Seamless ATM in an Aerodrome Operations Environment

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AOP/WG/3 Seminar

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Agenda

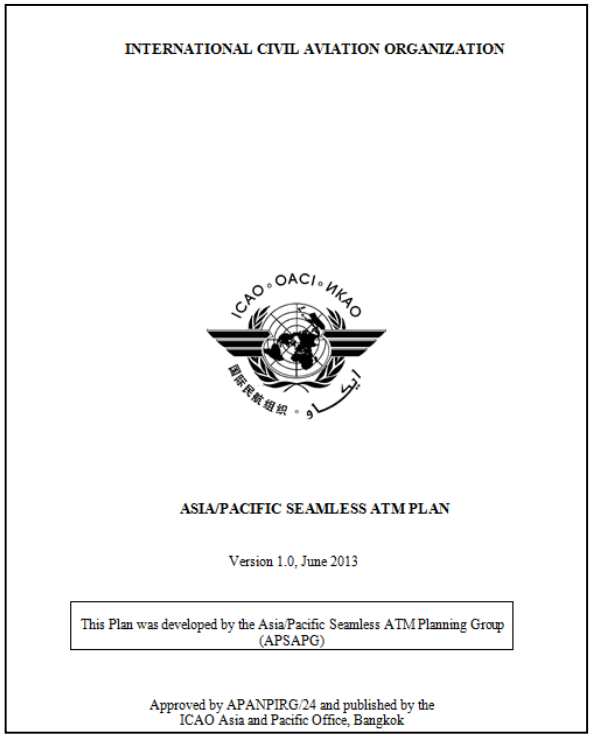
- Understanding Seamless ATM
- APAC Seamless ATM Weaknesses
- Seamless ATM Elements
- Seamless ATM Reporting and Monitoring
- Questions

Understanding Seamless ATM

- **What is Seamless ATM?**
  - Think of it as interoperable and harmonised systems.
- **Seamless ATM Context**
  - Historically, States and ANSPs have developed their own infrastructure tailored only to suit their own national needs.
  - Without a regional body, there was no means of the Asia/Pacific undertaking a European or North American type of ATM modernisation programme like SESAR or NextGen.
  - However, the Asia/Pacific aimed to make huge strides in safety and efficiency, simply by addressing the organisational and human performance issues that prevented optimal ATM, even with the current systems.

Understanding Seamless ATM

- **Asia/Pacific Seamless ATM Plan**
  - The Asia/Pacific Seamless ATM Plan incorporated the Aviation System Block Upgrades (ASBU), but also added a significant number of human performance and civil/military cooperation elements.
  - The Seamless ATM Plan and implementation guidance material is available on the Regional Office web site, under 'APAC eDocuments' at: http://www.icao.int/APAC/Pages/edocs.aspx


INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA/PACIFIC SEAMLESS ATM PLAN

Version 1.0, June 2013

This Plan was developed by the Asia/Pacific Seamless ATM Planning Group (APSAPG)

Approved by APANPIRG/24 and published by the ICAO Asia and Pacific Office, Bangkok

Understanding Seamless ATM

- **Two Areas of Applicability:**
  - Preferred Aerodrome/Airspace and Route Specifications (PARS, this is the area aerodrome operators will be mainly concerned with); and
  - Preferred ATM Service Levels (PASL).
- **Two Phases:**
  - Phase I (12 November 2015); and
  - Phase II (18 November 2018).

Note: the timing is not mandatory, but if applicable, States need to achieve these dates as close to the targets as possible.

APAC Seamless ATM Weaknesses

- **Indications of weaknesses**
  - Managers with poor knowledge of aeronautical fields, project management and human factors because selection is not based on merit or remuneration is insufficient to attract experienced individuals.
  - Poor consultation practices, even between Air Navigation Service Providers (ANSPs) and aerodrome operators where the interface is crucial.
  - Lack of proper (independent and complete) safety cases.
  - Short notice changes (lack of adherence to Annex 15 promulgation requirements).
  - Lack of a reporting culture and therefore critical safety information.
  - Lessons not being learnt internally, and across the region.
- **Examples of Consequences**
  - Slow and non-harmonised implementation across the region
  - Safety consequences from poor planning and lack of coordination/consultation.
  - Unplanned workload stress and lack of efficiency.
  - Individuals unfairly blamed for systemic problems and mistakes repeated.

APAC Seamless ATM Weaknesses

- **Culture**

  Culture is an important factor affecting aspects such as planning, coordination and reporting. Many States do not emphasise the imperative of an aviation culture, as opposed to a national or local culture, due to:

  - Tradition, such as high power-distance cultures that don't encourage staff to provide open feedback to managers;
  - 'Civil service' thinking, especially if aerodrome operators aren't 'mature', and separated from empowered and knowledgeable regulators; and
  - Lack of involvement or empowerment of professional bodies such as IFATCA.

  Although the human performance provisions in the Seamless ATM Plan paragraph 7.41 are for ANSPs, they are arguably as applicable to airside staff and mangers of aerodrome operators.

Seamless ATM Elements

- **PARS Phase 1**

  High Density Aerodromes

  - Apron Management
  - ATM Coordination
  - Capacity Analysis
  - Electronic Surface Movement Guidance and Control
  - A-CDM

Aerodrome Operations

7.1 All high density international aerodromes (100,000 scheduled movements per annum or more) should:

a) provide an appropriate apron management service in order to regulate entry of aircraft into and coordinate exit of aircraft from the apron;

b) have appropriate ATM coordination (including meetings and agreements) related to:

- airport development and maintenance planning;
- coordination with local authorities regarding environmental, noise abatement, and obstacles;
- ATM/PBN procedures for the aerodrome;

c) conduct regular airport capacity analysis, which included a detailed assessment of passenger, airport gate, apron, taxiway and runway capacity; and

d) provide electronic surface movement guidance and control.

Note 1: the 100,000 movement benchmark must not be viewed as lessening more stringent existing requirements and criteria established by the State, or superseding ICAO Annex 14 Volume I requirements, especially with regard to aerodrome certification.

Note 2: the provision of A-SMGCS should be subject to economic analysis (ASBU Priority 3).

7.2 All high density aerodromes should operate an A-CDM system serving the MTF and busiest city pairs, with priority implementation for the busiest Asia/Pacific aerodromes (ASBU Priority 2)[1].

Seamless ATM Elements

High Density Terminal Operations

- Continuous Climb and Continuous Descent Operations (CCO/CDO)
- PBN Standard Instrument Departures and Terminal Arrivals SID/STAR
- Instrument runways with guidance

Terminal Operations (Category T airspace)

7.3 CCO and CDO operations should be considered for implementation at all high density international aerodromes after analysis, based on a performance-based approach (ASBU Priority 2).

Note: this does not preclude a State considering implementation of CCO/CDO at other aerodromes as appropriate.

7.4 All international high density aerodromes should have **RNAV 1** (ATS surveillance environment) or **RNP 1** (ATS surveillance and non-ATS surveillance environments) SID/STAR.

7.5 Where practicable, all high density aerodromes with instrument runways serving aeroplanes should have (ASBU Priority 2):

a) precision approaches; or

b) Approaches with Vertical Guidance (APV), either RNP APCH with Barometric Vertical Navigation (Baro–VNAV) or augmented GNSS (SBAS or GBAS); or

c) if an APV is not practical, straight-in RNP APCH with Lateral Navigation (LNAV).

[1] Based on 2012 ICAO data, the 21 busiest Asia/Pacific aerodromes were:

- Australia (Sydney, Melbourne);
- China (Beijing, Shanghai Pudong and Hong Jiao, Guangzhou, Hong Kong, Xi'an, Shenzhen, Chengdu, Kunming);
- India (New Delhi, Mumbai);
- Indonesia (Jakarta);
- Japan (Haneda, Narita);
- Malaysia (Kuala Lumpur);
- Philippines (Manila);
- Republic of Korea (Incheon);
- Singapore (Changi); and
- Thailand (Suvarnabhumi).

Seamless ATM Elements

Aircraft Equipage - High Density Terminal Airspace

- Automatic Dependent Surveillance-Broadcast (ADS-B)
- Aircraft Safety Nets
- PBN capability

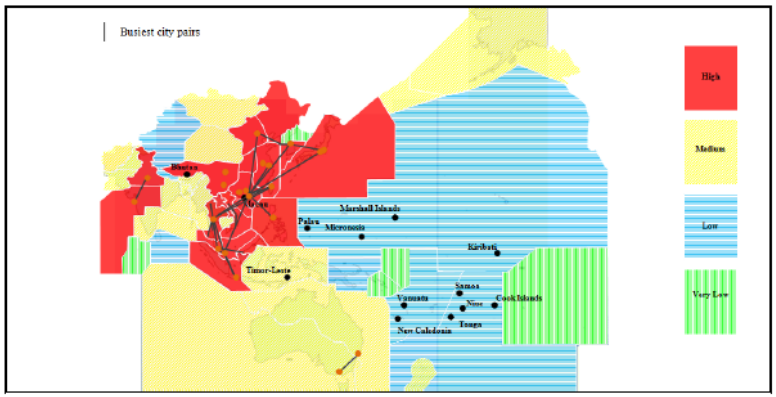


Figure 9: High Density FIRs

En-route Operations

7.6 All Category S upper controlled airspace and Category T airspace supporting high density aerodromes should be designated as non-exclusive or exclusive as appropriate ADS-B airspace requiring operation of ADS-B using 1090ES with DO-260/260A and 260B capability, with priority implementation for the following high density FIRs (**Figure 9**) supporting the busiest Asia/Pacific traffic flows (APANPIRG Conclusion 22/8 and 23/5 refer):

a) South Asia: Delhi, Mumbai;

b) Southeast Asia: Bangkok, Hanoi, Ho Chi Minh, Jakarta, Kota Kinabalu, Manila, Sanya, Singapore, Vientiane; and

c) East Asia: Beijing, Fukuoka, Guangzhou, Hong Kong, Kunming, Incheon, Shanghai, Shenyang, Taibei, Wuhan.

7.7 All Category R and S upper controlled airspace, and Category T airspace supporting high density aerodromes should require the carriage of an operable mode S transponder within airspace where Mode S radar services are provided; and ACAS and Terrain Awareness Warning Systems (TAWS), unless approved by ATC (ASBU Priority 2).

7.8 All Category R and S upper controlled airspace, and Category T airspace supporting high density aerodromes should be designated as non-exclusive or exclusive PBN airspace as appropriate. This is to allow operational priority for PBN approved aircraft, harmonised specifications and to take into account off-track events such as weather deviations, with priority implementation for high density FIRs.

Note: Non-exclusive means that non-PBN aircraft may enter the airspace, but may be accorded a lower priority than PBN aircraft, except for State aircraft.

Seamless ATM Elements

- **PARS Phase II**

  Aerodrome Operations

  - Aerodrome Infrastructure and Facilities
  - Aerodrome Terminal and Runway Capacity

Aerodrome Operations

7.12 Where practicable, all high density aerodromes should provide the following infrastructure and facilities to optimise runway capacity:

a) additional runway(s) with adequate separation between runway centrelines for parallel independent operations;

b) parallel taxiways, rapid exit taxiways at optimal locations to minimize runway occupancy times and entry/exit taxiways;

c) rapid exit taxiway indicator lights (distance to go information to the nearest rapid exit taxiway on the runway);

d) twin parallel taxiways to separate arrivals and departures;

e) perimeter taxiways to avoid runway crossings;

f) taxiway centreline lighting systems;

g) adequate manoeuvring area signage (to expedite aircraft movement);

h) holding bays;

i) additional apron space in contact stands for quick turnarounds;

j) short length or tailored runways to segregate low speed aircraft;

k) taxi bots or towing systems, preferably controlled by pilots, to ensure efficiency and the optimal fuel loading for departure; and

l) advanced visual docking guidance systems.

7.13 All high density aerodromes should have a declared airport terminal and runway capacity based on a capacity and efficiency analysis, to ensure the maximum possible efficiency of aircraft and passenger movement. Sample runway capacity figures are provided from several States in **Appendix G**.

Seamless ATM Elements

Terminal Airspace

- Rotary Wing PBN procedures
- PBN SID/STAR
- Instrument Runways with Guidance

Terminal Operations (Category T airspace)

7.14 **RNP 0.3** arrival/departure, approach and/or en-route transiting procedures should be considered at high density aerodromes with rotary wing operations.

7.15 All international aerodromes should have **RNAV 1** (ATS surveillance environment) or **RNP 1** (ATS surveillance and non-ATS surveillance environments) SID/STAR.

Note: the Asia/Pacific PBN Plan Version 3 required RNAV 1 SID/STAR for 50% of international airports by 2010 and 75% by 2012 (priority should be given to airports with RNP Approach); and RNAV 1 or RNP 1 SID/STAR for 100% of international airports and 70% of busy domestic airports where there are operational benefits by 2016.

7.16 Where practicable, all aerodromes with instrument runways serving aeroplanes should have (ASBU Priority 2):

a) precision approaches; or

b) APV, either RNP APCH with Barometric Vertical Navigation (Baro–VNAV) or augmented GNSS (SBAS or GBAS); or

c) when an APV is not practical, straight-in RNP APCH with LNAV.

Note: the Asia/Pacific PBN Plan Version 3 required RNP APCH (with Baro-VNAV) for 30% of instrument runways by 2010 and 50% by 2012 (priority should be given to airports with operational benefits); and RNP APCH with Baro-VNAV or APV in 100% of instrument runways by 2016.

Seamless ATM Elements

PBN Approaches

- Approach with Vertical Guidance (APV)
- Segregated SID/STAR for Low Speed Aircraft
- PBN-based Visual Procedures
- Holistic Planning

7.17 When establishing the implementation of PBN approach procedures in accordance with Assembly Resolution A37-11, States should first conduct an analysis of the instrument runway eligibility for APV approaches. This analysis should include the feasibility of the APV at a particular location, the presence of regular commercial operations and the current or projected user fleet capability for APV. The introduction of landing capability using GNSS and its augmentations such as GNSS Landing System (GLS) is recommended where these systems were economically beneficial. Locations where APV approach were either not feasible or where regular operators could not realise the benefit of APV should implement RNP APCH with LNAV minima instead of APV, to provide the safety benefits of straight-in approach procedures.

7.18 Where a short length or tailored runway designed to segregate low speed aircraft is established, the runway should be served by PBN procedures including SID and STAR that provided segregation from the procedures serving other aerodrome runways as far as practicable.

7.19 PBN procedures that overlay visual arrival and departure procedures should be established where this provided an operational advantage.

7.20 Airspace and instrument flight procedures associated with high density international aerodromes should not be constrained by international borders and political barriers as far as practicable. Airspace and procedures should be established only after appropriate consideration of:

a) environmental efficiencies;

b) noise abatement and local authority regulations;

c) adjacent aerodromes;

d) conflicting instrument flight procedures; and

e) affected ATC units or ATM procedures.

Seamless ATM Elements

Aircraft Equipage – Terminal Airspace

- Mode S Transponders
- Aircraft Safety Nets
- ADS-B equipage Mandates

<u>En-route Airspace</u>

7.21 All <u>Category R and S</u> upper controlled airspace, and <u>Category T</u> airspace should, unless approved by the State, require the carriage of an operable:

a) mode S transponder within airspace where Mode S radar services are provided; and

b) ACAS and TAWS (ASBU Priority 2).

7.23 All <u>Category S</u> upper controlled airspace and <u>Category T</u> airspace should be designated as non-exclusive or exclusive as appropriate ADS-B airspace requiring operation of ADS-B using 1090ES with DO-260/260A and 260B capability.

- **PASL Phase I**

Aerodrome/Terminal Operations

– AMAN/DMAN

– Meteorological Data

<u>Aerodrome Operations</u>

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

<u>Terminal Operations</u>

7.26 All high density aerodromes should provide meteorological forecasts, aerodrome warnings and alerts that support efficient terminal operations (ASBU Priority 2).

- **PASL Phase II**

Aerodrome/Terminal Operations

– ATC Terminal Capacity

– AMAN/DMAN

<u>Aerodrome Operations</u>

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.

<u>Terminal Operations</u>

7.44 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.

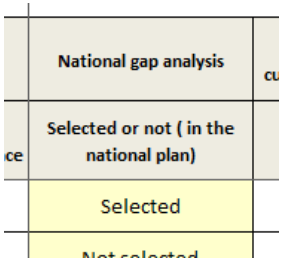
Seamless ATM Reporting and Monitoring

- **State Actions**

- ASBU framework - GANP 4th Edition
- Seamless plan v1.0
- Seamless ATM implementation guidance (table 3)
- Current national plans (PBN, surveillance strategy, …)
- Seamless ATM reporting form

APAC States

1. Seamless Items identified as applicable or not applicable
2. State Seamless ATM Plan (and other associated plans) updated
3. Seamless ATM reporting form updated



Seamless ATM Reporting and Monitoring

- **Regional Office Seamless ATM Implementation Guidance Material**

No	Element	Phase I (expected implementation by 12 November 2015)	Phase II (expected implementation by 08 November 2018)	Implementation actions (Refers to Table 2, implementation matrix)	Main impacts / Main requirements and guidance references
10	**Apron Management REGIONAL**	7.1.a All high density aerodromes should provide an appropriate apron management service in order to regulate entry of aircraft into and coordinate exit of aircraft from the apron		A B C D E F 1 √ √ √ √ **√** √ 2 √ √ √ √ √ √ 3 √ √ √ **√** 4 √ √ √ √ 5 √ √ √ √ 6 **√** √ √ **√** 7 √ **√**	**Main impacts** • People: Airport development and maintenance planners, Airport Operators, ANSP Capacity and safety Managers and procedure designers
20	**ATM (Airport) Coordination - REGIONAL**	7.1.b All high density should have appropriate ATM coordination (including meetings and agreements) related to: • airport development and maintenance planning; • coordination with local authorities regarding environmental, noise abatement, and obstacles; • ATM/PBN procedures affecting the aerodrome		A B C D E F 1 √ √ √ - **√** - 2 √ √ - - - - 3 √ √ - - 4 √ √ √ √ 5 √ - - - 6 - - √ **√** 7 - -	**Main impacts** • People: Airport development and maintenance planners, Airport Operators, ANSP Capacity and safety Managers and procedure designers, Airspace users
30	**Aerodrome capacity - REGIONAL**	7.1.c All high density aerodromes (100,000 scheduled movements per annum or more) should conduct regular airport capacity analysis, which includes a detailed assessment of passenger, airport gate, apron, taxiway and runway capacity	7.13 All high density aerodromes should have a declared airport terminal and runway capacity based on a capacity and efficiency analysis, to ensure the maximum possible efficiency of aircraft and passenger movement.	A B C D E F 1 √ √ √ - **√** - 2 - - - - - - 3 √ √ - - 4 √ √ √ 5 √ - -	**Main impacts** People: Airport development and maintenance planners, Airport Operators, ANSP Capacity and safety Managers and procedure designers, Airspace users

PARS or PASL element

Objective for Phase I

Objective for Phase II

Project management

Guidance Material

Seamless ATM Reporting and Monitoring

- **Suggested optimal project Management steps and milestones**

Stage Number	Action A	Action B	Action C	Action D	Action E	Action F
1. PROJECT PLANNING	Identify the problem or improvement required	Assess applicability to operating environment and State regulations	Gather and review data related to the desired change	Assess economic feasibility and cost/benefit	Start the project, determine project budget and milestones	Plan tendering and maintenance contract process
2. DESIGN	Determine initial design of the desired change, including alternatives	Determine Key Performance Indicators and/or success criteria	Design backup and transition procedures/ steps, including reversion	Determine maintenance considerations	Refine and agree on final design	Define system validation and verification (FAT, SAT)
3. SAFETY	Form safety teams or engage relevant safety experts	Assess operational strengths and weaknesses, opportunities, and threats (SWOT)	Develop the safety case	**Prepare and apply for regulatory approval or certification**		
4. COMMUNICATION	Consult with key stakeholders	Coordinate Regionally and bilaterally	Conduct formal promulgation/ notification	Advertise and brief about the change		
5. TRAINING	Develop simulations and procedures	Source relevant training experts	Conduct simulation and relevant training	Assess competency and authorise		
6. IMPLEMENTATION	**Conduct operational trials and testing**	Assess stability and performance	Make a Go/No-Go decision	**Implement and monitor**		
7. POST - IMPLEMENTATION	Develop review -Lessons learnt -KPI achievement -Report	Monitor medium and long term performance and safety				

Seamless ATM Elements

- **Electronic Reporting**

  The ICAO Asia/Pacific Regional Office had developed an Internet-based reporting tool to enable the ability to submit up to four reports times a year:
  https://portal.icao.int/RO_APAC/Reporting/Pages/default.aspx

  Two levels of monitoring were desirable:

  – monitoring of the regional performance gains, through the Regional Performance Dashboard, allowing global correlation of status and expectations for selected priority items; and
  – monitoring of regional implementation progress through a Regional Picture, one level below, allowing corrective actions by APANPIRG on the implementation for all Seamless ATM elements

Seamless ATM Reporting and Monitoring

- **State Seamless ATM Plan**

  The Plan provided:

  - A high level planning document for the State and its stakeholders, which may reference more detailed plans; and
  - May be reviewed by the Regional Office and APANPIRG.

Contents

Seamless Planning Elements

[10] Aerodrome Capacity - (REGIONAL)

[Phase I] [Phase II]

Project Planning

1A: Problem or Improvement Required

3.1 X

1B: Applicability to the Operating Environment and State Regulations

3.2 X

1C: Gathering and Reviewing Data Related to the Desired Change

3.3 X

*1E: Starting the Project – Determining the Budget and Milestones (**Reporting Action**)*

3.4 X

Seamless ATM Reporting and Monitoring

- **Importance of Reporting**

  Reporting is important for a number of stakeholders:

  - Airspace users (for planning of equipage and fleets;
  - Neighbouring FIRs (for harmonisation of progress);
  - Regional Office (to update the Seamless ATM Plan and for APANPIRG)
  - ICAO HQ (to update the GANP)

  Note: each Seamless ATM element is 'owned' by one of the APANPIRG contributing bodies and the Secretariats exchange information within the Regional Office.

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THANK YOU