International Civil Aviation Organization

Sixth Meeting of the Asia/Pacific Air Traffic Management Automation System Task Force (APAC ATMAS TF/6)

Bangkok, Thailand 2-4 June 2025

Agenda Item 10: Next Meeting date and any other business

CNS-RELATED ASBU IN ASIA/PACIFIC SEAMLESS ANS PLAN

(Presented by the Secretariat)

SUMMARY

This paper summarized the discrepancies observed in the Asia/Pacific Seamless ANS Plan Versio 4.0 and proposed plans for their resolutions.

1. INTRODUCTION

1.1 The Twenty Seventh Meeting of the Communications, Navigation and Surveillance Sub-group (CNS SG/27) of Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) was held at the ICAO APAC Regional Office, Bangkok, Thailand, from *28 August to 1 September 2023*. The meeting webpage containing all resources can be accessed at: https://www.icao.int/APAC/Meetings/Pages/2023-CNS-SG-27.aspx

1.2 The Twenty-Eighth Meeting of the Communications, Navigation and Surveillance Sub-group (CNS SG/28) of APAC Air Navigation Planning and Implementation Regional Group (APANPIRG) was held at the ICAO APAC Regional Office, Bangkok, Thailand, from *1-5 July 2024*. The meeting webpage containing all resources can be accessed at: https://www.icao.int/APAC/Meetings/Pages/2024-CNS-SG-28.aspx

1.3 The Thirty-Fifth Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/35) was held at the ICAO Asia and Pacific Regional Office in Bangkok, Thailand, from 25 to 27 November 2024. The Meeting adopted the Asia/Pacific Seamless ANS Plan by Conclusion 35/1. The meeting webpage containing all resources can be accessed at https://www.icao.int/APAC/Meetings/Pages/2024-APANPIRG-35.aspx

1.4 This paper shares information about some discrepancies observed in CNS-related ASBU mentioned in the Asia/Pacific Seamless ANS Plan Version 4.0 as published in the ICAO APAC eDocument webpage (https://www.icao.int/APAC/Pages/eDocs.aspx).

2. DISCUSSION

2.1 In CNS SG/27 (2023), the ICAO Secretariat, responsible for finalizing the Asia/Pacific Seamless ANS Plan Version 4.0, presented the draft and related outcomes by WP/28 and proposed an update of the Performance Improvement Plan of the Asia/Pacific Seamless ANS Plan for initial review by CNS SG. A draft proposal for revising the Asia/Pacific Seamless ANS Plan *Section 7 – Performance Improvement Plan* was shared for Meeting review.

2.2 The CNS SG/27 Meeting noted that the draft Section 7 was presented to the Seventh Meeting of the AOP Sub-Group (AOP/SG/7, Bangkok, Thailand, 03 – 06 July 2023). The proposed revisions of all sections of the Plan were also planned to be presented to the MET and ATM Sub-Groups of APANPIRG for discussion before being presented to APANPIRG/34 for approval under a formal Conclusion. The CNS SG/27 Meeting was invited to review and provide feedback to the Secretariat on the proposed revision of the Asia/Pacific Seamless ANS Plan, **identify Priority 1 ASBU elements** identified in **the new performance expectations**, and comment on a Secretariat proposal to revise the numbering format of performance expectations.

2.3 ICAO Secretariat CNS section informed that SWIM TF already shared the SWIM-related ASBUs to be included in the next edition of Asia/Pacific Seamless ANS Plan as per APANPIRG Conclusion APANPIRG/33/9 "The Asia-Pacific SWIM Implementation Timeframe and inclusion of the Asia/Pacific SWIM Implementation in the Asia/Pacific Seamless ANS Plan" in 2022. ICAO Secretariat CNS section added that, except for SWIM-related ASBUs, other ASBUs require Member States' observations, feedback, and consent before CNS SG agrees to incorporate them into the next version of the Plan.

2.4 The Meeting appreciated the ICAO's effort in conducting a preview of the Asia/Pacific Seamless ANS Plan. The Meeting noted that proposed CNS-related ASBUs for the next version of the Asia/Pacific Seamless ANS Plan were not yet discussed or consulted with relevant Point of Contact / CNS contributory bodies as per the agreed process in APANPIRG/33 (refer to paragraph 2.14 of WP/28). Therefore, it was impractical for CNS SG to provide comments on proposed modifications related to CNS-related ASBUs, new ASBUs to be added in phase 4, and which of the new block 2 ASBUs should be included in phase 5.

2.5 As a way forward, the CNS SG/27 Meeting agreed to form a "**CNS-related ASBUs review Ad-hoc Group for the next edition of Seamless ANS Plan,"** which was tasked to review the proposed ASBUs, prepare a list of CNS-related ASBUs to include in the Plan, share an interim report to APANPIRG/34, and seek consent from CNS SG/28 (2024). *Australia, China, Hong Kong China, India, Malaysia, New Zealand, Singapore, Thailand, and the United States* volunteered to join the Ad-hoc Group. Other interested member states were invited to share their willingness to join the ad-hoc group via email at snibhani@icao.int or yluo@icao.int

2.6 The Meeting also requested all Member States to nominate a Point of Contact (PoC) to review CNS-related updates that will be proposed by the Ad-hoc Group and share PoC information with the ICAO Secretariat by email at yluo@icao.int or snibhani@icao.int. Additionally, it was recommended that a review of the proposed draft version of the Asia/Pacific Seamless ANS Plan be initiated.

2.7 The ad-hoc group did offline discussions by email and met virtually on 26 September 2023 and finalized the list of CNS-related ASBUs. The list was circulated with member States/Administrations by ICAO APAC State Letter Ref.: T 8/2.15 –AP139/23(CNS) dated 04 October 2023 on Subject: The list of CNS-related ASBUs to incorporate in the next version of the Asia/Pacific Seamless ANS Plan. Response to the letter was incorporated in the revised list, and the list was finalized, which is provided in **Appendix A**.

2.8 The final list was shared with the ICAO secretariat responsible for incorporating all comments in February 2024. The finalized list was also presented to the CNS SG/28 (2024) meeting.

2.9 In CNS SG28, by WP/17, the ICAO Secretariat, responsible for finalizing the Asia/Pacific Seamless ANS Plan, presented the progress of the update of the draft Asia/Pacific Seamless ANS Plan Version 4.0 for review and approval by APANPIRG/35. The CNS SG28 Meeting noted that

the circulation of Draft Asia/Pacific Seamless ANS Plan V3.2.2 to POC for feedback from States was shared in April 2024. The deadline for feedback from States/Administrations by email was 10 June 2024. In response, only four States/Administrations provided feedback. In addition, the deadline for the Reporting of Asia/Pacific Seamless ANS Plan Version 3.0 implementation status by States/Administrations through the Seamless ANS Reporting Tool Portal was 31 May 2024, for which only 11 States /Administrations provided comprehensive reporting.

2.10 It was added that an update of the draft Asia/Pacific Seamless ANS Plan would include feedback from States/Administrations and an analysis of the implementation of the Asia/Pacific Seamless ANS Plan was in progress. It was added that, with the lack of enough data, it was not possible to present an adequate analysis of the status of implementation of the operational requirements in the APAC region as recommended in the Asia/Pacific Seamless ANS Plan.

2.11 In addition, the paper added that feedback provided by ATM/SG/11 and CNS SG/27 Ad-hoc review group, both during and since the Meeting and including the FF-ICE SWG outcomes, was included in Draft Asia/Pacific Seamless ANS Plan Version 3.2.2**.** The States/Administrations were urged to submit the Asia/Pacific Seamless ANS Plan Version 3.0 implementation status and provide feedback on the draft Asia/Pacific Seamless ANS Plan Version 3.2.2 through the respective PoCs as soon as possible.

2.12 Furthermore, the finalized draft Asia/Pacific Seamless ANS Plan Version 4.0 was presented to APANPIRG/35 for adoption, which was adopted by the APANPIRG/35 meeting by Conclusion 35/1, which is provided in **Appendix B**.

2.13 Recently, it was observed that the priorities of some CNS ASBUs finalized by *CNS-related ASBUs review Ad-hoc Group for the next edition of the Seamless ANS Plan* were not correctly reflected in the published Asia/Pacific Seamless ANS Plan Version 4.0. This discrepancy could be due to an inadvertent mistake when compiling feedback from all sources.

ASBU Element	Proposed Priority by CNS-related ASBUs Review Ad-hoc Group	Priority Published in Seamless ANS Plan Version 4.0
NAVS-B0/1 SBAS	Priority 1	Priority 2
NAVS-B0/2 GBAS	Priority 1	Priority 2
NAVS-B0/3 ABAS	Priority 1	Priority 2
NAVS-B0/4 MON	Priority 1	Priority 2

2.14 It is also noted that if a Priority 1 was assigned to the above NAVS ASBU elements, it would require a consequential review and amendment to the following paragraphs in the Asia/Pacific Seamless ANS Plan Version 4.0:

- Paragraph 5.6 (Table 1: Asia/Pacific ASBU Block 0, Block 1 and Block 2 Priority) related to APTA-B0/3 to be reviewed, due to the inconsistency in prioritization of related ASBU elements [NAVS-B0/1 to B0/2 (Priority 1) against APTA-B0/3 (Priority 3)];

- Paragraph 5.10 to be amended: **NAVS-B0/1** to **B0/4** to be included as Priority 1 elements;

- Paragraph 7.7 (refer below) to be amended: the current text in Seamless ANS Plan Version 4.0 suggested that those NAVS-B0/1 to B0/4 are <u>recommended</u> upgrade

(i.e. Priority 2).

*7.7 SBAS, GBAS, ABAS and MON systems should be established as appropriate to the level and type of aircraft operations and the operating environment consistent with **NAVS-B0/1** to **B0/4**, subject to an assessment of benefits and costs.*

Note 1: the application of GNSS and its augmentations such as GBAS Landing System (GLS) is recommended where these systems were economically beneficial.

Note 2: As far as practicable, airspace and instrument flight procedures associated with international aerodromes should not be constrained by international borders and political barriers, and 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.

2.15 After internal coordination within the ICAO Secretariat, it was decided that the responsible ICAO Secretariat would share the issues associated with proposed changes in the priorities of NAVS ASBUs with the responsible contributory bodies. These included GBAS-SBAS ITF and PBNICG. It was also decided that the ICAO secretariat will share this information with all contributory bodies under CNS for their information and necessary action. Based on the outcomes of the discussion with relevant contributory bodies, the plan to correct the list of CNS-related ASBUs and other impacted ASBUs, if any, will be finalized and shared with the CNS SG/29 meeting planned to be held from 16-20 June 2025.

2.16 The information was shared with the GBAS SBAS ITF/7 meeting held from 14-16 May 2025 in the ICAO APAC Office, Bangkok, Thailand by WP/02. The Meeting was informed about a comparison of the priorities adopted by CNS SG/28 based on a proposal from the CNS-related ASBUs Review Ad-hoc Group for the next edition of the Seamless ANS Plan and the priorities published in the Asia/Pacific Seamless ANS Plan Version 4.0. The Meeting was proposed following these changes:

ASBU Element	**Approved Priority by CNS SG/28**	**Priority Published in *Asia/Pacific Seamless ANS Plan Version 4.0***
NAVS-B0/1 to B0/4 SBAS, GBAS, ABAS, MON	Priority 1	Priority 2

Figure 1: Proposed Priorities vs. Published Priorities

2.17 Referring to the Fourteenth Air Navigation Conference (AN-Conf/14) (Montréal, 26 August to 6 September 2024) **Recommendation 2.2/2** – *Addressing GNSS interference and contingency planning* and the DGCA/59 Conference (Cebu, Philippines, 14 to 18 October 2024) **Action Item 59/15**, proposed changes to the priorities of NAVS-B0/3 ABAS and NAVSB0/4 MON to Priority 1 was presented to the GBAS/SBAS ITF/7 Meeting.

2.18 Recognizing the fact that not all ASBU NAVS module Block 0 elements may be implemented as Priority 1 in the Asia/Pacific Region, the ICAO Secretariat proposed considering the splitting of the elements from a 'Thread' (see **Figure 2**) into individual elements (see **Figure 3**) to ensure that appropriate Priority is assigned to each element.

Functional Category	Element	Description	Priority	Responsibility for Review
Technology	NAVS-B0/1 to B0/4	SBAS, GBAS, ABAS, MON (PARS 7.5, 7.7)	2	CNS SG

Figure 2: Priority Published in *Asia/Pacific Seamless ANS Plan Version 4.0*

Functional Category	Element	Description	Priority	Responsibility for Review
Technology	NAVS-B0/1	GBAS	2	CNS SG
	NAVS-B0/2	SBAS	2	
	NAVS-B0/3	ABAS	1	
	NAVS-B0/4	MON	1	

Figure 3: Proposed New Priority

2.19 The GBAS SBAS ITF/7 discussed the revised priorities and agreed to modify them as amendments in the plan v4.0. The ICAO Secretariat is debating the way forward and the need for change in Seamless ANS Plan v4.0. The outcomes of the discussion will be shared with the CNS SG/29 meeting planned to be held from 16 to 20 June 2025

3. ACTION BY THE MEETING

3.1 The Meeting is invited to:

a) note the information in this paper;

b) request States/Administrations to review CNS/other ASBUs in the Seamless ANS plan and share any discrepancies, if any; and

c) discuss any matters as appropriate.

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Key Messages:

x.xx The performance objectives of the Plan are expected to be **implemented in phases**:

- Phase I, expected implementation by 12 November 2015 (past);
- Phase II expected implementation by 07 November 2019 (past);
- Phase III expected implementation by 03 November 2022 (past);
- Phase IV expected implementation by 27 November 2025; and
- Phase V expected implementation by 23 November 2028.

x.xx No phase, nor any element, is binding on any State, but should be considered as a planning framework. The Seamless ANS Plan itself is therefore guidance material.

1.12 The review of the Plan during 2019 deleted reference Phase I as Phase II commenced in **November 2015**, although the uncompleted elements from Phase I were moved to Phase II. The implementation dates of Phase II PARS and PASL items align with the **commencement of** GANP Block 1, whereas Phase III is a mid-**Block 1** update scheduled for 2022.

x.xx Due to the unavailability of an implementation reporting mechanism since 2019, Phase II elements are retained in this version of the Plan. With the expected availability of an updated reporting mechanism from 2023/2024, it is envisaged that uncompleted elements from Phase II will be incorporated in III in the 2026 update of the Plan.

1.13 The 2023 update of the Plan introduces new ASBU Block 1 and some Block 2 modules in Phase IV, and Block 2 modules in Phase V. Phase IV of the PARS and PASL implementation framework will also be referenced.

2.13 The PARS and PASL were expected to be implemented in **five** phases; Phase I by 12 November 2015 (past), Phase II by 07 November 2019 (past), Phase III by 03 November 2022 and Phase IV by 27 November 2025, and Phase V by 23 November 2028.

x.xx The planned migration of this Plan into the Regional Air Navigation Plan Volume III may require a review of the PARS/PASL structure.

The allocation of priority was based on factors including its importance in promoting Seamless ANS:

- **Priority 1** = critical upgrade assignment based on whether the implementation of an element could bring most benefit to the region or regional upgrade by States and is essential to achieve the service level required globally;

- **Priority 2** = recommended upgrade for those elements which would bring benefits to the region and generally to be implemented from 2022, but States are encouraged to implement earlier if beneficial; and

- **Priority 3** = assigned to those elements which may not be universally implemented in the Asia/Pacific Region.

The proposed CNS related ASBUs:

Functional Category	Element	Description	Priority	Responsibility for Review, Endorsing and Monitoring	New ASBUs/Already in plan v3.0	Phase
Information	FICE-B0/1:	Automated basic AIDC	1	CNS SG	Already in plan v3.0	II
	FICE-B2/2	Filing Service	2	CNS SG ATM SG	New in Block 2	V
	FICE-B2/4	Flight data request service	2	CNS SG ATM SG	New in Block 2	V
	SWIM- B2/1 -2	SWIM-B2/1- Information service provision SWIM-B2/2- Information service consumption	2		New but adopted by SWIM TF/6, CNS SG/26, and APANPIRG/33.	IV
Operational	APTA-B0/1 – 2:	Basic PBN SID and STAR procedures, PBN non-precision approaches	1	CNS SG	Already in plan v3.0	II
	APTA-B0/3 and 6	SBAS/GBAS CAT I precision approach procedures, and PBN Helicopter PinS Operations	3		Already in plan v3.0	II
	APTA-B0/4 – 5, 7 – 8:	CDO (Basic) and CCO (Basic), and performance-based aerodrome operating minima for advanced/basic aircraft	2		Already in plan v3.0	II

The proposed CNS related ASBUs:

	APTA-B1/1 – 5:	advanced capability PBN approaches, PBN SID and STAR procedures and performance-based aerodrome operating minima for advanced aircraft with SVGS, CDO and CCO (Advanced)	3		Already in plan v3.0	IV
	APTA-B2/1	GBAS CAT II/III precision approach procedures	3		New	V
	APTA-B2/2	Simultaneous operations to parallel runways	3		New	V
	APTA-B2/3	PBN Helicopter Steep Approach Operations	3		New	V
	APTA-B2/4	Performance based aerodrome operating minima – Advanced aircraft with SVGS	3		New	V
	DATS-B1/1	Digital Aerodrome Air Traffic Services	3	AOP SG ATM SG CNS SG	Already in plan v3.0	IV
	RSEQ-B0/3	Point merge	3	CNS SG	Already in plan v3.0	II
	SNET-B0/1 – 4	STCA, MSAW, APW, APM	1	CNS SG ATM SG	Already in plan v3.0	II
	SNET-B1/1 – 2:	Enhanced STCA with aircraft parameters and in complex TMAs	2		Already in plan v3.0	III
	SURF-B0/1 – 3:	Basic ATC surface operations tools, comprehensive situational awareness, situational awareness, alerting service	2	CNS SG ATM SG	Already in plan v3.0	III

The proposed CNS related ASBUs:

	SURF-B1/1 – 5:	Advanced surface traffic management visual aids, pilot comprehensive awareness and runway alerting, enhanced ATC alerting, routing service to support ATC and EVS for taxiing	2		Already in plan v3.0	III
	SURF-B2/1 - B2/3	Enhanced surface guidance for pilots and vehicle drivers; Conflict alerting for pilots for runway operations	3	AOP SG CNS SG	New	V
	TBO-B0/1:	Introduction of time-based management within a flow centric approach	2	ATM SG CNS SG	Already in plan v3.0	III
	TBO-B1/1	Initial Integration of time-based decision-making processes	2		Already in plan v3.0	III
	TBO-B2/1-B2/2	Pre departure Trajectory synchronization; extended Time based management across multiple FIRs.	3		New	V
Technology	ASUR-B0/1 – 3:	ADS-B, MLAT, SSR-DAPS	1	CNS SG	Already in plan v3.0	II
	ASUR-B1/1	Reception of aircraft ADS-B signals from space (SB ADS-B)	2		Already in plan v3.0	III
	ASUR-B2/1	Evolution of ADS-B and Mode S	3		New	V

The proposed CNS related ASBUs:

	ASUR-B2/2	Community based surveillance system for airborne aircraft (low and higher airspace)	3		New	V
	COMI-B0/1 – 2, 4 – 6	ACARS, ATN/OSI, VDL Mode 2 Basic, SATCOM Class C Data, HFDL	2		Already in plan v3.0	III
	COMI-B0/3, 7	VDL Mode O/A, AMHS	1		Already in plan v3.0	II
	COMI-B1/1	Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS)	**1**		Already in plan v3.0	III
	COMI-B1/2 – 4:	VDL Mode 2 Multi-Frequency, SATCOM Class B (SB-S) Voice and Data, ATN/IPS and AeroMACS Ground-Ground	2		Already in plan v3.0	III
	COMI-B2/1	Air Ground ATN/IPS	3		New	V
	COMI-B2/2	Aeronautical Mobile Airport Communication System (AeroMACS) aircraft mobile connection	3		New	V
	COMI-B2/3	Links meeting requirements for non-safety critical communication	3		New	V

The proposed CNS related ASBUs:

	COMS-B0/1 – 2	CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace and ADS-C (FANS 1/A) for procedural airspace	2		Already in plan v3.0	III
	COMS-B1/1 – 3	PBCS approved CPDLC (FANS 1/A+), ADS-C and SATVOICE for domestic and procedural airspace	2		Already in plan v3.0	III
	COMS-B2/1-3	PBCS approved CPDLC, ADS-C, SATVOICE	3		New	V
	NAVS-B0/1 – 4	SBAS, GBAS, ABAS, MON	**1**		Already in plan v3.0	II
	NAVS-B1/1	Extended GBAS	3		Already in plan v3.0	IV
	NAVS-B2/1-3	DFMC- GBAS, SBAS, ABAS	3		New	V

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA/PACIFIC SEAMLESS ANS PLAN

Version 4.0, November 2024

This Plan was originally developed by the Asia/Pacific Seamless ATM Planning Group (APSAPG) and amended when appropriate by APANPIRG.

Approved by APANPIRG/35 and published by the
ICAO Asia and Pacific Office, Bangkok

CONTENTS

SCOPE OF THE PLAN

Plan Structure

1.1 The Seamless Air Navigation Service (ANS) Plan (hereinafter referred to as the 'Plan') references different levels of ANS planning. At the upper level is a global perspective, which is guided mainly by references to the *Global Air Navigation Plan* (GANP, ICAO Doc 9750) and its global technical planning frameworks, viz., the *Global Air Traffic Management (ATM) Operational Concept* (ICAO Doc 9854) and the *Global Aviation Safety Plan* (GASP). Beneath this level is regional planning primarily provided by the *Asia/Pacific Regional Air Navigation Plan*, this Plan and other guidance material, to define goals and means of meeting State planning objectives, such as:

- Asia/Pacific Regional Air Navigation Plan requirements and objectives;
- the Seamless ANS performance framework, with a focus on technological and human performance within the GANP's Aviation System Block Upgrade (ASBU) Block 0, Block 1 and Block 2 elements, non-ASBU elements, and civil-military cooperation elements;
- a deployment plan with specific operational improvements, transition arrangements, expected timelines and implementation examples; and
- an overview of financial outcomes and objectives, cross-industry business and performance/risk management planning.

1.2 Key components of this Plan, as updated, are expected to be migrated into the *Asia/Pacific Regional Air Navigation Plan Volume III*, under a future project to be initiated by ICAO.

1.3 The Plan does not use 'continental', 'remote' and 'oceanic' areas to refer to an assumed geographical application area, as many Asia/Pacific States have islands or archipelagos that can support a higher density of Communications, Navigation, Surveillance (CNS) systems than in a purely 'oceanic' environment. In accordance with the CONOPS that air navigation services should be provided commensurate with the capability of the CNS equipment, it is important to categorise airspace in this manner and simplify the numerous references to this capability throughout the Plan. Thus, the Plan categorises airspace by reference to its CNS capability as:

a) Category R: remote en-route airspace with Air Traffic Services (ATS) HF or CPDLC communications and outside the coverage of ground-based surveillance coverage; or

b) Category S: serviced (or potentially serviced) en-route airspace – by both direct [not dependent on a Communication Service Provider (CSP)] ATS communications and surveillance; or

c) Category T: terminal operations serviced by both direct ATS communications and surveillance.

1.4 The word 'States' in the Plan includes Special Administrative Regions and territories.

1.5 **DISCLAIMER:** The presentation of material in this Plan does not imply the expression of any opinion whatsoever on the part of ICAO or APANPIRG concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

1.6 The operational improvements addressed in the Plan are expected to be implemented in phases:

- Phase I – expected implementation by 12 November 2015 (past);
- Phase II – expected implementation by 07 November 2019 (past);
- Phase III – expected implementation by 03 November 2022 (past);
- Phase IV – expected implementation by 27 November 2025; and
- Phase V – expected implementation by 23 November 2028.

1.7 No phase, nor any element, is binding on any State, but should be considered as a planning framework. The Plan itself is therefore guidance material.

1.8 It is important to note that the Plan's Phase commencement dates are planning targets and should not be treated like a 'hard' date such as the example of the implementation of Reduced Vertical Separation Minimum (RVSM). In that case, there was a potential major regional problem if all States did not implement at the same time by the specific agreed date, which was clearly not the case for the start of the Plan's Phases I, II or III.

1.9 In that regard, although it would have been ideal if all States achieved capability on day one of each Phase, this was probably not realistic. However, States should consider the impact on stakeholders and improving capacity of the ANS system overall by not achieving target implementation dates. The Plan's Phase dates were chosen as being an achievable target for the majority of States. However, the dates were not designed to accommodate the least capable State, otherwise the region as a whole would fall behind the necessary urgent ANS improvements required by the Director's General of Civil Aviation and the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG).

Plan Review

1.10 The Plan needs to be updated to take into account ASBU threads in Block 1 and 2 elements, when these elements and their associated technology become mature.

1.11 Periodic updates to the Plan are also required in respect of the economic information contained therein.

1.12 As an iterative process, the Plan requires regular updating to keep current with aviation system changes. It is intended that APANPIRG, and its contributory bodies conduct a complete review of the Plan every three years (or a shorter period determined by APANPIRG) of the Plan to align with the review cycle of the GANP. The Plan and its subsequent revisions should be endorsed by APANPIRG.

1.13 The previous practice of scheduling Plan updates to coincide with the GANP cycle and the approval of the GANP update by the ICAO Assembly presented a significant challenge to the Asia/Pacific Region in terms of fully analyzing and comprehending GANP changes which may be still under final development quite late in the cycle, and then identifying and prioritizing GANP elements for regional implementation while developing any proposed regional planning elements in parallel. The 2019 update of the Plan included consideration of the major GANP update which was still being finalized during that year and had not yet been approved by the ICAO Assembly.

1.14 APANPIRG/33 (December 2022) agreed that the three-year update cycle of the Plan continue to be aligned with GANP updates, with each Plan update to be developed and endorsed in the year immediately following the scheduled meetings of the ICAO Assembly (**Figure 1**).

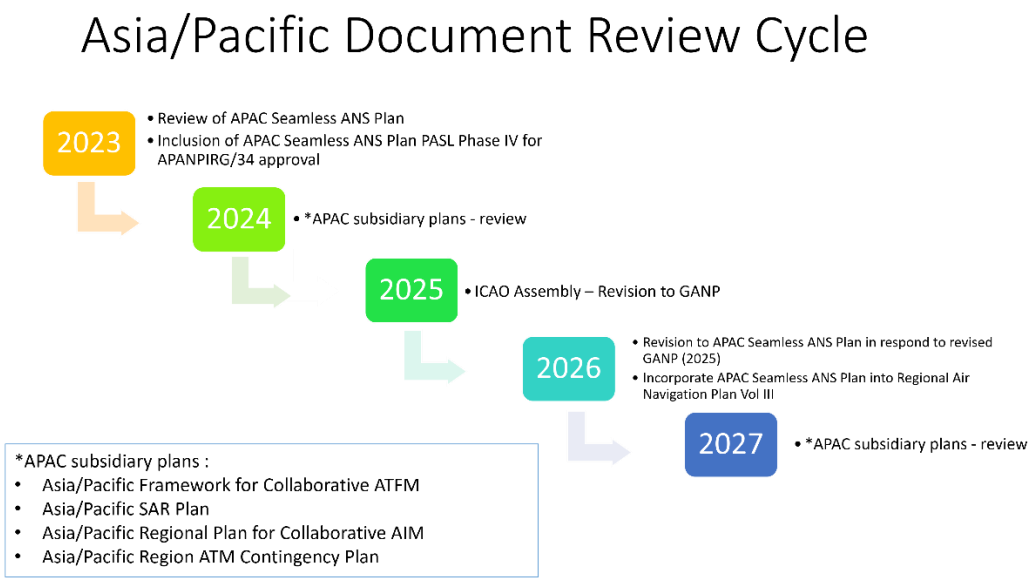

Figure 1: Planned Review and Update Process

1.15 Review of the Navigation and Surveillance strategies needs to result in the update to the Plan to ensure consistency.

1.16 The review of the Plan during 2019 deleted reference to Phase I as Phase II commenced in November 2019, although the uncompleted elements from Phase I were moved to Phase II. The implementation dates of Phase II Preferred Aerodrome/Airspace and Route Specifications (PARS) and Preferred ANS Service Levels (PASL) items align with the commencement of ASBU Block 1, whereas Phase III is a mid-Block 1 update.

1.17 Due to the unavailability of an implementation reporting mechanism since 2019, Phase II elements are retained in this version of the Plan. With the availability of an updated reporting mechanism from 2024, the uncompleted elements from Phase II will be incorporated in Phase III in the 2026 update of the Plan.

1.18 The 2023/2024 update of the Plan introduces new ASBU Block 1 elements in Phase IV, and some Block 2 elements in Phase V. Phase IV and Phase V of the PARS and PASL implementation framework are also be referenced.

PLAN OBJECTIVES AND DEVELOPMENT

Plan Objective

2.1 The objective of the Plan is to facilitate Asia/Pacific Seamless ANS operations, by developing and deploying ANS solutions capable of ensuring safety and efficiency of air transport throughout the Asia/Pacific Region. The Plan provides a framework for a transition to a Seamless ANS environment, in order to meet future performance requirements.

2.2 The Plan provides the opportunity for the Asia/Pacific Region to pursue the benefits from research and development conducted by various States including the NextGen programme (United States of America), the European Single European Sky ATM Research (SESAR), and Japanese Collaborative Actions for Renovation of Air Traffic Systems (CARATS).

2.3 ICAO Doc 9854 contains a vision of an integrated, harmonized, and globally interoperable ATM system, with a planning horizon up to and beyond 2025. In this context, the Plan is expected to encourage more partnering relationships among States within sub-regions.

Hierarchy of Plans

2.4 The Plan was developed as part of a suite of Asia/Pacific air navigation plans, and thus, the Plan should not be considered in isolation. The *Asia/Pacific Regional Collaborative Air Traffic Flow Management (ATFM) Framework, Asia/Pacific Plan for Collaborative Aeronautical Information Management (AIM), Regional ATM Contingency Plan, Asia/Pacific Search and Rescue (SAR) Plan* and *Asia/Pacific Airport Collaborative Decision Making (A-CDM) Implementation Plan* all form part of the aforementioned suite of planning and guidance material connected to the Plan (**Figure 2**).

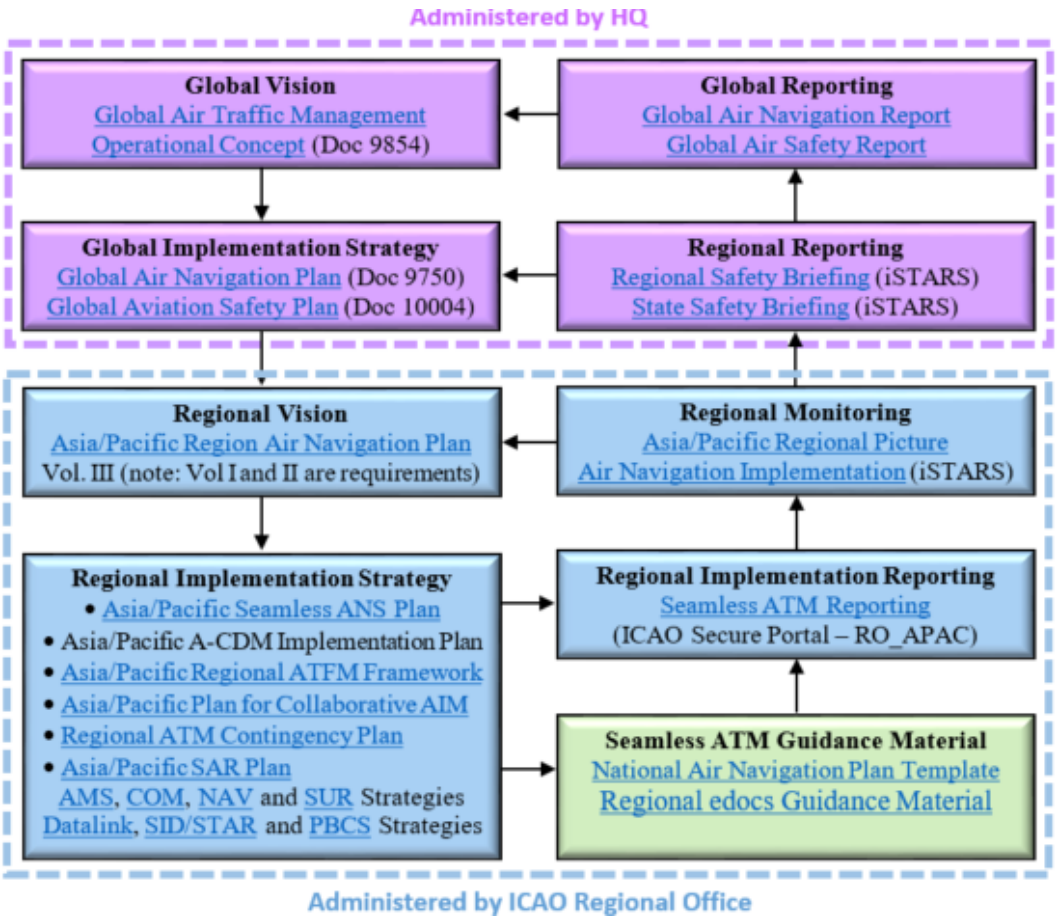

Figure 2: Structure of Global and Regional Planning and Reporting

2.5 The Plan should also be read in conjunction with the *Asia/Pacific Regional Aviation Safety Plan* (RASP-AP), to ensure the safety initiatives related to ANS are taken into account.

2.6 This Plan addresses the full range of ATM stakeholders, including civil and military Air Navigation Services Providers (ANSPs), civil and military aerodrome operators as well as civil and military airspace users. The Plan has been developed in consultation with Asia/Pacific States, administrations and also with International Organizations (IOs).

Note: civil airspace users include scheduled aviation, business aviation, general aviation and Unmanned Aircraft System (UAS) operators.

2.7 States should consult with stakeholders and determine actions, in order to commit to achieving the objectives of Seamless ANS and the requisite performance objectives in the areas of safety, environment, capacity and cost-efficiency that flow from this Plan.

2.8 ASBU Block 0 modules contained technologies, systems and procedures which were expected to be available from 2013. The Plan also references ASBU Block 1 and 2 elements, available from 2019 and 2025 respectively. Where such technology, systems, standards and procedures are available earlier than these dates and appropriate deliverables can be provided, the intention was to develop aggressive yet practical implementation schedules within this Plan to provide the earliest possible benefits.

2.9 The Manual on Global Performance of the Air Navigation System (ICAO Doc 9883) provides guidance on implementing a performance-oriented ATM System. The Manual on ATM System Requirements (ICAO Doc 9882) contains 11 Key Performance Area (KPA) system expectations, as well as a number of general performance-oriented requirements. In accordance with the expectations of these documents, the Asia/Pacific Seamless ATM Planning Group (APSAPG) adopted the following categories of operational improvements to facilitate Seamless ANS operations:

a) Preferred Aerodrome/Airspace and Route Specifications (PARS); and

b) Preferred ANS Service Levels (PASL).

2.10 The PARS contains expectations for airspace and ATS routes, including aircraft equipage to facilitate Seamless ANS operations, and are primarily for the State regulator and airspace authority, and are of interest to airspace planners, flight procedure designers and aircraft operators.

2.11 The PASL contain the expectations for ANSPs and is therefore a matter for the State regulator or the ATS authority. The PASL is of primary interest to ANSPs and aircraft operators. The PARS and PASL together form the foundation of Seamless ANS development, and as such should be enabled by national regulations, rules and policies wherever applicable to enable a harmonised effort by all stakeholders.

2.12 The PARS/PASL introduced two categories of operational improvements, which incorporate system expectations, such as general performance-oriented requirements. Each operational improvement is composed of a list of expectations of different aspects of the aviation system.

2.13 In considering the planning necessary before the PARS/PASL Phase dates, it is important to ensure everyone in the planning process is aware that the necessary groundwork and capability building must take place as a priority, and that full operational capability by the Phase date commencement was a secondary consideration. It is recognised that some States would be working towards implementation during the Phase, in an effort to implement as soon as possible, and others that implemented as soon as the technology and systems were available.

2.14 Prior to implementation, each State should verify the applicability of PARS and PASL by analysis of safety, ATM capacity requirements to meet current and forecast traffic demand, efficiency, predictability, cost effectiveness and environment to meet the expectations of stakeholders. The PARS/PASL elements would be either:

a) not applicable; or

b) already implemented; or

c) not implemented.

2.15 The PARS and PASL were/are expected to be implemented in five phases: Phase I by 12 November 2015 (past); Phase II by 07 November 2019 (past); Phase III by 03 November 2022 (past); Phase IV by 27 November 2025; and Phase V by 23 November 2028.

2.16 The planned migration of this Plan into the *Asia/Pacific Regional Air Navigation Plan Volume III* may require a review of the PARS/PASL structure.

Seamless ATM Definition

2.17 The objective of Seamless ATM was agreed by the Asia/Pacific Seamless ATM Planning Group (APSAPG) as follows:

The objective of Seamless ATM is the safe and interoperable provision of harmonized and consistent air traffic management service provided to a flight, appropriate to the airspace category and free of transitions due to a change in the air navigation service provider or Flight Information Region.

2.18 APSAPG noted the following description as the CANSO definition of Seamless ATM:

Seamless ATM operations is defined as ATM operations in contiguous airspace that is technically and procedurally interoperable, universally safe, and in which all categories of airspace users transition between Flight Information Regions, or other vertical or horizontal boundaries, without requiring a considered action to facilitate that transition and without any noticeable change in:

1) Type or quality of service received;

2) Air navigation and communications performance standards; and

3) Standard practices to be followed.

Note: the term 'Seamless ATM' was amended to 'Seamless ANS' in 2019, to reflect the fact that there are areas such as aerodromes that are not part of the Air Traffic Management field.

2.19 The ICAO Twelfth Air Navigation Conference (AN-Conf/12, Montreal, Canada, 19-30 November 2012) endorsed ten High Level Air Navigation Policy Principles in the GANP, and the Asia/Pacific Seamless ANS Principles are aligned with these high-level principles.

EXECUTIVE SUMMARY

Seamless ANS

3.1 Aviation is a significant driver of economic growth in the and contributes strongly to the economic wellbeing of the diverse cultures and people in the Asia/Pacific Region. In 2016, aviation contributed USD 684 billion in economic activity and generated 30.2 million jobs (direct and indirect) to the regional economies. By 2030, it is forecast these figures will grow to USD 1.3 trillion and 70 million jobs.

3.2 Strong demand for air travel continued to propel the recovery of passenger markets in 2023. The total industry achieved a remarkable 36.9 per cent year-on-year (YoY) growth, as traffic, measured in Revenue Passenger Kilometres (RPKs), reached 94.1 per cent of 2019 levels, a significant increase from 2022 when it stood at 68.7 per cent. While the airline industry had recovered the majority of its traffic 2019 levels as of December 2023, network restoration remained relatively uneven as connectivity and passenger demand to and from Asia/Pacific has not yet reached its pre-pandemic status (source: IATA monthly statistics).

3.3 The Asia/Pacific Region is showing the largest passenger recovery in 2023, expected to reach close to 3 billion passengers. In 2024, the region will continue its growth, yet at a slower pace, and is expected to attain 3.5 billion or 103 per cent of the 2019 level. In the current scenario, the region is forecasted to be near 3.9 billion passengers by the end of 2025 (source: ACI).

3.4 The global air cargo industry is forecasted to grow at a four per cent per year from 2020 through to 2039 **(Figure 3**). The domestic China region is expected to have the highest growth rate at 5.8 per cent. They are followed by the Intra-East Asia and Oceania region with an expected growth of 4.9 per cent.

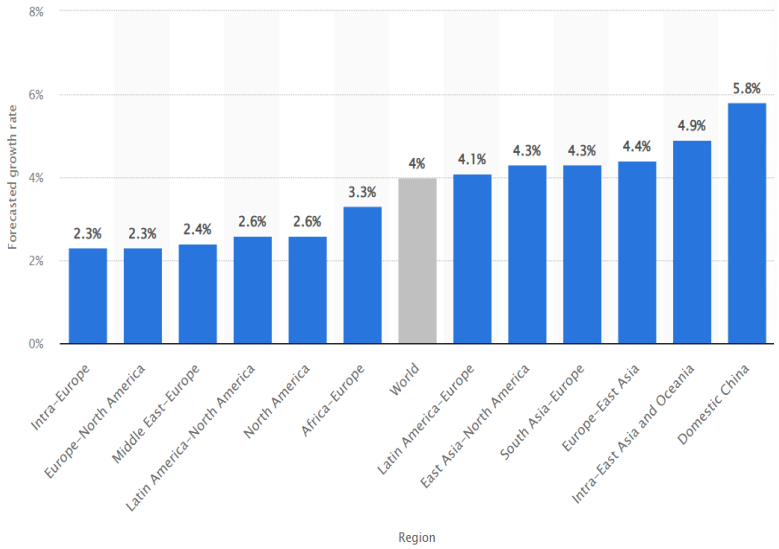

Figure 3: World Cargo Growth Forecast by Region (Source: Statista)

3.5 From 2023 to 2042, total passenger traffic worldwide is predicted to grow at a Compound Annual Growth Rate (CAGR) of 4.3 per cent, with a steep recovery gradient observed in the first three years (9.1 per cent CAGR for 2023 to 2026), then converging to the pre-COVID-19 growth rate (3.6 per cent CAGR for 2023 to 2052). Global passenger traffic is expected to reach nearly 20 billion in 2042, double the 2024 projection (source: ACI).

3.6 In 2052, global passenger traffic is expected to reach close to 25 billion, approximately 2.5 times the 2024 projection (source: ACI).

COVID-19 Impact

3.7 Global passenger traffic in 2024 is predicted to surpass the 2019 level for the first time since COVID-19, reaching 9.7 billion passengers or 106 per cent of the 2019 level (12 per cent YoY growth rate). The growth rate is expected to gradually decelerate in succeeding years, as more markets recover from the effects of COVID-19.

3.8 The COVID-19 pandemic had a severe impact on the aviation industry in the Asia/Pacific Region during 2020-2023. In 2019, international travel within Asia represented 13.3 per cent of global international travel, ranking it as second biggest market after the intra-Europe market. In 2021, Asia's share fell to 1.5 per cent. Air traffic in Asia/Pacific Region was predicted to record only slow improvement in 2022, achieving only 62 per cent of 2019 levels.

3.9 "Lost" travel between 2020 and 2022 was equivalent to 1.8 x 2019 RPKs and by 2040, if 2022 forecasts are realized, traffic may still be 6 per cent below pre-pandemic forecasts. However, after a slow start, post COVID-19 recovery remains on track despite several obstacles, both predicted and unforeseen. Overall RPKs are currently (2023) at 84 per cent of 2019 levels.

3.10 The aviation industry is expected to recover to 2019 levels in 2024. Domestic and international passenger numbers are expected to recover to 2019 levels in 2024 and 2025 respectively. Asia/Pacific lags behind other regions' recovery in the short term with the regional split showing North America in the lead, in 2023, followed by Europe and the Middle East in 2024, and Latin America, Africa, and Asia/Pacific in 2025. Asia/Pacific is forecast to lead traffic growth in the longer term (2040 horizon) surpassing other regions by 2028 (source: IATA).

3.11 At the beginning of the COVID-19 pandemic, the international passenger market had more impact than the domestic passenger market due to international travel restrictions. The international passenger market has recovered significantly in 2023, expected to reach 3.5 billion with 42 per cent YoY growth. In 2024, international passenger traffic is forecasted to be four billion with 14 per cent YoY growth. Domestic passenger traffic is forecasted to be 5.2 billion in 2023 with 25 per cent YoY growth, then slowing down to 5.7 billion in 2024 with 10 per cent YoY growth (source: ACI).

3.12 Given the size and diversity of the region, ANS harmonisation efforts will require the needs of the least developed ANSPs to be addressed especially in the areas of technical assistance such as funding, expertise and training. Differences in economic development may also mean that traffic demands are not uniform in the region, and therefore ANS solutions should be driven by analysis of costs and benefits and performance requirements appropriate to the traffic demands.

3.13 The diverse operating environments also mean that the implementation situation varies significantly across States. As such, the economic analysis of implementation activities such as ASBUs should be undertaken by States, and assisted by the Plan.

3.14 **Figure 4**, **Figure 5 and Figure 6** indicate the projected economic and air traffic growth which necessitated the Seamless ANS approach.

World Economic Outlook Growth Projections

(Real GDP, annual percent change)		PROJECTIONS	
	2023	2024	2025
World Output	**3.2**	**3.2**	**3.2**
Advanced Economies	**1.6**	**1.7**	**1.8**
United States	2.5	2.7	1.9
Euro Area	0.4	0.8	1.5
Germany	-0.3	0.2	1.3
France	0.9	0.7	1.4
Italy	0.9	0.7	0.7
Spain	2.5	1.9	2.1
Japan	1.9	0.9	1.0
United Kingdom	0.1	0.5	1.5
Canada	1.1	1.2	2.3
Other Advanced Economies	1.8	2.0	2.4
Emerging Market and Developing Economies	**4.3**	**4.2**	**4.2**
Emerging and Developing Asia	5.6	5.2	4.9
China	5.2	4.6	4.1
India	7.8	6.8	6.5
Emerging and Developing Europe	3.2	3.1	2.8
Russia	3.6	3.2	1.8
Latin America and the Caribbean	2.3	2.0	2.5
Brazil	2.9	2.2	2.1
Mexico	3.2	2.4	1.4
Middle East and Central Asia	2.0	2.8	4.2
Saudi Arabia	-0.8	2.6	6.0
Sub-Saharan Africa	3.4	3.8	4.0
Nigeria	2.9	3.3	3.0
South Africa	0.6	0.9	1.2
Memorandum			
Emerging Market and Middle-Income Economies	4.4	4.1	4.1
Low-Income Developing Countries	4.0	4.7	5.2

Source: IMF, *World Economic Outlook*, April 2024

Note: For India, data and forecasts are presented on a fiscal year basis, with FY 2023/24 (starting in April 2023) shown in the 2023 column. India's growth projections are 6.9 percent in 2024 and 6.5 percent in 2025 based on calendar year.

Figure 4: World Economic Growth Outlook (Source: IMF)

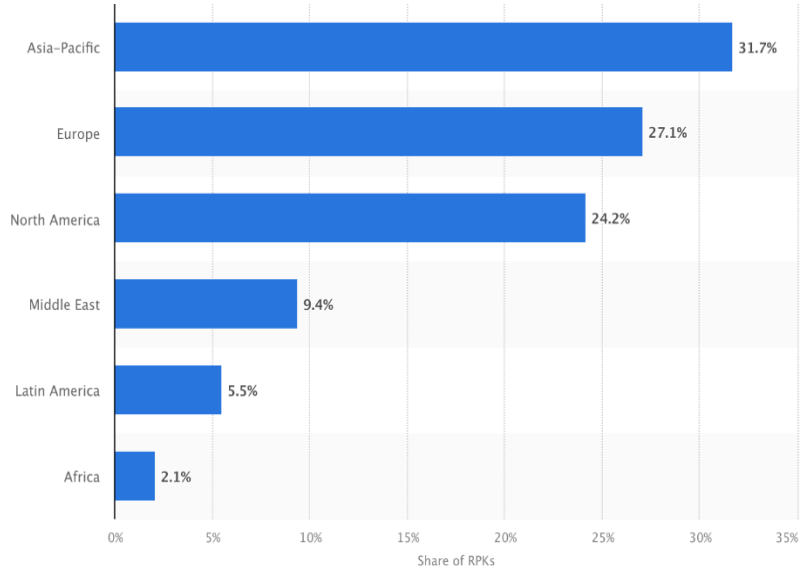

Figure 5: Worldwide Passenger Air Traffic by Region, in 2023 (Source: Statista)

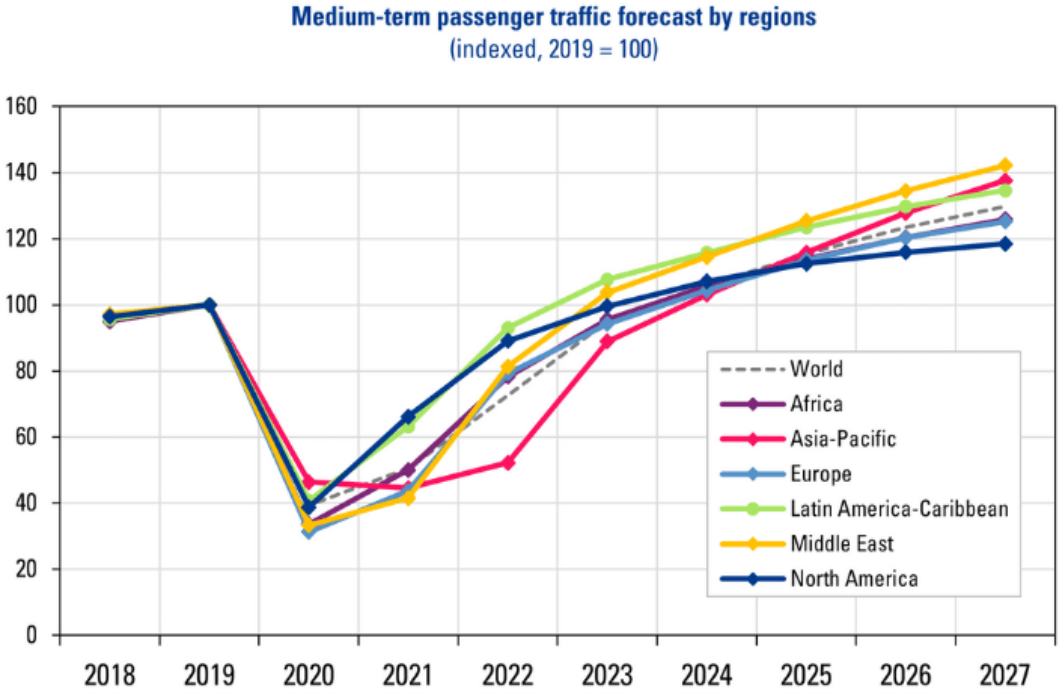

Figure 6: Medium Term Passenger Traffic Forecast by Region (Source: ACI)

3.15 The 46th Directors General Civil Aviation Conference (DGCA/46, Osaka, Japan, October 2009) was the genesis of Asia/Pacific Seamless ANS discussion. The DGCA Conference requested that APANPIRG to take a lead role in development of Seamless ATM in the Asia/Pacific Region.

3.16 APANPIRG/22 created the APSAPG in 2011 under Decision 22/56, with a primary goal to develop an Asia/Pacific Seamless ATM Plan. APANPIRG/24 (2013) adopted version 1 of the Plan.

3.17 The Global Air Navigation Industry Symposium (GANIS, Montreal, Canada, 20-23 September 2011) introduced the ASBU concept. This inferred an iterative improvement, from Block 0 to 3. Although the implementation of all ASBU elements is not mandatory, it is intended to achieve the highest level of conformance; thus, supporting global interoperability and Seamless ANS.

3.18 Subject to several recommendations, the AN-Conf/12 endorsed the ASBU concept and the consequential changes to the GANP. The AN-Conf/12 stressed that ASBU implementation and requirements needed to be coordinated at a regional level based on operational requirements, and that action plans to address identified impediments to ATM modernization should be developed. This Plan is part of the Asia/Pacific strategy to address the requirement for action plans, and to guide Asia/Pacific administrations in their ANS planning.

3.19 At the First ICAO APAC Ministerial Conference on Civil Aviation, held in Beijing, China in January 2018, the Ministers in charge of civil aviation representing 36 Asia/Pacific governments endorsed the Beijing Declaration, formalizing their shared commitments to high-priority aviation safety and efficiency objectives. They agreed to pursue cooperative progress on objectives relating to aviation safety oversight, State Safety Programme (SSP) implementation, airport certification, independence of accident investigation authority, the timely implementation of the Asia/Pacific Seamless ATM Plan (now Seamless ANS Plan), and the sharing of information and best practices for air navigation and SAR services.

Note: Beijing Declaration commitments to ANS implementation have been updated by the declaration of the Second ICAO APAC Ministerial Conference on Civil Aviation, held in New Delhi, India in September 2024. Excerpts from both the Beijing Declaration and the Delhi Declaration are provided in ***Appendix A***.

Air Navigation Service Provider Summary

3.20 The safety and efficiency of flights transcend national borders and airspace boundaries. Seamless ANS is therefore possible only if there is close regional collaboration among States, their ANSPs and all stakeholders. Cooperation is the key to success.

3.21 Given the size and diversity of the region, ANS harmonisation efforts will require the needs of the least developed ANSPs to be addressed especially in the areas of technical assistance such as funding, expertise and training. Differences in economic development may also mean that traffic demands are not uniform in the region, and therefore ANS solutions should be driven by analysis of costs and benefits and performance requirements appropriate to the traffic demands.

Aerodrome Operator Summary

3.22 Aerodrome operations are a key component for Seamless ANS, especially in regard to infrastructure and operational efficiencies. The collaborative interaction of various stakeholders is important to ensure that aerodrome operations, facilities and equipment are suitable for all aircraft operators. Aerodrome operators require the airspace, air traffic management, aerodrome and aircraft operations to be cohesive and interoperable. This includes not only the aerodrome movement areas but the terminal and ancillary services, which may include border protection, fuel, baggage and passenger facilitation, which need to be aware of the interaction of their services with the aircraft operations.

3.23 Short-, medium- and long-term aerodrome planning needs to take into account the seamless system so that capital investment is aligned to ANS operational efficiencies. Aerodrome development and airline changes are catalysts for changes driven by the aerodrome operator, but there is a need to ensure en-route and terminal ATS efficiencies are not impacted or lost, due to poor aerodrome infrastructure and operations. A saving in aircraft flight time can easily be eroded by lack of gates, poor taxiway-runway interface and inadequate terminal facilities. Stakeholder involvement and infrastructure changes needs to be coordinated to maximise the efficiencies from a systemic approach to aerodrome, airspace, air traffic management and aircraft operations.

ABBREVIATIONS AND ACRONYMS

AAR	Aerodrome Arrival Rate or Airport Acceptance Rate
ABAS	Aircraft Based Augmentation Systems
ABI	Advanced Boundary Information (AIDC)
ACARS	Aircraft Communication Addressing and Reporting System
ACAS	Airborne Collision Avoidance System
A-CDM	Airport Collaborative Decision-Making
ACIS	Airport Collaborative Information Sharing (ACIS)
ACC	Area Control Centre
ACP	Acceptance (AIDC)
ADIZ	Air Defence Identification Zone
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance-Contract
AeroMACS	Aeronautical Mobile Airport Communication System
AIDC	ATS Inter-facility Data Communications
AIGD	ICAO ADS-B Implementation and Guidance Document
AIM	Aeronautical Information Management
AIRB	Basic Airborne Situational Awareness
AIS	Aeronautical Information Service
AIXM	Aeronautical Information Exchange Model
AMAN	Arrival Manager
AMHS	ATS Message Handling System
AMS	Aeronautical Mobile Service
ANSP	Air Navigation Service Provider
AN-Conf	Air Navigation Conference
AOC	Assumption of Control (AIDC)
AOP	Airport Operations Plan
AOP SG	Aerodrome Operations and Planning Sub-Group of APANPIRG
APAC	Asia/Pacific
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APCH	Approach
APOC	Airport Operations Centre
APSAPG	Asia/Pacific Seamless ANS 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
ASM	Airspace Management
ASMGCS	Advanced Surface Movements Guidance Control Systems
ATC	Air Traffic Control
ATFM	Air Traffic Flow Management
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATM SG	Air Traffic Management Sub-Group of APANPIRG
ATN/IPS	Aeronautical Telecommunication Network/Internet Protocol Suite
ATN/OSI	Aeronautical Telecommunication Network/Open System Interconnection
ATS	Air Traffic Services
BOB	Bay of Bengal
CAGR	Compound Annual Growth Rate
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
CDP	Climb Decent Procedure
CLAM	Cleared Level Adherence Monitoring
COM	Communication
CONOPS	Concept of Operations
CNS	Communications, Navigation, Surveillance
CNS SG	Communications, Navigation and Surveillance Sub-Group of APANPIRG
CPAR	Conflict Prediction and Resolution
CPDLC	Controller Pilot Data-link Communications
CPWG	Cross-Polar Working Group
CSP	Communication Service Provider
DARP	Dynamic Airborne Re-route Planning
DCL	Data-link Departure Clearance
DFMC	Dual Frequency Multi Constellation
DGCA	Conference of Directors General of Civil Aviation
DMAN	Departure Manager
EST	Coordinate Estimate
EVS	Enhanced Vision System
FAA	Federal Aviation Administration
FANS	Future Air Navigation Systems
FDPS	Flight Data Processing System
FIR	Flight Information Region
FL	Flight Level
FLAS	Flight Level Allocation Scheme
FLOS	Flight Level Orientation Scheme
FRA	Free Route Airspace
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
GLS	GBAS Landing System
GNSS	Global Navigation Satellite System
HF	High Frequency
HFDL	High Frequency Data Link
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IM	Interval Management Procedure
IMC	Instrument Meteorological Conditions
IO	International Organizations
IPACG	Informal Pacific ATC Coordinating Group
ISPACG	Informal South Pacific ATS Coordinating Group
ITP	In-Trail Procedure
IWXXM	ICAO meteorological information exchange model
KPA	Key Performance Area
LNAV	Lateral Navigation
MET	Meteorological
MET SG	Meteorology Sub-Group of APANPIRG
MLAT	Multilateration
MON	Minimal Operating Networks
MSAW	Minimum Safe Altitude Warning
MTCD	Medium Term Conflict Detection Tool
MTF	Major Traffic Flow

NANP	National Air Navigation Plan
NAV	Navigation
NextGen	Next Generation Air Transportation System
NOPS	Network Operations
OLDI	On-Line Data Interchange
OTS	Organised Track System
PACOTS	Pacific Organized Track System
PARS	Preferred Aerodrome/Airspace and Route Specifications
PASL	Preferred ANS Service Levels
PBN	Performance-based Navigation
PinS	Point in Space
RAM	Route Adherence Monitoring
RPAS	Remotely Piloted Aircraft System
RPK	Revenue Passenger Kilometres
RNAV	Area Navigation
RNP	Required Navigation Performance
RVSM	Reduced Vertical Separation Minimum
SATVOICE	Satellite Voice Communications
SAR	Search and Rescue
SB ADS-B	Space Based ADS-B
SBAS	Satellite-based Augmentation System
SCS	South China Sea
SESAR	Single European Sky ATM Research
SHEL	Software, Hardware, Environment and Liveware
SID	Standard Instrument Departure
SB ADS-B	Space-Based ADS-B
SSR-DAPS	Secondary Surveillance Radar Downlink of Aircraft Parameters
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
SVGS	Synthetic Vision Guidance Systems
SWIM	System-Wide Information Management
TBO	Trajectory Based Operations
TCAS	Traffic Collision Avoidance System
TOC	Transfer of Control
UAS	Unmanned Aircraft Systems
UPR	User Preferred Routes
VHF	Very High Frequency
VDL	VHF Data Link
VMC	Visual Meteorological Conditions
VNAV	Vertical Navigation
VOLMET	Meteorological information for aircraft in flight
VSA	Visual Separation on Approach
VSAT	Very Small Aperture

BACKGROUND INFORMATION

Principles

5.1 There were considered to be three major areas of Seamless ANS Principles, involving People (human performance), Facilities (physical equipment), and Technology and Information. The 37 Principles agreed by APSAPG and endorsed by APANPIRG are included as **Appendix B**.

Aviation System Block Upgrade (ASBU)

5.2 At the Global level, ICAO started the ASBU initiative as a programme framework that developed a set of aviation system solutions or upgrades intended to exploit current aircraft equipage, establish a transition plan and enable global interoperability. ASBUs comprised a suite of elements organised into flexible and scalable building blocks, where each element represented a specific, well bounded improvement. The building blocks could be introduced and implemented in a State or a region depending on the need and level of readiness, while recognizing that not all the elements were required in all airspaces. ASBUs described a way to apply the concepts defined in the ICAO Doc 9854 with the goal of implementing regional performance improvements and were used in the new edition of the GANP to guide implementation. AN-Conf/12 agreed that the ASBUs and the associated technology roadmaps were integral parts of the GANP and a valuable implementation tool kit.

5.3 ASBU are comprised of a suite of elements, each having the following qualities:

- a clearly-defined measurable operational improvement and success metric;
- necessary equipment and/or systems in the aircraft and on the ground along with an operational approval or certification plan;
- standards and procedures for both airborne and ground systems; and
- a positive business case over a clearly defined period of time.

5.4 ASBU are groups of operational improvements to advance air navigational capabilities and improve the performance of their air navigation system in a cost-effective way. They are classified into three functional categories:

- Information;
- Operational; and
- Technology.

Asia/Pacific ASBU Implementation

5.5 **Table 1** provides a summary of the Block 0, Block 1 and Block 2 elements, and the expected priority for implementation within the Asia/Pacific Region. The allocation of priority was based on factors including its importance in promoting Seamless ANS:

- **Priority 1** – critical upgrade assignment based on whether the implementation of an element could bring most benefit to the region or regional upgrade by States and is essential to achieve the service level required globally;
- **Priority 2** – recommended upgrade for those elements which would bring benefits to the region and generally to be implemented from 2022, but States are encouraged to implement earlier if beneficial; and
- **Priority 3** – assigned to those elements which may not be universally implemented in the Asia/Pacific Region.

5.6 A cost-benefit or economic analysis before implementation was identified as essential to determine whether to implement certain elements such as SURF-B0/1 but should not preclude an economic analysis of other elements as determined by the State. Detailed information on the development, scope, objectives, stakeholders and dependencies for each ASBU element is provided at https://www4.icao.int/ganpportal/.

Functional Category	Element	Description	Priority	Responsibility for Review
Information	AMET-B0/1 to B0/4	Meteorological observations, forecast, warning, climatological and historical products, and dissemination (PASL 7.44)	1	MET SG
	AMET-B1/1 to B1/4	Meteorological products supported by automated decision systems or aids using IWXXM (PASL 7.59, 7.61)	2	
	AMET-B2/1 to B2/4	Integrated meteorological observations in support of enhanced ATM and airport decision-making processes, particularly in the near-term (PASL 7.69, 7.70, 7.72)	3	
	DAIM-B1/1 to B1/6	Provision of quality-assured digital aeronautical data and information, including AIP, terrain and obstacle, aerodrome and instrument flight procedure data sets (PASL 7.43)	1	ATM SG
	DAIM-B1/7	Provision of digital NOTAM improvements (PASL 7.58)	2	
	DAIM-B2/1 to B2/5	Integrated aeronautical information service in a SWIM environment in support of enhanced operational ground and air decision-making processes for all phases of flight (PASL 7.72)	3	
	FICE-B0/1	Automated basic AIDC (PASL 7.29)	1	CNS SG
	FICE-B2/2	Filing Service (PASL 7.72)	2	ATM SG CNS SG
	FICE-B2/4	Flight Data Request Service (PASL 7.72)	2	
	SWIM-B2/1	Information service provision (PASL 7.62)	2	
	SWIM B2/2	Information service consumption (PASL 7.62)	2	
Operational	ACDM-B0/1	Airport CDM Information Sharing (ACIS) (PARS 7.3, 7.18)	1	AOP SG ATM SG
	ACDM-B0/2	Airport CDM integration with ATM Network (PARS 7.3, 7.18)	2	
	ACDM-B1/1 to B1/2	Airport CDM Integration with ATM Network, AOP and APOC (PARS 7.25)	2	
	ACDM-B2/1 to B2/3	AOP, APOC and Total Airport Management (PARS 7.25)	3	AOP SG
	APTA-B0/1	PBN non-precision approaches (with basic capability) (PARS 7.4, 7.5, 7.10, 7.13, 7.14, 7.21)	1	CNS SG

	APTA-B0/2	Basic PBN SID and STAR procedures (with basic capability) (PARS 7.4, 7.5, 7.10, 7.13, 7.14, 7.21)	1	
	APTA-B0/3	SBAS/GBAS CAT I precision approach procedures (PARS 7.5, 7.6, 7.10, 7.14, 7.21)	3	
	APTA-B0/4	CDO (Basic) (PARS 7.14, 7.19, 7.21)	2	
	APTA-B0/5	CCO (Basic) (PARS 7.14, 7.19, 7.21)	2	
	APTA-B0/6	PBN Helicopter Point in Space (PinS) Operations (PARS 7.5, 7.6, 7.10, 7.14, 7.21)	3	
	APTA-B0/7	Performance-based aerodrome operating minima for advanced aircraft (PARS 7.14, 7.19, 7.21)	2	
	APTA-B0/8	Performance-based aerodrome operating minima for basic aircraft (PARS 7.14, 7.19, 7.21)	2	
	APTA-B1/1	PBN approaches (with advanced capability) (PARS 7.14, 7.21, 7.22, 7.23)	3	
	APTA-B1/2	PBN SID and STAR procedures (with advanced capability) (PARS 7.14, 7.21, 7.22, 7.23)	3	
	APTA-B1/4	CDO (Advanced) (PARS 7.14, 7.21, 7.22, 7.23)	3	
	APTA-B1/5	CCO (Advanced) (PARS 7.14, 7.21, 7.22, 7.23)	3	
	APTA-B2/1	GBAS CAT II/III precision approach procedures	3	
	APTA-B2/2	Simultaneous operations to parallel runways	3	
	APTA-B2/3	PBN Helicopter Steep Approach Operations	3	
	APTA-B2/4	Performance-based aerodrome operating minima for advanced aircraft with SVGS (PARS 7.14, 7.21, 7.22, 7.23, 7.26)	3	
	CSEP-B1/1 to B1/4	basic airborne situational awareness AIRB and VSA, and performance-based horizontal separations (PARS 7.20)	2	ATM SG
	CSEP-B2/1 to B2/3	Interval management procedure; cooperative separation at low altitudes and higher airspace	3	
	DATS-B1/1	Digital Aerodrome Air Traffic Services (PASL 7.60)	3	AOP SG ATM SG CNS SG
	FRTO-B0/1 to B0/4	Direct routing, airspace planning and FUA, flexible routings, and basic conflict detection and conformance monitoring (PASL 7.32, 7.34, 7.39)	1	ATM SG

	FRTO-B1/1 to B1/7	Free Route Airspace, RNP routes, Advanced FUA and Airspace Management (ASM), Dynamic Sectorisation, Enhanced Conflict Detection Tools and Conformance Monitoring, and Multi-Sector Planner Function (PASL 7.32, 7.54)	2	
	FRTO-B2/1 to B2/4	Integrated ATFM and ATC Planning, Dynamic Airspace Configuration, Cross-border FRA, Enhanced Conflict Resolution Tools (PASL 7.65, 7.66, 7.67)	3	
	NOPS-B0/1 to B0/5	Initial integration of ASM with ATFM, Collaborative Network Flight Updates, Basic Network Operation Planning and Initial Airport/ATFM slots, A-CDM Network Interface and Dynamic Slot Allocation (PASL 7.41)	1	
	NOPS-B1/1 to B1/10	Short Term ATFM measures, Enhanced NOPS Planning, Enhanced integration of airport operations and NOPS planning, Enhanced Traffic Complexity Management, Full integration of ASM with ATFM, Initial Dynamic Airspace configurations, Enhanced ATFM slot swapping, Extended Arrival Management, ATFM Target Times and Collaborative Trajectory Options Programme (PASL 7.55)	2	
	NOPS-B2/1 to B2/2	Optimised ATFM in initial TBO context and enhanced dynamic airspace configuration (PASL 7.65, 7.68)	3	
	NOPS-B2/3	Collaborative Network Operation Planning (PASL 7.68)	3	
	NOPS-B2/4	Multi ATFM slot swapping and Airspace User priorities (PASL 7.68)	3	
	NOPS-B2/5	Further airport integration (PASL 7.68)	3	
	NOPS-B2/6	ATFM for cross border FRA (PASL 7.68)	3	
	NOPS-B2/7	UTM Network operations	3	
	NOPS-B2/8	High upper airspace network operations	3	
	OPFL-B0/1	ITP	3	
	OPFL-B1/1	CDP	3	
	OPFL-B2/1	Separation minima using ATS surveillance where VHF not available	3	
	RSEQ-B0/1 to B0/2	Arrival and Departure Management (PASL 7.35)	1	
	RSEQ-B0/3	Point merge (PARS 7.24)	3	AOP SG ATM SG CNS SG

	RSEQ-B1/1	Extended arrival metering (PASL 7.49)	2	ATM SG
	RSEQ-B2/1	Integration of arrival and departure management (PASL 7.64)	3	
	SNET-B0/1 to B0/4	STCA, MSAW, APW, APM (PASL 7.34)	1	ATM SG CNS SG
	SNET-B1/1 to B1/2	Enhanced STCA with aircraft parameters and in complex TMAs (PASL 7.53)	2	
	SURF-B0/1 to B0/3	Basic ATC surface operations tools, comprehensive situational awareness, situational awareness and alerting service (PASL 7.50)	2	
	SURF-B1/1 to B1/5	Advanced surface traffic management visual aids, pilot comprehensive awareness and runway alerting, enhanced ATC alerting, routing service to support ATC and EVS for taxiing (PASL 7.51)	2	
	SURF-B2/1 to B2/3	Enhanced surface guidance for pilots and vehicle drivers and conflict alerting for pilots for runway operations (PASL 7.63)	3	
	TBO-B0/1	Introduction of time-based management within a flow centric approach (PASL 7.52)	2	
	TBO-B1/1	Initial Integration of time-based decision-making processes (PASL 7.55, 7.68)	2	
	TBO-B2/1-B2/2	Pre departure trajectory synchronization and extended time-based management across multiple FIRs.	3	
	WAKE-B2/1 to B2/2	Wake turbulence separation minima based on 7 aircraft groups and time-based wake separation minima on final approach	3	
Technology	ASUR-B0/1 to B0/3	ADS-B, MLAT, SSR-DAPS (PARS 7.8, 7.9, 7.11, 7.12; PASL 7.30, 7.31, 7.33)	1	CNS SG
	ASUR-B1/1	Reception of aircraft ADS-B signals from space (SB ADS-B) (PASL 7.57)	2	
	ASUR-B2/1	Evolution of ADS-B and Mode S	3	
	ASUR-B2/2	Community based surveillance system for airborne aircraft (low and higher airspace)	3	
	COMI-B0/1, B0/2, B0/4, B0/5, B0/6	ACARS, ATN/OSI, VDL Mode 2 Basic, SATCOM Class C Data, HFDL (PARS 7.21, PASL 7.56)	2	
	COMI-B0/3, B0/7	VDL Mode O/A, AMHS (PASL 7.28)	1	

	COMI-B1/1	Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS) (PARS 7.21, PASL 7.56)	1	
	COMI-B1/1 to B1/4	VDL Mode 2 Multi-Frequency, SATCOM Class B (SB-S) Voice and Data, ATN/IPS and AeroMACS Ground-Ground (PASL 7.56)	2	
	COMI-B2/1	Air Ground ATN/IPS (PASL 7.71)	3	
	COMI-B2/2	AeroMACS, aircraft mobile connection (PASL 7.71)	3	
	COMI-B2/3	Links meeting requirements for non-safety critical communication (PASL 7.71)	3	
	COMS-B0/1 to B0/2	CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace and ADS-C (FANS 1/A) for procedural airspace (PASL 7.56)	2	
	COMS-B1/1 to B1/3	PBCS approved CPDLC (FANS 1/A+), ADS-C and SATVOICE for domestic and procedural airspace (PASL 7.56)	2	
	COMS-B2/1 to B2/3	PBCS approved CPDLC, ADS-C, SATVOICE (PASL 7.71)	3	
	NAVS-B0/1 to B0/4	SBAS, GBAS, ABAS, MON (PARS 7.5, 7.7)	2	
	NAVS-B1/1	Extended GBAS	3	
	NAVS-B2/1 to B2/3	DFMC – GBAS, SBAS, ABAS	3	

Table 1: Asia/Pacific ASBU Block 0, Block 1 and Block 2 Priority

Implemented Elements

5.7 The following ASBU Block 0 elements were considered to be almost universally implemented within the Asia/Pacific Region in terms of being established Annex 6 standards (ACAS) by or in the early stages of Block 1 from 2019 (GADSS), so were not referenced as a priority in Table 1:

- **ACAS-B1/1**: ACAS Improvements (TCAS Version 7.1); and
- **GADS-B1/1 to B1/2**: Aircraft Tracking and Contact directory service (PASL 7.42).

Regional Elements

5.8 The Regional elements were incorporated into the Seamless ANS framework used to assess the uptake by Asia/Pacific States.

5.9 **Table 2** provides a summary of the Regional Seamless ANS elements, and the expected priority for implementation within the Asia/Pacific Region. The allocation of priority was based on factors including its importance in promoting Seamless ANS.

Functional Category	Regional Seamless ANS Element	Priority
Operational	Aerodrome management and coordination (PARS 7.1)	2
	Optimization of runway capacity facilities (PARS 7.2)	3
	ADS-B, SSR Mode S and PBN Airspace (PARS 7.8, 7.9, 7.10)	2
	Flight Level Orientation Scheme (FLOS) (PARS 7.15)	2
	Civil-Military Special Use Airspace (SUA) management (PARS 7.16)	1
	Unmanned Aircraft Systems (PARS 7.17)	2
	Adjacent ATS sector coordination (PASL 7.27)	2
	Airspace classification (PASL 7.36)	2
	ATC horizontal separation (PASL 7.37)	2
	Flight Level Allocation Schemes (FLAS) (PASL 7.38)	2
	ATC sector capacity (PASL 7.40)	2
	Electronic Flight Progress Strips (PASL 7.42)	2
	Enhanced SAR systems (PASL 7.45)	1
	ANSP human and simulator performance (PASL 7.46)	1
	Civil-Military strategic and tactical coordination (PASL 7.47)	1
	Civil-Military common procedures and training (PASL 7.47)	2
	Space object launch and re-entry management (PASL 7.48)	1
Technology	ATS surveillance data sharing (PASL 7.31)	2
	Civil-Military integrated systems and facilities (PASL 7.47)	2
	Data-Link Departure Clearance (DCL) (PASL 7.52)	2

Table 2: Asia/Pacific Seamless Regional Elements Priority

5.10 There are 18 Priority 1 elements as follows:

a) Aeronautical Meteorology: AMET-B0/1 to B0/4;

b) Aeronautical Information Management: DAIM-B1/1 to B1/6*;

c) Airport CDM: ACDM-B0/1;

d) ANSP human and simulator performance (Regional);

e) ATS Inter-facility Datalink Communications: FICE-B0/1;

f) Space object launches and re-entry management (Regional);

g) Civil-Military SUA management (Regional);

h) Civil-Military strategic and tactical coordination (Regional);

i) Core data communications: COMI-B0/3, B0/7 and B1/1;

j) Direct and Free Route Operations: FRTO-B0/1 to B0/4;

k) Enhanced SAR systems (Regional);

l) Ground-based Surveillance: ASUR-B0/1 to B0/3;

m) Network Operations: NOPS-B0/1 to B0/5;

n) Performance-based Navigation Approach Procedures: APTA-B0/1 and B0/2;

o) Runway Sequencing: RSEQ-B0/1 to B0/2; and

p) Safety Nets SNET-B0/1 to B0/4.

**Note: DAIM-B1/7 is placed within PASL Phase III.*

Human Performance

5.11 The Global ATM Operational Concept (ICAO Doc 9854) states:

Humans will play an essential and, where necessary, central role in the global ATM system. Humans are responsible for managing the system, monitoring its performance and intervening, when necessary, to ensure the desired system outcome. Due consideration to human factors must be given in all aspects of the system.

5.12 The AN-Conf/12 emphasised the importance of human performance considerations by endorsing Recommendation 6/4, which called for the integration of human performance as an essential element for the implementation of ASBU modules and in the planning and design phase of new systems and technologies, as part of a safety management approach.

5.13 The role of the human is especially important in delivering high quality and consistent services supporting Seamless ANS. Therefore, it is crucial to ensure that, training and licensing requirements are developed using a competency-based framework, fatigue-related risk is managed appropriately, and safety data, including the reporting of hazards, is collected, analysed and acted upon within ATM systems that support Seamless ANS. States should identify specific efficiency improvements expected from ASBU element deployment. These expectations should include regulatory and/or procedural changes needed to optimize new capabilities.

5.14 One of the more important human performance aspects in order to deliver a consistent, harmonised and efficient service is ATC training, to change from a procedural mind set to one that used the tactical delivery of services based on ATS surveillance and automated safety net decision support tools (airborne and ground).

5.15 Moving from reliance on paper-based flight progress strips to an electronic equivalent connected to the ATS surveillance Flight Data Processing System (FDPS) or direct data inputs to the Aircraft Situation Display (ASD) support this paradigm shift. The use of paper flight progress strips in automated ATM environments reduces efficiency, increases transcription error/data mismatch, and artificially caps ATC capacity due to retention of manual tasks made redundant by the automation capability.

5.16 Controllers need to be trained on the application of tactical separation, including the use of positive control techniques, such as vectoring and speed control when conflict pairs approach minimum separation. In this regard, it is important that managers facilitate a modern operating environment in terms of air safety incidents and human factors, so personnel are confident using the full capability provided by the CNS facilities.

5.17 A critical human performance issue is the training of ANSP management and regulators in human performance issues. These decision-makers had an important influence on outcomes in terms of supporting the right environment for Seamless ANS activities, whether that is providing financial resources, or establishing high-level policies and procedures.

5.18 A key component of Seamless ANS is the ability of controllers to operate, and have confidence in, a new operating environment. The appropriate use of ATC simulators to enhance their learning experience is an essential part of the necessary training.

5.19 In planning to deliver Seamless ANS services, it is assumed that each State and aircraft operator will comply with the English language proficiency requirements in accordance with ICAO Standards and Recommended Practices. States should be considering the highest levels of English language proficiency for all operational controllers to ensure they can respond appropriately to irregular occurrences (e.g. emergencies) by use of an internationally recognised system.

5.20 States must acknowledge the challenge of modifying current practices and procedures to incorporate and optimize improved system capability. States and ANSPs are encouraged to establish sub-regional or bilateral relationships to share best practices and develop strategies to improve performance.

5.21 An optimal 'aviation culture' within regulators and service providers can only be implemented when top managers instil an understanding of a system-wide approach that creates an organic, learning and safe environment. When considering the key factors supporting an 'aviation culture', it is important to acknowledge that no 'national culture' is perfectly aligned with 'aviation culture', so there will always be a need for gap analysis and changes where development of an appropriate culture is required. In focussing on management, it is therefore important to train managers, and for managers to have a level of competency in the following areas (**Figure 7**):

a) the advantages of a responsible, informed and accountable management, which promotes a proactive organisational culture with safety as a first priority, using open communications and a team management approach; and

b) the implementation of an appropriate organizational culture which is effectively driven by management through embedded safety review and assessment teams, allowing the organization to respond organically to its operating environment;

c) the systematic application of human factors principles in –

- air safety investigation;
- system design (ergonomics, human-in-the-loop);
- effective training (including the use of simulators);
- fatigue management;
- automated safety nets; and
- contingency planning;

d) the implementation of effective safety reporting systems that –

- are non-punitive, supporting a 'Just Culture';
- promote open reporting to management; and
- focus on preventive (systemic), not corrective (individual) actions in response to safety concerns, incidents and accidents.

Figure 7: Optimal Aviation Culture Factors

Civil-Military Cooperation

5.22 One of the key enablers for improvement of ATM efficiencies supported by *Global ATM Operational Concept* (ICAO Doc 9854) is the use of FUA. This is an airspace management concept based on the principle that airspace should not be designated as purely civil or military, but rather as a continuum in which all user requirements are accommodated to the greatest possible extent. FUA normally referred to the activation of SUA, but could also include controlled airspace.

5.23 The establishment and operation of SUA required careful assessment, review and management, to ensure the most appropriate airspace designation is used, and the airspace is operated in a cooperative manner. This is ordinarily only possible through discussion between military and civil parties. Thus, a key to the establishment of effective FUA is risk-based assessments, determining the risks or security issues involved through coordinated and cooperative methods if possible.

5.24 Restricted areas designed to segregate civil aircraft from airborne military operations or ordnance firing would be expected when the risk of an accident for non-segregated operations is higher than acceptable. However, lower risk military operations (such as using small calibre weapons at an established firing range) may only require the establishment of a danger area or even no SUA. Thus, the type, dimensions, activation notice and duration of SUA activity should be appropriate and commensurate with the type of activity affecting the airspace.

> *Note: Annex 2 Rules of the Air states that restricted areas were airspace of defined dimensions, above the land areas or territorial waters of a State, which means that restricted areas must not be designated over the high seas or in airspace of undetermined sovereignty.*

5.25 APANPIRG/9 (August 1998) developed the following guidelines for Civil-Military cooperation in the following areas: military procedures, aeronautical facilities and ground services, civil and military ATS unit personnel, airspace, research and development, common terminology, abbreviations rules and procedures, military exercises, and non-sensitive military data.

- If at all possible, military training should be conducted in locations and/or at times that do not adversely affect civilian operations, particularly those associated with major aerodromes. This requires strategic planning by formal Civil-Military coordination bodies.
- Consideration of the interoperability and operations of military systems is an integral part of a Seamless ANS environment. With increasingly complex aircraft equipage civil requirements, non-compliant military or other State aircraft may become more difficult to manage using Special Handling Status (STS). The limitations or requirements of military aircraft cockpits, avionics and airframes may even preclude some civil systems, and yet military aircraft still need to transit airspace used predominantly by civil operations.
- Military participation at civil ATM meetings and within ATS centres will often lead to a better understanding of civil needs, as well as military requirements, including the operation of Unmanned Aircraft Systems (UAS). UAS have been predominately used by the military in segregated airspace, but now many forms of State missions including customs, immigration and police operations are being planned, as well as a myriad of potential civil uses.
- Responses to Search and Rescue (SAR), Civil Defence (normally natural disaster emergencies), and national security events will inevitably require Civil-Military coordination so this needs to be taken into account during the planning for such operations. As these occurrences could involve a number of States, regional Civil-Military planning is crucial in order to reduce the response time for emergency services to aid those in need.

- The response to an international aviation SAR event may well involve a location over the high seas, so all States should have SAR agreements with neighbouring nations to ensure that SAR services were unimpeded to the maximum possible extent.

5.26 The Asia/Pacific Civil-Military Cooperation Seminar/Workshop (Bangkok, Thailand, 28 February to 1 March 2012) recommended that the following Civil-Military cooperation/coordination principles and practices should be elevated to the highest political level in the Asia/Pacific regions:

- Civil-Military working arrangements should be enacted where discussion of both civil and military needs were able to be negotiated in a balanced manner;
- the importance of the interoperability of civil air transport infrastructure and national security was recognized;
- the interoperability of civil and military systems including data-sharing was emphasized; and
- regular review of controlled airspace and special use airspace was encouraged to be undertaken by States to ensure its establishment, size, activation and operation was appropriate in terms of optimal Civil-Military operations.

5.27 The Asia/Pacific Civil-Military Cooperation Seminar/Workshop requested ICAO to update existing provisions related to Civil-Military cooperation/coordination and further develop guidance material related to airspace planning and management, including FUA.

5.28 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.

5.29 Aircraft operating ADS-B technology transmit their position, altitude and identity to all listeners, conveying information from co-operative aircraft that have chosen to equip and publicly broadcast ADS-B messages. Thus, there should be no defence or national security issues with the use and sharing of such data.

Note: Some military transponders may support ADS-B using encrypted messages, but this data is not normally decoded or used at all by civil systems. In many cases, tactical military aircraft are not ADS-B equipped or could choose to disable transmissions. In future, increasing numbers of military aircraft would be ADS-B capable, with the ability to disable these transmissions. ADS-B data sharing should not influence the decision by defence agencies to equip or not equip with ADS-B. Moreover, it is possible for States to install ADS-B filters that prevent data from sensitive flights being shared. These filters can be based on a number of criteria and typically use geographical parameters to only provide ADS-B data to an external party if aircraft were near the boundary.

5.30 The ten Civil-Military elements identified by APANPIRG are as follows:

a) **Strategic Coordination**. This element emphasised the creation of a permanent body, facilities and procedures to facilitate long and medium-term planning for optimal civil and military operations, and the tactical coordination element. This element features the establishment of a national body that encompasses military (and State aircraft operators) and civil stakeholders, to develop high level Civil-Military cooperation policy.

b) **Tactical Coordination.** The establishment of facilities and procedures derived from the high-level strategic coordination body for the daily, safe and efficient tactical management of operations. Tactical coordination features participation of military officers at appropriate civil ATM meetings, airspace scheduling through interaction and communications between civil and military units, and military representation within civil ATC Centres where necessary.

c) **Airspace Review**. The regular review of SUA and controlled airspace, to ensure that the means and notice of activation provide adequate warning for other airspace users, the SUA types reflect the usage, and the lateral and vertical limits are the minimum required to safely contain the activity therein (Annex 11 2.19.2.1 (b) refers). The review of airspace should be conducted by an airspace authority independent or a collaboration of civil and military airspace users.

d) **Flexible Use Airspace**. Mechanisms to ensure the minimisation of airspace being exclusively assigned for civil or military use in accordance with FUA principles, assessed by the percentage of military SUA within a Flight Information Region (FIR).

e) **International Airspace**. The minimisation of SUA and other military entities that may adversely affect international airspace. Restricted and prohibited areas must not be designated within international airspace or airspace of undefined sovereignty.

f) **Integrated Civil-Military ATM Systems**. The integration of civil and military ATM systems where practicable, including the management of civil and State UAS aircraft, policies and procedures to manage State aircraft that are non-compliant with civil requirements, systems to manage civil and military SAR units, and joint procurement of systems where possible.

g) **Joint Civil-Military Aerodromes and Navigation Aids**: The operation of joint civil-military aerodromes if possible, and the provision of navigation aids that could be utilised by both civil and military aircraft where practical.

h) **Shared Civil-Military Data**: The provision of ATS surveillance data from civil surveillance systems to military units to improve monitoring (thereby minimising the need for individual defence identification authorisation), trust and confidence. The provision of surveillance data from military surveillance systems where this would enhance ATS surveillance coverage and redundancy; suitably filtered as appropriate.

i) **Common Civil-Military Training and Procedures**. The familiarisation of civil and military ATM personnel with each other's systems and procedures, where national security allows. Training and licensing of civil and military air traffic controllers to equivalent standards. The implementation of the same or equivalent standards, procedures and policies for the provision of ATS and the management of air traffic.

j) **Space Object Launch and Re-entry**. Effective coordination mechanisms established by States responsible for space object launch and re-entry activities to ensure the safety of civil air navigation in the air and on the ground, with particular emphasis on how such activity affects other States in terms of safety and efficiency.

5.31 The efficient management of space object launch and space re-entry activity by both State and civil agencies is critical to minimise disruption to other airspace users. Increasingly, space object launch and space re-entry activity may be conducted by other State or civil/private agencies, which should conform with the same expectations in this Plan as military agencies. The coordination of all the stakeholders will be enhanced by:

a) coordination agreements between the State civil aviation authority, the ANSP, and the launch/re-entry agency concerned; and

b) strategic coordination conducted between the State civil aviation authority prior the activity and tactical management of the launch/re-entry activity.

Note: the Asia/Pacific Regional Guidance for Space Object Launch and Re-Entry Activities Coordination is available on the ICAO Asia/Pacific eDocuments webpage at: https://www.icao.int/APAC/Pages/eDocs.aspx.

Airspace Equipage Mandates

5.32 From operators' perspective, the following were important considerations:

- Preparation Time: operators need time to prepare for any mandated equipage requirement – if new equipment is involved, several years may be required to allow fitment to take place during normal airframe maintenance cycles.
- Cost Benefit: operational improvements, including the use of new technologies or implementing ASBUs, need to provide operational benefits that outweighed the total cost of implementation and operation. This included the airspace user side of the equation. States/ANSPs should carry out studies of the costs and benefits for all stakeholders.
- Education and Promulgation: States/ANSPs should work with local airlines and International Organizations to ensure industry and other stakeholders are educated and informed regarding upcoming aircraft equipage mandates very early in the planning process. Ideally, the dialogue should begin with user consultation pertaining to the selection of appropriate solutions. Once a decision has been made, user education should include briefings, media notifications as well as required Aeronautical Information Service (AIS) promulgation.
- Service Outcomes: States/ANSPs must ensure the service delivery efficiencies enabled by an aircraft equipage mandate are actually delivered operationally coincident with the implementation date of the mandate. If service delivery is delayed, any related aircraft equipage mandate should also be delayed accordingly. States/ANSPs should consider offering operational advantages to early adopters of the desired equipage or capability to offset costs. This would enable operators to make at least partial use of the mandated capability in advance of the mandated date.
- Harmonization: it is essential that States/ANSPs harmonize requirements with neighbours as far as practicable, including implementation dates.
- Regulatory considerations: it is essential that regulators are involved very early in the planning process. Experience shows that regulatory approvals are often a problem with the introduction of aircraft equipage mandated environments.
- High Seas: where airspace over the High Seas is affected, States must ensure appropriate ICAO processes are followed, including amendments to the required ICAO provisions.

Regulation and Safe Operation of Unmanned Aircraft Systems

5.33 ICAO Headquarters, supported by the Unmanned Aircraft Systems Advisory Group (UAS-AG), developed a global resource of information and guidance material, including:

- the UAS Toolkit, providing general guidance on such issues as UAS regulations and risk-based approaches to regulation, training and education needs and authorizations, and examples of, and links to, existing UAS regulations of 39 States; and
- a UAS Traffic Management (UTM) framework, summarizing key principles, lessons learned and best practices in the establishment of requirements for approval of UTM service providers.

Note: the UTM framework is subject to ongoing development, in line with the growth of global knowledge and experience in UTM.

5.34 The UAS Toolkit, UTM framework and other relevant information is available on the ICAO Unmanned Aviation webpages at: https://www.icao.int/safety/UA/Pages/default.aspx.

5.35 Considering the rapid growth of the UAS industry, and the consequent economic and social benefits arising, there is an immediate need for an aviation regulatory response to facilitate access to non-segregated airspace while protecting the safety and access to airspace of conventional airspace users. For this purpose, an Asia/Pacific regional performance expectation for the regulation of UAS is included in PARS Phase II.

CURRENT SITUATION

Aerodrome Analysis

6.1 In the last three decades, aerodrome operators in Asia/Pacific Region invested billions of dollars to enhance capacity of existing aerodromes and to build new aerodromes to meet increasing air traffic demand. Notable examples are the opening of Siem Reap-Angkor, Beijing Daxing, Chengdu Tianfu and Kertajati airports and the expansion of Hong Kong and Suvarnabhumi airports. The automation and the adoption of self-service technology for passenger handling such as check-in and automated border control has enabled many airports to build up capacity without expanding passenger terminal footprint.

6.2 Runways are typically the capacity bottleneck of aerodromes but aircraft parking stands, baggage sorting and transfer facilities, aprons and passenger security screening points operating close to or over capacity are becoming choke points as well, especially at hub airports. A-CDM promises to alleviate congestion but the close collaboration between airport management and other stakeholders such as its operator, ATM and airlines is essential to a coordinated development of the capacity of the regional air transport network in the long-term.

Implementation Progress

6.3 To cater for *Asia/Pacific Seamless ANS Plan Version 3.0*, the new ICAO APAC Seamless ANS Reporting Tool was developed to enable States to report on their Seamless ANS implementation progress. The status of the reporting process as of October 2024 is depicted in **Figure 8**.

Important note: the new ICAO APAC Seamless ANS Reporting Tool (accessible via the ICAO APAC SharePoint Platform using the pre-registered secure login credential at https://oaci.sharepoint.com/sites/ATM_reporting/SitePages/ANS-Reporting-Implementation.aspx) had been developed by ICAO HQ to take into account the changes to the latest version of the Global Air Navigation Plan and the 2019 (version 3.0) update of the Asia/Pacific Seamless ANS Plan. According to State letter Ref.: T 8/5.1 – AP060/24(CNS), States/Administrations were required to complete the reporting over this new platform by 31 May 2024.

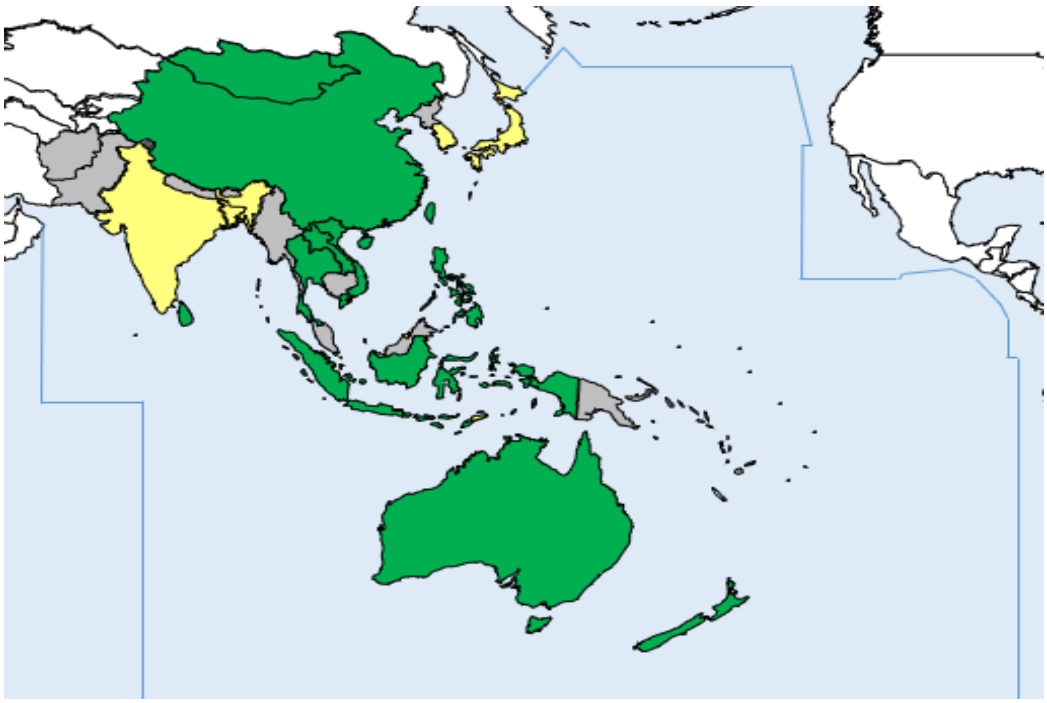

Figure 8: Seamless ANS Reporting (2024)

6.4 A total of 19 States, i.e. 44 per cent of the Asia/Pacific States, had submitted some form of reporting on the new ICAO APAC Seamless ANS Reporting Tool. Among those 19, only 13 States had submitted a comprehensive report. Hence, there was insufficient information to carry out effective evaluation on the implementation progress.

6.5 Seamless ANS implementation data is used to support an iSTARS tool intended to illustrate ANS planning and implementation (https://istars.icao.int/Sites).

6.6 The progress of implementation of the Plan had been unacceptably slow, with the Plan having been endorsed by APANPIRG in 2013, and the Phase I elements expected to be at least partly implemented by the start of Phase I in November 2015, to ensure a matching of ground-based capability with that on modern aircraft systems. However, as of March 2019, the implementation progress by States and Administrations that had been reporting was illustrated in **Figure 9**.

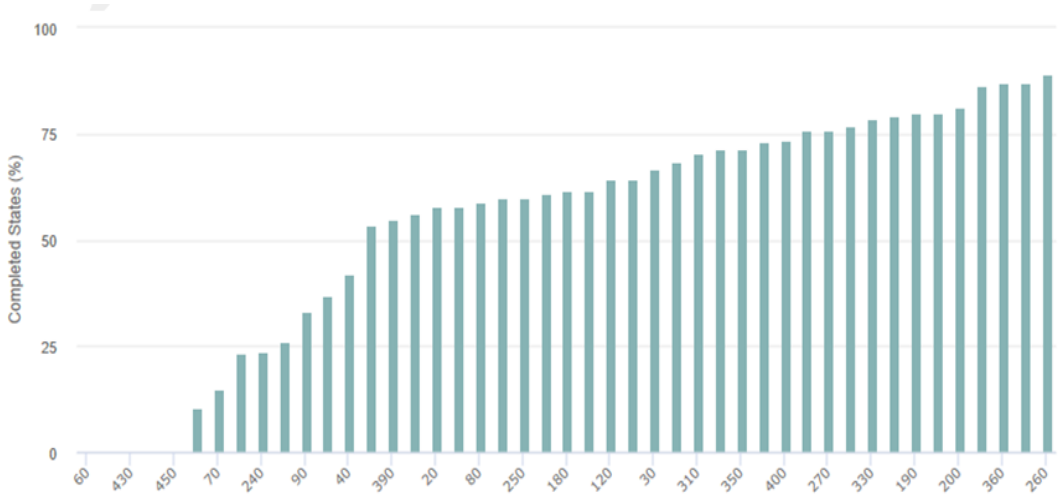

Figure 9: Percentage of Completed Seamless ATM Elements (March 2019)

6.7 The following APANPIRG Conclusions are related to implementation actions that Asia/Pacific States should have taken:

APANPIRG 24/55 State Seamless ATM Planning

That, given the urgency and priority of Seamless ATM planning for the Asia/Pacific as acknowledged by the 46th Conference of Directors General of Civil Aviation (DGCA, Osaka, Japan, 12-16 October 2009) and APANPIRG/22 (05-09 September 2011), States should be urged to:

a) review Version 1.0 of the Asia/Pacific Seamless ATM Plan and utilise the Plan to develop planning for State implementation of applicable Seamless ATM elements;

b) ensure relevant decision-makers are briefed on the Seamless ATM Plan;

c) submit the first Regional Seamless ATM Reporting Form to the ICAO Regional Office by 01 March 2014; and

d) where possible, participate and contribute to Seamless ATM system collaborative training and research initiatives.

APANPIRG 27/1 Mobilization of Human / Financial Resources to Achieve the Seamless ATM Plan Objectives

That, States/Administrations not achieving the expected implementation progress of regional priorities for Air Navigation Systems, should: a) give highest priority to the implementation of regional priorities and provide human/financial resources to CAAs and ANSPs to complete Seamless ATM phase I implementation; and b) mobilize human and financial resources to plan for timely implementation of phase 2 and phase 3 elements assessed as relevant by their national gap analysis.

6.8 In 2013, the Asia/Pacific Region agreed in endorsing APANPIRG Conclusion 24/55 that it was essential to brief decision-makers and to review the Plan to develop State planning. Three years later, APANPIRG/27 had noted that: the ten regional targets planned for completion in November 2015 were far from being achieved as of August 2016; the second cycle of the seamless ATM planning is starting and needs focus from high decision makers to mobilize adequate resources.

6.9 Notwithstanding these APANPIRG Conclusions and associated Action Items (such as Action Item 52/21) from the Conferences of Directors General of Civil Aviation Asia and Pacific Regions, the lack of adherence to commitments first outlined in the Kansai Statement in 2009 indicated a lack of high-level agreement to modernisation by many States. Therefore, a stronger emphasis on a whole-of government planning approach to include all stakeholders using a National Air Navigation Plan (NANP) is necessary, to ensure greater buy-in, resource allocation and accountability through monitoring.

6.10 The *Asia/Pacific Regional Air Navigation Plan Volume II* requires that States shall establish and maintain a NANP that supports implementation of the Global Air Navigation Plan and regional air navigation planning[1]. It further states that States shall report their implementation progress and status of the applicable global and regional air navigation planning elements at least once each year, and provides a list of Basic Planning Elements (BPE) that should be included in the NANP.

6.11 Few States have reported their NANP status, and a NANP reporting template proposed by ICAO in 2021 did not reach consensus agreement.

Airspace and FIR Analysis

6.12 During earlier studies, there were several features of the lack of Seamless ANS facilities and practices that had been evident in the Asia/Pacific Region:

a) size of FIR – fragmented FIRs resulting in flights transiting multiple FIRs with multiple Transfer of Control (TOC) points.

b) traffic density – the capacity of ANSP infrastructure and airspace had not kept up with traffic growth.

c) airspace and ATS route design and capacity –

- route structure based on historical requirements and not on current aircraft navigational capability;
- ground-based navigation aid routes, around which SUAs have grown;
- crossing tracks with and without ATS surveillance, whereby States mainly rely on the use of FLAS for procedural flight level separation;

[1] Asia/Pacific Regional Air Navigation Plan Volume II Section 3 *Specific Regional Requirements*

- requirement for vertical transitions because of the two different FLOS (metric and imperial) in the region;
- routes with flight level, direction, and time restrictions making flight planning more complex;
- routes with restrictions that are un-coordinated with neighbouring FIRs; and
- restrictive route structures agreed to in a historical context which is inadequate for today's traffic requirements.

d) ATS surveillance and communications capability –

- non-existent/unreliable surveillance or communications capability at times;
- capability not fully utilised to provide appropriate level of service; and
- hand-off procedures not aligned to ATM facilities and capabilities.

e) compatibility between FIRs –

- infrastructure development based only on national requirements, resulting in duplicated and yet uncoordinated facilities; and
- unnecessarily conservative separation requirements at TOC points (it was not clear if this is due to lack of confidence in adjacent FIRs capability to adhere to agreed procedures, or for other operational reasons).

f) ATC standards –

- apparent reluctance in applying ICAO standard separation minima (it was not clear if this is due a lack of confidence in ATM competence or capability); and
- although GNSS separation is available in ICAO Doc 4444, few ANSPs in the Asia/Pacific Region used this as an alternative means of providing longitudinal separation.

g) focus groups –

- lack of effective focus groups to address airspace capacity and FIR issues, although there had been an increase in informal and bi-lateral ATM coordination;
- lack of a requirement for regular review mechanisms of operational issues within an FIR, including feedback from aircraft operators.

h) non-universal implementation of AIDC.

6.13 Generally, flights operating on Major Traffic Flows (MTFs) between large FIRs (particularly where there were multiple FIRs being provided services by one State) in Category R airspace were already reasonably seamless, such as in the Pacific. However, apart from being largely oceanic in nature, these MTFs had the advantage of being usually in an east/west alignment between continents and were not impacted by busy crossing routes.

6.14 In addition, lower traffic density MTF enabled flexible tracks such as UPR applications. It was notable that these MTFs tended to have dedicated focus groups like Informal South Pacific ATS Coordinating Group (ISPACG) and Informal Pacific ATC Coordinating Group (IPACG) conducting regular reviews of operational efficiency.

6.15 Where long and short haul routes crossed multiple smaller FIRs, particularly with busy regional flows, there was a greater likelihood of reduced efficiency caused by a combination of inconsistent application of ATM procedures and standards, non-harmonized infrastructure development, route structure, TOC and other legacy issues. However, there were also examples of partly Seamless ANS between some busy city pairs (such as Singapore/Kuala Lumpur and Kuala

Lumpur/Bangkok) in the region, resulting from bilateral efforts between ANSPs.

6.16 **Figure 10** and **Figure 11** provide information on ground-based ATS surveillance and communication gaps in the South China Sea (SCS).

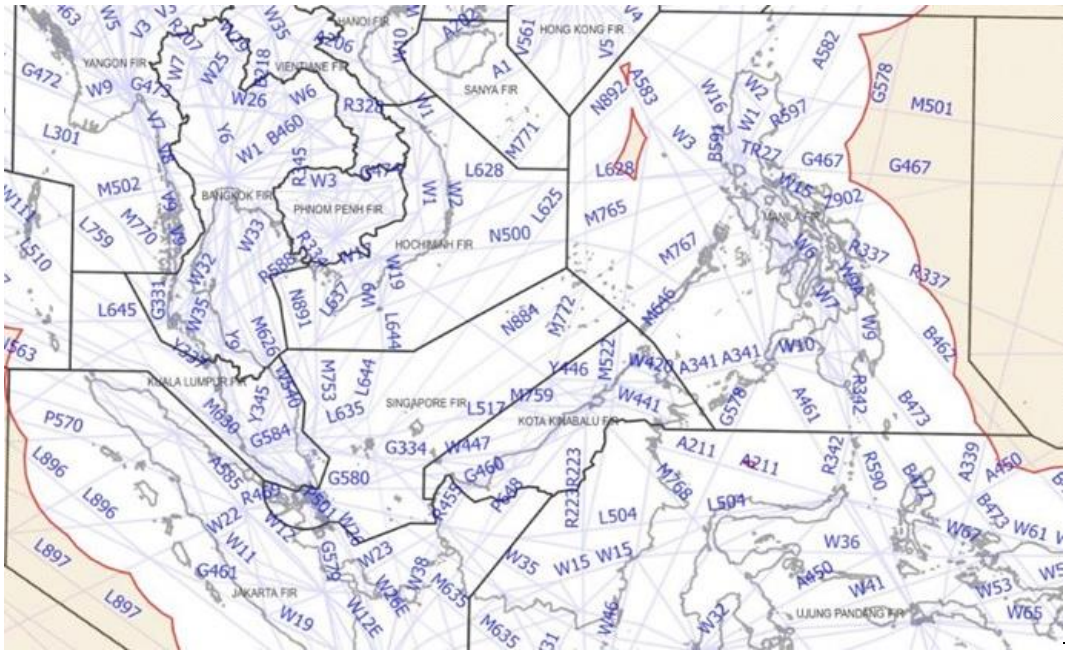

Figure 10: SCS Ground-based ATS Surveillance Gaps (as of 2022)

Note: Figure 10 only considers ground-based surveillance infrastructures and does not include other forms of space-based interrogation.

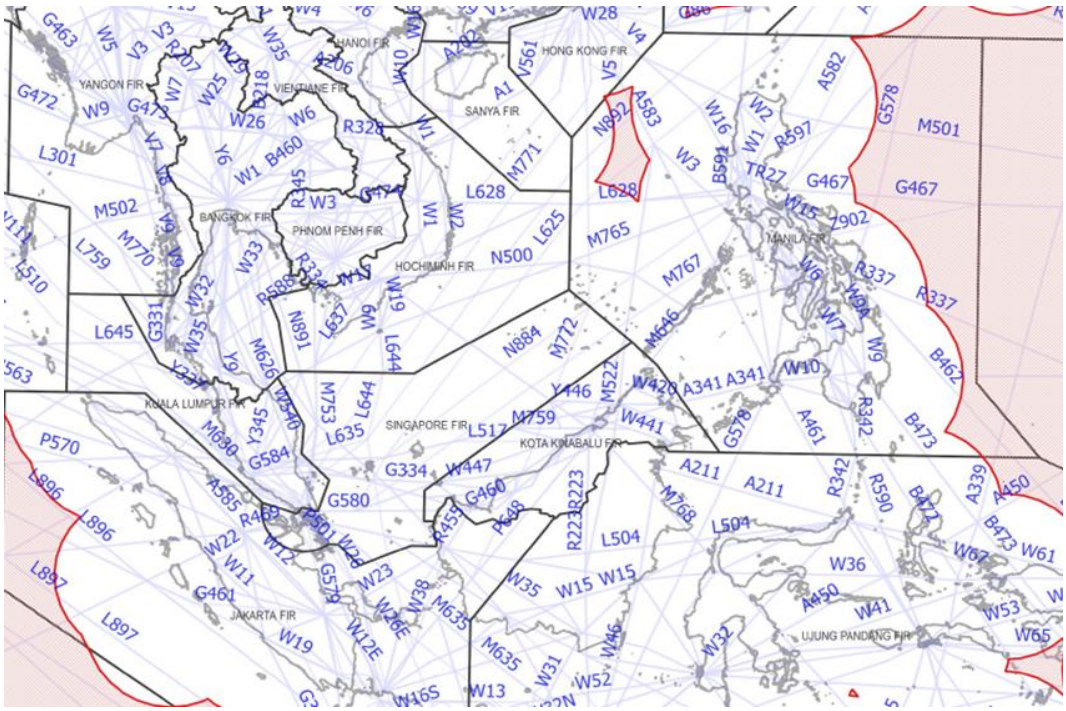

Figure 11: SCS ATS DCPC VHF Gaps (as of 2022)

Note: Figure 11 only considers DCPC VHF communications and does not include other forms of DCPC communications.

6.17 **Figure 12** and **Figure 13** provide information on Ground Based ATS surveillance and communication gaps in the Bay of Bengal (BOB).

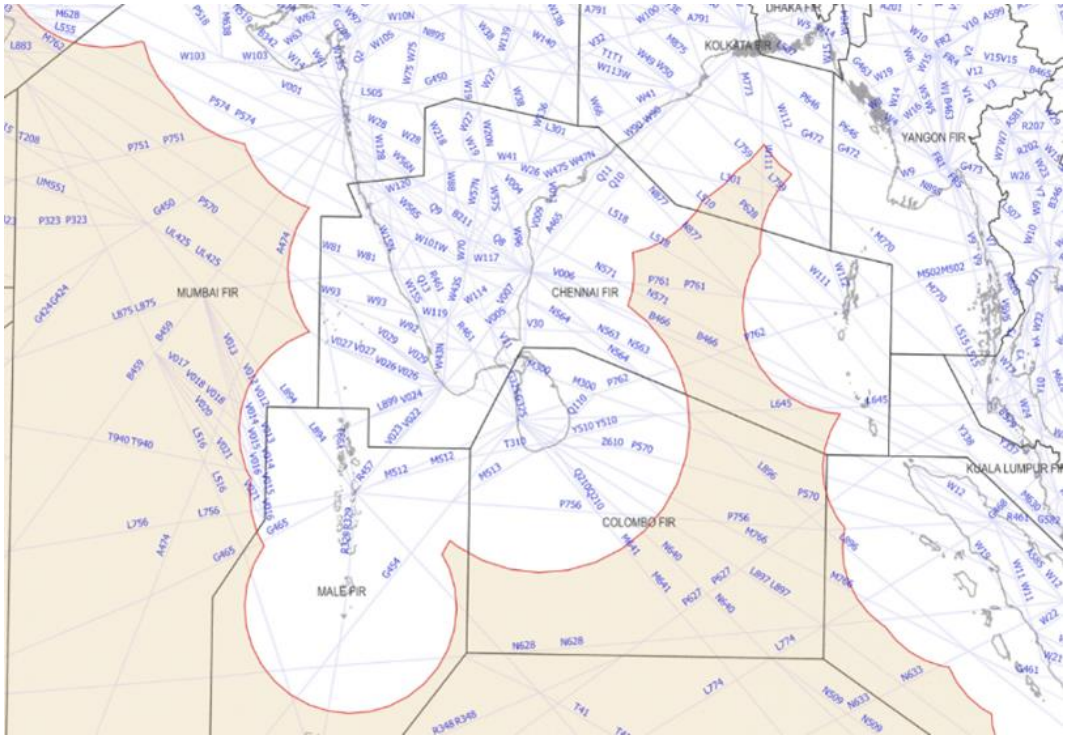

Figure 12: Bay of Bengal ATS Surveillance Gaps (as of 2022)

Note: Figure 12 only considers ground-based surveillance infrastructures and does not include other forms of space-based interrogation.

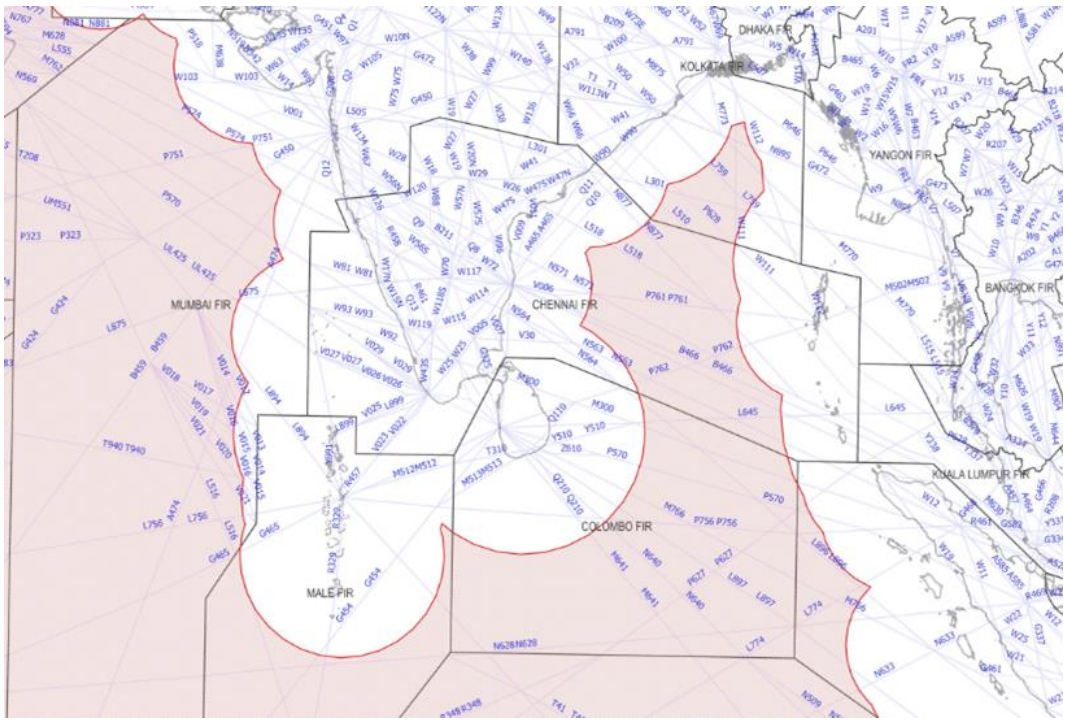

Figure 13: Bay of Bengal ATS DCPC VHF Gaps (as of 2022)

Note: Figure 13 only considers DCPC VHF communications and does not include other forms of DCPC communications.

6.18 The main areas of the Asia/Pacific Region lacking ATS surveillance and DCPC VHF only communication coverage which need to be rectified with such capability from ground or space-based solutions due to traffic density, weather deviations and contingency responses are as follows:

a) highest priority: SCS airspace and the northwestern portion of the Manila FIR (**Figure 10** and **Figure 11**);

b) high priority: BOB airspace between the Indian subcontinent and the Andaman Islands (**Figure 12** and **Figure 13**), the Indian subcontinent and the Arabian Sea;

c) medium priority: airspace between Indonesia and Australia (between Java and West Australia); and

d) lower priority: Coral Sea between Papua New Guinea and Australia.

Europe – Asia/Pacific Trans-Regional Issues

6.19 A number of ATS routes from the Russian Federation converged within Mongolian airspace because of the limited number of entry/exit points on the Mongolian/Chinese airspace boundary. Military restrictions had affected ATS route development to China/Mongolia/DPRK and Japanese airspace. An enhancement of Civil-Military cooperation and ATM coordination is necessary to address these trans-regional issues.

6.20 There was a long-standing problem with the incompatibility of some elements of the European On-Line Data Interchange (OLDI) system with the more global AIDC messages from the Russian Federation to China and Mongolia.

6.21 Russia utilised a 30 km (16 NM) separation within its upper airspace, while Mongolia initially used 80 NM when ATS surveillance was implemented in mid-2012, with an intention to reduce this to a surveillance-based separation after appropriate training.

6.22 Given the need to minimise safety issues such as Large Height Deviations and to improve confidence in order to minimise trans-regional separations, ATS surveillance data-sharing between the Russian Federation and China/Mongolia is necessary in accordance with PASL Phase I, even if only based on ADS-B.

North/South America – Asia/Pacific Trans-Regional Issues

6.23 There were no major trans-regional issues between Asia and North America via the Anchorage Oceanic, Fukuoka and Oakland Oceanic FIR due to the continuing work at the IPACG involving Japan and the United States of America. The Cross-Polar Working Group (CPWG) also discussed operations extending into the area between Asia and North America. The Fukuoka and Oakland Oceanic FIRs had high-density Category R airspace but is served by an OTS (PACOTS; Pacific Organized Track System). ADS-C, CPDLC and AIDC were fully deployed in the Anchorage Oceanic, Fukuoka and Oakland Oceanic FIRs, and common procedures, including 30 NM separation standards based on RNP 4, DARP, UPR were applied.

6.24 The Oakland Oceanic FIR and South Pacific utilised technologies consistent with ASBU Block 0 and with Conflict Prediction and Resolution (CPAR), AIDC, CPDLC and ADS-C, were able to provide a Seamless ANS service already between Asia/Pacific and North America. This included the provision of UPRs and DARP where operationally possible. These developments had been managed through the ISPACG, and were a model for other oceanic regions in the Asia/Pacific.

6.25 The airspace between the Pacific and South America had very low-density traffic. South American States had not yet developed the same Seamless ANS services capability in the trans-regional airspace to support ATM and essential SAR services. However, Chile is an active member of ISPACG.

Middle East/Africa – Asia Trans-Regional Issues

6.26 The transition of traffic from the Muscat FIR to the Mumbai FIR is identified as a contributing factor to the congestion in the Bahrain FIR and causal factor for the delayed departures from airports, particularly in the United Arab Emirates. India had recently reduced horizontal separation on some routes to 50/50 NM. In addition, FLAS is also used in Arabian Sea Airspace and applied to low density traffic against the higher density Middle East (MTF AR-5) routes. Owing to the improved utilisation of CPDLC, FLAS is currently being used only on the following five ATS routes in Mumbai FIR: P751, G450 (non-CPDLC equipped aircraft), P570, N563 and M300.

6.27 Oman required 10-minute longitudinal separation between eastbound aircraft from the United Arab Emirates regardless of the level the aircraft were climbing to, with plans to reduce this to seven minutes, consistent with the 50 NM standard applied within the Mumbai FIR. However, this is still very restrictive, given the ATS surveillance coverage within the Muscat FIR and the fact that the aircraft were climbing to a number of different flight levels.

6.28 The problem of OLDI conversions to AIDC between India and the Sultanate of Oman had prevented implementation of AIDC trans-regionally in this area thus far.

ADS-B Collaboration

6.29 Potential projects highlighted in the past include ADS-B data sharing between Myanmar and India over the BOB and among Singapore, Brunei Darussalam and the Philippines in the eastern part of the SCS.

6.30 In May 2015, the ANSPs of India and Myanmar had signed an ADS-B data sharing agreement at the sidelines of the CANSO Asia Pacific Conference in Fukuoka, Japan thus establishing the collaborative framework for ADS-B data sharing involving ADS-B stations in India (Port Blair and Agartala) and ADS-B stations in Myanmar (Coco Island and Sittwe). The objective was to provide end-to-end surveillance for several busy ATS routes over the BOB similar to that accomplished over the SCS. India had also completed an agreement for implementation of SB ADS-B Data Services for the oceanic regions of Indian FIRs.

6.31 ADS-B collaboration over the eastern part of the SCS had also been making progress. Singapore had worked closely with the Philippines and Brunei Darussalam to share ADS-B data and VHF communications to plug surveillance gaps on the trunk routes M767 and N884. SB ADS-B was also being considered to fill any remaining gaps. When completed, these ATS routes within the SCS should have complete surveillance coverage.

Impact of Major Regional and Global Events

6.32 The unavailability of Russian Federation airspace to the vast of airlines in recent period induced a significant impact to the choice of ATS routes to conduct efficient air transport between Europe and APAC Regions. Such airspace closure activity has also worsened the inter-regional traffic demand through the already limited and geopolitically sensitive Middle East Corridor.

6.33 Russian invasion of Ukraine on 24 February 2022 led to the restriction of air traffic in Ukrainian and Russian airspaces due to the military activity and war-related sanctions. Airspace closures have forced airlines to take detours and seek alternative routes. All these causes considerable increasing of flight time on routes connecting Europe and Asia, North America and Asia and North America and Middle East. In turns, longer travel times lead to the increasing of aircraft fuel burn, which causes higher airlines operating costs and carbon emissions.

6.34 The Russia-Ukraine conflict has challenged commercial aviation in yet another way. The closure of the airspace over Russia causes a lengthening of intercontinental routes to Asia for European airlines. Similarly, transatlantic routes to and from North America have been significantly hindered by the closure of Russian airspace. The most heavily impacted markets are Europe-Asia and Asia-North America. This includes flights between the United States of America and Northeast Asia, and between Northern Europe and most of Asia.

PERFORMANCE IMPROVEMENT PLAN

The Asia/Pacific Seamless ANS Plan Version 3.0 (November 2019), specified performance objectives to be implemented in three phases of *Preferred Aerodrome/Airspace and Route Specifications* (PARS) and *Preferred ANS Service Levels* (PASL). This version of the Plan, is structured under the following phases:

- Phase II – expected implementation by 07 November 2019;
- Phase III - expected implementation by 03 November 2022;
- Phase IV – expected implementation by 27 November 2025; and
- Phase V – expected implementation by 23 November 2028.

Note 1: Phase I – elements (expected implementation by November 2015) that had not been completed by November 2019 were moved to Phase II.

Note 2: Phases II and III are retained in this version of the plan due to the delayed availability of the implementation reporting mechanism following the 2019 update, and taking into consideration the impact of the COVID-19 pandemic.

Preferred Aerodrome/Airspace and Route Specifications (PARS)

Note 1: prior to implementation, the applicability of PARS should be verified by analysis of safety, current and forecast traffic demand, efficiency, predictability, cost effectiveness and environment to meet expectations of stakeholders.

Note 2: Phase I had an expected implementation by 12 November 2015.

PARS Phase II (expected implementation by 07 November 2019)

Aerodrome Operations

7.1 All high-density international aerodromes[2] should enable, in accordance with an Airport Master Plan, aerodrome management and coordination services:

a) when traffic density requires, an appropriate apron management service to regulate aircraft operations in coordination with ATS;

b) ATS coordination (including meetings and agreements) related to:

- airport development and maintenance planning;
- local authority coordination (environmental, noise abatement, and obstacles);

c) regular airport capacity analysis, including a detailed assessment of passenger, airport gate, apron, taxiway and runway capacity.

[2] High-density international aerodromes referenced in these performance objectives are:

- aerodromes having 100,000 scheduled movements per annum or more; or
- aerodromes where strategic slot allocation is implemented; or
- aerodromes designated by the relevant authority as requiring or potentially requiring ATFM implementation.

7.2 Where practicable, all high-density international aerodromes should provide, in accordance with an Airport Master Plan, the following 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.

7.3 All high-density international aerodromes should operate an A-CDM system for ACIS integrated with the ATM network function consistent with **ACDM-B0/1** to **B0/2** (Priority 1).

Terminal Operations (Category T airspace)

7.4 Where practicable, all aerodromes should have **RNAV 1** (ATS surveillance environment) or **RNP 1** (ATS surveillance and non-ATS surveillance environments) SID/STAR procedures consistent with **APTA-B0/2** (Priority 1).

Note 1: 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.

Note 2: PBN procedures that overlay visual arrival and departure procedures should be established where this provided an operational advantage.

7.5 Where practicable, all instrument runways serving aeroplanes should have the following approach procedures consistent with **APTA-B0/1** (Priority 1) and **APTA-B0/3**:

a) SBAS/GBAS CAT1 precision approaches; or ILS CAT1 approaches (with APV approach as a backup); or

b) Approaches with Vertical Guidance (APV); RNP APCH with LNAV-VNAV or LPV Minima; or

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

Note: 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. 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.

7.6 All international aerodromes with rotary wing operations should establish PBN Helicopter PinS Operations consistent with **APTA-B0/6** where there is an operational benefit (Priority 2).

7.7 SBAS, GBAS, ABAS and MON systems should be established as appropriate to the level and type of aircraft operations and the operating environment consistent with **NAVS-B0/1** to **B0/4**, subject to an assessment of benefits and costs.

Note 1: the application of GNSS and its augmentations such as GBAS Landing System (GLS) is recommended where these systems were economically beneficial.

Note 2: As far as practicable, airspace and instrument flight procedures associated with international aerodromes should not be constrained by international borders and political barriers, and 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.

7.8 Unless supported by alternative means of ATS surveillance (such as radar, where there are no plans for ADS-B), all Category T airspace supporting international aerodromes should be designated as non-exclusive or exclusive as appropriate ADS-B airspace requiring operation of ADS-B OUT using 1090ES with DO-260/260A and 260B capability to support **ASUR-B0/1**.

Note 1: non-exclusive means that non-ADS-B aircraft may enter the airspace, but may be accorded a lower priority than ADS-B equipped aircraft, except for State aircraft.

Note 2: in areas where ADS-B based separation service was provided, a mandate for the carriage of ADS-B OUT using 1090ES with DO260/60A or 260B is recommended.

Note 3: States should refer to the ADS-B implementation in the ICAO ADS-B Implementation and Guidance Document (AIGD).

7.9 All Category T airspace supporting international aerodromes should require the carriage of an operable mode S transponder within airspace where Mode S radar services are provided to support **ASUR-B0/3**.

7.10 All Category T airspace supporting international aerodromes should be designated as non-exclusive or exclusive PBN airspace as appropriate to allow operational priority for PBN approved aircraft, except for State aircraft, to facilitate seamless operations and off-track events such as weather deviations to support **APTA-B0/1, B0/2, B0/3** and **B0/6**.

En-route Operations

7.11 Unless supported by alternative means of ATS surveillance (such as radar, where there are no plans for ADS-B), all Category S upper controlled airspace supporting international aerodromes should be designated as non-exclusive or exclusive as appropriate ADS-B airspace requiring operation of ADS-B OUT using 1090ES with DO-260/260A and 260B capability to support **ASUR-B0/1**.

7.12 All Category R and S upper controlled airspace should require the carriage of an operable mode S transponder within airspace where Mode S radar services are provided to support **ASUR-B0/3**.

7.13 All Category R and S upper controlled airspace should be designated as non-exclusive or exclusive PBN airspace as appropriate to allow operational priority for PBN approved aircraft, except for State aircraft, to facilitate seamless operations and off-track events such as weather deviations to support **APTA-B0/2**.

Note: airspace mandates should be harmonised with adjacent airspace and implemented in accordance with guidance provided in this document.

7.14 As far as practicable, all new ATS routes should be PBN routes in accordance with the following specifications to support **APTA-B0/1 to B0/8**, and **APTA-B1/1 to B1/5**:

- Category R airspace – **RNP 4**, **RNP 10** (RNAV 10); and
- Category S airspace – **RNAV 2** or **RNP 2**.

Note 1: ATS routes should be designated with a navigation performance specification commensurate with the CNS/ATM operational environment (within Category S airspace, the PBN specification is not significant to ATC as it is used for track-keeping assurance, not ATC separation). The ATS route navigation performance specification selected should be harmonised and utilise the least stringent requirement needed to support the intended operation. When obstacle clearance or ATC separation requirements demand, a more stringent navigation specification may be selected.

Note 2: RNP 2 is expected to be utilised before Phase 2, when the RNP 2 instrument procedure design, ATC separation standards and operational approval are in place. The Asia/Pacific recognises an equivalency for RNP 2 as being an aircraft approved for RNAV 2, RNP 1 and with GNSS. Prior to the ICAO standard flight plan being updated to recognise RNP 2, States should ensure that aircraft operators with RNP 2 approval file designator 'Z' in field 10 and 'NAV/RNP 2' in field 18 (in addition to designator 'R' to indicate PBN approved).

Note 3: within Category R airspace, transition to RNP 4 or RNP 2 oceanic specifications is recommended at the earliest opportunity. RNP 4 and RNP 2 requires ADS-C and CPDLC, whereas RNP 2 oceanic requires dual independent installations.

7.15 All States should use the ICAO Table of Cruising Levels (FLOS) based on feet as contained in Annex 2 Appendix 3a.

Civil-Military Cooperation

7.16 Civil-Military Airspace expectations are as follows:

a) SUA should only be established after due consideration of its effect on civil air traffic by the appropriate Airspace Authority to ensure it will be:

- used for the purpose that it is established;
- used regularly;

- as small as possible, including any internal buffers, required to contain the activity therein;
- if applicable, operated in accordance with FUA principles; and
- activated only when it is being utilised; and

b) SUA should be regularly reviewed to ensure the activities that affect the airspace, and size and timing of such activity are accurately reflected by the SUA type, dimensions, activation notice and duration of activation.

Unmanned Aircraft Systems

7.17 States should implement regulations supporting the integration of UAS operations in non-segregated airspace, using a risk-based approach and in accordance with the guidance provided by the UAS Advisory Group of the Remotely Piloted Aircraft Systems (RPAS) Panel, as a minimum.

PARS Phase III (expected implementation by 03 November 2022)

Aerodrome Operations

7.18 All high-density international aerodromes should operate an A-CDM system integrated with the ATM network, consistent with **ACDM-B0/1** and **B0/2**.

Terminal Area Operations

7.19 Terminal Areas serving high-density international aerodromes should implement CCO and CDO operations consistent with **APTA-B0/4** and **B0/5** where practicable, and performance-based aerodrome operating minima-advanced and basic aircraft consistent with **APTA-B0/7** and **B0/8**.

Note: this does not preclude a State considering implementation of CCO/CDO and performance-based aerodrome operating minima at other aerodromes as appropriate.

7.20 Unless excepted by ATC, all aircraft operating within Category S and T controlled airspace should have systems that enable basic airborne situational awareness AIRB and VSA and where applicable, performance-based horizontal minima consistent with **CSEP-B1/1** to **B1/4**.

En-Route Operations

7.21 As far as practicable, all new ATS routes should be PBN routes in accordance with the following specifications to support **COMS-B0/1** and **B0/2, COMS-B1/1** to **B1/3**, **APTA-B0/1** to **B0/8**, and **APTA-B1/1** to **B1/5**:

- Category R airspace – **RNP 2** (or **RNP 4**); and
- Category S airspace –**RNAV 2** or **RNP 2**.

PARS Phase IV (expected implementation by 27 November 2025)

Terminal Operations

7.22 Where there is an operational benefit Terminal Areas serving all high-density international aerodromes should implement advanced capability PBN SID and STAR procedures and performance-based aerodrome operating minima for advanced aircraft with SVGS consistent with **APTA-B1/1** to **B1/3**.

Note: this does not preclude a State considering implementation of advanced capability PBN SID and STAR procedures and performance-based aerodrome operating minima for advanced aircraft at other aerodromes as appropriate.

7.23 Where there is an operational benefit, all Terminal Areas serving high-density international aerodromes should implement Advanced CDO and CCO operations consistent with **APTA-B1/4** to **B1/5**.

7.24 Where there is an operational benefit, Terminal Areas serving all high-density international aerodromes should implement point merge operations consistent with **RSEQ-B0/3**.

PARS Phase V (expected implementation by 23 November 2028)

Aerodrome Operations

7.25 All high-density international aerodromes should establish Airport Operations Centres (AOPCs) consistent with **ACDM-B2/2**.

7.26 Where there is an operational requirement and benefit, all high-density international aerodromes should implement performance-based aerodrome operating minima consistent with **APTA-B2/4**.

Preferred ANS 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 II (expected implementation by 07 November 2019)

ATS Communications

7.27 All ATS sectors providing ATS surveillance in adjacent airspace should have direct speech circuits or digital voice communications, meeting pre-established safety and performance requirements, and where practicable, automated hand-off procedures that allow the TOC of aircraft without the necessity for voice communications, unless an aircraft requires special handling.

Note: this element is applicable to ATC sectors within ATS units and between ATS units providing services in adjacent airspace.

7.28 Where applicable, all ATC Sectors should be supported by VDL Mode O/A and AMHS communication systems consistent with **COMI-B0/3 and B0/7** (Priority 1).

7.29 ATS systems should enable AIDC (version 3 or later), or an alternative process that achieves at least the same level of performance as AIDC, between en-route ATC units and terminal ATC units where transfers of control are conducted consistent with **FICE-B0/1,** unless alternate means of automated communication of ATM system track and flight plan data are employed (Priority 1). As far as practicable, the following AIDC messages types should be implemented:

- Advanced Boundary Information (ABI);
- Coordinate Estimate (EST);
- Acceptance (ACP);
- TOC; and
- Assumption of Control (AOC).

Note: States should note the necessity to utilise Logical Acknowledgement Message processing (LAM) when implementing AIDC [refer to guidance in Pan Regional (NAT and APAC) Interface Control Document for ATS Interfacility Data Communications (PAN AIDC ICD)].

ATS Surveillance

7.30 ADS-B (using 1090ES), MLAT or radar surveillance systems should be used to provide coverage of all Category S airspace as far as practicable, and Category T airspace supporting high-density international aerodromes, consistent with **ASUR-B0/1** and **B0/2**. Data from ATS surveillance systems should be integrated into operational ATC aircraft situation displays (standalone displays of ATS surveillance data should not be used operationally).

Note 1: ATM systems, including ATS surveillance systems and the performance of those systems, should support the capabilities of PBN navigation specifications and ATC separation standards applicable within the airspace concerned. Guidance on the performance of ATS communication and surveillance systems is available in Global Operational Data-link Document (ICAO Doc 10037).

Note 2: ATC units with ADS-B where Category S and Category T airspace supporting high-density aerodromes may consider utilizing ADS-B for situational awareness and/or separation.

Note 3: ATC units operating within controlled airspace wholly served by Mode S SSR and/or ADS-B surveillance should implement the use of the standard non-discrete Mode A code 1000 for Mode S transponder equipped aircraft to reduce the reliance on assignment of discrete Mode A SSR codes and hence reduce the incidence of code bin exhaustion and duplication of code assignment.

7.31 Subject to appropriate filtering, ATS surveillance data, particularly from ADS-B, should be shared with neighbouring ATC units to support **ASUR-B0/1** and **B0/2**.

7.32 Within Category R airspace, ADS-C surveillance and CPDLC should be enabled to support PBN-based separations, as well as UPR and DARP, consistent with **COMS-B0/1** and **B0/2, FRTO-B0/1** to **B0/4** and **FRTO-B1/1** to **B1/7**.

7.33 Mode S surveillance and the use of Mode S Downlinked Aircraft Parameters (DAPS) should be enabled in all upper level Category S airspace and all Category T airspace servicing high-density city pairs consistent with **ASUR-B0/3**. ATM automation system specifications should include the processing and presentation in ATC human-machine interfaces and decision support and alerting tools, the communications, navigation and approach aid indicators received in items 10 and 18 of FPL and ATS messages, where applicable, and the following Mode S or ADS-B downlinked aircraft parameters as a minimum:

- Aircraft Identification;
- Aircraft magnetic heading;
- Aircraft indicated airspeed or Mach Number; and
- Pilot selected altitude.

Note 1: DAPS may not be present in downlinked reports from some aircraft ADS-B applications.

Note 2: Downlinking of correct Aircraft Identification (Flight ID) enables automated coupling of ATS surveillance system information with the flight plan, and unambiguous ATC identification of aircraft. States should undertake comprehensive education programs to ensure pilots set the correct Flight ID. Guidance on the correct use of the aircraft identification function is provided in the ADS-B Implementation and Operations Guidance Document, available on the ICAO Asia/Pacific Regional Office website.

7.34 ATS surveillance systems should enable basic conflict detection and conformance monitoring STCA, MTCD, APW, APM and MSAW consistent with **FRTO-B0/4** and **SNET-B0/1** to **B0/4** (Priority 1). Route Adherence Monitoring (RAM) should be utilised when monitoring PBN route separations. Cleared Level Adherence Monitoring (CLAM) should be utilised to monitor RVSM airspace.

Air Traffic Management

Note: ATM system design (including ATS communication and surveillance, ATC separation minimum, aircraft speed control and ATC training) should be planned and implemented to support optimal aerodrome and enroute operations determined by the capacity expectations for the runway(s) and airspace concerned.

7.35 All high-density international aerodromes where ATFM facilities are required should be served by AMAN/DMAN facilities consistent with **RSEQ-B0/1** and **B0/2** (Priority 1).

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

7.36 Controlled airspace classification should be consistent with Annex 11 Appendix 4 and applied as follows:

a) Category R upper controlled airspace – **Class A**; and

b) Category S upper controlled airspace – **Class A**, or if there are high level general aviation or military VFR operations: **Class B** or **C**; and

c) Category S lower controlled airspace – **Class C**, **D** or **E** airspace, as determined by safety assessments.

7.37 All ATC units should authorise the use of the horizontal separation minima stated in ICAO Doc 4444 (PANS ATM), or as close to the separation minima as practicable, taking into account such factors as:

a) the automation of the ATM system, including automated hand-off between sectors;

b) the capability of the ATC communications system; the performance of the ATS surveillance system, including data-sharing or overlapping coverage at TOC points;

c) and ensuring the competency of air traffic controllers to apply the full tactical capability of ATS surveillance systems.

Note 1: the delivery of ATC services should be based primarily on the CNS/ATM capability. When using Annex 10 compliant ATS surveillance, 5 NM (en-route) or 3 NM (terminal) surveillance-based separations should be authorised within ATC sectors. At the TOC points in such environments, 5-10 NM should be authorised with auto hand-off and surveillance data-sharing or overlapping coverage at the TOC point, and 5-20 NM without auto hand-off, as determined by an appropriate safety assessment.

Note 2: the efficacy, continuity and availability of ATM services should be supported by adherence with regional planning and guidance material regarding ATM automation and ATM contingency systems (regarding ATM contingency operations, refer to the Regional ATM Contingency Plan).

7.38 Priority for FLAS level allocations should be given to higher density ATS routes over lower density ATS routes. FLAS should comply with Annex 2, Appendix 3a unless part of an OTS. FLAS other than OTS should only be utilised for safety and efficiency reasons within:

a) Category R airspace with the agreement of all ANSPs that provide services:

- within the airspace concerned; and
- within adjacent airspace which is affected by the FLAS; or

b) Category S airspace with the agreement of all ANSPs that provide services:

- where crossing track conflictions occur within 50 NM of the FIR boundary; and
- ATS surveillance coverage does not overlap the FIRs concerned, or ATS surveillance data is not exchanged between the ATC units concerned.

7.39 ATC units should conduct Airspace Planning and enable systems that manage direct and flexible routings where practicable, and the optimal operation of FUA consistent with **FRTO-B0/1** to **B0/4** (Priority 1).

7.40 All 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 C**.*

7.41 All ACCs operating within FIRs where demand may exceed capacity should implement ATFM incorporating CDM to enhance capacity, using bi-lateral and multi-lateral agreements, initial integration of ASM with ATFM, Collaborative Network Flight Updates, Basic Network Operation Planning and Initial Airport/ATFM slots, A-CDM Network Interface and Dynamic Slot Allocation consistent with **NOPS-B0/1** to **B0/5** (Priority 1).

Note 1: refer to the Asia/Pacific ATFM Framework on Collaborative ATFM for more details on Network Operations expectations.

Note 2: full FUA is not yet incorporated into the Asia/Pacific ATFM Framework for Collaborative ATFM.

7.42 ATC systems should utilise electronic flight progress strips wherever automation systems allow the capability due to efficiency and transcription error/data mismatch issues.

Air Navigation Services

7.43 ATM systems should be supported by digitally-based AIM systems consistent with **DAIM-B1/1** to **B1/6,** in adherence with ICAO and regional AIM planning and guidance material. ATM systems should be supported by aeronautical information digital data exchange of at a minimum, version AIXM 5.1 (Priority 1).

Note: Regional AIM policies are contained within the Asia/Pacific Regional Plan for Collaborative AIM.

7.44 Aeronautical meteorological observations, forecast, warning, climatological and historical products (such as aerodrome meteorological forecasts and reports, aerodrome warnings and wind shear warnings) should be disseminated to users consistent with **AMET-B0/1** to **B0/4**, and in accordance with global and regional guidance material. An agreement between the MET authority and the appropriate ATS authority should be established to ensure the appropriate exchange of meteorological information obtained from aircraft (Priority 1).

7.45 An appropriate enhanced SAR system and systems to support aircraft tracking capability should be established consistent with the provisions of Annex 12 and to support **GADS-B1/1** and **B1/2**, and in accordance with the *Asia/Pacific SAR Plan*.

ANSP Human and Simulator Performance

7.46 The following systems should be established to support human performance in the delivery of a Seamless ANS service. The systems should consider all the elements of the SHEL Model (Software, Hardware, Environment and Liveware – humans), in accordance with the ICAO Human Factors Digest No. 1 and related reference material:

a) human performance training for all managers of operational air navigation services (such as aerodrome operators, ATC organisations and aeronautical telecommunications), such training to include the importance of:

- a proactive organisational culture where managers and operational staff are informed and safety is a first priority, using open communications and an effective team management approach;
- assessment and management of risks by safety review and assessment teams comprising multidisciplinary operational staff and managers which review safety performance and assess significant proposals for change to ATM systems, particularly those related to human capabilities and limitations;
- human factors in –
  - air safety investigation;
  - system design (ergonomics, human-in-the-loop);
  - effective training (including the improved application of simulators);
  - fatigue management;
  - automated safety nets; and
  - contingency planning;
- effective safety reporting systems that –
  - are non-punitive, supporting a "positive safety culture";
  - promote open reporting to management; and
  - focus on preventive (systemic), not corrective (individual) actions in response to safety concerns, incidents and accidents.

b) human performance-based training and procedures for operational staff providing ATS, including:

- the application of tactical, surveillance-based ATC separation;
- control techniques near minimum ATC separation; and
- responses to ATM contingency operations, irregular/abnormal operations and safety net alerts.

c) human performance-based training and procedures for staff providing operational air navigation services (such as aerodrome staff operating 'airside', air traffic controllers and aeronautical telecommunications technicians) regarding the importance of:

- an effective safety reporting culture; and
- 'Just Culture' (Priority 1).

Note 1: prevention of fatigue systems should be established to support human performance in the delivery of a Seamless ANS service. The systems should be consistent with guidance within ICAO Doc 9966 FRMS – Fatigue Risk Management System.

Note 2: regarding ATM contingency operations, refer to the Regional ATM Contingency Plan.

Civil-Military Cooperation

7.47 Civil-Military ATM expectations are as follows:

a) a national Civil-Military body should be formed to coordinate strategic civil-military activities (military training should be conducted in locations and/or at times that do not adversely affect civilian operations, particularly those associated with major aerodromes);

b) formal civil-military liaison should take place for tactical responses by encouraging military participation at civil ATM meetings and within ATC centres;

c) integration of civil and military ATM systems using joint procurement, and sharing of ATS surveillance data (especially from ADS-B systems) should be provided as far as practicable;

d) joint provision of Civil-Military navigation aids and aerodromes;

e) common training should be conducted between civil and military ATM units in areas of common interest; and

f) civil and military ATM units should utilize common procedures as far as practicable.

Note: the term 'military' in this context may include other State functions such as customs, police, and paramilitary activities.

7.48 All States with organisations that conduct space object launch or re-entry activities should ensure:

a) the development of written coordination agreements between the State civil aviation authority and the launch/re-entry agency concerned;

b) that strategic coordination is conducted between the State civil aviation authority and any States affected by the launch/re-entry activity at least 14 days prior to the proposed activity, providing notice of at least:

- three days for the defined launch window; and
- 24 hours for the actual planned launch timing;

c) that consideration of affected airspace users and ANSPs is made after consultation, so that the size of the airspace affected is minimized and the launch window is optimized for the least possible disruption to other users; and

d) that communication is established with affected ANSPs to provide accurate and timely information on the launch/re-entry activity to manage tactical responses (for example, emergencies and activity completion) (Priority 1).

Note 1: increasingly, space object launch and re-entry activity is being conducted by commercial organisations, so this element applies equally to State or private operations.

Note 2: guidance for States on space object launch and re-entry activity is available on the ICAO Asia/Pacific eDocuments webpage.

PASL Phase III (expected implementation by 03 November 2022)

Aerodrome Operations

7.49 All ATC units providing services to high-density international aerodromes should operate extended arrival metering consistent with **RSEQ-B1/1**.

7.50 All ATC units providing services to high-density international aerodromes should operate basic ATC surface operations tools, comprehensive situational awareness, situational awareness, alerting service consistent with **SURF-B0/1** to **3**.

7.51 All ATC units providing services to high-density international (ICAO aerodrome reference codes[3] 3 and 4) aerodromes having complex layouts should implement A-SMGCS incorporating advanced surface traffic management visual aids, pilot comprehensive awareness and runway alerting, enhanced ATC alerting, routing service to support ATC and enhanced vision systems (EVS) for taxiing and runway safety alerting logic consistent with **SURF-B1/1** to **5**.

Note 1: AMAN/DMAN arrival/departure management needs to be integrated with advanced surface management systems: A-SMGCS with SMAN or ASDE-X.

Note 2: SURF standards are provided in EUROCAE/RTCA documents ED-159/DO-312/ ED-165.

7.52 All ATM systems serving high-density international aerodromes should implement Data-link Departure Clearance (DCL) compliant with EUROCAE WG78/RTCA SC 214 standards.

Terminal Operations

7.53 ATS surveillance systems should enable Enhanced STCA with aircraft parameters and in complex TMAs consistent with **SNET-B1/1** and **B1/2**.

En-Route Operations

7.54 ACCs should enable, where practicable, Free Route Airspace, RNP routes, Advanced FUA and Airspace Management (ASM), Dynamic Sectorisation, Enhanced Conflict Detection Tools and Conformance Monitoring and Multi-Sector Planner Function consistent with **FRTO-B1/1** to **B1/7**.

Note: CPAR is a key enabler for 'free route airspace' and enroute UPR and DARP operations.

7.55 All ACCs operating within FIRs where demand may exceed capacity should operate systems that enable, where applicable, Short Term ATFM measures, Enhanced NOPS Planning, Enhanced integration of airport operations and NOPS planning, Enhanced Traffic Complexity Management, Full integration of ASM with ATFM, Initial Dynamic Airspace configurations, Enhanced ATFM slot swapping, Extended Arrival Management, ATFM Target Times and Collaborative Trajectory Options Programme consistent with **NOPS-B1/1** to **B1/10** supporting the integration of time-based management within a flow centric approach, consistent with **TBO-B0/1** and **TBO-B1/1**.

7.56 All ATC units should be equipped with or be able to interface with communication systems appropriate to support the service provided, consistent with:

a) **COMI-B0/1, B0/2, B0/4, B0/5** and **B0/6**, including ACARS, ATN/OSI, VDL Mode 2 Basic, SATCOM Class C Data, and HFDL; and

b) **COMI-B1/1** to **B1/4**, including VDL Mode 2 Multi-Frequency, SATCOM Class B (SB-S) Voice and Data, ATN/IPS and AeroMACS Ground-Ground; and

c) **COMS-B0/1** and **B0/2**, including CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace and ADS-C (FANS 1/A) for procedural airspace; and

[3] Annex 14 *Aerodromes* Volume I *Aerodrome Design and Operations* Section 1.6

d) **COMS-B1/1** to **B1/3**, including PBCS approved CPDLC (FANS 1/A+), ADS-C and SATVOICE for domestic and procedural airspace.

Note 1: the Asia/Pacific Region has established the CRV (Common aeRonautical Virtual private network), in order for ANSPs serving as Inter-regional Backbone Boundary Intermediate Systems to connect to the IP network infrastructure of other regions.

Note 2: ANSPs should upgrade their ATS voice communication systems or implement analogue/digital VoIP converters in compliance with the EUROCAE ED-137 standards (interoperability standards for VOIP ATM components).

7.57 ACCs operating within Category R airspace should implement SB ADS-B consistent with **ASUR-B1/1**, subject to an assessment of costs and benefits.

Note: this does not preclude the use of SB ADS-B by other ATC units to augment surveillance capability or to act as a backup.

Air Navigation Services

7.58 ATM systems should be supported by digitally-based NOTAM consistent with **DAIM-B1/7**.

Note: Regional AIM policies are contained within the Asia/Pacific Collaborative AIM Plan.

7.59 All States should ensure that aeronautical meteorological products supported by automated decision systems or aids using IWXXM consistent with **AMET-B1/1** to **B1/4**.

PASL Phase IV (expected implementation by 27 November 2025)

Aerodrome Operations

7.60 Where there is an operational benefit, remotely operated Aerodrome Air Traffic Services should be implemented, consistent with **DATS B1/1**.

Air Navigation Services

7.61 Capability for providing aeronautical meteorological observations in support of automated decision processes or aids and performance-based requirements, involving meteorological information, meteorological information translation, ATM impact conversion and ATM decision support should be enabled, consistent with **AMET-B1/1**.

Information Exchange

7.62 States should establish SWIM services consistent with **SWIM-B2/1** and **B2/2**, implementing the following as a minimum:

a) Information Service Provision (**SWIM-B2/1**); and

b) Information Service Consumption (**SWIM-B2/2**).

PASL Phase V (expected implementation by 23 November 2028)

Air Traffic Management

7.63 All ATC units providing services to high-density international aerodromes should operate enhanced surface guidance for pilots and vehicle drivers, comprehensive situational awareness and conflict alerting service for runway operations consistent with **SURF-B2/1** to **B2/3.**

7.64 All aerodromes where ATFM facilities are required, should be served by an integrated system of arrival and departure management sequences into a single runway or dependent runways consistent with **RSEQ-B2/1**.

7.65 ACCs and terminal airspaces should enable Dynamic Airspace Configurations for different traffic flow or complex situations, Enhanced Conflict Detection Tools and Conformance Monitoring consistent with **FRTO-B2/1** and **B2/2**, and **NOPS-B2/2**.

7.66 ACCs should enable, where practicable, large-scale cross-border Free Route Airspace in coordination with adjacent FIRs, and enhanced conflict resolution tools consistent with **FRTO-B2/3** and **B2/4**.

7.67 ACCs should enable, where practicable, ATFM for cross-border Free Route Airspace in coordination with adjacent FIRs, and enhanced conflict resolution tools consistent with **NOPS-B2/6** and **FRTO-B2/3** and **B2/4**.

7.68 All ACCs operating within FIRs where demand may exceed capacity should operate systems that enable, where applicable, collaborative network operations planning, further integration of airport operations and NOPS planning, multi ATFM slot swapping and airspace user priorities consistent with **NOPS-B2/1-5** supporting the integration of time-based management within a flow centric approach, consistent with **TBO-B0/1** and **TBO-B1/1**.

Air Navigation Services

7.69 Capability for providing integrated aeronautical meteorological observations, forecast and, warning information, climatological and historical products in support of automated decision processes and the design and planning of infrastructure, flight routes and airspace management should be enabled, consistent with **AMET-B2/1** to **B2/3**.

7.70 Integrated meteorological information service in the SWIM environment in support of enhanced operational ground and air decision-making processes, particularly in the planning phase and near-term should be implemented consistent with **AMET-B2/4**.

ATS Communications

7.71 All ATC units should be equipped with or be able to interface with communication systems appropriate to support the service provided, consistent with:

a) **COMI-B2/1** to **B2/3**, including Air/Ground ATN/IPS and AeroMACS and Links for non-safety communication; and

b) **COMS-B2/1** to **B2/3**, including PBCS approved CPDLC, ADS-C and SATVOICE for domestic and procedural airspace.

Information Exchange

7.72 States should establish FF-ICE (Flight and Flow Information for Collaborative Environment) consistent with **FICE-B2/2** and **B2/4,** SWIM services consistent with **SWIM-B2/3**, Aeronautical Information dissemination consistent with **DAIM-B2/1** and Meteorological information service consistent with **AMET-B2/4**, implementing the following as a minimum;

a) Filing Service (**FICE-B2/2**);

b) Flight Data Request Service (**FICE-B2/4**);

c) SWIM Registry (**SWIM-B2/3**);

d) Dissemination of Aeronautical Information in a SWIM Environment (**DAIM-B2/1**); and

e) Meteorological Information Service in SWIM (**AMET-B2/4**).

RESEARCH AND FUTURE DEVELOPMENT POSSIBILITIES

Research and Development

8.1 To develop the tools and systems required to meet foreseeable long-term requirements, there is a need for States to undertake and co-operate on ATM Improvement. This includes major efforts to define concepts, to extend knowledge and invent new solutions to future ATM challenges so these new concepts are selected and applied in an appropriate timely manner. Such efforts could be forged through collaborative partnerships between, States, ANSPs, International Organizations, institutes of higher learning and specialised technical agencies. This concept is consistent with Seamless ANS Principle 36 (*Inter-regional cooperation ('clustering') for the research, development and implementation of ATM projects*).

8.2 The need for concepts beyond current technology and systems was reinforced at APANPIRG/23 in 2012. 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 ANS beyond ASBU Block 0 and Block 1 implementations and global interoperability:

a) Space-Based ATS Surveillance – the AN-Conf/12 endorsed Recommendation 1/9 regarding SB ADS-B systems being included in the GANP. With the availability of SB ADS-B several APAC States have commenced studies with a view to its implementation to support improved separation, particularly in oceanic (Category R) airspace. Subject to the development by ICAO of standards and procedures for the application of this technology for ATC separation and the necessary supporting communications systems, regional policy and planning development should examine opportunities and develop policies to take advantage of this technology;

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 ANS 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*;

c) Collaborative Air Navigation Services – this concept is consistent with the following Seamless ANS Principles: 9 (*Cross-border/FIR cooperation for use of aeronautical facilities and airspace, collaborative data sharing, airspace safety assessment and ATM Contingency planning*) and 15 (*Collaboration by ANSPs for evaluation and planning of ATM facilities*). The AN-Conf/12 endorsed Recommendation 5/1, regarding collaboration in airspace organization and routing, which emphasised, *inter alia*, the need to take advantage of improved models for inter-regional coordination and collaboration to achieve seamless air traffic management and more optimum routes through airspace.

d) Airspace Optimisation – the CONOPS states: *Where possible the number of FIRs should be minimized particularly along traffic flows. FIRs should not necessarily be based strictly on the boundaries of sovereign territories*. This concept is consistent with and the following Seamless ANS Principles: 12 (*The optimisation of airspace structure through amalgamation and use of technology*) and 16 (*Optimization of ATM facilities through amalgamation and the use of technology, including automation, satellite-based systems and remote facilities*). The Global ATM Operational Concept paragraph 2.2.2 states: *While acknowledging sovereignty, airspace will be organized*

globally. Homogeneous ATM areas and/or routing areas will be kept to a minimum, and consideration will be given to consolidating adjacent areas;

e) Consistent Operating Practices and Procedures – this is aligned with Seamless ANS Principle 3 (*Harmonised regional or sub-regional rules and guidelines*) and 4 (*Shared ATM operational standards, procedures, guidance materials through common manuals and templates*); and

f) Transition Altitude/Layer Harmonisation – this is consistent with AN-Conf/-12 Recommendation 5/1 b).

MILESTONES, TIMELINES, PRIORITIES AND ACTIONS

Milestones

9.1 Section 7 (Performance Improvement Plan) provides milestones and timelines for a number of elements in the PARS and PASL Phase II, III, IV and V, being effective 07 November 2019, 03 November 2022, 27 November 2025 and 23 November 2028 respectively. Phase I elements that had not been completed as of 2019 were moved to Phase II.

9.2 It should be noted that States should commence planning for the various elements, such as PBN specifications detailed in the PARS to cover overall ATM operations, taking into account the whole phase of flight. This should be planned from the approval of this Plan, to ensure a smooth transition by the onset of Phase I, and should include consideration of issues such as:

- aircraft equipage and certification;
- safety/operational analysis and assessment;
- cost-effectiveness;
- budgetary issues;
- development of operational procedures; and
- training.

9.3 States should commence planning for PBN specifications detailed in the PARS and other initiatives which have been globally documented, to facilitate a smooth transition by the onset of Phase I. The Regional PBN Plan is expected to transition to a general guideline for implementation during this period, with the prescriptive PBN specifications being incorporated into this Plan.

9.4 Section 8 (Research and Future Development Possibilities) provides, subject to future agreement by concerned parties, possible Seamless ANS improvements beyond 2019 until 2031.

Priorities

9.5 It is a matter for each State to determine priorities in accordance with its own economic, environmental, safety and administrative drivers. Such drivers may include a data driven assessment of their own performance.

Actions

9.6 Noting that the Plan had the status of guidance material in terms of regional policy expectations, this Plan necessitated a number of implementation actions.

9.7 The ICAO Seamless ANS Reporting Tool supports the implementation of the global and regional items by monitoring progress of States and Administrations.

9.8 APANPIRG and its contributory bodies such as the ATM Sub-Group and the CNS Sub-Group are responsible for the oversight of air navigation issues within the Asia/Pacific, so these bodies needed to be made aware of State implementation progress of Seamless ANS initiatives. APANPIRG and its contributory bodies need to manage the implementation of Seamless ANS through the ASBU framework and this Plan.

9.9 Section 6 (Current Situation) provides detailed analysis and major concerns in the region. Some of the non-ICAO sub-regional collaborative frameworks or actions have successfully achieved ATM operational improvements in the past. These forums will continue to be important in Seamless ANS implementation in the future.

9.10 The ICAO Asia and Pacific Regional Office assists, where necessary, the implementation of Seamless ANS within its accredited States. In addition, the Asia and Pacific Regional Office coordinates with adjacent ICAO regional offices on an ad hoc basis or at relevant trans-regional meetings.

Appendix A: Beijing and Delhi Declarations

Beijing Declaration

2.0 Air Navigation Services

2.1 Commit to implementation by 2022 of the Asia/Pacific Seamless Air Traffic Management (ATM) Plan to enhance ATM capacity and harmonisation in the Region, including a focus on:

a) Transitioning from Aeronautical Information Service (AIS) to Aeronautical Information Management (AIM) System;

b) Performance Based Navigation (PBN) implementation;

c) Common ground/ground telecommunication infrastructure to support Air Navigation Services (ANS) applications;

d) An enhanced level of civil/military cooperation;

e) Enhanced surveillance capability including Automatic Dependent Surveillance-Broadcast (ADS-B) technology;

f) Air Traffic Flow Management/Collaborative Decision Making (CDM) implementation for high density airports; and

g) Air navigation in national planning frameworks such as National Development Plans (NDPs) supported by National Air Navigation Plans.

2.2 Promote sharing of best practices in the provision of ANS including Aeronautical Search and Rescue (SAR), Meteorological Services for International Air Navigation (MET) and Air Traffic Flow Management (ATFM) through regional cooperation and enhanced coordination.

Delhi Declaration

4.0 Air Navigation Services

4.1 Commit to resources in modernization and innovation in Air Navigation Services, in tandem with developments in the airport and airline capacity, to support recovery and meet future demand for air travel and new entrants.

4.2 Commit to implement the ICAO Standards and Procedures for Air Navigation Services (PANS), and the Asia/Pacific Seamless ANS Plan (including prioritized GANP elements) and its subsidiary plans to enhance ANS capacity and harmonization in the Asia and Pacific Region focusing on as a matter of priority:

a) Phase I, II and III of the Asia/Pacific Regional Aeronautical Information Management (AIM);

b) Improved Airspace Safety and Capacity through the implementation of more efficient Air Traffic Control (ATC) separation minima;

c) Performance Based Navigation (PBN) implementation in accordance with ICAO Assembly Resolution A37-11 on Global PBN Goals;

d) Common Ground/Ground Telecommunication Infrastructure to support ANS applications;

e) Expediting the implementation of ICAO provisions related to System Wide Information Management (SWIM);

f) Enhanced civil/military cooperation;

g) Enhanced Surveillance capability for improved Safety and Efficiency;

h) Air Traffic Flow Management (ATFM) and Airport Collaborative Decision Making (A-CDM) implementation;

i) Air Traffic Management (ATM) contingency planning, in coordination with neighbouring States/Administrations;

j) Air navigation in national planning frameworks such as National Development Plans (NDPs) supported by National Air Navigation Plans (NANP); and

k) Enhancement of safety risk assessment capability.

4.3 Share best practices, resources and capability in the provision of ANS, including Aeronautical Search and Rescue (SAR), Meteorological Services for International Air Navigation (MET) and Air Traffic Flow Management (ATFM) through regional cooperation and enhanced coordination.

4.4 Work collaboratively through ICAO and Regional collaborative platforms towards Seamless ANS, including Flight and Flow Information for a Collaborative Environment (FF-ICE) and Trajectory-Based Operations (TBO) to support future traffic growth and sustainability.

Appendix B: Seamless ANS Principles

People: Cultural and Political Background

1. High-level political support (including development of educational information for decision-makers) to support Seamless ANS initiatives, including military cooperation and AIM.
2. Education and implementation of non-punitive reporting and continuous SMS improvement systems.

Aviation Regulations, Standards and Procedures

3. Harmonised regional or sub-regional rules and guidelines, modelled on the regional application of common regulations incorporated by reference into local legislation.
4. Shared ATM operational standards, procedures, guidance materials through common manuals and templates.
5. The promotion of mutual recognition of ATM qualifications between States.
6. An emphasis on delivery of ATM services based on CNS capability, resulting in flexible, dynamic systems.
7. The use of high-fidelity simulators to train controllers on the optimal application of ATC separations and procedures that support Seamless ANS applications, emergency and contingency responses, testing of software releases, and may serve as a backup ATM platform.

ATM Coordination

8. Sub-regional ATFM based on system-wide CDM serving the busiest terminal airspace and MTF.
9. Cross-border/FIR cooperation for use of aeronautical facilities and airspace, collaborative data sharing, airspace safety assessment and ATM Contingency planning.
10. Encouragement of military participation in civil ATM meetings and in ATS Centres where necessary.

Airspace Organisation

11. Promoting flexible use airspace arrangements and regular review of airspace to ensure it is appropriate in terms of purpose, size, activation and designation.
12. The optimisation of airspace structure through amalgamation and use of technology.

Facilities: Aerodromes

13. To encourage aerodrome operators to actively participate in ATM coordination in respect of Airport CDM development and operational planning, including aerodrome complexity and capacity.
14. Planning and coordination with local authorities and government agencies to take into account environmental issues, obstacles, aerodrome and PBN development.

ATS Units

15. Collaboration by ANSPs for evaluation and planning of ATM facilities.
16. Optimization of ATM facilities through amalgamation and the use of technology, including automation, satellite-based systems and remote facilities.

Navigation Aids

17. The continued rationalisation of terrestrial navigation aids to satellite-based procedures, while retaining a minimum network necessary to maintain safety of aircraft operations.
18. Support for a GNSS-based global PBN approval standard.
19. Regional cooperation for augmentation systems in terms of interoperability and increased service areas, and a GNSS ionospheric monitoring network.

Telecommunication

20. Encouragement of the use of ground-ground ATN/AMHS and diverse satellite communication systems.
21. Enhancement of data-link capabilities (VHF including VDL M2, SATCOM).
22. Where cost beneficial and appropriate, the implementation of:
    - SATVOICE technologies and standards;
    - HF data-link;
    - VSAT networks in support of COM and SUR.
23. The prioritisation of AIDC systems to alleviate ATC coordination issues.

ATS Surveillance

24. The encouragement of ADS-B and/or MLAT implementation to improve ATS surveillance coverage, redundancy and multiple tracking capability.
25. Establishment of ADS-C where radar, ADS-B (including satellite –based ADS-B) and/or MLAT is not possible.
26. Expansion of ATS surveillance data-sharing initiatives.

Technology and Information: Flight Operations

27. Implementation of UPR and DARP where practicable.
28. Implementation of CDO and CCO where possible.
29. The encouragement of appropriate technologies that support Trajectory-Based Operations.

Aeronautical Data

30. Early implementation of AIM, including cooperative development of aeronautical databases and SWIM to support interoperable operations.

ATM Systems and Safety Nets

31. Application of ground-based safety nets, which includes tactical and strategic conflict probing (such as APW, STCA) and MSAW.
32. Support for Inter-facility Flight Data Processing System capability.
33. Collaborative development of CDM, ATFM, A/MAN and D/MAN support tools.
34. Encouragement of Digital ATIS and VOLMET information systems.
35. Encourage sharing of air traffic data between military ATM systems and civil ATM systems.

ATM Modernisation Projects

36. Inter-regional cooperation (‘clustering’) for the research, development and implementation of ATM projects.
37. A focus on technologies for earliest deployment and best cost benefits.

Appendix C: 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 C1** 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 C1: 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 *Manual on Collaborative Air Traffic Flow Management* (ICAO Doc 9971) contained guidelines for ATC sector capacity assessment. **Table C2** provides simplified ATC sector calculation guidance from ICAO 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 C2: Simplified ATC Sector Capacity Table (no complexity/automation allowance)

4 Australia, Japan, New Zealand, Singapore, Thailand and the United States of America 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: **45** (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

9 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).

10 ATC Sector capacity expectations:

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

Thailand

11 Suvarnabhumi aerodrome capacity expectations:

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

United States of America

12 **Table C3** 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 C3: Capacity at Selected United States of America Aerodromes

13 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).

14 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

15 **Table C4** 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**
ICAO Doc 9971 Simplified Table Comparison						15	18	18

Table C4: 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.

Appendix D: List of References

Global and Regional Framework

Asia/Pacific Regional Air Navigation Plan
Doc 9750 *Global Air Navigation Plan*
Doc 9854 *Global Air Traffic Management Operational Concept*
Doc 10004 *Global Aviation Safety Plan*

Air Navigation Services

Annex 10 *Aeronautical Telecommunications*
Annex 11 *Air Traffic Services* (particularly Chapter 2 [2.1 and 2.30], and Attachment C)
ASBU Document
ASEAN *Master Plan on ASEAN Connectivity*
Asia/Pacific Regional Air Traffic Flow Management Concept of Operations
Asia/Pacific Regional Performance-Based Navigation Implementation Plan (V4.0)
Doc 4444 *Procedures for Air Navigation Services Air Traffic Management (PANS ATM)*
Doc 8071 *Manual on Testing of Radio Navigation Aids Volume 2*
Doc 9613 *Performance-based Navigation Manual*
Doc 9882 *Manual on ATM System Requirements*
Doc 9883 *Manual on Global Performance of the Air Navigation System*
Doc 9906 *Quality Assurance Manual for flight Procedure Design Volume 5*
Doc 9971 *Manual on Collaborative Air Traffic Flow Management*
Doc 10037 *Global Operational Data Link (GOLD) Manual*
Doc 10088 *Manual on Civil-Military Cooperation in Air Traffic Management*
ICAO AN-Conf/12 Yellow Cover Report on Agenda Item 1
Roadmap for the Transition from AIS to AIM

Flight Operations

Annex 6 *Operation of Aircraft*
Doc 8168 *Procedure for Air Navigation Service Aircraft Operations Volume I Flight Procedures*
Doc 8168 *Procedure for Air Navigation Service Aircraft Operations Volume II Construction of Visual and Instrument Flight Procedures*
Doc 9931 *Continuous Descent Operations (CDO) Manual*
Doc 9993 *Continuous Climb Operations (CCO) Manual*

Human Factors

Annex 1 *Personnel Licensing*
Circular 214 *Fundamentals on Human Factors*
Circular 227 *Training of Operational Personnel on Human Factors*
Circular 241 *Human Factors in ATC*
Circular 249 *Human Factors in CNS and ATM Systems*
Circular 318 *Language Testing Criteria for Global Harmonization*
Circular 323 *Guidelines for Aviation English Training Programmes*
Doc 9835 *Manual on the Implementation of ICAO Language Proficiency Requirements*
Doc 9966 *Fatigue Risk Management Systems*
Human Factors Digest No. 1