INTERNATIONAL CIVIL AVIATION ORGANIZATION

REPORT OF THE AIR TRAFFIC FLOW MANAGEMENT SEMINAR

AND

REPORT OF THE SECOND MEETING OF THE ASIA/PACIFIC AIR TRAFFIC FLOW MANAGEMENT STEERING GROUP (ATFM/SG/2)

HONG KONG, CHINA, 30 September – 04 OCTOBER 2013

The views expressed in this Report should be taken as those of the Meeting and not the Organization

Approved by the Meeting
and published by the ICAO Asia and Pacific Office, Bangkok

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APPENDICES

INTRODUCTION

Meeting

1.1 The Air Traffic Management Seminar and the Second Meeting of Air Traffic Flow Management Steering Group (ATFM/SG/2) were held at Hong Kong Civil Aviation Department Headquarters, Hong Kong, China, from 30 September to 1 October 2013.

1.2 The Air Traffic Flow Management Seminar, conducted to assist States in developing their understanding of the drivers for Air Traffic Flow Management and of Regional and Global ATFM developments, was conducted on 30 September 2013. ATFM/SG/2 was held from 1 – 4 October 2013.

Attendance

2.1 The seminar and meeting were attended by 69 participants from Australia, Bangladesh, China, Germany, Hong Kong China, India, Indonesia, Japan, Malaysia, Maldives, Nepal, New Zealand, Philippines, Singapore, Thailand, United States, Viet Nam, CANSO, EUROCONTROL, IATA, ICCAIA, IFATCA and ICAO. A list of participants is at **Appendix A** to this report.

Officers & Secretariat

3.1 Mr. Mr. Sylvester Israel, General Manager (ATM), Airports Authority of India, and Mr. Peter Chadwick, Senior Operations Officer (Support), Hong Kong China Civil Aviation Department, co-Chaired the meeting.

3.2 Mr. Shane Sumner, Regional Officer ATM, was Secretary for the meeting.

Opening of the Meeting

4.1 On behalf of Mr. Mokhtar A. Awan, Regional Director of ICAO Asia and Pacific Office, Mr. Shane Sumner welcomed all the participants to the seminar and meeting.

4.2 Mr. Norman Lo, Director General of the Hong Kong Civil Aviation Department and Chairman of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG), formally opened the ATFM Seminar and ATFM/SG/2 meeting.

4.3 In his opening address Mr. Lo commented that the Asia/Pacific Region had become the largest aviation market and one of the driving engines for global economic growth, accounting for almost one third of the world's air traffic in terms of Passenger-Kilometres Performed, with robust growth expected to continue in coming years. Devising ways and means to match the strong air traffic demand with sufficient airspace capacities in a timely and efficient manner was a major challenge for ANSPs in the region.

4.4 Mr. Lo further reflected that in Europe, despite a 33% growth in traffic over the last 12 years, additional capacity had been created and ATM delays were contained to an average of 2 minutes per flight. This impressive result was made possible by the effective application of Air Traffic Flow Management (ATFM) measures in the region. APANPIRG had assigned the important task of developing a collaborative, pragmatic ATFM strategy for the Region to the ATFM/SG, and as APANPIRG Chairman Mr. Lo expressed his confidence that ATFM/SG would be able to formulate a suitable ATFM strategy and operating mechanism for the Region.

Election of Co-Chairs

4.5 It was noted that the First Meeting of ATFM/SG/1 was conducted in 2010, and the office of Chair of that meeting had been filled temporarily at the request of the Secretariat for assistance. Due to the complex, technical nature of the work of ATFM/SG and the pressing need for ATFM in varying degree across a diverse range of State and sub-Regional ATM environments, it was considered appropriate that that co-Chairs were appointed for ATFM/SG/2 and future meetings. Accordingly, Mr. Sylvester Israel, General Manager (ATM), Airports Authority of India, and Mr. Peter Chadwick, Senior Operations Officer (Support), Hong Kong China Civil Aviation Department, were elected by the meeting as co-Chairs of ATFM/SG.

Documentation and Working Language

5.1 The working language of the meeting and all documentation was English. There were 15 working papers and 6 information papers considered by the meeting. A list of papers is included at **Appendix B** to this report.

Draft Conclusions, Draft Decisions and Decisions of ATFM/SG – Definition

6.1 A recorded its actions in the form of Draft Conclusions, Draft Decisions and Decisions within the following definitions:

a) **Draft Conclusions** deal with matters that, according to APANPIRG terms of reference, require the attention of States, or action by the ICAO in accordance with established procedures;

b) **Draft Decisions** deal with the matters of concern only to APANPIRG and its contributory bodies; and

c) **Decisions** of ATFM/SG that relate solely to matters dealing with the internal working arrangements of ATFM/SG.

List of Decisions and Draft Conclusions/Decisions

7.1 List of Draft Decisions

ATFM/SG Draft Decision 2/1: ATFM/SG Terms of Reference

That, the proposed Terms of Reference appended at **Appendix C** to this report be adopted for the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG).

7.2 List of Decisions

ATFM/SG Decision 2/2: Asia/Pacific Region ATFM Study

That, the APAC ATFM SG agrees to support a project to be funded by IATA which will, for consideration by the ATFM Steering Group and States:

1. collate current and planned ATFM initiatives in order to establish a regional baseline view of ATFM capability and interoperability, commencing in the 1st quarter of 2014; and, based on this information

2. develop recommended implementation strategies for collaborative Regional and sub-Regional ATFM;

ATFM/SG Decision 2/3: ATFM Specialist Team

That, ATFM/SG forms a team of experienced ATM/ATFM specialists and other stakeholders, communicating by electronic means and, where necessary, holding ad-hoc meetings, to draft, develop and circulate with the coordination and guidance of the Secretariat:

i) the Interim Framework for Collaborative ATFM, in final draft for consideration by APANPIRG/25; and

ii) the Asia Pacific Regional Framework for Collaborative ATFM

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AIR TRAFFIC FLOW MANAGEMENT SEMINAR OUTCOMES

1.1 The seminar was attended by 68 participants from Australia, Bangladesh, China, Germany, Hong Kong China, India, Indonesia, Japan, Malaysia, Maldives, Nepal, New Zealand, Philippines, Singapore, Thailand, United States, Viet Nam, CANSO, EUROCONTROL, IATA, ICCAIA, IFATCA and ICAO.

1.2 Presentations by ICAO, 4 States, and 2 international organizations generated discussion on a range of topics including the industry and aircraft operator business drivers for ATFM, the development of global ATFM guidance material, State collaborative ATFM and Collaborative Decision Making (CDM) implementation programs, tactical ATFM development and outcomes, and the ATFM programs in place in Australia, Europe and the USA. The presentations made were:

Introduction to ATFM

- Asia/Pacific Air Traffic Flow Management (IATA);
- ATFM – An Airline Perspective (IATA);
- ATFM – An Aircrew Perspective (IATA);
- ICAO Doc 9971 ATFM Manual Walk Through (ICAO);
- ATFM – Enabler for Seamless ATM (India);

ATFM in Action

- Development of Tactical Arrival Sequencing (Hong Kong, China);
- ATFM/CDM Development in Australia;
- ATFM – The USA Model; and
- ATFM in Europe (EUROCONTROL)

1.3 The Seminar presentations elicited considerable discussion, and the program was carried over into the morning of Tuesday 1 October. A panel discussion exploring the topic of what ATFM would look like in 2020 had been provisionally planned, but was not conducted due to time constraints.

1.4 The presentations and the subsequent discussion provided useful information to all participants, provided important context and effectively set the tone for the work conducted by the ATFM/SG/2 meeting.

REPORT ON AGENDA ITEMS

Agenda Item 1: Adoption of Agenda (WP01)

1.5 The provisional agenda was adopted by the meeting.

Agenda Item 2: Review Outcomes of Related Meetings

Related Meeting Outcomes (WP02)

2.1 The Secretariat provided information on meeting outcomes related to ATFM/SG from the following meetings, noting that the outcomes from these meetings, conducted over a period of 6 years, may provide important context to the on-going work of the ATFM/SG:

a. The 18th Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/18), Bangkok, Thailand, 3 – 7 September 2007;

b. The ICAO Air Traffic Flow Management (ATFM) Seminar and Workshop, Fukuoka, Japan, 7 - 9 October 2008;

c. The 20th Meeting of the ICAO Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/20), Bangkok, Thailand, 7 – 11 September 2009;

d. The 1st Meeting of the Air Traffic Flow Management Steering Group (ATFM/SG/1), Tokyo, Japan, 8 – 10 December 2010; and

e. The 24th Meeting of APANPIRG (APANPIRG/24), Bangkok, Thailand, 24 – 26 June 2013.

2.2 APANPIRG/18 had noted that regional development of ATFM had recently been added to its list of Key Priorities. Recognizing the need to actively endorse ATFM activities in the region, ***Conclusion 18/7 – Conduct Regional ATFM Seminar*** was adopted to enable parties experienced in the provision of ATFM to share knowledge and provide guidance to less experienced States, with the expectation that it would lead to wider implementation of ATFM regionally. Consequently an ATFM seminar was held in October 2008.

2.3 Recognizing that the ATFM seminar would provide an opportunity to influence regional ATFM planning, a workshop was included in the program to allow the opportunity for recommendations to come forward. Following further consideration by APANPIRG/19 (Bangkok, Thailand, 1 to 5 September 2008) the Seminar/Workshop was tasked with identifying and recommending appropriate regional objectives such as a high level ATFM Concept of Operations for the Region, enhancement of the draft ATFM Communications Manual, mechanisms for data gathering, collation and sharing, reviewing the activities of the Bay of Bengal ATFM Task Force, raising awareness of ICAO provisions regarding ATFM, enhancing ATFM coordination and cooperation in the Asia and Pacific Regions; and identifying regional initiatives to optimize ATFM activities.

2.4 There were 6 Outcomes and 5 Recommendations from the Seminar/Workshop, relating to an ATFM Concept of Operations, a high level Steering Group for ATFM, ATFM data and its use in ATFM planning, data sharing arrangements, sector capacity assessments, a web-based "virtual" ATFMU, Regional ATFM communications guidance material, inclusion of

Seminar/Workshop material in the ICAO HQ ATFM work program, the preference for structural airspace capacity increases over ATFM, and the benefits to other States from access to and use of ATFM knowledge and experience of Australia, Japan, Thailand and the United States.

2.5 Responding to these outcomes, APANPIRG/20 had agreed to ATFM related conclusions forming the ATFM Steering Group to prepare a regional ATFM concept of operations (Conclusion 20/11), adopting the ATFM Communications Handbook as regional guidance material (Conclusion 20/12) and conducting a survey to benchmark the status of ATFM activities in the region (Conclusion 20/13).

2.6 The first meeting of the ATFM Steering Group had developed its own terms of reference, developed the *Asia/Pacific Regional ATFM Concept of Operation* and reviewed the ATFM Communications Handbook.[1]

2.7 ATFM/SG/1 had broadly discussed the current Status of ATFM initiatives in the region, and considered that each of the Major Traffic Flows (MTF) should have ATFM planning regardless of traffic density, to cater for contingency operations in addition to traffic loading. IATA had suggested to the meeting that it may be better to concentrate on sub-regional strategies that focused on MTF, rather than a detailed regional ATFM concept which may be difficult to achieve. ATFM priorities were discussed, and the meeting agreed that civil/military coordination was a key enabler to effective ATFM, as was a common language for expressing ATFM measures. It was also noted that aerodrome operators had a role to play in ATFM Collaborative Decision Making (CDM).

2.8 The ATFM/SG/1 meeting had closed with no outstanding tasks, and no plan for further meetings. Notwithstanding the uncertainty of whether it was necessary for the Steering Group to meet again, the TOR[2] developed by the meeting included the development and maintenance of the aforementioned Regional ATFM concept and communications documents, encouragement and development of mechanisms for ATFM data gathering, collation and sharing, support for the development of integrated sub-regional ATFM systems, and development of CDM processes.

2.9 IATA's views on the focus of ATFM in the Asia/Pacific Regions were considered by the APANPIRG/24 meeting, including the relatively small FIRs in South East Asia and the corresponding low flight transit times, often in the order of 10 to 20 minutes, and the effects on other FIRs of any ATFM measures or procedures applied. Flow management in the region had until recently been based on local actions restricting volumes rather than a wider network view that optimized available capacity on a sub-regional basis. Network-based ATFM was a key element in ASBU Block Zero, which was identified as a critical element in the Asia/Pacific Seamless ATM Plan. It was noted that a centralized ATFM Unit (ATFM) approach was not practical for the Asia/Pacific Region at this

[1] The guidance material provided in the *Asia/Pacific Regional ATFM Concept of Operations* and the *ATFM Communications Handbook for the Asia/Pacific Region* has been incorporated in the *Asia/Pacific Seamless ATM Plan* (adopted by APANPIRG/24), and in the final draft version of Part II of the ICAO *Manual on Collaborative Air Traffic Flow Management* (Doc 9971), which is expected to be adopted by ICAO during 4th Quarter 2013.

time, and a more pragmatic approach would be to concentrate on and support sub-regional multi-State programs.

2.10 The collaborative effort by Hong Kong China, Singapore and Thailand to develop a sub-regional ATFM concept was also considered by the APANPIRG/24. Recognizing the need to research and develop a CDM/ATFM concept that could be implemented at a sub-regional level, a sub-regional ATFM concept comprised of independent virtual CDM/ATFM nodes supported by interconnected information sharing framework had been developed.

2.11 The ATFM Small Working Group (SWG) discussions at the Combined 3rd Meeting of the South Asia/Indian Ocean ATM Coordination Group and 20th Meeting of the South-East Asia ATS Coordination Group (SAIOCG/3 and SEACG/20, Bangkok, Thailand, 12 – 22 February 2013) resulted in the adoption by APANPIRG/24 of several ATFM-related Conclusions regarding ATFM flow management capacity assessments and information sharing, and the re-convening of the ATFM/SG:

Conclusion 24/13: Air Traffic Flow Management Capacity Assessments

That States be urged to establish capacity assessment and adjustment mechanisms, and regular review for all aerodromes and ATC sectors where traffic demand is expected to reach capacity, or is experiencing traffic congestion, and to report the assessment outcomes to the Asia/Pacific Regional Office prior to 1 May 2014.

Conclusion 24/14: Air Traffic Flow Management Information Sharing

That States, where ATFM processes are in place, including within adjacent airspace, be urged to share information, which may include:

a) capacity assessment: including factors of interest affecting capacity, such as special use airspace status, runway closures and weather information;

b) traffic demand information: which may include flight schedules, flight plan, repetitive flight plan data as well as associated surveillance updates of flight status; and

c) ATFM Daily Plan.

Conclusion 24/15: Asia/Pacific ATFM Steering Group

That, States participate in, and support the Asia/Pacific ATFM Steering Group to develop a common Regional ATFM framework, which addresses ATFM implementation and ATFM operational issues in the Asia/Pacific region.

2.12 The Secretariat noted the recurring nature of the central topics discussed during the course of these meetings over the last 6 years.

Review the ATFM SG Terms of Reference (WP03)

2.13 The Terms of Reference (TOR) for ATFM/SG had been developed by ATFM/SG/1, as directed by APANPIRG/20, and were and subsequently agreed by APANPIRG/22 (Bangkok, Thailand, 5 – 9 September 2011).. ATFM/SG/1 completed its assigned tasks, and no further meetings were planned.

2.14 APANPIRG/24 adopted a number of ATFM related conclusions which are noted in paragraph 2.11 of this report. Also adopted was the Asia/Pacific Seamless ATM Plan, which includes a number of ATFM-related references. the Seamless Plan:

- incorporated and built upon the Asia/Pacific Air Traffic Flow Management (ATFM) Concept of Operations;
- endorsed the Aviation System Block Upgrade (ASBU) Block 0 Element – **B0-NOPS** – (*Network Flow Management*) as highest priority – *Critical ASBU Upgrades*, which should be accorded the highest priority in terms of the earliest implementation and required resources;
- recommended the implementation of a range of ATFM-related ASBU Block-0 and Block-1 upgrades:
- referenced Global Plan Initiatives (GPI) 13 (*Aerodrome Design and Management*) and 14 (*Runway Operations)*, and data sharing arrangements to facilitate Collaborative Decision-Making (CDM);
- specified implementation of ATFM incorporating CDM to enhance capacity, as part of the Preferred ATM Service Levels (PASL) Phase 1, with expected implementation by 12 November 2015;
- discussed research and future development possibilities including Sub-Regional ATFM; and
- included among its Seamless ATM Principles Sub-Regional ATFM based on system-wide CDM (ATM Coordination principles) and Collaborative development of CDM, ATFM, A/MAN and D/MAN support tools (ATM Systems and Safety Nets principles);

2.15 Noting the subsuming of ATFM-relevant provisions of global and Asia/Pacific Region-specific documents into the draft Doc 9971, the Conclusions adopted by APANPIRG 24 and its adoption of the Seamless ATM Plan, revised TOR for ATFM/SG were proposed by the Secretariat.

2.16 While review of the TOR was normally undertaken at the end of meetings, the Secretariat proposed that due to the long hiatus between meetings of the Steering Group and the significant changes in the ATFM environment in that time, their review should be considered early in the meeting. The meeting agreed that the proposed TOR amendment should be borne in mind during the course of the meeting, but in order to fully consider the proposed amendments in the context of the

latest ATFM developments and any other direction that would arise, final review of the TOR should be deferred until after all items under Agenda Item 5 had been completed. Consequently, and after completion of Agenda Item 5, the meeting agreed to the proposed changes with some further amendments, with following explanatory notes:

- Reference to the ATS Planning Manual (Doc 9426) was replaced by reference to the Manual on Collaborative Air Traffic Flow Management (Doc 9971);
- Reference to Major Traffic Flows (MTF) was replaced with a more clear and better targeted description of airspace considerations for ATFM;
- Reference to the Seamless ATM Plan and its provisions for structural airspace capacity measures replaced the former wording;
- The requirement to develop a Concept of Operations was replaced by the requirement to develop an ATFM framework addressing ATFM implementation and operational issues;
- The requirement to review and update the *ATFM Communications Handbook for the Asia/Pacific Region* was deleted due to its supersession by Doc 9971 and the Seamless ATM Plan;
- The provisions of APANPIRG Conclusions 24/13 and 24/14 were incorporated in paragraph 2, with some rewording to clarify the expected output of the Group;
- A new requirement to research and recommend guidance regarding compliance by airspace users with ATFM measures was added;
- Redundant information in paragraph 3 was removed and replaced with a requirement for the coordination and alignment of CDM/ATFM programs;
- Reference to development of an ATFM web site was removed as it was now covered by the reworded paragraph 2;
- The reporting requirement was changed to reflect the re-named ATM Sub-Group.

2.17 The meeting agreed that the proposed TOR should provide guidance for the on-going work of the Group, pending their adoption by APANPIRG/25 in September 2014. The meeting also agreed to the following Draft Decision for consideration by the ATM Sub-group:

ATFM/SG Draft Decision 2/1: ATFM/SG Terms of Reference

That, the proposed Terms of Reference appended at **Appendix C** to this report be adopted for the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG).

Agenda Item 3: ATFM/CDM Global Update

3.1 There were no papers provided under this Agenda Item.

Agenda Item 4: Review of Current CDM/ATFM Operation and Problem Areas

Current ATFM Status in Japan (IP03)

4.1 The meeting was provided with an update of the current status of ATFM in Japan. In response to the approval of the new CNS/ATM concept by the 10th ICAO Air Navigation Conference in 1991, Japan had in 1994 commenced implementation of modernized and system based ATFM with the establishment of the ATFM Center, balancing demand and capacity and distributing delay information to aircraft. In 2005 The Air Traffic Management Centre (ATMC) was established, recomposing the ATFM Center to act as the leading and central function to drive forward Japan's Air Traffic Management (ATM) by integrating Airspace Management, ATFM and Air Traffic Control services Japan recognized that CDM/ATFM would contribute to future Trajectory Based Operations (TBO), and would enable improvements in the accuracy of traffic demand forecasts.

4.2 Japan had developed and implemented ground delay, ground stop and slot swapping programs, a rerouting program for strategic, pre-tactical and tactical ATFM phases, miles-in-trail and minutes in trail, and the Specifying Calculated Fix Departure Time for Arrival Spacing (SCAS) program. The ATMC coordinated closely with the meteorological agency to determine capacity values, and was continuing to study the effective utilization of weather information for ATFM. Bi-annual collaborative meetings with all ATM stakeholders were held to ensure transparency of the equality of all stakeholders. CDM would be achieved by close coordination and cooperation with concerned parties,, enabling effective ATFM taking into consideration the plans of aircraft operators.

International ATFM in Japan (IP04)

4.3 Japan provided the meeting with information on the status of collaborative international ATFM programs. These programs had commenced in 2007 based on bi-lateral agreements between Japan, South Korea and Taiwan. Letters of Agreement (LOA) had been established to introduce procedures intended to maximizing ATC capacity and minimizing restrictions. Flow control was implemented when excessive airborne holding was occurring or predicted, when capacity fell at defined international airports, if ATC systems malfunctioned, if foreign ATC or ATFM facilities imposed restrictions, to address adverse effects on international traffic flows, and as necessary to ensure safety.

ATC Delays at Male' International Airport (WP09)

4.4 Maldives provided information briefing States on the ATC delays faced at Male'/Ibrahim Nasir International Airport (INIA), and requesting ATFM/SG participant States to share their experiences in resolving similar issues.

4.5 The volume of air traffic demand at certain periods of the day had exceed the airport's capacity, and ATC and ground services were facing day to day problems and complaints from airline operators. The existing single runway operations without rapid exit taxiways, and the towing of the majority of aircraft from the apron onto the runway had stretched the system. Towing was necessary due to the limited space available for aircraft to maneouvre under their own power, due to the

proximity of the terminal building, property and persons. This required at least 7 to 15 minutes per aircraft. If two or three aircraft required towing for departure the third could take up to 30 minutes to depart from time of door closure. A spacing of 20NM or 10 minutes was applied between arriving aircraft, with 10 to 15 minutes applied between consecutive PANS/OPS Category E aircraft.

4.6 The meeting noted that airport design had a significant impact on ATM and on the management of traffic flow. It was further noted that the problem at INIA was a good example of a location where a schedule coordination scheme would be very useful. Such a scheme should be managed by agreement between airport management and aircraft operators. It was further noted that there were two peak periods, and a slot management system would smooth out demand.

4.7 Maldives advised that there was a slot committee for the airport at which ATC were represented, but had little influence.

4.8 New Zealand commented that the situation appeared to be similar to that of Queenstown, New Zealand, where an effective ATFM process was in place, and would discuss this further with Maldives.

Current ATFM Status in China (IP16)

4.9 China provided information highlighting the significance of developing an ATFM system, and on China's introduction of a CDM/ATFM in 2012 its continuing development.

4.10 China had established its CDM system at 23 major airports, with the function of providing Target Start Approval Time (TSAT) and Calculated Take-off Time (CTOT) to concerned units such as airlines and airports 90 minutes before estimated time of departure.

4.11 During the trial and implementation of CDM operation at Beijing, Shanghai, Guangzhou and Shenzhen airports there was a reduction in ground holding time and ground taxying time. Statistical data indicated that CDM effectively reduced ground holding time at Beijing by an average of 7 minutes and ground taxying time by an average 5 minutes, and at Guangzhou/Baiyun by an average of 13 minutes (ground holding) and 5 minutes (ground taxying).

The future plan for China included an upgrade of flight plan management and traffic situation display, and of strategic and tactical ATFM. A CDM system construction project included three phases of airport CDM:

- CDM systems at 23 major airports in 2013; followed by
- CDM systems at 44 regional airports; then
- CDM systems at all airports in China.

4.12 A national level CDM/ATFM system **(Figure 1**) would also be constructed, providing CDM-flight plan management and real time CDM-operation management**.** The integration of Hong Kong China and Macau China airports with the China CDM system coordination processes was also being planned.

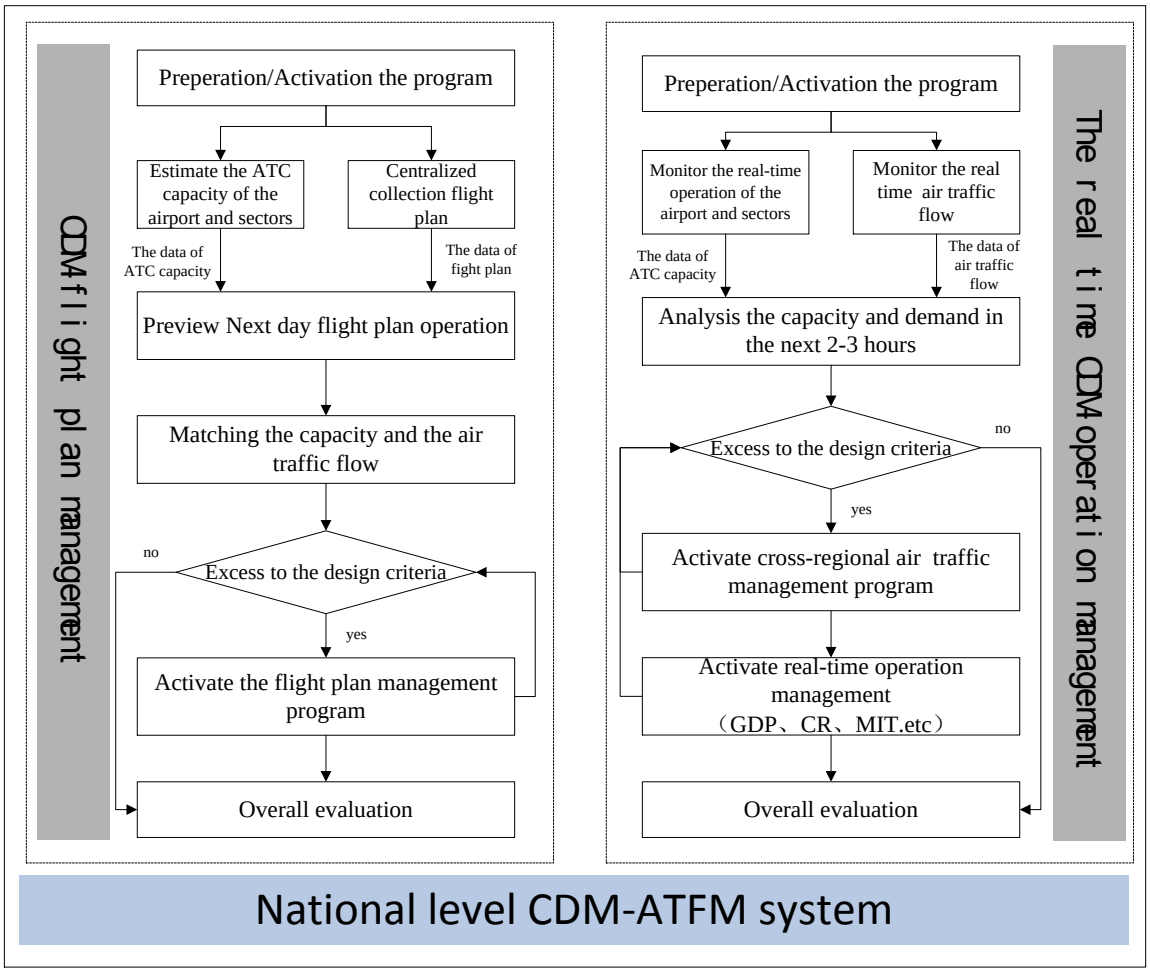

Figure 1: China's Planned National Level CDM/ATFM System

Agenda Item 5: Development of Regional ATFM Framework

ASEAN AATIP Approach to ATFM (WP08)

5.1 EUROCONTROL provided a summary of the proposed approach of the Association of South East Asian Nations (ASEAN) Air Transport Integration Project (AATIP) in the domain of ATFM. The views presented are those of the AATIP project team, and the endorsement of the ASEAN member States had not been sought or received.

5.2 AATIP was a project funded by the European Union to support ASEAN in the creation of an aviation single market. The project was implemented by the European Aviation Safety Agency (EASA), through a consortium with EUROCONTROL, the United Kingdom Civil Aviation Authority and the Directorate General of Civil Aviation of France. Air Traffic Management (ATM) was one of 4 work packages. The main elements of the ATM domain are illustrated in **Figure 2**.

5.3 A workshop of experts from ASEAN member States agreed that AATIP would take the lead in the development of an ASEAN concept of operations for ATFM. Such developments would build on the ICAO ATFM guidance document (Doc 9971), and would take into consideration the on-going developments in the area such as the ATFM/CDM tri-partite initiative.

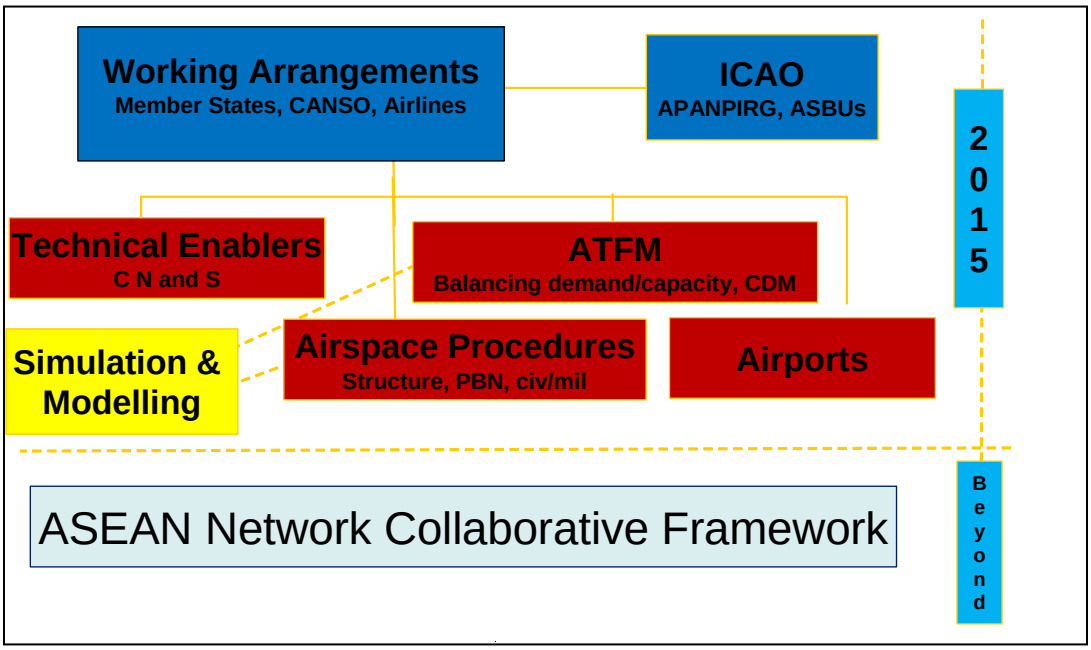

Figure 2: AAITIP ATFM Domain Elements

5.4 It was proposed to further analyze current and planned ATFM initiatives in the ASEAN and APAC region. Any AATIP proposals would be based on the strengthening and harmonizing these initiatives, rather than any proposal to design an ATFM system from start.

5.5 An important enabler for a functioning ATFM was the development of correct capacity baselines. This was a major element of the AATIP ATM work program and it was intended to acquire a functioning simulation and modelling capability for the ASEAN area within the next 18 months.

5.6 The priorities of AATIP in proposing an ATFM development plan for the ASEAN area included include, *inter alia*,

- ATFM in ASEAN must be fully in line with ICAO regional (APAC) and global considerations.
- Interoperability and exchange of flight and all other relevant ATFM data was a strong long term requirement.
- Sharing of information on ATM system resources and constraints across regions on a real time basis was a long term requirement.
- ATFM should be an integrated component of the ATM system
- Local ATFM initiatives should complement and add to a regional ATFM concept and consistency between ATFM initiatives must be assured.
- The concepts of equity and regional performance optimization needed to be carefully balanced.
- ATFM must address capacity shortfalls with capacity improvement initiatives and not just ration current capacity.

- Airports and their operators and stakeholders must be fully integrated in ATFM initiatives form the outset.
- Relatively simple ATFM initiatives could be established to deal with specific capacity issues.

5.7 The meeting was informed that the objective date of 2015 was established by ASEAN Ministers to maintain pressure for forward movement, and to reaffirm their intent. ATFM initiatives under AATIP would be progressed during that time, but a more realistic expectation for complete implementation was 2017 – 2020.

Sub-Regional Air Traffic Flow Management (WP05)

5.8 IATA and CANSO presented a proposal to the meeting that the goal for the ATFM/SG should be a collaborative flow management function with distributed authority across the airspace and FIRs associated with the region's major traffic flows (MTF).

5.9 The meeting was reminded that the Asia/Pacific Seamless ATM Plan identified ATFM as a critical element (Aviation System Block Upgrade B0-NOPS). There was also a growing recognition that taking a network view of ATFM was a critical process in order for APAC to manage forecast aviation growth. Additionally, the IATA Economic study in support of the Seamless ATM Plan estimated that aviation's contribution to Regional GDP will rise from 2.2% to 4% by 2030 if demand can be accommodated. The economic penalty of not implementing seamless operations was a 1.42% drop in that contribution to Regional GDP, to 0.8%. By 2030 this would represent a cumulative economic loss in the order of USD15trillion to APAC economies.

5.10 While it was clear that a regional centralized flow management function was not feasible in the medium term, IATA and CANSO supported some form of regional collaborative flow management function with distributed authority as the goal for the APAC environment.

5.11 There was a clear need for multi-FIR (sub-regional) ATFM solutions taking a network view to be developed and implemented. There was also now the opportunity to harmonize procedures and rules for sub-regional ATFM before implementation, rather than trying to harmonize already operational systems.

5.12 It was proposed that sub-regional ATFM centred on the airspace and FIRs associated with the MTF AR 2, 4 and 9 would yield the most effective participation levels for ATFM measures.

5.13 IATA was prepared to support and commission a study by external subject matter expert(s) to develop a baseline of current capabilities and chart future plans, from which the work would continue to develop a set of options for consideration by States and the ATFM/SG. IATA required agreement and support from States and ATFM/SG to strengthen the case for internal approval.

5.14 It was clarified that the proposal was, in simple terms, to do a survey to establish the current situation, and then develop a possible implementation strategy for further consideration by the ATFM Steering Group and States. The meeting discussed the proposal at length, and deferred the decision on the proposal until Agenda Item 5 had been completed, as this would provide a more complete view of the different ATFM initiatives being conducted in the Region, and the need for the proposed study.

5.15 Subsequent discussion by the meeting recognized the necessity of ensuring the alignment of the different multi-State ATFM projects and the regional ATFM framework. The IATA-sponsored study would provide the Steering Group with essential information that would assist the Group in meeting the requirements of its new Terms of Reference. The meeting supported the initiative, and agreed to the following Decision:

ATFM/SG Decision 2/2: Asia/Pacific Region ATFM Study

That, the APAC ATFM SG agrees to support a project to be funded by IATA which will, for consideration by the ATFM Steering Group and States:

1. collate current and planned ATFM initiatives in order to establish a regional baseline view of ATFM capability and interoperability, commencing in the 1st quarter of 2014; and, based on this information

2. develop recommended implementation strategies for collaborative Regional and sub-Regional ATFM;

Regional Framework for Collaborative ATFM (WP04)

5.16 The Secretariat proposed a work plan and methodology to develop the Asia/Pacific Region Framework for Collaborative Air Traffic Flow Management.

5.17 The meeting was reminded of the adoption by APANPIRG/24 of the Asia/Pacific Seamless ATM Plan, and of the several Conclusions listed in paragraph 2.11 of this report, one of which included the requirement that ATFM/SG develops a common regional ATFM framework.

Hierarchy of Regional Planning Documents

5.18 Regional air navigation planning documents including the *Asia/Pacific Region Air Navigation Plan or (*RANP, Doc 9763), *Asia/Pacific Seamless Air Traffic Management (ATM) Plan* and other Regional guidance material or framework documents fell within a hierarchy of documents detailing global vision and strategy, and guiding regional implementation. It was envisaged that the Regional Collaborative ATFM Framework would be contributory to the Seamless ATM Plan. The new Part III of the RANP was under development, and was expected to detail non-binding Regional guidance material, incorporating key components of the Seamless ATM Plan.

Schedule of Meetings and Work Plan for ATFM/SG

5.19 While no schedule of meetings was specified by APANPIRG, the need for a regional ATFM framework to guide ATFM implementation that would manage the rapid growth of Asia/Pacific Region traffic indicated that an aggressive timeline should be pursued. It was proposed the regional ATFM framework be developed over the course of three further meetings, held at intervals of approximately five or six months according to the following work plan:

ATFM/SG/2 - Conceptualizing

- Discuss, develop and agree to the Draft Framework for Collaborative ATFM concept and methodology;
- Construct the initial draft of the framework document; including:
  - Table of Contents;
  - ATFM principles;
  - ATFM service capability elements including ATFM services, tools and procedure levels; and
  - Preferred ATFM Service Categories (PAS) based on airspace complexity and traffic density, and defining the minimum suite of capability elements required for each category of PAS.

- Discuss a process for collection, analysis and reporting of demand and capacity data;

- Agree to the concept and deliverables for a draft Interim Collaborative Framework document.

- Form a group of 4 to 6 appropriately skilled and experienced ATM specialists from ATFM/SG participants for the development, review and circulation of the framework and the interim framework document between meetings, coordinated and assisted by the Secretariat.

ATFM/SG/3 – Analyzing

- Conduct Analysis and further development of:
  - Demand and capacity data and related information;
  - ATFM service capability elements; and
  - Preferred ATFM Service Categories.

- Agree to the final draft of a Preliminary Framework for Collaborative ATFM for approval by the 2nd Meeting of the Air Traffic Management Sub-Group (ATM/SG/2).

ATFM/SG/4 – Early Draft Framework

- Early Draft Regional Framework for Collaborative ATFM.

ATFM/SG/5 – Completion

- Completion of the final draft of the Regional Framework for Collaborative ATFM, for submission to APANPIRG through its Air Traffic Management Sub-Group (ATM/SG).

5.20 While the scheduled dates for meetings were dependent on the ICAO Regional Office meetings program, scheduling considerations would take into account the Asia/Pacific Seamless ATM Plan and its Performance Improvement Plan objectives and milestones. In particular, the ATFM/SG/5 meeting would need to be scheduled to ensure the framework document was in its final draft form and ready for consideration by the ATM/SG/3, tentatively scheduled for late July or early August 2015, and subsequent adoption by APANPIRG/26 in September 2015.

5.21 After lengthy discussion the meeting agreed to the proposed schedule, noting the need for an aggressive schedule to provide the earliest possible delivery of the regional framework. It was also noted in response to questions from participants that this was an agreement by the meeting relating to its work plan. It did not infer or imply that the meeting's agreement to the schedule required participants to commit their State to provide resources.

Alignment of Regional Collaborative ATFM Framework and Seamless ATM Plan

5.22 In order to ensure a standardized approach and the alignment of the Regional ATFM Framework with policy direction provided by the Seamless Plan, the objectives, principles, and implementation timelines of the ATFM framework would be based on those of the parent document.

5.23 ATFM-Related elements of the Seamless ATM Plan are provided in **Appendix D** to this report.

Framework for Collaborative ATFM Document

5.24 As it was envisaged that the ATFM framework document would be contributory to the Seamless ATM Plan, it was proposed that it should be presented in the same structure and format. A skeletal draft of the proposed structure of the framework document was provided for the meeting's consideration (**Appendix E** to this report). The meeting agreed to use this initial draft as the basis for development of the framework document, noting that the development of the document would be enhanced by the involvement of the meeting participants who had been involved in the drafting of the global ICAO Manual on Collaborative Air Traffic Flow Management (Doc 9971). This would ensure the framework was aligned with the global guidance material. .

5.25 The document would be further developed offline before it was again presented in draft form to ATFM/SG/3 for consideration and further direction.

Draft Regional ATFM Principles

5.26 The ICAO Twelfth Air Navigation Conference (AN-Conf/12, Montreal, 19-30 November 2012) endorsed 10 High Level Air Navigation Policy Principles in the GANP. The Asia/Pacific Seamless ATM Principles were aligned with these high level principles. The *Asia/Pacific Region ATFM Concept of Operations* also included policies and principles developed by ATFM/SG/1. While this document is now superseded, its principles could also provide guidance to the ATFM/SG for formulating principles for the Framework for Collaborative ATFM.

5.27 Principles from the following documents were considered for inclusion in the Framework:

i. Seamless ATM Plan;
ii. Asia/Pacific Region ATFM Concept of Operations; and
iii. Final Draft of the Manual on Collaborative Air Traffic Flow Management (Doc 9971)

5.28 It was proposed that the ATFM/SG should define sufficient principles to ensure completeness of the framework document, while avoiding where practicable the duplication of principles already stated in related higher level documents or in global guidance.

5.29 A draft suite of principles was provided by the Secretariat for the meeting to consider. The draft principles included those from the abovementioned documents only where they were specific to ATFM, or where modification or elaboration to render them more ATFM-specific would be beneficial to the framework.

5.30 The meeting discussed whether ATFM was part of a regulated service, and whether personnel providing ATFM services should be licensed. It was apparent that some States were planning license qualifications and requirements for ATC experience for ATFM operators, while others were not. It was agreed that this was a matter for State regulators to determine, and the framework should rather provide guidance on competencies of ATFM operators, should it be considered necessary. It was further noted that rather than a prescriptive approach in the framework to the qualifications of ATFM or other related ATC support staff, a system should be in place to ensure the quality of decisions made by ATFM system administrators/operators.

5.31 The role of ATC in management of pilot/aircraft operator compliance with ATFM measures was also discussed. Australia and New Zealand advised that this was a significant problem. Australia had addressed this by post-operational analysis and reporting in the longer term, supplemented by short term targeted activities, including a "blitz" of reporting of non-compliance and the de-prioritization of non-compliant aircraft. The meeting generally agreed that the prioritization of compliant flights and de-prioritization of the non-compliant was necessary to ensure the effectiveness of the network.

5.32 EUROCONTROL noted a "compliance day" in Europe had resulted in a capacity improvement of more than 5%. There was extensive compliance material available, which would be provided for the Steering Group's consideration.

5.33 Thailand noted that where there was generally compliance of 80% or more targeted activities would yield positive results, but some current situations where compliance was in the range of 20 – 30% would be more problematic.

5.34 The draft principles, as discussed and either amended by the meeting or with added comments for further consideration, are provided at **Appendix F**. The meeting agreed that these would form the basis of the final regional collaborative ATFM principles, after further development by the Steering Group.

ATFM Capability Elements (Tools/Procedures)

5.35 It was recognized that most if not all ATC units in the Region provided some form of ATFM service. The actual service may in many cases have been simple, or may have been provided through a well-developed and coordinated, automated CDM/ATFM system, or by manual flow control process, or by far less developed ad-hoc traffic management techniques applied by individual sector controllers. In other cases rudimentary ATFM outcomes were achieved by applying a single large longitudinal spacing no matter the level of demand, or use of non-surveillance separation standards within areas of contiguous surveillance coverage.

5.36 It was proposed that a central task for the ATFM/SG was the definition of the minimum ATFM service capability applicable to particular types of airspace, using a tailored selection of *capability elements* from a suite of tools, procedures and practices to flexibly and efficiently manage demand. This required the definition of a comprehensive list of ATFM capability elements.

5.37 An initial draft suite of ATFM tools, practices and procedures was provided for the meeting's consideration, to provide a starting point for the development of a suite of capability elements for inclusion in the ATFM framework.

5.38 The meeting discussed the concepts of Strategic, Pre-Tactical and Tactical ATFM, and noted that the delineation between the three ATFM phases was not well defined. It was noted that the phases should best be defined by their outcomes, rather than a rigid definition of the times or the particular pre-flight or in-flight stages to which they would apply.

5.39 The draft ATFM capability elements, as discussed and either amended by the meeting or with added comments for further consideration, are provided at **Appendix G**. The meeting agreed that these would form the initial basis for the final regional collaborative ATFM capability elements, after further development by the Steering Group.

Preferred ATFM Service Categories

5.40 To correctly define the ATFM service capability applicable to any particular airspace sector it was necessary to also define categories of airspace sector within which a minimum set of service capability elements should be provided. Such categories should be determined by traffic density and airspace complexity, where complexity measurement includes such factors as traffic mix (IFR and VFR traffic, jet v non-jet, military activity, general aviation activity), airspace constraints, environmental factors, meteorological factors, etc.

5.41 Once the ATFM service categories were determined, the ATFM Capability Elements applicable to each category should be defined. An example of a matrix of Preferred ATFM Service Categories and the associated ATFM capability elements is provided at **Appendix H** to this report.

5.42 The meeting agreed that the matrix would, with further refinement, be a useful tool for determining ATFM categories of airspace and the associated minimum capability elements. Singapore stated that the airport capacity must be included in definitions of airspace capacity, as it was fundamental to the management of overall airspace capacity and demand.

5.43 The meeting agreed that the determination of preferred ATFM service categories for ATFM would require consideration of all factors affecting capacity, including but not limited to airport capacity.

Functional Airspace Blocks

5.44 It was proposed that contiguous sectors of airspace of the same Preferred ATFM Service Category should form functional airspace blocks, sharing common ATFM procedures and processes, with CDM/ATFM decisions and coordination provided from a common ATFM Unit, Centre or Virtual Centre.

5.45 This proposal generated considerable discussion. Much of that discussion was generated by some confusion regarding the intent of the proposal, the airspace concepts of the seamless ATM plan, and the use of the term *functional airspace blocks* in the European airspace context. There was, however, also differing opinion on whether the concept of contiguous sectors of airspace with the same level of ATFM service was either desirable or valuable. It was noted that the future ATFM network could be adversely affected by differing levels of ATFM capability applicable to flights transiting between airspaces with high levels of ATFM service through airspace with a lower level of ATFM service. Conversely, an ATFM network may be capable of managing the airspace of lower

capability within the overall network operation. Noting this, the meeting considered that this concept may be more appropriately explored at later meetings of the Steering Group, as the framework becomes further developed.

Interim Asia/Pacific Regional Framework for Collaborative ATFM

5.46 It was proposed to the meeting that, given the time required for development of the regional ATFM framework notwithstanding, there was also the need to develop within a shorter timeframe guidance material for the implementation of interim ATFM procedures, particularly in cases where little or no organized or targeted ATFM was currently in place.

5.47 Development and promulgation of Regional guidance for interim ATFM solutions would not only provide earlier benefit to airspace users, but would also provide States having little experience in ATFM the opportunity to gain knowledge and experience before embarking on the more detailed implementation that would be driven by the broader ATFM framework.

5.48 It was envisaged that interim ATFM framework may include fundamental, introductory Tactical and Strategic ATFM guidance such as:

- Demand and Capacity Analysis:
- Tactical ATFM Implementation:
  - procedure development;
  - Training Development
  - Initial ATFM implementation
  - Review of outcomes
- Tactical ATFM Optimisation:
  - airspace and ATS route re-design;
  - procedure re-design
  - training development
  - optimized tactical ATFM implementation
- Strategic ATFM
  - Arrival slot program.

5.49 The Interim Asia/Pacific Regional Framework for Collaborative ATFM would be primarily based on the guidance provided in the *Manual on Collaborative Air Traffic Flow Management* (Doc 9971), once adopted by ICAO. The guidance material developed could later be included in or appended to the regional collaborative ATFM framework.

5.50 The meeting agreed that the Steering Group should develop the interim framework, with the final draft planned to be available for consideration by ATFM/SG/3.

ATFM/SG Specialist Team

5.51 In order to progress the work of the ATFM/SG it was necessary to form a small team ATFM experts, primarily from an operational ATM and ATFM background but also including industry representation, and having access to technical/engineering advice on network communications technology and applications. The primary task of this team was the initial drafting of the ATFM framework and on-going, between-meetings development of its Principles, Capability Elements and Preferred ATFM Service Categories before wider circulation to the Steering Group.

5.52 In parallel to this work the team would also develop the Interim Regional Framework for Collaborative ATFM, using similar work methods and supplemented where necessary by ad-hoc meetings.

5.53 ATFM/SG agreed to the following Decision:

ATFM/SG Decision 2/3: ATFM Specialist Team

That, ATFM/SG forms a team of experienced ATM/ATFM specialists and other stakeholders, communicating by electronic means and, where necessary, holding ad-hoc meetings, to draft, develop and circulate with the coordination and guidance of the Secretariat:

iii) the Interim Framework for Collaborative ATFM, in final draft for consideration by APANPIRG/25; and

iv) the Asia Pacific Regional Framework for Collaborative ATFM

Parallel Implementation Programs

5.54 Primary points of contact for the ATFM Specialist Team are provided at **Appendix I**.

5.55 A number of Asia/Pacific States/Administrations and/or air navigation service providers had commenced the analysis, development and implementation of ATFM solutions, either independently or assisted by other States, international organizations, industry partners and/or ATM and ATFM systems vendors. While it was in the interests of all parties to recognize the importance of this work, and that the initiation and progress of these programs continued, it was also important to ensure these programs and the regional framework were compatible. This was particularly so in the context of the envisaged sub-regional collaborative ATFM networks.

5.56 It was proposed that the sharing of information between States and the ATFM/SG would provide valuable opportunity for the Steering Group to benefit from knowledge and experience gained by States, and for the inclusion of beneficial aspects of State plans in the regional framework. Conversely, the deliberations and decisions of the Steering Group would provide useful guidance for States to adapt their ATFM programs to align with the framework. A draft Conclusion had been proposed, but the meeting considered that **ATFM/SG Decision 2/2** supporting an IATA funded project would provide the required information on parallel programs within the Region, from which the Steering Group could then determine how best to ensure alignment of such programs and the regional ATFM framework.

Concept Development for a Distributed ATFM Network for the Region (WP06)

5.57 The meeting was presented with an update on the on-going collaboration between Hong Kong China, Singapore and Thailand to develop a concept of ATFM based on Collaborative Decision Making (CDM) through sub-regional cooperation, and involving the development of a distributed regional ATFM network.

5.58 Unlike ATFM solutions based on centralised systems such as those found in Europe and North America, the concept for the Asia/Pacific region would be a distributed multi-nodal ATFM network. Such interconnected ATFM nodes residing within individual ANSPs in the region could form the larger virtual ATFM for the region.

5.59 The concept involved each ANSP operating an independent, virtual CDM/ATFM node supported by an interconnected information sharing framework. Airport-CDM mechanisms, especially at busy airports could aid the CDM process between the ANSPs, and flows of air traffic would be managed effectively based on a common set of agreed principles among the participating ANSPs and airports.

5.60 A node comprising an ANSP with associated airports within a defined catchment area would manage the demand and capacity through adjustments in aircraft Target Landing Times (TLDT) which would in turn influence the issuance of Calculated Takeoff Times (CTOT) for aircraft at the participating airports within that catchment area. The resulting coordination would further enable the assignment of Target Start-up Approval Times (TSAT) for aircraft with the aid of A-CDM. The relevant information would in turn be shared with other participating nodes in the network. When replicated among similar combinations of ANSPs and airports in defined catchment areas the result would be a larger network, eventually connecting each sub-Region with other ATFM nodes beyond, as illustrated in **Figure 3**.

5.61 The concept would benefit both ANSPs that manage hubs with predominant international air traffic and those that handled domestic air traffic, and complement existing established ATFM units and any other developing ATFM units that manage domestic air traffic.

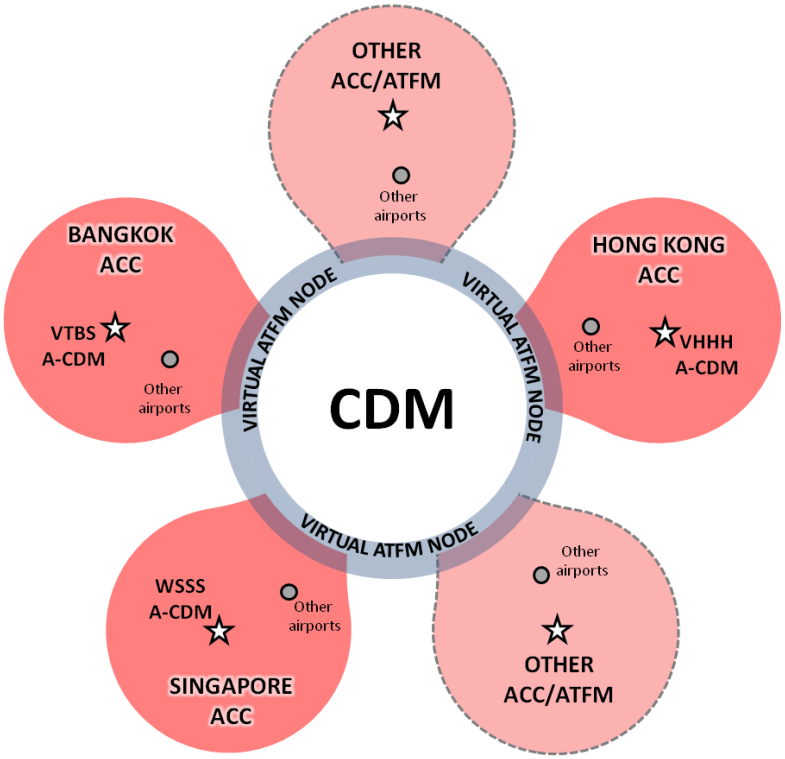

Figure 3: Distributed Multi-Nodal ATFM Network

5.62 Recognizing the challenges involved in developing a mature multi-nodal virtual ATFM/CDM concept, a two-part approach to this endeavour was adopted. First was a CDM information sharing trial focused on the objective of a framework enabling effective exchange of relevant operational information between the three parties. This is essential for the collaborative decision making process between the three ANSPs, and the consideration of a web-based portal to enhance information-sharing between the ANSPs. An operational trial utilizing existing

communication resources commenced in early September 2013.

5.63 A second, concurrent part of the project focused on concept development and the potential for implementation on a sub-regional scale. Stakeholder engagement sessions involving airlines, airport operators, ground handling agents and the three ANSPs formed the basis for the development of ATFM concepts and procedures.

5.64 The concept exploration would be carried out on an integrated test bed facility at the Singapore Aviation Academy, using fast time and Human in the Loop (HITL) simulation to test various scenarios. It was anticipated that the results of this research would be completed by December 2013.

5.65 The three States were also participating in other ATFM efforts in the region, including the Asia Pacific Economic Cooperation (APEC) Air Traffic Management Emissions Reduction Project, and the Association of South East Asian Nations Air Transport Integration Project (AATIP). Recognizing the various parallel developments, there was a need for convergence of effort and collaboration in order to avoid duplication of effort in implementing a sustainable ATFM framework.

5.66 EUROCONTROL commented that this was an encouraging development in ATFM, and that this was the first attempt anywhere in the world to establish a distributed multi-nodal ATFM network. While it would be challenging to implement, it should be encouraged as it would introduce operational improvements without waiting for the regional framework to be developed. It was further commented that as this initiative was breaking new ground it would merit exposure on the global stage.

5.67 Hong Kong, China commented that the concept had already delivered benefits during the passage of two typhoon systems and the recent disabled aircraft runway outage in Bangkok.

5.68 The meeting agreed that the distributed multi-nodal network was perhaps the only viable solution to the ATFM needs of the region, and that the Specialist Team should include the concept in the work of developing the regional framework.

ATFM Capacity Scope and Units (WP07)

5.69 A discussion of the need for guidance on units and scope of ATFM airport and airspace capacity measurement was presented by Thailand.

5.70 APANPIRG Conclusion 24/13 urged States to establish capacity assessment and adjustment mechanisms and regular review of all aerodromes and ATC sectors where traffic demand was expected to reach capacity, or was experiencing traffic congestion, and to report the assessment outcomes by 1 May 2014.

5.71 Thailand had established a capacity assessment for Bangkok Area Control Centre (ACC) sectors in 2010, and the airport capacity for six major airports involved in the IATA slot coordination process had been established for some time. A system monitoring traffic demand in the ACC sectors in the form of an occupancy count, as well as demand at major airports in Thailand, had also been developed. These systems and associated tools had been deployed to manage such major planned disruptions as runway maintenance during June – July 2012, and runway unavailability due to a disabled aircraft incident in September 2013. Throughout these and other experiences in deploying CDFM/ATFM procedures Thailand had found capacity units to be a major challenge.

5.72 While airport capacity measurement may be more developed and assessed than ATC Sector capacity, especially where slot coordination processes were in place, the scope and assumptions of airport capacity assessments needed to be clarified. Thailand suggested the ATFM/SG provide guidance in respect of the scope of airport capacity assessment.

5.73 In contrast to airport capacity assessment, ATC sector capacity units may be more diverse. Based on ATFM study and guidance in the draft of Part II of the ICAO Manual on Collaborative Air Traffic Flow Management (Doc 9971), the 60 minute entry count capacity used for Bangkok ACC may be an elementary count capacity unit. In reality ANSPs may be applying the entry count capacity in time intervals of 15 – 30 minutes. For example, a sector with an hourly entry count of 30 aircraft per 60 minutes may instead be 10 aircraft per 20 minutes or 15 aircraft per 30 minutes to ensure smooth traffic flow.

5.74 Advanced en-route sectors in European airspace may have been measuring capacity and demand in terms of occupancy count – the number of aircraft within airspace within a time interval, which required accurate demand data hours in advance, typically enabled by surveillance data exchange. Without sufficient surveillance update of flight progress occupancy counts may have been inaccurate, reducing the credibility of ATFM based on them.

5.75 Due to varying units of sector capacity available and applicable for various uses it was suggested that ATFM/SG provide guidance in the respect of the units of airspace capacity to be reported, to ensure common and harmonized ATFM implementation.

5.76 The meeting noted that there was no formula for capacity measurement in the global guidance material (doc 9971). ICAO observed that the measurement varied among States according to such factors as social conditions, tools, and controller capability. While aiming to use a single, standardized method for the assessment of capacity was a sound objective, it may not be an absolute requirement. More important than using the same method was the sharing of capacity related figures, which was key to global ATFM implementation. Accepting that each State retained full responsibility for establishing its own capacities could better facilitate the disclosure of capacity figures.

5.77 Concerning units of measurement, ICAO also commented that there was no doub that assessing capacities using occupancy figures was a very efficient method. It was noted, however, that it relied on extensive use of surveillance related data. Hourly entry counts had proven to be an extremely valuable and accurate way to express capacity in other parts of the world.

5.78 The meeting considered that the wording of APANPIRG Conclusion 24/13 was sufficiently broad to permit States to report their capacity assessments in the units they were currently using internally for this purpose. It was also noted that this would be a large task for some States, which may be reflected in the number of reports eventually received.

Framework for Efficient C-ATFM Implementation (WP10)

5.79 India provided a brief review of collaborative ATFM implementation in India, and the road ahead for an international ATFM effort as envisage by India.

5.80 Due to current and forecast traffic growth in India’s airports and airspace an ATFM system was necessary to optimize the capacity and. demand both strategically and dynamically by integrating various operational constraints and weather parameters in the ATM system. India had accordingly decided to implement Central ATFM (C-ATFM) system covering entire Indian airspace which would integrate various subsystems for collaborative decision making and to ensure regulated flow of traffic to minimize delays and congestion.

5.81 The proposed C-ATFM System would provide the ANSP and Aircraft Operators with a decision support capability to safely, efficiently, and predictably manage demand when it exceeds capacity, in the Strategic, Pre-Tactical, and Tactical phases of ATFM. The C-ATFM system would be progressively implemented in three stages comprising:

- the establishment of the C-ATFM baseline of ATFM and CDM capabilities, encompassing six major airports in the country;
- A Nationwide ATFM system covering airports throughout India, with the future functionality depending on customer needs and advances in ATFM system; and
- developing capabilities to expand as a sub-regional/regional ATFM system, including the scope for data-exchange interfaces with other ATFM systems in the sub-region and region.

5.82 Key components of the future ATM concept were Collaborative Decision Making, Flexible Use of Airspace (FUA), dynamic airspace management, and active data sharing supported by appropriate data confidentiality policies.

5.83 ATFM operating procedures would include ATFM participants such as aircraft operators, aerodrome operators, ANSPs military agencies and the regulator in transparent ATFM processes, taking into account such considerations as traffic demand, airspace, ATS and aerodrome capacity, traffic handling priorities of aerodrome operators, needs of affected aircraft operators and other ANSPs, and the requirements of the Aeronautical Information Service (AIS).

5.84 The ATFM system would initially balance demand and capacity at certain points in India's ATM system, but would eventually develop to encompass airspace across many States. India foresaw internationally harmonized, upper airspace, but with small volumes of airspace without adequate ATM infrastructure facing difficulties in the development of ATFM systems/activities. This would require a proactive and participatory framework.

5.85 The Chair noted that India's plans included the three most significant objectives for an ATFM program; it should be network based, it should involve all stakeholders and it should be evolutionary.

Development of Meteorological Products to Support ATFM (WP11)

5.86 Hong Kong China provided information on collaboration between the Civil Aviation Department and Hong Kong Observatory in the development of Meteorological Services for the larger Terminal Area (MSTA) to support ATFM.

5.87 Maximum runway throughput for landing traffic could only be achieved with optimum inter-arrival spacing. Convective weather over the airport, on final approaches, and base area would significantly affect the runway capacity. As the existing meteorological products such as Aerodrome Forecasts (TAF) were focused mainly on the control zone, it was inadequate to present the weather forecast in the terminal area airspace. Met forecast covering the approach airspace was required.

5.88 Another important factor was the mode of the runway operation. Deteorating weather conditions required dependent parallel runway operations, with additional arrival spacing reducing runway capacity. Meteorological products focusing on these weather criteria would facilitate ATFM operations.

5.89 Major airborne delays for arriving aircraft were absorbed in 3 primary holding patterns in the terminal airspace. Inclement weather in these holding areas reduced airspace capacity significantly. Hong Kong had established contingency holding patterns to handle the issue tactically, but these measures are not adequate in extensive poor weather. Meteorological products forecasting the availability of these holding patterns would determine required ATFM measures.

5.90 When ATFM measures were required it was preferable that aircraft be held on the ground at the departure aerodrome. With a catchment area of 1,500NM from HKIA, ATFMU would endeavour to provide 4 hours advance notice of ATFM measures to upstream ACCs, requiring supporting meteorological products providing a similar lead time.

5.91 MSTA products supporting runway capacity estimation included:

- Aviation Thunderstorm Nowcasting System (ATNS), to track the past movement and forecast the future location of weather cells that may block the intended flight path or significant points in the air space;
- 1 hour convection nowcast for arrival/departure corridors updated every 6 minutes or as manually adjusted;
- 9hr performance-based weather forecast for the aerodrome including forecasts of significant convection, headwind, crosswind, visibility and cloud ceiling, providing information that is not subject to the limitations of the TAF or Trend Type Forecast (TTF), permitting fine tuning of the expected airport arrival rate
- 12 hour and 6 hour forecasts of significant convection for key areas of the Hong Kong FIR including holding areas and busy air routes.

5.92 A web-based integrated display, named Significant Convection Monitoring and Forecast, has been developed to provide a “one-stop shop” to ATFMU/ATC. Aviation weather forecasters would also conduct weather briefings twice a day with ATMFU.

5.93 In addition to MSTA products supporting the ATFMU, textual information was provided on the ATIS broadcast to heighten pilots’ situation awareness, such as information on significant thunderstorms or weather cells affecting or expected to affect approach and departure areas which may not be readily available from the Aerodrome Weather Report (METAR, including the approximate distance and bearing of the TS/WX CELLS from the airport and their respective direction of movement.

5.94 Examples of MSTA products and their display are provided in **Appendix J** to this report.

5.95 The meeting discussed the nature of meteorological forecasting, and the occasional inaccuracy of forecasts. Hong Kong China advised that there had been some early problems, such as some forecasters having not fully developed their understanding of the operational requirement, and there had been some issues of immediate updates not being made to forecasts in the event that they needed amendment. However, overall the program had been a success, and the Hong Kong Observatory was enthusiastically engaged with the program.

5.96 It was further noted that meteorological services and the specialists providing them are integral to ATM operations, and critical in CDM. There would be an increasing dependency on these services, and meteorological authorities needed to prepare to expand their capability to support CDM. The Secretariat, in reminding the meeting of the upcoming Meteorological Requirements Task Force (MET/R TF) meeting, requested that Hong Kong China consider submitting the information in this working paper to the Task Force, and urged States to attend and participate.

APEC Air Traffic Management Emissions Reduction Project (WP12)

5.97 In a joint working paper provided by Indonesia, Malaysia, Thailand and the United States the meeting was briefed on activities under the APEC Air Traffic Management Emissions Reduction Project. The project was proposed by the United States, with the goals of studying economic and environmental benefits of CDM/ATFM implementation and proposing the path to implementation of required procedures and systems. The project report was planned to be published by the end of 2013.

5.98 The paper noted the multiple other CDM/ATFM projects under development in the Asia/Pacific Region, including the European Union/ASEAN AATIP, the Hong Kong China – Singapore – Thailand tripartite project, the Indonesia – Philippines – Australia CDM/ATFM Joint Task Force (JTF-IPA), and Indonesia's plans to create a similar task force with Singapore and Malaysia as an improvement on the current bi-lateral meetings process.

5.99 It was proposed that the ATFM/SG coordinates such efforts as these to ensure CDM/ATFM developments were proceeding towards the same goals while reducing duplication of work.

5.100 EUROCONTROL, as a participating party in the AATIP program, stated that until very recently they were not aware of either the APEC work in the Asia/Pacific CDM/ATFM domain. EUROCONTROL had therefore identified the need to contact APEC, to reach agreement on ensuring the avoidance of duplicated or poorly targeted effort, and to identify any gaps in the overall work being done by both projects.

5.101 Japan was very interested in this activity, and in suggesting that Japan may like to also join the initiative stated the need for close coordination and information sharing.

5.102 IATA commented that it was clearly becoming more important to be aware of what is going on in the region, and that the Steering Group had a role to play in terms of project overview which should be reflected in its Terms of Reference.

Thailand ATFM Status (IP05)

5.103 Thailand provided a presentation on the status of ATFM initiatives in Thailand, as they related to the ICAO *Manual on Collaborative ATFM* (Doc 9971). The presentation included information on current initiatives, mapping them to traffic demand, airport and airspace capacity assessment and ATFM in various phases of ATFM Operational management described in the manual, including ATFM Daily Plan, Tactical ATFM, Strategic Demand and Capacity Balancing, Updated Traffic Demand, Dynamic Traffic Situation, Capacity Analysis and Management, and Optimized Operations.

Agenda Item 6: Any Other Business

Establishment of ICAO APAC Regional Sub-Office (IP02)

6.1 ICAO presented the meeting with information on the establishment of the ICAO Asia/Pacific Regional Sub-Office, its history, strategic framework and initial activities.

6.2 The ICAO Council had in November 2011 agreed to establish a Regional Sub-Office (RSO) of the Asia and Pacific (APAC) Office, aiming to enhance support to States in the APAC Region. The RSO was hosted by the People's Republic of China, and was located near Beijing Airport.

6.3 The RSO was established to engage in project–oriented activities aiming to support States in their air traffic management enhancement projects. The project areas which were in scope of the RSO included Airspace Organization and Management (AOM), Collaborative Decision Making (CDM), Air Traffic Flow Management (ATFM), Flexible Use of Airspace (FUA) and Performance-Based Navigation (PBN).

6.4 While the APAC Regional Office would continue its activities as the center of regional strategic planning and regional policies, the RSO, in cooperation with industry partners, would support Asia/Pacific States in their implementation of air navigation system and service improvements, focusing on ATM enhancement projects according to the policies developed by Regional Office and endorsed by APANPIRG.

6.5 Initial projects for the RSO were the assistance of Bangladesh, Myanmar and Fiji in their PBN planning and implementation. The RSO's ATFM/CDM unit would support implementation activities in Collaborative Air Traffic Flow Management. The RSO was expected to support States who were willing to introduce ATFM, and seek to coordinate with States that have already commenced ATFM/CDM systems/concepts and operations to share their experience and knowledge.

6.6 In 2014, the RSO is planned to host a workshop on CDM/ATFM in Beijing, China, building on the outcomes and recommendations of the ATFM/SG. Future RSO projects may include Airport CDM.

Review of ATFM Related Provisions of Asia/Pacific BANP (WP13)

6.7 The Secretariat brought to the attention of the meeting the ATFM related provisions of the Asia and Pacific Regions Air Navigation Plan Volume I (Basic ANP), and the need for their alignment with the Regional Framework for Collaborative ATFM.

6.8 Part V of the Asia and Pacific Regions Air Navigation Plan Volume I, Basic ANP contained elements of the existing planning system and introduced the basic planning principles, operational requirements and planning criteria related to Air Traffic Management (ATM) as developed for the Asia/Pacific Regions. This included the objectives and general principles of the ATFM service. ATFM related extracts from the BANP are appended at **Appendix K**.

The meeting agreed that the alignment of the BANP with both the Regional Framework for Collaborative ATFM and the ICAO Manual on Collaborative ATFM (doc 9971) should be included in the ATFM/SG Task List.

Air Navigation Reporting – ASBU Module B0NOPS (WP14)

6.9 Information on global air navigation reporting requirements for Aviation System Block Upgrade (ASBU) Module B0NOPS, and the role of ATFM/SG/2 in developing reporting criteria, was provided by the Secretariat. APANPIRG 24 had supported the plan for an online Regional Performance Dashboard in March 2014 and Global Air Navigation Report in April 2014.

6.10 ICAO was planning to introduce regional 'Performance Dashboard' homepages for every public website of the ICAO Regional Offices. These dashboards would illustrate the regional implementation status of air navigation systems. This new interactive online system would be in place for Africa in August 2013 and for the remaining regions in March 2014, and would be updated semi-annually.

6.11 The objective of the annual Global Air Navigation Report was to assist PIRGs and States in understanding which areas required special attention to effectively improve air navigation performance worldwide, as well as to help propagate information on success stories. The first edition of this Report, planned for April 2014, would also provide an opportunity for the civil aviation community to evaluate progress across different ICAO regions. The outcomes reflected in the proposed Report would also help identify annual tactical adjustment priorities for regional work programs, as well as informing longer-term policy adjustment.

6.12 The Global Air Navigation Report would consist of qualitative and quantitative information and cover key performance areas of air navigation systems. The report would cover global air navigation challenges and implementation progress of selected ASBU Block 0 Modules, including B0-NOPS (ATFM). The initial dataset for both *Regional* Performance Dashboard and the *Global* Air Navigation Report was recently agreed by the PIRG Chairs, and would be proposed for regional adoption. The task of developing performance measurement within the APANPIRG mechanism was assigned to the sub-Groups.

6.13 APANPIRG/24 supported the plan for an online Regional Performance Dashboard in March 2014 and annual Global Air Navigation Report in April 2014, and adopted the following Conclusion;

Conclusion 24/3 - Regional and Global Air Navigation Reporting

That States:

a. support the the plan for an online Regional Performance Dashboard in March 2014 and annual Global Air Navigation Report in April 2014

b. provide requisite information to the ICAO Regional Office, Bangkok to demonstrate operational improvements; and

c. establish, if not yet done so, a performance measurement strategy that comprises of data compilation, processing, storage and reporting for the identified regional performance metrics for the air navigation systems.

6.14 In line with APANPIRG's agreement that performance measurement be assigned to its Sub-Groups, the Chairs of the Sub-Groups were working on regional priorities and targets for inclusion in Regional and Global Air Navigation Reporting. The target date for completion of this work was December 2013 in order to facilitate submission to ICAO by May 2014.

6.15 It was proposed that the ATFM/SG was the appropriate body to develop ATFM planning targets and implementation priorities, and performance monitoring metrics, for the consideration of the Sub-Group Chairs. Accordingly, the meeting agreed that the Secretariat would draft priorities, targets and performance monitoring metrics for ASBU B0-NOPS, for review and agreement by the Specialist Team and subsequent presentation to ATFM/SG.

Agenda Item 7: Review of the Task List

7.1 The meeting agreed to the updated task list included as **Appendix L** to this report.

Agenda Item 8: Date and Venue of the Next Meeting

8.1 It was proposed that the next meeting will be from 10 to 14 March 2014 at a venue to be advised.

Closing of the Meeting

9.1 The Chairman thanked the meeting participants for their contributions.

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LIST OF WORKING PAPERS (WPs) and INFORMATION PAPERS (IPs)

(Presented by the Secretariat)

WORKING PAPERS

NUMBER	AGENDA	WORKING PAPERS	PRESENTED BY
WP/1	1	Provisional Agenda	Secretariat
WP/2	2	Related Meeting Outcomes	Secretariat
WP/3	2	Review ATFM/SG Terms of Reference	Secretariat
WP/4	5	Regional Framework for Collaborative ATFM Methodology	Secretariat
WP/5	5	Sub-Regional Air Traffic Flow Management	IATA
WP/6	5	Concept Development for a Distributed ATFM Network for the Region	Hong Kong China, Singapore, Thailand
WP/7	5	ATFM Capacity Scope and Units	Thailand
WP/8	5	ASEAN AATIP Approach to ATFM	EUROCONTROL
WP/9	6	ATC Delays at Male' International Airport	Maldives
WP/10	5	Framework for Efficient C-ATFM Implementation	India
WP/11	4	Development of Meteorological Products to support ATM	Hong Kong, China
WP/12	3	APEC Air Traffic Management Emission Reduction Project	Indonesia, Malaysia, Thailand and the United States
WP/13	6	Review of ATFM Related Provisions of Asia/Pacific BANP	Secretariat
WP14	6	Air Navigation Reporting – ASBU Module B0-NOPS	Secretariat
WP15	7	Review of the ATFM/SG Task List	Secretariat

INFORMATION PAPERS

NUMBER	AGENDA	INFORMATION PAPERS	PRESENTED BY
IP01	-	List of Papers	Secretariat
IP02	6	Establishment of ICAO APAC Regional Sub-Office	ICAO
IP03	4	Current ATFM Status in Japan	Japan
IP04	4	International ATFM in Japan	Japan
IP05	5	Thailand ATFM Status	Thailand
IP06	4	Current ATFM Status in China	China

Terms of Reference

AIR TRAFFIC FLOW MANAGEMENT STEERING GROUP (ATFMSG)

1. Having considered ~~the *ATS Planning Manual* (Doc 9426)~~ relevant documents such as the *Manual on Collaborative Air Traffic Flow Management* (Doc 9971), regional air traffic data and the ~~Major Traffic Flows~~ Asia/Pacific Region city pairs and associated airspace and ATS routes experiencing the most significant traffic demand, and noting ~~that recognized structural airspace capacity increasing measures have preference to use of ATFM~~ the Asia/Pacific Seamless ATM Plan provisions for structural airspace capacity increasing measures, develop an Asia/Pacific Regional ATFM ~~Concept of Operations(including principles and objectives)~~ Framework which addresses ATFM implementation and ATFM operational issues in the Asia/Pacific Region;

~~1. Review and update the *ATFM Communications Handbook for the Asia Pacific Region* until superseded by Global Material;~~

2. ~~Encourage and develop~~Identify, research and recommend appropriate guidance regarding:

   a. capacity assessment and adjustment mechanisms;

   b. regular review for all aerodromes and ATC sectors where traffic demand is expected to reach capacity, or is resulting in traffic congestion;

   c. mechanisms for ATFM data gathering, collation and sharing between States, International Organizations and ICAO, which may include;

      i. capacity assessments, including factors affecting capacity such as special use airspace status, runway closures and weather information;

      ii. traffic demand information which may include flight schedules, flight plan data, repetitive flight plan data as well as associated surveillance updates of flight status; and

      iii. ATFM Daily Plan;

   d. compliance by airspace users with ATFM measures; and

   e. any other guidance relevant to the Regional ATFM Framework.

3. ~~Research suitable and regionally harmonized benchmarks for airport acceptance rates (AAR) and the throughput of airspace (sector capacity) which may vary depending on weather conditions, and associated technique, e.g. the ground delay programme and miles/minutes in trail (MIT).~~ Maintain an overview of CDM/ATFM programs being conducted within the Region, with a view to facilitating their coordination and alignment.

4. Review the ~~safety and efficacy of~~ effectiveness of existing and planned ATFM ~~systems~~ programs in the Asia and Pacific Region, and make specific recommendations regarding ATFM, including any adjacent airspace affecting the Asia and Pacific Regions, and research and recommend appropriate mechanisms for the on-going review of such programs.

~~5. Encourage the development of an ATFM web site by Asia and Pacific Region States with significant experience in ATFM, which contains information on regional ATFM, including *inter alia*,~~

~~real time flight delay data.~~

6. The Group reports to the ATM~~/AIS/SAR~~ Sub-Group.

.....

ATFM-Related Elements of the Seamless ATM Plan

BACKGROUND INFORMATION

Critical ASBU Upgrades

5.8 The following ASBU Block 0 elements were considered by APSAPG and endorsed by APANPIRG as critical upgrades for Seamless ATM, and thus should be accorded the highest priority in terms of the earliest implementation and the resources required to support this.

Note: This did not suggest that 'critical' elements had a higher priority than safety critical improvements.

5.9 **B0-FRTO** *Enhanced En-route Trajectories*: Flexible Use Airspace (FUA), User Preferred Routes (UPR), Dynamic Airborne Re-route Planning (DARP) and CDM. These will allow the use of airspace which would otherwise be segregated, along with flexible routing adjusted for specific traffic patterns for greater routing possibilities, reducing flight time and fuel burn. The applicable Global Plan Initiatives related to this element are GPI-1 (FUA), GPI-7 Dynamic and Flexible ATS Route Management, and GPI-8 Collaborative Airspace Design and Management.

5.10 **B0-FICE** *Ground – Ground Integration and Interoperability*: ATS Inter-facility Data Communications (AIDC). AIDC application exchanges information between ATS units in support of critical ATC functions, including notification of flights approaching a Flight Information Region (FIR) boundary, coordination of boundary-crossing conditions, and transfer of control. AIDC application improves the overall safety of the ATM system, as well as increasing airspace capacity, as it permits the controller to simultaneously carry out other tasks. While there is no related GPI, this element has been considered to be a high priority to support GPI-7 Dynamic and Flexible ATS Route Management, and is also a key enabler to reduce Air Traffic Control (ATC) coordination errors as a result of human factors.

5.11 **B0-DATM** *Digital Aeronautical Information Management* (AIM). AIM is one of the foundation elements that supports other aspects of ASBU, and as such requires a high priority. A key strategy activity during Block 0 may include the development of the System-Wide Information Management (SWIM) concept of operations to support the next phase of AIM development and integration within the future SWIM framework.

5.12 **B0-NOPS** *Network Flow Management* ATFM: GPI-6 ATFM. The related GPI is GPI-10 Terminal Area Design and Management. ATFM is used to balance demand and capacity to manage the flow of traffic in a manner that minimises delay and maximises the use of the available airspace. ATFM is one of the solutions to ensure a sustainable air traffic growth for the future. Inter-linked and networked ATFM nodes between ANSPs should be developed to serve various sub-regions (refer Doc 9971 *Manual on Collaborative Air Traffic Flow Management*).

5.13 **B0-TBO** *En-route Data-link*: Automatic Dependent Surveillance-Contract (ADS-C), Controller Pilot Data-link Communications (CPDLC). Data-link application for ATC surveillance and communications supports flexible routing, reduced separation and improved safety. In areas where the provision of direct ATS surveillance is possible, ATC separation should be based on these surveillance systems (i.e. radar, multilateration and ADS-B), and that ADS-C and CPDLC with backup provided by High Frequency (HF) and/or Satellite Voice Communications (SATVOICE) were necessary elsewhere. Moreover, the Regional Surveillance Strategy states that ADS-C should be used where technical constraint or cost benefit analysis did not support the use of Automatic Dependent Surveillance-Broadcast (ADS-B), SSR or Multilateration (MLAT).

5.14 **B0-ASUR** *Ground-Based ATS Surveillance*: ADS-B, MLAT. The related GPI is GPI-17 Data-Link Applications. The Regional Surveillance Strategy stated that ADS-B should be used to support ATC separation service, while reducing dependence on Primary Radar for area surveillance and reliance on 4-digit SSR octal codes. ADS-B technology is an initial step in creating a more flexible air transportation system that will create seamless surveillance and shared situational awareness picture for both ground and air operations. Recommendation 1/7C adopted by the AN-Conf/12 urged States to share ADS-B data to enhance safety, increase efficiency, achieve seamless surveillance and work closely together to harmonize their ADS-B plans to optimize benefits. The provision of communication capability such as Very High Frequency (VHF) to support ATS surveillance is also necessary. Furthermore, APANPIRG/22 urged States to support provision of Very High Frequency (VHF) radio voice air/ground communication infrastructure for use by adjacent States to enable a reduction of ATS separation based on surveillance.

Recommended ASBU Upgrades

5.15 **B0-CDO**: *Improved Flexibility and Efficiency in Descent Profiles* CDO and Standard Instrument Arrival (STAR). These arrival procedures allow aircraft to fly their optimum profile, taking into account airspace and traffic complexity. The related GPI is GPI-11 Area Navigation (RNAV) and Required Navigation Performance (RNP) Standard Instrument Departures (SIDs) and STARs. This element has been accorded a high priority by ICAO HQ, due to the improvement in safety regarding Controlled Flight into Terrain (CFIT) and greater efficiency in terms of fuel usage and emissions.

Note: the terms 'Standard Terminal Arrivals' and 'Standard Instrument Arrival' from Doc 9750 and Doc 4444 respectively have the same meaning.

5.16 **B0-RSEQ** *Runway Sequencing*: Arrival Manager (AMAN), Departure Manager (DMAN). AMAN/DMAN procedures are designed to provide automation support for synchronisation of arrival sequencing, departure sequencing and surface information. Training on automation support, operational standards and procedures were necessary.

5.17 Point Merge PBN procedures (Section 6, **Appendix F**) are examples of procedures that may be used to assist sequencing until the following ASBU modules were implemented, to ensure more accurate Trajectory Based Operations (TBO):

- **B1-RSEQ** (*extended arrival metering, integration of surface management with departure sequencing*);
- **B1-NOPS** (*integrated ATFM including airspace management, user driven prioritisation and collaborative ATFM solutions*);
- **B1-TBO** (*synchronisation of traffic flows at merge points through controlled time of arrival capability and airport applications such as D-TAXI*); and
- **B1-AMET** (*weather information supporting automated decision support or aids*).

5.18 **B0-CCO** *Flexible and Efficient Departure Profiles* Continuous Climb Operations (CCO), SID. This element has been accorded a high priority by ICAO HQ, due to greater efficiency in terms of fuel usage and emissions. The related GPI is GPI-11 (RNP and RNAV SIDs, STARs).

5.20 **B0-ACDM** *Airport CDM*: the relevant GPI is GPI-13 Airport Collaborative Decision-Making. The decision making process at the airport is enhanced by sharing up-to-date relevant information and by taking into account the preferences, available resources and the requirements of the stakeholders at the airport. Material from the ICAO CDM Manual is being incorporated into a global manual on collaborative ATFM (Doc 9971).

5.24 **B0-AMET**: *Meteorological Forecasts, Warnings and Alerts*: Aerodrome warnings, including windshear. World Area Forecast Centre (WAFC), Volcanic Ash Advisory Centre (VAAC), and Tropical Cyclone Advisory Centre (TCAC) forecasts. The relevant GPI is GPI-19: improving the availability of meteorological (MET) information in support of a seamless global ATM system.

5.25 The future, net-centric oriented ATM system requires the smart use of uncertainty characteristics often associated with MET information, enabling decision-makers to make choices according to their own objectively determined thresholds for action. This needs a transition of MET information, specifically in table-driven data representation supporting ATM collaborative, knowledge-based, and decision-making through free-flowing information exchange (ASBU B1-AMET).

5.26 The first evolutionary step in the improved provision of MET information includes the provisions in Amendment 76 to Annex 3 – Meteorological Service for International Air Navigation (applicable November 2013). This will facilitate the exchange of OPMET information (specifically METAR, SPECI, TAF and SIGMET) in a digital form (XML/GML), accompanied by the appropriate metadata, in accordance with the globally interoperable information exchange model. These developments were designed to foster the future SWIM environment, which would include meteorological, aeronautical and flight information, amongst others.

5.27 Amendment 77 to Annex 3 (intended applicability in November 2016) was expected to upgrade these particular provisions to a recommendation, while Amendment 78 to Annex 3 (intended applicability in November 2019) was expected to make it standard practice for States to exchange such OPMET information in digital form. During Amendments 77 and 78 of Annex 3, and beyond, a significant portion of current MET products would transition to supporting digital information exchange within SWIM. In addition, there would be an increased reliance on the automated relay of meteorological information to and from aircraft, including enhanced aircraft-based meteorological reporting capabilities (ASBU B3-AMET).

Global and Regional Elements

5.32 **Aerodrome Capacity Analysis**. GPI-14 *Runway Operations* establishes requirements to maximize runway capacity. In addition, there is a need to determine capacity and related constraints for runways, taxiways and gates, especially for Low Visibility Operations (LVO). Aircraft gate movement predictability affecting ATFM may be influenced by the efficiency of the embarkation and disembarkation of people and goods. In conducting aerodrome capacity analysis, it is important to include an assessment of the capacities of the airport passenger and cargo terminals and landside infrastructure to handle passengers, checked-in baggage, air freight and road traffic to ensure that the airfield, passenger/cargo terminals and landside capacities are balanced as much as possible.

5.33 Apron Management Services need to be integrated with ATC services using interoperable systems (including automated tools), shared data and harmonised procedures. Therefore clear procedures between a provider of aerodrome ATS services and the aerodrome operator are necessary in order to ensure that the planning, operation and review of aerodrome services are conducted collaboratively.

Civil/Military Cooperation

5.62 Data sharing arrangements (including aircraft surveillance), are a key part of civil/military cooperation for tactical operational responses, and to increase trust between civil and military units. Data sharing between the civil and military could facilitate CDM, a vital component of ATFM. The Regional Surveillance Strategy espouses civil/military cooperation and system interoperability.

Preferred ATM Service Levels (PASL)

Note: prior to the implementation, the applicability of PASL should be verified by analysis of safety, current and forecast traffic demand, efficiency, predictability, cost effectiveness and environment to meet expectations of stakeholders.

PASL Phase I (expected implementation by 12 November 2015)

Aerodrome Operations

7.25 All high density aerodromes should have AMAN/DMAN facilities (ASBU priority 2).

En-route Operations

7.27 High density FIRs (refer **Figure 9**) supporting the busiest Asia/Pacific traffic flows and high density aerodromes should implement ATFM incorporating CDM to enhance capacity, using bi-lateral and multi-lateral agreements (ASBU Priority 1).

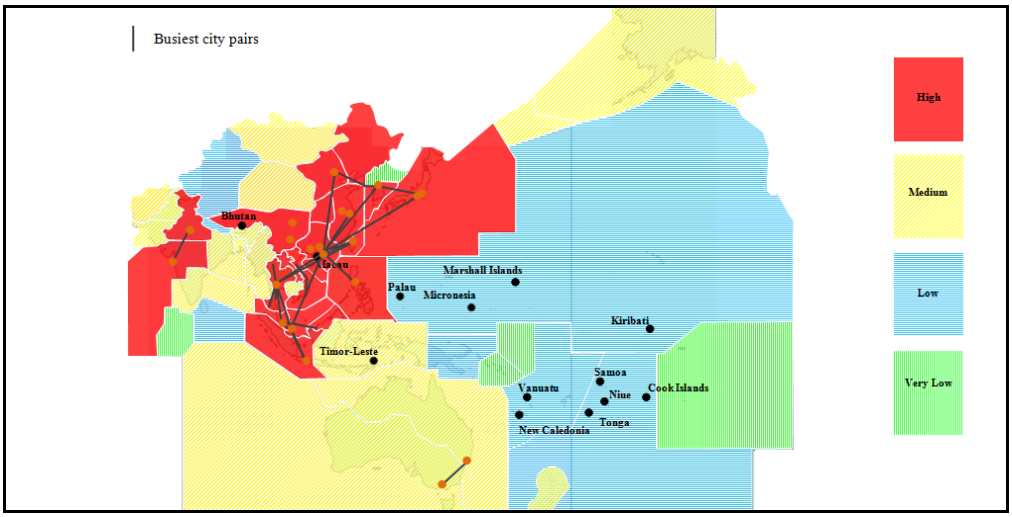

Figure 9: High Density FIRs

PASL Phase II (expected implementation by 08 November 2018)

Aerodrome Operations

7.43 ATM system design (including ATS surveillance, ATS communication systems, ATC separation minimum, aircraft speed control and ATC training) should be planned and implemented to support optimal aerodrome capacity expectations for the runway(s) concerned.

Terminal Operations

7.1 All terminal ATC Sectors should have a nominal aircraft capacity figure based on a scientific capacity study and safety assessment, to ensure safe and efficient aircraft operations.

*Note: A study of the terminal ATC Sector airspace capacity every 15 minutes is provided in **Appendix G**.*

7.45 All AMAN systems should take into account airport gates for runway selection and other aircraft departures from adjacent gates that may affect arriving aircraft.

En-route Operations

7.47 All FIRs supporting Major Traffic Flows should implement ATFM incorporating CDM to enhance capacity, using bi-lateral and multi-lateral agreements (ASBU Priority 1).

7.49 To ensure the safety and efficiency of aircraft operations, a nominal aircraft capacity figure based on a scientific capacity study and safety assessment should be available for all enroute ATC sectors.

*Note: a study of the en-route ATC Sector airspace capacity every 15 minutes is provided in **Appendix G**.*

RESEARCH AND FUTURE DEVELOPMENT POSSIBILITIES

Research and Development

8.1 The need for concepts beyond current technology and systems had been reinforced at APANPIRG/23. With the end goal of a globally interoperable ATM system in mind, the region will have to consider planning for a long term supporting concept and infrastructure. States should not overlook the need to include the development of future ATM concepts that will ensure the safety and fluidity of air transportation over the next few decades. The following are possible areas that should be considered for future development, in order to continue pursuance of seamless ATM beyond ASBU Block 0 implementations and global interoperability:

b. Sub-Regional ATFM - Inter-linked (data-sharing) ATFM units (which may be virtual offices) should be developed to serve various sub-regions. This concept is consistent with Seamless ATM Principle 8 (*Sub-regional ATFM based on system-wide CDM serving the busiest terminal airspace and MTF*). The Global ATM Operational Concept paragraph 2.4.3 states: *Demand and capacity balancing will be integrated within the ATM system*;

Appendix G: Capacity Expectations

1 Capacity metrics will vary considerably, depending upon many factors such as the COM and SUR capabilities, the presence of terrain, physical attributes of aerodromes and weather. Thus the expectations outlined for the following States need to be treated with caution, however they form a useful guide as to the sort of capability being achieved with modern systems and appropriately trained controllers.

2 **Table G1** provides an indication of potential Aerodrome Arrival Rate (AAR) for a single runway, given aircraft ground speeds and aircraft spacing near the runway threshold (source: *Guide for the Application of a Common Methodology to Estimate Airport and ATC Sector Capacity for the SAM Region, Attachment 7: Calculation of the Aerodrome Acceptance Rate used by the FAA*).

Speed	3NM	3.5NM	4NM	4.5NM	5NM	6NM	7NM	8NM	9NM	10NM
140kt	46	40	35	31	28	23	20	17	15	14
130kt	43	37	32	28	26	21	18	16	14	13
120kt	40	34	30	26	24	20	17	15	13	12

Table G1: Potential Runway Arrival Rate

3 ATC capacity calculations needed to take into account the volume of airspace of each sector, which varied considerably by State, and factors such as automation, density of traffic and complexity of routes/airspace. The ICAO *Manual on Collaborative Air Traffic Flow Management* (Doc 9971) contained guidelines for ATC sector capacity assessment. **Table G2** provides simplified ATC sector calculation guidance from Doc 9971.

Average sector flight time (minutes)	**Optimum sector capacity value (aircraft)**
3 minutes	5 aircraft
4	7
5	8
6	10
7	12
8	13
9	15
10	17
11	18
12 minutes or more	18

Table G2: Simplified ATC Sector Capacity Table (no complexity/automation allowance)

4 Australia, Japan, New Zealand, Singapore, Thailand and the United States provided runway and airspace (ATC Sector) capacity data, to indicate potential capacity figures in varying Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC) circumstances.

Australia

5 Brisbane and Melbourne aerodrome capacity expectations:

- single runway: **48** (24 arrivals - 150 seconds between arrivals, 24 departures, VMC);
- single runway: **40** (20 arrivals - 180 seconds, 20 departures, IMC).

Japan

6 Aerodrome capacity expectations:

- Narita (dual runways): 56-64;
- Haneda (4 runways): 74.

New Zealand

7 Auckland aerodrome capacity expectations:

- single runway: **40** (VMC);
- single runway: **39** (IMC circling);
- single runway: **37** IMC below circling with missed approach protection for jets);
- single runway: **32** (IMC below circling with missed approach protection)

8 ATC Sector capacity expectations:

- terminal/low level Category T airspace: **12** aircraft; and
- en-route Category S airspace: **15** aircraft;
- en-route Category R airspace: **15** aircraft.

Singapore

8 Changi aerodrome capacity expectations:

- single runway: **30** (IMC); and
- two parallel/near parallel runways: **72** (IMC);
- three parallel/near parallel runways: to be confirmed, possibly 100+ (IMC).

9 ATC Sector capacity expectations:

- terminal/low level Category T airspace: **14** aircraft; and
- en-route Category S airspace (sector dimension of 150NM x 100NM): 7 aircraft (extrapolated √6.66 x airspace volume = 2.58 x 7 = **18**).

Thailand

10 Suvarnabhumi aerodrome capacity expectations:

- single runway: **34** (VMC/IMC).

United States of America

11 **Table G3** provides an indication of optimal aerodrome parallel or near parallel arrival rate runway arrival capacity at selected USA aerodromes. It should be noted that multiple runway combinations or whether runways were used for arrivals, departures, or both yielded a number of permutations from the data.

Aerodrome	Runways	IMC	VMC
ATL	5	104	126
ORD	5	84	112
DFW	5	90	96
ATL	4	92	112
DEN	4	-	114
LAX	4	64	80
ORD	4	-	92
ATL	3	76	96
DEN	3	-	96
IAD	3	72	100
ATL	2	68	82
JFK	2	-	58
SDF	2	40	52
ATL	1	34	42
SDF	1	20	26
SFO	1	25	27

Table G3: Capacity at selected US airports

12 Average aerodrome arrival capacity expectations (range):

- single runway: IMC average **26** (25-34), VMC average **32** (26-42);
- two parallel/near parallel runways: IMC **55** (40-68), VMC **64** (52-82);
- three parallel/near parallel runways: IMC **74** (72-76), VMC **97** (96-100);
- four parallel/near parallel runways: IMC **78** (64-92), VMC **100** (80-112);
- five parallel/near parallel runways: IMC **92** (84-104), VMC **111** (96-126).

13 ATC Sector capacity expectations:

- terminal/low level Category T airspace: **12-18** aircraft; and
- en-route Category S airspace: **16-20** aircraft; and
- en-route Category R airspace: **17-24** aircraft.

Summary

14 **Table G4** summarises runway and airspace capacity expectations from States, with the greatest capacity achieved in optimum conditions highlighted in bold.

	Parallel or Near Parallel Runway Capacity					ATC Sector Capacity		
	1	2	3	4	5	T	S	R
Australia	40-48							
Japan		56-64		74				
NZ	32-40					12	15	15
Singapore	30	72				14	18	
Thailand	34							
USA	**61**	**95**	**150**	**177**	**211**	12-**18**	16-**20**	17-**24**
Doc 9971 Simplified Table Comparison						15	18	18

Table G4: Capacity Expectations Summary

Note: Given the unique operation environment and constraints of individual States, these figures are indicative only and do not represent the same expectation across different States in the region

INTERNATIONAL CIVIL AVIATION ORGANIZATION

D R A F T

ASIA/PACIFIC REGIONAL FRAMEWORK FOR COLLABORATIVE AIR TRAFFIC FLOW MANAGEMENT

DRAFT Version 0.1, MONTH YEAR

This Plan was developed by the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG)

Approved by APANPIRG/XX and published by the
ICAO Asia and Pacific Office, Bangkok

CONTENTS

SCOPE OF THE PLAN

Framework Structure

1.1 The Asia/Pacific Region Air Traffic Flow Management Framework (hereinafter referred to as "the Framework") forms part of a range of regional planning documents which, together with other regional documents is contributory to the Asia/Pacific Seamless Air Traffic Management (ATM) Plan.

1.2 Global vision and strategy perspectives are provided by the *Global Air Navigation Plan* (GANP, Doc 9750), the *Global ATM Operational Concept* (Doc 9854) and the *Global Aviation Safety Plan* (GASP). Beneath this level is regional planning primarily provided the Seamless Plan together with its contributory documents (including the Framework) and other guidance material, to define goals and the means of meeting State planning objectives.

1.3 The Framework references the *Manual on Collaborative Air Traffic Flow Management* (Doc 9971)

1.4 Implementation timelines for ATFM service levels defined in the Framework are aligned with the Seamless Plan's Preferred ATM Service Levels (PASL).

1.5 XXXXXXXX

Plan Review

1.6 As the Framework is contributory to the Seamless Plan it is intended that it is reviewed each three years, or at more frequent intervals as determined by APANPIRG, coincident with the regular review of the Seamless Plan.

OBJECTIVES

Framework Objective

2.1 Having considered relevant documents such as the Manual on Collaborative Air Traffic Flow Management (Doc 9971) and the Asia/Pacific Region Seamless ATM Plan, the objective of the Framework is to address ATFM implementation and operational issues in the Asia/Pacific Region by recommending appropriate guidance for:

a. capacity assessment and adjustment mechanisms;

b. regular review for all aerodromes and ATC sectors where traffic demand has reached or is expected to reach or exceed capacity, or is resulting in traffic congestion;

c. mechanisms for ATFM data gathering, collation and sharing; and

d. regionally harmonized benchmarks for airport acceptance rates (AAR) and the throughput of airspace (sector capacity);

Figure x: x

Framework Development

2.2 The Framework was developed as a contributory document to the Seamless ATM Plan, in response to the identified need for guidance in the State, Sub-Regional and Regional implementation of ATFM. The Framework has been developed in consultation with Asia/Pacific States and Administrations, and International Organizations.

2.3

- x;
- x; and
- x.

EXECUTIVE SUMMARY

x

3.1 x.

Stakeholder Summary

3.2 x

ABBREVIATIONS AND ACRONYMS

AAR	Aerodrome Arrival Rate or Airport Acceptance Rate
ATM	Air Traffic Management
ABI	Advanced Boundary Information (AIDC)
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
ACP	Acceptance (AIDC)
ADOC	Aircraft Direct Operating Cost
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance-Contract
AIDC	ATS Inter-facility Data Communications
AIGD	ICAO ADS-B Implementation and Guidance Document
AIM	Aeronautical Information Management
AIRAC	Aeronautical Information Regulation and Control
AIRD	ATM Improvement Research and Development
AIS	Aeronautical Information Service
AIXM	Aeronautical Information Exchange Model
AMAN	Arrival Manager
ANSP	Air Navigation Service Provider
AN-Conf	Air Navigation Conference
AOC	Assumption of Control (AIDC)
AOM	Airspace Organization and Management
APAC	Asia/Pacific
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APCH	Approach
APEC	Asia Pacific Economic Cooperation
APSAPG	Asia/Pacific Seamless ATM Planning Group
APV	Approach with Vertical Guidance
APW	Area Proximity Warning
ASBU	Aviation System Block Upgrade
ASD	Aircraft Situation Display
ASEAN	Association of Southeast Asian Nations
ASMGCS	Advanced Surface Movements Guidance Control Systems
ATC	Air Traffic Control
ATCONF	Worldwide Air Transport Conference
ATFM	Air Traffic Flow Management
ATIS	Automatic Terminal Information Service
ATS	Air Traffic Services
ATSA	Air Traffic Situational Awareness
ATM	Air Traffic Management
CANSO	Civil Air Navigation Services Organization
CARATS	Collaborative Actions for Renovation of Air Traffic Systems
CDM	Collaborative Decision-Making
CCO	Continuous Climb Operations
CDO	Continuous Descent Operations
CFIT	Controlled Flight into Terrain
CLAM	Cleared Level Adherence Monitoring
COM	Communication

CONOPS	Concept of Operations
CNS	Communications, Navigation, Surveillance
CPAR	Conflict Prediction and Resolution
CPDLC	Controller Pilot Data-link Communications
CPWG	Cross-Polar Working Group
CSP	Communication Service Provider
CTA	Control Area
CTR	Control Zone
DARP	Dynamic Airborne Re-route Planning
DGCA	Conference of Directors General of Civil Aviation
DMAN	Departure Manager
DME	Distance Measuring Equipment
EST	Coordinate Estimate
FAA	Federal Aviation Administration
FDPS	Flight Data Processing System
FIR	Flight Information Region
FIRB	Flight Information Region Boundary
FL	Flight Level
FLAS	Flight Level Allocation Scheme
FLOS	Flight Level Orientation Scheme
FRMS	Fatigue Risk Management System
FUA	Flexible Use Airspace
GANIS	Global Air Navigation Industry Symposium
GANP	Global Air Navigation Plan
GASP	Global Aviation Safety Plan
GBAS	Ground-based Augmentation System
GDP	Gross Domestic Product
GLS	GNSS Landing System
GNSS	Global Navigation Satellite System
GPI	Global Plan Initiative
HF	High Frequency
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IMC	Instrument Meteorological Conditions
INS	Inertial Navigation Systems
IO	International Organizations
IPACG	Informal Pacific ATC Coordinating Group
ISPACG	Informal South Pacific ATS Coordinating Group
ITP	In-Trail Procedure
KPA	Key Performance Area
LNAV	Lateral Navigation
LVO	Low Visibility Operations
MET	Meteorological
METAR	Meteorological Aerodrome Report
MLAT	Multilateration
MSAW	Minimum Safe Altitude Warning
MTF	Major Traffic Flow
NextGen	Next Generation Air Transportation System
OPMET	Operational Meteorological
OLDI	On-Line Data Interchange

OTS	Organised Track System
PACOTS	Pacific Organized Track System
PARS	Preferred Aerodrome/Airspace and Route Specifications
PASL	Preferred ATM Service Levels
PBN	Performance-based Navigation
PIA	Performance Improvement Areas
PKP	Passenger Kilometres Performed
PVT	Passenger Value of Time
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Route Adherence Monitoring
RANP	Regional Air Navigation Plan
RPK	Revenue Passenger Kilometres
RNAV	Area Navigation
RNP	Required Navigation Performance
RVSM	Reduced Vertical Separation Minimum
SAARC	South Asian Association for Regional Cooperation
SATVOICE	Satellite Voice Communications
SAR	Search and Rescue
SBAS	Space Based Augmentation System
SCS	South China Sea
SESAR	Single European Sky ATM Research
SHEL	Software, Hardware, Environment and Liveware
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Information
SPECI	Special Weather Report
STAR	Standard Terminal Arrival Route or Standard Instrument Arrival (Doc 4444)
STCA	Short Term Conflict Alert
STS	Special Handling Status
SUA	Special Use Airspace
SUR	Surveillance
SWIM	System-Wide Information Management
TAF	Terminal Area Forecast
TAWS	Terrain Awareness Warning Systems
TBO	Trajectory Based Operations
TCAC	Tropical Cyclone Advisory Centre
TCAS	Traffic Collision Avoidance System
TOC	Transfer of Control
UAS	Unmanned Aircraft Systems
UAT	Universal Access Transceiver
UPR	User Preferred Routes
VHF	Very High Frequency
VMC	Visual Meteorological Systems
VNAV	Vertical Navigation
VAAC	Volcanic Ash Advisory Centre
VMC	Visual Meteorological Conditions
VOLMET	Volume Meteorological
VOR	Very High Frequency Omni-directional Radio Range
VSAT	Very Small Aperture
WAFC	World Area Forecast Centre

BACKGROUND INFORMATION

Principles

5.1 x.

5.2 x:

- x;
- x;
- x; and
- x.

5.3 x

CURRENT SITUATION

x Analysis

6.1 x

6.2 x:

a) x;

b) x;

c) x;

- x; and
- x.

6.3 x.

PERFORMANCE IMPROVEMENT PLAN

7.1 x:

a) x;

b) x:

- x;
- x; and

c) x.

7.2 x.

RESEARCH AND FUTURE DEVELOPMENT

x

8.1 x.

MILESTONES, TIMELINES, PRIORITIES AND ACTIONS

x

9.1 x.

APPENDICES

x

Proposed ATFM Framework Principles

People: Aviation Regulations, Standards and Procedures

1. Regional model of inter-connected sub-regional ATFM networks based on system-wide CDM, serving the busiest terminal airspace and major sub-Regional traffic flows.

2. Harmonized regional or sub-regional ATFM rules and guidelines based on the ICAO Manual on Collaborative Air Traffic Flow Management (Doc 9971).

3. Regionally harmonized methodology for the collection, analysis and ongoing monitoring of demand and capacity data.

4. Consistency between the ICAO Regional Air Navigation Plan, Asia/Pacific Seamless ATM Plan and Regional ATFM Framework.

~~5.~~ An emphasis on delivery of ATFM services to deliver best network outcomes ~~based on CNS capability, resulting in flexible, dynamic systems.~~

6. The use of high-fidelity simulators to train controllers and ATFMU personnel involved in in ATFM procedures and techniques.

7. Harmonized compliance framework to ensure …..

ATM Coordination

8. Development of manual processes and skills to promote practical knowledge and understanding of ATFM before implementing technology based solutions, and as a contingency response capability.

9. Cross-border/FIR cooperation for use of aeronautical facilities and airspace, collaborative data sharing, airspace demand and capacity assessment and ATFM planning.

Facilities: Aerodromes

10. To encourage aerodrome operators to actively participate in ATM coordination in respect of Airport CDM development and operational planning, including aerodrome complexity and capacity.

ATS Units

11. Collaboration by ANSPs for evaluation and planning of ATFM facilities.

12. Optimization of ATFM facilities through automated, networked, central flow management centres and units or equivalent virtual platforms.

13. The prioritization of integrated AIDC systems for timely ATM and ATFM system updates of trajectory data.

~~14. Regional cooperation for augmentation systems in terms of interoperability and increased service areas, and a GNSS ionospheric monitoring network.~~

Technology and Information: ATFM Systems

15. Continuous supervision, operation, adjustment, monitoring and executive control of ATFM systems and their output by qualified ATC or ATFM personnel.

16. Encouragement of the use of dual-redundant automated ATFM processing and communications systems, supported by agreed contingency procedures and facilities including ATN/AMHS and public telephone systems.
17. Collaborative development of CDM, ATFM, A/MAN and D/MAN support tools.
18. Encourage sharing of air traffic data between military ATM systems and civil ATM/ATFM systems

ATM Modernisation Projects

19. Inter-regional and sub-regional cooperation (‘clustering’) for the research, development and implementation of ATFM projects
20. A focus on harmonized technologies for earliest deployment and best cost benefits.
21. x
22. x
23. x

Proposed ATFM Framework – Examples of Capability Elements

The following are derived from the draft ICAO Manual on Collaborative Air Traffic Flow Management (Doc 9971), and may provide a guide for the Steering Group's development of ATFM Capability Elements

Planning Tools

- Airspace design and ATS Route Planning
- Capacity Analysis and workload modelling
- *Network Operational Plans*

ATFM Unit, Centre or Virtual ATFM Centre Structure

- Strategic management unit;
- Pre-Tactical Management Unit;
- Tactical Management Unit;
- Capacity Unit;
- Operability Monitoring Unit;
- Coordination and Decision Unit; and
- Flow Management Positions (ACC, TMA positions linked to ATFM Unit or Centre)

Prediction and Monitoring Tools

- Demand and workload prediction
- weather prediction
- monitoring tools

CDM Tools

- information exchange
- collaboration
- electronic user helpdesk
- crisis management

Tactical ATFM Capability

- Segregated SIDS and STARS

  Reconsider whether this is a necessary part of Tactical ATFM capability
- Agreed acceptance rates
- Holding patterns permitting CDO
- Agreed flow gates at uniform distances from the aerodrome
- Prioritization of landing aircraft;

- Industry notification of additional fuel for traffic delays;

Prioritization of compliant flights and de-prioritization of non-complaint flights

ATFM Execution Tools

- Slot Allocation
- Route and Fix Balancing
- Flight Level Balancing

Clarify where this originated, and consider removing. Was included in draft doc 9971 diagram of ATFM tools, but may have been replaced/removed.

ATFM Measures

- Miles in Trail
- Minutes in trail
- fix balancing
- rerouting

(could be both strategic and dynamic)

- mandatory rerouting
- level capping
- alternative or advisory routing
- minimum departure intervals
- slot swapping
- playbook routes

(amended terminology)

- ground delay programme
- ground stop
- airborne holding

Analysis Tools

- data analysis and reporting

ATC Procedures and Practices (Should not be among ATFM capability elements, but instead form an appendix to the framework)

- standard phrases for delaying action (ICAO Doc 4444);
- early advice to pilots of expected delays;
- delays in the cruise if and where possible;
- maximized the use of speed control to achieve delays;
- optimized of separation minima;

- use of vectoring to:
  - Increase track miles to adjust time;
  - Meet set course times or Required Time of Arrival (RTA);
  - Continuous descent during vectoring.
- development of ATC skills in vectoring and holding for efficient sequencing;
- holding and vectoring for delay outside terminal airspace;
- terminal operations (re-sequencing missed approaches, speed control within terminal airspace, wind monitoring and runway change procedures, non-normal events such as short notice runway closure, rejected approaches);
- aerodrome operations (wind monitoring, runway change procedures, non-normal events);
- ATC ATFM competency measurement;

…….

Example ATFM Service Category	Example ATFM Capability Elements																						
	Planning			Prediction and Monitoring		CDM				Tactical ATFM Capability						ATFM Execution				ATFM Measures			
	Airspace Design/ATS Route Planning	Capacity Analysis and Modelling	Demand and Workload Prediction	Weather Prediction	Monitoring	Information Exchange	Collaboration	Electronic User Helpdesk	Crisis Management	Segregated SIDS and STARS	Agreed Acceptance Rates	Holding Patterns with CDO	Agreed Flow Gates at Uniform Distances	Prioritization of Landing Aircraft	Notification of Additonal Fuel for Delays	Slot Allocation	Route and Fix Balancing	Flight Level Balancing	Miles in Trail	Minutes in Trail	Fix Balancing	Reroutingq	Mandatory Rerouting
Category A - TMA - Major International Airport	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x		x		
Category A - Enroute - Major ATS Routes/City Pairs - Radar	x	x	x	x	x	x	x	x	x		x	x	x				x	x				x	x
Category B - Enroute - Major ATS Routes/City Pairs - Non-Radar	x	x	x	x	x	x	x	x	x		x							x	x	x		x	x
Category X - TWR/TMA - Regional - Radar	x	x	x	x		x	x			x							x		x		x		
Category Y - TWR/TMA - Regional Non-Radar	x	x	x	x		x	x													x			

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Meterological Services for the larger Terminal Area (MSTA) Functional Displays

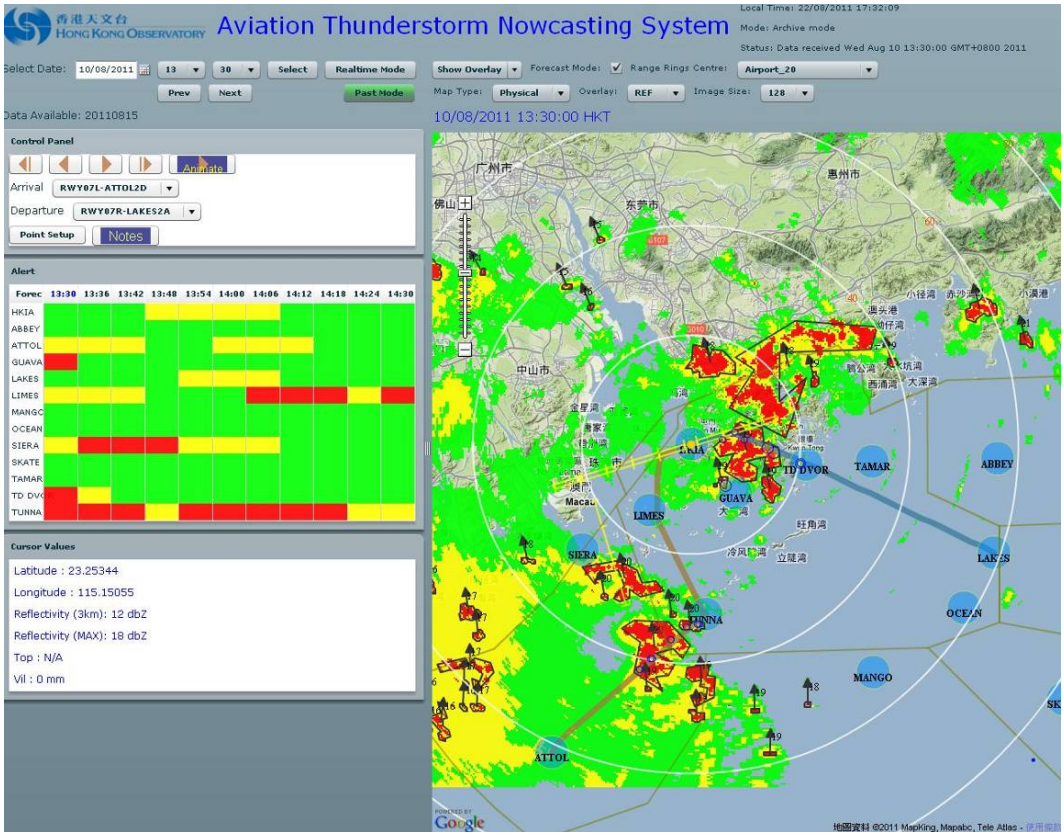

Figure 1: The display panel of the Aviation Thunderstorm Nowcasting System (ATNS).

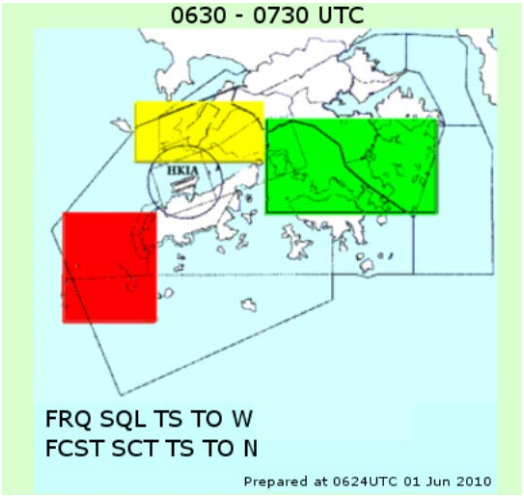

Figure 2: 1hr convection nowcast for arrival/departure corridors. The box to the West has changed to Red, indicating that intense convection is affecting or to affect the arrival (departure) area for runway 07(25). The box to the North has changed to Amber, indicating that less intense convection is affecting or to affect the miss-approach area for the northern runway (07L/25R). The box to the East remains in Green, suggesting that no significant convection will affect the arrival (departure) corridor for runway 25(07).

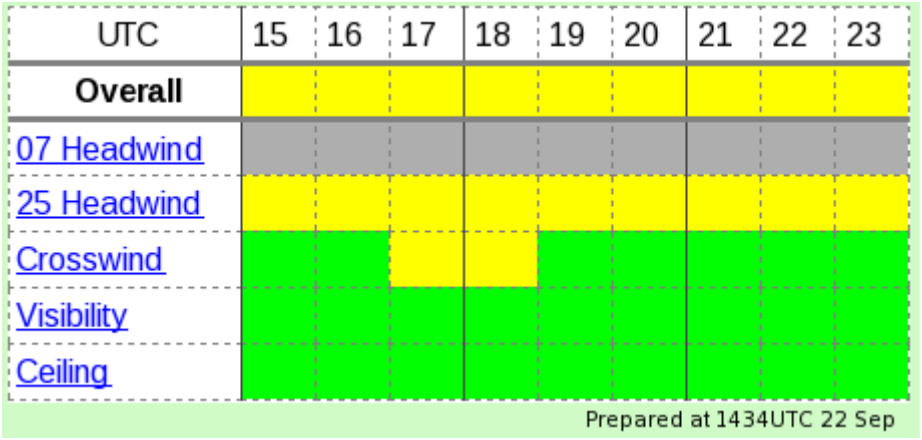

Figure 3: 9hr performance-based weather forecast for the aerodrome.

Level	Head wind	Cross wind	Visibility	Ceiling
1	=< 20 kt	< 30 kt	> 1000 m	> 400 ft
2	21 - 40 kt	30 - 35 kt	600 – 1000 m	200 – 400 ft
3	> 40 kt	> 35 kt	< 600 m	< 200 ft
-	< -5 kt	-	-	obscured sky

Figure 4: Thresholds for the 9hr performance-based weather forecast. The headwind condition is related to the aircraft separation, the crosswind condition is related to the operation threshold of aircraft, while the visibility and ceiling thresholds are associated with the Low Visibility Procedures of HKIA.

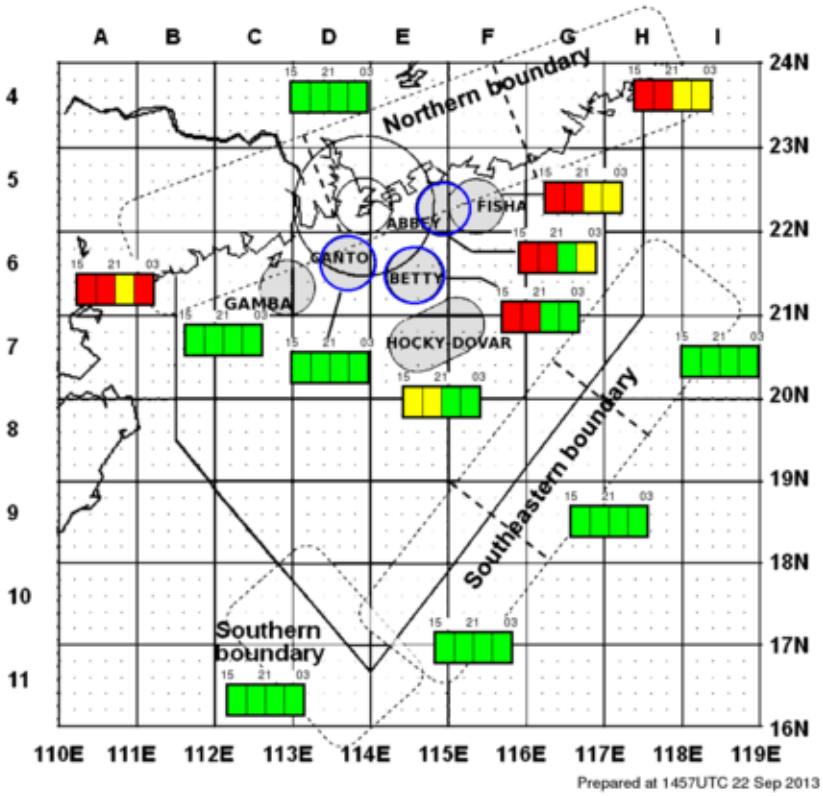

Figure 5: 12hr significant forecast time series for key ATC areas. Shaded areas are the location of key holding patterns with a 20NM radius. Dotted lines mark the other important air spaces which cover busy air routes at the southern and northern boundaries of the HKFIR.

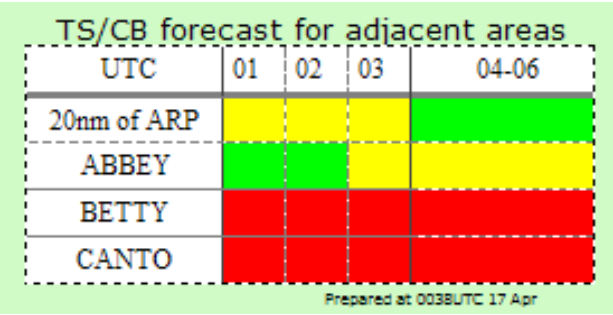

Figure 6: 6hr convection forecast for the aerodrome area and critical holding areas for entering the HKIA.

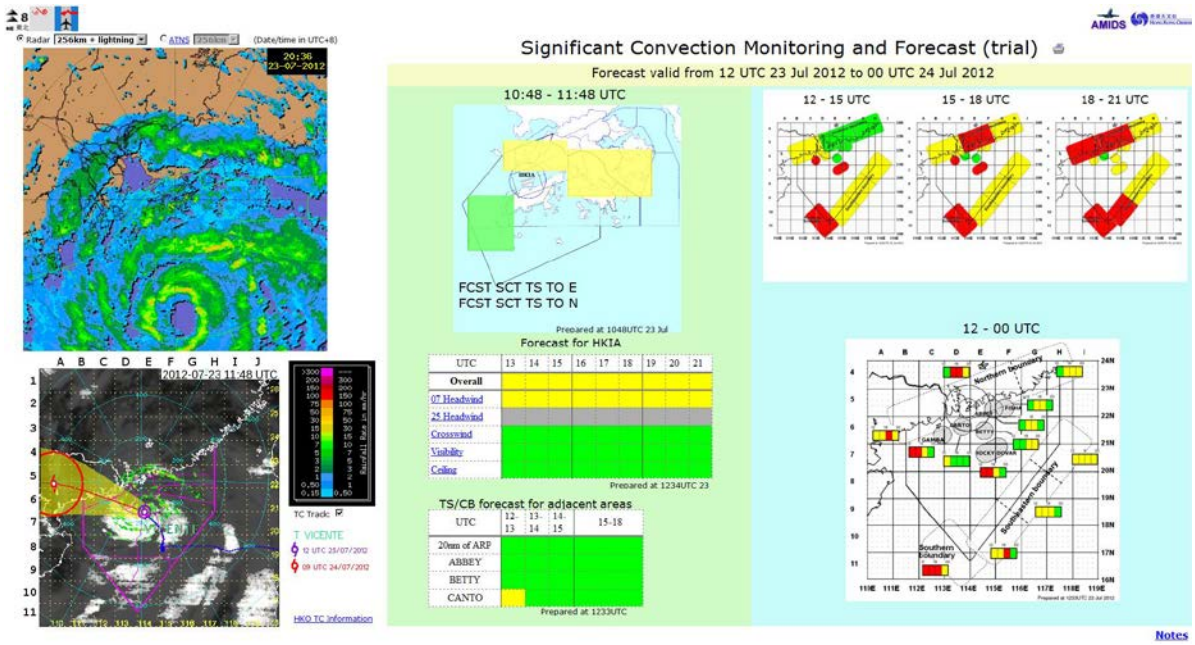

Figure 7: Integrated web display of the forecast suite. The above screen was captured during the passage of Severe Typhoon Vicente in July 2012.

香港天文台 HONG KONG OBSERVATORY

民航處 CIVIL AVIATION DEPARTMENT

Hong Kong International Airport (HKIA)
Automatic Terminal Information Service (ATIS)

ATIS 128			
A-TITLE	HONG KONG ARRIVAL INFORMATION	D-TITLE	HONG KONG DEPARTURE INFORMATION
A-IDENT	J	D-IDENT	S
A-TIME	0335	D-TIME	0337
A-INFO-D1		D-INFO-D1	
A-RUNWAY	07L	D-RUNWAY	07R
A-INFO-D2		D-WS/TURB	
A-WS/TURB	WS AND TURB FCST	D-SUPPL1	RWY SFC WET
A-SUPPL1		D-WIND	130
A-WIND	120	D-SPEED	15
A-SPEED	15	D-VRB-BTN	
A-VRB-BTN		D-AND	
A-AND		D-MAX	
A-MAX		D-MNM	
A-MNM		D-VIS	5000M
A-VIS	10 KM	D-RVR	
A-RVR		D-PRESENT-WX	PASSING SHOWERS
A-PRESENT-WX	PASSING SHOWERS	D-CLOUD	FEW 1000FT SCT 3500FT
A-CLOUD	FEW 1000FT SCT 3500FT	D-WXCHG	
A-WXCHG		D-TEMP	27
A-TEMP	27	D-DEWPOINT	25
A-DEWPOINT	25	D-QNH	1007
A-QNH	1007	D-METINFO	TS 15 NM SW MOV NE
A-METINFO	TS 15 NM SW MOV NE	D-TREND	
A-TREND		D-SUPPL2	
A-SUPPL2		D-ACK	ACK INFO S
A-ACK	ACK INFO J	D-CDCGMC	DELIVERY

Figure 8: TS/WX CELL message shown on ATIS (highlighted in red boxes).

Part V

AIR TRAFFIC MANAGEMENT (ATM)

INTRODUCTION

1. This part of the Asia and Pacific (ASIA/PAC) Basic Air Navigation Plan contains elements of the existing planning system and introduces the basic planning principles, operational requirements and planning criteria related to air traffic management (ATM) as developed for the ASIA/PAC regions.

2. As a complement to the Statement of Basic Operational Requirements and Planning Criteria (BORPC) set out in Part I, Part V constitutes the stable guidance material considered to be the minimum necessary for effective planning of ATM facilities and services in the ASIA/PAC regions. A detailed description/list of the facilities and/or services to be provided by States in order to fulfil the requirements of the plan is contained in the ASIA/PAC Facilities and Services Implementation Document (FASID). During the transition and pending full implementation of the future communications, navigation and surveillance/air traffic management (CNS/ATM) system, it is expected that the existing requirements will gradually be replaced by new CNS/ATM system-related requirements. Further, it is expected that some elements of CNS/ATM system will be subject to amendment, as necessary, on the basis of experience gained in their implementation.

3. The Standards, Recommended Practices and Procedures to be applied are contained in:

a) Annex 2 — *Rules of the Air*;

b) Annex 6 — *Operation of Aircraft*;

c) Annex 11 — *Air Traffic Services*;

d) *Procedures for Air Navigation Services — Air Traffic Management* (Doc 4444);

e) *Procedures for Air Navigation Services — Aircraft Operations* (Doc 8168); and

f) *Regional Supplementary Procedures* (Doc 7030).

4. Background information of importance in the understanding and effective application of this part of the plan is contained in the *Report of the Third Asia/Pacific Regional Air Navigation Meeting* (Doc 9614, ASIA/PAC/3 (1993)).

5. The elements of the material referred to above are presented in the following paragraphs under the headings of Airspace Management (Part V.I — ASM), Air Traffic Services (Part V.II — ATS) and Air Traffic Flow Management (Part V.III — ATFM), with appropriate cross-references to ASIA/PAC/3 recommendations and conclusions.

OBJECTIVES OF AIR TRAFFIC MANAGEMENT

General

6. The primary objective of an integrated ATM system in the ASIA/PAC regions is to enable aircraft operators to meet their planned times of departure and arrival and adhere to their preferred flight profiles with minimum constraints and with no compromise to safety. To accomplish this, the technologies afforded through new CNS systems will have to be fully exploited through international harmonization of ATM standards and procedures. From the aircraft operator's point of view, it is desirable to equip aircraft operating internationally with a minimum set of avionics usable everywhere. Additionally, many of the expected service improvements cannot be meaningfully implemented by one State, but must be implemented in contiguous regions. Therefore, the ATM regional concept of providing ATM over expanded areas must be pursued.

Elements of the ATM system

7. The envisaged ATM system in the ASIA/PAC regions will consist of several sub-elements; these are: airspace management (ASM), air traffic services (ATS), air traffic flow management (ATFM) and the ATM-related aspects of flight operations. These sub-elements will evolve and take on different roles, mainly because they will integrate into a total system. Rather than viewing ground and air as separate functions, the ATM-related aspects of flight operations will be fully integrated as a functional part of the ATM system. Ultimately, this interoperability and functional integration into a total system is expected to yield a synergy of operations that does not currently exist. Through the use of data link for data interchange between elements of the ATM system, this functional integration will be accomplished.

Airspace management

8. The objective of ASM is to maximize, within a given airspace structure, the utilization of available airspace by dynamic time-sharing and, at times, segregation of airspace among various categories of users based on short-term needs. It is also an adjunct to air traffic control (ATC) along the same lines as ATFM.

9. In the seamless, global ATM system, ASM will not be limited only to tactical aspects of airspace use. Its main scope will be toward a strategic planning function of airspace infrastructure and flexibility of airspace use.

Air traffic services

10. ATS will continue to be the primary element of ATM in the ASIA/PAC regions. ATS is composed of several sub-elements: alerting service, flight information service (FIS) and ATC. The primary objective of ATC service is to prevent collisions between aircraft and between aircraft and obstructions on the manoeuvring area, and to expedite and maintain an orderly flow of air traffic. The objective of FIS is to provide advice and information useful for the safe and efficient conduct of flights. The objective of the alerting service is to notify appropriate organizations regarding aircraft in need of search and rescue aid and assist such organizations as required.

Air traffic flow management

11. The objective of ATFM is to ensure an optimum flow of air traffic to or through areas during times when demand exceeds or is expected to exceed the available capacity of the ATC system. The ATFM system in the ASIA/PAC regions should therefore reduce delays to aircraft both in flight and on the ground and prevent system overload. The ATFM system will assist ATC in meeting its objectives and achieving the most efficient utilization of available airspace and airport capacity. The ATFM system in the ASIA/PAC regions should also ensure that safety is not compromised by the development of unacceptable levels of traffic congestion and, at the same time, assure that traffic is managed efficiently without unnecessary flow restrictions being applied.

ATM system regional evolution and implementation timelines

12. Although changes in the ATM system in the ASIA/PAC regions will be implemented in an evolutionary manner, the design of the emerging system should allow for the implementation of a series of well-planned and feasible improvements with a favourable cost-benefit ratio. The ATM system should satisfy user needs while meeting safety, capacity, efficiency, regularity and environmental protection requirements. The implementation plan should allow for incremental improvements, so that the services provided are appropriate to given applications and areas, thereby ensuring homogeneous, continuous and effective service from gate-to-gate. A well-planned implementation schedule is also essential to guarantee an interface between adjacent systems so that boundaries remain transparent to airspace users.

13. The evolution of ATM in the ASIA/PAC regions has been planned on the basis of an integrated regional infrastructure. This is accomplished through planning based on a series of homogeneous areas and major international air traffic flows. Nine areas have been identified, taking into consideration the varying degrees of complexity and diversity in the region. A high-level view of ATM system implementation is depicted in the *Asia Pacific Regional Plan for the New CNS/ATM Systems* (ASIA/PAC Document 007/4).

Part V.III

AIR TRAFFIC FLOW MANAGEMENT (ATFM)

GENERAL PRINCIPLES OF THE ATFM SERVICE

61. In airspaces with high volumes of air traffic, ATFM is needed to support ATM as a planning tool by providing for an optimum flow of air traffic to or through areas during times when demand exceeds or is expected to exceed, the available capacity of the ATM system. The oceanic ATFM service should be interfaced with domestic ATFM organizations/units to provide maximum harmonization.

62. When operationally required, the APANPIRG should develop appropriate procedures for the provision of the ATFM service within the ASIA/PAC regions to cater for the requirements of flights to and from FIRs in the regions and adjacent to it. To achieve this, the following basic principles should be covered in the future ATFM system:

a) pro-active ATFM requires the ability to dynamically interact with the strategic planning of traffic flows. Therefore, ATFM in the ASIA/PAC regions should be interfaced with the overall ATFM strategies in other regions. To this end, the ATM system should also be capable of adjusting to the varying requirements;

b) re-active ATFM is required to take account of short-term contingencies. The ATM system should be able to react quickly and provide early information and advice to the controller and the pilot of the best tactical response necessary to achieve ATFM objectives;

c) data should be collated on likely future demand using historical information, planned development by airports and airlines, aircraft manufacturers, plus the economic forecasts and trends in States of the regions;

d) a recognized and common methodology for the assessment of the capacity of the current and planned ATM system should be developed to include sector capacities and in particular "choke" points;

e) regions should consider the introduction of a centralized flow management unit; and

f) where more than one flow management unit exists, plans to harmonize procedures and practices with adjacent units should be developed.

Air Traffic Flow Management Steering Group

Task List

(last updated ATFM/SG/2, 4 October 2013)

ACTION ITEM	DESCRIPTION	TIME FRAME	RESPONSIBLE PARTY	STATUS	REMARKS
2/1	Research guidance on qualifications and competencies for ATFM operators	ATFM/SG/3	Specialist Team/Secretariat	Open	
2/2	Research guidance material on ATFM compliance	ATFM/SG/3	Specialist Team/Secretariat	Open	Can be sourced from EUROCONTROL
2/3	Further develop draft Regional Framework for Collaborative ATFM.	ATFM/SG/3	Specialist Team/Secretariat	Open	First draft to be presented to ATFM/SG/3
2/4	Develop final draft of Interim Regional Framework for Collaborative ATFM	ATFM/SG/3	Specialist Team/Secretariat	Open	
2/5	Align Asia/Pacific BANP Volume 1 ATFM provisions with the ATFM framework and Doc 9971	ATFM/SG/5	Secretariat	Open	In consultation with ATFM/SG
2/6	Develop Regional priorities, targets and performance monitoring metrics for ASBU Module B0-NOPS	March 2014	Specialist Team/Secretariat	Open	To be provided to APANPIRG Sub-Group Chairs by March 2014
2/7	Conduct study to establish regional baseline of ATFM capability and develop recommended implementation strategies.	ATFM/SG/4	IATA	Open	Decision 2/2