's GDP, estimated to be growing at 11.2 percent annually, will continue to have a stimulating effect on the future demand for air transport services as more Chinese find air travel within economic reach. RPK growth in China is similarly robust, and is estimated to be 8.8 percent a year, nearly double the world's projected growth of 5 percent.[80]

The rise in the middle class population is another factor in China's rapidly emerging demand for air transport services, and should be one of the principal drivers of future demand. The Chinese Academy of Social Science reported that there were 247 million middle-income consumers in China, defined as households with assets of US $18,000–36,000, accounting for 19 percent of the 2003 population.[81] This group is forecasted to reach 40 percent of the population by 2020 and is concentrated in the coastal provinces of the Beijing-Tianjin corridor, Yangtze River Delta, and the Pearl River Delta.[82] Further, while McKinsey & Co. analysts estimate that over 77 percent of China's population lived in poverty in 2005,

[79] Airbus S.A.S., *Global Market Forecast 2004–2023,* 20.
[80] Boeing, *Current Market Outlook, 2007*, 41.
[81] BBC, "China's new middle class growing fast." This figure rose to 250 million in 2004. McKinsey & Co., "The value of China's emerging middle class." The income associated with the term middle class is open to debate: see *ChinaDaily*, "Middle class society."
[82] Airbus S.A.S., *Global Market Forecast 2004–2023,* 19.

this will drop to 23 percent by 2015, and 10 percent by 2025. The groups that will grow the most are lower middle classes followed by the upper middle classes.[83] These analysts see the demand for transport services increasing at a compound rate of over 9 percent between 2004 and 2025.

Relaxation of Government Travel Regulations

By July 2007, China's Approved Destination Status list had expanded to eighty-six nations, and is scheduled to continue to grow.[84] The more liberal travel policies have spurred demand for air transport in China, creating opportunities for strong growth in this industry. Prior to 1980, airlines in China were severely restricted in where they could fly outside of China by this list, which was controlled by the Central Government.[85] Between 1980 and 2004, the list expanded to fifty-five nations, while domestic air travel grew by an average of 16.5 percent a year.[86]

Improved Air Traffic Control (ATC) Facilities

To improve air traffic flow and safety and add capacity, a new system of regional ATC centers and full conversion from program to radar-based ATC is scheduled to be introduced over the next 10–15 years.[87] Under the new ATC system, the location of each aircraft using the system would be known at all times. This system would be capable of incorporating more aircraft into China's airspace, thereby allowing more people and freight to be flown. Unlike Western countries, not all of China's aircraft are under positive civilian flight control; that is, there is limited nonmilitary radar control of airliners as they fly in domestic air space. The system relies partially on timing a flight's departure to interpolate where the aircraft would be at any given time. Although traditionally a safe method of flight, it is not the most efficient use of air space in the air traffic system. As of 2006, China had 42 air traffic control centers, 34 primary and 78 secondary surveillance radars, 180 Very High Frequency (VHF) systems, and 190 Omnidirectional Range and Distance Measurement Systems (VOR/DMEs), all vital components in their air traffic infrastructure.[88]

Barriers to Air Transport Service Growth

Despite the robust growth in demand for air transport service, an improving aerospace infrastructure, and relaxation of some governmental controls, global LCA producers continue to face several impediments that may limit their realization of expanded opportunities in China. Many of these barriers are governmental in nature, while others are airline industry shortfalls; both serve to moderate the pace of air traffic growth in China.

Government Regulation

The demand by airlines in China for LCA is subject to the Central Government's plan for regulating the overall market's growth. The Chinese market for LCA is unique in that China's airlines lack the authority to consummate a negotiated contract to purchase aircraft independent of government approval. After an airline negotiates a contract with an LCA manufacturer, it must apply to the central

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[83] McKinsey & Co., "The value of China's emerging middle class."

[84] China Consulting on Tourism Action, "China's ADS list." The United States and Canada are not on China's ADS list. Therefore, China's population is not permitted to go to either country solely for leisure travel.

[85] In 1980, only Hong Kong, Macau, and Thailand were on China's Approved Destination Status list. Airbus S.A.S., *Global Market Forecast 2004–2023,* 22 .

[86] Airbus S.A.S., *Global Market Forecast 2004–2023,* 22, 20.

[87] U.S. Department of Commerce, *Aerospace and Aircraft.* System capacity refers to the number of aircraft that can fly safely in the air traffic control system.

[88] *China Civil Aviation*, "Dawn of a new age."

government for contract approval. The central government considers the number of aircraft requested, the proposed routes they will fly, the airline's financial position, and both the existing and planned infrastructure needed to support the airline's plans.[89]

Part of the reason for this oversight is to ensure the additional aircraft will be adequately accommodated by the domestic ATC infrastructure both in the air and on the ground. It also restricts the level of competition among the airlines, a limiting factor to growth. This convention adds another layer of concern for a manufacturer's sales campaign, and can be a risk for the domestic airlines who are thereby subject to the political will regarding ATC infrastructure development. Objectively, China does not have the system capacity to allow unlimited airline growth at this time; therefore, the lack of capacity is a constraint on the plans for growth both of the domestic airlines and foreign airlines wishing to start or expand service.

The route structure of China's airlines has been strictly regulated by the Central Government to about 30 percent of China's existing airspace.[90] However, this will change in the future as regulators allow airlines to service additional domestic destinations outside of Beijing, Chengdu, Guangzho, and Shanghai.[91] This move will aid China's domestic airlines both in expanding their existing service and creating new service. The central government may also provide some support to airlines seeking to initiate new services, though it is not clear as to the circumstances necessary for such aid.[92]

In addition to being the final arbiter in LCA purchases, the central government of China also sets landing fees and monitors both ticket prices and jet fuel costs. These impediments are particularly frustrating for airlines wishing to develop a low-cost carrier model, as they are prevented from securing fuel and aircraft at market-based prices, and are limited in their ability to price their airline tickets. While established airlines have dealt with the system for years, it is onerous for new entrants who wish to use proven low-cost models from around the world in China's air travel market. Central governance of landing fees, in particular, adds cost for these aspirants; in other countries, local areas set these fees, which can be used as incentives to promote more traffic at the local airport. Until these governmental controls are moderated, LCA sales to China's new airlines will be constrained. One analyst with China Galaxy Securities Co., Ltd. has stated it will take at least five years for China to realize a low-cost aviation market, because of governmental controls on essential elements of the factors of competition.[93] If they should be surmounted, sales should be even greater than currently predicted.

Reservation Systems

A concern for all carriers in China, but perhaps more so for new entrants, is that consumers in China typically do not use the Internet for their reservations nor use credit cards to the same extent found in other areas of the world. This necessitates additional staffing for low-cost airline operations in China, as consumers are more comfortable using cash for their transactions. These factors contribute to a higher cost for low-cost airlines wishing to do business in China.[94] Essentially, though the low-cost model is the aim of some new airlines, they must operate under the same cost structure as that of China's heritage

[89] Industry sources.

[90] Center for Pacific Aviation, "China, IATA in talks to open two new air corridors." There are a total of 29 commercial air routes not under military control. Jonathan Hicap, "CAAC issues ..."

[91] *Xinhua News Agency*, "China to Further Deregulate Management Of Domestic Flights."

[92] *Associated Press*, "China to Let Airlines Pick Routes," January 5, 2006.

[93] Civil Aviation Resource Net of China, "Budget Airlines To Enter Chinese Market."

[94] India, which is further along in its airline deregulation policies, has seen yearly passenger growth of 20 percent, outstripping China's growth. Sachdev, "Planemakers Turn East" and Fullbrook, "Greater China: Budget Airlines Rev Up To Take Off In China."

carriers. Part of the success of budget carriers in both the United States and Europe lies in their ability to do business with a lower cost structure, something internet sales has helped with.[95]

Systemic Challenges

Airports

The infrastructure supporting the growth of China's airlines has lagged demand for air transport service. As a result, many existing facilities face capacity restrictions and have limited ability to service LCA. Previous restrictions on travel limited the need for an extensive infrastructure to support relatively low passenger demand. Between 1990 and 2005, China spent $14.9 billion on airport infrastructure improvements in an attempt to remedy this situation. China continues to address its infrastructure investment needs and has instituted a program to both modernize certain existing airports and build 44 new airports by 2010 at an estimated additional cost of $17.9 billion.[96] In January 2008, CAAC announced the State Council approved a more ambitious development plan to build 97 new airports at a cost of Rmb 450 million ($62 billion) by 2024.[97]

In 2005, China had 147 airports, of which only 22 could accommodate large Western twin-aisle aircraft (e.g., wide-bodied aircraft such as the Boeing 747 and 777, and Airbus A340).[98] Three large airports serve as domestic and regional hubs: Beijing Capital International Airport (BCIA), Shanghai Pudong, and Guangzhou Baiyun. Together, these three hub airports accounted for approximately 38 percent of China's total passenger turnover in 2004.[99]

The handling of air freight traffic is becoming more difficult. By March 2006, 18 airports had reached their operational capacity for freight transport; by 2010, an additional 29 airports will have reached their freight-handling limit, according to CAAC.[100] CAAC's plan to increase the number of airports should significantly help mitigate this problem.

In 2002, the Central Government began allowing foreign direct investment in some of China's airports, to develop them more quickly. Investment began with German airport operator Fraport A.G. reportedly agreeing to take a 25 percent share of Ningbo airport in east China and a 24.5 percent stake in Xi'an's airport, subject to governmental approval.[101] Singapore's Changi airport now owns a 29 percent share of Nanjing Lukow Airport while the Hong Kong International Airport has bought a 35 percent share of Hangzhou airport, located in Zhejiang province, and is partnered with Zuhai Municipal Airport for the daily management of the airport.[102]

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[95] China Business Information Center, "Low-cost airlines expansion not easy."

[96] *Associated Press*, "China To Spend $17 Billion On Airports By 2010: report."

[97] *Flight International*. "China to spend $62 billion on airports by 2020." Projections on airport expenditures through 2010 have also risen, to about Rmb 140 billion, or about $20 billion vs. $17.9 billion originally projected.

[98] U.S. Commercial Service, *Aerospace Industry Market Briefs - China*. *Answers.com* lists 137 airports open or under construction. For additional information on China's transport infrastructure, see appendix G. For a complete list of China's commercial airports, see appendix H.

[99] U.S. Commercial Service, *Aerospace Industry Market Briefs - China*, 4–5.

[100] Su, "Frantic Rush To Upgrade China Airports."

[101] *The Hindu*. "China's airport building gathers pace." Fraport AG, "Xi'an Airport Participation Signed Today."

[102] *Chinadaily.com*. "Changi buys stake in Nanjing airport." Hong Kong International Airport. "Agreement for capital increase subscription signed in major strategic alliance."

Pilot Shortage

China has long contracted foreign pilots to fly their aircraft due to a shortage of qualified pilots in China. One industry source[103] indicates that China needs 50,000 pilots by 2024 for its future LCA fleet, an increase of 355 percent over today's 11,000 registered pilots.[104] CAAC has stated it will need an additional 12,000 pilots by 2010, a number its domestic flight schools[105] will be unable to meet.[106] To satisfy this demand, China has enlisted the help of Boeing,[107] Australian pilot schools,[108] and domestic private schools, such as the pioneering Beijing PanAm International Aviation Academy to train pilots.[109] Other pilot academies are scheduled to open in Harbin and Shandong.

General Aviation

With only 22 airports capable of handling wide-bodied LCA, smaller aircraft are essential for the economic growth of China. General aviation aircraft, typically business jets and turbopropeller aircraft, typically supplement scheduled airline service around the world. They have become an essential tool of industry, allowing corporate staff to travel on short notice. In China, the growth of general aviation is stymied.[110] The Central Government has allocated only two slots for nonscheduled air transports at Beijing International, severely restricting corporate jets from using this facility.[111] Import duties and value-added taxes are significantly higher for general aviation aircraft than for LCA imported into China.[112] Given the dependence on air travel and the limited number of airports capable of being served by LCA, private air transports would provide the needed flexibility for companies in China while providing jobs to support their growth.

Other Entry Barriers

While the lack of secondary airports in China affects both new and established airlines, new entrants have questioned the ability of major airlines who control many of the ground handling firms to provide timely service to them. Aircraft turnaround, or the time it takes to unload, clean, and reload an aircraft (thereby increasing its utilization/lowering its costs) is crucial to the success of driving down the cost of running the new airlines.

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[103] Aerospace Forum Asia is "...a pan-Asian association that acts like the Chamber of Commerce for the aviation supply chain..." Roberts and Frederik Balfour, "The Battle for China's Lucrative Skies."

[104] Roberts and Frederik Balfour, "The Battle for China's Lucrative Skies." An estimated 1,000 pilots are nearing retirement age, according to a survey done by Orient Aviation. *Orient Aviation*, "Challenges in the Cockpit," 16.

[105] There were thirteen domestic flight schools as of March 2006. Dingding, "General aviation sector to scale new heights."

[106] CAAC feels the maximum yearly graduation at its two approved state schools is 850-900 a year. *Flight International*, "Pilots Wanted."

[107] "From 1993 till present, Boeing instructed over 27,000 Chinese aviation professionals, half of whom are pilots, maintenance and flight operations people. Training takes place in Seattle, Wash., Long Beach, Calif., and China." Boeing, "The Boeing Company and China."

[108] China Southern Airlines has a 65 percent stake with Singapore Airlines in a flight training center located in Jandakot, Australia, and its own facility in Merrin, Western Australia. *Orient Aviation*, "Challenges in the Cockpit," 17.

[109] *Flight International*, "Pilots Wanted."

[110] Out of a world corporate jet fleet of 13,124, only 26 operate in China. Chao, "2006 China General Aviation Forum," 7.

[111] Roberts and Frederik Balfour, "The Battle for China's Lucrative Skies."

[112] ~ 4–5 percent import duty and 17 percent VAT, 21 percent total for general aviation aircraft; for LCA, there is a 1 percent import duty and a 4 percent VAT. Tusa, Jr., "Electrical Equipment & Multi-Industry," 15; staff interview with aerospace industry official.

Conclusion

China's market for LCA is expected to generate up to $350 billion in LCA sales alone over the next twenty years. As the dominant suppliers of LCA to the world, Boeing and Airbus are likely to account for the vast majority of aircraft delivered. The challenge for these producers in meeting this demand comes less from each other than from the regulation of China's market by its government, the lack of adequate air transport infrastructure to serve its population, and China's nascent attempt at building its own LCA. Should China continue to aggressively address governmental and infrastructure restraints, it will benefit through increased trade and tourism, both of which will spur LCA sales to satisfy air transport demand. China has committed $17.9 billion to this effort in its current five-year plan; however, additional investment in infrastructure will be required to take advantage of the multiple destinations both business and tourist passengers demand. Foreign direct investment in airports is certainly a start, though additional efforts by the central government are critical.

The scope of Airbus' move into China is unprecedented. LCA have been manufactured principally by the designers of the aircraft in their home country, and have not been 'farmed out' to the extent proposed by Airbus. Should this joint Airbus-China project meet with success, it will likely begin worldwide discussions on the current aircraft manufacturing paradigm, directly impacting traditional suppliers to the world's LCA manufacturers. If successful, the project will improve China's design, engineering, and manufacturing skills, important considerations for the country's LCA aspirations.[113]

Lastly, the future LCA market in China could be greatly affected by China's stated goal of producing its own LCA within the next 15 years. Should China realize success in this endeavor, it is likely that domestically produced LCA would be substituted for foreign-built LCA to some extent. China's success in designing, manufacturing, and supporting a domestic LCA, although likely in the long-term, is unlikely to pose a short-term competitive threat for either Airbus or Boeing.

[113] For more information on this joint venture, see Haoting, "Chinese partner of A320 details shareholding."

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Appendix A

TABLE A-1 Global LCA fleet geographic distribution by manufacturer, year-end 2006[a]

	North America	Europe	Asia & Pacific	Latin America & Carribean	Middle East	Africa	Commonwealth of Independent States	Grand Total
Airbus	965	1,507	993	242	287	141	43	4,178
Boeing[b]	4,915	2,178	2,389	904	440	624	205	11,655
Fokker F100	23	127	28	53	25	4	1	261
Lockheed	47	32	5	1	20	3	0	108
C.I.S. aircraft[c]	0	29	30	10	33	12	797	911
Other[d]	96	297	33	12	9	14	8	470
Total	6,046	4,170	3,478	1,222	815	798	1,054	17,583
Fleet distribution (percent)	34	24	20	7	5	4	6	

Source: World Jet Inventory Year-2006 Summary.

[a]Included are LCA owned by airlines, governments, leasing companies, manufacturers, and private operators.
[b]Includes McDonnell Douglas aircraft.
[c]Ilyushin's IL-62 and IL-96, and Tupolev's Tu-154 and Tu-204.
[d]Some models of the following aircraft may seat 100 or more passengers and weigh over 15,000 kg; product configuration is not available at this time. From Brazil: Embraer 190; the UK: BAe/Avro 146-300, BAC 1-11, and VC-10. From France, the Sud Est Caravelle.

TABLE A-2 World LCA orders, China's orders, China's share of world orders, 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total 1997-2006
World LCA orders											
Boeing[a]	544	606	355	588	314	251	249	277	1,028	1,058	5,270
Airbus	460	556	476	520	375	300	284	370	1,111	824	5,276
Total	1,004	1,162	831	1,108	689	551	533	647	2,139	1,882	10,546
China's LCA orders											
Boeing	56	13	2	11	43	3	38	17	143	120	446
Airbus	30	0	8	5	0	20	30	47	223	150	513
Total	86	13	10	16	43	23	68	64	366	270	959
China's share of world LCA orders (*percent*)											
	8.6	1.1	1.2	1.4	6.2	4.2	12.8	9.9	17.1	14.3	9.1

Source: Boeing and Airbus S.A.S. corporate websites and company-provided information. Airbus data reflect gross orders; Boeing data net in year of order.

[a]McDonnell Douglas orders included in Boeing data from 1997 onward.

TABLE A-3 World LCA deliveries, to China, China's share of world deliveries, 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total deliveries
Worldwide LCA deliveries	557	792	914	802	852	684	586	605	668	832	7,292
LCA deliveries to China											
Boeing	17	35	24	21	15	22	15	17	33	29	228
Airbus	19	21	20	11	9	7	22	35	56	76	276
Total	36	56	44	32	24	29	37	52	89	105	504
Market share in China by manufacturer (*percent*)											
Boeing	47.2	62.5	54.5	65.6	62.5	75.9	40.5	32.7	37.1	27.6	45.2
Airbus	52.8	37.5	45.5	34.4	37.5	24.1	59.5	67.3	62.9	72.4	54.8
China's share of world LCA deliveries (*percent*)											
	6.5	7.1	4.8	4.0	2.8	4.2	6.3	8.6	13.3	12.6	6.9

Source: Boeing and Airbus S.A.S. corporate websites and company-provided information. Airbus data reflect gross orders; Boeing data net in year of order.

Appendix B

TABLE B-1 U.S. LCA and parts exports to world by value, to China, China's market share of parts exports, 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
LCA (*million US dollars*)										
China	1,769	3,122	1,984	1,424	2,068	3,076	2,168	1,615	3,715	5,222
World	21,457	29,988	26,599	20,405	22,787	23,897	21,121	20,165	24,467	34,449
China's share of U.S. LCA exports (*percent*)										
	8.2	10.4	7.5	7.0	9.1	12.9	10.3	8.0	15.2	15.2
Parts (*million US dollars*)										
China	360	381	450	329	482	406	478	474	757	1,028
World	17,249	20,298	22,405	23,724	25,134	21,972	21,555	25,554	31,059	35,186
China's share of U.S. parts exports (*percent*)										
	2.1	1.9	2.0	1.4	1.9	1.8	2.2	1.9	2.4	2.9

Source: U.S. Department of Commerce and U.S. International Trade Commission tariff and trade data. For a definition of parts, see appendix C.

[a]Civil aircraft parts includes other civil aircraft, aerostructures, engines, and individual parts.
[b]LCA import data is comprised of new and used passenger and cargo aircraft (Harmonized Tariff System numbers 8802.40.0040, 8802.40.0060, 8802.40.0070, and 8802.40.0090).

TABLE B-2 U.S. exports of LCA and parts[a] to China by value, LCA vs. parts exports, 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Exports (*million US dollars*)										
LCA[b]	1,769	3,122	1,984	1,424	2,068	3,076	2,168	1,615	3,715	5,222
Parts	360	381	450	329	482	406	478	474	757	1,028
Total	2,130	3,503	2,435	1,753	2,550	3,482	2,646	2,089	4,472	6,250
LCA vs. parts exports (*percent*)										
LCA	83.1	89.1	81.5	81.3	81.1	88.3	81.9	77.3	83.1	83.5
Parts	16.9	10.9	18.5	18.7	18.9	11.7	18.1	22.7	16.9	16.5

Source: U.S. Department of Commerce and U.S. International Trade Commission tariff and trade data. For a definition of parts, see appendix C.

[a]Civil aircraft parts includes other civil aircraft, aerostructures, engines, and individual parts. U.S. export data does not discriminate between civil and military engines and parts for engines.
[b]LCA export data is comprised of new and used passenger and cargo aircraft (Harmonized Tariff System numbers' 8802.40.0040, 8802.40.0060, 8802.40.0070, and 8802.40.0090).

TABLE B-3 U.S. exports of LCA and parts[a] to world by value, LCA vs. parts exports, 1997-2006

Items	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Exports (million US dollars)										
LCA[b]	21,457	29,988	26,599	20,405	22,787	23,897	21,121	20,165	24,467	34,449
Parts	17,249	20,298	22,405	23,724	25,134	21,973	21,555	25,554	31,059	35,186
Total	38,706	50,285	49,004	44,128	47,921	45,870	42,676	45,719	55,526	69,635
LCA vs. parts exports (*percent*)										
LCA	55.4	59.6	54.3	46.2	47.6	52.1	49.5	44.1	44.1	49.5
Parts	44.6	40.4	45.7	53.8	52.4	47.9	50.5	55.9	55.9	50.5

Source: U.S. Department of Commerce and U.S. International Trade Commission tariff and trade data. For a definition of parts, see appendix C.

[a]Civil aircraft parts includes other civil aircraft, aerostructures, engines, and individual parts.
[b]LCA import data is comprised of new and used passenger and cargo aircraft (Harmonized Tariff System numbers 8802.40.0040, 8802.40.0060, 8802.40.0070, and 8802.40.0090).

TABLE B-4 U.S. imports of civil aircraft and parts from China by value, from world, China's market share, 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
(*million US dollars*)										
From China[a]	44	56	46	63	86	80	90	142	150	229
From World[b]	16,152	20,516	22,211	25,381	30,060	24,857	23,049	23,410	24,591	27,208
China's share of U.S. imports (*percent*)										
	0.3	0.3	0.2	0.2	0.3	0.3	0.4	0.6	0.6	0.8

Source: U.S. Department of Commerce and U.S. International Trade Commission tariff and trade data.

[a]For a complete list of the top 15 and total imports from China, see appendix E.
[b]For a complete list of the top 15 products and total U.S. imports from the world, see appendix E.

Appendix C

TABLE C-1 Harmonized tariff system numbers comprising civil aerospace parts imports

HS number	Description
8407.10.0020	New spark-ignition reciprocating or rotary internal combustion piston engines for civil aircraft, less than 373 kW
8407.10.0040	New spark-ignition reciprocating or rotary internal combustion piston engines for civil aircraft, equal to or more than 373 kW
8407.10.0060	Used or rebuilt spark-ignition reciprocating or rotary internal combustion piston engines for civil aircraft
8409.10.0040	Parts suitable for use solely or principally in spark-ignition reciprocating or rotary internal combustion civil aircraft piston engines
8411.11.4000	Turbojets for aircraft (civil or military) of a thrust not exceeding 25 kN
8411.12.4000	Turbojets for aircraft (civil or military) of a thrust exceeding 25 kN
8411.21.4000	Turbopropellers for aircraft (civil or military) of a power not exceeding 1,100 kW
8411.22.4000	Turbopropellers for aircraft (civil or military) of a power exceeding 1,100 kW
8411.81.4000	Other aircraft turbines (civil or military) of a power not exceeding 5,000 kW
8411.82.4000	Other aircraft turbines (civil or military) of a power exceeding 5,000 kW
8411.91.1060	Cast-iron parts of turbojets or turbopropellers for use in civil aircraft, not advanced beyond cleaning, and machined only for the removal of fins, gates, sprues and risers or to permit location in finishing machinery
8411.91.9080	Other cast-iron parts for aircraft gas turbines
8411.99.1040	Cast-iron parts of for use in other civil aircraft turbine engines, not advanced beyond cleaning, and machined only for the removal of fins, gates, sprues and risers or to permit location in finishing machinery
8411.99.9090	Other types of parts for use in civil or military turbine aircraft engines
8801.10.0030	Hang gliders
8801.10.0060	Gliders
8801.90.0000	Other non-powered aircraft such as balloons, dirigibles, and other
8802.11.0030	New nonmilitary helicopters of an unladen weight not exceeding 998 kg
8802.11.0045	New nonmilitary helicopters of an unladen weight not exceeding 2,000 kg
8802.11.0090	Used or rebuilt nonmilitary helicopters of an unladen weight not exceeding 2,000 kg
8802.12.0040	New nonmilitary helicopters of an unladen weight exceeding 2,000 kg
8802.12.0080	Used or rebuilt nonmilitary helicopters of an unladen weight exceeding 2,000 kg
8802.20.0015	Airplanes and other aircraft (civil or military) of an unladen weight not exceeding 450 kg
8802.20.0040	New nonmilitary single engine airplanes and other aircraft of an unladen weight exceeding 450 kg but not exceeding 2,000 kg
8802.20.0050	New nonmilitary multiple engine airplanes and other aircraft of an unladen weight exceeding 450 kg but not exceeding 2,000 kg
8802.20.0060	Other new nonmilitary aircraft of an unladen weight not exceeding 2,000 kg
8802.20.0080	Used or rebuilt nonmilitary aircraft of an unladen weight not exceeding 2,000 kg
8802.30.0030	New nonmilitary multiple engine airplanes and other aircraft of an unladen weight exceeding 2,000 kg but not exceeding 4,536 kg
8802.30.0040	New nonmilitary multiple turbofan powered airplanes and other aircraft of an unladen weight exceeding 4,536 kg but not exceeding 15,000 kg
8802.30.0050	New nonmilitary multiple nonturbofan-powered airplanes and other aircraft of an unladen weight exceeding 4,536 kg but not exceeding 15,000 kg
8802.30.0060	Other new nonmilitary aircraft of an unladen weight exceeding 2,000 kg but not exceeding 15,000 kg
8802.30.0080	Used or rebuilt nonmilitary airplanes and other aircraft of an unladen weight exceeding 2,000 kg but not exceeding 15,000 kg

TABLE C-1 Harmonized tariff system numbers comprising civil aerospace parts imports—*Continued*

HS number	Description
8803.10.0010	Propellers and rotors and parts thereof for civil aircraft not used by the Department of Defense and/or the United States Coast Guard
8803.10.0030	Propellers and rotors and parts thereof for civil aircraft not used by the Department of Defense and/or the United States Coast Guard (HTS number change in 1998)
8803.20.0010	Undercarriages and parts thereof for use in civil aircraft and not used by the Department of Defense and/or the United States Coast Guard
8803.20.0030	Undercarriages and parts thereof for use in civil aircraft and not used by the Department of Defense and/or the United States Coast Guard (HTS number change in 1998)
8803.30.0010	Other parts of civil airplanes or helicopters not used by the Department of Defense and/or the United States Coast Guard
8803.30.0030	Other parts of civil airplanes or helicopters not used by the Department of Defense and/or the United States Coast Guard (HTS number change in 1998)
8803.90.9030	Other parts of civil aircraft not used by the Department of Defense and/or the United States Coast Guard

Note: These descriptions paraphrase those found in the Harmonized Tariff Schedule of the United States (2006)-Supplement 1 (Rev. 2). Civil aircraft over 15,000 kg are not included, as they are considered Large Civil Aircraft; however, civil aircraft under 15,000 kg are included in this appendix.

TABLE C-2 Harmonized tariff system numbers comprising civil aerospace parts exports

HS number	Description
8407.10.0020	New spark-ignition reciprocating or rotary internal combustion piston engines for civil aircraft, less than 373 kW
8407.10.0040	New spark-ignition reciprocating or rotary internal combustion piston engines for civil aircraft, equal to or more than 373 kW
8407.10.0060	Used or rebuilt spark-ignition reciprocating or rotary internal combustion piston engines for civil aircraft
8409.10.0040	Parts suitable for use solely or principally in spark-ignition reciprocating or rotary internal combustion civil aircraft piston engines
8411.11.4010	Turbojets for civil aircraft of a thrust not exceeding 25 kN
8411.12.4010	Turbojets for civil aircraft of a thrust exceeding 25 kN
8411.21.4010	Turbopropellers for civil aircraft of a power not exceeding 1,100 kW
8411.22.4010	Turbopropellers for civil aircraft of a power exceeding 1,100 kW
8411.81.4010	Other civil aircraft turbines of a power not exceeding 5,000 kW
8411.82.4010	Other civil aircraft turbines of a power exceeding 5,000 kW
8411.91.7010	Parts of civil aircraft gas turbines
8411.99.7010	Other cast-iron parts for aircraft gas turbines
8801.00.0010	Hang gliders
8801.00.0020	Gliders, excluding hang gliders
8801.00.0050	Balloon, dirigibles, and other nonpowered aircraft
8801.10.0030	Hang gliders
8801.10.0060	Gliders, excluding hang gliders
8801.90.0000	Balloon, dirigibles, and other nonpowered aircraft
8802.11.0030	New nonmilitary helicopters of an unladen weight not exceeding 998 kg
8802.11.0045	New nonmilitary helicopters of an unladen weight not exceeding 2,000 kg
8802.11.0090	Used or rebuilt nonmilitary helicopters of an unladen weight not exceeding 2,000 kg
8802.12.0040	New nonmilitary helicopters of an unladen weight exceeding 2,000 kg
8802.12.0080	Used or rebuilt nonmilitary helicopters of an unladen weight exceeding 2,000 kg
8802.20.0015	Airplanes and other aircraft (civil or military) of an unladen weight not exceeding 450 kg
8802.20.0040	New nonmilitary single engine airplanes and other aircraft of an unladen weight exceeding 450 kg but not exceeding 2,000 kg
8802.20.0050	New nonmilitary multiple engine airplanes and other aircraft of an unladen weight exceeding 450 kg but not exceeding 2,000 kg
8802.20.0060	Other new nonmilitary aircraft of an unladen weight not exceeding 2,000 kg
8802.20.0080	Used or rebuilt nonmilitary aircraft of an unladen weight not exceeding 2,000 kg
8802.30.0030	New nonmilitary multiple engine airplanes and other aircraft of an unladen weight exceeding 2,000 kg but not exceeding 4,536 kg
8802.30.0040	New nonmilitary multiple turbofan powered airplanes and other aircraft of an unladen weight exceeding 4,536 kg but not exceeding 15,000 kg
8802.30.0050	New nonmilitary multiple nonturbofan-powered airplanes and other aircraft of an unladen weight exceeding 4,536 kg but not exceeding 15,000 kg
8802.30.0060	Other new nonmilitary aircraft of an unladen weight exceeding 2,000 kg but not exceeding 15,000 kg
8802.30.0080	Used or rebuilt nonmilitary airplanes and other aircraft of an unladen weight exceeding 2,000 kg but not exceeding 15,000 kg
8803.10.0010	Propellers and rotors and parts thereof for civil aircraft not used by the Department of Defense and/or the United States Coast Guard

TABLE C-2 Harmonized tariff system numbers comprising civil aerospace parts exports—*Continued*

HS number	Description
8803.20.0010	Undercarriages and parts thereof for use in civil aircraft and not used by the Department of Defense and/or the United States Coast Guard
8803.30.0010	Other parts of civil airplanes or helicopters not used by the Department of Defense and/or the United States Coast Guard
8803.90.9010	Other parts for use in civil aircraft not used by the Department of Defense and/or the United States Coast Guard

Note: These descriptions paraphrase those found in the Harmonized Tariff Schedule of the United States (2006)-Supplement 1 (Rev. 2). Civil aircraft over 15,000 kg are not included, as they are considered Large Civil Aircraft; however, civil aircraft under 15,000 kg are included in this appendix.

Appendix D

TABLE D-1 Global imports of aircraft and parts thereof, China's imports, China's market share of global imports 1997-2006, by value

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Global imports[a]										
	Million US dollars									
840710	445.4	391.2	531.6	486.2	485.9	493.0	600.4	1,081.1	1,076.1	1,307.9
840910	259.5	302.9	429.1	446.8	488.7	762.0	767.0	698.5	1,249.4	1,593.0
8801	19.8	28.7	20.8	31.5	26.9	28.6	29.5	29.7	39.5	35.4
8802	21,131.3	28,069.7	52,305.3	49,125.5	52,432.1	47,237.3	49,441.3	55,786.7	65,837.3	58,422.4
8803	11,327.9	13,351.9	18,735.2	18,787.0	19,480.8	17,948.6	18,457.8	21,312.7	24,484.9	28,647.2
8411	15,880.5	18,985.3	36,927.9	40,264.6	43,853.5	40,047.9	38,479.6	43,750.9	50,130.3	53,752.4
Total	49,064.5	61,129.7	108,949.8	109,141.7	116,767.8	106,517.4	107,775.7	122,659.7	142,817.4	143,758.3
China's imports										
840710	12.6	8.5	2.1	0.8	10.4	2.8	1.4	1.9	4.8	6.8
840910	5.4	3.1	1.3	1.9	0.8	2.8	0.4	1.1	1.1	2.1
8801	0.2	0.0	0.1	0.6	0.1	0.0	0.1	0.6	0.5	0.0
8802	2576.0	2602.8	2316.8	1629.5	3542.3	2842.3	3500.6	4206.1	5766.1	9802.7
8803	563.7	566.7	792.8	533.9	880.6	1142.8	934.3	680.2	783.7	1085.8
8411	298.7	248.3	308.2	261.2	299.5	484.3	388.6	786.6	1452.8	1601.6
Total	3,456.7	3,429.4	3,421.4	2,427.8	4,733.6	4,475.1	4,825.4	5,676.4	8,008.9	12,498.9
China's market share	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	5.6%	8.7%

Source: Global Trade Atlas.

[a]1997-2003 total imports represent available data and may be undercounted.
[b]1997-2004 not comparable due to data limitations.

TABLE D-2 China: Aerospace imports from top fifteen nations and total, 1997-2006

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	Million US dollars									
United States	1,771.5	1,674.8	1,646.3	1,545.8	2,102.5	2,451.9	2,496.8	2,918.2	4,118.9	6,464.8
EU-25	1,432.4	1,180.7	1,307.9	600.0	708.8	710.2	1,654.6	2,337.0	3,494.6	5,569.5
Japan	1.4	29.0	1.6	23.7	3.5	7.4	8.3	45.3	129.9	312.8
Canada	63.6	85.8	7.4	57.0	315.4	202.1	66.8	21.8	59.0	39.1
Brazil	1.7	0.5	0.0	56.3	38.0	0.2	5.9	23.3	22.4	33.0
Russia	134.0	421.0	428.2	85.3	1,482.2	1,032.3	542.0	272.8	144.7	26.2
Switzerland	2.2	0.7	3.4	10.3	0.5	7.7	4.7	5.1	4.3	18.9
Singapore	13.2	25.0	16.9	5.3	9.1	16.8	23.1	33.8	18.2	18.1
Hong Kong	2.2	0.5	0.7	1.0	3.7	1.8	1.5	8.1	1.7	4.7
Israel	0.3	1.4	5.2	30.2	56.9	3.0	1.1	1.5	1.1	3.8
Romania	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9
Turkey	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.5	0.3	2.2
Australia	1.7	1.6	0.1	0.1	7.8	1.2	0.7	1.1	4.2	0.6
South Korea	0.1	0.3	0.2	3.7	1.3	1.0	1.8	0.5	0.2	0.5
China	0.0	0.0	0.0	0.0	0.1	0.9	0.0	0.1	0.6	0.4
Subtotal	3,424.2	3,421.4	3,417.9	2,418.9	4,729.9	4,436.4	4,807.2	5,669.1	8,000.1	12,497.6
All other	32.3	8.0	3.6	8.9	3.7	38.7	18.2	7.2	8.9	1.3
Total	3,456.5	3,429.4	3,421.4	2,427.8	4,733.6	4,475.1	4,825.4	5,676.4	8,008.9	12,498.9

Source: Data from China Customs as found in the World Trade Atlas.

Note: This data is based on six-digit HS numbers which cannot be equated with the ten-digit numbers used in U.S. import and export data presented in this paper. The data includes both civil and military aircraft and parts thereof.

TABLE D-3 China: Principal aerospace imports from European Union (25) 1997-2006

HS number	Description	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
		Million US dollars									
8802.40	Airplane & other aircraft with an unladen weight greater than 15,000 kg	1,210.6	986.3	1,083.6	343.1	380.9	316.1	1,331.0	1,817.4	2,694.3	4,938.9
8411.99	Gas turbine parts, nesoi	18.3	3.3	2.8	14.1	19.5	38.5	24.3	69.3	190.5	150.7
8803.30	Parts of airplanes or helicopters other than propellers, rotors, or undercarriages	105.9	89.9	128.6	109.1	83.7	122.4	104.6	76.7	112.7	122.9
8411.12	Turbojets of a thrust exceeding 25 kN	30.9	22.4	57.5	42.8	53.7	162.9	55.8	102.9	129.9	121.5
8411.91	Turbojet and turbopropeller parts	10.1	30.5	25.6	44.9	30.4	28.8	50.3	60.1	91.8	83.2
8803.20	Undercarriage & parts thereof	1.1	1.2	1.7	1.0	5.3	4.8	4.3	10.9	20.5	46.1
8411.82	Gas turbines of a power exceeding 5,000 kW	25.9	12.8	0.1	0.0	22.0	5.0	38.0	67.8	135.1	33.2
8802.30	Airplanes & other aircraft with an unladen weight exceeding 2,000 kg but not exceeding 15,000 kg	0.0	0.0	0.0	0.0	82.6	0.0	0.0	70.0	47.6	20.0
8803.10	Propeller and rotors and parts of gliders and aircraft, powered and unpowered	8.5	1.0	1.3	10.8	2.9	5.4	7.9	13.6	20.8	16.2
8802.12	Helicopters of an unladen weight exceeding 2,000 kg	0.0	16.5	0.0	17.3	4.0	13.9	18.5	27.9	34.0	14.9
8803.90	Parts of non-powered and powered aircraft nesoi	8.7	5.8	4.5	2.8	2.7	4.4	6.8	13.1	5.3	10.9
8802.20	Airplanes & other aircraft of an unladen weight not over 2,000 kg	0.0	7.4	0.6	0.0	0.0	0.1	0.0	0.3	2.9	3.7
8802.11	Helicopters of an unladen weight not exceeding 2,000 kg	8.8	0.0	0.0	3.1	4.8	4.6	3.5	0.0	0.0	2.7
8411.11	Turbojets of a power not exceeding 25 kN	0.8	1.5	0.1	6.9	10.6	0.2	6.0	0.3	2.2	2.5
8407.10	Spark ignition, reciprocating or rotary internal combustion engines designed for use in aircraft	1.6	1.3	1.2	0.6	4.1	1.7	1.3	1.7	3.9	1.3
Subtotal		1,430.0	1,179.9	1,307.6	596.5	707.2	708.9	1,652.3	2,332.1	3,491.6	5,568.7
All other		1.5	0.8	0.3	3.5	1.6	1.4	2.3	4.9	3.1	0.8
Total from EU-25		1,432.4	1,180.7	1,307.9	600.0	708.8	710.2	1,654.6	2,337.0	3,494.6	5,569.5
China's total aerospace imports from world		3,479.0	3,429.4	3,421.4	2,427.8	4,733.6	4,475.1	4,825.4	5,676.4	8,008.9	12,498.9
China's aerospace imports from the European Union (25) as a percentage of total aerospace imports		41.2%	34.4%	38.2%	24.7%	15.0%	15.9%	34.3%	41.2%	43.6%	44.6%

Source: Data from China Customs as found in the World Trade Atlas.

TABLE D-4 European Union (25):[a] Aerospace imports from top 15 nations and total, 1997-2006

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	Million Euros									
United States	15,976.8	20,846.9	28,056.3	32,126.9	29,317.9	27,829.0	23,671.9	25,725.2	27,747.7	25,763.5
Canada	1,133.2	1,286.0	1,342.7	2,031.6	2,154.3	2,492.5	1,792.0	1,577.4	1,807.5	2,344.6
Switzerland	1,002.4	1,611.6	2,847.5	3,616.1	2,749.3	1,451.9	1,769.9	1,159.4	1,565.6	808.8
Japan	408.6	511.5	538.2	623.2	703.6	592.7	482.7	635.1	739.8	761.8
Qatar	169.7	129.3	82.4	207.6	486.9	129.7	409.2	116.6	208.4	581.3
Saudi Arabia	289.5	275.5	371.5	301.9	477.0	661.3	408.2	397.0	700.9	542.1
China	279.4	298.5	435.2	390.7	830.7	760.0	454.1	518.9	1,186.9	506.6
Singapore	101.9	142.0	246.7	325.1	249.7	257.1	228.5	278.6	589.9	472.5
Brazil	164.4	373.9	612.7	1,399.7	1,128.1	437.9	424.0	597.7	559.7	387.4
Hong Kong	94.3	63.2	192.8	227.2	495.5	300.7	170.7	186.2	235.0	299.8
Norway	124.1	182.3	186.6	422.9	418.2	247.9	341.9	263.7	220.4	271.9
Turkey	351.3	530.9	469.4	403.4	328.2	334.7	210.2	278.5	331.8	244.4
United Arab Emirates	377.5	300.3	208.0	245.7	142.4	200.2	130.6	307.4	766.2	218.3
Israel	98.0	103.2	179.1	216.4	173.9	153.9	122.7	111.4	200.2	191.2
South Korea	82.4	141.3	105.0	122.1	105.3	121.0	105.6	101.8	120.9	166.7
Subtotal	20,653.5	26,796.4	35,874.1	42,660.4	39,761.1	35,970.3	30,722.5	32,255.2	36,981.1	33,561.1
All other	4,918.8	4,878.8	4,760.9	4,514.8	5,045.2	3,360.2	4,426.0	5,125.9	7,457.2	2,279.8
Total	25,572.3	31,675.1	40,635.0	47,175.2	44,806.3	39,330.5	35,148.4	37,381.2	44,438.3	35,840.9

Source: Data from Eurostat as found in the World Trade Atlas. Data may not add due to rounding.

[a]Data for 1997 and 1998 are unavailable for the following EU25 countries: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia. Data for these years taken from EU15.

Note: This data is based on six-digit HS numbers which cannot be equated with the te- digit numbers used in U.S. import and export data presented in this paper. The data includes both civil and military aircraft and parts thereof.

TABLE D-5 European Union (25):[a] Principal aerospace imports from China, 1997-2006

HS number	Description	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
		Million Euros									
8411.12	Turbojets of a thrust exceeding 25 kN	116.4	126.2	253.7	274.2	371.3	417.6	313.9	247.8	196.6	220.1
8411.91	Turbojet and turbopropeller parts	9.1	9.9	15.6	78.0	94.1	59.8	60.4	76.4	101.7	122.1
8803.30	Parts of airplanes or helicopters, nesoi	3.4	9.8	13.6	16.2	19.2	21.4	19.4	26.3	43.0	68.8
8411.99	Gas turbine parts, nesoi	1.8	3.1	4.2	9.9	10.7	11.7	17.2	27.9	35.8	62
8802.40	Airplanes and other aircraft, of an unladen weight exceeding 15,000 kg	127.6	108.4	134.1	3.4	320.4	229.9	27.1	117.3	745.9	12.0
8411.22	Turbopropellers of a power exceeding 1,100 kW	12.6	21.6	1.6	1.1	0.0	0.0	1.2	0.0	0.0	11.1
8803.20	Undercarriage and parts for gliders and aircraft, powered and nonpowered	1.0	3.3	9.0	4.7	6.3	7.8	7.2	8.7	10.8	4.6
8411.82	Gas turbines, other than turbojets or turbopropellers, of a power exceeding 5,000 kW	2.5	0.0	0.0	0.8	2.1	0.0	0.1	0.6	47.4	2.8
8803.90	Parts of powered and nonpowered aircraft, nesoi	0.3	0.0	0.1	0.1	0.8	1.4	0.5	0.3	0.5	1.4
8803.10	Propellers and rotors and parts thereof	0.1	0.0	0.3	0.1	0.1	1.6	0.1	0.3	0.1	0.4
8801.90	Balloons, dirigibles, and other nonpowered aircraft	0.0	0.1	0.0	0.0	0.0	0.3	0.1	0.1	0.1	0.3
8409.10	Parts for spark ignition, reciprocating or rotary internal combustion engines designed for use in aircraft	0.0	0.0	0.2	0.7	1.0	5.2	5.6	6.9	0.8	0.3
8407.10	Spark ignition, reciprocating or rotary internal combustion engines designed for use in aircraft	0.0	0.5	0.1	0.0	0.0	0.2	0.2	0.2	0.3	0.3
8411.81	Gas turbines, other than turbojets or turbopropellers, of a power not exceeding 5,000 kW	0.3	1.1	0.0	1.5	0.0	0.0	0.5	0.1	0.3	0.2
8802.20	Airplanes and other aircraft with an unladen weight not exceeding 2,000 kg	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Subtotal		275.1	284.0	432.6	390.7	826.0	756.9	453.5	512.9	1,183.4	506.6
All other		4.3	14.5	2.6	0.0	4.7	3.1	0.8	6.0	3.5	0.0
Total		279.4	298.5	435.2	390.7	830.7	760.0	454.3	518.9	1,186.9	506.6
European Union's (25) total aerospace imports from world		25,566.4	31,667.9	40,635	47,175.2	44,806.3	39,330.5	35,148.4	37,381.2	44,438.3	35,840.9
European Union (25) aerospace imports from China as a percentage of total aerospace imports		1.1%	0.9%	1.1%	0.8%	1.9%	1.9%	1.3%	1.4%	2.7%	1.4%

Source: Data from China Customs as found in the World Trade Atlas.

[a]Data for 1997 and 1998 are unavailable for the following EU25 countries: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, and Slovenia. Data for these years taken from EU15.

TABLE D-6 Global exports of aircraft and parts thereof, China's imports, China's market share of global imports 1997-2006, by value

Global exports[a]

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	Million US dollars									
840710	445.4	391.2	531.6	486.2	485.9	493.0	600.4	1,081.1	1,076.1	1,307.9
840910	324.2	337.5	477.6	552.9	575.8	556.4	586.2	687.0	982.6	1,268.9
8801	17.5	20.4	28.5	36.8	37.0	35.0	35.0	43.1	28.4	35.6
8802	31,723.6	44,019.0	66,234.4	60,536.5	66,881.0	61,902.1	60,883.8	64,331.7	78,718.5	87,238.9
8803	18,076.3	20,432.4	23,956.3	24,606.3	26,037.1	24,079.9	25,990.9	28,509.7	32,006.8	37,576.3
8411	16,038.4	19,281.6	36,990.2	40,628.8	46,219.8	42,808.6	42,299.0	49,795.8	56,173.4	58,399.7
Total	66,625.3	84,482.2	128,218.6	126,847.6	140,236.6	129,874.9	130,395.3	144,448.4	168,985.6	185,827.4
China's exports										
840710	0.1	[b]	0.7	0.6	0.2	[b]	5.6	[b]	0.1	0.0
840910	0.5	1.2	0.9	1.4	4.4	1.9	0.2	0.1	0.1	0.5
8801	1.2	0.4	0.1	[b]	[b]	0.1	[b]	0.1	0.1	0.5
8802	28.2	106.1	321.9	161.7	216.7	9.5	42.6	10.8	32.4	275.7
8803	258.8	285.8	322.2	371.4	346.4	422.4	389.6	504.5	705.9	1,006.8
8411	35.8	45.0	79.3	97.9	130.3	151.8	168.5	263.2	327.7	692.7
Total	324.5	438.5	725.0	633.0	698.0	585.8	606.7	778.7	1,066.3	1,976.2
China's market share	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	0.6%	1.1%

Source: Global Trade Atlas.

[a]1997-2003 total exports represent available data and may be undercounted.
[b]Less that $100,000.
[c]1997-2004 not comparable due to data limitations

TABLE D-7 China: Aerospace exports to top fifteen nations and total 1997-2006

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	Million US dollars									
United States	83.4	98.5	98.2	137.5	106.3	111.4	162.3	164.1	204.2	468.4
EU25	24.6	41.7	187.7	62.0	89.6	75.4	131.1	177.4	239.8	387.3
Hong Kong	87.5	122.3	185.4	173.0	138.8	215.7	100.1	177.6	294.1	380.7
Japan	1.1	16.6	22.7	71.6	76.6	88.4	76.0	117.5	130.2	228.6
Nigeria	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.2	112.1
Singapore	2.2	15.9	7.3	17.2	19.7	8.2	19.4	33.1	50.2	108.1
South Korea	2.0	1.8	1.3	0.5	1.0	1.6	6.4	10.6	7.2	51.5
Canada	3.2	3.7	5.1	7.2	10.7	11.3	12.1	17.7	23.4	32.3
Laos	0.0	0.3	0.1	0.1	0.4	0.3	0.0	0.1	0.0	30.9
India	0.0	0.0	0.0	0.1	0.1	0.1	0.0	3.5	0.1	29.0
Zambia	0.0	0.3	0.2	0.2	0.1	0.0	0.0	0.0	0.0	23.3
Zimbabwe	0.4	0.0	0.0	0.0	0.0	0.0	0.0	1.8	30.4	13.9
Russia	0.3	0.3	0.0	0.8	10.6	1.7	10.4	2.6	2.8	13.4
Congo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.1
Sudan	0.0	0.0	0.0	1.0	0.0	28.7	9.6	0.7	2.1	12.5
Subtotal	204.7	301.4	508.0	471.1	453.9	542.6	527.7	706.7	984.7	1,905.2
All other	119.8	137.1	217.1	161.9	244.1	43.2	79.0	72.0	81.7	71.0
Total	324.5	438.5	725.1	633.0	698.0	585.8	606.7	778.7	1,066.4	1,976.2
China's exports to the European Union (25)	24.6	41.7	187.7	62.0	89.6	75.4	131.1	177.4	239.8	387.3
China's exports to the European Union (25) as a percentage of total aerospace exports	7.6%	9.5%	25.9%	9.8%	12.8%	12.9%	21.6%	22.8%	22.5%	19.6%

Source: Data from China Customs as found in the World Trade Atlas.

Note: This data is based on a six-digit HS number, which cannot be compared with the ten-digit numbers used in U.S. import and export data presented in this paper. The data includes both civil and military aircraft and parts thereof.

TABLE D-8 European Union (25):[a] Aerospace exports to top 15 nations and total, 1997-2006

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	Million Euros									
United States	11,063.3	15,607.6	17,821.6	23,426.5	26,484.8	20,430.8	13,917.6	14,239.3	15,571.7	15,880.6
China	1,496.4	1,338.6	1,207.8	1,369.3	1,516.3	1,783.8	1,948.8	2,884.5	4,020.4	5,147.6
U.A.E.	295.2	516.8	987.8	1,333.9	1,552.0	1,246.1	1,487.4	1,752.6	1,729.5	2,200.0
India	328.5	344.2	327.3	453.7	394.5	485.3	412.2	571.6	947.5	1,984.9
Canada	1,972.1	2,017.6	2,404.6	1,840.5	2,835.9	2,733.9	1,781.8	1,812.5	1,653.2	1,669.5
Hong Kong	701.5	1,334.4	583.7	1,022.4	2,267.4	1,308.9	1,356.0	1,119.2	1,481.1	1,392.8
Qatar	187.6	194.3	308.1	249.6	740.6	557.0	780.9	1,286.3	696.7	1,344.8
Brazil	433.9	731.2	1,027.3	1,673.0	1,856.8	1,894.5	801.8	825.4	1,118.1	1,309.5
Switzerland	1,951.0	2,735.9	4,992.0	4,570.4	3,628.5	2,235.0	3,064.3	1,890.4	2,161.6	1,305.7
Turkey	574.1	693.6	678.9	732.1	709.4	573.3	322.2	684.0	885.6	1,168.7
Singapore	754.8	702.6	509.2	618.2	656.4	555.9	884.8	1,229.9	1,233.1	1,050.9
Japan	383.2	521.1	459.7	840.8	462.4	886.9	539.3	628.3	475.5	871.1
Saudi Arabia	411.7	424.9	350.6	544.2	809.5	1,021.1	931.9	750.1	1,060.1	869.0
Malaysia	148.7	196.0	93.7	93.0	255.7	100.3	118.2	196.6	286.7	677.1
Norway	262.8	361.8	378.5	620.2	561.0	699.7	681.6	636.7	636.9	621.8
Subtotal	20,964.8	27,720.6	32,130.4	39,387.8	44,731.3	36,512.5	29,028.8	30,507.4	33,957.7	37,493.8
All other	9,955.6	8,811.5	9,074.5	10,627.1	11,240.8	9,443.2	11,812.4	12,344.0	16,980.6	9,600.2
Total	30,920.4	36,532.1	41,204.9	50,014.9	55,972.1	45,955.7	40,841.2	42,851.4	50,938.3	47,094.0

Source: Data from Eurostat as found in the World Trade Atlas. Data may not add due to rounding.

[a]Data for 1997 and 1998 are unavailable for the following EU25 countries: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, and Slovenia. Data for these years taken from EU15.

Table D-9 Global exports of aircraft and engine parts,[a] China's parts exports, China's market share, 1997-2006

HTS numbers	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	Million U.S. dollars									
Engine parts										
840710	452.2	400.2	556.8	546.2	533.5	521.2	614.5	1,081.1	1,076.1	1,308.4
840910	324.2	337.5	477.6	552.9	575.8	556.4	586.2	687.0	982.6	1,268.9
841191	6,996.8	8,505.1	14,833.2	15,744.9	16,788.1	15,642.7	15,076.2	18,133.2	20,391.2	23,914.1
841199	3,606.4	3,403.3	6,178.5	7,143.0	8,517.7	8,810.3	8,341.2	10,357.4	10,830.6	12,513.5
Subtotal	11,379.6	12,646.1	22,046.1	23,987.0	26,415.1	25,530.6	24,618.1	30,258.7	33,280.5	39,004.9
Aircraft parts										
8803	18,076.3	20,432.4	23,956.3	24,606.3	26,037.1	24,079.9	25,990.9	28,509.7	32,006.8	37,576.3
Total	29,455.9	33,078.5	46,002.4	48,593.3	52,452.2	49,610.5	50,609.0	58,768.4	65,287.3	76,581.2
China's exports: engine parts										
840710	[b]	[b]	0.7	0.6	0.2	[b]	5.6	[b]	0.1	[b]
840910	0.5	1.2	0.9	1.4	4.4	1.9	0.2	0.1	0.1	0.5
841191	17.1	25.1	28.2	44.8	71.4	74.3	107.6	133.7	192.3	257.4
841199	3.7	3.2	23.0	13.2	27.2	21.6	19.7	18.8	30.9	76.5
Subtotal	21.3	29.5	52.8	60	103.1	97.8	133.1	152.6	223.3	334.4
Aircraft parts										
8803	258.8	285.8	322.2	371.4	346.4	422.4	389.6	504.5	705.9	1,006.80
Total	280.1	315.3	375.0	431.4	449.5	520.2	522.7	657.1	929.2	1,341.2
China's market share										
	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	1.4%	1.8%

Source: Global Trade Atlas.

[a]1997-2003 total imports represent available data and may be undercounted.
[b]less than $100,000.
[c]1997-2004 not comparable due to data limitations.

Table D-10 Global imports of aircraft and engine parts,[a] China's parts imports, China's market share, 1997-2006

HTS nu;mber	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	Million U.S. dollars									
Engine parts										
840710	457.5	449.4	523.1	518.9	460.9	434.6	441.7	410.3	839.3	1,075.20
840910	259.5	302.9	429.1	446.8	488.7	762.0	767.0	698.5	1,249.4	1,593.0
841191	6,865.8	8,169.5	15,093.4	16,346.7	18,030.6	15,393.7	15,809.3	17,942.2	21,179.5	24,500.4
841199	2,429.1	2,424.7	4,901.5	6,625.8	7,217.9	6,940.3	6,705.5	7,905.9	9,115.3	9,553.8
Subtotal	10,011.9	11,346.5	20,947.1	23,938.2	26,198.1	23,530.6	23,723.5	26,956.9	32,383.5	36,722.4
Aircraft parts										
8803	11,327.9	13,351.9	18,735.2	18,787.0	19,480.8	17,948.6	18,457.8	21,312.7	24,484.9	28,647.2
Total	21,339.8	24,698.4	39,682.3	42,725.2	45,678.9	41,479.2	42,181.3	48,269.6	56,868.4	65,369.6
China's imports: engine parts										
840710	12.6	8.5	2.1	0.8	10.4	2.8	1.4	1.9	4.8	6.8
840910	5.4	3.1	1.3	1.9	0.8	2.8	0.4	1.1	1.1	2.1
841191	58.5	80.1	79.2	81.3	92.8	119.7	121.1	204.7	290.2	325.1
841199	27.2	18.4	32.3	29.2	27.6	57.0	42.5	203.3	509.1	627.0
Subtotal	103.7	110.1	114.9	113.2	131.6	182.3	165.4	411.0	805.2	961.0
Aircraft parts										
8803	563.7	566.7	792.8	533.9	880.6	1,142.8	934.3	680.2	783.7	1,085.8
Total	667.4	676.8	907.7	647.1	1,012.2	1,325.1	1,099.7	1,091.2	1,588.9	2,046.8
China's market share										
	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	2.8%	3.3%

Source: Global Trade Atlas.

[a]1997-2003 total imports represent available data and may be undercounted.
[b]Less than $100,000.
[c]1997-2004 not comparable due to data limitations.

Appendix E

TABLE E-1 U.S. imports of aerospace goods from China

HTS number	Description	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
		Thousands US dollars									
8803300030[a]	Other parts of airplanes or helicopters, nesoi, not for use by the department of defense or the U.S. coast guard	35,235	36,841	24,614	31,582	55,863	50,587	51,860	67,552	70,513	114,587
8411919080	Parts, nesoi, of turobjet or turbopropeller aircraft engines	7,008	8,057	13,277	26,137	25,415	24,784	27,319	53,472	67,398	98,963
8411999090	Parts, nesoi, of aircraft gas turbines except turbojets or turbopropellers	16	357	791	3,219	3,175	3,586	41,130	6,324	7,912	8,799
8409100040	Parts for spark-ignition or compression-ignition internal combustion piston engines for use in civil aircraft	2	6	12	398	36	49	136	1,528	2,233	2,339
8411124000	Turbojet aircraft engines, of a thrust exceeding 25kN	0	10,050	3,799	0	0	0	5,227	12,400	0	1,775
8411911060	Cast-iron parts, not advanced beyond cleaning, for turbojet or turbopropeller aircraft engines for civil aircraft	0	1	0	0	6	165	511	17	333	1,023
8411991040	Cast-iron parts, not advanced beyond cleaning, for aircraft gas turbines for use in civil aircraft, except turbojet or turbopropellers	0	0	0	0	0	8	43	6	36	1,008
8803200030[b]	Undercarriages and parts thereof for use in civil aircraft not for use by the Department of Defense or the United States Coast Guard	211	1	217	557	1,354	150	21	23	283	342
8801900000	Balloons, dirigibles, and other non-powered aircraft, excluding gliders and hang gliders	9	23	170	435	101	318	56	221	6	260
8802200080	Used or rebuilt aircraft, non-military, nesoi, of an unladen exceeding 450 kG but not exceeding 2,000 kg	336	134	950	164	0	144	255	174	0	184
8801100030	Hang gliders	71	76	49	19	7	4	22	12	86	44
8801100060	Gliders excluding hang gliders	0	24	0	0	11	0	8	0	2	39
8803100030[c]	Propellers and rotors and parts thereof for use in civil aircraft, not for use by the Department of Defense or the United States Coast Guard	2	0	10	5	0	8	5	9	0	34
8803909030[d]	Other parts, nesoi, for use in civil aircraft, not for use by the Department of Defense or the United States Coast Guard	38	5	6	140	55	55	23	136	16	5
8407100020	Spark-ignition reciprocating or rotary internal combustion piston engines for civil aircraft, new, less that 373 kW	10	0	0	0	0	0	0	0	0	0
	Subtotal	42,938	55,575	43,895	62,656	86,023	79,858	126,616	141,874	148,818	229,402
	All other	780	14	2,097	320	126	6	8	15	879	0
	Total	43,718	55,589	45,992	62,976	86,149	79,864	126,624	141,889	149,697	229,402

Source: U.S. Department of Commerce and U.S. International Trade Commission tariff and trade data.

[a]1997 data reported under 8803.30.0010.
[b]1997 data reported under 8803.20.0010.
[c]1997 data reported under 8803.10.0010.
[d]1997 data reported under 8803.90.9010.

TABLE E-2 U.S. imports of aerospace goods from world

HTS number	Description	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
		Thousand US dollars									
8411919080	Parts, nesoi, of turbojet or turbopropeller aircraft engines	4,239,902	5,021,272	4,339,698	4,761,455	5,392,595	4,485,294	4,376,983	5,054,225	5,854,735	6,777,637
8802400040	New aircraft passenger transports, non-military, of an unladen weight exceeding 15,000 kg	767,539	1,982,813	2,994,455	5,108,882	5,588,181	4,113,352	4,059,154	5,247,650	5,988,164	4,945,812
8803300030[a]	Other parts of airplanes or helicopters, nesoi, for use in civil aircraft, not for use by the Department of Defense of the United States Coast Guard	3,012,669	3,916,434	4,013,301	3,904,250	4,434,076	3,261,321	3,076,645	3,204,830	3,639,156	4,656,296
8802300040	New turbofan powered airplanes, non-military, of an unladen weight exceeding 4,536 kg but not exceeding 15,000 kg	1,795,228	2,860,845	3,879,126	4,647,760	5,879,352	6,141,321	5,805,040	4,274,978	3,360,849	3,495,951
8411124000	Turbojet aircraft engines, of a thrust exceeding 25 kN	2,323,995	3,230,518	3,731,474	2,859,280	3,841,218	2,862,343	1,791,272	1,731,392	2,210,538	2,688,243
8802400090	Used or rebuilt aircraft, non-military, of an unladen weight exceeding 15,000 kg	296,087	71,619	324,346	898,170	925,211	1,064,019	1,333,577	622,888	343,420	555,949
8802300080	Used or rebuilt aircraft, non-military of an unladen weight exceeding 2,000 kg but not exceeding 15,000 kg	262,280	310,497	286,302	368,867	298,525	216,255	453,622	561,489	231,692	491,937
8803200030[b]	Undercarriages and parts thereof for use in civil aircraft, not for use by the Department of Defense or the United States Coast Guard	146,593	101,694	122,240	143,763	180,848	189,784	216,170	240,763	353,889	443,376
8802110045	New helicopters, non-military, of an unladen weight exceeding 998 kg but not exceeding 2,000 kg	205,623	235,890	217,738	242,783	196,855	158,385	184,830	290,210	332,576	424,698
8411999090	Parts, nesoi, of aircraft gas turbine engines, except turbojets or turbopropellers	281,739	269,011	228,382	231,793	267,850	288,761	283,620	339,867	322,593	417,582
8411114000	Turbojet aircraft engines, of a thrust not exceeding 25kN	281,287	326,801	310,679	319,514	388,136	281,313	207,666	289,879	344,397	365,669
8411214000	Turbopropeller aircraft engines, of a power not exceeding 1,100 kW	213,535	222,264	268,918	298,394	326,651	281,707	225,802	287,066	331,655	322,483
8409100040	Parts for spark-ignitions or compression-ignition internal combustion piston engines for use in civil aircraft	114,199	129,642	109,635	120,907	146,570	135,906	135,166	173,697	174,523	242,903
8802120040	New helicopters, non-military, of an unladen weight exceeding 2,000 kg	245,613	264,218	192,688	234,879	189,891	148,767	155,186	189,548	158,802	224,436
8802300060	New airplanes, other than multiple engines, non-military, of an unladen wgt exceeding 2,000 kg but not exceeding 15,000 kg	62,489	72,361	127,380	119,614	149,876	76,149	98,889	127,681	139,610	184,043
	Subtotal	14,248,778	19,015,879	21,146,360	24,260,309	28,205,834	23,704,677	22,403,623	22,636,164	23,786,597	26,237,014
	All other	1,903,706	1,500,141	1,064,639	1,120,573	1,854,513	1,152,813	645,308	773,679	804,049	970,731
	Total	16,152,484	20,516,020	22,210,999	25,380,882	30,060,346	24,857,490	23,048,931	23,409,843	24,590,646	27,207,745

Source: Data compiled from tariff and trade data from the U.S. Department of Commerce and the U.S. International Trade Commission.

[a]Data reported under 8803.30.0010 in 1997.
[b]Data reported under 8803.20.0010 in 1997.

Appendix F

TABLE F-1 Passenger and freight traffic in China, selected years, in millions

	1978	1989	1997	2003	2004	2005	2006
Civil passenger traffic	2.3	12.8	56.3	87.6	121.2	138.3	159.7
Freight traffic, in tons	0.06	0.3	1.3	2.2	2.8	3.1	3.5

Source: National Bureau of Statistics for China, *China Statistical Yearbook 2005*, table 2-3, 28; *China Statistical Yearbook 2006*, table 2-3, 29; *China Statistical Yearbook 2007*, table 2-3, 29.

TABLE F-2 Historical and projected revenue passenger kilometers (RPKs)

Traffic flow - China to:	1995	2000	2001	2002	2003	2004	2005	2006	Projected 2026	Overall growth 1995-2006	Proj. yearly growth 2006-2026
	Billion RPKs									Percent	
China (domestic market)	56.6	76.7	86.9	101.5	106.9	143.8	163.8	182.6	986.9	222.6	8.8
Europe	26.6	41.1	40.2	42.6	37.5	51.2	60.1	73.9	236.8	177.8	6.0
North America	21.6	33.2	36.2	33.2	24.9	34.4	43.5	48.6	167.4	125.0	6.4
Northeast Asia	16.0	19.4	18.4	24.5	20.1	27.3	29.0	30.0	93.3	87.5	5.8
Oceania	9.2	12.1	12.4	13.2	10.6	15.0	19.1	19.4	47.8	110.9	4.6
Southeast Asia	23.0	29.3	31.7	36.9	27.7	41.2	48.9	48.6	153.2	111.3	5.9
Total RPKs	153.0	211.8	225.8	251.9	227.7	312.9	364.4	403.1	1,685.4	163.5	7.4

Source: Boeing, *Current Market Outlook, 2007*. USITC calculation.

TABLE F-3 China per capita GDP, disposable urban Income, annual GDP increase,1996-2006

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Per capita GDP (US dollars)	703.2	774.4	820.9	865.0	949.2	1,042.1	1,137.2	1,275.6	1,492.8	1,716.0	2,019.7
Annual GDP (percentage increase)		10.1	6.0	5.4	9.7	9.8	9.1	12.2	17.0	15.0	17.7
Per capita disposable income (estimated US dollars.)	582.0	622.5	655.3	707.3	758.6	829.1	932.0	1,025.0	1,140.0	1,282.5	1,476.7
Annual percentage increase in per capita disposable income		7.0	5.3	7.9	7.3	9.3	12.4	10.0	11.2	12.5	15.1

Source: National Bureau of Statistics, *China Statistical Yearbook, 2006*, tables 3-1 and 10-2, 57 and 347, respectively; National Bureau of Statistics, *China Statistical Yearbook, 2007*, tables 3-1 and 10-2, 57 and 345, respectively. USITC calculations utilizing raw yuan data and average exchange rate for each year found at Oanda Corporation, "FXHistory: historical currency exchange rates."

Appendix G

TABLE G-1 Transport infrastructure of the United States and China, 2007

		United States	China
Land area:		9,826,630 sq km	9,596,960 sq km
Airports:		14,947	467
- with paved runways:			
	over 3,047 meters:	191	58
	2,438 to 3,047 meters:	224	128
	1,524 to 2,437 meters:	1,452	130
	914 to 1,523 meters:	2,323	20
	under 914 meters:	953	67
Total:		5,143	403
- with unpaved runways:			
	over 3,047 meters:	0	4
	2,438 to 3,047 meters:	7	4
	1,524 to 2,437 meters:	153	13
	914 to 1,523 meters:	1,732	17
	under 914 meters:	7,912	26
Total:		9,804	64
Heliports		146	35
Railways:			
	standard gauge:[a]	226,612 km (2005)	75,438 km
	electrified:	unk.	20,151 km (2005)
Roadways:			
	paved:	4,165,110 km[b]	1,870,161 km[c]
	unpaved:	2,265,256 km (2005)	354,864 km (2004)
Total:		6,430,366 km	1,870,661 km
Waterways:		41,009 km[d]	124,000 km

Source: Central Intelligence Agency, *World Fact Book*.

Appendix H

TABLE H-1 China's provincial airports with IATA letter code

Province/other	Location	Airport
Anhui	Anqing	Anqing Airport (AQG)
	Bengbu	Bengbu Airport (BFU)
	Fuyang	Fuyang Airport (FUG)
	Hefei	Hefei Luogang International Airport (HFE)
	Huangshan	Huangshan Tunxi Int'l Airport (TXN)
	Wuhu	Wuhu Airport (WHU)
Beijing Municipality	Beijing	Beijing Capital International Airport (PEK)
	Beijing	Beijing Nanyuan Airport (NAY)
Chongquing Municipality	Chongqing	Chongqing Jiangbei International Airport (CKG)
	Qiangjiang	Qiangjian Zhoubai Airport (under construction)
	Wanzhou	Wanzhou Wuqiao Airport (under construction)
	Wanzhou	Wanxian Airport (WXN)
Fujian	Fuzhou	Fuzhou Chengle International Airport (FOC)
	Longyan	Longyan Airport (LCX)
	Quanzhou	Quanzhou Jinjiang Airport (JJN)
	Xiamen	Xiamen Gaoqi International Airport (XMN)
	Wuyishan, Nanping	Nanping Wuyishan Airport (WUS)
Gansu	Dunhuang	Dunhuang Airport (DNH)
	Jiayuguan	Jiayuguan Airport (JGN)
	Jiuquan	Jiuquan Airport (CHW)
	Lanzhou	Lanzhou Zhongchuan-(Lanzhou West Airport-ZGC)
	Lanzhou	Lanzhou Airport (LHW)
	Qinyang	Qingyang Airport (IQN)
Guangdong	Guanzhou	Guanzhou Baiyun International Airport (CAN)
	Meixian	Meixian Airport (MXZ)
	Shantou	Shantou Airport (SWA)
	Shaoguan	Shaoguan Airport (HSC)
	Shenzhen	Shenzhen Bao'an International Airport (SZX)
	Zhanjiang	Zhanjiang Airport (ZHA)
	Zhuhai	Zhuhai International Airport (ZUH)
Guangxi Zhuang Autonomous Region	Beihai	Beihai Airport (BHY)
	Guilin	Guilin Liangjiang International Airport (KWL)
	Liuzhou	Liuzhou Airport (LXH)
	Nanning	Nanning Wuxu International Airport (NNG)
	Wuzhou	Wuzhou Changzhoudao Airport (WUZ)
Guizhou	Anshun	Anshun Airport (AVA)
	Dayong	Dayong Airport (DYG)
	Guiyang	Guiyang Longdongbao Airport (KWE)
	Liping City	Liping Airport (HZH)
	Tongren	Tongren Daxing Airport (TEN)
	Zunyi	Zunyi Airport (ZYI)
Hainan	Haikou	Haikou Meilan International Airport (HAK)
	Sanya	Sanya Fenghuang International Airport (SYX)

TABLE H-1 China's provincial airports with IATA letter code—*Continued*

Province/other	Location	Airport
Hebei	Qinhuangdao	Qinhuangdoa Shanhaiguan Airport (SHP)
	Shijiazhuang	Shijiazhuang Daguocun International Airport (SJW)
	Xintai	Xintai Airport (XNT)
Heilongjiang	Harbin	Harbin Taiping International Airport (HRB)
	Heihe	Heihe Airport (HEK)
	Jiamusi	Jiamusi Airport (JMU)
	Mudanjiang	Mudanjiang Airport (MDG)
	Qiqihar	Qiqihar Airport (NDG)
Henan	Anyang	Anyang Airport (AYN)
	Luoyang	Luoyang Airport (LYA)
	Nanyang	Nanyang Airport (NNY)
	Zhengzhou	Zhengzhou Xinzheng International Airport (CGO)
Hong Kong Speical Administrative Region	Hong Kong	Hong Kong International Airport (Chep Lap Kok - HKG)
Hubei	Enshi	Enshi Airport (ENH)
	Shashi	Shashi Airport (SHS)
	Wuhan	Wuhan Tianhe Airport (WUH)
	Xiangfan	Xiangfan Airport (XFN)
	Yichang	Yichang Airport (YIH)
	Zhijiang	Zhijiang Airport (HJJ)
Hunan	Changde	Changde Airport (CGD)
	Changsha	Changsha Huanghua International Airport (CSX)
	Hengyang	Hengyang Airport (HNY)
Jiangsu	Changzhou	Changzhou Airport (CZK)
	Lianyungang	Lianyungang Airport (LYG)
	Nanjing	Nanjing Lukow Internationa Airport (NKG)
	Nantong	Nantong Airport (NTG)
	Suzhou	Suzhou Guangfu Airport (SZV)
	Wuxi	Wuxi Airport (WUX)
	Xuzhou	Xuzhou Airport (XUZ)
	Yancheng	Yancheng Airport (YNZ)
Jiangxi	Ganzhou	Ganzhou Airport (KOW)
	Ji'an	Ji'an Airport (JGS)
	Jingdezhen	Jingdezhen Airport (JDZ)
	Jiujiang	Jiujiang Lushan Airport (JIL)
	Nanchang	Nanchang International Airport (KHN)
Jilin	Changchun	Changchun Longjia International Airport (CGQ)
	Jilin	Jilin Airport (JIL)
	Tonghua	Tonghua Liuhe Airport (TNH)
	Yanji	Yanji Airport (YNJ)

TABLE H-1 China's provincial airports with IATA letter code—Continued

Province/other	Location	Airport
Liaoning	Anshan	Anshan Airport (AOG)
	Changhai	Changhai Airport (CNI)
	Chaoyang	Chaoyang Airport (ZHG)
	Dalian	Dalian Zhoushuizi International Airport (DLC)
	Dandong	Dandong Airport (DDG)
	Jinzhou	Jinzhou Airport (JNZ)
	Shenyang	Shenyang Taoxian International Airport (SHE)
	Xingcheng	Xingcheng Airport (XEN)
Macau Special Administrative District	Macau	Macau International Airport (MFM)
Neimengu (Inner Mongolia Autonomous Region)	Baotou	Baotou Airport (BAV)
	Chifeng	Chifeng Airport (CIF)
	Hailar	Hailar Airport (HLD)
	Hohhot	Hohhot Baita International Airport (HET)
	Jining	Jining Airport (JNG)
	Manzhouli	Manzhouli Airport (NZH)
	Tongliao	Tongliao Airport (TGO)
	Ulanhot	Ulanhot Airport (HLH)
	Wuhai	Wuhai Airport (WUA)
	Xilinhot	Xilinhot Airport (XIL)
Ningxia Hui Autonomous Region	Yinchuan	Yinchuan Helanshan Airport (not yet assigned)
	Yinchuan	Yinchuan Hedong Airport (INC)
Qinghai	Golmud	Golmud Airport (GOQ)
	Xining	Xining Airport (XNN)
Shaanxi	Ankang	Ankang Airport (AKA)
	Hanzhong	Hanzhong Airport (HZG)
	Xi'an	Xi'an Xianyang International Airport (XIY)
	Yan'an	Yan'an Airport (ENY)
	Yulin	Yulin Airport (UYN)
Shandong	Dongying	Dongying Airport (DOY)
	Jinan	Jinan Yaoqiang Airport (TNA)
	Jining	Jining Airport (JNG)
	Qingdao	Qingdao Liuting Airport (TAO)
	Weifang	Weifang Airport (WEF)
	Weihai	Weihai Airport (WEH)
	Yantai	Yantai Laishan Airport (YNT)
Shanghai Municipality	Shanghai	Shanghai Hongqiao International Airport (SHA)
	Shanghai	Shanghai Pudong International (PVG)
Shanxi	Changzhi	Changzhi Airport (CIH)
	Datong	Datong Airport (DAT)
	Taiyuan	Tiayuan Wusi Airport (TYN)
	Yuncheng	Yuncheng Airport (YCU)

TABLE H-1 China's provincial airports with IATA letter code—Continued

Province/other	Location	Airport
Sichuan	Chengdu	Chengdu Shuangliu International Airport (CTU)
	Daxian	Daxian Airport (DAX)
	Guangyuan	Guangyuan Airport (GYS)
	Jiuzhaigou, Songpan	Jiuzhaigou Huanglong Airport (JZH)
	Luzhou	Luzhou Airport (LZO)
	Mianyang	Mianyang Airport (MIG)
	Nanchong	Nanchong Airport (NAO)
	Panzhihua	Panzhihua Airport (PZI)
	Xichang	Xichang Airport (XIC)
	Yibin	Yibin Airport (YBP)
Tianjin Municipality	Tianjin	Tianjin Binhai International Airport (TSN)
Tibet Autonomous Region	Lhasa	Lhasa Gonggar Airport (LXA)
	Nyingchi	Nyingchi Airport (LZY)
	Qambo	Qamdo Bangda Airport[a] (BPX)
	Shiquanhe, Ngari	Ngari Airport (non assigned)
	Tawa	Tawa Airport (TWY)
Xinjiang Uyghur Autonomous Region	Aksu	Aksu Airport (AKU)
	Altay	Altay Airport (AAT)
	Fuyun	Fuyun Airport (FYN)
	Hami	Hami Airport (HMI)
	Hotan	Hotan Airport (HTN)
	Karamay	Karamay Airport (KRY)
	Kashgar (Kashi)	Kashgar Airport (Kashi Airport - KHG)
	Korla	Korla Airport (KRL)
	Kuqa	Kuqa Airport (KCA)
	Qiemo	Qiemo Airport (IQM)
	Tacheng	Tacheng Airport (TCG)
	Ürümqi	Ürümqi Diwopu International Airport (URC)
	Yining	Yining Airport (YIN)
Yunnan	Baoshan	Baoshan Airport (BSD)
	Dali	Dali Airport (DLU)
	Diqing	Diqing Airport (DIG)
	Jinghong	Jinghong Gasa Airport (JHG)
	Kunming	Kunming Wujiaba International Airport (KMG)
	Lijiang	Lijiang Airport (LJG)
	Lincang	Lincang Airport (LNJ)
	Luxi	Luxi Mangshi Airport (YUM)
	Simao	Simao Airport (SYM)
	Wenshan	Wenshan Airport (WNH)
	Xishuangbanna	Xishuangbanna Gasa Airport (JHG)
	Zhaotung	Zhaotong Airport (ZAT)

TABLE H-1 China's provincial airports with IATA letter code—Continued

Province/other	Location	Airport
Zhejiang	Hangzhou	Hangzhou Xiaoshan International Airport (HGH)
	Huangyan	Huangyan Luqiao Airport (HYN)
	Ningbo	Ningbo Lishe International Airport (NGB)
	Quzhou	Quzhou Airport (JUZ)
	Wenzhou	Wenzhou International Airport (WNZ)
	Yiwu	Yiwu Airport (YIW)
	Zhoushan	Zhoushan Airport (HSN)

Source: "China Travel, Airline and Airports," *Asia Times*, July 27, 2007. *www.atimes.com/atimes/Others/airlines-airports.html*; Wikipedia, "List of airports in the People's Republic of China." *http://en.wikipedia.org/wiki/List_of_airports_in_the_People%27s_Republic_of_China* (accessed July 23, 2007).

[a]This airport, built in 1995, is currently the world's most elevated airport 4,334 meters above sea level. Embassy of the People's Republic of China, news release, 8/16/05. http://www.china-embassy.org/eng/zt/zgxz/t207424.htm (accessed January 31.2006).