

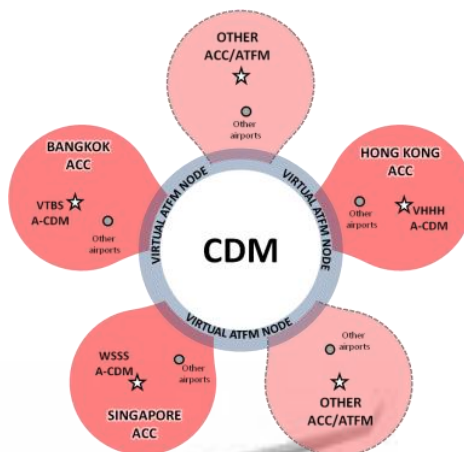


ATFM Operational Trial

based on

Distributed Multi-Nodal CDM/ATFM Concept

ICAO ATFM Workshop Asia-Pacific 2014



27 – 30 October 2014

Beijing, China

Hermizan Jumari

Head (ATM Ops Planning), CAAS

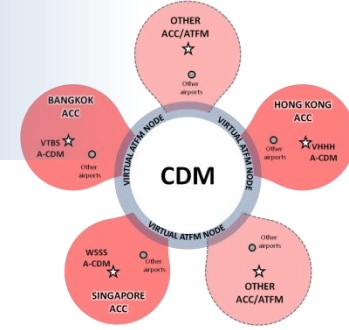
Piyawut Tantimekabut (Toon)

Engineering Manager, AEROTHAI



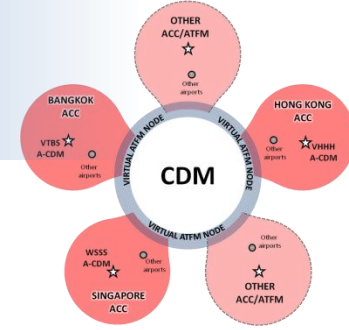
Outline

- History
- Multi-Nodal ATFM Concept Development
- Multi-Nodal ATFM Concept of Operations
- Benefits of Cross-Border ATFM
- ATFM Operational Trial

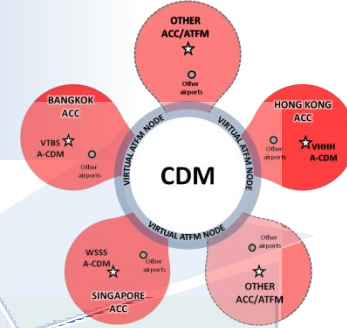


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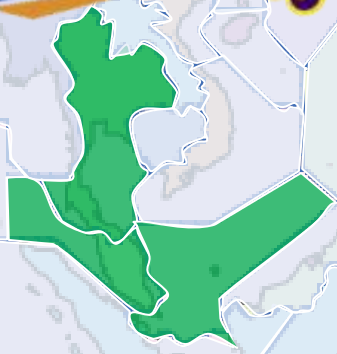
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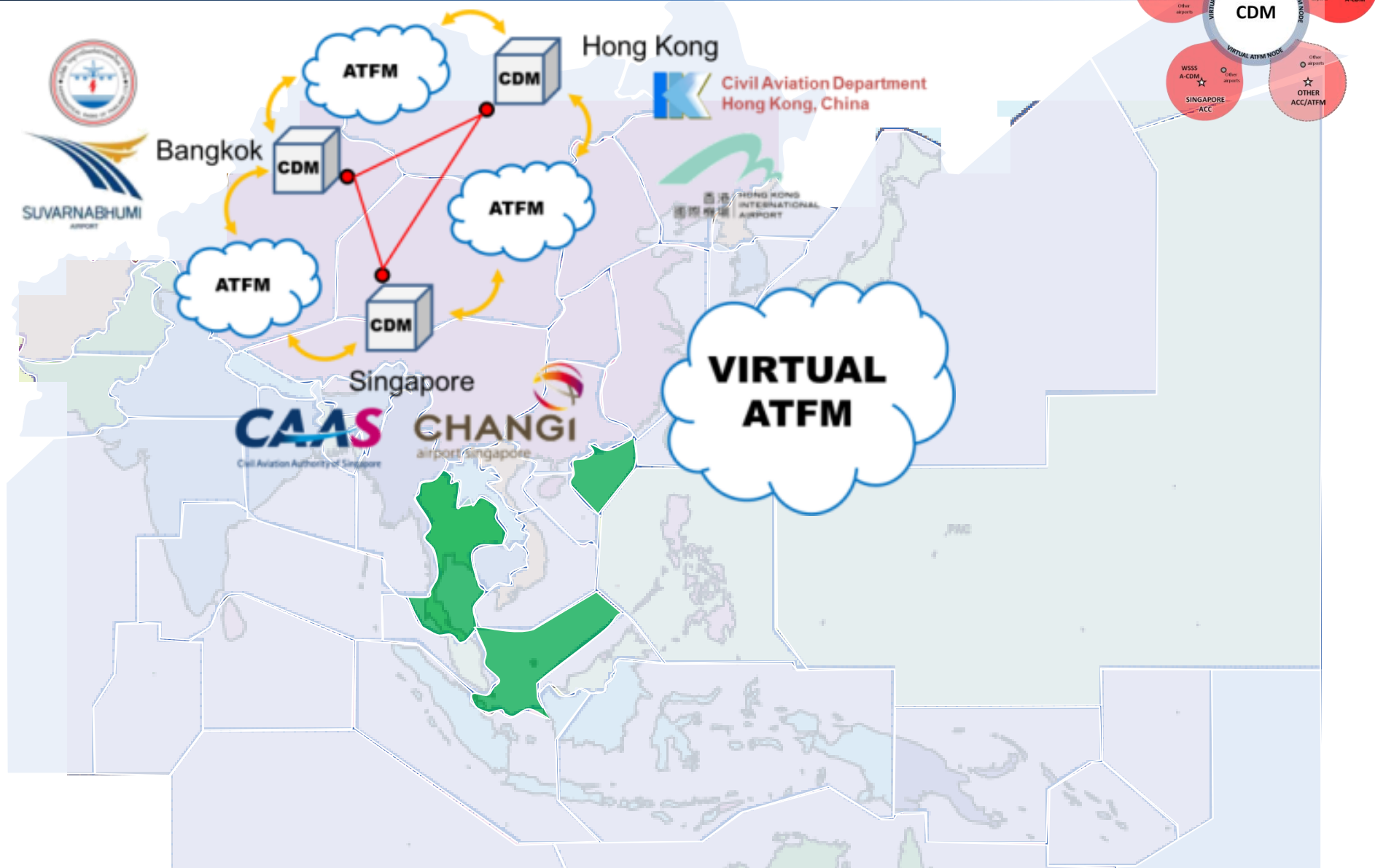
CANSO Bangkok – Singapore Whole-Flight CDM (2011 - 2012)



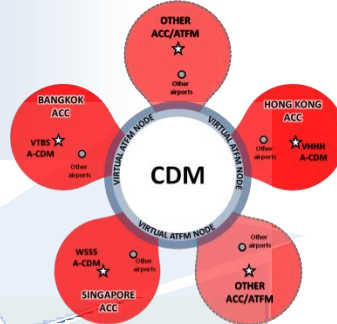
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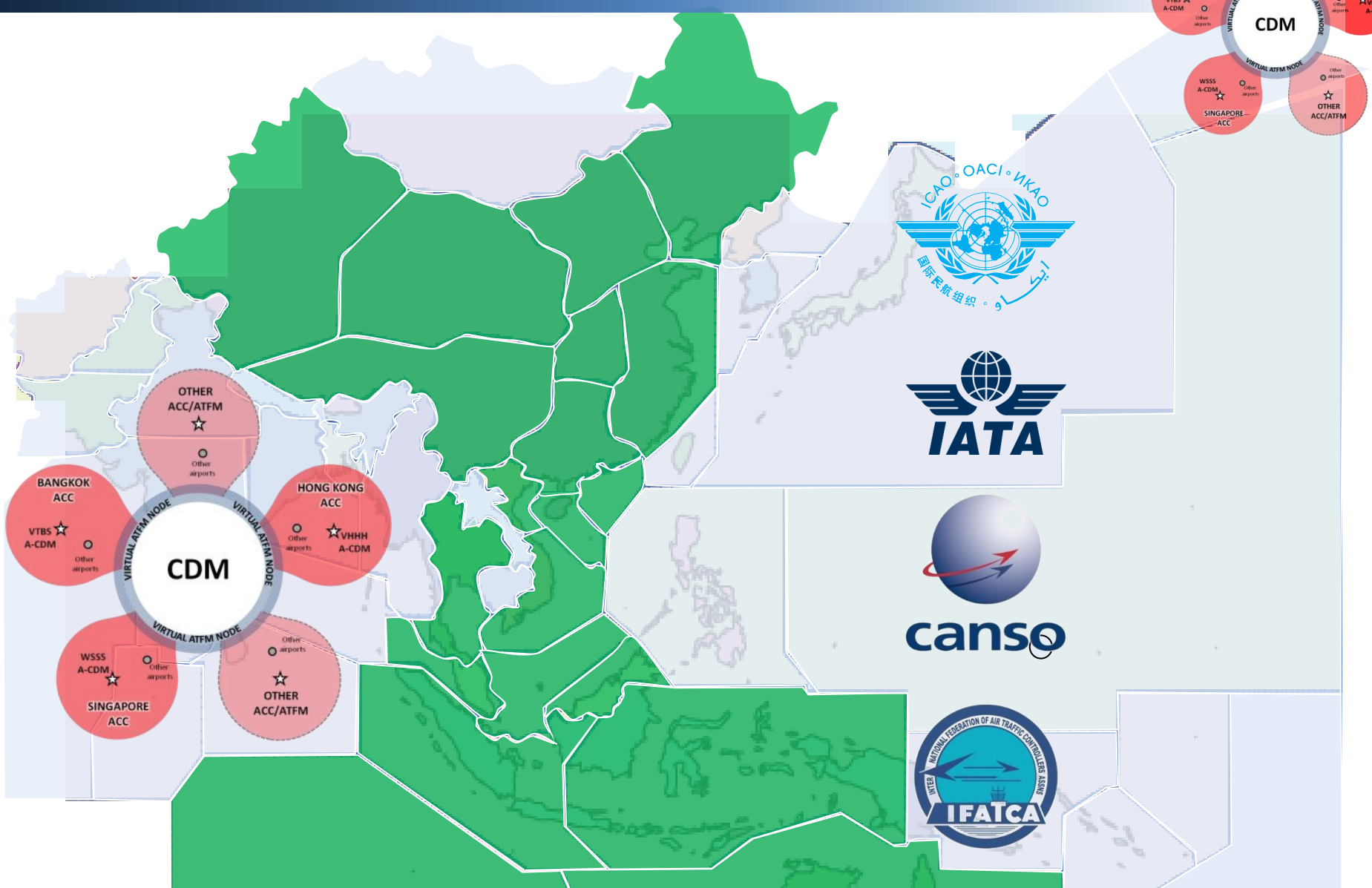
Tripartite CDM/ATFM Project (2012-2013)



APEC ATM Emissions Reduction (2012-2013)

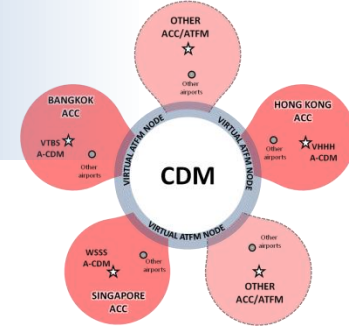


Distributed Multi-Nodal CDM/ATFM (2014)

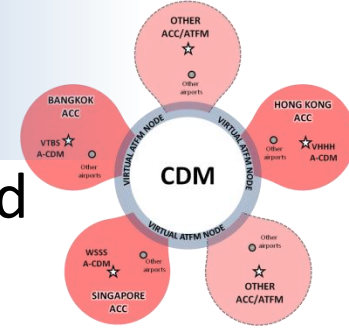


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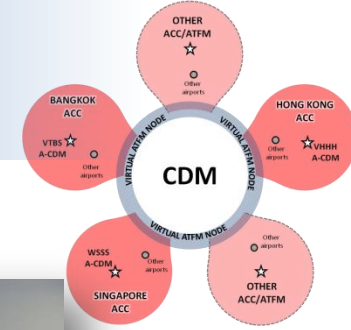


ATFM/CDM Proof of Concept Project



- 10 months proof of concept research project supported by industry partner.
- Develop a viable ATFM/CDM concept suitable for adoption by States in the APAC region
- Concept development through the concept engineering process involving concept Analysis, Exploration, Development including a benefit analysis
- Industry Stakeholders such as ANSPs, Airlines and airports operators collaborated as key contributors of operational inputs
- The project has concluded in Jan 2014 with the concept and shared at the ICAO ATFM/SG 3 meeting

Use of Existing ATFM/CDM Methods

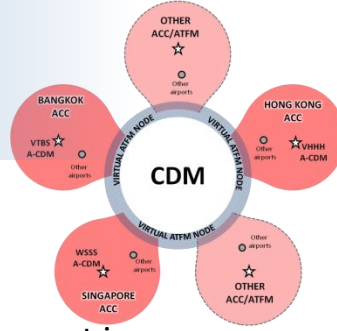


- ATFM Implementations Studied: USA, Europe, Australia, and South Africa

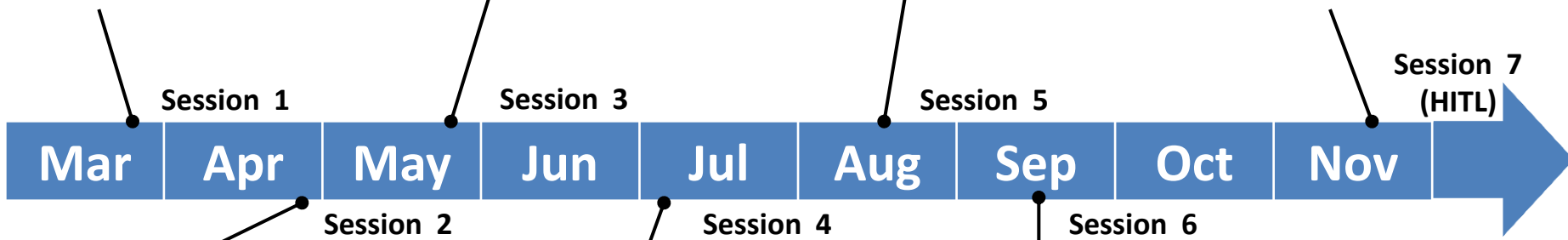


- Current ATFM implementations achieve demand and capacity balance when applied to flights regulated by a single authority
- Asia Pacific has a number of international hub airports with limited domestic traffic to apply existing ATFM principles
 - e.g. Hong Kong and Singapore are 100% international
 - Concept applicable to ANSPs with significant domestic traffic
- Concept had to be developed to regulate flights to an airport with a demand and capacity imbalance departing from ANSPs under a different control authority

Stakeholder Involvement



- Present concept engineering process
- Operational site visits
- Introduce and refine core functionality of Regional ATFM/CDM concept
- Discussion on specific components of concept
- Prepare for November HITL
- Validate concept in a simulation environment



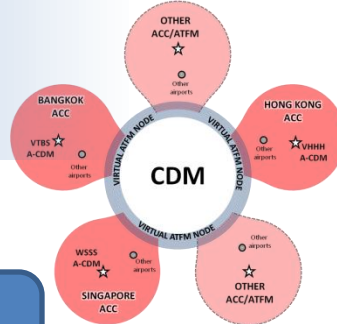
Local industry stakeholders

Local & other stakeholders



ANSP (ATC), Airlines and Airport Operators

HITL Simulation - Technology Testbed



Technology Testbed

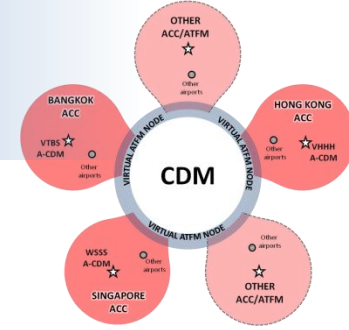
Server and Storage Array HITL Software Workstations

- Manager Position
- Airline
- Airport Operator
- Departure Tower

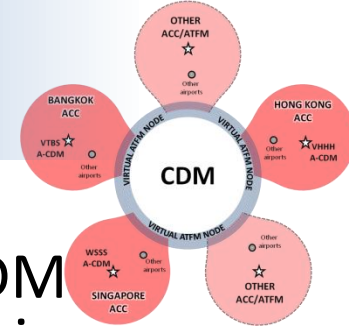


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- **Multi-Nodal ATFM Concept of Operations**
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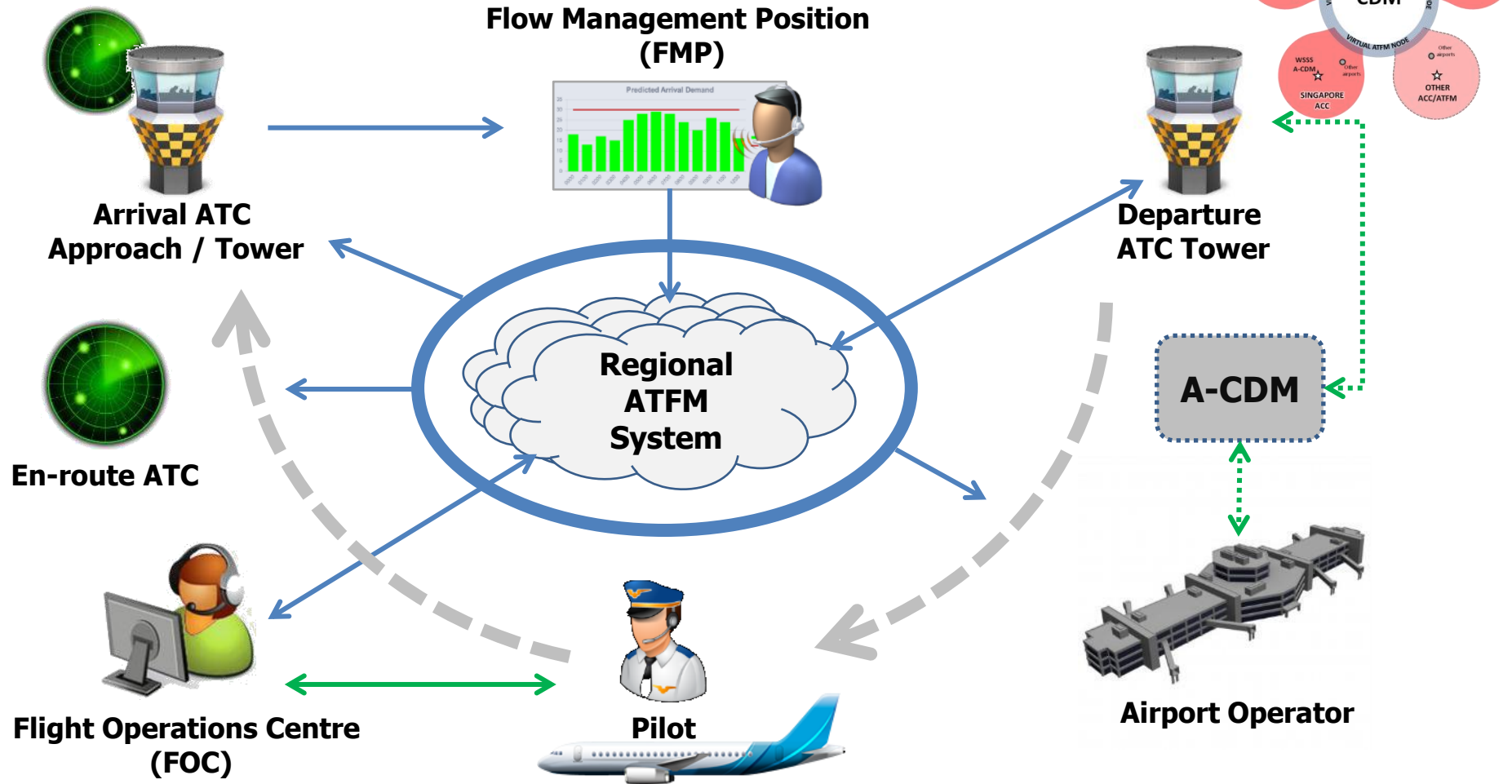


Multi-Nodal ATFM Concept of Operation



- Each ANSP operating an independent, virtual ATFM/CDM node supported by an interconnected information sharing framework.
- A-CDM mechanisms, especially at busy airports, can supplement ATFM in the CDM process.
 - Air traffic flow effectively managed between participating ANSPs through agreed set of business rules for stakeholders.
 - Concept of Operation allows inclusion of international flights and airborne flights
- Accords greater flexibility to airspace users to manage delays through collaboration and negotiation with ANSPs and Airport Operators within existing ATC procedures and constraints

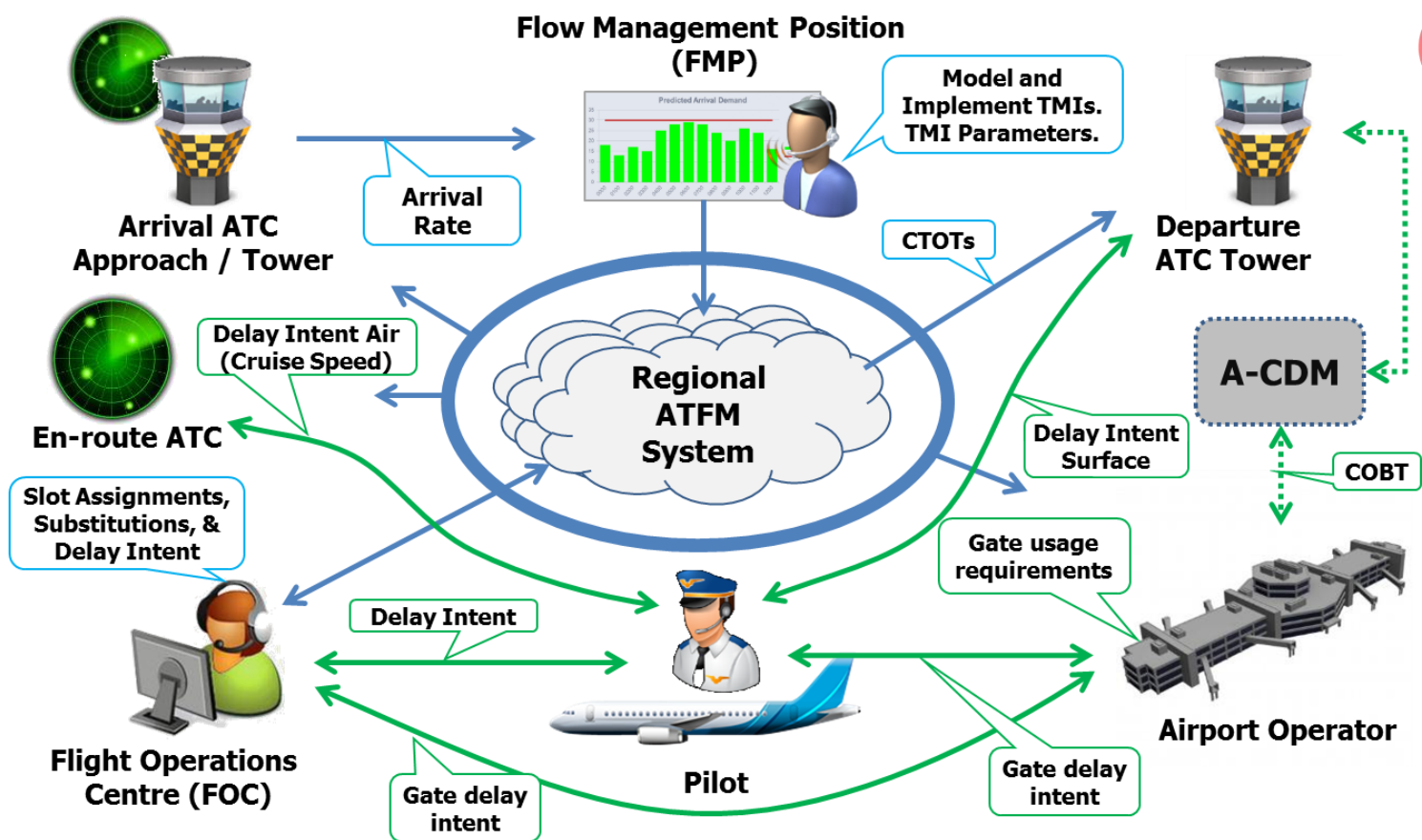
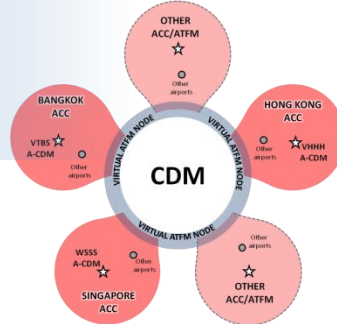
Regional ATFM/CDM Stakeholders & Environment



- Each ANSP has an independent FMP and ATFM System
- Each ANSP independently manages demand/capacity of its own Arrival Airport(s)/ Air space
- Stakeholders/ANSPs communicate via existing Internet/Telecommunications networks
- Data from each ANSP is viewable by stakeholders via software web interfaces

- Between ATFM and Stakeholders
- Between Stakeholders

Delay Management by Aircraft Operators

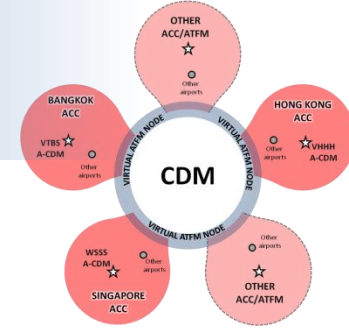


- Aircraft Operators manage the TMI delay assigned to flights
- Aircraft Operators perform CDM with Airport Operators for ground/surface delay intent
- Slot assignments can be viewed via software web interface and notifications
- FOC performs CDM with Pilots to coordinate delay absorption intent and update into ATFM
- Pilots operate request Cruise Speed and Flight Levels per current ATC procedures and within ATC constraints

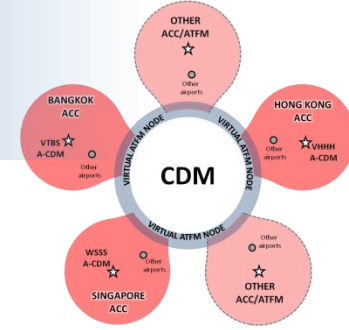


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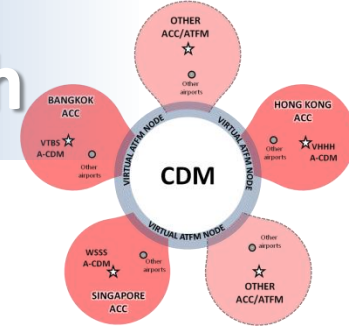
Benefits of ATFM



- Qualitative
 - Situational Awareness and Improved Predictability
 - Reduced Sector Times
 - Enhanced Safety
 - Consistent orderly flow of traffic
- Quantitative
 - Reduced Fuel burn and emissions reduction
 - SGD 2.8 million in fuel savings annually
 - 7,000 Metric Tons reduction in CO2

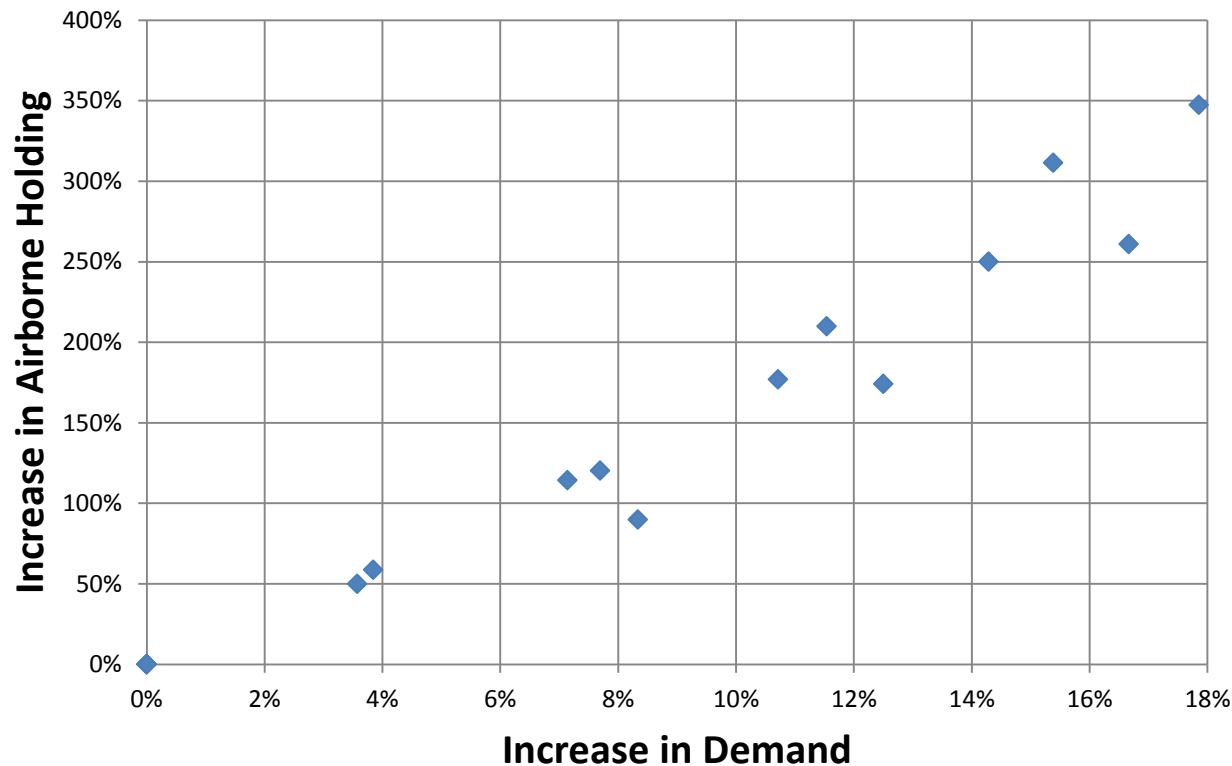


Airborne Holding & Projected Traffic Growth

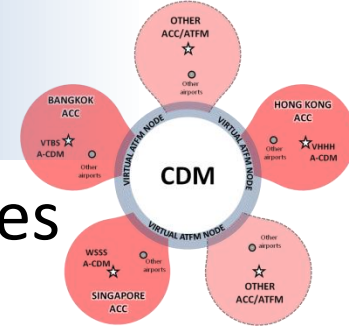


- Fast Time simulation analysis showed that:
 - 6% traffic growth → potentially 75% increase in airborne holding
 - 12% traffic growth → potentially 175% increase in airborne holding

Fast Time Simulation Results



Potential benefits at Current Traffic Volume

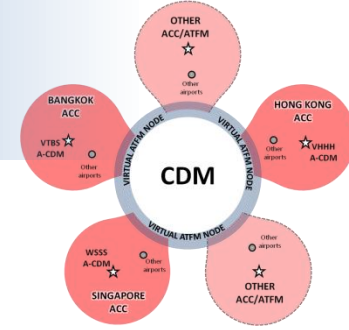


- Annual Airborne Holding is about 137,000 minutes
 - Annual potential fuel savings: 13.6 mil SGD
- Estimate of airborne holding savings
 - Estimate based on:
 - Sample size, fleet mix, and modeling fidelity
 - ATFM will not eliminate all airborne holding

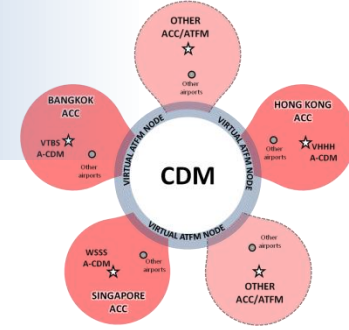
Percentage of Airborne Holding Saved by ATFM	Fuel Savings (millions SGD)	Emissions Reduction (Metric Tonnes CO ₂)
3/4 (75%)	\$10	24,000
2/3 (66%)	\$9.0	22,000
1/2 (50%)	\$6.8	16,000
1/3 (33%)	\$4.5	11,000

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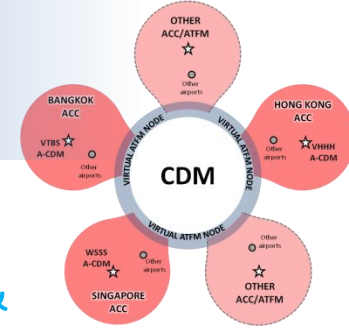


ATFM Operational Trial



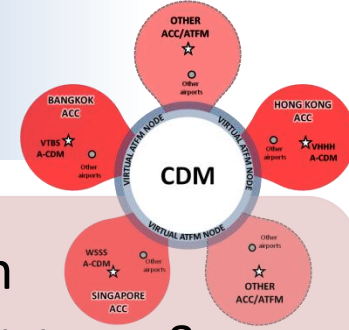
- ATFM Operational Trial using the concept of **Distributed Multi-Nodal ATFM Network**
- Trial Participation - **ANSPs, Airport Operators** and **Airspace Users**
- Strong support and participation from **ICAO, IATA, CANSO** and **IFATCA**
- **Members** - Australia, China, Hong Kong China, Indonesia, Malaysia, Singapore, Thailand, Viet Nam
 - Airports of Thailand, Changi Airport Group
 - Singapore Airlines and Cathay Pacific Airways.
- **Dedicated POCs** have formed a working group to work on several essential capability building elements for the trial
- Target to **commence ATFM Operational Trial in June 2015**

ATFM Operational Trial : Objectives



- Create greater ATFM awareness
 - Increase collaboration among trial members
 - Increase stakeholder participation
 - Agree on common concept
 - Define appropriate ATFM Tool
 - Define stakeholder roles and responsibilities
 - Define Business rules for stakeholder groups
 - Draft appropriate ATFM procedure
 - Develop ATFM education/ Training
 - Identify staffing requirement
 - Validate the concept
 - Test various ATFM measures
 - Overall cross border ATFM effectiveness
- Stakeholder engagement & involvement
- Capability development approach
- ATFM Operational Trial as the test platform

ATFM Ops Trial : Phased Approach



Phase 1 2015

- Distributed Ground Delay Program
 - Airport Arrival Constraints (short-term & medium-term) e.g. weather, runway outage

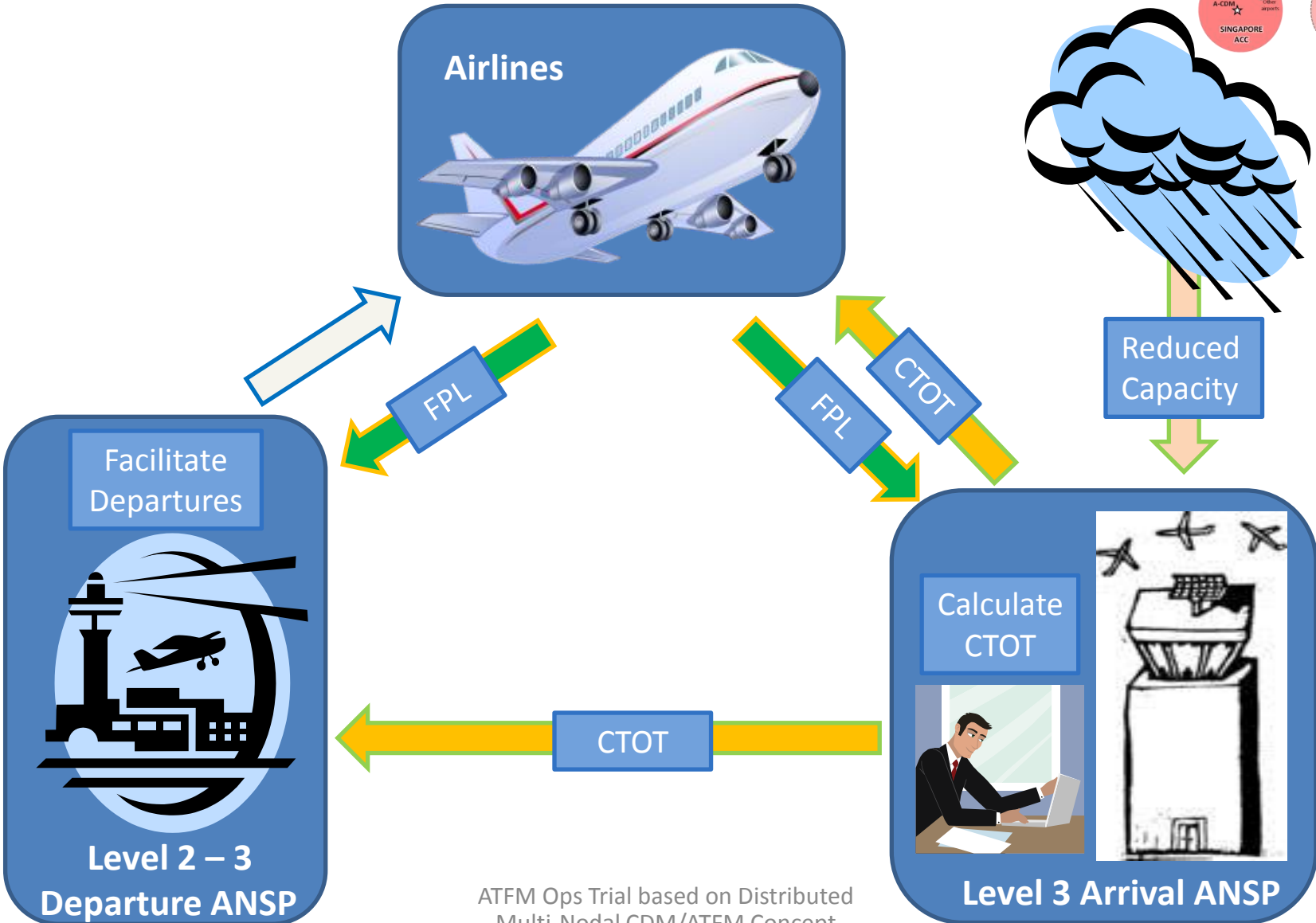
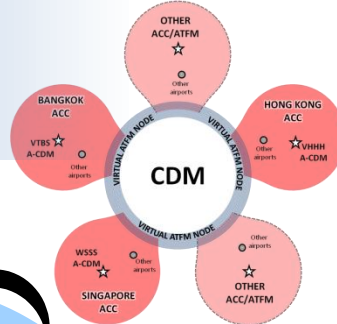
Phase 2

- Ground Delay Program supporting Airspace Congestion & Capacity Planning
- Explore interconnectivity among ATFM systems

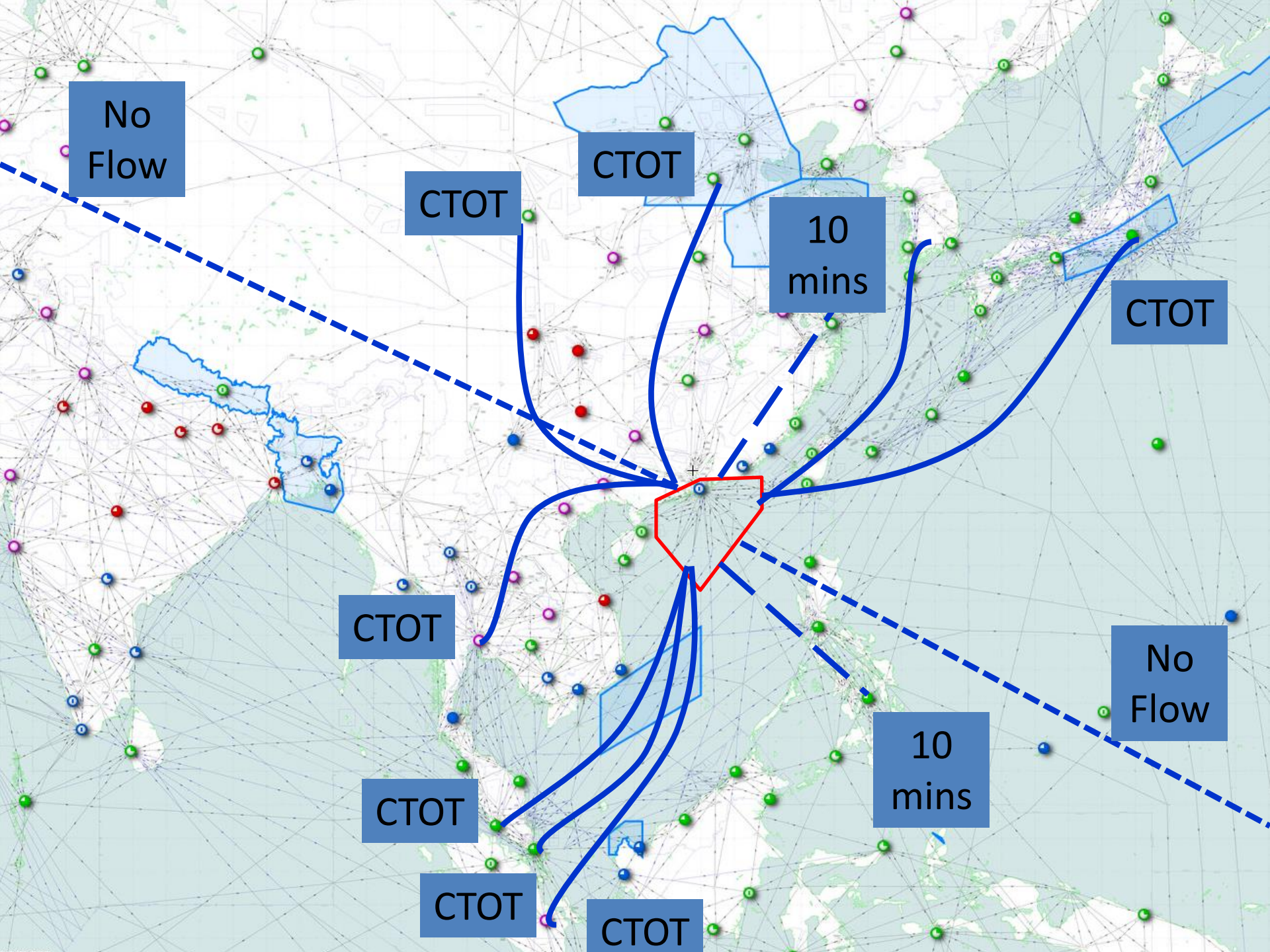
Phase X Vision

- Fully interconnected Global ATFM Service
- Integration with SWIM and 4D-Trajectory Management

ATFM Ops Trial : Phase 1



ATFM Ops Trial based on Distributed Multi-Nodal CDM/ATFM Concept



No Flow

CTOT

CTOT

10 mins

CTOT

CTOT

No Flow

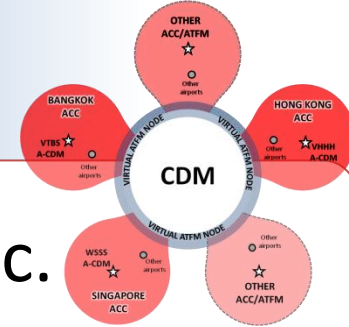
10 mins

CTOT

CTOT

CTOT

Tiered Participation Level : ANSPs



Level 0

- Current Operations: MDI, MIT, MINIT, etc.

Level 1

- Observe ATFM Ops Trial (includes Level 0)

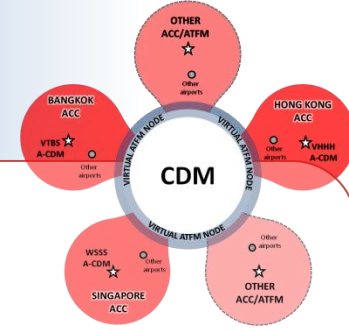
Level 2

- Facilitate CTOT for Departures (includes Level 1)

Level 3

- Demand-Capacity Balancing (DCB) Capability (includes Level 1 and Level 2)

ATFM Ops Trial : Aircraft Operator



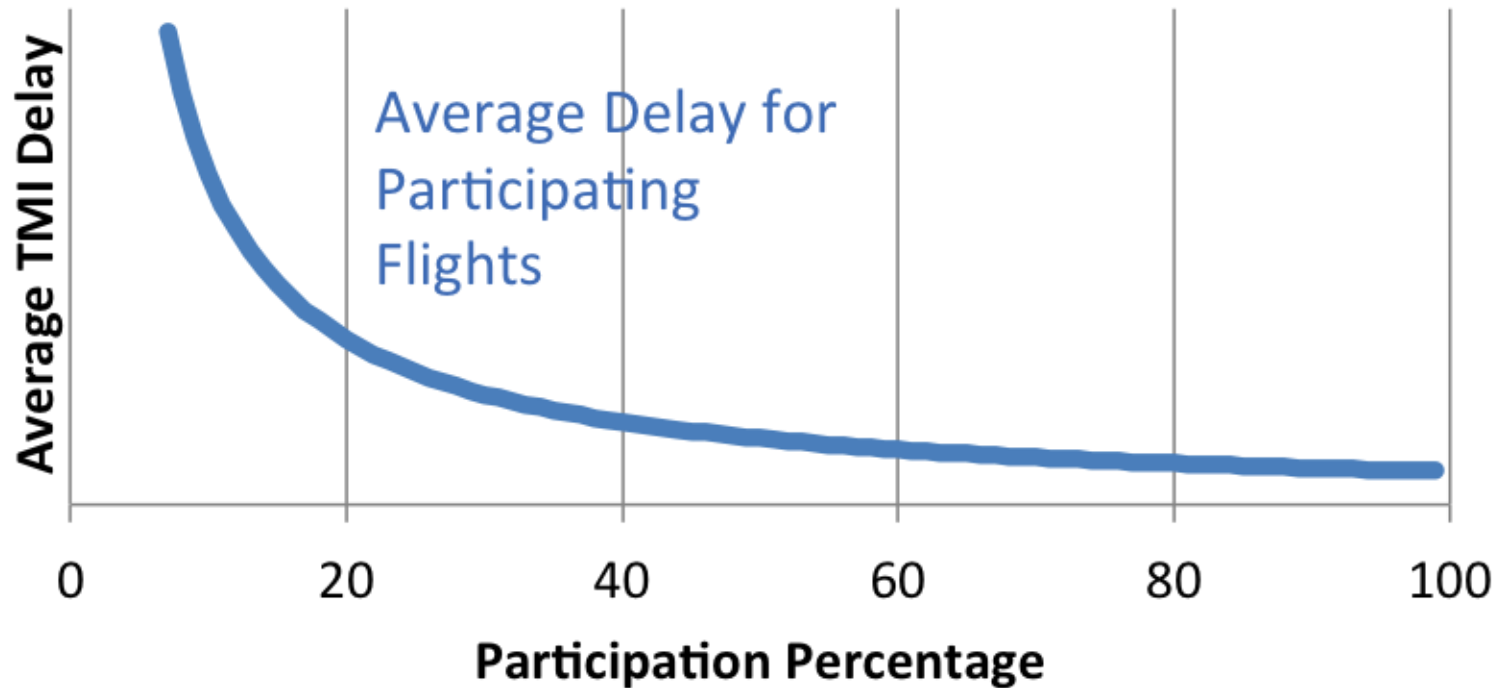
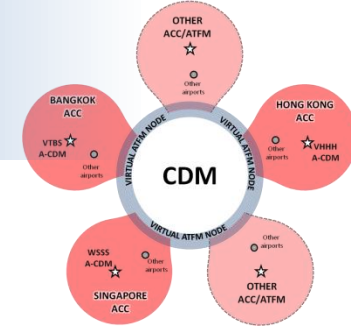
Level 1

- Participate in ATFM Ops Trial
 - Manage flight based on CTOTs

Level 2

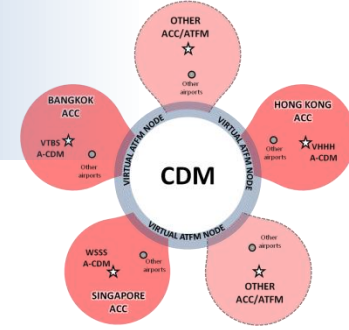
- Advanced CTOT Management
 - Slot Swapping
 - CTOT User Input (Delay Intent)

ATFM Ops Trial : Aircraft Operator



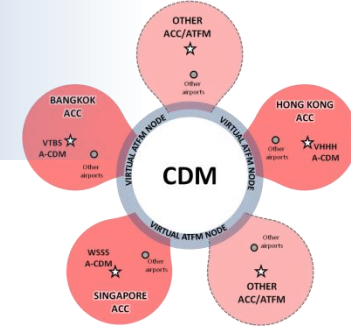
Maximum Participation of flights is key for equitability and effectiveness of ATFM Ops Trial outcomes

ATFM Ops Trial : Airport Operator



- The trial offers the opportunity to chart the A-CDM framework support for ATFM
- Airport Operator has the opportunity to examine and derive acceptable delay component at gates
- Airport Operator & ANSP has opportunity for establishing the collaborative framework to support an interlinked ATFM and A-CDM mechanisms
- The collaborative framework bring greater predictability to air traffic flow and optimisation of resources at Airport and airspace
- Optimisation of resources → reduced wastage of capacity → Savings

ATFM Operational Trial : “Evolution”



Ops Trial 1 (Phase 1) : Starting Out – June 2015

- Step 1: Testing linkages, CTOT calculation and distribution, Communication trials (parallel convent. ATFM)
- Step 2: Implement CTOT for departures



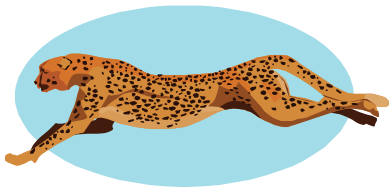
Ops Trial 2 (Phase 1) : Gaining Confidence – Sept 2015?

- Automated Slot Swapping? Further enhancements ...



Ops Trial Phase 2:

- Address congestion at other ATM resources : airspace



Questions & Discussions

