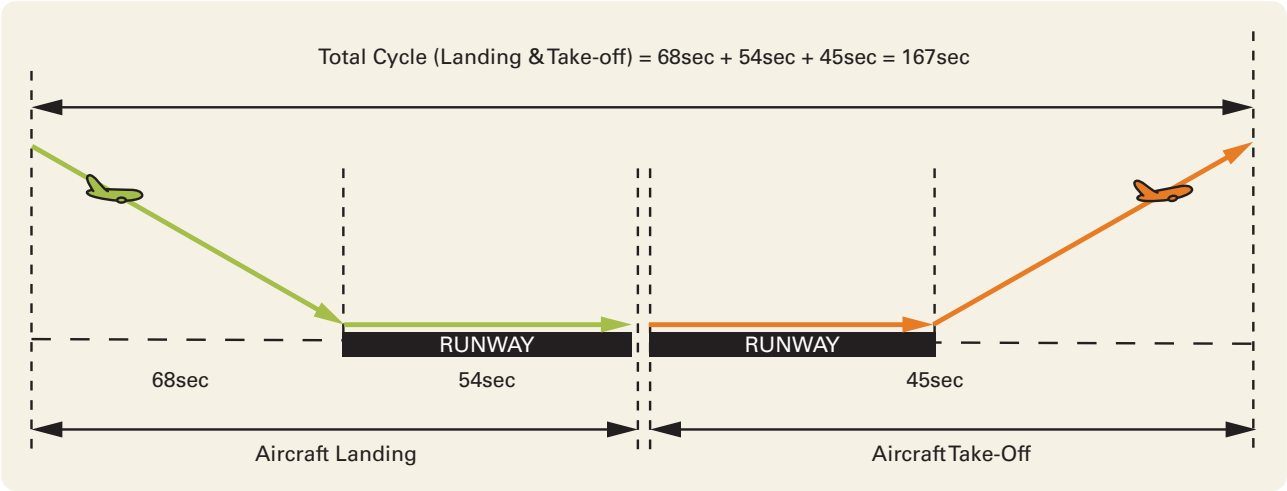
4 PRACTICAL MAXIMUM CAPACITY OF HKIA'S TWO-RUNWAY SYSTEM

According to the 1992 published New Airport Master Plan (NAMP), Hong Kong International Airport (HKIA) was designed to handle an ultimate capacity of 87 million passengers, 8.9 million tonnes of cargo and 376,000 air traffic movements (ATMs, also known as flight movements) per annum in 2040. However, the latest base-case traffic demand forecast from International Air Transport Association (IATA) Consulting by 2030 is 97 million passengers, 8.9 million tonnes of cargo and 602,000 ATMs per year. The main reason for the discrepancy between the 1992 NAMP and the IATA Consulting estimates for annual ATMs is that many of the working assumptions adopted back in early 1990s were based on the operating environment of Kai Tak Airport which at that time was highly constrained and fully stretched –

(a) The 1992 NAMP assumed the forecast flights at HKIA would comprise a very high percentage of wide-bodied aircraft (84%), resulting in a high average passenger load forecast of over 300 people per aircraft. When Kai Tak exhausted its runway capacity, it was natural that airlines maximised the value of each slot by deploying the biggest aircraft possible. The opening of HKIA with two runways has provided more runway capacity for airlines to increase frequency, serve new secondary destinations (especially on the Mainland) and deploy narrow-bodied aircraft (less than 200 seats) on routes that have yet to mature. The average passenger load per aircraft as a result decreased from around 200 at airport opening in 1998 to about 190 since 2000. For the same passenger throughput of 87 million passengers, IATA Consulting forecasts that it would entail 437,000 ATMs, instead of 278,000 ATMs that were originally estimated in the NAMP.

(b) The 1992 NAMP also assumed extensive use of wide-bodied freighters (for example, B747F of 100 tonnes) and lower than actual cargo tonnage carried by freighter at 45% of the total cargo throughput. As it turns out, the extraordinary growth of the cargo market in the last decade (supported by the Government's progressive liberalisation policies on air services) and the rapid

Figure 4.1 Single Runway's Arrival/Departure Cycle under a Mixed Mode Operation



Note: The landing aircraft must be at least 3 nautical miles from the runway end when the departure begins and may not touch down before the departing aircraft has left the runway.

development of express cargo services at HKIA has resulted in a much greater percentage of cargo traffic being carried by freighter (at 60%) and the greater use of medium-sized freighters (for example, A300F of 55 tonnes), thus increasing the overall ATMs at HKIA. As opposed to 66,000 freighter ATMs carrying 8.9 million tonnes that were forecast in the NAMP, IATA Consulting estimates that 108,000 freighter ATMs would be required.

THEORETICAL RUNWAY CAPACITY OF THE TWO-RUNWAY SYSTEM

Under a completely unconstrained environment and operating under a "Mixed Mode" (i.e. allowing both landing and take-off), a runway can deliver a maximum of 44 ATMs per hour[8], based on International Civil Aviation Organization (ICAO) recommended practices and other relevant factors such as the traffic mix at HKIA. Accordingly, two runways operating completely independently should theoretically deliver 88 ATMs per hour (44 ATMs x 2). However, in reality, this is rarely the case. Due to different constraints, none of the runway capacity currently declared by airports in the region with two runways could reach this theoretical maximum.

PRACTICAL MAXIMUM RUNWAY CAPACITY OF HKIA

HKIA started with a single runway operation (South Runway) with 34 ATMs per hour at the airport opening in 1998. Since the opening of the second runway (North Runway) in 1999, the dual runway system has been operating under a Segregated Mode (i.e. South Runway dedicated to departures and North Runway to arrivals). The Civil Aviation Department (CAD) has gradually increased the declared runway capacity from 40 in 1999 to 61 in 2011. The length of time taken is to allow sufficient time for CAD to familiarise its air traffic controllers with dual runway operations and gradually build up its air traffic control capacity.

In order to establish the practical maximum capacity of HKIA's two-runway system, National Air Traffic Services (NATS), a leading provider of air traffic management services based in the United Kingdom, was commissioned to study and identify measures required to further raise HKIA's runway capacity against different possible modes of operation including –

- Segregated operation – one runway exclusively for departures and the other runway exclusively for arrivals;

[8] There can be 3,600sec (seconds) ÷ 167sec = 21.56 ≈ 22 cycles (i.e. 22 pairs of landing and take-off) per hour, thus 44 movements per hour.

- Mixed operation – both arrivals and departures are allowed on each runway.

NATS concluded that given HKIA's special circumstances (for example, terrain constraint surrounding HKIA including the Lantau Peak, Lo Fu Tau and Sunset Peak on Lantau Island as well as Tai Mo Shan and Castle Peak, congested and complicated airspace management, the aircraft mix at HKIA, etc.) and to remain fully in compliance with ICAO's safety and minimum separation requirements, the practical maximum runway capacity of HKIA can only be increased from 61 to 68 ATMs per hour by 2015 regardless of the mode of operation. This has been verified and accepted by CAD.

On the basis of 68 ATMs per hour, NATS assessed that the practical maximum daily movements is about 1,200 per day. This assessment was based on the historical flight movement pattern of a typical busy day and having taken into account –

(a) Alternate closure of the two runways each night for about 8 hours for routine maintenance;

(b) The matching of slot availability at HKIA and the destination airports;

(c) Typical hourly fluctuations of a busy day; and

(d) Provision for recovery periods to cater for operational delays.

The practical maximum daily movements of 1,200 can be translated into the practical maximum annual movements of 420,000, taking into account the historical seasonal adjustment of flight movements by airlines as reflected in their flight schedule published twice a year for the summer and winter seasons respectively. The practical maximum annual movement capacity is expected to be reached sometime between 2019 and 2022 as indicated in Figure 4.2.

LATEST DEVELOPMENTS

To support HKIA's continued growth, we have committed HK$9.3 billion to the first phase of the Midfield Development which will enable HKIA to optimally accommodate, in terms of both its terminal and apron facilities, approximately 60 million passengers and 5 million tonnes of cargo per year. This is mainly to meet the additional passenger and freighter aircraft stands demand in the interim, while maintaining HKIA's high service standards. The project involves –

(a) The construction of 20 aircraft parking stands including 11 airbridge-served stands, as well as an "I-shaped" passenger concourse at the Midfield;

Figure 4.2 Forecast Air Traffic Movements to Reach the Two-Runway Capacity Between 2019 and 2022

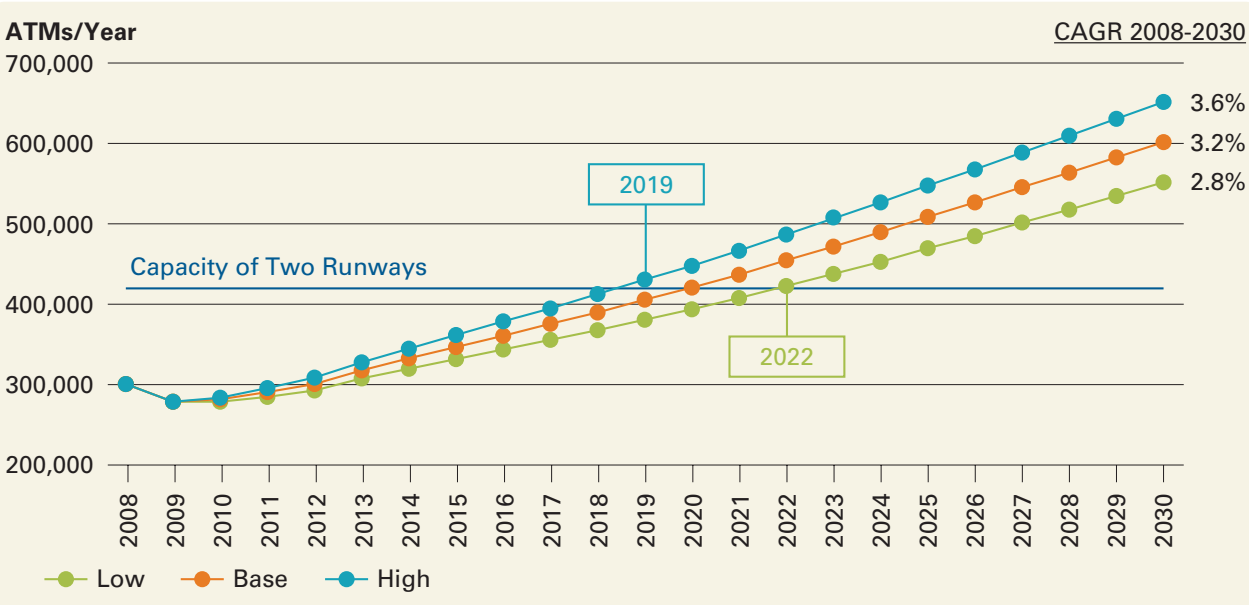
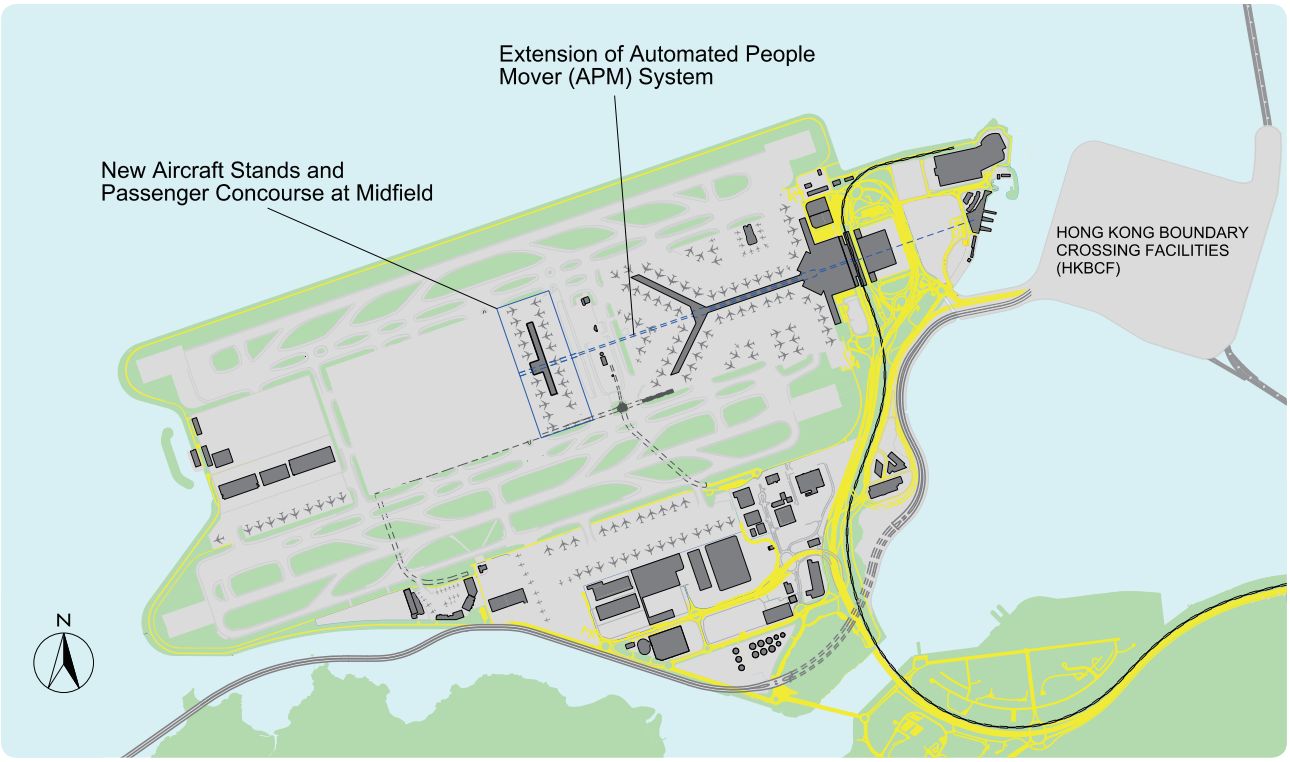


Figure 4.3 Planned Midfield Development by 2015



(b) An extension of the existing automated people mover (APM) system from Terminal 1 to the passenger concourse at the Midfield;

(c) Minor enhancement works on the baggage handling system; and

(d) The building of a new cross-field taxiway.

With these enhancements, HKIA will be able to meet the unconstrained demand forecast of about 60 million passengers and 5 million tonnes of cargo per year by 2015. Beyond that, we must explore other development options. The Master Plan 2030 has evaluated different options to cater for the "capacity crunch" beyond 2015. These are analysed in the following chapters.

An artist's impression of the Phase 1 of Midfield Development.