Singapore Changi Airport

Preparation For & Experience With the A380

Mr Andy YUN
Assistant Director
(Apron Control Management Service / Safety)
Civil Aviation Authority of Singapore
Presentation Outline

1. Infrastructure Upgrade
   o Runway
   o Taxiway
   o Apron
   o Aerobridge
   o Baggage Handling
   o Gate Holdroom
2. New Handling Equipment
3. Ground Working Group
4. Training of Operators
5. Trial Flights & Challenges
1. Infrastructure Upgrade
Planning ahead to serve the A380.

- Changi Airport was the launch pad for the inaugural A380 commercial flight.
- Planning started as early as the late 1990s.
- New infrastructure designed to provide high levels of safety, efficiency and service for A380 operation.
- Existing infrastructure was upgraded at a total cost of S$60 million.

**Airfield Infrastructure**

- Upgrade to meet international standards for safe and efficient operation of the bigger aircraft.

**Passenger Terminals**

- Increase processing capacity, holding and circulation spaces within the terminals to cater to larger volume of passengers.
Infrastructure Upgrade - Airfield

Airfield Separation Distances

- Changi’s runways, taxiways and airfield objects are designed with adequate safety separation to meet A380 requirements.
Infrastructure Upgrade - Runway

Runway Length and Width
• Changi’s 4km long by 60m wide runways exceed A380 take-off and landing requirements.

Runway Shoulders
• Completed widening of runway shoulders to provide additional paved area in case of aircraft veering off the runway and to protect aircraft engines against ingestion of foreign objects during take-off.
Runway Shoulders

B747 outboard engines

Former 3m-wide paved runway shoulders

60m-wide runway

Additional 4.5m-wide paved runway shoulders

A380 outboard engines

SINGAPORE CHANGI AIRPORT
Taxiway Pavement

- Changi’s 30m wide taxiways exceed A380 requirements.

- Taxiway pavement at turning junctions are being widened to provide additional safety distance between A380 outer wheels and taxiway edge.

- Existing paved and turfed taxiway shoulders support A380 operations.
Infrastructure Upgrade - Taxiway

Taxiway Pavement at Turning Junctions

Taxiway pavement being widened at junctions
Infrastructure Upgrade - Taxiway

Taxiway Shoulders

- Combination of paved and turfed taxiway shoulders in use.

- B747 outboard engines
- 30m-wide taxiway
- Existing 3m-wide paved taxiway shoulders
- 12m-wide combination of paved and turfed taxiway shoulders
- A380 outboard engines
Taxiway Bridges

- Changi’s taxiway bridges are designed from the onset for the next generation of larger aircraft, such as the A380.

- Shielding is provided along the sides of the bridges to contain the jet blast of A380 and protect road users below the bridges.
Aircraft Pavement

- Changi’s runways, taxiways and aircraft parking apron pavements are designed for A380 loading.
Infrastructure Upgrade - Apron

Apron Facilities

- Pre-arrival equipment staging area enlarged by around 30%.
- Fuel hydrant pits adjusted to suit A380 refueling inlets.
- Ground handlers acquiring new equipment for servicing the upper deck directly.
- Aircraft docking guidance systems configured for A380 use.
Aerobridge configuration comparisons

Option 1 – 2 aerobridges for access to Main Deck only
Option 2 – 2 aerobridges for access to Main and Upper Decks
Option 3 – 3 aerobridges for access to Main and Upper Decks

[Source: Airbus]
**Infrastructure Upgrade - Aerobridge**

**Aerobridges**

- 3 aerobridge arms for more efficient access.
- 1\(^{st}\) airport in the world to use 3\(^{rd}\) aerobridge arm for Direct Upper Deck Access.
Infrastructure Upgrade – Baggage Handling

Baggage Handling

- Baggage claim belts lengthened to provide longer frontage for presentation of larger number of bags.

Baggage claim belts extended to provide 90m presentation frontage

[Diagram showing Baggage Handling infrastructure with labels for Arrival Greeters’ Hall, Baggage Claim Hall, and Baggage Sorting Area.]
Expansion of Gate Holdrooms

• Gate holdrooms expanded by 30% to provide more seating space for passengers’ comfort.

• Additional X-ray machines & boarding machines
2. New Handling Equipment
3. Ground Working Group
4. Training of Operators
New Handling Equipment

- Aircraft pushback tractor (heavier in tonnage)
- Upper deck catering hi-lift truck
- 3rd arm aerobridge for upper deck
- Modification of existing fuel dispenser or purchase new ones which can raise 2m higher
Passenger Handling Preparation

Passenger Processing

• Adequate check-in, immigration and security screening channels to process the larger volume of passengers efficiently.
Ground Working Group

• Form working group consisting of ground handlers, airline reps, aircraft maintenance, aircraft refueller, airport planner, engineers etc.

• Work out terms of reference

• Monthly meeting to monitor progress of infrastructure works, delivery of new equipment, training of operators

• Plan compatibility tests on all equipment when A380 is available

• Evaluate each test and look into ways to overcome areas which failed
Training of Operators

Passenger Loading Bridge Operation
- Brief operators on new procedures and docking sequence for 3 arms
- Hands-on training on all 3 arms with mock-up fuselage
- Operators must be certified competent

Upper Deck Catering Hi-Lift
- Classroom and site briefing on equipment parts
- Staff with class 5 Airfield Driving Permit
- Training with hi-lift raised to upper deck height using mock-up fuselage
- Training must also be conducted with marshaller as guide
- Operator must be certified competent
Training of Operators

Aircraft Push Back Tractor
• Practise tractor on other aircraft types to get familiarise in absence of A380
• Practise during A380 visits
• Trainer to certify driver is competent

Other Equipment
• All other equipment used for B744 which can be used for A380 needs to be practised on A380

Close Monitoring By Trainers and Airbus Reps
• Trainers and Airbus reps must be around for first few flights
5. Trial Flights & Challenges
Trial Flights & Challenges

• Comprehensive integrated trials were conducted during each A380 visit to Changi Airport, with the latest from 9 – 15 August 2007.
• Rigorous tests were conducted in all areas from equipment compatibility tests to ground handling
• Over 450 participants were involved to test out boarding and de-boarding scenarios
Pictures from the Trial
## Trial Flights & Challenges

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Challenge</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Ground Power Unit (GPU)</td>
<td>If GPUs are not positioned properly, the AIC hi-lift will not be able to dock at M1R.</td>
<td>Ensure GPUs are parked parallel to nose-wheels and the rear end of GPUs are clear of the path of the AIC hi-lift during its docking at Door M1R.</td>
</tr>
</tbody>
</table>

Position of GPU on Right Hand Side (RHS)

Door M1R
# Trial Flights & Challenges

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Challenge</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate Docking Of Passenger Loading Bridge</td>
<td>If the 1st arm of the PLB is not accurately docked, it may hit the pilot tubes, as well as other instruments outside aircraft.</td>
<td>Make markings on cab bumper to assist PLB operator to dock accurately.</td>
</tr>
</tbody>
</table>

Marking on cab bumper to assist PLB operator to correctly adjust the cab to fit the aircraft door.
## Trial Flights & Challenges

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Challenge</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd PLB (L2) Arm at Door M2L</td>
<td>Cap closure reached aircraft before cap bumper.</td>
<td>Modify the cap closure in order for the cap bumper to contact aircraft fuselage first for proper closure.</td>
</tr>
</tbody>
</table>
### Trial Flights & Challenges

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Challenge</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Docking sequences</td>
<td>Power could get cut off when docking 2 arms simultaneously.</td>
<td>Introduce working procedures on which arm should move first.</td>
</tr>
</tbody>
</table>

The closeness of the 2nd and 3rd arm
### Trial Flights & Challenges

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Challenge</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>JCPL at rear cargo door &amp; Catering Hi-lift at M4R</td>
<td>When Catering Hi-lift is at M4R door, the JCPL gets very close beside it and the transporter cannot align behind the JCPL.</td>
<td>Do not use M4R door for Catering Hi-lift.</td>
</tr>
</tbody>
</table>

Door M4R
## Trial Flights & Challenges

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Challenge</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Deck Catering Hi-lift (DUDC) at U1R</td>
<td>Upper Deck Door is very close to aircraft wing. DUDC faces difficulty in docking to door.</td>
<td>Need Marshallers as well as a marshalling box, for marshaller to position himself to guide DUDC.</td>
</tr>
</tbody>
</table>

DUDC Hi-lift docking to Door U1R

DUDC hi-lift’s proximity to aircraft engine
### Trial Flights & Challenges

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Challenge</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilet truck below Door M5R</td>
<td>Toilet truck cannot enter from the direction of the M5R door.</td>
<td>Toilet truck must reverse inwards from the rear, with marshalling aid.</td>
</tr>
</tbody>
</table>

---

Photo of airplane and workers.
# Trial Flights & Challenges

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Challenge</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positioning of air-con trucks</td>
<td>In the event where the APU does not work, no provisions are made for air-con trucks.</td>
<td>2 locations on the port side were identified for positioning the air-con trucks.</td>
</tr>
</tbody>
</table>

Position of 1st air con unit

Position of 2nd air con unit
## Trial Flights & Challenges

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Challenge</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport Emergency Service (AES) air stairs</td>
<td>In an emergency, AES air stairs have to be used for evacuation.</td>
<td>Remove DUDC so that air stairs can be positioned.</td>
</tr>
</tbody>
</table>
Thank You