



Agenda Item 5: ATM Systems (Modernisation, Seamless ATM, CNS, ATFM)

RECENT CNS-RELATED DEVELOPMENTS

(Presented by the Secretariat)

SUMMARY

This paper presents the recent developments in the CNS area since CNS SG/23 meeting that may be of interest to the ATM Sub-group. The draft Conclusions from the related contributory bodies will be presented to CNS SG/24 meeting for consideration, which is scheduled for 30 November to 4 December 2020. Expected action from this meeting is at section 3.

1. INTRODUCTION

1.1 The CNS SG/23 meeting was held from 2 to 6 September 2019, and the CNS SG/24 meeting is scheduled from 30 November to 4 December 2020 (VTC). A number of CNS related contributory bodies of APANPIRG held their meetings during the period between SG/23 and SG/24.

- 1) Flight Inspection and Procedure Validation Seminar, 24-27 Sep 2019 at the ICAO APAC Office;
- 2) Asia Pacific Cyber Safety and Resilience Workshop with Tabletop Exercise (APAC TTX), 19-21 November 2019 at the ICAO APAC Office;
- 3) SEABOB ADS-B WG/15, 3-5 December 2019 in Singapore;
- 4) CRV OG/7, 20-22 January 2020 at the ICAO APAC Office;
- 5) DAPs WG/3, 12-15 May 2020, VTC;
- 6) SRWG/4, 9-10 June 2020, VTC;
- 7) SBAS/GBAS ITF/ 1, 23-24 June 2020, VTC;
- 8) APA TF/6 (AIDC TF), 14-16 July 2020, VTC;
- 9) ACSICG/7, 21-23 July 2020, VTC;
- 10) SBAS/GBAS ITF/ 2, 9-10 Sep 2020, VTC;
- 11) SURICG/5, 22-24 Sep 2020, VTC;
- 12) PBNICG/7, 21-23 Oct. 2020 VTC;
- 13) ATMAS Seminar and TF /1, 27-30 Oct, VTC
- 14) SWIM TF/4, 3-6 Nov 2020, VTC.

1.2 2020 APAC Aeronautical Fixed Service Safety and Protection Planning Working Group meeting (AFSSP WG 2020) originally planned for 21-23 April 2020, was postponed to 2021, and the Frequency Finder Workshop was postponed to 2021 as well.

1.3 This paper briefly introduces the outcome of the CNS SG/23 meeting and recent developments in the past year that may be of interest to the APANPIRG ATM Subgroup.

2. DISCUSSION

Conclusions/Decisions adopted in 2019

2.1 The CNS SG/23 meeting reviewed the outcome of a number of meetings of APANPIRG contributory bodies, adopted following 9 Conclusions and 4 Decisions on technical and operational matters:

- | | |
|---|---|
| Conclusion CNS SG/23/1 (<i>ACSICG/6/1</i>) | - AFTN/AMHS-Based Interface Control Document for ATFM |
| Conclusion CNS SG/23/3 (<i>ACSICG/6/3-CRV OG/5/2</i>) | - CRV Implementation Plan amendment (Version 2) |
| Conclusion CNS SG/23/4 (<i>SWIMTF/3/1</i>) | - The philosophy and roadmap for APAC SWIM implementation |
| Conclusion CNS SG/23/5 (<i>SWIMTF/3/3</i>) | - Interoperable Registry Model for SWIM Registry in APAC Region |
| Conclusion CNS SG/23/10 (<i>SURICG/4/1</i>) | - ADS-B and Flow Management |
| Conclusion CNS SG/23/11 (<i>SURICG/4/2</i>) | - UAS Cooperative Surveillance Equipage |
| Conclusion CNS SG/23/12 (<i>SURICG/4/3</i>) | - Adoption of Mode S DAPs Implementation and Operations Guidance Document |
| Conclusion CNS SG/23/15 (<i>SURICG/4/7</i>) | - Revised ADS-B Implementation and Operations Guidance Document (AIGD) |
| Conclusion CNS SG/23/17 | - Adoption of Guidance for Procurement and Certification of CNS/ATM Services and Systems |
| Decision CNS SG/23/2 (<i>ACSICG/6/2 - CRV OG/5/1</i>) | - Revised Terms of Reference of CRV OG |
| Decision CNS SG/ 23/9 | - Establishment of the Asia/Pacific Ground-based Augmentation System (GBAS)/Satellite-based Augmentation System (SBAS) Implementation Task Force (APAC GBAS/SBAS ITF) |
| Decision CNS SG/23/13 (<i>SURICG/4/5</i>) | - Establishment of the Asia/Pacific ATM Automation System Task Force (ATMAS/TF) |
| Decision CNS SG/23/18 | - Need for Study Human Factor Issues of Air Traffic Safety Electronics Personnel (ATSEP) |

2.2 The CNS SG/23 meeting also endorsed 4 draft Conclusions which were then reviewed and adopted by APANPIRG/30 meeting.

Conclusion APANPIRG/30/12 (CNS SG/23/6-SWIM TF/3/4) - Asia/Pacific Regional FIXM Extension for ATFM	
<p>What: That, noting:</p> <ol style="list-style-type: none"> the need for interoperable system-to-system information exchange to support the implementation and automation of cross-border ATFM in the Asia/Pacific Region; and the data attributes included in the Asia/Pacific FIXM version 4.1 Extension were endorsed by ATFM/SG. <p>The Asia/Pacific FIXM version 4.1 Extension described and provided in Appendix A to the Report on agenda item 3.4 be adopted and uploaded to the ICAO APAC Regional Office website for immediate use by Asia/Pacific Administrations, where the capability to do so exists, for cross-border ATFM information exchange.</p>	<p>Expected impact:</p> <p><input type="checkbox"/> Political / Global</p> <p><input checked="" type="checkbox"/> Inter-regional</p> <p><input type="checkbox"/> Economic</p> <p><input type="checkbox"/> Environmental</p> <p><input checked="" type="checkbox"/> Ops/Technical</p>
<p>Why: To provide the information exchange model necessary to support cross-border ATFM in the Asia/Pacific Region, in order to support the implementation of the performance objectives of the Asia/Pacific Regional Framework for Collaborative ATFM.</p>	<p>Follow-up: <input checked="" type="checkbox"/> Required from States</p>
<p>When: 6-Nov-19</p>	<p>Status: adopted by PIRG</p>
<p>Who: <input checked="" type="checkbox"/> Sub groups <input type="checkbox"/> APAC States <input checked="" type="checkbox"/> ICAO APAC RO <input type="checkbox"/> ICAO HQ <input type="checkbox"/> Other</p>	

Conclusion APANPIRG/30/13 (CNS SG/23/7-ACSICG/6/4) - Direct controller-pilot communication SATVOICE Trials	
<p>What: That, States who are interested in direct controller-pilot communication (DCPC) SATVOICE services are encouraged to conduct DCPC SATVOICE trials to verify its performance.</p>	<p>Expected impact:</p> <p><input checked="" type="checkbox"/> Political / Global</p> <p><input checked="" type="checkbox"/> Inter-regional</p> <p><input type="checkbox"/> Economic</p> <p><input type="checkbox"/> Environmental</p> <p><input checked="" type="checkbox"/> Ops/Technical</p>
<p>Why: SATVOICE is a potential DCPC over remote/oceanic airspace.</p>	<p>Follow-up: <input type="checkbox"/> Required from States</p>
<p>When: 6-Nov-19</p>	<p>Status: adopted by PIRG</p>
<p>Who: <input checked="" type="checkbox"/> Sub groups <input checked="" type="checkbox"/> APAC States <input checked="" type="checkbox"/> ICAO APAC RO <input checked="" type="checkbox"/> ICAO HQ <input type="checkbox"/> Other: XXXX</p>	

Conclusion APANPIRG/30/14 (CNS SG/23/8-PBNICG/6/1) - Asia/Pacific Regional Transition Plan for RNP APCH Chart Identification from RNAV to RNP	
<p>What: Considering ICAO provided a guidance and template on transition planning for RNP approach chart identification, That,</p> <ol style="list-style-type: none"> The Asia/Pacific Regional Transition Plan for RNP APCH Chart Identification from RNAV to RNP in Appendix B to the Report on agenda item 3.4 be adopted as a regional plan for RNP APCH chart identification transition; ICAO Regional Office coordinate with ICAO PBN Programme Office for the inclusion of the plan in the Global Dashboard for the progress monitoring; 	<p>Expected impact:</p> <p><input checked="" type="checkbox"/> Political / Global</p> <p><input checked="" type="checkbox"/> Inter-regional</p> <p><input type="checkbox"/> Economic</p> <p><input type="checkbox"/> Environmental</p> <p><input checked="" type="checkbox"/> Ops/Technical</p>

<p>c) ICAO PBN Program Office to confirm that a global contingency plan has been developed and coordinated with all Regional Offices and with the major data houses;</p> <p>d) ICAO PBN Programme Office to provide an updated version of the Asia/Pacific Regional Transition Plan for RNP APCH Chart Identification from RNAV to RNP to ICAO Regional Office;</p> <p>e) ICAO Regional Office to publish the plan on the ICAO Regional Office website; and</p> <p>f) States develop their transition plan and implement the chart identification transition according to their designated slots.</p>	
<p>Why: To minimize the exposure to the mixed operational environment of RNAV and RNP chart identification, and to reduce confusion between them by air traffic controllers and pilots, the regional transition of RNP APCH chart identification should be progressed in orderly manner based on Asia/Pacific Regional Transition Plan.</p>	<p>Follow-up: <input checked="" type="checkbox"/>Required from States</p>
<p>When: 6-Nov-19</p>	<p>Status: adopted by PIRG</p>
<p>Who: <input checked="" type="checkbox"/>Sub groups <input checked="" type="checkbox"/>APAC States <input checked="" type="checkbox"/>ICAO APAC RO <input checked="" type="checkbox"/>ICAO HQ <input type="checkbox"/>Other: ICAO APAC RSO</p>	

<p>Conclusion APANPIRG/30/15 (CNS SG/23/14-SURICG/4/6) - Revised Surveillance Strategy for the APAC Region</p>	
<p>What: That, the Revised Surveillance Strategy for the APAC Region provided in Appendix D to the Report on agenda item 3.4 be adopted.</p>	<p>Expected impact: <input type="checkbox"/> Political / Global <input checked="" type="checkbox"/> Inter-regional <input checked="" type="checkbox"/> Economic <input type="checkbox"/> Environmental <input checked="" type="checkbox"/> Ops/Technical</p>
<p>Why: To reflect the outcome of ANC13 and the latest development of surveillance technology.</p>	<p>Follow-up: <input checked="" type="checkbox"/>Required from States</p>
<p>When: 6-Nov-19</p>	<p>Status: adopted by PIRG</p>
<p>Who: <input checked="" type="checkbox"/>Sub groups <input checked="" type="checkbox"/>APAC States <input checked="" type="checkbox"/>ICAO APAC RO <input type="checkbox"/>ICAO HQ <input type="checkbox"/>Other:</p>	

Outcome of Flight Inspection and Procedure Validation Seminar (FIPV)

2.3 The need for development of guidance material on the regional best practices for undertaking flight inspection was identified, considering the typical need of States/Administrations without a national FIS provider and some recommended measures necessary for conducting flight inspection at night. The initial table of contents based on the flight inspection manual of Hong Kong-China is provided. The guidance material will be presented to CNS SG for adoption and then will be posted on the ICAO APAC Website. The volunteering member of the group: Hong Kong CAD, CAAS, New Zealand Airways, CAAC FIC, FCS and Aeropearl (Hong Kong CAD acts as lead).

2.4 Further guidance from ICAO is expected on the use of UAS (RPAS) as a viable/supplementary solution to carry out the flight inspection including cost/effectiveness analysis for introducing this emerging technology.

Asia Pacific Cyber Safety and Resilience Workshop with Tabletop Outcome

2.5 The ICAO Asia Pacific Cyber Safety and Resilience Workshop with Tabletop Exercise (APAC TTX) was facilitated by Ms. Olga de Frutos Martin (TO/AN) and Mr. Michael Goodfellow (TO/GIS) from Air Navigation Bureau, ICAO Headquarters and Mr. Li Peng and Mr. Luo Yi, Regional Officers CNS from APAC Regional Office provided Secretariat support to the workshop. Mr. Shane Summer and Ms. Zhou Ying, Regional Officers, ATM also assisted in the discussions during the workshop.

2.6 The objective of the Cyber Safety and Resilience Workshop was to empower CAAs and ANSPs with measures to mitigate the exploitation of critical information systems, develop awareness on cyber issues affecting aviation, and foster a cyber-safety culture that promotes a resilient and secure cyberspace. Particular focus was placed on the development and promotion of a common understanding of cyber threats, vulnerabilities and resultant risks across the aviation ecosystem. The workshop was also expected to identify gaps in State policies and operations and identify and promote regional mechanisms for information sharing on emerging threats and incident response.

2.7 Air navigation and airport infrastructure and information systems are exposed to a multitude of threat sources, including organized crime, motivated activists or so called ‘hacktivists’, Insider threats and; accidental or inadvertent system damage due to employee or contractor misuse. Each of these threats is able to cause a large and wide-spread disturbance to the order of air and ground operations.

Outcome of SRWG/4

2.8 The Fourth Meeting of the Spectrum Review Working Group (SRWG/4) was assisted by Mr. Robert Witzen in voluntary way from Montreal, who’s a former ICAO Officer, expert in frequency management and main developer of Frequency Finder software tool.

2.9 After review of the regional Frequency List No. 3, through further discussion in the meeting, a decision was made as following:

Draft Decision SRWG/4/2 – Simulation of VHF COM Frequency requirements for next 10 years	
What: To conduct a new round of simulation for VHF COM frequency assignment based on new operational requirements of States to 2025 or to 2030 as necessary.	Expected impact: <input type="checkbox"/> Political / Global <input type="checkbox"/> Inter-regional <input type="checkbox"/> Economic <input type="checkbox"/> Environmental <input checked="" type="checkbox"/> Ops/Technical
Why: To support regional strategy on the use of 8.33KHz channel spacing.	Follow-up: <input checked="" type="checkbox"/> Required from States
When: 13-Nov-20	Status: Draft to be adopted by SG
Who: <input checked="" type="checkbox"/> Sub groups <input checked="" type="checkbox"/> APAC States <input checked="" type="checkbox"/> ICAO APAC RO <input type="checkbox"/> ICAO HQ <input type="checkbox"/> Other: XXXX	

2.10 The most important function of this expert working group was to study the issue of the requirement of 8.33 kHz channel spacing, and it could be considered as completed by 2016 after SRWG/3. However, with the expected changes in air traffic, it has been agreed to conduct another round of simulation on VHF COM frequency assignment in APAC Region based on operational needs submitted by States, it has also been identified in spectrum capacity to accommodate GBAS/VDB and other emerging issues in optimizing the efficient and safe use of radio spectrum. The keynote for this

revision is to conduct simulation on VHF COM frequency assignment and expand its scope of work to cover Navigation systems with highlight on GBAS implementation.

Outcome of SBAS/GBAS ITF/ 1 and SBAS/GBAS ITF/ 2

2.11 The second Meeting of the ICAO GBAS/SBAS Implementation Task Force (GBAS/SBAS TF/2) was held by Video Teleconference (VTC) from 09-10 September 2020.

2.12 Australia had presented the status of two currently functional GBAS Landing Systems at Sydney and Melbourne airports. China presented that the Beidou (BDS) is one of the 4 core satellite constellations defined in Annex 10 and that the validation of BDS is being discussed and promoted. Hong Kong, China shared their strategy and experience in conducting a GBAS trial at the Hong Kong International Airport (HKIA). Japan had presented that MSAS SBAS has completed satellites transition from MTSAT to QZSS at the end of March 2020. The Korea Augmentation Satellite System (KASS) will be completed by 2023 for the provision of the Safety of Life (SoL) service across the designated coverage.

2.13 IATA had presented that GBAS infrastructure and GLS procedures should be implemented as appropriate based on a positive business case and consultation with airlines. Activities of ICAO Navigation Systems Panel (NSP) GBAS working group (GWG) Ionosphere Gradient Mitigation (IGM) ad hoc group were introduced. The United States had provided an overview of their research, design approval, commissioning, and oversight of GBAS, highlighting the benefits and technical differences between GBAS and ILS.

Outcome of APA TF/6 (AIDC TF)

2.14 The Sixth meeting of the ATS Inter-facility Data Communication Task Force (APA TF/6) noted that AIDC implementation in South China Sea sub-region had been satisfactory while further efforts by States in the Bay of Bengal sub-region are required. The summary of the new AIDC connections implemented since the APA TF/5 meeting is listed below:

- Automatic handling over based on OLDI ICD between Shenyang ACC and Khabarovsk ACC implemented in October 2019 over a dedicated line;
- AIDC operational implementation between Kuala Lumpur ACC and Chennai OCC came into effect on 01 April 2020;
- Operational AIDC between Singapore ACC and Kuala Lumpur ATCC with limited messages set was implemented on 01 November 2019;
- Operational AIDC between Bangkok ACC and Kuala Lumpur ATCC with limited messages set was implemented on 14 March 2020;
- Operational AIDC between Bangkok ACC and Vientiane ACC with 5 messages set was implemented on 14 July 2020;
- AIDC service between Manila ACC and Hong Kong ACC implemented on 23 May 2019;
- AIDC service between Manila ACC and Singapore ACC implemented on 1 Nov.2019; and
- AIDC service between Manila ACC and Taipei ACC implemented on 5 December 2019.

2.15 The latest AIDC issues were presented to APA TF/6 meeting by Indonesia with supports from India and Singapore. Totally 89 issues were consolidated. The meeting considered that the issue table would continue to serve as a reference for other States. A summary of the identified issues is shown in the Table below:

Fault Categories	APA TF/6 (2020)		
	Issues Reported	Closed	Open
a. Communication Link	9	3	6
b. ATM System	50	20	30
c. AIDC Message	17	15	2
d. Airspace Design/Procedures	8	4	4
e. Other	5	2	3
Total	89	44	45

2.16 The meeting encouraged States/Administrations to provide the identified issues with recommended solutions to Indonesia for consolidation into the issues form.

Outcome of ACSICG/7

2.17 The meeting recognized the challenges and difficulties faced by States/Administrations under current pandemic situation and recommended to postpone the target year of regional implementation of CRV from 2020 to end of 2021. It was informed by the Secretariat that PCCWG also agreed to extended target year for regional CRV implementation from 2020 to 2021.

2.18 The Russian Federation provided updates on their plan and progress of joining CRV at number of centres (Moscow, Khavarosk Irkusk) in Russia to interact with COM centres (Fukuok, Beijing and Ulaanbaatar) in the APAC Region. In following up the outcome of COM Coordination Meeting in May 2019, Russian Federation is considering options to join CRV at those designated entry/exit points in Russia with entry/exit points in the APAC Region. It was informed that minimum three months would be required for Russina Federation to perform the tender process.

2.19 PNG and ICCAIA jointly made a presentation on use of CRV for delivery of surveillance data from spaced based ADS-B. PNG Air Services Limited (PNGASL) has contracted for the supply of space based ADS-B data from Aireon LLC and is intending to contract for a CRV connection in early 2020 for a number of applications including space based ADS-B. One prime purpose for using CRV is to reduce the need for point to point circuits and would result in lower data communications costs for ANSPs. Aireon and PNG ASL believe that delivery of space based ADS-B via CRV will achieve these objectives. Indonesia expressed support to PNG’s proposal to use CRV for distribution of space based ADS-B data.

2.20 The meeting noted that SWIM Demonstration on CRV to be hosted by Hong Kong China scheduled for March 2020 has been postponed without a definite date. Hong Kong China was requested to keep the Secretariat informed of the new date of the Demonstration once available.

2.21 The following ANSPs should be able to support IWXXM using their respective AMHS with FTBP capability: Australia; Bangladesh; Bhutan; Cambodia; China; Hong Kong, China; Macao, China; Fiji; India; Japan; Republic of Korea; Myanmar; Nepal; New Zealand; Pakistan; Philippines; Singapore; Sri Lanka; Thailand; and USA.

2.22 The meeting reviewed the draft on the revised strategies attached to WP presented by China, Australia, Japan and USA. The meeting further discussed some additional changes proposed by Singapore. As a result of discussion, the meeting endorsed the revised regional strategies and formulated the following Draft Conclusion for consideration by CNS SG:

Draft Conclusion ACSICG/7/1 - the Revised Regional Strategies on AMS and Datalink	
What: That, the revised Aeronautical Mobile Service (AMS) Strategy for the Asia/Pacific Region provided in Appendix C and the revised Strategy for Implementation of the Air-Ground Data Link in the Asia/Pac Region provided in Appendix D to the Report be adopted.	Expected impact: <input type="checkbox"/> Political / Global <input type="checkbox"/> Inter-regional <input type="checkbox"/> Economic <input type="checkbox"/> Environmental <input checked="" type="checkbox"/> Ops/Technical
Why: Need to update the regional strategies on AMS and Datalink based on the latest developments	Follow-up: <input checked="" type="checkbox"/> Required from States
When: 1-Dec-20	Status: Adopted by Subgroup
Who: <input checked="" type="checkbox"/> Sub groups <input checked="" type="checkbox"/> APAC States <input type="checkbox"/> ICAO APAC RO <input type="checkbox"/> ICAO HQ <input type="checkbox"/> Other: XXXX	

2.23 The Tenth Meeting of the Asia/Pacific ATFM Steering Group (ATFM/SG/10, Video Teleconference, 04 to 08 May 2020) proposed amendment to the AFTN/AMHS-based ATFM ICD which was endorsed by ACSICG and adopted by CNS SG/23 meeting in 2019. Subsequent to the ATFM/SG/10 meeting the Secretariat conducted a further editorial review of the ICD, in consultation with the ATFM/SG/10 Chair and the AMNAC Technical Sub-group. The document was the further amended to correct some errors and minor omissions. In view of the foregoing, the meeting endorsed the following Draft Conclusion formulated by ATFM/SG/10 meeting for consideration by CNS SG.

DRAFT Conclusion ACSICG/7-X (ATFM/SG/10-3) - Amendment of the AFTN/AMHS-based Interface Control Document (ICD) for ATFM	
What: That, the AFTN/AMHS-based Interface Control Document for ATFM Version 2.0 provided in Appendix F to this Report be adopted and posted on the ICAO Asia/Pacific Regional Office website to supersede the existing version, for use by Asia/Pacific Administrations in implementing cross-border ATFM communications in accordance with the provisions of the Regional Framework for collaborative ATFM.	Expected impact: <input type="checkbox"/> Political / Global <input type="checkbox"/> Inter-regional <input type="checkbox"/> Economic <input type="checkbox"/> Environmental <input checked="" type="checkbox"/> Ops/Technical
Why: To align with message format provisions of Annex 10 Vol II, and to support implementation by States through amendment to specific provisions.	Follow-up: <input checked="" type="checkbox"/> Required from States
When: 1-Dec-20	Status: Draft to be adopted by Subgroup
Who: <input checked="" type="checkbox"/> Sub groups <input checked="" type="checkbox"/> APAC States <input type="checkbox"/> ICAO APAC RO <input type="checkbox"/> ICAO HQ <input checked="" type="checkbox"/> other: ACSICG/7	

2.24 Singapore presented an update on Singapore's technical studies on the space-based VHF Voice Communication Service. The paper further introduced the next steps of studies on space-based VHF radio communications concept. Singapore encouraged States/Administrations to support the potential development of space-based VHF and invited interested States/Administrations to join Singapore in the space-based VHF technical studies and POC trials. Singapore also proposed a draft Conclusion to urge States/ Administrations to actively participate in the relevant ICAO and ITU WP5B meetings to support the space-based VHF communications concept and the need to support for inclusions of this new service into the AMS(R)S spectrum allocation in the Radio Regulation.

Outcome of SURICG/5

2.25 The Fifth Meeting of the Surveillance Implementation Coordination Group (SURICG/5) was informed that there was no outstanding issue on surveillance in Assembly 40, however, some of the Assembly Resolutions were relevant to CNS area with reference to Resolutions adopted by the Assembly (Provisional Edition October 2019), as well as some paragraphs relevant to CNS incorporated in Technical Commission Report of 40th Assembly (Doc10137). The meeting also noted the latest update of Integrated Communications, Navigation, Surveillance and Spectrum Task Force (ICNSS-TF).

2.26 The meeting noted the Proposal for Amendment (PfA) to the Regional Supplementary Procedure (SUPP Doc 7030) from SURICG/2 has been processed in accordance with established procedure, and the approved PfAs were circulated to States on 18 June 2020 through a State Letter with reference: T8/11.2 – AP130/20 (CNS), and this change will be incorporated in the new Six Edition of Doc 7030/6 as part of the restructuring process of Doc 7030.

2.27 After a successful Space based ADS-B trial using a VPN on the internet to deliver data, PNG has contracted for Space based ADS-B to serve the whole PNG FIR plus 50 miles. The system has been installed and data is now flowing, will bring improved safety and efficiency to the PNG FIR. Service acceptance testing will be performed by the ANSP, supported remotely by Aireon (due to COVID). It is expected to become operational later in 2020 and will operate in tandem with existing ADS-B and radar services. PNG also anticipates sharing ADS-B ground station data with Australia and Indonesia via CRV.

2.28 FAA shared with the meeting about its Operational Evaluation of Space-Based ADS-B (SBA) trials in the Caribbean, including an overview of the SBA trials, data analysis summary, and identified installation and performance issues. Review of the received SBA data has highlighted the following potential issues:

- 1) Lack of detection for single antenna installations (e.g., Bottom only)
- 2) Poor performance (e.g. low power) from diversity installations
- 3) Short periods of time with single satellite coverage.

2.29 In order to assess SBA performance in the trial airspace, the following update threshold requirements were identified:

- 1) 8 second 97%
- 2) 30 second 99.9%

2.30 The 8 second 97% requirement is necessary to meet the RTCA DO-318 requirement for use of SBA in radar airspace. The 30 second 99.9% requirement is used by the FAA to track aircraft that have entered into a coasting condition, and is an “operational suitability” threshold defined by FAA controllers.

2.31 ZMA controllers have used the test area in Miami Centre to determine the feasibility of using SBA data operationally to separate aircraft transiting through the SBA trial airspace. During this testing, ZMA determined the number of aircraft exhibiting detection issues exceeds the minimum acceptable level required to begin using SBA to provide separation services.

2.32 The FAA will continue to analyse data to identify improvements made from coordinated work with Aireon and relevant stakeholders. This analysis and coordinated work will assist in identifying the potential impact that each issue is having on aircraft detection. If necessary, the FAA will also work with appropriate foreign counterparts to create an adequate Standard Operating Procedure (SOP) for handling aircraft with diversity antenna installations versus non-diversity installations.

2.33 Hong Kong China has developed an in-house system for displaying long-range air traffic surveillance tracks up to 4000km from the Hong Kong International Airport, which is approximately 5 hours of flying time beyond airspace boundary. The system is designed to enhance the situational awareness of flow managers on the air traffic and assist in flow control decision making. It is currently used by Air Traffic Flow Management (ATFM) Unit of Hong Kong China in assessing the overall impacts of certain flow restriction imposed by other airspaces.

2.34 The long-range air traffic surveillance display system is based on terrestrial ADS-B data service for monitoring air traffic from “departure to destination”. Space-based ADS-B data is planned to be integrated into the system to strengthen the coverage by early 2021. The Human Machine Interface (HMI) of the display system has been specially designed for flow managers with an aim to reduce display clutter caused by various elements and enhance HMI efficiency.

2.35 Singapore proposed solutions for sharing of surveillance data using SWIM/CRV (other networks and datalink may work as well), viz. Distributed, Single Source or Hybrid solutions. The paper discussed the advantages and drawbacks of each solution which offers States the freedom to choose for the implementation which best suits them. The paper also discussed the solutions in detail requiring technical and governance issues to be ironed out. The meeting proposed that a study group to be set up to explore the three solutions or other solutions that may be presented.

2.36 DPRK presented the information on the transition of surveillance system from SSR to ADS-B within Pyongyang FIR. The relevant information of new surveillance system implementation was issued by NOTAM early in February of this year and published the relevant AIRAC AIP AMDT effective from October 08, 2020 through the AIS. RAIM prediction NOTAM is planned in future and ADS-B data sharing with adjacent States is also proposed.

2.37 China proposed to conduct the sharing of ADS-B data with Myanmar and Laos PDR in the following steps for consideration:

- a) choose the existing ground transmission link for the ADS-B data sharing; or to promote the opening of the CRV link;
- b) consider the implementation of the transmission link according to the actual business promotion plan;
- c) conduct signal routing, testing and evaluation; and
- d) implement ADS-B data sharing and advance data-related applications.

2.38 As advanced ATM, like Trajectory Based Operation (TBO), requires high-accurate trajectory prediction. One of major factors of estimated flight time error in TBO is weather uncertainty. DAPs data are expected to be useful for improving numerical weather prediction because temporal and spatial intervals of DAPs data are very short. Japan conducted experiments for improving weather forecast accuracy by utilizing DAPs data extracted from BDS 5,0 and BDS 6,0, and the experimental results indicated that Mode S DAPs data have a potential to improve weather forecasts.

2.39 Considering that a number of applications will require Mode S, and that it would be easier for new aircraft to be fitted with Mode S upon delivery rather than to retrofit at a later date. It is also noted that EHS can support more applications than ELS, States are strongly encouraged to mandate forward fit of Mode S of EHS by 1 Jan 2022. IATA expressed support to Mode S in general. As for retrofitting existing airframes equipped with Mode A/C with Mode S transponders, the proposed timeframe for 1 Jan 2022 was tight for airlines that had portions of their fleet with Mode A/C only. It was a challenging target date to meet in normal circumstances and with the impact of the COVID crisis on airline economics, it could become even more challenging.

2.40 As such, the meeting agreed to defer retrofit of Mode S transponder to DAPs WG for further deliberation. IATA would also be invited to take part in discussion on Mode S roadmap/mandate in the coming meetings of DAPs WG.

Draft Conclusion SURICG/5/3(DAPS WG3/1) - Mode S Forward Fit Equipage in APAC Region	
<p>What: Regarding fitment of Mode S equipage,</p> <p>That, States/Administrations in APAC Region be strongly encouraged to mandate that registered aircraft with a maximum certified take-off mass exceeding 5 700 kg or having a maximum cruising true airspeed capability greater than 250 knots, with a date of manufacture on or after 1 January 2022 be equipped with Mode S avionics compliant with EHS.</p>	<p>Expected impact:</p> <p><input type="checkbox"/> Political / Global</p> <p><input type="checkbox"/> Inter-regional</p> <p><input checked="" type="checkbox"/> Economic</p> <p><input type="checkbox"/> Environmental</p> <p><input checked="" type="checkbox"/> Ops/Technical</p>
<p>Why: Considering that a number of DAPs applications will require Mode S, most aircraft already have Elementary Mode S and that it's easy for new aircraft to be equipped with Enhanced Mode S.</p>	<p>Follow-up: <input type="checkbox"/> Required from States</p>
<p>When: 16-Dec-20</p>	<p>Status: To be adopted by PIRG</p>
<p>Who: <input checked="" type="checkbox"/> Sub groups <input checked="" type="checkbox"/> APAC States <input checked="" type="checkbox"/> ICAO APAC RO <input checked="" type="checkbox"/> APANPIRG <input type="checkbox"/> ICAO HQ <input checked="" type="checkbox"/> Other: SURICG</p>	

2.41 Parts of Asia Pacific may require the use of SI code due to high concentration of Mode S radars. Other parts may not. It is possible for certain regions in Asia Pacific to commence the use of SI codes first while the rest continue to uses the II code first. To overcome the issue with non SI-capable aircraft, the II/SI Code Operation may also be considered.

2.42 Very few States are practicing radar clustering. States with the competency and operational requirement may apply such technique.

2.43 Most Asia Pacific States still uses Mode A codes for flight plan coupling. In anticipation that Mode S codes would be used in future, it was agreed that the Mode A code of 1000 be reserved as the conspicuity code for Asia Pacific so as to match the European region. It is likely to take many years before all States can support this capability across APAC and EUR. The ATM systems must support the conspicuity code feature. In preparation on the use of the conspicuity code, States developing new automation systems are encouraged to include the conspicuity code capability into the system.

2.44 The Mode S DAPs WG was briefed on possible changes to the allocation of 24-bit aircraft addresses. Blocks of 24-bit aircraft addresses are assigned to States by ICAO. Each block is defined by a fixed pattern of the first 4, 6, 9, 12 or 14 bits of the 24-bit address. Thus, blocks of different sizes (1,048,576, 262,144, 32,768, 4,096 and 1,024 consecutive addresses) are made available.

2.45 In the last decade, some States with 1,024 addresses have developed their air hub and does not have enough addresses. The SP-ASWG has tasked its Technical Sub-group (TSG) to investigate/identify options for additional allocation of 24-bit aircraft addresses to States who currently have a small number of addresses (such as 1024).

Outcome of PBNICG/7

2.46 The Secretariat informed the meeting that Asia/Pacific Regional Transition Plan for RNP APCH Chart Identification from RNAV to RNP as accepted by states in PBNICG/6 and endorsed by ATMSG/7 and CNSSG/23 was adopted by the thirtieth meeting of the Asia/Pacific Air navigation planning and implementation regional group (APANPIRG/30) Bangkok, Thailand, 4 to 6 November 2019. Proposed contingency measure for the Regional Transition Plan for RNP APCH Chart identification as discussed in APANPIRG/30 was also presented.

2.47 China shared with the meeting implementation process for CDO/CCO, its benefits, and implementation status so far and planned implementation of CDO/CCO in China. So far CDO/CCO have been implemented at six international airports including Guangzhou Baiyun Intl. airport and Kunming Changshui Intl. airport and etc. CDO/CCO will be implemented in more airports in China in phases. India discussed with the meeting implementation process for CDO/CCO implementation at Delhi, its benefits, and challenges in terms of Traffic Pattern, Airspace Constraint, Pilot sensitization, ATC training etc. It shared some of the pictures from the actual CDO/CCO conducted at Delhi Airports and explained in detail how it is being done at one of the busiest airport with several airspace constraints.

Outcome of ATMAS Seminar and TF /1

2.48 The Seminar on Air Traffic Management Automation System and the First Meeting of the Asia/Pacific Air Traffic Management Automation System Task Force (ATMAS TF/1) were held from 27 to 30 October 2020. The seminar was conducted in two sessions, the Session 1 focused on Experience Sharing from CAA/ANSPs, while the session 2 focused on New Technology and Approach from Industry, it provided a platform for participants to exchange experience and keep abreast of the latest knowledge on the subject of air traffic management automation.

2.49 Hong Kong China expressed its concerns on the absence of automation system roadmap in GANP edition 6, and the Philippines advised the meeting about one paragraph in GANP edition 6 to explain its Relationship with other Documents, could be a response on ICAO roadmap, and quoted as following:

The Global Air Traffic Management Operational Concept (GATMOC, Doc 9854) presents a vision for a common operational concept of an integrated, sustainable, harmonized and globally interoperable air traffic management (ATM) system. The operational concept is independent of technology and is a statement of the envisaged “what”. The timely development of a sustainable aviation system based on the GATMOC requires a collaborative, synchronized and maintained planning tool such as the GANP. Hence, the vision, performance ambitions and conceptual roadmap embedded in the GANP refer directly to the GATMOC. The GATMOC’s companion manuals, which include, inter alia, the Manual on Air Traffic Management System Requirements (Doc 9882) and the Manual on Global Performance of the Air Navigation System (Doc 9883), will continue to evolve and provide the sound conceptual basis and focus for an integrated, sustainable, harmonized and globally

The implementation of ATM Automation system is a complex task in terms of Time, Money & acceptance of ATM Automation system by the user. With the successful commissioning for a new ATM Automation system at Delhi International Airport and Delhi ACC recently, India shared the challenges faced during the implementation in different phases of project, as well as suggestions to address the challenges.

2.50 China has more than 90 sets of ATM Automation System and established the software management and technical support system. It covers all system construction and operation stages, including many actives, such as system requirements analysis, system fault management, software release, test and evaluation, parameter configuration management. It is essential to the safe and regular operation of the system in the whole life cycle.

2.51 India has installed multiple ATM automation systems of various capabilities across the Indian airports to utilize the large network of surveillance sensors. Since each of the ATM automation system was installed in different stages, the Air Navigation Service Provider (ANSP), Airports authority of India (AAI) operates a combination of Automation systems from various vendors having different capabilities and with varied experiences. India shared the common features and differences between various Automation System architecture installed.

2.52 Flight plan centralized processing system (FCPS) is a set of intelligent control system independently developed by ATMB, which is responsible for processing National flight plans and telegrams. It was officially put into operation in September 2017. With the construction of National Flight Plan Processing Center, the unified processing of flight plans of 237 airports in China has been completed. The rudiment and new business mode of unified management of national flight plans have been preliminarily established.

2.53 Singapore shared its experience in the implementation of Departure Manager (DMAN). Singapore introduced A-CDM in Oct 2016 at Singapore Changi Airport. A-CDM and DMAN are closely inter-linked and have high dependencies on one another. DMAN is a key system to support the implementation of A-CDM, and it uses the information shared through A-CDM to work effectively. DMAN requires the TOBT inputs from airlines or ground handling agents to calculate TTOT and TSAT. The importance of accurate TTOT was emphasized. The interdependencies between A-CDM and DMAN is highlighted. The success of DMAN implementation does not solely depend on the system itself. It is much more complex than Arrival Manager (AMAN) implementation, where automation alone can probably achieve the desired results. For DMAN to work, it requires a reasonable level of TOBT accuracy, and this can only be achieved if stakeholders act in the spirit of collaboration and commit to adhering to the agreed A-CDM processes and procedures.

2.54 Singapore also shared her plans to integrate the DMAN system with AMAN, and later with an SMAN which will result in greater automation. TTOT calculation will take into consideration of the arrival and thus impact the TSAT. With the systems integrated, this process is done automatically with information sharing. When the SMAN is integrated, a dynamic taxi time can be derived using ground sensors to determine speed and controllers' set taxi route to re-compute the taxi distance, thereby providing a real time adjustment of taxi duration time.

2.55 ATM-MET Integration system shows graphical information of meteorological forecasts in the air space, i.e. Flight Information Regions (FIRs), Upper Control Areas (UTAs), Flight Service Sectors (FSSs), Control Areas (CTAs) and Terminal Control Areas (TMAs) of Indonesian region. Impact-based weather information for the ground area is displayed according to aerodrome forecast and warnings, as well as for the holding area surround the airport. Forecast information in Holding Area consists of forecast information of some parameters which include temperature, wind direction and speed, and forecast of Cumulonimbus development in 6 hours ahead. Categorization of impact-based is determined according to the weather condition which will affect the reduction of capacity both of the airport and the air space managed by air navigation service provider. The categorization has been made based on mutual-understanding between meteorological service providers and ANSPs in each airport.

2.56 Hong Kong, China has conducted a safety case study for the implementation of ICAO "enhanced Wake Turbulence Separation" (eWTS) at Hong Kong International Airport (HKIA). The study involved a 12-month wake study and analysis on the real-time data collection, generation and dissipation rates of wake vortices of different aircraft types in the local Hong Kong environment. The wake vortex data was analyzed by international experts, and a safety case was prepared to demonstrate with evidence that the safety assurance arguments supported the implementation of eWTS in HKIA operations, and that the wake encounter risk for each aircraft pair under eWTS would remain with the current acceptable safety risk level.

2.57 Based on the study of historical traffic data at HKIA, it is anticipated that the overall arrival spacing on final approach would be reduced safely under the application of eWTS. Additional arrival slots would be generated by Arrival Manager (AMAN) dynamically according to actual traffic mix. As a result, an increase in runway capacity is anticipated through the implementation of the eWTS scheme.

2.58 In recent years, China has promoted the application of Mode S radar in ATM automation system in three stages. In the first stage, Mode S elementary surveillance data has been applied in ATM automation system. DAPs data with specific application scenarios are currently underway in the second stage, and the rest will be further studied in the third stage. At present, China is in the second stage and this paper concludes the specific application, benefits and problems of DAPs data in ATM automation system.

2.59 Singapore shared their experience in the introduction of DAP. The ATM automation system in Singapore was upgraded in 2018 to display DAPS on the aircraft label for the following:

- ACAS Resolution Advisory notification (BDS code 3,0)
- MCP/FCU Selected Altitude (part of Selected Vertical Intention, BDS code 4,0)
- Indicated Airspeed (part of Heading and Speed report, BDS code 6,0)
- Mach Number (part of Heading and Speed report, BDS code 6,0)
- Magnetic Heading (part of Heading and Speed report, BDS code 6,0)

*The last 3 items are only displayed in the extended label when invoked by the controller.

2.60 Singapore highlighted the issues (and resolution) and challenges in the implementation such as erroneous 24-bit address and MCP/FCU mismatch showing incorrect values.

2.61 Since the introduction of the MCP/FCU Selected Altitude mismatch alert, multiple potential level bust had been prevented as the MCP/FCU Selected Altitude mismatch alerts provided controllers an additional layer of defence. Besides the display of information obtained from DAPs, the ATM automation system in Singapore was also enhanced to incorporate the information in its processing of existing safety nets which results in lesser false alerts.

2.62 CAAC ATMB has deployed Medium Term Conflict Detection (MTCD) function in Beijing and Shanghai ATM Automation System. It is widely commended by controllers, mainly being ascribable to call their attention to keeping aircrafts separation in a certain time advance rather than in a closely short time, and is helpful for airspace safety especially in heavy traffic. China presented to the meeting on the concept of MTCD and the differences between MTCD and STCA, as well as the tuning experience and operational use of MTCD in ATM Automation System.

2.63 Hong Kong, China has adopted a progressive approach in the implementation of applicable safety net functions in the ATM Automation System, so as to minimize the risks involved in transition to the ATM Automation System, and to best suit the operational needs of air traffic control officers (ATCOs). Following this approach, three safety net functions, namely Short Term Conflict Alert (STCA), Special Use Airspace Intrusion Warning (SUAIW) and Cleared Level Adherence Monitoring (CLAM) have been successfully implemented since the full commissioning of the ATM Automation System in November 2016.

2.64 Another three safety net functions, namely Approach Path Monitoring (APM), Departure Path Monitoring (DPM) and Similar Callsign Advisory (SCA) have been successfully implemented in 2019. All the safety net functions have been operating satisfactorily. To assess effectiveness of the implemented safety net functions, post implementation review with ATC operations were conducted to obtain feedbacks from front-line ATCOs to identify if there was a need to fine-tune the system parameters. Riding on the experience gained, Hong Kong, China would continue to adopt the progressive approach to implement other applicable safety net functions.

2.65 Hong Kong, China provided information about its proactive and systematic approach in protecting digitised Air Traffic Services (ATS) against cyber threats in Hong Kong. Hong Kong, China fully supported the ICAO’s initiative on aviation cyber security management against cyber threats, and had taken proactive measures in a systematic manner to address an increasing challenge on cyber security for ATS systems. The meeting was informed of the key elements of the provisions of the measures implemented by Hong Kong, China, covering aspects on policy, administration, procedures, drills, systems/technologies, as well as physical security. States are encouraged to strengthen their cyber security management to protect the increasingly digitised ATS against cyber threats.

Outcome of SWIM TF/4

2.66 The task lead recalled the main regional activities since the establishment of SWIM Task Force in 2017. Considering the important role and function of SWIM in Global Air Navigation Plan (Doc 9750) and the Global ATM Operation Concept (GATMOC), as well as the significant impact of COVID-19 on the aviation industry, it is essential to highlight more efficiency and a strengthened and shared strategy for implementing SWIM in the region with stakeholders.

2.67 The meeting agreed to develop an action item for next Task Leads meeting to revise the TOR and further consolidate the list of action items, with consideration on the impact of COVID-19, new provisions from GANP edition 6, APAC Seamless ANS Plan, and enhancement of the interaction with various contributory bodies under APANPIRG. The meeting also proposed to consider to prepare another SWIM workshop for this region during the next Task Leads meeting.

China implemented the wide-area surveillance network function verification system which was fed with various data sources including AFS message system, satellite/ground-based ADS-B system, surveillance radar system, ACARS, etc. The system provides multi-category data services for airlines, airports, ATC units, administration, GADSS-related organizations and other data users. GUFU (Globally Unique Flight Identifier) is used in flight data management in the system, which is usually generated in the flight planning stage by the simulated ATM role and participate in the subsequent data exchange, and it is managed in the entire life cycle of a flight, so as to realize the persistent storage of FIXM format flight data in the system.

2.68 The paper briefed the GUFU’s textual representation, encoding rules, and the accessing of various flight-related data, part of which is generated in real time, while others is generated after the flight. At each flight data access point, a GUFU management component is set up. Some identified issues to be addressed were also discussed in the paper, such as the method to exchange data between systems in different countries/regions, difficulty to uniformly generate GUFU on a global scale, and GUFU use to exchange flight data in the transition environment.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information contained in this paper;
- b) note the updated ATN/AMHS/AIDC implementation status provided in Appendix A, ADS-B Implementation Status in Appendix B, Recommended Functions and Performances of Air Traffic Management Automation System (Edition 0.0) in Appendix C and Revised Task Group for SWIM TF in Appendix D to this paper; and
- c) discuss any relevant matters as appropriate.

ATN/AMHS/AIDC Implementation Status in the APAC Region

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
AFGHANISTAN					
AUSTRALIA	<p>ATN tests were conducted. BIS Router and Backbone BIS Router and AMHS implemented.</p> <p>AMHS has been migrated to CRV.</p> <p>Connection with Singapore using AMHS was implemented October 2016;</p> <p>Another AMHS connections pending CRV (target date by March 2020) including both connection with New Zealand and USA.</p> <p>AMHS connection with Indonesia pending on CRV implementation</p> <p>AMHS connection with South Africa has been established</p> <p>Plan to upgrade AMHS support IWXXM traffic from Nov. 2020.</p>	COMSOFT	<p>AFTN/AMHS based AIDC Implemented between Brisbane and Melbourne, Oakland, Nadi and Auckland;</p> <p>Implemented between Melbourne and Johannesburg;</p> <p>AIDC is also in use between Melbourne and Mauritius;</p> <p>Operational trial between Brisbane and Ujung Pandang since May 2013. Implementation in July 2017. LOA needs to be updated.</p>		

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
BANGLADESH	In Q1/2013, Bangladesh installed ATN/AMHS and BIS Router at Dhaka (VGHS) with User Agents at Chittagong (VGEG) and Sylhet (VGSY).	COMSOFT	Tentative date of implementation of AIDC is Q4 of 2023 with Kolkata and Yangon.		Implementation of AIDC is included in the “Modernization of CNS-ATM System of CAAB” project which is going on G2G agreement with French Government and likely to be implemented by the end of 2023.
BHUTAN	<p>ATN/AMHS circuits, using IP over VPN, with Thailand (Bangkok) and India (Mumbai) commissioned in June and July 2017 respectively.</p> <p>IOT and POT with Mumbai completed on 27th June 2017.</p> <p>IOT and POT with Thailand completed on 2nd May 2017.</p> <p>TMC signing with both countries at final stage.</p>	AEROTHAI’S AMHS System	Currently not applicable. If required in the future, will be decided after CRV implementation (scheduled for mid-2019).		

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
BRUNEI DARUSSALAM	ATN BIS Router planned for 2015 and AMHS planned for 2015				
CAMBODIA	BIS Router and AMHS installed. Cambodia (CATS) AMHS connected with Bangkok via VSAT IP link since 10 December 2013	AVITECH	<p>AIDC function and capability made available.</p> <p>Ready for testing with neighbors ATS Facilities starting from 2017 and target date of implementation with Bangkok in 4Q2019</p>	THALES which supports AIDC ICD Version 1.	
CHINA	<p>ATN Router and AMHS including NCC deployed in 2008 which is being upgraded to support ATN/IPS with target date of completion in December 2013.</p> <p>The Beijing-Hong Kong AMHS link was put into operation in 2018;</p> <p>With Thailand is completed POT, after sign the TMC was put into operation in Q12020</p> <p>AMHS/ATN technical tests with Macau completed in 2009. Plan for ATN/AMHS implementation with Macao China is TBD.</p>	IN-HOUSE (Aero-Info Technologies Co., Ltd)	<p>AIDC between some of ACCs within China has been implemented.</p> <p>AIDC between several other ACCs are being implemented.</p> <p>AIDC between Sanya and Hong Kong China put into operational use since 8 Feb 2007.</p> <p>AIDC between Dalian and Incheon</p>	<p>ATN Router and AMHS including NCC deployed in 2008 which is being upgraded to support ATN/IPS with target date of completion in December 2013.</p> <p>The Beijing-Hong Kong AMHS link was put into operation in 2018;</p>	IN-HOUSE (Aero-Info Technologies Co., Ltd)

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	<p>ATN/AMHS circuit with ROK has been put into operation since June 2011.</p> <p>ATN/AMHS tests with India has been put into operation since 2016.</p> <p>ATN and AMHS IOT with Mongolia is completed in May 2018. Plan for commissioning after POT completion in 2020</p> <p>Connection tests with Nepal is TBD.</p> <p>AMHS testing with Japan in Q4 2020.</p> <p>AMHS testing with Russia in 2020.</p>		<p>implemented in Nov. 2016;</p> <p>AIDC between Shanghai/Guangzhou and Tapei put in to operational use since 2013.</p> <p>AIDC between Guangzhou and Hong Kong China put into operational use since May 2018.</p> <p>OLDI between Shenyang and Khabarovsk put into operational use since Oct.2019.</p> <p>For Beijing/Ulaanbaatar, Further testing is planned in 2020.</p> <p>Kunming/Yangon under test and progress since May 2017</p>	<p>With Thailand is completed POT, after sign the TMC circuit and was put into operation in Q12020</p> <p>AMHS/ATN technical tests with Macau completed in 2009. Plan for ATN/AMHS implementation with Macao China in 2019.</p> <p>ATN/AMHS circuit with ROK has been put into operation since June 2011.</p> <p>ATN/AMHS tests with India has been put into operation since 2016.</p> <p>ATN and AMHS IOT with Mongolia is completed in May 2018. Plan for commissioning after POT completion in 2020</p>	

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>Kunming/Vientiane under test and progress since Dec. 2018.</p> <p>Sanya/Hanoi under test trial since 2019.</p>	<p>Connection tests with Nepal is TBD.</p> <p>AMHS testing with Japan in 2020.</p> <p>AMHS testing with Russia in 2020</p>	
HONG KONG, CHINA	<p>Manila / Philippines CRV/AMHS circuit was put into operation in May 2019.</p> <p>Beijing / China ATN/AMHS circuit was put into operation in 2018. Plan to migrate to CRV in Q4 2020.</p> <p>Macao / China ATN/AMHS circuit was put into operation in December 2009. Wait for Macao to join CRV.</p> <p>Bangkok / Thailand ATN/AMHS circuit was put into operation use in 2014. Wait for Thailand to join CRV.</p>	COMSOFT	<p>AFTN-based AIDC with Sanya put into operational use in Feb 2007.</p> <p>AIDC with Taipei put into operational use in Nov 2012.</p> <p>AIDC with Guangzhou put into operational use in May 2018.</p> <p>AIDC with Manila put in operational use in May 2019.</p>	<p>Raytheon ATM system Support AIDC ICD Version 3 commissioned in November 2016.</p>	<p>Already support exchange of IWXXM messages based on FTBP.</p> <p>Support of IHE is planned for October 2020.</p>

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	<p>Fukuoka / Japan Currently on AFTN. Plan to carry out IOT of CRV/AMHS in July 2020 and cut over to CRV/AMHS in Q3 or Q4 2020.</p> <p>HoChiMinh / Vietnam Currently on AFTN. Simple AMHS IOT was conducted in Dec 2019. Wait for Vietnam to join CRV.</p> <p>Taipei CRV/AMHS circuit was put into operation in June 2020.</p>				
MACAO, CHINA	<p>ATN/AMHS interoperability test with Beijing commenced in March 2009.</p> <p>ATN/AMHS circuit with Hong Kong put into operational use in end Dec 2009.</p> <p>Upgrade of ATN/AMHS to support IPS and IWXXM planned with tentative target date of Q3 2021.</p>	COMSOFT	[Not applicable for using AIDC, looking into the possible application between TWR and ACC/APP]		

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
COOK ISLANDS					
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA	The ATN BIS Router and AMHS planned for in 2011.		With neighboring ACCs to be implemented		
FIJI ISLANDS	<p>ATN BBIS IPS router and AMHS implemented over CRV for connection to USA in April, 2019 with Australia planned for June, 2019.</p> <p>.</p> <p>For connections with sub-regional centers: For New Caledonia using AMHS since 2017; For connection with Kiribati using UA/AMHS implemented in 2015.</p>	COMSOFT	AFTN based AIDC implemented between Nadi/ Brisbane, Auckland and Oakland.	<p>- Support and implemented AIDC messaging: ABI, EST, CPL, CDN, ACP, TOC, AOC with all three centers</p> <p>- AIDC ICD version 2.0 implemented with Auckland and Oakland.</p> <p>- AIDC ICD Version 1.0 implemented with Brisbane</p>	
FRANCE <i>(French Polynesia Tahiti)</i>	<p>Planned for implementation of AMHS in 2020.</p> <p>Using IP with New Zealand since 2017.</p>		Implementation of AIDC (based on Version 3) with adjacent centers (Oakland and Auckland) since 2009.	THALES EUROCAT for AIDC	Alternate routing for backup between Tahiti and Christchurch via

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
					Tahiti/New Caledonia IP link
INDIA	<p>Dual stack ATN/IP router and AMHS implemented at Mumbai in 2011. Operational AMHS connections with Bangkok, Dhaka, Singapore, Kathmandu, Karachi implemented. With Beijing implemented in 2016; With Colombo implemented in May2017; With Bhutan implemented in July 2017; Planned for IOT with Nairobi and Muscat forQ4 2020.</p>	COMSOFT	<p>Initially-15-May-2017, AIDC implemented between Chennai and Kuala Lumpur with ABI and EST messages. India is currently using APAC AIDC ICD version 3.</p> <p>A. Implementation within India:</p> <p>Trials have been carried out between various ATS units listed below I Delhi: Ahmedabad, Varanasi, Nagpur I. Chennai: Mumbai, Kolkata, Trivandrum, Mangalore, Trichy, Hyderabad, Bengaluru II. Kolkata: Chennai, Nagpur, Varanasi, Guwahati</p>		

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>III. Mumbai: Chennai, Ahmedabad, Nagpur</p> <p>AIDC operations between Chennai and Mumbai have been put into regular operations.</p> <p>B: Implementation with Neighbouring States: The status on trails with following ATSUs of neighboring FIRs is as under:</p> <p>I. Chennai & Kuala Lumpur (Malaysia) – ABI, EST successful. CDN is done with voice confirmation. TOC/AOC will be implemented later. LOA signed.</p> <p>II. Chennai & Male (Maldives) –Trails have been successful. LOA in process.</p> <p>III. Chennai & Colombo (Sri Lanka) - Colombo in process to address the syntax errors in ABI. Thereafter, trails will be conducted. LOA</p>		

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>in</p> <p>IV. Chennai & Yangon (Myanmar) – Trials commenced in January 2018. Issues of incorrect reference number in Counter CDN from Yangon persists</p> <p>V. Mumbai & Male (Maldives) – Operational. LOA signed.</p> <p>VI. Ahmedabad & Karachi (Pakistan) – Automatic message exchange (e.g. ABI, EST) happens for most of the East bound flights between Karachi & Ahmedabad. Karachi Automation system not generating auto ACP message in response of EST messages.</p> <p>VII Kolkata & Yangon (Myanmar) – Trials under process. Most of the message exchanges were successful</p>		

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>C. Under Planning</p> <p>I. To conduct operational trials between Mumbai-Muscat, Kolkata-Dhaka, Mumbai Karachi (Pakistan), Delhi – Karachi (Pakistan), Delhi – Lahore (Pakistan), Chennai-Jakarta and Varanasi-Kathmandu subject to readiness from the concerned states.</p> <p>II. AFTN (AMSS) system upgradation to IP based AMSS is underway at various stations to address the latency issues for exchange of AIDC data.</p>		
INDONESIA	<p>ATN BIS Router and AMHS with Singapore implemented since February 2018;</p> <p>AMHS Trial (IOT) with Brisbane pending for CRV implementation.</p>	IDS	<p>AIDC implementation in Ujung Pandang ACC conducted as follows:</p> <ol style="list-style-type: none"> 1) Ujung Pandang ACC –Brisbane ACC: Implemented since July 2017. 2) Ujung Pandang ACC – Manila ACC: - Operational trial since October 2019; 	Thales TopSky in Makassar able to support ICD version 3 since December 2015.	For CRV, target of contract in 4Q2020 and implementation in 1Q2021.

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<ul style="list-style-type: none"> - Target date for implementation in 3Q2020. 3) Ujung Pandang ACC – Kota Kinabalu ACC: <ul style="list-style-type: none"> - Successfully tested and target date for operational trial in 4Q2020; - Target date for implementation 1Q2021. 4) Ujung Pandang ACC – Oakland ARTCC: <ul style="list-style-type: none"> - Successfully tested and target date for implementation in 4Q2020. 5) Ujung Pandang ACC – Port Moresby ACC: <ul style="list-style-type: none"> - Successfully tested on 7 July 2020; - Target date for operational trial in 3Q2020. - Target date for implementation 1Q2021. 		

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>6) Ujung Pandang ACC – Jakarta ACC (4Q2020);</p> <p>AIDC implementation in Jakarta ACC will be carried out with the following priorities:</p> <ol style="list-style-type: none"> 1) Jakarta – Ujung Pandang (4Q2020); 2) Jakarta – Chennai (3Q2021); 3) Jakarta – Melbourne (4Q2021); 4) Jakarta – Colombo (2Q2022); 5) Jakarta – Singapore (3Q2022); 6) Jakarta - Kuala Lumpur (4Q2022); 7) Jakarta – Kota Kinabalu (4Q2022). 		<p>Priority is in accordance with Hot Spot identified by RASMAG/23</p>
JAPAN	<p>ATN BBIS router and AMHS installed at 2000. Connection tests with USA 2000 - 2004 and put into operational use in 2005.</p> <p>ATN BBIS router (to apply to Dual Stack) and AMHS (to upgrade in 2015. The connection test with each country which is</p>	NEC	<p>AIDC implemented between Fukuoka ATMC and Oakland ARTCC in 1998.</p> <p>AIDC implemented between Fukuoka ATMC</p>		<p>Japan and USA conducting testing AIDC over AMHS and cutover date is 5 May 2017.</p>

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	<p>not currently connecting is started after update.</p> <p>Upgrading connection with Hong Kong and Singapore using VPN will be implemented in 2020 after implementation of CRV.</p> <p>Coordinating for all other circuits upgrading.</p> <p>Connection tests with Hong-Kong and Singapore using AMHS/FTBP over CRV since Dec 2019 and testing is going.</p> <p>AMHS/FTBP over CRV implementation with Beijing/China in 4Q2020, and with Incheon/Korea in 1Q2021.</p>		<p>and Anchorage ARTCC in 2005.</p> <p>AIDC implemented between Tokyo ACC/Fukuoka ACC and Incheon ACC in 2010.</p> <p>Implemented between Fukuoka and Incheon since June 2009.</p> <p>AIDC implemented between Fukuoka ACC/Naha ACC and Taipei ACC implemented.</p> <p>AIDC between Fukuoka ACC and Shanghai ACC under negotiation.</p>		
KIRIBATI	Connection with Nadi using UA/AMHS implemented in 2015.				
LAO PDR	ATN BIS Router and AMHS completed, planned for operation with Bangkok since 4Q 2016.	THALES	AIDC testing with Bangkok in 2017 and target for implementation in 4Q2019.	THALES which is able to support ICD Version 2.	

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>Testing with Hanoi on-going since 2017; with Cambodia operational test again in June 2018, and implementation 2Q 2019.</p> <p>Testing with Kunming and Yangon ongoing.</p>		
MALAYSIA	<p>ATN BIS Router completed 2007.</p> <p>AMHS for Malaysia – Singapore implemented in March 2020.</p> <p>AMHS for Malaysia – Thailand implemented in Dec 2019.</p>	FREQUENTIS	<p>AIDC technical test between Kuala Lumpur ACC and Bangkok ACC conducted since November 2016 (ABI/EST/ACP/LAM/LRM/CDN/REJ/TOC/AOC).</p> <p>The operational trial commenced in August 2019 (EST/ACP/LAM/LRM).</p> <p>The operational implementation commenced on 14th March 2020 (EST/ACP/LAM/LRM). AIDC technical test between Kuala Lumpur</p>	SELEX which is able to support ICD Version 3.	

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>ACC and Chennai OCC conducted since February 2013.</p> <p>The operational trial implemented in phases from September 2016 (ABI/EST/MAC/LAM/LRM/ACP). Review on the CDN message implementation conducted in August 2017. SOP signed 26 April, 2017.</p> <p>The MOU signed on March 2020.</p> <p>The operational implementation commenced on 1st April 2020 (ABI/EST/ACP/LAM/LRM/CDN/R EJ/MAC).</p> <p>The operational trial for TOC/AOC started on 1st July until 1st August 2020.</p> <p>AIDC technical test between Kuala Lumpur</p>		

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>ACC and Singapore ACC conducted since April 2015 (ABI/EST/ACP/LAM/LRM/CDN/REJ).</p> <p>The operational trial started on September 2018 (EST/ACP/LAM/LRM).</p> <p>The operational implementation commenced on 1st November 2019 (EST/ACP/LAM/LRM).</p> <p>AIDC technical test between Kuala Lumpur ACC and Ho Chi Minh ACC To Be Discussed (TBD).</p> <p>AIDC technical test between Kuala Lumpur ACC and Jakarta ACC TBD.</p> <p>AIDC technical test between Kota Kinabalu ACC and Manila ACC</p>		

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>started on May 2019 (EST/ACP/ LAM/LRM). The operational trial plan to be started in 4Q2020 (EST/ACP/ LAM/LRM). The operational implementation plan to be started in 1Q2021 (EST/ACP/LAM/ LRM).</p> <p>AIDC technical test between Kota Kinabalu ACC and Ujung Pandang ACC started on August 2019 (EST/ACP/LAM/ LRM).</p> <p>The operational trial plan to be started in 4Q2020 (EST/ACP/ LAM/LRM).</p> <p>The operational implementation plan to be started in 1Q2021 (EST/ACP/LAM/ LRM).</p> <p>AIDC technical test between Kota Kinabalu</p>		

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>ACC with Jakarta ACC TBD.</p> <p>AIDC technical test between Kota <u>Kinabalu</u> ACC and Singapore ACC started on November 2019 (EST/ACP/LAM/ LRM).</p> <p>The operational trial to be commenced on October 2020 (EST/ ACP/LAM/LRM).</p> <p>The operational implementation to be started in 1Q2021 (EST/ACP/LAM/ LRM).</p> <p>AIDC technical test between Kuching ACC and Singapore ACC started on November 2019 (EST/ACP/LAM/ LRM).</p> <p>The operational trial to be commenced on 20th July until 18th October</p>		

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>2020 (EST/ACP/LAM/LRM).</p> <p>The operational implementation to be started in 4Q2020 (EST/ACP/LAM/LRM).</p> <p>AIDC between Kuching ACC and Jakarta ACC TBD.</p>		
MALDIVES	<p>In the process of replacing the existing operational AFTN system by AMHS. It is expected to complete the installation before the end of 2019.</p> <p>With the new AMHS, it is planned to establish a new IP connection between an additional neighboring ATSU as the current link is an X.25 connection between Colombo.</p> <p>Also will look for the possibility of implementing the CRV network to use with AMHS and AIDC during the same phase.</p>		<p>Connection established with all the adjacent ATSUs. Interoperability tests successfully completed in 2017.</p> <p>LOA signed for operational trials between Mumbai, Chennai, and Trivandrum. Operational trials were also successful with these ATSUs, while several issues were resolved from both ends.</p>	SELEX which is able to support ICD Version 3.	

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>Ready to sign LOA with Melbourne and is expected during the 2nd quarter of 2019.</p> <p>Trials with Colombo had few issues, which Colombo is working to resolve it on their end with the automation system supplier. Connections between all 5 ATSU's are turned ON in the ATS automation system to conduct pre-notified operational trials.</p>		
MARSHALL ISLANDS					
MICRONESIA (EDERATED STATES OF)					
Chuuk					
Kosrae					
Pohnpei					
Yap					

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
MONGOLIA	<p>AMHS/AFTN gateway implemented 2012.</p> <p>ATNBIS router implemented in 2014.</p> <p>ATN and AMHS IOT with China was completed in May 2018. Plan for commissioning after POT completion in 2019.</p>	COMSOFT	<p>ATM automation system supports both AIDC and OLDI.</p> <p>Coordinating with Russia on OLDI connection in target date 2016.</p> <p>Coordinating with China on AIDC connection between Beijing/Ulaanbaatar technical trials in progress. Planned date of testing in 2019.</p>	INDRA Aircon 2100 supporting AIDC ICD Version 2.	
MYANMAR	<p>AMHS including AFTN/AMHS gateway implemented in Nov 2011.</p> <p>Connection with Thailand implemented in 4Q2016.</p> <p>Planned for AMHS connection with Beijing. Target date TBC.</p>	THALES	<p>AIDC connection pre-operation test with Thailand conducted in 4Q2017 and Target date of implementation 4Q2020; AIDC testing with Chennai, Kolkata and Vientiane conducted in 2020. Myanmar improved ATS Surveillance Coverage at coordination point with China and will start</p>	THALES Automation system (Topsky ATC) supports APAC AIDC ICD Ver. 2.	<p>AMHS including AFTN/AMHS gateway implemented in Nov 2011.</p> <p>Connection with Thailand implemented in 4Q2016.</p> <p>Planned for AMHS connection with Beijing. Target date TBC.</p>

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			AIDC test again with Kunming ACC in 2020.		
NAURU					
NEPAL	<p>AFTN/AMHS Gateway implemented in 2012.</p> <p>AMHS implemented with India since June 2014.</p> <p>AFTN connection with China. Plan to test AMHS connection soon.</p>	COMSOFT	<p>Nepal uses custom built ATM system from NEC.</p> <p>Some issues regarding ICD need to be resolved in order to proceed ahead with AIDC testing with India and China.</p>		
NEW CALEDONIA	New router and AMHS commissioned December 2016	COMSOFT			
NEW ZEALAND	AMHS connection with the USA over CRV was implemented in April 2019. AMHS connection to Australia over CRV is scheduled for June 2019.	COMSOFT	AIDC implemented between New Zealand, Australia, Fiji, Tahiti, Chile and USA.	Supported the Basic 5 message set. ATM systems are LEIDOS and ADACEL	
PAKISTAN	ATN/AMHS connections with Mumbai since 2015.	COMSOFT	Implemented between Karachi and Lahore ACCs	ATM system from Intra AIRCON 2100	Existing Radar system being upgraded.

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	Planning for AMHS connection with Beijing and Kuwait after upgrading existing facilities between the Countries. Target dates for implementation TBC.		Further testing to be conducted between Delhi/Karachi & Delhi/Lahore after system upgradation at Indian end; Mumbai/Karachi & AHM/Karachi on trial operation. For testing with Muscat planned for 4Q2019. Coordination for testing with Tehran is in progress.		
PAPUA NEW GUINEA	Currently AFTN over IP. AMHS implementation is planned for after successful implementation of CRV this year. AMHS implementation planned for 2020.	COMSOFT is the supplier of PNG AFTN/AMHS system	AIDC using AFTN operational with Australia, testing/trial with Oakland (USA) started late last year and in progress. AIDC implementation with Indonesia to happen after CRV implementation this year.	New ATM System from Thales (TopSky-ATC) implemented and operational now supports AIDC V3.	
PHILIPPINES	New ATN/AMHS was installed at the New CNS/ATM Center in Manila. Site Acceptance was successfully done on October 2015.	Frequentis - Comsoft	MANILA with: HONG KONG – Implemented	THALES which is able to support ICD Version 2.	New ATN/AMHS was installed at the New CNS/ATM Center in Manila.

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	<p>The new AMHS commissioned and operational in March 2018.</p> <p>The AMHS Implemented over CRV with HONG KONG - May 2019.</p> <p>The AMHS Implemented over CRV with TAIPEI - September 2019.</p> <p>Planned AMHS implementation over CRV with SINGAPORE by end of 3Q2020.</p> <p>Planned AMHS implementation over CRV with OAKLAND, USA by 1Q2021.</p>		<p>May 2019 via CRV;</p> <p>SINGAPORE – Implemented November 2019 via X25;</p> <p>TAIPEI – Implemented December 2019 via CRV;</p> <p>UJUNG PANDANG - Operational Trial since April 2020 via SINGAPORE (X25);</p> <p>HO CHI MINH – Tests conducted on October 2019. For further tests;</p> <p>KOTA KINABALU – Tests conducted on May and October 2019 via SINAGPORE (X25). For further tests;</p> <p>OAKLAND – Planned AIDC tests after AMHS</p>		<p>Site Acceptance was successfully done on October 2015.</p> <p>The new AMHS commissioned and operational in March 2018.</p> <p>The AMHS Implemented over CRV with HONG KONG - May 2019.</p> <p>The AMHS Implemented over CRV with TAIPEI - September 2019.</p> <p>Planned AMHS implementation over CRV with SINGAPORE by end of 3Q2020.</p> <p>Planned AMHS implementation over CRV with</p>

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			successful implementation.		OAKLAND, USA by 1Q2021.
REPUBLIC OF KOREA	<p>ATN/AMHS circuit with China put into operational use in June 2011.</p> <p>AMHS implementation with China over CRV in 2Q2020.</p> <p>AMHS implementation with Japan over CRV in 4Q2020.</p>	SAMSUNG	<p>AIDC implemented between ACC and Fukuoka ATMC in 2010</p> <p>AIDC between Incheon and Dalian implemented in Nov. 2016.</p>	Rockheed Martin System	
SINGAPORE	<p>AMHS implemented.</p> <p>ATN/AMHS circuit with India put into operational use in March 2011.</p> <p>ATN/AMHS circuit with UK put into operational use in March 2012.</p> <p>ATN/AMHS circuit with Thailand put into operational use in December 2014.</p> <p>ATN/AMHS circuit with Australia put into operational use in October 2016.</p> <p>ATN/AMHS circuit with Indonesia put into operational use in February 2018.</p> <p>ATN/ AMHS circuit with Malaysia put into operational in March 2020.</p> <p>Inter-Operability Test (IOT) with Japan and Vietnam started in 2019. IOT with</p>	FREQUENTIS COMSOFT	<p>Operational with Ho Chi Minh implemented July 2014</p> <p>Kuala Lumpur operational trial started since September 2018 and is implemented Nov. 2019.</p> <p>Manila operational trial started in February 2019. Implementation Nov. 2019</p> <p>Technical trials with Jakarta ACC will be initiated once the Jakarta</p>	THALES supports ICD Version 3 since December 2018	<p>AMHS implemented.</p> <p>ATN/AMHS circuit with India put into operational use in March 2011.</p> <p>ATN/AMHS circuit with UK put into operational use in March 2012.</p> <p>ATN/AMHS circuit with Thailand put into operational use in December 2014.</p> <p>ATN/AMHS circuit with Australia put into</p>

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	Philippines, Sri Lanka, Bahrain and Brunei targeted in 2020/2021.		ACC ATMS renewal is completed.		operational use in October 2016. ATN/AMHS circuit with Indonesia put into operational use in February 2018. ATN/ AMHS circuit with Malaysia put into operational in March 2020. Inter-Operability Test (IOT) with Japan and Vietnam started in 2019. IOT with Philippines, Sri Lanka, Bahrain and Brunei targeted in 2020/2021.
SRI LANKA	ATN BIS Router Planned for 2013. IP based AMHS implemented by Oct. 2017. <ul style="list-style-type: none"> - Mumbai tested May 2017 operational planned for Q4 2017; - Singapore testing in Q4 2017 operational for 2018; - Male testing and operational date TBD. 	IDS	Trials with Male planned for in 3Q2019. Trial with Chennai on-going. Plan for implementation in 2018 and with Melbourne plan for 1Q2018.	INTELCAN which is able to support ICD Version 3.	

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
THAILAND	<p>BBIS/BIS Routers already implemented. AMHS has been implemented since July 2011.</p> <p>Connection with Bangladesh, Bhutan, Cambodia, China, India, Lao PDR, Myanmar, Singapore, Hong Kong China, and Malaysia implemented.</p> <p>Bangkok -Viet Nam Circuit</p> <ul style="list-style-type: none"> • IOT Test: Done • POT Test: Planned for end of 3Q2020 <p>Bangkok - Rome Circuit</p> <ul style="list-style-type: none"> • IOT Test: Planned for 4Q2020 <p>Connection with SITA (SITA AMHS Gateway inter-connections) implemented.</p>	AEROTHAI's AMHS System	<p>The implementation with</p> <ul style="list-style-type: none"> • Malaysia has done on 14th March 2020 • Lao PDR has done on 14th July 2020 <p>In addition, it is planned to implement AIDC with Cambodia and Myanmar by 3Q2020 and 4Q2020 consecutively.</p>	THALES which supports AIDC feature, APAC AIDC ICD V.3.	
TONGA	<p>AMHS planned for 2008.</p> <p>The provider is linked to the New Zealand AFTN</p>				CPDLC and ADS-C is not considered for lower airspace

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
UNITED STATES	<ul style="list-style-type: none"> - Australia (1/2019) - Fiji (1/2019) - New Zealand (1/2019) - Japan (2/2019) - Philippines (1Q2021) 	IN-HOUSE	<ul style="list-style-type: none"> - Fiji, Japan, New Zealand, - Tahiti (via New Zealand), - Papua New Guinea (via Australia) (4Q2021) - Philippines (3/2021) - Indonesia via Australia (2020) - Russian Federation (pending joining CRV) 	IN-HOUSE which is able to support APAC and NAT ICDs currently Version 2.	
VANUATU					
VIET NAM	<p>AMHS (basic) implemented. Trial phase from 4Q/2015 to 3Q/2018. IOT with Thailand in progress from 4Q/2017 Plan to use AMHS in 4Q/2018;</p> <p>Planned for IOT with Hong Kong, Singapore and Thailand in 2019</p> <p>For IOT with Laos PDR and Cambodia in 2019.</p>	IN-HOUSE	<p>Operational between Ho Chi Minh and Singapore since July 2014. Trial for additional messages sets since 2018.</p> <p>Implementation between Ho Chi Minh with Philippines planned for 4Q2020;</p>	<p>Support ICD Version 1.0 with THALES at Ho Chi Minh ATM system.</p> <p>Support ICD Version 3.0 with Selex at Hanoi ATM System.</p>	

ATM/SG/8 – WP17
Appendix A

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			<p>Technical testing with Cambodia already done; Trials between Hanoi and Vientiane, Lao. PDR on going.</p> <p>with Malaysia TBC</p> <p>Testing with Cambodia on – going; For operation trial TBC.</p>		
Wallis and Futuna (FRANCE)	AMHS implementation planned for end of 2017			COMSOFT	

ADS-B IMPLEMENTATION STATUS IN THE APAC REGION

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
AFGHANISTAN	ADS-B & Multi Lateration system installed.				subject to safety assessment
AUSTRALIA	<p>A total of 50 ADS-B ground stations and 28 WAM stations are operational (Total 78)</p> <p>ATC readiness since 2004 ADS-B data sharing with Indonesia operational since 2/2011.</p> <p>ADS-B data sharing planned with PNG</p> <p>ASMGCS using multilateration and ADS-B is operational in Brisbane, Sydney, Melbourne and Perth</p> <p>November 2016 – ADS-B converted to “radar like” Cat 48 for use in Melbourne Terminal Area and Perth Terminal Area in early 2017.</p> <p>CMATS replacing the current ATM system is expected to be fully operational in 2024 period.</p>	<p>2009/effective date of mandating in upper airspace 12/12/2013.</p> <p>An ADS-B mandate for all IFR aircraft applies from 2/2017.</p> <p>Some limited exemptions for foreign registered aircraft and some private operations.</p>	All airspace for IFR aircraft from 2/2017	<p>2.5NM, 3NM and 5 NM surveillance separations.</p> <p>3/2016 - Manual of ATC updated to include 3 nautical mile separation using ADS-B in terminal control unit.</p> <p>3/2017 – 2.5NM separation authorized using ADS-B when also used with radar.</p> <p>Vectoring allowed using ADS-B</p> <p>Precision Runway Monitoring for Sydney WAM</p>	<p>WAM is operating in Tasmania since 2010 with 5 NM separation service.</p> <p>WAM is also operating in Sydney for 3 NM separation service in TMA and for precision runway monitoring function.</p> <p>CASA has approved the use of reduced specification ADS-B avionics to support ADS-B IN and ATC situational awareness for VFR aircraft</p>
BANGLADESH	<p>Bangladesh has a plan to install four ADS-B ground stations to be installed at Dhaka, Cox’s Bazar, Saidpur and Barisal Airports by 2019.</p> <p>ADS-B data will be integrated with new ATM system at Dhaka.</p> <p>Bangladesh has also a plan to install MLAT stations to provide surface movement control at HSIA, Dhaka as well as TMA coverage as a backup and complimentary RADAR coverage to the Dhaka MSSR.</p>				Bangladesh is willing to share ADS-B data with neighbouring States to enhance the safety and surveillance capability in the sub-region.

ATM/SG/8 – WP14
Appendix B

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
BHUTAN	ADS-B ground infrastructure feasibility study will be completed in the middle of 2020.	Equipage mandate will be issued once after the completion of feasibility study.			
BRUNEI DARUSSALAM	<p>5 ADS-B ground stations with WAM functionality installed in 2015 and full operation in October 2016. ADS-B/WAM data are fused with radar data in the TopSky ATC Automation system (Thales) to enhance full radar surveillance coverage for Brunei Darussalam.</p> <p>Memorandum of Understanding (MOU) on ADS-B data sharing with Singapore and Brunei Darussalam is expected to sign in April 2019.</p>				
CAMBODIA	3 ADS-B ground stations installed at Phnom Penh, Siem Reap and Stung Treng City since 2011 and able to provide full surveillance coverage for Phnom Penh FIR. Cambodia is willing to share data with others.				
CHINA	<p>5 UAT ADS-B stations are used for flight training of CAFUC. The upgrade to 1090ES ADS-B stations project has already started in 2017, and the project is planned to finish by 2022.</p> <p>308 ADS-B stations nationwide have already finished installation and SAT by the end of 2018.</p> <p>4 ADS-B stations operational in Sanya FIR since 2008.</p> <p>Chengdu-Jiuzhai and Chendu - Lhasa route with 9 ADS-B stations.</p> <p>9 ADS-B stations deployed on the routes H15 and Z1 by the end of 2015.</p>	<p>The operation of national ADS-B Service is implementing in step-by-step way.</p> <p>The phase 1-plan has been carried out since October 2019, details as follows:</p> <ul style="list-style-type: none"> ➤ ADS-B control operation will be implemented in En-route area upper 8400m without Radar control ability; ➤ Radar/ADS-B combined control operation will be implemented in En-route area upper 8400m with Radar control ability. 			

ATM/SG/8 – WP14
Appendix B

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
	19 ADS-B stations at the small airport.	The ADS-B mandate published in October, 2019, in a separated AIC named “Implementation of ADS-B Control Services”			
HONG KONG CHINA	<p>A larger-scale A-SMGCS covering the whole Hong Kong International Airport put into operational use in April 2009.</p> <p>Data collection/ analysis on aircraft ADS-B equipage in Hong Kong airspace conducted on quarterly basis since 2004.</p> <p>ADS-B trial using a dedicated ADS-B system completed in 2007.</p> <p>ADS-B out operations over PBN routes L642 and M771 at or above FL 290 within HK FIR was effective in December 2013 and within HK FIR at or above FL 290 has been effective since December 2016.</p> <p>ADS-B ground station infrastructure completed in 2013.</p> <p>ADS-B signal provided by Mainland China to cover southern part of Hong Kong FIR commenced in 2010 and has been put into operational use after commissioning of the new ATMS since November 2016.</p>	AIP supplement issued on 29 Aug 2014 with 8 Dec 2016 as effective date.	HKFIR at or above FL290	5NM surveillance separation	Fully implemented ADS-B in HKFIR by phased approach to ensure safe and smooth integration of ADS-B into the Air Traffic Management System to provide aircraft separation service since November 2018.
MACAO, CHINA	Mode S MSSR coverage available for monitoring purposes.				Airspace – ATZ only
DEMOCRATIC PEOPLE’S REPUBLIC OF KOREA	ADS-B has been used as back-up surveillance of SSR since 2008.				

ATM/SG/8 – WP14
Appendix B

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
FIJI ISLANDS	ADS- B /multilateration ground stations installed. Situations awareness service provided in 2013.	ADS-B mandate commencing from 31 st December 2013	Mandate for domestic registered aircraft.		
FRANCE <i>(French Polynesia)</i>	ATM system is ready for ADS-B sensors/Installation of 5 first GS expected at beginning of 2017. 2 nd stage with implementation of 7 GS and associated VHF coverage.			5 NM for airspace under coverage.	
INDIA	<p>ASMGCS (SMR + Multilat) is operational at Delhi, Mumbai, Chennai, Kolkata, Bangalore, Hyderabad, Jaipur, Amritsar, Lucknow, Ahmedabad and Guwahati Airports.</p> <p>ASMGCS(SMR+MLAT) proposed at Cochin and Bhubaneswar (VOCI&VEBS) Expected to be completed by December 2019.</p> <p>ADS-B Ground Stations were installed at 21 locations across continental airspace and including Oceanic airspace at Port Blair. Installation of 10 more ADS-B Ground stations was completed.</p> <p>ATM automation systems at 22 ATC Centres are capable of processing ADS-B data and provide the information on Display.</p>	AIP supplement issued on 17 th April 2014 with effective date of implementation from 29 th May 2014.			<p>ADS-B in India to provide redundancy for radar and filling the surveillance gaps.</p> <p>ADS-B data trial operations commenced in 2015 in both Non-radar and radar environment, in En-route & Terminal phases of flight for ATC purposes.</p> <p>AIP SUP 18 of 2014 issued</p> <p>ADS-B based APP approved at VOCL and VOCB</p>
INDONESIA	<p>All 30 ADS-B ground station have been met with DO260B in November 2019;</p> <p>The 18 new ADS-B ground stations, with DO260B capability, will be established to cover the traffic in terminal and area. The 7 ADS-B ground station has been installed in Papua. The</p>		Starting on 23 rd April 2020, Indonesia has implemented mandatory ADS-B equipment for all transport	Using 5 NM separation standard.	<p>ADS-B data sharing had been conducted by Indonesia with Australia and Singapore.</p> <p>LOA of collaboration in ADS-B data</p>

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
	<p>rescheduling of completion for 11 ground stations in 4Q2021.</p> <p>The ADS-B ground stations has been integrated to 9 ATC systems and 3 others will follow after being upgraded.</p>		<p>aircraft category flying at all level (SFC up to FL600) in 2 ACCs, 9 TMA and 10 Airports.</p>		<p>sharing has been achieved with India.</p> <p>LOA of collaboration in ADS-B data sharing are under reviewing by Malaysia, Philippines and PNG.</p>
JAPAN	<p>Multilateration Systems for surface monitoring have been implemented at eight airports</p> <p>PRM (WAM) has been implemented at Narita Airport.</p> <p>En-route WAM system is manufacturing and will be put into operation in FY2018</p> <p>Plan to evaluate accuracy of ADS-B information under RAD condition.</p>				
LAO PDR.	<p>2 ADS-B ground stations were installed in Vientiane and Luangprabang Int'l Airport in 2015 and the ADS-B data is fused with MSSR data target in the ATM Automation system.</p> <p>3 additional ADS-B ground stations (DO-260B compliant) will be completed the installation at existing MSSR sites (Xiengkhouang, Savannakhet and Champasack) by 2016 to Q1 of 2017 to enhance the full ADS-B coverage of Lao FIR.</p>				

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipment mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
MALAYSIA	<p>Ground Infrastructure: Kuala Lumpur FIR: 1. Installation of two (2) ADS-B GS in Langkawi and Genting has been completed in October 2017. 2. Upgrading of Kuala Terengganu ADS-B for ADS-B Version 2 capability is to be completed at the end of Dec 2021. 3. Operation of all three ADS-B in new Kuala Lumpur ATC System is to be completed in Dec 2021.</p> <p>Kota Kinabalu FIR: Four (4) new ADS-B will be installed in Kuching, Bintulu, Kota Kinabalu and Sandakan, to be completed in Dec 2021.</p> <p>Implementation Plan:</p> <p>Phase 1: ADS-B services on specific ATS routes and Flight Levels within Kuala Lumpur FIR, target date Mar 2021.</p> <p>Phase 2: ADS-B as secondary means of surveillance within the Kuala Lumpur FIR for en-route airspace. Target date: Mar 2022.</p> <p>Phase 3: ADS-B used as the primary means of surveillance for en-route airspace. (TBA)</p>	<p>AIC Issued on September 2017.</p> <p>AIP Supp on 16 Jan 2020.</p>	<p>Phase 1: On ATS routes N571, P628, L510, P627, L645 and P574 at FL 290 to FL 410 within Kuala Lumpur FIR</p> <p>Phase 2: En-route airspace</p>	<p>ICAO approved surveillance separation.</p>	
MALDIVES	<p>4 ADS-B stations installed in Nov. 2012 (2 at Male' Ibrahim Nasir Intl Airport, 1 at Kulhudhuffushi Island in the North and 1 at Fuah Mulah Island in the South to cover 95% of the FIR at/above FL290.</p> <p>Maldives' ADS-B is integrated with the ATM system (in November 2013), and under observation prior to commencing trials.</p> <p>Maldives has planned to share ADS-B data with its adjacent FIRs. Updated by email</p>				<p>Seaplane in Maldives equipped with ADS-B for AOC purpose. These seaplanes have ADS-B IN functions as well.</p>

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
MONGOLIA	Ten ADS-B ground stations for combination SSR and filled the surveillance gaps implemented in 2015 and integrated with ATM system and trial operation in early 2016.				
MYANMAR	<p>a) The ADS-B Implementation Update</p> <ul style="list-style-type: none"> - The five ADS-B ground stations have been installed in Myanmar. Among them, SITTWE and CoCo Island ground stations are installed in 2014, and are DO260 compliant. The other 3 stations, YANGON, MANDALAY and MYEIK airport ground stations are DO260B compliant and installations were finished in 2016. - All ADS-B data are fused with MSSR data in the TopSky ATC Automation system (Thales) in 2016 and using as MSSR backup in Yangon ACC. <p>b) The ADS-B data sharing update between neighbouring States</p> <ul style="list-style-type: none"> - Myanmar and India signed the MOU agreement for ADS-B data sharing on 6th May 2015. ADS-B data sharing test between Agartala (India) - Sittwe (Myanmar), and Port Blair (India) - CoCo Island (Myanmar) have been accomplished between technical teams since June 2018. At present, the shared ADS-B data from Myanmar side is now using as backup automation system at Kolkata for test purpose. But, Myanmar side is needed to discuss with ATM manufacturer for operational use of the India's Data at Yangon ACC. - Myanmar have planned to install new ADS-B Station in the 2nd quarter of 2019 at LASHIO 	Doing ADS-B data analysis and statistic for ADS-B equipped Aircraft in Yangon FIR.			Supplement radar and fill the gaps to improve safety and efficiency ADS-C/CPDLC integrated in Yangon ACC since 2010.

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipment mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
	Airport located in north-eastern part of Myanmar closed to the China-Myanmar border near the LINSO transfer point on A599 ATS route. After the installation finished, the ADS-B data sharing process can be proceeded between Myanmar and China.				
NEPAL	Four ADS-B ground stations have been installed in 2019 at Kathmandu (Phulchowki), Bhairahawa, Nepalgunj and Dhangadi.				Safety assessment will be done soon.
NEW CALEDONIA	Three ADS-B ground stations commissioned in 2010 to cover international traffic at La tontouta airport serving Tontouta ACC & APP. It is used for Situation awareness and SAR.				
NEW ZEALAND	<p>MLAT and ADS-B data is being used from the WAM system centred in the Queenstown area to provide surveillance coverage and surveillance separation (5 NM) over the southern half of the South Island of New Zealand.</p> <p>MLAT and ADS-B data from the Auckland MLAT system is used to support surface movement control at NZAA (Auckland).</p> <p>The New Zealand Navigation and Airspace and Air Navigation Plan “New Southern SKY” was issued in May 2014</p> <p>34 ADS-B ground stations have been installed.</p>	<p>New Zealand introduced the following ADS-B OUT mandate as follows: ADS-B OUT equipment requirement for all aircraft operating in NZZC FIR controlled airspace above FL 245 from 31 December 2018</p> <p>New Zealand has plans to introduce the following ADS-B OUT mandates: ADS-B OUT equipment requirement for all aircraft operating in any controlled airspace within the NZZC FIR from 31 December 2021.</p>	All controlled airspace within the NZZC FIR above FL245	5 NM surveillance separation in en-route controlled airspace, and 3NM surveillance separation in terminal controlled airspace – where surveilled.	

ATM/SG/8 – WP14
Appendix B

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipment mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
		<p>Since July 2018 all new aircraft registered in New Zealand, or any currently registered aircraft upgrading transponder(s) are required to install DO260B transponder(s) which meet the relevant NZCAA rule set.</p> <p>The Rule specifies the minimum Technical Standing Orders (TSO), or transponder GNSS receiver models for position input into ADS-B.</p>			
PAKISTAN	<p>Tender for procurement of 5 ADS-B stations issued to be installed at Pasni, Lakpass, Rojhan, Dalbandin and Laram-top. Contract expected to be finalized by end of 2016. These stations will be DO260B compliant and operational by end of 2017.</p>				
PAPUA NEW GUINEA	<p>Initially 7 ADS-B sites to be deployed across PNG to provide seamless coverage above FL285.</p> <p>Three (3) sites installed as of December 2017. Two (2) of these are operational. First site to be installed May/June 2017, with remainder to be completed in 2018.</p> <p>Additional 7 sites to be rolled-out in the 2018/19 timeframe. Site location will be dependent on infrastructure, security and an analysis of Phase 1 site performance.</p> <p>PNGASL (ANSP) will commence a transition to new ATM automation system in May 2018.</p>	<p>An ADS-B mandate is on CASA PNG roadmap, however legislation yet to be developed.</p> <p>The Australian mandates will largely drive equipment for overflights (e.g. East-Asia to Australia/South Pacific).</p> <p>Expectation is that PNGASL (the ANSP) will lead development of ADS-B mandate framework.</p>	None	<p>Air Traffic Control</p> <p><u>Approach/ Arrivals</u></p> <p>2018 – 5NM 2019 – 3NM (approach)</p> <p><u>Upper Airspace (>FL245)</u></p> <p>2017/18 – Situational awareness.</p> <p>2018/19 – 5NM</p> <p>Note: Implementation dictated by</p>	

ATM/SG/8 – WP14
Appendix B

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
	<p>The system will support fusion of ADS-B and RADAR data.</p> <p>5 mile separation to be provided using ADS-B and fused ADS-B/Radar from May 2018.</p> <p>From 2018 onwards, PNGASL will be looking to share ADS-B data with Indonesia and Australia.</p>	<p>Initial steps may include mandate above F245 – but will depend on performance of Phase 1 ADS-B deployment.</p> <p>Country-wide mandate not envisaged before 2021/22.</p>		<p>training requirements and new ATM system transition priorities.</p> <p>Flight Service</p> <p><u>Directed Traffic (FIS)</u></p> <p>2019 – Situational awareness</p>	
PHILIPPINES	<p>One ADS-B GS installed at the Manila ATM Center for situational awareness.</p> <p>One ADS-B Ground Station installed at Bataraza, Palawan for data sharing with Singapore.</p> <p>Additional ground stations are planned to be installed in Laoag Airport, Tagaytay, Jomalig Island, Puerto Princesa Airport, Mt. Majic Mactan, and General Santos “Tambler” Airport.</p>				
REPUBLIC OF KOREA	<p>Currently, MLAT/ADS-B are being used for surface monitoring and situation awareness at some airports.</p> <p>For enroute surveillance , additional installation of 10 ADS-B Ground stations is now in progress. It will be completed by December 2019.</p> <p>95% of Korean national carriers are equipped with ADS-B Out transponder as of 2018.</p>	<p>After trial operation in the first half of 2020, time for equipage mandate will be decided.</p>	<p>After trial operation in the first half of 2020, the scope of application will be decided .</p>	<p>After trial operation in the first half of 2020, separation criteria will be decided.</p>	
SINGAPORE	<p>The airport MLAT system was installed in 2007 and “far-range” ADS-B sensor was installed in 2009.</p> <p>ATC system has been processing ADS-B data since 2013.</p>	<p>AIC was issued on 28 December 2010/effective from 12 Dec.2013.</p> <p>ADS-B OUT equipment requirement for all</p>	<p>At and above FL290, affecting the following ATS routes L642, L644, M753, M771,</p>	<p>40nm implemented on ATS routes L644 and N891.</p> <p>20nm implemented on ATS routes L642,</p>	<p>Safety case was completed end of November. 2013.</p>

ATM/SG/8 – WP14
Appendix B

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipment mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
		<p>aircraft operating on selected ATS routes within the WSSS FIR from 27 January 2022.</p> <p>ADS-B OUT equipment requirement for all aircraft operating within the WSSS FIR from 26 January 2023.</p> <p>AIP updated in May 2018 to reflect the ADS-B equipment certified as meeting:</p> <p>a. EASA - (AMC 20-24), or</p> <p>b. EASA CS-ACNS (Subpart D - Surveillance - SUR), or</p> <p>c. FAA - Advisory Circular No: 20-165A (or later versions), or</p> <p>d. The equipment configuration standards in Appendix XI of Civil Aviation Order 20.18 of CASA.</p>	<p>N891 & N892</p> <p>At and above FL290, affecting the following ATS routes L517, L625, L649, M758, M767, M768, M772 & N884.</p>	<p>M771, M753 and N892.</p>	
SRI LANKA	<p>Total of 5 ADS-B Ground Receiving Stations and 01 Central Processing Station have been installed in March 2017. ADS-B Data is fused with Multi-sensor Data, including MSSR and ADS-C in the ATM system at Colombo ACC Ratmalana was launched for operational used on 15 Nov. 2017. New ATM system planned for operational at APP Centre in 2018 will also be capable of fusing Multi-sensor Data, including MSSR and ADS-B</p>	<p>Revised Date of Equipage mandate would be 31st Dec 2020.</p> <p>Ref: AIC A02/16 (Initially AIC A02/14 was issued in November 2014)</p>	<p>All ATS Routes within Colombo TMA</p>	<p>Initially 5 NM within Approach Radar Coverage, 8 Nm within Area Radar Coverage & Procedural Separation minima outside Radar Coverage.</p>	<p>On completion of a safety assessment, use of ADS-B alone for ATC separation purposes.</p>

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipment mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
THAILAND	<p>Six ADS-B ground stations (DO-260B compliant) have been installed since 2015 for the research and development purpose. Installation of more ADS-B ground stations to provide coverage in terminal and airport areas is being assessed.</p> <p>The MLAT system have been implemented at VTBS and VTBD. At VTSP and VTCC, MLAT systems are being installed with expectation to be operational in 2020.</p> <p>Multiple surveillance sensor data such as Mode-S SSR, ADS-B, MLAT and WAM are integrated into the new ATM systems and expected to be operational in early 2020.</p> <p>The ATS surveillance data sharing with the adjacent FIRs was approved in principle in October 2018.</p>	Aircraft equipment mandate is expected to be issued in 2021 with the expected target effective date in 2026.			
TONGA	Trial planned for 2017				
UNITED STATES	<p>The US identified required ADS-B Service Volumes in 2007. Using data from over 600 terrestrial radio sites, the US domestic ADS-B system became operational in 2014.</p> <p>As of 1 January 2020, ADS-B aircraft equipment is mandated in most controlled airspace within the US. Over 160,000 US registered aircraft are now equipped. ADS-B is available to U.S. air traffic control facilities for ATC separation; all En Route Centers and major Terminal facilities are using ADS-B for ATC separation.</p>	The U.S. ADS-B Out rule (14 CFR 91.225 and 14 CFR 91.227) was issued in May 2010 and specifies that the ADS-B Out mandate is effective on 1 January 2020.	Class A, B, and C airspace, plus Class E airspace above 10,000 ft MSL. See 14 CFR 91.225 for details.	<p>The U.S. is using both terminal and en route (5nm) separation criteria, depending on the specific airspace and available surveillance information. Terminal separation includes the following separation criteria:</p> <ul style="list-style-type: none"> - 3nm - 2.5nm 	<p>The U.S. has implemented integrated WAM/ADS-B in the following terminal areas: Charlotte LAX</p> <p>Implementation of integrated WAM/ADS-B is being considered for additional U.S. terminal areas.</p>

ATM/SG/8 – WP14
Appendix B

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS- routes	Intended separation criteria to be applied	Remarks
				- independent parallel approach operations down to 3600 ft centreline separation - dependent parallel approach operations down to 2500 ft centreline separation (currently 1.0 nm diagonal distance).	
VIET NAM	Two phases ADS-B implementation plan adopted. Phase 1 implemented in March 2013. Phase 2 commenced in 2015 for whole lower and upper Hanoi FIR and 2018 for Ho Chi Minh FIR	AIC issued on 20 June 2013/ADS-B mandating effective from 12 December 2013 in Ho Chi Minh FIR.	M771, L642, L625, N892, M765, M768, N500 and L628 At/above FL290.		Operators required to have operational approval from State of aircraft registry.



**INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE**

**RECOMMENDED FUNCTIONS AND PERFORMANCES
OF AIR TRAFFIC MANAGEMENT AUTOMATION SYSTEM**

Edition 0.0 - October 2020

TABLE OF CONTENTS

1. INTRODUCTION.....	4
1.1 PURPOSE	4
1.2 BACKGROUND	4
1.2.1 ATM Operational Concept	4
1.2.2 ATM System and Its Sub-system	5
1.2.3 Concept of ATM Automation System	6
1.2.4 Challenges and Solutions	6
1.2.5 Outcomes and Endorsements	7
1.3 ARRANGEMENT OF RFAP OF ATM AS	7
1.4 DOCUMENT HISTORY AND MANAGEMENT	8
1.5 COPIES	8
1.6 CHANGES TO RFAP OF ATM AS.....	8
1.7 EDITING CONVENTIONS	9
1.8 RFAP OF ATM AS REQUEST FOR CHANGE FORM.....	10
1.9 AMENDMENT RECORD	11
2. ACRONYMS AND ABBREVIATIONS	12
3. REFERENCE DOCUMENTS	13
4. SYSTEM FUNCTIONAL BASELINE.....	15
4.1 SYSTEM COMPULSORY FUNCTIONS.....	15
4.1.1 Surveillance Data Processing Function (SDP).....	15
4.1.2 Flight Data Processing Function (FDP)	15
4.1.3 Bypass Surveillance Data Processing Function (BSDP).....	15
4.1.4 Correlation of Surveillance and Flight Data	15
4.1.5 Alerts and Warning Function.....	15
4.1.6 Meteorological Information Processing Function.....	16
4.1.7 Air Ground Data Link Function (AGDL).....	16
4.1.8 Variable System Parameter Management Function.....	16
4.1.9 ATS Inter-facility Data Communication Function.....	16
4.1.10 Human Machine Interface Function (HMI).....	17
4.1.11 Recording and Playback Function.....	17
4.1.12 System Monitoring and Controlling Function	17
4.1.13 Software Version Management Function	17
4.1.14 GNSS Time Synchronization	17
4.2 SYSTEM OPTIONAL FUNCTION	17
4.2.1 Extended Surveillance Data Processing	17
4.2.2 Extended Correlation.....	17
4.2.3 Extended Alerts and Warning.....	18
4.2.4 Downlink Aircraft Parameters Processing and Display Function.....	19
4.2.5 AMAN	19
4.2.6 System Log Management Function.....	19
4.2.7 Enhancement Record and Replay Function.....	19

4.2.8	Re-categorization Function	20
4.2.9	Operational Data Synchronization Function.....	20
4.2.10	Statistics and Analysis	20
5.	SYSTEM DESIGN.....	20
5.1	SYSTEM ARCHITECTURE.....	20
5.2	POSITION ROLES AND TYPES	20
5.3	MAIN AND BACKUP CONFIGURATION	21
5.4	SYSTEM OPERATIONAL MODE.....	21
5.5	CAPACITY AND PERFORMANCE.....	21
5.5.1	System Design Capacity.....	22
5.5.2	System Time Performance.....	22
5.5.3	Performance of Surveillance Data Processing	22
5.5.4	Flight Data Processing Capacity.....	23
5.5.5	Record and Playback Function Capacity	23
5.6	EXTERNAL INTERFACE.....	23
5.7	SYSTEMS INTEROPERABILITY.....	23
5.8	CYBER THREATS AND MITIGATION	23
6.	SYSTEM SOFTWARE MANAGEMENT	24
6.1	SYSTEM REQUIREMENTS ANALYSIS AND MANAGEMENT	24
6.2	SYSTEM FAULT MANAGEMENT	24
6.3	SOFTWARE RELEASE & PATCH MANAGEMENT	25
7.	SYSTEM TRANSITION	25
7.1	TRANSITION PLAN AND ASSESSMENT	25
7.2	TRANSITION REHEARSAL.....	25
7.3	SYSTEM OPERATIONAL CHECK	25
7.4	FLIGHT CHECK FOR SYSTEM PERFORMANCE ACCEPTANCE	25
8.	SYSTEM MAINTENANCE.....	27
8.1	SYSTEM SUPPLIER.....	27
8.2	MAINTENANCE SERVICE PROVIDER (MSP).....	29
8.3	AIR NAVIGATION SERVICE PROVIDER (ANSP).....	30

1. Introduction

1.1 Purpose

Since the Air Navigation Conference held in 2012, ICAO has been exploiting a global roadmap in the aviation system block upgrades (ASBU) under its Global Air Navigation Plan (GANP) , with a focus on harmonization and interoperability leading to a global air traffic management (ATM) system.

Following the framework of GANP and the timeline of ASBU, the Asia/Pacific Seamless ATM Plan, was adopted by the 24th Meeting of the Asia/Pacific Planning and Implementation Regional Group (APANPIRG/25) in 2013. It defines goals and the means of meeting State planning objectives for a Regional seamless ATM performance framework, with a focus on technological and human performance.

Along with carrying out of the Asia/Pacific Seamless ATM Plan, and many times' meeting discussion, it is getting more and more clear, a specific recommendations and developing guidance material related to Air Traffic Management Automation System (ATM AS) is necessary, which aim at facilitating the implementation or provision of robust, safe, efficient and orderly ATM services by the use of existing and/or new procedures, facilities and technologies.

This Recommended Functions and Performances of ATM AS (RFAP of ATM AS) provides guidance for systems planning, design, testing and implementation of ATM automation system in the Asia and Pacific Regions, with the purpose of ensuring continuous and coherent development of the ATM automation systems that is harmonized with adjacent regions.

The system requirements and operational procedures for ATM automation system are detailed in the relevant States' projects and AIP. This RFAP is intended to provide the basic and the most important functions and performances of ATM automation system, based on the operations and maintenances practices.

1.2 Background

1.2.1 ATM Operational Concept

The global air traffic management (ATM) operational concept presents the ICAO vision of an integrated, harmonized and globally interoperable ATM system. The planning horizon is up to and beyond 2025. The baseline against which the significance of the changes proposed in the operational concept may be measured is the global ATM environment in 2000.

Vision Statement

To achieve an interoperable global air traffic management system, for all users during all phases of flight, that meets agreed levels of safety, provides for optimum economic operations, is environmentally sustainable and meets national security requirements.

While the operational concept is visionary and even challenging, many of the current practices and processes will continue to exist through the planning horizon. In this sense, this operational concept document should be seen as evolutionary.

A key point to note is that the operational concept, to the greatest extent possible, is independent of technology; that is, it recognizes that within a planning horizon of more than twenty years, much of the technology that exists or is in development today may change or cease to exist. This operational concept has therefore been developed to stand the test of time.

Air Traffic Management

Air traffic management is the dynamic, integrated management of air traffic and airspace — safely, economically and efficiently — through the provision of facilities and seamless services in collaboration with all parties.

1.2.2 ATM System and Its Sub-system

The mission of ATM is to effectively maintain and promote the safety, order and smooth of air traffic. ATM includes Air Traffic Service (ATS), Air Traffic Flow Management (ATFM) and Airspace Management (ASM), as shown in Figure 1-1.

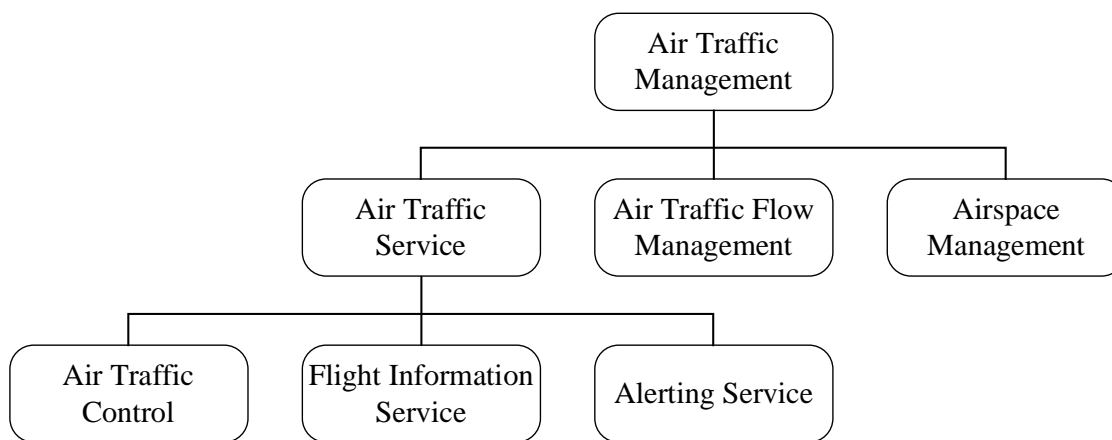


Figure 1-1 Composition of air traffic management.

ATS is the main part of ATM, which includes air traffic control (ATC), flight information service (FIS) and alerting service (ALS).

ATC is to prevent collision between aircraft and aircraft, and collision between aircraft and obstacle in maneuvering area. The object of FIS is to provide advice and intelligence helpful for flight safety and effectiveness to the aircraft in flying. ALS is to issue notices of searching for and rescuing aircraft to relevant organizations, and to assist these organizations or coordinate this work if necessary.

1.2.3 Concept of ATM Automation System

The ATM automation system mentioned in this document is mainly applied in ATC service, as well as offering assistance for ALS and ATFM. It comprises a group of processing sub-systems dedicated to specific functions, which are integrated as an air traffic management system to provide functional capabilities to air traffic controllers in the Area Control Centers (ACC), Approach (TCUs and TMAs) and towers. The ATM automation system helps controllers keeping conformance monitor, hazard monitor, and assuring safety separation to air traffic flow.

Normally, the ATM automation system has a modular design and has a distributed architecture to ensure robustness under adverse operating conditions. The modularity enables modifications to the baseline product to be made with relative ease. The principle of distributed processing ensures the safe, uninterrupted provision of Air Traffic Services by controllers.

All processing and display sub-systems are interconnected via a high capacity redundant LAN. Computers providing common services (e.g. Flight Data Processing) may be duplicated with each individual computer connected to each LAN providing a high degree of redundancy. Fail soft operation of the dual computer groups is achieved by multiple computation redundancy, (parallel operation of the computer), or hot stand-by redundancy, in order to provide an uninterrupted service to the controllers.

Popularly, considering about the safety and redundancy requirements, the ATM automation system has two individual LANs. Two of the LANs are called working LAN, where the redundancy computers connected. The working LANs keep sharing information all the time and work as main and backup mode. Besides, for the air traffic control airspace with high flight flow, it is recommended to build the third LANs. The third LAN is called service LAN, its mainly function is collecting system's trace and handle recording and playback functions, etc.

1.2.4 Challenges and Solutions

Considering about the framework for global ATM roadmap requirements and the current world situation, the ATM automation system is facing following challenges:

The system functions are stacking huge, and the system is getting more and more complex. These problems result in that the new ATM automation system is taking more time and much more effort to develop, some system functions are seldom used, the system is getting hard to maintain and spending much more money to deploy.

The outbreak of COVID-19 has a devastating impact on the economy and the aviation industry worldwide. It will not be surprising that the ICAO members, including those in the APAC Region, have to review and even reduce both their capital and operational expenses (CAPEX and OPEX) in coming years, including the expenditure in ATM automation system.

The seamless ATM Plan requires the individual ATM automation systems sharing a common set of accurate information in a timely manner, which need to interface each other seamless, and work interoperability.

To meet the above challenges, it is important to work out a specific recommendation and guidance materials of ATM automation system in main functions/performances, which aim at facilitating the implementation or provision of the robust, safe, efficient ATM automation systems. This will help the APAC regional ATM automation systems share common/core functions/performances, and achieve seamless easily. At the same time, rather than encouraging the APAC CAAs/ANSPs to invest more CAPEX/OPEX to cope with future increase in air

traffic, it is important for the APAC members to put focus on (a) application of new/innovative technologies would help making good business cases, (b) incorporating baseline/key optional features into their system design at early stage, and (c) getting ready/completing system changes during low air traffic periods, with lower costs and risks, before full traffic recovery.

1.2.5 Outcomes and Endorsements

To ensure continuous and coherent development of the ATM automation systems that is harmonized with adjacent regions to enhance systems interoperability, and to keep abreast of the latest developments in ASBU and ATM automation systems, topics pertaining to ATM automation system has been focusing and fruiting in APAC Region since 2018.

The ICAO Asia Pacific Regional ATM Automation System Symposium (APAC RATMS) was held in Nanjing, China, from 22 to 23 November 2018. The symposium successfully addressed the Action Item 54/13 of 54th DGCA Conference on ATM automation system, and it also suggested States/Administrations to consider establishment of a regional working group/task force under the ICAO CNS Sub-group of APANPIRG to deal with matters arisen from this symposium in regard to ATM automation systems. The symposium agreed to formulate an action item for the 23rd meeting of CNS Sub-group in 2019 to review and consider whether such regional working group/task force is needed.

The SURICG/4 was held in Nanjing, China from 9 to 12 April 2019. The meeting reviewed and further discussed the outcome of the ICAO APAC Regional ATM Automation System Symposium (APAC RATMS) and other SURICG/4 papers relevant to ATM automation system, and endorsed the draft Decision of **“Draft Decision SURICG/4/5 - Establishment of ATM Automation System Working Group (ATMAS/WG)”** for consideration by CNS SG.

The Twenty Third Meeting of the Communications, Navigation and Surveillance Sub-group (CNS SG/23) of Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG), was held at the ICAO Regional Office, Bangkok, Thailand, from 2 to 6 September 2019. The meeting considered the report of SURICG/4 with some other CNS SG/23 working papers, and noted that a briefing on the proposal on establishing a working group to deal with ATM automation system issue was also provided to ATM SG/7 meeting. A number of States/Administration expressed their willingness to support the work of the Task Force including: China, Hong Kong-China, India, Indonesia, Nepal, Singapore, Thailand and USA. Hence, the meeting adopted the **“Decision CNS SG/23/13 (SURICG/4/5) - Establishment of ATM Automation System Task Force (ATMAS/TF)”**.

APANPIRG/30 meeting was held from 4-6 November 2019 at ICAO APAC Office, Bangkok, Thailand, The APANPIRG/30 meeting noted with appreciation the work done and achievements by the CNS SG and the contributory bodies reporting to APANPIRG through the SG pertaining to ATM automation system. The meeting noted that CNS SG/23 meeting had adopted 9 Conclusions and 4 Decisions on technical and operational matters, including the **“Decision CNS SG/23/13 (SURICG/4/5) Establishment of the Asia/Pacific ATM Automation System Task Force (ATMAS/TF)”**.

1.3 Arrangement of RFAP of ATM AS

This Recommended Functions and Performances of Air Traffic Management Automation System consists of the following parts:

Section 1	Introduction
Section 2	Acronyms and Abbreviations

Section 3	Reference Documents
Section 4	System Functional Baseline
Section 5	System Design
Section 6	System Software Management
Section 7	System Transition
Section 8	System Maintenance

1.4 Document History and Management

The framework of this document was first introduced in the first Working Group Meeting of ATM Automation System Task Force (ATM AS TF/1) of video conference, which is held in Oct. 2020. The Meeting agreed to further develop based on the proposed framework to a complete document for approval as regional guidance document. A working team, consisting of volunteers from **member states (names of member states will be listed after decided)**, was established by the Meeting to contribute to the content of the document.

The aim of this document is to supplement SARPs, PANS and relevant provisions contained in ICAO documentation and it will be regularly updated to reflect evolving provisions. To support the ICAO in making specific recommendations and developing guidance materials, such as minimum functional/performance requirements and additional/local requirements, which aim at facilitating the implementation or provision of robust, safe, efficient and orderly ATM services by the use of existing and/or new procedures, facilities and technologies in relation to ATM automation systems.

1.5 Copies

Paper copies of this RFAP of ATM AS are not distributed. Controlled and endorsed copies can be found at the following web site: <http://www.icao.int/APAC/Pages/edocs.aspx>

Copy may be freely downloaded from the web site, or by emailing APANPIRG through the ICAO Asia and Pacific Regional Office who will send a copy by return email.

1.6 Changes to RFAP of ATM AS

Whenever a user identifies a need for a change to this document, a Request for Change (RFC) Form (see Section 1.6 below) should be completed and submitted to the ICAO Asia and Pacific Regional Office. The Regional Office will collate RFCs for consideration by the ICAO Communications, Navigation, Surveillance (CNS) Sub-group of APANPIRG.

When an amendment has been agreed by a meeting of the ICAO CNS Sub-group of PANPIRG, then a new version of the RFAP of ATM AS will be prepared, with the changes marked by an “|” in the margin, and an endnote indicating the relevant RFC, so a reader can see the origin of the change. If the change is in a table cell, the outside edges of the table will be highlighted; e.g.:

--	--	--

Final approval for publication of an amendment to the RFATP of ATMAS will be the responsibility of APANPIRG.

1.7 Editing Conventions

(Intentionally blank)

1.8 RFAP of ATM AS Request for Change Form

RFAP Nr:	
-----------------	--

Please use this form when requesting a change to any part of this RFAP of ATM AS. This form may be photocopied as required, emailed, faxed or e-mailed to ICAO Asia and Pacific Regional Office

+66 (2) 537-8199 or APAC@icao.int

1. SUBJECT:			
2. REASON FOR CHANGE:			
3. DESCRIPTION OF PROPOSAL: [expand / attach additional pages if necessary]			
4. REFERENCE(S):			
5. PERSON INITIATING:			DATE:
ORGANISATION:			
TEL/FA/X/E-MAIL:			
6. CONSULTATION		RESPONSE DUE BY DATE:	
Organization	Name	Agree/Disagree	Date
7. ACTION REQUIRE :		DATE REC'D :	
8. AIGD EDITOR		DATE :	
9. FEEDBACK PASSED			

1.9 Amendment Record

Amendment Number	Date	Amended by	Comments
0.0	Feb 2020	China	The framework of this document is firstly work out by China.
0.1			First completed draft based on the agreed document framework in XXX for review and comment by States
0.2			Based on Version 0.1 draft, States make a full comment on the XXX. This is a revised document according to those comments.

2. ACRONYMS AND ABBREVIATIONS

(To be developed)

3. REFERENCE DOCUMENTS

Id	Name of the document	Edition	Date	Origin	Domain
1	Annex 2 - Rules of the Air	10th Edition	2005	ICAO	
2	Annex 12 - Search and Rescue	8th Edition,	July 2004	ICAO	
3	Annex 11 — Air Traffic Services	15th Edition	2018	ICAO	
4	Annex 17 - Security	10th Edition	2017	ICAO	
	11th Edition	March 2020	ICAO		
5	“PANS-ATM, or Procedures for Navigation Services – Air Traffic Management (DOC 4444)	16th Edition	2016	ICAO	
6	Global Air Navigation Plan (GANP) (Doc 9750)	6th Edition	2020	ICAO	
7	Global Air Traffic Management Operational Concept (Doc 9854)	First Edition	2005	ICAO	
8	Manual on Air Traffic Management System Requirements (Doc 9882)	First Edition	2008	ICAO	
9	Manual on Global Performance of the Air Navigation System (ICAO Doc 9883)	First edition	2009	ICAO	
10	Doc 10031 Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes	First edition	2014	ICAO	
11	Restricted — Air Traffic Management Security Manual(Doc 9985)	First edition	2013	ICAO	
12	Air Traffic Services Planning Manual (Doc 9426)	4th Edition	2007	ICAO	
13	Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9574)	4th Edition	2013	ICAO	
14	Performance Based Navigation (PBN) Manual (Doc 9613)	4th Edition,	2013	ICAO	

15	Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689)	2nd Edition	2007	ICAO	
16	Manual of Air Traffic Services Data Link Applications (Doc 9694)	5th Edition	2010	ICAO	
17	Manual on Flight and Flow — Information for a Collaborative Environment (FF-ICE) (Doc 9965)	First edition	2012	ICAO	
18	Manual on Simultaneous Operations or Parallel or Near-Parallel Instrument Runways (SOIR) (Doc 9643)	2nd Edition	2020	ICAO	
19	Asia/Pacific Regional Interface Control Document (ICD) for ATS Interfacility Data Communications (AIDC)	Version 3.0	2007	ICAO APAC	
20	The Revised ADS-B Implementation and Operations Guidance Document (AIGD) Adopted by CNS SG/23 September	Version 12.0	2019	ICAO APAC	
21	The Mode S DAPs Implementation and Operation Guidance Document Adopted by CNS SG/23 September 2019	Edition 1.0	2019	ICAO APAC	

4. SYSTEM FUNCTIONAL BASELINE

The functional baseline, forming the core of the ATM automation system, are broadly described as those which are involved with the processing and display of operational information that will be used in providing an alerting, flight information and separation service to aircraft.

4.1 System Compulsory Functions

The compulsory functions are the necessary functions of ATM automation system.

4.1.1 Surveillance Data Processing Function (SDP)

The Surveillance Data Processing function receives and processes surveillance data, including single and multiple radar data can form a single radar track and conduct tracking processing, and also can process multi-radar coupling, multi-radar target data fusion.

4.1.2 Flight Data Processing Function (FDP)

The Flight Data Processing Function receives and processes flight information data from different sources including AFTN line, SITA line, database, Human Machine Interface Function input and so on. This function follows the progress of a flight through the system, and use relevant data to dynamically optimize 4-D trajectory planning and operation, provides accurate flight information to controllers, and interacts with Human Machine Interface Function.

4.1.3 Bypass Surveillance Data Processing Function (BSDP)

The Bypass Surveillance Data Processing Function receives and processes bypass e radar data. This function distributes bypass surveillance data to the system in case of failure of the Surveillance Data Processing Function, acting as a redundancy in the system.

4.1.4 Correlation of Surveillance and Flight Data

The Correlation of Surveillance and Flight Data Function combines surveillance data and flight data, establishing an association between a surveillance track and a flight plan, based on the surveillance track's and the flight plan's identification codes, as well as the surveillance track's position in relation to the plan's route.

4.1.5 Alerts and Warning Function

The Alerts and Warning Function provides many alerts and warnings to controllers that are mandatory features of a safe operational system. The presentation of alerts and warnings to controllers occurs through audible alarm, color change and warning text.

MSAW: The Minimum Safe Altitude Warning function detects and advises controllers of impending penetrations of hazardous airspace by aircraft (aircraft to ground conflict).

STCA: The Short-term Conflict Alert function detects and advises controllers of impending violation of separation standards between two aircraft (aircraft to aircraft conflicts).

APW: The Area Proximity Warning function detects and advises controllers of impending penetrations of danger areas to aircraft traffic, (aircraft to airspace conflict).

Approach Path Monitoring Warning Function (APM) : The Approach Path Monitoring Warning Function informs the controller the aircraft detected to be outside the predefined approach path profile

Departure Path Monitoring Warning Function (DPM) : The DPM monitors the flight trajectory of departing aircraft from each runway and generates visual and audio warning when a departing associated track leaves the required track keeping tolerances.

4.1.6 Meteorological Information Processing Function

The Meteorological Information Processing Function receives and processes meteorological information, including QNH and GRIB. This function takes meteorological messages into flight computation, when necessary.

4.1.7 Air Ground Data Link Function (AGDL)

The Air Ground Data Link Function manages dialogue between pilots and controllers by the PILOT-CONTROLLER two-way data link, and handles ADS-C reports to establish ADS-C tracks. The Functions support ATS applications, such as Controller–Pilot Data Link Communications (CPDLC), Automatic Dependent Surveillance - contract (ADS-C) and departure clearance (DCL).

4.1.8 Variable System Parameter Management Function

The Variable System Parameter Management Function enables the system optimized by the use of Variable System parameter (VSP) settings that can be handled offline and online by specific position.

4.1.9 ATS Inter-facility Data Communication Function

The ATS Inter-facility Data Communication Function receives and processes AIDC messages, enabling flight handover between different ATM Automation systems.

4.1.10 Human Machine Interface Function (HMI)

The Human Machine Interface Function provides an environment whereby the controller is able to comfortably use the hardware and software technology as tools to enhance the air traffic control service.

4.1.11 Recording and Playback Function

The Recording and Playback Function enables the recording of operational data and allows playback of air traffic situations for subsequent analysis. Normally, the playback function is required to be synchronized with voice.

4.1.12 System Monitoring and Controlling Function

The System Monitoring and Controlling Function provides monitoring and control facilities for the system.

4.1.13 Software Version Management Function

The Software Version Management Function provides a tool to manage software patch and version, for system upgrade and rollback.

4.1.14 GNSS Time Synchronization

The GNSS Time Synchronization Function enables the system to synchronize with external GNSS time signals, and ensures that all components of the system are time synchronized.

4.2 System Optional Function

For the air traffic control airspace with high flight flow, the ATM automation system optional functions can be added according to the requirements of the air control operation. The optional functions, playing a decisive and strategic role in system, enhance the operational and technical capacity of the ATM automation system.

4.2.1 Extended Surveillance Data Processing

ATM automation system should be capable of processing multi-source surveillance data such as ADS-B, WAM, MODE S RADAR, etc.

The system should also be capable of processing DAPs in surveillance data.

4.2.2 Extended Correlation

The extension correlation function should use the ICAO 24-bit aircraft address, aircraft identification and the Mode 3/A code to correlate an aircraft's track with flight plan.

4.2.3 Extended Alerts and Warning

Multi Runway NTZ Alert Function : The Multiple Runway NTZ Alert Function informs the controller if a track is predicted to infringe an NTZ area within a predefined time interval, or has already infringed an NTZ area in multiple runways mode.

Medium Term Conflict Detection Warning Function (MTCD) : The purpose of the MTCD function is to provide information on present and future loss of separation between two aircrafts for executive controllers, at a tactical time horizon. MTCD facilitates a more pro-active air traffic control, thereby balancing more evenly the workload of tactical and planning tasks, enhancing sector team efficiency and providing an even safer and better service to airspace users. By maximizing the opportunity of pro-actively solving problems during sector planning especially between smaller and highly-sectorized airspaces, it is hoped to reduce tactical workload of air traffic controllers.

Route Adherence Monitoring (RAM): Route Adherence Monitoring (RAM) capability shall check if an aircraft (i.e. surveillance track) is following the planned route, as stated in the associated flight plan.

Cleared Level Adherence Monitoring (CLAM) checks the conformance of the actual flight level of a surveillance track with respect to the Cleared Flight Level.

Departure No Transgression Zone (DTZ) Warning. This function informs the controller if a track is predicted to infringe a Departure No Transgression Zone area within a predefined time interval, or has already infringed a Departure No Transgression Zone area.

Similar Callsign Warning Function (SC) : The Similar Callsign Warn Function informs the controller if aircraft carries similar callsign with other one in sector.

Reduced Vertical Separation Minimum Warning Function (RVSM) : The Reduced Vertical Separation Minimum Warning Function inform the controller if the aircraft competent of RVSM capacity.

Position Report Monitoring (PMON) Warning. The PMON alerts the controller when the ATO and/or ETO next point stated in the position report differ from that calculated by the flight trajectory by more than a defined time interval.

4.2.4 Downlink Aircraft Parameters Processing and Display Function

Downlink Aircraft Parameters can be obtained from Mode S data link or ADS-B broadcast data. The former Application is called Mode S DAPs, and the latter Application is called ADS-B derived data (ADS-B ADD). All these data come from different registers of aircrafts' avionics system, which include aircraft identification, flight status, operation and etc. These data can be used by ATM AS to improve many functions.

24-Bit Code Mismatch Warning: When the 24-bit code of the coupled surveillance track does not match the 24-bit code of the FDR, an ICAO 24-bit code mismatch warning shall be presented to the responsible controller.

Callsign Mismatch Warning: When the callsign of the coupled surveillance track, if available, does not match the callsign of the FDR, a callsign mismatch warning shall be presented to the responsible controller.

SFL/CFL Mismatch Warning: The Predicted Level Mismatch (PLM) function Should be continuously monitored the consistency of Selected Altitude from the airborne equipment and the Cleared Flight Level from controller and notify the controller of inconsistency.

Resolution Advisory (RA) alert indication: When a RA alert is established by airborne ACAS system for a risk of collision, on the ATM automation system, RA report via DAPs is gained and processed, and a RA notification is presented on the track label to the responsible controller.

Downlink Aircraft Parameters (DAPs) display window : The Downlink Aircraft Parameter Function provides downlink aircraft parameters from Mode S Radar or ADS-B.

4.2.5 AMAN

The Arrival Management Function generates advisories for the controller and provides functions including automatic runway allocation and separation calculation to properly expedite the incoming traffic to the managed airports and runways, aimed at reducing the workload of the supported sector controllers, as well as minimizing the aircraft delays and excessive fuel consumption.

4.2.6 System Log Management Function

The System Log Management Function manages system hardware and software logs.

4.2.7 Enhancement Record and Replay Function

The Air Traffic Situation Scenario Record and Replay Function enables controller position screen recording in common video file format (MP4, WMV, MOV, AVI ,etc) and

corresponding video-replaying. This function provides exact human machine interface recording and replaying.

4.2.8 Re-categorization Function

The Re-categorization Function provides wake turbulence re-categorization function to optimize the separation minimum between aircraft, based on safety as priority.

4.2.9 Operational Data Synchronization Function

In order to provide continuous ATM service in case of the working ATM AS suffering with technical problems, system failures or other critical anomalies, some ATM centers are configured with two types ATM automation systems, which works in main and backup mode.

The Operational Data Synchronization Function serves for both master and backup ATM automation systems deployed in the same ATM center. This function enables the system to synchronize operational data to backup system when in master mode. This function also synchronizes the system when in backup mode with operational data from other master system.

4.2.10 Statistics and Analysis

Statistical Analysis Function provides statistical analysis based on surveillance and flight data originated or utilized by ATM automation system. This function involved tabulating and depicting of ATC operational data, based on flexible time slot.

5. SYSTEM DESIGN

5.1 System Architecture

Considering about the safety and redundancy requirements, the network of ATM automation system is recommended to build with A and B dual network structure. Besides, for the air traffic control airspace with high flight flow, it is recommended to build a large scale ATM automation system and add service network C to provide a higher level support. Network A / B are the redundant working LAN, which is used to transmit surveillance data, flight plan and other operational data. Network C is a separate service LAN, which is used to transmit bypass surveillance data, system log and replay data.

The system software should adopt modular designation and distributed architecture to ensure robustness under adverse operating conditions. Different software functions should be deployed on independent servers, and each individual sever connects to the redundancy network. For the key function modules, such as FDP and SDP, should be deployed on dual redundancy servers. Hot stand-by redundancy is achieved by the dual computer groups to ensure the safe, uninterrupted provision of Air Traffic Services by controllers

5.2 Position Roles and Types

The system positions may include: controller position, tower position, supervisor position, backup controller position, flight plan position, system monitoring position, technical supervisor

position, software data management position, flow management position, coordination position, military coordination position, search and rescue position , operational supervisor position, NTZ monitor position. The position types and quantity can be configured according to the operational situation on each site.

5.3 Main and Backup Configuration

For the air traffic control airspace with high flight flow, the operational site requiring a higher level of support, it is recommended to build two sets of ATM automation systems (Main and Backup) simultaneously as the baseline. The Backup system should keep the consistent position scale, system configuration and software function with the Main system. In addition, the Main/Backup data synchronization function should be provided to ensure controllers can switch to the Backup system seamlessly in case of Main system failures.

For the ATM Automation systems handling busy and high density airspaces, it was recommended provision of the main and fallback ATM automation systems with same functions, capability and capacity but in separated systems in order to enhance robustness and continuity in provision of safe, efficient and orderly ATM services. In the APAC Region with high growth in air traffic, disruption to air traffic is not an option. As a best industry practice, the main and fallback systems with compatible data synchronization scheme should be able to switch their main and fallback roles seamlessly once required and regularly for use by ATC controllers and air traffic engineers. To further enhance resilience and mitigate risks for users handling high air traffic demands, if main and fallback systems were with same functions, capability and capacity provided under the same manufacturer, an ultimate fallback system provided from different manufacturers could be a necessity. All in all, avoiding common software failure across main / fallback / ultimate fallback systems should be a critical consideration for system configuration design.

Should the ATM Automation systems of States/Administrations have not yet equipped with ultimate fallback systems, States/Administrations may consider to take chance of low traffic before traffic recovery by 2024. Likewise, if States/Administrations already have ultimate fallback systems, it could be a chance to plan to upgrade it with same capacity as Main/Fallback to cope with anticipated traffic recovery by 2024.

5.4 System Operational Mode

The system should have normal and degraded working modes. When the whole system key functions work normally, the HMI shows system in normal mode. When the system key function (such as FDP or SDP) is failure, the system should automatically change from normal mode to degraded mode. Therefore, the user could be noticed in HMI.

For the site which equipped with Main/Backup systems, the system should also have Main and Backup modes. In the Main operation mode, the system can process AFTN messages, assign SSR codes, and output flight plan data to the Backup system. In the Backup operation mode, the system does not carry out the above processing, but receives and processes the flight plan information from the Main system. It is suggested that the Main/Backup modes should be manually switched by the user at the special position.

5.5 Capacity and Performance

5.5.1 System Design Capacity

The technical indicators of system design capacity can also be distinguished according to the volume of air traffic control airspace flow, such as high level indicator requirements and low level indicator requirements can be proposed.

The technical indicators shown in the table are the minimum recommended values.

Indicator name	high level requirements	low level requirements
System coverage	4096km*4096km	2048km*2048km
Maximum number of sectors	48	20
Maximum number of UCS	120	40
Simultaneously controlled aircraft	1500	750
Number of restricted areas	256	128
Maximum adjacent AIDC control centers	40	20
Server, workstation CPU load average	20%	20%
Server, workstation CPU maximum load	40%	40%

5.5.2 System Time Performance

The system time performance indicators shown in the table are the minimum recommended values.

Performance parameter name	high level requirements	low level requirements
Single workstation cold start time	5min	5min
Cold start time of the entire system station	10min	10min
MTBF of surveillance data processing	100000hours	100000hours
MTBF of a single workstation	10000hours	10000hours
Maximum clock synchronization error	100ms	100ms

5.5.3 Performance of Surveillance Data Processing

The performance of surveillance data processing indicators shown in the table are the minimum recommended values.

Surveillance data processing performance indicators		high level requirements	low level requirements
Root Mean Square Error of Aircraft Position	Straight flight	200m	200m
	Turn flight	450m	450m
Maximum aircraft position error	Straight flight	500m	500m
	Turn flight	1100m	1100m

The maximum number of tracks in the system	2048	1024
Maximum number of radar inputs	48	16
Maximum number of ADS-B inputs	8	8
System track refresh cycle	≤5s	≤4s

5.5.4 Flight Data Processing Capacity

The capacity of flight data processing indicators shown in the table are the minimum recommended values.

The capacity of flight data processing	high level indicator requirements	low level requirements
Number of flight plans	10000	3000
Activate the flight plan Simultaneously	3000	1000

5.5.5 Record and Playback Function Capacity

The record and playback function capacity indicators shown in the table are the minimum recommended values.

The record and playback function capacity	high level indicator	low level requirements
Minimum time for data retention in the system	31d	31d
Record historical flight plans and AFTN messages	3months	3months

5.6 External Interface

The ATM automation system shall be able to receive and process data from radar sensor, ADS-B, WAM, AFTN, GRIB. Besides, the system shall provide interfaces to Voice Replay System interface, Adjacent ATC centers, Time Signals from GNSS, etc.

5.7 Systems Interoperability

The systems interoperability function enables ATM automation system to exchange data and interact with other ATM automation system, A-SMGCS, Tower electronic strip system, etc.

5.8 Cyber Threats and Mitigation

Cyber threats and mitigation prevent system from suffering cyber-attacks, intrusions, data theft, and the other potential risks in the interconnection environment.

With the extensive deployment and closer interconnection of Commercial-Off-The-Shelf (COTS) Information and Communications Technology (ICT) Systems which is built on common standards rather than on the conventional proprietary equipment, Air Navigation Service Providers (ANSPs) have been facing increasing challenges to manage potential risks arising from cyber security threats. To address the growing concerns on cyber security threats, ICAO published Doc 9985 “ATM Security Manual” in 2013 setting out the principles and guidelines for protecting ATC system infrastructure. States are encouraged to pursue appropriate level of compliance to the cyber security control requirements as stated in the ICAO Doc 9985 ATM Security Manual and make collaborative efforts to effectively address cyber security threats.

Experience from States and Administrations, such as presented in *WP19 of APANPIRG/27 Implementation of Effective Cyber Security Measures to Achieve a Safe, Secured and Efficient Air Traffic Control System by Hong Kong, China*, could be referred on the establishment of management framework in addressing challenges from cyber security threats. This Paper shared the key elements of an effective cyber security management framework for a safe and secured ATC system as well as the latest status achieved by Hong Kong, China in pursuing the ICAO’s ATM Cyber Security Manual.

From experience from Hong Kong, China, it is suggested to establish relevant Committee and Working Group to steer for proactive implementation of effective cyber security measures for their ATC system in Hong Kong. In preparing the transition to the new ATC Centre, a series of verification tests and inspections on the design and implementation of the new ATC system were conducted over the past few years both internally by the subject matter experts, as well as independent cyber security audits carried out by the external consultants from different perspectives.

6. SYSTEM SOFTWARE MANAGEMENT

The ATM automation system software management consists of system requirements analysis and management, system fault management, software release & patch management, etc. The purpose of system software management is to build a robust and practical ATM automation system, and keep it in the good operative mode in whole lifecycle.

6.1 System Requirements Analysis and Management

The objective of system requirements analysis and management is to ensure the quality, effectiveness and consistency of ATM automation systems’ requirements, building robust and practical system with updated technologies to meet the challenge of civil aviation development.

6.2 System Fault Management

The ATM automation system fault management includes fault recording, fault diagnosis, fault handling, troubleshooting, etc.

6.3 Software Release & Patch Management

Software release & patch management focuses on software modification and test management to ATM automation system, in order to maintain system software stability in multi-sites, reduces system running risks.

7. SYSTEM TRANSITION

System Transition is the switch of automation system from old version to the new one. There are two types of transition. One is the software transition in which case there are almost no changes of the hardware. The other one is overall transition. The whole system will be transit to the new one with new hardware and new software.

7.1 Transition Plan and Assessment

Before the transition, the technical department and controller department should map out a scheme including the next information at least:

- The preconditions of transition;
- The necessary cooperation between technical department, controller department and other support departments;
- Operational procedure;
- The emergency plans.

7.2 Transition Rehearsal

To make sure the success of transition, rehearsals are necessary before implementation. During these rehearsals, all the departments should act according to the operational procedure. The purpose of rehearsal is to find out whether the operational procedure is smooth and the cooperation between departments is perfect.

7.3 System Operational Check

To ensure the transition successfully, a check list is necessary to make sure the new system work well. The list should include the technical tests and controller tests. The technical tests mainly focus on the interface test, network test and system monitor test. The controller tests pay attention to the controller functions including flight plan, system tracks, coupling, system warning, and HMI operations.

7.4 Flight Check for System Performance Acceptance

To ensure the performance of multi-sensor tracker for non-manoeuving and manoeuvring aircraft shall be equal to or better than system specification and global/national requirements in performance specification for surveillance applications, such as *EUROCONTROL Specification*

for ATM Surveillance System Performance, flight checks are recommended for system performance verification and acceptance.

A recommended check list is provided below to make sure the relevant items for multi-sensor tracker performance could meet the basic requirements for ATM Surveillance System, including but not limited to:

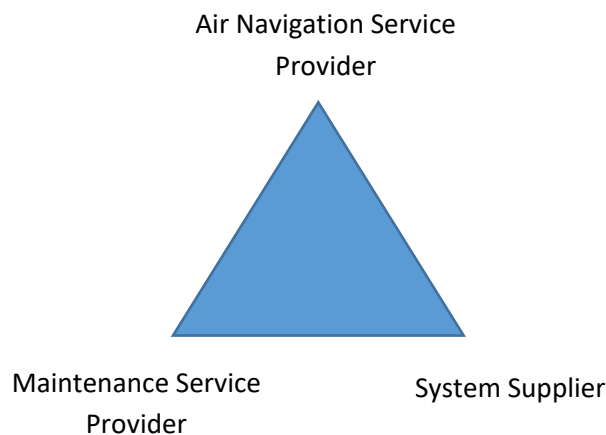
- Measurement interval for probability of update assessments
- Probability of update of horizontal position
- Ratio of missed position involved in long gaps
- Horizontal position RMS error, including
 - Total horizontal RMS error (m)
 - Ground speed RMS error (kt)
 - Course RMS error (deg.)
 - Ground speed std. dev. (stability) (kt)
 - Course std. dev. (stability) (deg.)
 - Probability of update of pressure altitude with correct value
 - Forwarded pressure altitude average data age
 - Forwarded pressure altitude maximum data age
 - Ratio of incorrect forwarded pressure altitude
 - Pressure altitude unsigned error
 - Delay of change in emergency indicator/SPI report
 - Delay of change in aircraft identity
 - Probability of update of aircraft identity with correct value
- Ratio of incorrect aircraft identity
- SSR Code Change Time in selected waypoints
- Flight Route Accuracy in Position Check in selected waypoints in flight profile, on difference combinations of sensors selectable for contributing to MST.

8. SYSTEM MAINTENANCE

As ATM automation system could comprise of provisions from different manufacturers, a robust and systematic maintenance management and practice should be set up with close cooperation with the system supplier, the maintenance service provider (MSP as the frontline maintenance agent, as well as the air navigation service provider (ANSP) as the system management authority, the contract management agent and the end-user to ensure the performance of the system.

Trio for Maintenance Management

Under the maintenance framework for ATMS, the system supplier, MSP, and ANSP form a close coordination trio in operating and supporting the maintenance framework.



8.1 System Supplier

The design of system plays a critical part for ease of maintenance in operation stage. Before system commissioning, system supplier as the entity with the most comprehensive know-how on the system, should provide sufficient maintenance documentation and training to ANSP and MSP containing complete information for the proper installation, set-up, use, operation, support and maintenance of the system.

System supplier should provide documentation to the ANSP and MSP for aiding the use, application and maintenance of the system and individual equipment. These documentation should include:

- i) operating handbooks and user manuals for operating procedures and system functionalities for use by controllers, supervisors, assistants and support specialists;

ii) technical literature for full technical description of configuration and operation in the system as well as full details of each system component, block diagrams with data flow, mechanic and wiring schematic diagrams, as-built drawings etc.; and

iii) service and maintenance manuals including system setup, optimization and parameterization, preventive maintenance procedures (system checking and rebooting, calibration, cleaning, housekeeping, etc.) with recommended frequencies, and troubleshooting procedures in hardware and software (recommended solution and flow chart to identified issues, handling of alarms and error messages, etc.).

All documentations should be reviewed and endorsed prior to use.

System supplier should prepare training plans and training course materials to ANSP and MSP for review with sufficient lead time prior to critical milestones, such as commencement of design review, factory/site acceptance tests, and ATC operational train-the-trainer course. ANSP, in coordination with MSP, has to set out the required training topics in the contract to system supplier. Training topics should be specific to different user groups.

Subject to actual needs, after ANSP and MSP have built up their own training capability, on-site maintenance review and assessment on MSP should be conducted by system supplier after commissioning on regular basis, with more frequent training/assessment as needed during the start-up and run-in period after commissioning.

As ATMS is a complex system, it is unavoidable that unexpected technical issues might emerge, especially teething issues during the early stage of operation. As such, system supplier should be required to respond to requests from ANSP or MSP to provide timely assistance in dealing with and rectifying all faults or deficiencies in software and hardware within pre-defined response time according to the criticality of such faults or deficiencies as specified in the contract. Same faults occur repeatedly should be handled with high priority by system supplier to investigate root cause and implement measures to prevent recurrences.

As technology is changing rapidly, some spare parts might become obsolete and will be difficult to source in the market. System supplier should provide a list of obsolete equipment and its replacement models on regular basis, and the replacement model should be evaluated on-site for its compatibility prior to use as a spare for operation.

The performance of system supplier has to be regularly reviewed in suitable forum, such as performance review meetings in conjunction with ANSP and MSP representatives.

System supplier should form user groups to allow sharing of users' experience and gather feedbacks. System supplier should facilitate regular hosting of user group meetings.

8.2 Maintenance Service Provider (MSP)

Engagement of a MSP to perform frontline maintenance under supervision of ANSP is a practical solution in leveraging skill sets and latest technology available in private sector in order to facilitate provision of reliable services with cost benefit.

Under the regime of compliance to all applicable ordinances and regulations, Safety Management System and Air Traffic Safety Electronics Personnel (ATSEP), the maintenance services provided by MSP should include, watch-keeping of equipment, preventive/corrective maintenance, system/equipment minor modification/replacement works, staff training, and procurement of spares and test equipment/ tools. Support services such as record-keeping on maintenance activities, preparation of statistics and reports and inventory control etc. could be provided as part of the package from MSP.

MSP needs to perform maintenance according to system supplier's established procedures at recommended intervals, including health checks on system, servers, equipment and workstations, critical data backup and log capture/review for hardware, software, user management and other activities, system parameters and user preference checks and backup, regular clean-up and reboots of hardware including servers and workstations etc. Proactive system housekeeping procedures adopting industry best practice with recommendation from system supplier and expertise from MSP, together with close monitoring of system healthiness/system resources, and housekeeping of servers/workstations on regular basis to upkeep the system performance, should be in place.

There could be cases that due to local specific environment/operational status of the ATMS, it would require extra steps or more frequent maintenance on top of recommended maintenance procedures by system supplier. MSP, who looks after the system day-by-day and is familiar with local environment, would contribute their expertise for adapting the maintenance procedures to fit into the local needs after consulting the system supplier.

In addition, like any critical systems running on round-the-clock basis, ATMS has no exception that it might encounter system fault where immediate attention from MSP is required. For example, a server breakdown after a software bug is hit with no or little pre-alerts. It is important that MSP has geared up with a full deck of operational instructions for their watch-keeping staff to handle all sorts of foreseeable system scenarios with proper initial and re-fresher trainings/drills on such scenarios. The build-up of know-how and experience for MSP in dealing with urgent scenarios is crucial to smooth operations of the ATMS.

Similar to system supplier, the service level of performance of MSP has to be constantly monitored to meet with the target levels set out in the contract and regularly reviewed in suitable forum, such as operations & maintenance review meetings in conjunction with ANSP representatives to ensure maintenance provisions could meet the service needs.

8.3 Air Navigation Service Provider (ANSP)

As the party to govern maintenance service performance by MSP and system supplier through various means discussed above, ANSP has to ensure the necessary support and resources to be provided to MSP and system supplier for fulfilling, or even exceeding, the baseline maintenance requirements set out in the contracts with these parties. For example, timely certification of invoice and payment in accordance with the contract requirements against their performance. Payment deduction might be incorporated into the contract to handle cases where performance does not meet requirements but it might bear impacts on maintaining good relationship with MSP or system supplier.

ANSP has to ensure the services provided by MSP and system supplier are in compliance with ICAO standards and international best practice. ANSP can share experience and best practice gained from ICAO and international meetings/ symposia/ seminars, as well as overseas facts-finding visits, with MSP and/or system supplier with a view to enhancing the maintenance regime.

To allow air traffic control (ATC) professionals to perform their work safely and satisfactorily, it is highly desirable for ANSP engineering professionals to understand the ATC needs such that the ATMS could fully support their work. As such, constant communications with ATC in addressing their needs via suitable steering forums and communication channels would be critical to the smooth operations on ATMS. Following the commissioning, an ATMS technical team comprising ANSP engineering professionals, system supplier and MSP was established with regular meetings with ATC to oversee system performance and deployment of software builds/system adaptation updates to ensure smooth operation of the ATMAS.

SWIM TF/4 Appendix A. Revised Task Group

Groups	Task No.	Subject/Task	Task Leads
Implementation Planning	1	Regional implementation philosophy & roadmap (combined previous Task 1-1 and Task 1-2)	David Leow (Singapore) & Amornrat Jirattigalachote (Thailand)
SWIM infrastructure	2	Regional SWIM infrastructure (previous Task 1-8)	Xiaodong Lu (Japan), Yukinobu Ryu (Japan), Henry Chan (Hong Kong, China)
	3	Security service (New task)	TBD & Joe Jones (USA)
Technical Architecture	4	Development and maintenance of regional information exchange models (previous Task 1-6)	Amornrat Jirattigalachote (Thailand) & Wen Zhu (USA)
Governance	5	Governance (Policies and Procedures) (combined previous Task 1-4, Task 1-5, Task 2-1-2, Task 2-1-4)	Jiseok Kang (ROK), Mark Kaplun (USA), Yukinobu Ryu (Japan), Xiaodong Lu (Japan), Honglei Gao (China)
Information Services	6	Information services (previous Task 1-2)	Joe Jones (USA) & Marco Kok (Hong Kong, China)
Validation & Demonstration	7	SWIM in ASEAN Demonstration (previous Task 2-1-1)	David Leow (Singapore) & Amornrat Jirattigalachote (Thailand)
	8	SWIM services and application validation (previous Task 2-1-3)	Yukinobu Ryu (Japan), Xiaodong Lu (Japan), Honglei Gao (China), Jiseok Kang (ROK)
Coordination and Promotion	9	Monitoring of Panels' work (previous Task 1-7)	Yukinobu Ryu (Japan)
	10	Regional coordination and SWIM-related information sharing (previous Task 1-3)	John Moore (IATA)
	11	SWIM implementation education and promotion (New task)	TBD