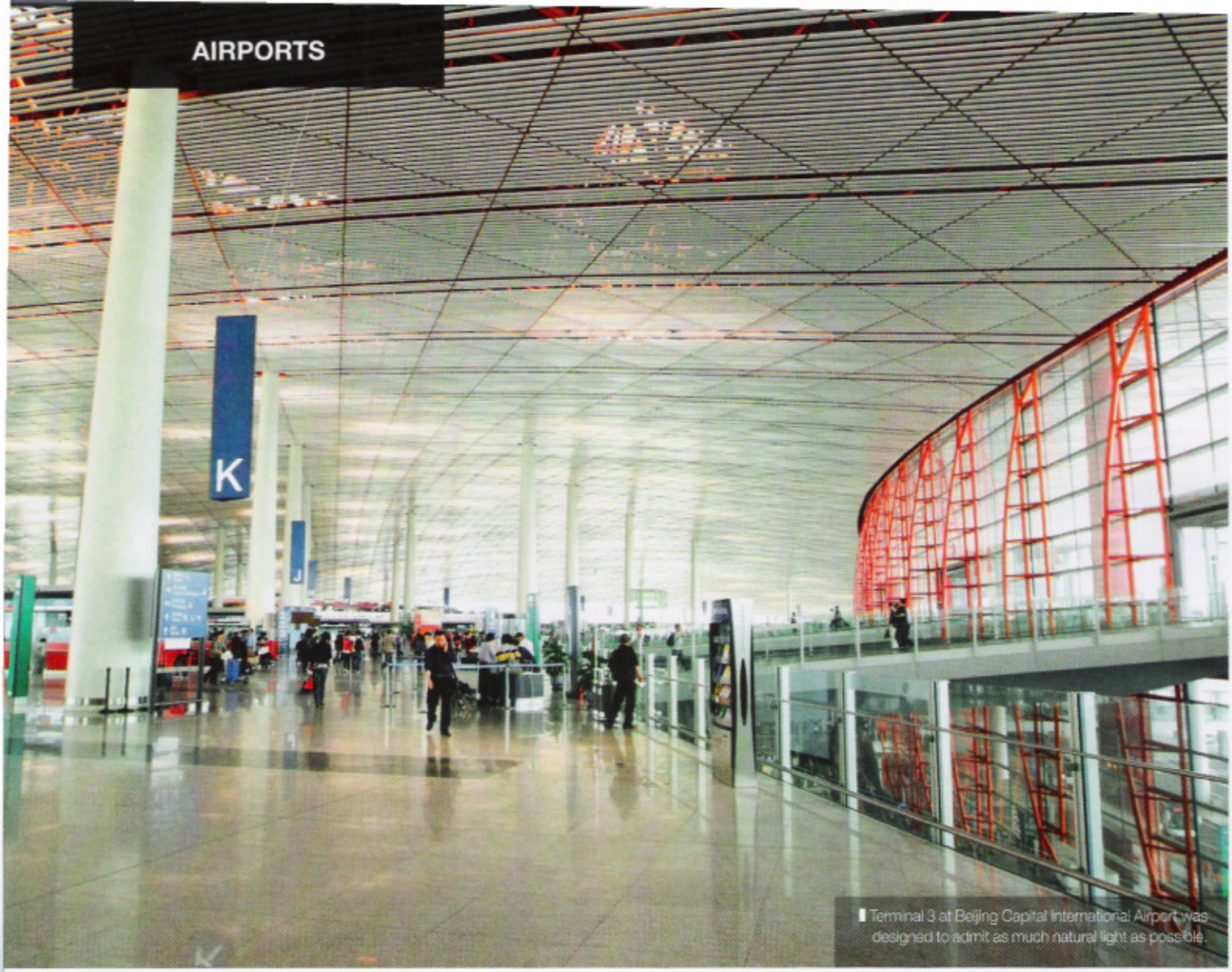

Terminal 3 at Beijing Capital International Airport was designed to admit as much natural light as possible.

Justin Szlasa: 1354670

Chinese ambition remains undimmed

Having weathered the economic storm, expansion and upgrades in China continue unabated

In recent years the Chinese airport sector has experienced an enormous upswing, reflecting the country's emergence as a global economic superpower. Air travel demand is likely to continue growing in line with continued economic expansion – a May 2009 forecast from the International Monetary Fund predicts that national gross domestic product (GDP) will grow by 7.5 per cent in 2010.

In response to the demands of a fast-growing economy and the increased prosperity of its citizens, the Civil Aviation Administration of China (CAAC) is implementing a construction programme that will increase the number of airports in the country from 147 in 2006 to 244 by 2020, when 81 per cent of the population is forecast to live within 100 km of an airport. In addition, many existing airports are being greatly expanded to cope with increasing traffic.

Yet this surge presents problems, as the CAAC is faced with the need for extensive new-build projects and infrastructure upgrades simply to keep pace with short-term demand, let alone plan for the medium and long term.

Main national hub Beijing Capital International Airport (BCIA) boosted capacity in 2008 with its new Terminal 3 (T3), and in 2009 it became the third-busiest airport in the world with passenger traffic of 65.37 million – an increase of 16.87 per cent compared with the previous year, when it was ranked eighth. For the first half of 2010, BCIA posted 13.2 per cent year-on-year growth, to 3.5 million.

Chinese airports are starting to dominate the Asia-Pacific region, given the size of their domestic expansion, though they have some way to go before they will overtake Hong Kong in terms of international operations. Dubai is probably a bigger international threat for many traditional Asia-Pacific hubs, given the long-haul expansion of home-based carrier Emirates and its geographical position, but Beijing and Shanghai should continue to grow rapidly and move through the rankings as well.

The robust state of the Chinese sector is underlined by the fact that Beijing – and other major airports in China – grew rapidly during the global economic downturn, while traffic at European and North American airports fell. Of the top 20 Chinese airports rated highest in passenger traffic, all but two recorded double-digit increases in 2009, and CAAC figures indicate that throughput at its 166 airports rose by 19.8 per cent, to 486.1 million. Take-offs and landings increased by 14.5 per cent and cargo volume grew by 7 per cent year on year.

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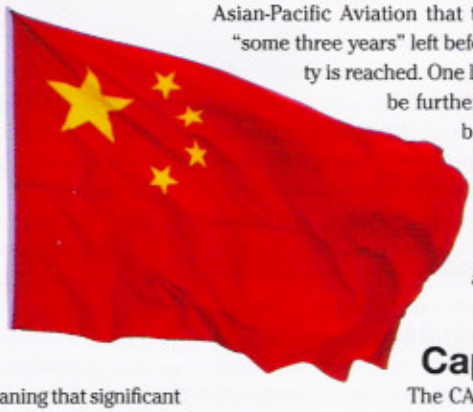
BCIA officials say that by the end of 2010, 20 more common-use self-service kiosks will be added to the 60 in service at T3.

Unique among the world's major freight airports, Guangzhou Baiyun, the Asia-Pacific hub for FedEx, recorded double-digit freight growth in 2009; its 39.3 per cent increase enabled it to rise five places to become the 21st-largest cargo airport in the world. Other Chinese airports that posted double-digit freight growth include Sanya, Guiyang, Changsha Huanghua, Jinan, Wuhan Tianhe and Hangzhou Xiaoshan.

While airports recorded a marginal CNY500 million (USD73.8 million) fall in operating revenues for 2009, they made a total profit of CNY30 billion. The CAAC is ploughing CNY90 billion into 25 major expansion projects in 2010 – including preparations for a new airport serving Beijing; renovations of Shanghai Hongqiao (the new Terminal 2 opened in March), Shenzhen Bao'an and Hangzhou Xiaoshan (the new second terminal opened in late June); and construction of new airports at Kunming and Hefei.

This follows CAAC investment of CNY60 billion in 2009, including construction of new airports at Batang, Lindu, Saertu, Shadi and Tuofeng, as well as the opening of new terminals at Shanghai Pudong. Guangzhou Baiyun airport is also expanding, to cope with the upcoming additional traffic at the Asian Games in November 2010.

Against this background, the CAAC still expects BCIA to play a crucial role. For 2009, BCIA reported CNY300 million in net profits with a 253 per cent rise, as revenues increased by 7.4 per cent, to CNY4.96 billion. Aeronautical revenue accounted for 63 per cent of turnover.



Rapid domestic growth is causing congestion in Beijing, Shanghai and Guangzhou – meaning that significant investment will be required to develop airport systems in these cities to cope with domestic and international requirements. The CAAC intends to commence construction on a new second airport for Beijing by the end of 2010, making it the second Chinese city (after Shanghai) to be served by two airports The new Beijing airport is planned for completion in 2015, as BCIA approaches saturation point. Despite the addition of T3 in 2008, Dong Zhiyi, BCIA general manager, told the Center for Asian-Pacific Aviation that the airport only has "some three years" left before maximum capacity is reached. One logical solution would be further expansion at BCIA, but CAAC Director General Li Jiaxiang said in early 2010 that this is unlikely because of lack of available airspace.

'With a planned ultimate annual capacity of 60 million at the second airport, Beijing would handle up to 145 million passengers each year and rival Dubai as an international mega-hub'

Capital gains

The CAAC is, therefore, proceeding with the new second airport for Beijing. The municipal government had planned to build the airport by 2008, in time for the Beijing Olympic Games, but opted instead to expand BCIA.

Maximum annual capacity at BCIA is 82 million passengers – so with a planned ultimate annual capacity of 60 million at the second airport, Beijing would handle up to 145 million passengers each year and rival Dubai as an international mega-hub.

There were alternatives to a second Beijing airport. For example, a small facility is already in use near the city at Nanyuan. Previously used exclusively by the Air Force of the People's Liberation Army, Nanyuan is a base for China United Airlines and features a terminal with an annual capacity of 1.2 million passengers. Traffic at Nanyuan has grown rapidly in recent years as it has become an alternative to BCIA for low-cost domestic airlines.

Gao Lijia, executive vice-president of Beijing Capital International Airport Co Ltd, the management company at BCIA, tells *Jane's* that domestic traffic drove growth in 2009 while international demand was affected by the global recession. "We have kept our passenger statistics on an upward path," Gao says. "Last year, international passenger volume was influenced by global economics, like the other major airports in the world. This year is totally different, because in the first four months of 2010 we had an increase of 10 per cent in passenger traffic. We feel very confident about international passenger growth."

This confidence can be attributed partly to the success of the T3 mega-terminal, which opened in before the summer 2008 Olympic Games. T3 covers seven floors (including two underground levels) and comprises a main passenger terminal (T3C) and two satellite concourses (T3D and T3E). T3 is 17 per cent larger than all five terminals at London Heathrow, which made it the largest terminal building in the world when it opened. (T3 at Dubai International gained this status in October 2008.)

A masterplan contract for T3 was awarded in 2002

to Netherlands-based NACO with Foster & Partners and Arup, ahead of competition from seven other consortiums. The three companies employed a modular structural method at T3, which enabled rapid construction in just over four years. Arup was responsible for structural, mechanical, electrical and public health engineering; building physics; and IT and communications systems. It reduced the carbon footprint of the terminal by minimising energy consumption with integrated environmental control systems, incorporating shading into the design to reduce the need for cooling and combining natural daylight with the use of artificial lighting.

East-facing skylights are intended to maximise natural heat and available light, and solar panels are a source of heat.

Several A380s can be accommodated on the apron at one time. T3 is equipped with 132 passenger boarding bridges, some of which can be configured to feed one or more aircraft and others to handle the A380. Around one third of the aircraft parking stands (42 out of 125) are remote.

There are 88 moving walkways, 198 lifts and 187 escalators in T3, which also features 196 check-in counters for international flights and 96 for domestic. The 60 common-use self-service (CUSS) check-in kiosks are based on SITA's AirportConnect platform – there is even a kiosk in the underground car park. "This year we are buying 20 more kiosks for the domestic parts of T3," says Du Xiaoming, T3 operating and planning director. BCIA management is also researching the idea of spreading self-service check-in to hotels and railway stations in central Beijing.

Justin Szlasa: 1354669

Gao Lijia, executive vice-president of Beijing Capital International Airport Co Ltd.

Additionally, Air China is running a self-baggage tagging trial at T3 as part of the International Air Transport Association (IATA) Fast Travel programme. Du says the trial began on 28 April with four kiosks. "The Air China guys tell us the trial is going very well after teething problems on the first day," he adds.

The Siemens baggage-handling system (BHS) at T3 remains one of the most complex to be implemented. "In peak times, we can now process about 20,000 items of departure baggage per hour, not including transfer items," says Du.

The BHS features almost 68 km of conveyor belt. Baggage is processed by a five-level in-line screening system; domestic items are then sorted on an underground level before being transported to the carousel one level above. Items for international flights are sent through a 2.2 km tunnel at 36 km/h.

The computer-controlled BHS includes a combination of high-speed tray conveyors, conveyor belts and tilt-tray sorters. The trays are fitted with radio frequency identification tags. There are more than 9,000 Siemens motors installed across the entire system, controlled by 109 Simatic S7 programmable logic controllers.

T3 also features a dedicated ground transportation hub. This includes an Airport Express station linking the terminal with central Beijing on a 20-minute journey; parking for 6,000 vehicles; and a drop-off and pickup zone for taxis. Du tells *Jane's* that 30 per cent of passengers drive to BCIA, 30 per cent take a taxi, 10 per cent take a bus and 30 per cent travel by train.

Processes and facilities at T3 are monitored around the clock on a bank of eight screens at the compact BCIA Operational Control Centre. The centre is managed by SITA with input from other technology suppliers at BCIA, including BHS

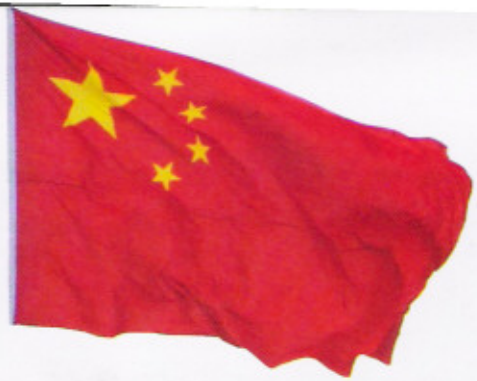
manufacturer Siemens. It is normally staffed by 10 people. "There is another centre at T2 that covers the rest of the airport," says Eric Hsu, SITA ICT manager at BCIA. "In the future – two or three years' time – we may combine them into one centre."

Security measures

T3C handles domestic flights, T3E is used for international flights and T3D was used for charter flights during the 2008 Beijing Olympics. The CAAC estimates that, with the addition of T3 and the third runway, total airport capacity at BCIA will be expanded to 2,000 flights per day and 100 million passengers per year by 2015. NACO forecasts that T3 alone will be able to handle 500,000 aircraft movements by 2015 and an annual throughput of 43 million passengers by 2020.

At the moment T3 can handle 82 million passengers annually, with T3D used by international flights. If T3D is converted to accommodate domestic traffic, an extra 6 million could be added to this total and short-term capacity needs would be met.

However, this can only be a stopgap measure as T3 approaches saturation just two years after it opened. "From an early part of the design process we thought this end point would be reached in 2015," remarks Du. "Right now, the bottleneck in passenger flow for domestic departures comes at the security checkpoint." Four more security channels were added in 2009 (bringing the total to 30),



but Du admits needing "to make room for more".

He calculates that the domestic check-in counters can process a maximum of 7,200 passengers per hour at peak times, but the domestic security checkpoints can only process 5,400 per hour at most. "It's our aim to get 9,000 people per hour through security," he says. "We have several optimisation scenarios to boost checkpoint throughput."

Shifting security demands mean that new or altered threats lead to changes in checkpoint procedures – these could have further implications for throughput at airports facing a capacity crunch.

Growing expectations

Gao acknowledges that BCIA must continue expansion to keep pace with demand: "This is a good problem to have – we're delighted by the fast growth at the airport. This reflects the very strong standing of BCIA domestically, in Asia and all over the world. As our passenger volume grows and airlines focus increasingly on our airport, we will have more opportunities to increase our operations. Our goal is not only to become the largest airport in the world but also to provide the best service for our customers, particularly as a transfer hub.

"We foresee a bright future but we also know challenges lie ahead. We are in constant communication with our customers and suppliers to look into solutions. Using high technology can help us improve our standards, especially with respect to environmental awareness."

BCIA is gunning for the prestigious status of the busiest airport in the world as measured by passenger traffic. On current trends it will overtake Heathrow in 2010 and Atlanta by 2014-15, subject to congestion issues. "In 2009, during the global financial crisis, we felt pressures in common with the wider Chinese economy. We were just 600,000 passengers behind Heathrow in 2009. Earlier this year, ACI [Airport Council International] statistics showed that in the first two months our passenger levels overtook Heathrow," says Gao. But being the largest airport in the world is not our main objective – we want to be the best in terms of management skills and customer service."

Technology partners

SITA manages 50 CUSS kiosks and 600 Common Use Terminal Equipment workstations at BCIA on its AirportConnect platform.

The company is becoming a strategic partner at the airport, having signed a multimillion-dollar deal in May to handle passenger processing for the

Justin Sziasa: 1354672

A total of 88 automatic walkways aid movement around BCIA T3.

55 international airlines that use BCIA. SITA is implementing with BCIA a jointly managed IT services business model, which is intended to maintain low costs for tenant airlines.

Outside Beijing, the forecast increase in passenger demand and airport infrastructure expansion is exerting pressure on the Chinese air traffic management (ATM) network, particularly in the congested eastern part of the country. Advanced surveillance and ATM technologies could enable the CAAC Air Traffic Management Bureau (ATMB) to cope with this surge while cutting taxi times, saving fuel and reducing carbon emissions.

In the Pearl River Delta, for example, five international airports (Shenzhen, Zhuhai, Hong Kong, Macau and Guangzhou) handle an average of 2,000 arrivals and departures on a daily basis. Speaking on 16 July during the first Pan-Pearl River Delta Airport Cooperation & Development Forum, ACI Asia-Pacific Regional Director Maggie Kwok said that the catchment area of airports in the delta includes half of the world's population within five hours of flying time. "The dense population within a short span of flying time has made possible the rapid development of many air transport hubs in the Asia-Pacific region," she said.

However, the IATA has identified the complex airspace in the Pearl River Delta as among the least efficient in the world – the organisation estimated in 2008 that it is costing USD128,000 a day, with Chinese carriers affected the most.

Political issues mean that air traffic control in the Pearl River Delta faces unique challenges. Three separate civil aviation authorities are responsible for ATM at these five major airports, resulting in inevitable difficulties in co-operation. The Hong Kong Civil Aviation Department and the Civil Aviation Authority of Macau cover their respective airports, while the CAAC has authority over Shenzhen, Guangzhou and Zhuhai.

The CAAC is keen to consolidate control, but independent ATM for Hong Kong and Macau is enshrined in the agreement that preceded the handover of political power to China (in 1997 and 1999 respectively).

As a technological solution to Pearl River Delta congestion, the ATMB is

Justin Szlasa: 1354673

using the AeroTrac data fusion system from Telephonics at Macau, Guangzhou (as back-up to the main Thales-supplied system), Shenzhen and Zhuhai.

AeroTrac is an advanced automation system that features multiradar data fusion processing (including ADS-B), flight data processing, high-resolution display systems, and simulation and training. The system can be configured to cover en route, terminal and tower control.

Telephonics is also training Chinese air traffic control executives in ADS-B at its facility in New York state. Training took place from 9-11 June 2010 under the US government-funded Air Traffic Management Executive Training (ATMET) programme.

ATMET is designed to train and familiarise ATMB executives with the types of technology being developed in the United States for the NextGen ATM modernisation initiative. The ATMB is turning to performance-based navigation (PBN), as the CAAC plans to expand aviation infrastructure in parts of the country where the terrain makes airspace management difficult.

Required Navigation Performance – Authorization Required (RNP-AR) procedures, for example, have been implemented at airports serving remote areas of China.

Top 20 Chinese airports by passenger traffic, 2009

Rank	Name	Traffic (millions)	% change year-on-year
1	Beijing Capital	65.37	16.9
2	Guangzhou Baiyun	37.05	10.8
3	Shanghai Pudong	31.92	13.1
4	Shanghai Hongqiao	25.08	9.6
5	Shenzhen Bao'an	24.49	14.4
6	Chengdu Shuangliu	22.64	31.3
7	Kunming Wujiaba	18.94	19.3
8	Xi'an Xianyang	15.29	28.3
9	Hangzhou Xiaoshan	14.94	17.9
10	Chongqing Jiangbei	14.04	26.0
11	Xiamen Gaoqi	11.33	20.7
12	Wuhan Tianhe	11.30	22.8
13	Changsha Huanghua	11.00	33.5
14	Nanjing Lukou	10.84	22.0
15	Qingdao Liuting	9.66	17.8
16	Dalian	9.55	16.4
17	Haikou Meilan	8.39	2.0
18	Sanya Phoenix	7.94	32.2
19	Shenyang Taoxian	7.50	10.2
20	Zhengzhou Xinzheng	7.34	24.7

Source: CAAC

▮ The use of modern technology, such as CUSS, can help BCIA to improve its customer service standards, says Gao.

Most recently, in late July airspace design specialist Naverus announced it will design RNP-AR approaches for Lijiang Airport in Yunnan Province, for Air China and Sichuan Airlines. Large areas of China "feature the traditional problems for aviation of difficult terrain and limited navaids infrastructure", remarks Steve Fulton, co-founder of Naverus and technical fellow at GE Aviation. "In southern and western China, particularly, a number of airports will require RNP-AR."

In 2004 Naverus introduced RNP-AR at Lhasa Gonggar Airport in Tibet. Aircraft operating at the high-altitude Lin Zhi Airport must use RNP procedures (also designed by Naverus). "[Lin Zhi is] the only one in China requiring all airlines to use RNP, but the CAAC PBN implementation roadmap envisages many more," Fulton says. Other Chinese projects for the company (which was acquired by GE Aviation in late 2009) include Bangda (the highest airport in the world, on the Tibetan plateau at 14,200 ft above sea level) and Yushu. An earlier effort at Jiu Zhai is not currently validated.

The International Civil Aviation Organization required all air navigation service providers to submit PBN implementation plans by the end of 2009. The CAAC published theirs in October, outlining the phased development of PBN up to 2025. Ultimately, the CAAC document states, "PBN operations will be primary in all phases of flight, and co-existence of conventional operations and PBN operations will evolve into full PBN operations." *Ben Vogel* ■

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