

Regional ATM Network Requirements- Asia-Pacific Perspective

WMO VCP MET-ATM Workshop

APAC Aviation Growth

- Exceptional growth within APAC
 - Predicted to be world's largest aviation market in the next decade
 - Experiencing similar effects as USA in late 70's and Europe in late 80's
 - Capacity increase has not kept up with demand
 - Increasing delays
 - Network congestion
 - Approaching gridlock on some occasions

Busiest International Routes: 14 of the Top 20 in APAC



OAG busiest routes

Rank	Route	Frequency (Mar17-Feb18)
1	KUL-SIN	30,537
2	HKG-TPE	28,887
3	CGK-SIN	27,304
4	HKG-PVG	21,888
5	CGK-KUL	19,849
6	ICN-KIX	17,488
7	HKG-ICN	17,075
8	LGA-YYZ	16,956
9	DXB-KWI	15,332
10	HKG-SIN	15,029
11	BKK-SIN	14,859
12	BKK-HKG	14,832
13	HKG-PEK	14,543
14	DUB-LHR	14,390
15	KIX-TPE	14,186
16	JFK-LHR	13,888
17	KIX-PVG	13,576
18	ICN-NRT	13,517
19	AMS-LHR	13,170
20	ORD-YYZ	13,100

Based on frequency in the 12 months to February 2018

© 2018 OAG Aviation Worldwide Limited. All rights reserved



APAC Aviation Growth

- Exceptional growth within APAC
 - Predicted to be world's largest aviation market in the next decade
 - Experiencing similar effects as USA in late 70's and Europe in late 80's
 - Capacity increase has not kept up with demand
 - Increasing delays
 - Network congestion
 - Approaching gridlock on some occasions
- How to Manage?
 - Networked cross-border Air Traffic Flow Management (ATFM)

Demand/Capacity Balancing (DCB)

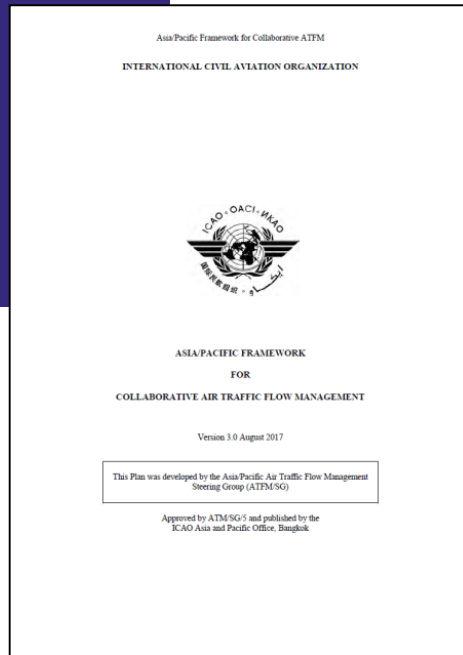
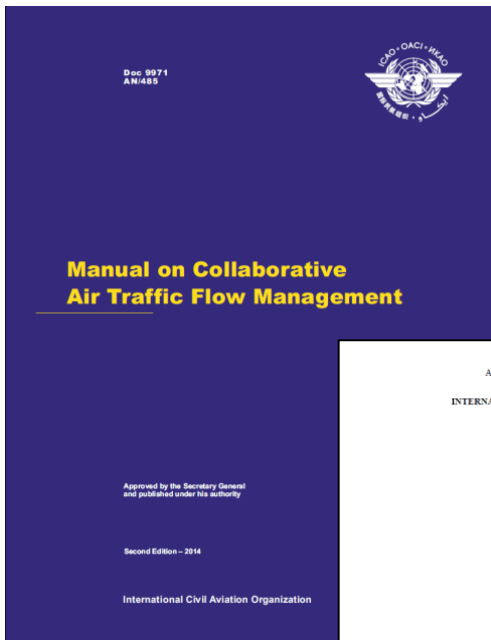


Applied through all phases of ATFM- Strategic,
Pre-tactical, Tactical

Dynamic Capacity

- Given that MET conditions are often the most significant factor in the determination of dynamic capacity:
 1. How to determine their impact on capacity and the extent of ATFM measures needed? and,
 2. How to distribute those ATFM measures and what is the lead time required?

Global and Regional ICAO Guidance Docs



- Doc 9971
- ICAO APAC Framework for Collaborative ATFM
- Provides a common Regional framework that addresses ATFM implementation and ATFM operational issues in the Asia/Pacific region.

MET Requirements for ATFM

APAC ATFM Framework:

“...to enable rational and quantifiable capacity determination, ANSPs and Meteorological service authorities should collaborate closely to define meteorological services to be provided to support ATM and ATFM decisions, based on specific impact to operations. Such targeted MET information should address key thresholds for various weather criteria which have a quantifiable impact on airport and terminal airspace capacity...”

MET Requirements for ATFM (2)

When identifying criteria to be used in determining MET services, consideration should be given to thresholds for meteorological elements that result in a change of runway operating mode, such as:

- a change of runway dependency;*
- a change of spacing between arriving aircraft;*
- a change in nominal aircraft approach speeds;*
- an exceedance of aircraft operating limitations for significant numbers of aircraft (eg maximum crosswind component);*
- an inability to commence an approach via the IAF; or*
- an inability to hold in the primary published holding areas, etc.*

Dynamic Capacity Determination: Critical Thresholds (HKG perspective)

- Critical airport Met thresholds for ATC
 - when crossed, cause a change in the Mode of runway operation or cause an equivalent capacity-reducing effect
 - Visibility
 - Ceiling
 - Crosswind component
 - Headwind component
 - Wind Shear
 - TS/CB activity



Final approach spacing

- Simultaneous Mode: 3NM
- Coordinated Mode: 5-6NM
- LVP Cat II ILS: 7NM
- LVP Cat III ILS: 8NM



Visibility and Ceiling

- >1000m/400 ft : Cat 1 ILS operations, Simultaneous Mode (no impact on ops)
- 600-1000m/200-400ft: Cat 1 ILS operations, Coordinated Mode (Moderate impact on ops – capacity reduced ~ 15-20%)
- <600m/200 ft: Cat 2/3 ILS, Low Visibility Ops (significant impact on ops – capacity reduced > 33%)



Crosswind component

- Reduces tracking ability for departures and possible missed approaches
- <30 kts: Simultaneous Mode (no/minor impact on ops)
- 30-35 kts: Coordinated Mode (Moderate impact on ops – capacity reduced ~ 15-20%)
- >35 kts: Coordinated Mode + exceeding many aircraft limitations (significant impact on ops – capacity reduced > 33%)

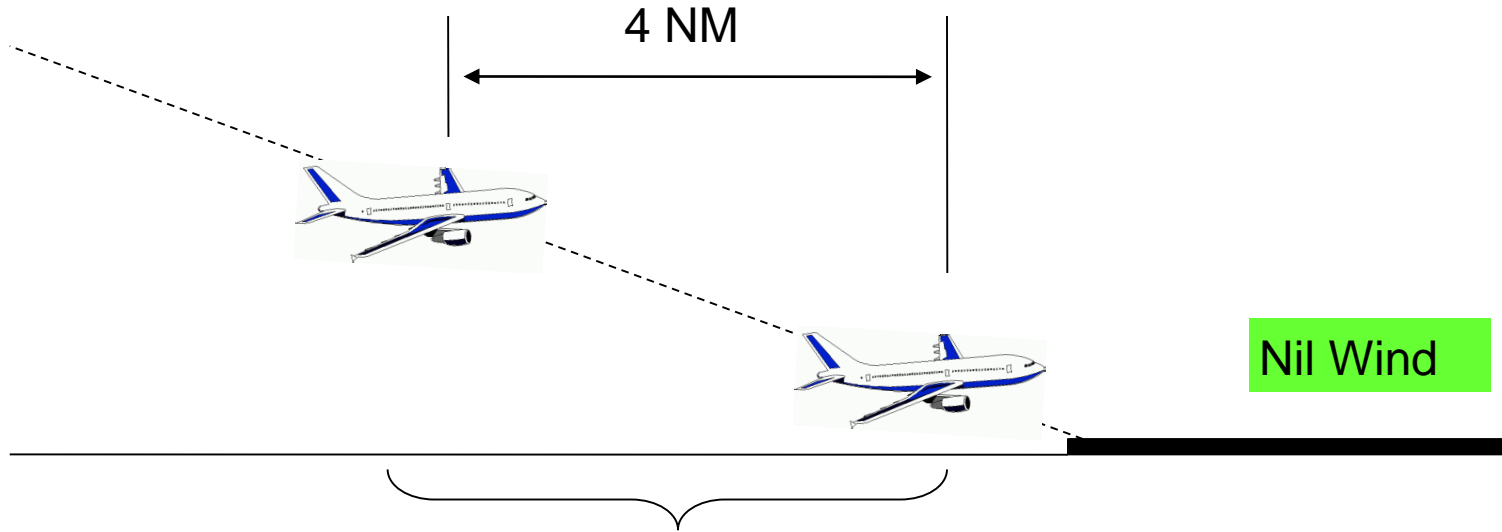


Headwind component

- While not affecting the Mode of operations, has a related impact on landing rate
- Simultaneous Mode maintained
- <20 kts: (no/minor impact on ops)
- 21-40 kts: Equivalent to Coordinated Mode (Moderate impact on ops – capacity reduced ~ 15-20%)
- >40 kts: Equivalent to LVP (significant impact on ops – capacity reduced > 33%)



Effect of Headwind

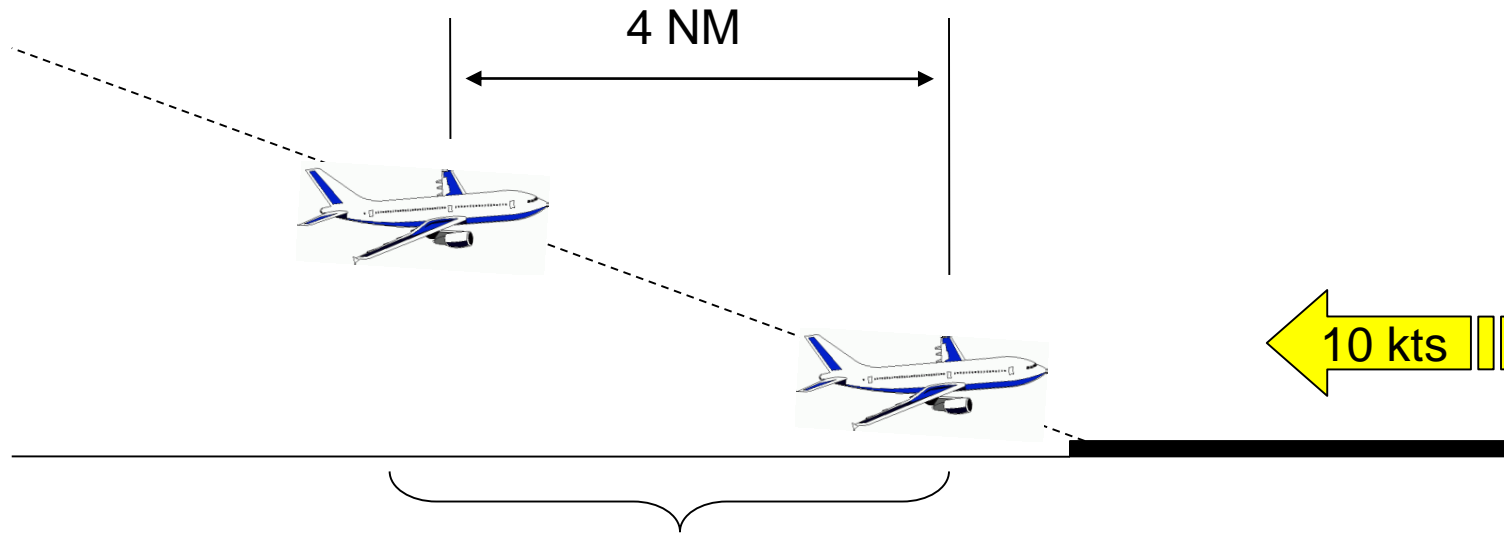


~100 seconds

= 36 arrivals per hour



Effect of Headwind

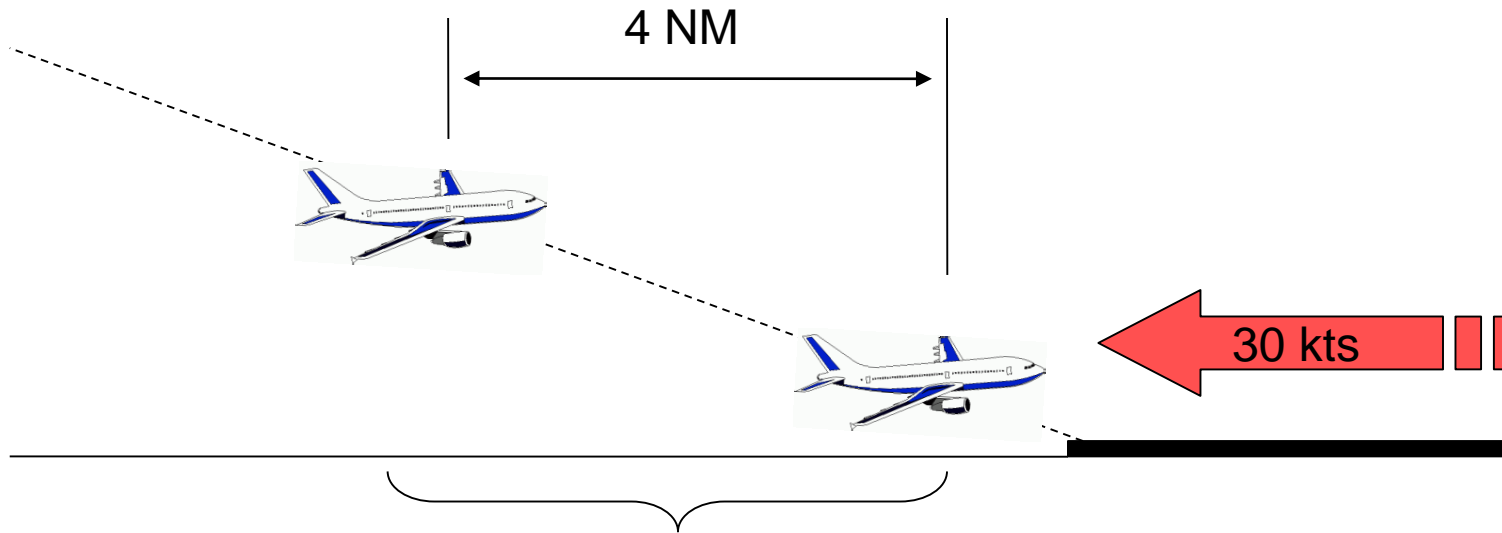


~107 seconds

= 33 arrivals per hour



Effect of Headwind



~125 seconds

= 29 arrivals per hour



Graphical Impact Matrix

Detailed Terminal Area Forecast for the next 9 hours

Issue time: 220734Z

Time (UTC)	0730	0800	0900	1000	1100	1200	1300	1400	1500	1600
Overall										
Wind TEMPO	290/05 —	290/05 —	290/05 —	290/05 040/10	040/10 —	040/10 —	040/10 —	040/10 —	040/10 —	040/10 —
07 Headwind (kt) TEMPO	-4 —	-4 —	-4 —	-4 -9	-9 —	-9 —	-9 —	-9 —	-9 —	-9 —
25 Headwind (kt) TEMPO	-4 —	-4 —	-4 —	-4 -9	-9 —	-9 —	-9 —	-9 —	-9 —	-9 —
Crosswind (kt) TEMPO	N 3 —	N 3 —	N 3 —	N 3 N 5	N 5 —	N 5 —	N 5 —	N 5 —	N 5 —	N 5 —
Visibility TEMPO	1300 m —	1300 m —	1300 m —	1500 m 7000 m	7000 m —	7000 m —	7000 m —	7000 m —	7000 m —	7000 m —
Ceiling (ft) TEMPO										

Notes:

- (i) The forecasts are normally updated every half an hour.
 (ii) The colours highlighted are based on the thresholds in the following Table. TEMPO group, when given, will also be used when determining the colour levels.

Level	Head wind	Cross wind	Visibility	Ceiling
1	< 10 kt	< 30 kt	> 1000 m	> 400 ft
2	11 - 40 kt	30 - 35 kt	600 - 1000 m	200 - 400 ft
3	> 40 kt	> 35 kt	< 600 m	< 200 ft
-	< 5 kt	-	-	obscured sky

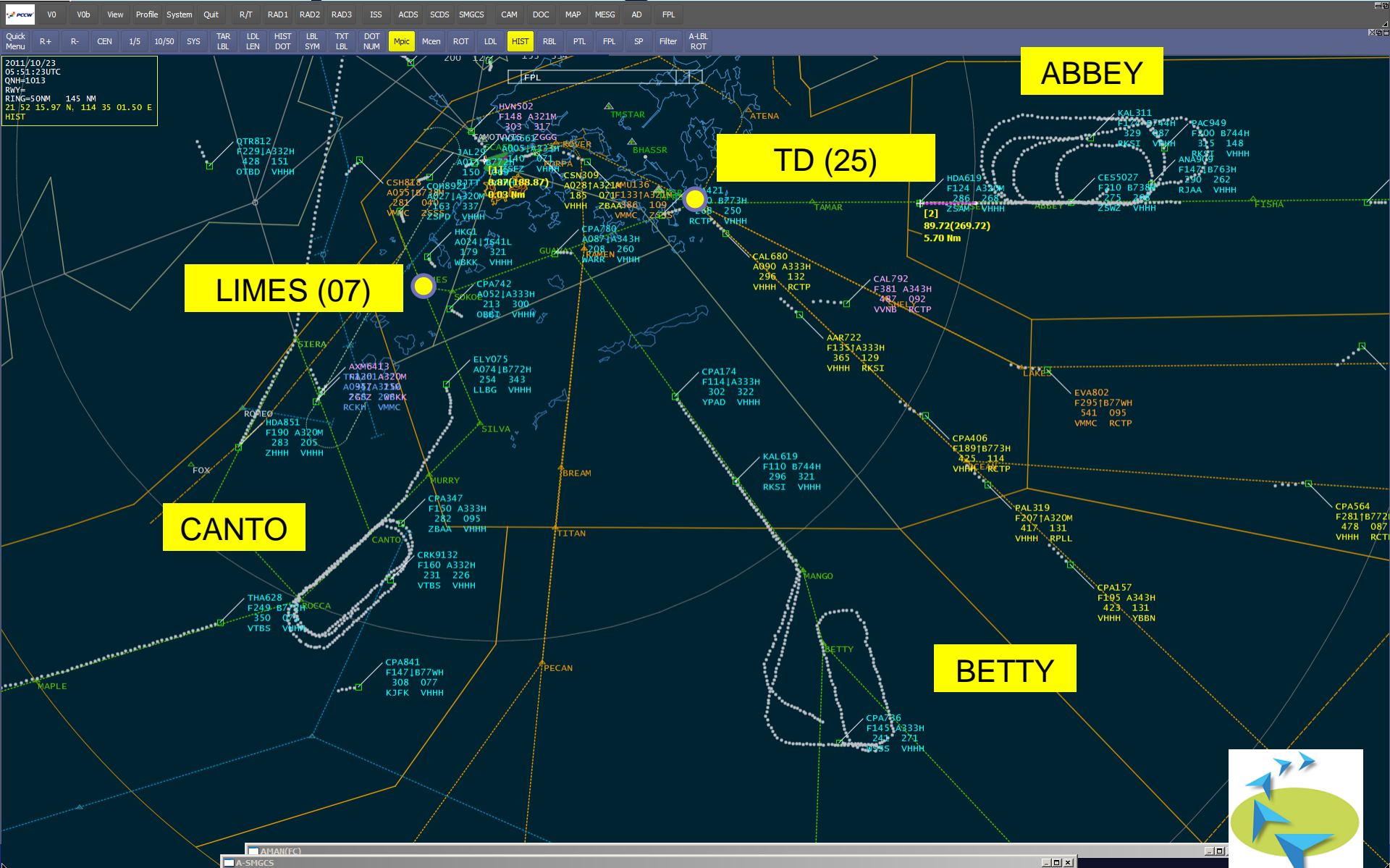
- (iii) The winds are for the central part of the North Runway. "Q" refers to gust. "07" and "25" indicate respectively Runway 07 and Runway 25.
 (iv) Grey colour will be shown under "Headwind" in cases when the headwind is less than -5 kt (i.e. tailwind greater than 5 kt).
 (v) "N" and "S" in crosswind represent northerly crosswind and southerly crosswind respectively.
 (vi) "—" in cloud ceiling means no cloud or cloud ceiling above 5000 ft. Obscured sky will be indicated by grey colour.
 (vii) Dusts (D) will not be indicated in the Headwind or crosswind row in view of their nature. Instead, a symbol "8" will be displayed.
 (viii) Winds which are highly variable in wind direction will be displayed as VRB. VRB winds will be indicated in the headwind and crosswind in full strength.

Critical Airspace Areas

- Critical airspace for ATC
 - Normal arrival holding areas and terminal area feeds
 - Inner and outer holding stacks
 - ABBEY, BETTY, CANTO, DOVAR, FISHA, GAMBA etc
 - Initial Approach Fix Areas and MAP area
 - LIMES, TD



Primary Holding Areas & IAFs



Critical Airspace Areas

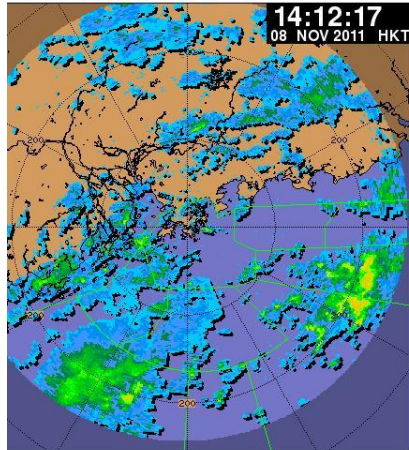
- Loss of 1 arrival feed reduces effective capacity by ~15%
- Loss of 2 arrival feeds reduces effective capacity by ~ 50%
- TS/CB activity near the IAF generally reduces hourly arrival capacity by ~33%



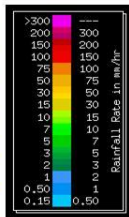
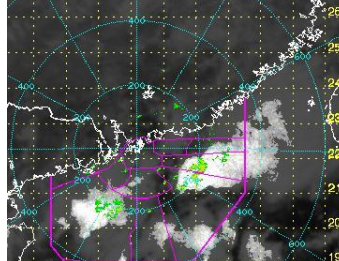
MET Services for the Terminal Area



256km ATNS 256km (Date/time in UTC+8)



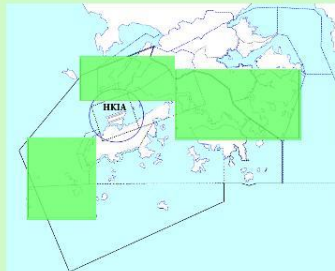
A B C D E F G H I J
2011-11-08 05:48 UTC



Significant Convection Monitoring and Forecast (trial)

Terminal Area Forecast valid from 06 UTC 08 Nov 2011 to 18 UTC 08 Nov 2011

06:12 - 07:12 UTC

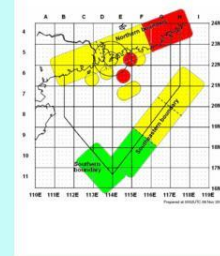


Prepared at 0612UTC 08 Nov 2011

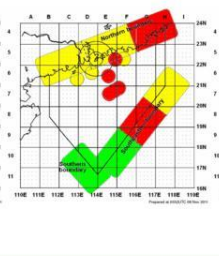
Forecast for HKIA

UTC	07	08	09	10	11	12	13	14	15
Overall									
07 Headwind									
25 Headwind									
Crosswind									
Visibility									

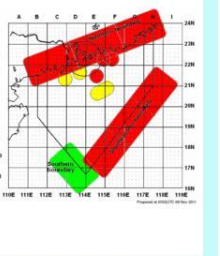
06 - 09 UTC



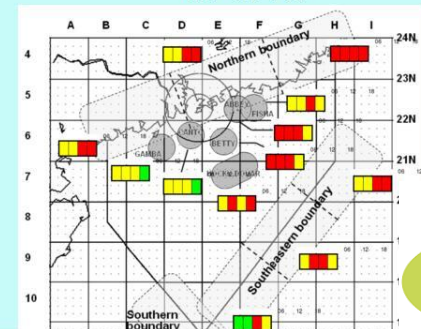
09 - 12 UTC



12 - 15 UTC



06 - 18 UTC



Capacity Notification

Expected Runway	07 ▾				
FACILITIES					
Runway Availability	<input checked="" type="radio"/> Dual <input type="radio"/> Single (Rwy Maint) <input type="radio"/> Single (Day)				
Approach	<input checked="" type="radio"/> ILS/RNAV <input type="radio"/> VOR				
WEATHER					
	DIR	SPD	X/W	H/W	Note:if SFC wind > 20kts, Enter 1000' wind
WIND	070 ▾	5 ▾	0	5	
VIS/RVR(m)	5000 ▾				
CLOUD CEILING (BKN+)	3000 ▾				
TS/CB in 20NM?	<input checked="" type="radio"/> Nil/Green <input type="radio"/> Yellow <input type="radio"/> Red <input checked="" type="radio"/> Isolated <input type="radio"/> Broken <input type="radio"/> Extended TS				
Available Arrival Feeds	<input checked="" type="radio"/> 3 <input type="radio"/> 2 <input type="radio"/> 1 <input type="radio"/> 0				
OTHER FACTORS					
Additional Spacing (WX/AWK?)	0 ▾				
Mode of Operation					
Final Spacing	NM				
Final Speed	kts				
Airport Acceptance Rate					
Capacity Level					
Expected Delay					
Critical Factors					
Remarks	▾				

Calculate

ATFM Daily Plan (ADP)

ATFM Daily Plan (ADP)

ATFM DAILY PLAN	HONG KONG
DATE / TIME OF ISSUE	07 JUN 2018, 0800 UTC
STATUS / REFERENCE	EFFECTIVE – UTC, 07 JUN 2018 HK 2

CONSTRAINTS AND IMPACT					
LOCATION	PERIOD (UTC)		DETAILS	REMARK	
VHHH	07 JUN 2018	0800	1300	VHHH under the influence of Tropical Storm EWINIAR	AAR=30

ATFM MEASURE				
LOCATION	ATFM MEASURE PERIOD (UTC)		ATFM MEASURE	
VHHH	07 JUN 2018	0800	1300	GDP

POSSIBLE / DEVELOPING ISSUES				
LOCATION	PERIOD (UTC)		REMARK	
VHHH	07 JUN 2018	0800	1300	CONDITIONS IMPROVING. REVISED CTOTs TO BE ISSUED SHORTLY

WEATHER BRIEFING				

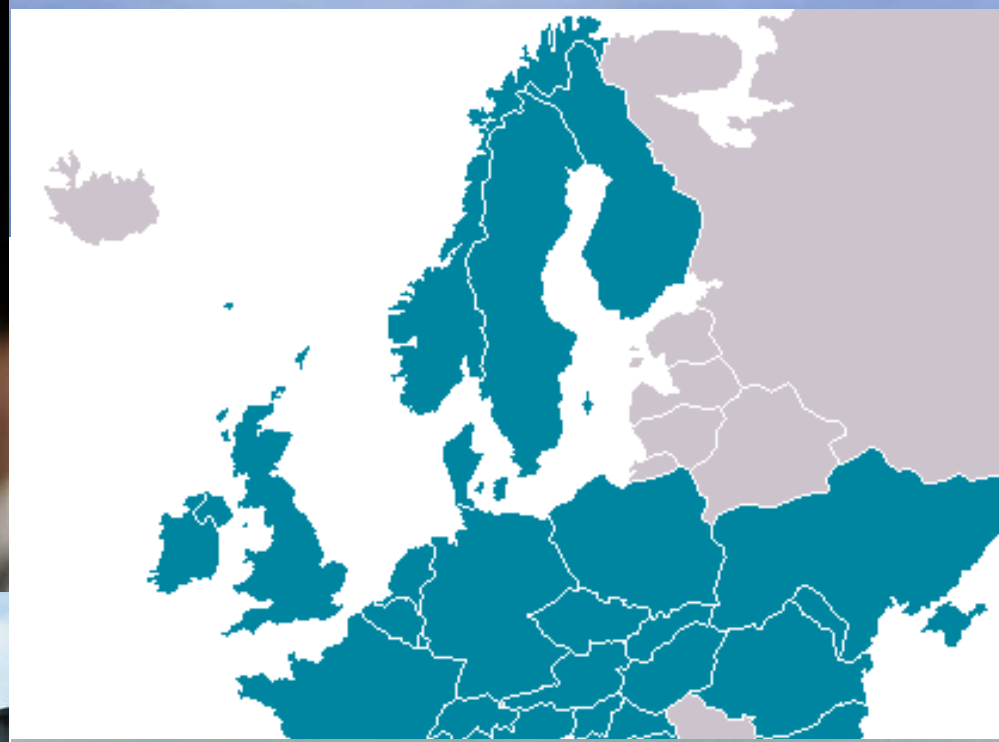
AIRSPACE STATUS BRIEFING				

OTHER INFORMATION				
Normal AAR=34				
Hong Kong Flow Manager Phone Line: +852 29106859 or +852 29100072 (atmdfm@cad.gov.hk)				
Hong Kong ATFMU Email: hkatfmu@cad.gov.hk or +852 2910 6275				

ATFM NETWORK DISTRIBUTION



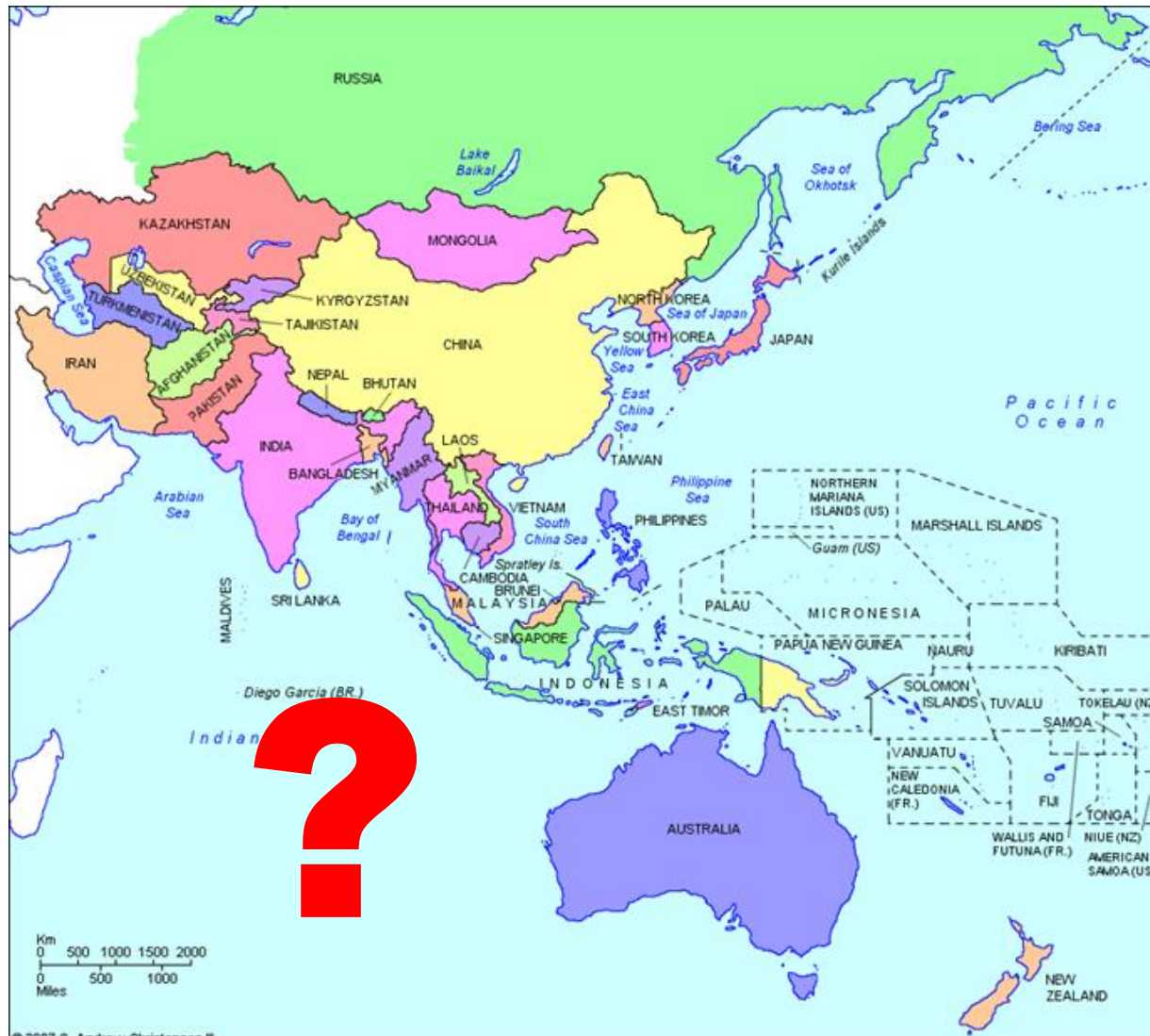
FAA Command Centre



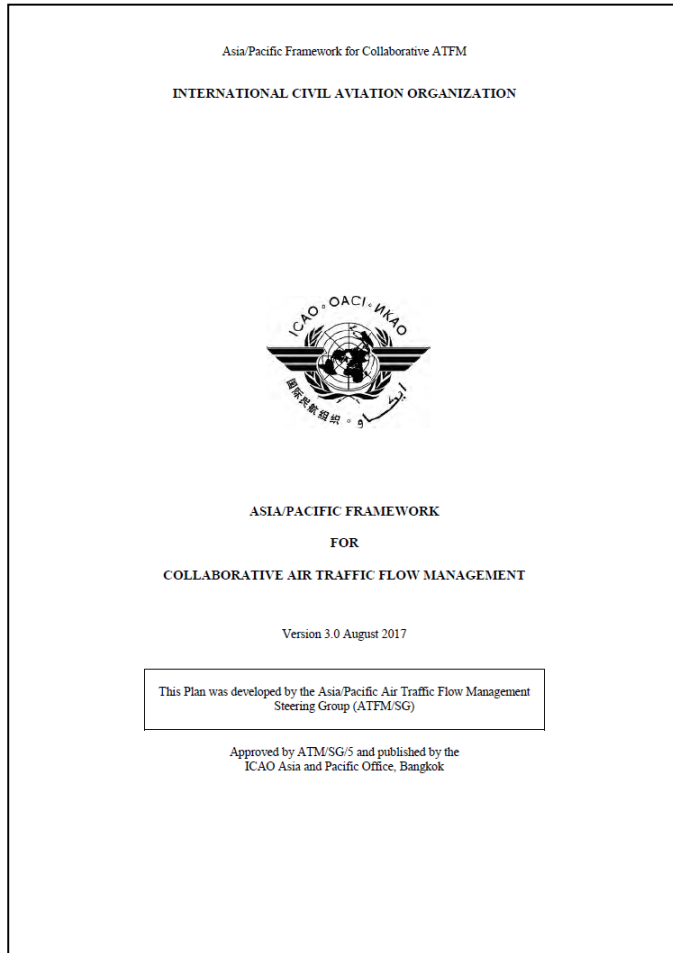
NMOC Eurocontrol



Asia Pacific?



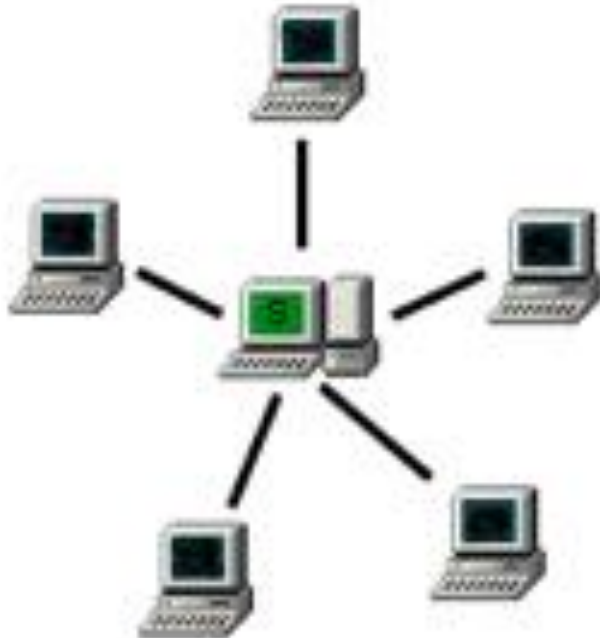
APAC Regional Framework for Collaborative ATFM



- Core concept of the Framework is the ***distributed multi-nodal ATFM network***, i.e. interconnected States and/or sub-Regional groups operating in an ATFM network without the need for any central, physical facility providing the network management function.

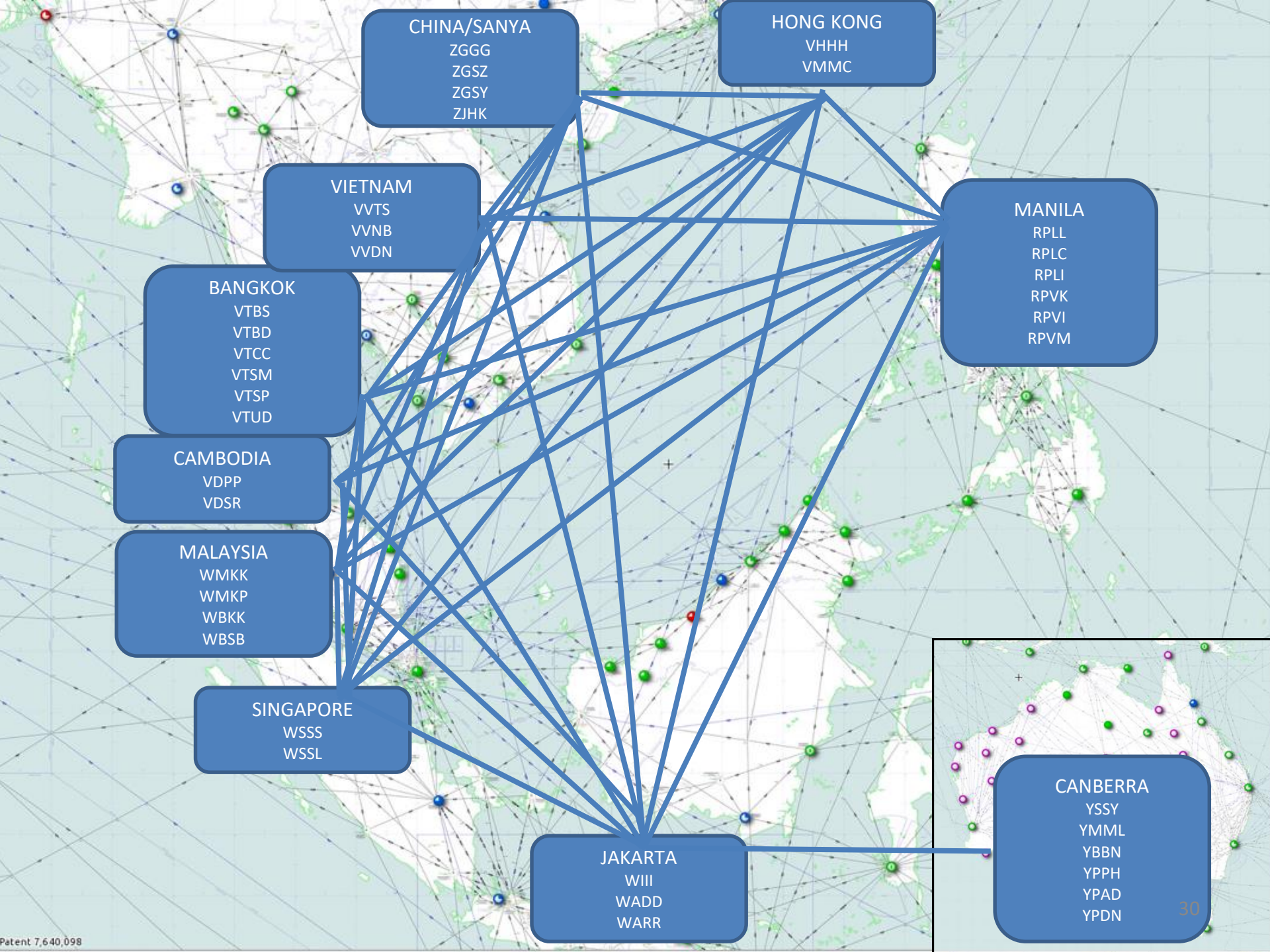
Distributed Multi-Nodal Network

Centralized



Multi-Nodal





CHINA/SANYA
 ZGGG
 ZGSZ
 ZGSY
 ZJHK

HONG KONG
 VHHH
 VMMC

VIETNAM
 VVTS
 VVNB
 VVDN

MANILA
 RPLL
 RPLC
 RPLI
 RPVK
 RPVI
 RPVM

BANGKOK
 VTBS
 VTBD
 VTCC
 VTSM
 VTSP
 VTUD

CAMBODIA
 VDPP
 VDSR

MALAYSIA
 WMKK
 WMKP
 WBKK
 WBSB

SINGAPORE
 WSSS
 WSSL

JAKARTA
 WIII
 WADD
 WARR

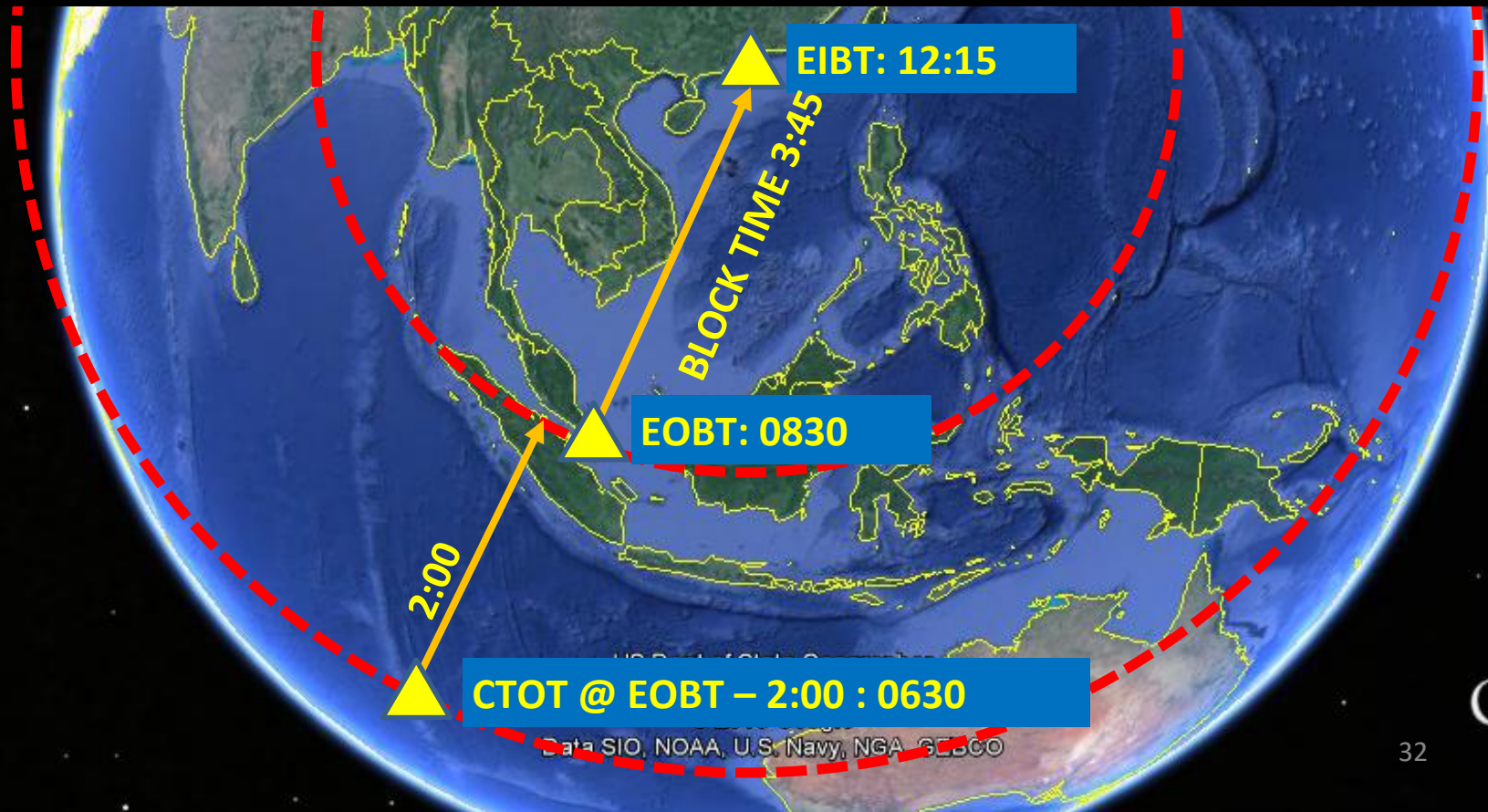
CANBERRA
 YSSY
 YMML
 YBBN
 YPPH
 YPAD
 YPDN

ATFM “Horizon”

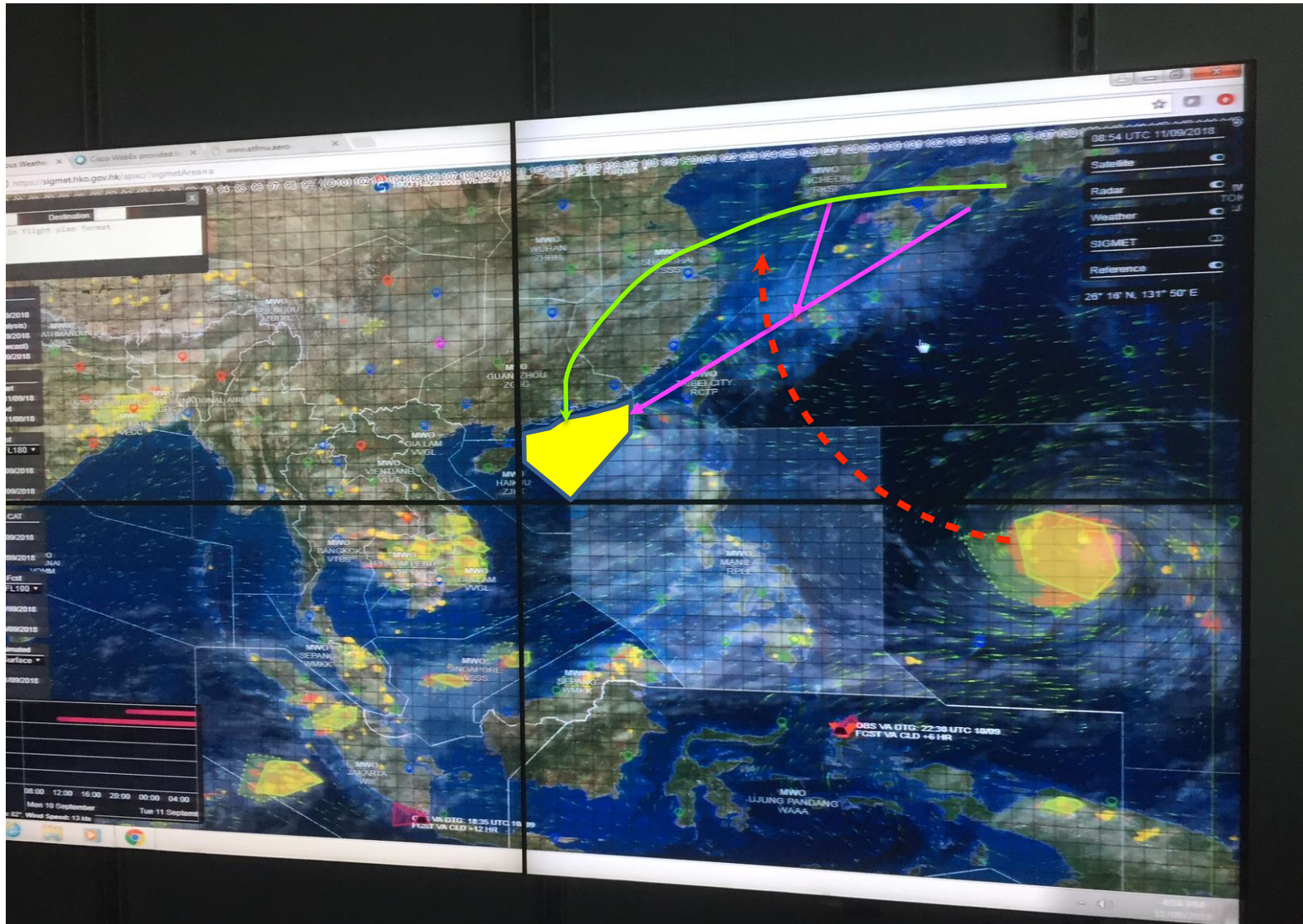
- Governed by the time ahead that we have reasonable predictability
- Ideally based on the need to distribute delay efficiently and equitably amongst at least 70% of the total flights
- For HKIA ~1500NM Radius ~4 hours flying time

Example:SQ860 Singapore Airlines ([Boeing 777-200](#))
Departs Singapore (SIN) 08:30 (02 Oct) Changi Intl
Terminal 3
Arrives Hong Kong (HKG) 12:15 (02 Oct) Hong Kong
Terminal 1
Total travel time 3hrs 45mins

ATFM “Horizon” = Minimum Forecast Period



Expanding to a Regional View



Collaborative Decision Making

- The difficult nature of forecasting and uncertainty involved is understood
- Ultimately an ATFM decision **will** be made based on the information provided
- Need your assistance in providing a level of confidence in those decisions
- Your expertise and efforts in providing the most relevant and accurate MET information is greatly appreciated