ATFM in Singapore
Purpose of ATFM

• Air Traffic Flow Management (ATFM) is the regulation of air traffic to avoid exceeding airport or air traffic control capacity in handling traffic and to ensure that available capacity is used efficiently.

• ATFM is one of the elements of Air Traffic Management (ATM). The other elements being Air Traffic Control (ATC) and Airspace Management (ASM).

• ATFM uses updated flight information to predict traffic demand, and pre-tactically adjust the aggregate flows of flights to balance the demand against capacity through optimising the use of available resources.
Usual Capacity Reduction Events

- Capacity reduction due to operational conditions
  - Inclement weather,
  - Abnormal operations (e.g. FOD, emergency, etc)
  - Planned events leading to closure of airspace (e.g. Singapore Airshow, National Day, etc)
CAAS ATFM Unit – Operationalised in Dec 2018

- 40+ trained FMPs
- 24/7 operations
ATFM Initiatives for Singapore

- Regional flights – Distributed Multi-Nodal ATFM procedures and processes
  - GDPs, MINITs conversion
- Long Range ATFM (LR-ATFM) processes to complement flow management
- Interoperability with other ATFM groups
- Working towards Trajectory Based Operations (TBO)
Distributed Multi-Nodal ATFM
ATFM around the World

- NavCanada’s National Operations Center
- FAA’s ATC System Command Center
- EUROCONTROL Network Manager Operations Centre (NMOC)
- South Africa’s ATNS Central Airspace Management Unit (CAMU)
- Japan’s Air Traffic Management Centre (ATMC)
- AirServices Australia’s Network Operations Centre (NOC)
The Need for ATFM in the Asia and Pacific (APAC) Region

- Lack of ATFM service for the APAC region
- The airspace of the Asia/Pacific Region, particularly that of South East Asia, consists of a number of relatively small FIRs and high volume of air traffic movement between major city pairs traversing several FIRs
- Unlike the others, a centralized ATFM Unit (ATFMU) for the Asia/Pacific region may not be palatable as there are many FIRs managed by different ANSPs
- A unique ATFM concept of operation is thus required for the Asia Pacific Region which can potentially be applied in regions to address cross-border ATFM issues, as an alternative to the centralized ATFM concept
Particularly important to Singapore, as Changi’s traffic comprises entirely of international traffic.

Approximately 80% of Changi’s traffic operates within the APAC region.
Distributed Multi-Nodal ATFM Concept of Operation

**ARRIVAL ATFM NODE**
- AeroMET
- Flow Management Position (FMP)
- ATFM Information Exchange
- ATS Units
- Airport Operator

**DEPARTURE ATFM NODE**
- Flight Operations Centre (FOC)
- Pilot
- ATS Units
- A-CDM

**Flow Management Position (FMP)**
- Distributed Multi-Nodal ATFM Concept of Operation
Distributed Multi-Nodal ATFM Network Concept - Tiered Approach in ANSP Participation

- Project expanded to include 11 ANSPs and their encompassing stakeholders
  - i.e. Airport and Airlines Partners

- Adopted a tiered-approach to cater for the varying levels of readiness

- Total Airports in the Multi-Nodal ATFM Network

38

Level 3 ATFM Nodes
Generate, Distribute, Comply to CTOT
- China
- Cambodia
- Hong Kong China
- Singapore
- Thailand

Level 2 ATFM Nodes
Receive and Comply to CTOT
- Indonesia
- Malaysia
- Myanmar
- Philippines

Level 1 ATFM Nodes
Observers
- Lao PDR
- Viet Nam*
An Example of Post Ops results – Jan/Jul 2017

- 13 ATFM measures conducted
- 3400 Minutes Saved
- 166600 Kg
- 523600 Kg
- S$206,000
- Increased Predictability for stakeholders
- Decreased Air Traffic Complexity
Long Range ATFM
Long Range ATFM

- Need for ATFM for flights beyond short/medium haul range to achieve a holistic approach to optimizing air traffic flow
- Tripartite collaboration between Airways NZ, CAAS and NATS UK
  - To develop a sustainable concept of operation for the regulation of long haul flights (greater than 2500NM)

- On-going development of the concept of operations (Conops)
- Each ANSPs would alter the initial Conops to suit their operating environment
- CAAS conducted 2 trials which validated the feasibility of the concept
Concept of Operation

Window for Est Time Over (ETO) and TTO passing/revision

Target Time Over (TTO) fix

DCB Process
- Recalculates TTO on receipt of:
  - Change in ETO of greater than VSP value
  - Change of TMA capacity and resulting delay

DCB Process
- Calculates and forecasts arrival airspace demand and capacity
- Issues initial TTO based on forecast demand and capacity balance
- Only applied when balancing is required

Tactical ATFM measures i.e. AMAN/Vectors/speeds

Top of Climb

Minimum time from TTO fix for TTO passing (Based on amount of DCB process and delay absorption capability of flight)

Crew Based Response to TTO

Aircraft acceptance or renegotiation

1st ETO for TTO fix established

FIR

FIR

FIR

FIR

FIR

ADEP

ADES

Crew request to active ATC authority and approval before commencing any change to meet TTO
LR-ATFM- ASIST
ASIST – Arrival Sequencing in Singapore TMA

- CAAS and SIA’s joint initiative to reduce arrival delay, expansion of the LR-ATFM initiative
- Three phases of operational trials prior implementation
- Phase 1 (Proof of concept) commenced in Jan 19
  - SQ flights with STA between 0500-0700LT via waypoint VPK and ARAMA
  - TTOs are spaced 2mins apart to regulate flow over boundary point
  - TTOs are calculated and issued by SIA OCC
- Phase 2 and 3 to involve CAAS
  - ATFMU to calculate and issue TTOs
  - Tentative to start in Nov 2019
Phases of ASIST operational trials

Phase 1
• Proof of concept using selected waypoints for SIA flights scheduled to arrive at Changi Airport from 0500LT to 0700LT

Phase 2
• Refinement of Phase 1 and expand to all waypoints
• SQ and MI flights
• Real-time compliance monitoring on random flights

Phase 3
• Include other airlines with flights expected to land between 0500LT and 0700LT
Benefits of ASIST as seen in Phase 1 trials

3 SQ arrivals approaching VPK at the same time

20 Oct 18 2115 utc

2 Aug 19 2115 utc

Average Track Mile

Holding Rate (%)
Summary
Summary

• Development of ATM concepts such as LR-ATFM and ASIST will help to enhance our ability to regulate traffic into Singapore
• Prelude to future CONOPS such as Trajectory Based Operations (TBO)
• Quantitative benefits
  • With full ATFM operationalisation and reduced fuel burn:
    • SGD 2.8 million in fuel savings annually
    • 7,000 metric tons reduction in CO2
THANK YOU