INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

FINAL REPORT OF THE WEBINAR ON IMPLEMENTATION OF ATM AUTOMATION SYSTEM AND THE THIRD MEETING OF THE ASIA/PACIFIC AIR TRAFFIC MANAGEMENT AUTOMATION SYSTEM TASK FORCE (ATMAS TF/3)

Video Tele-Conference (VTC)

7 – 10 June 2022

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

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

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PART I – HISTORY OF THE MEETING

1. Introduction

1.1. The Webinar on Implementation of ATM Automation System and the Third Meeting of the Asia/Pacific Air Traffic Management Automation System Task Force (APAC ATMAS TF/3) were held *from 7 to 10 June 2022* via Video Tele-Conferencing (VTC).

2. Attendance

2.1 The Webinar was attended by One hundred and ninety-five (195) participants from Twenty (20) States/Administrations, Three (3) International Organizations, and Five (5) System Providers from the industry. The Meeting was attended by One hundred and eighty-five (185) participants from Nineteen (19) States/Administrations, Three (3) International Organizations, and Five (5) System Providers from the industry, namely Australia, Bangladesh, Cambodia, China, Hong Kong China, Fiji, India, Indonesia, Malaysia, Mongolia, New Zealand, Pakistan, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand, USA, Viet Nam, CANSO, IATA, ICAO, the Chengdu Civil Aviation Air Traffic Control Science & Technology Co., LTD (CDATC), Chinney, Frequentis, Saab, and Thales. The list of participants is provided in **Attachment 1**.

3. Opening of the Meeting

3.1 The meeting was opened by Ms. Xie Yulan, Deputy Director General of North China Regional Air Traffic Management Bureau of Civil Aviation Administration of China, Co-Chair of ATMAS TF. Ms. Xie Yulan welcomed the participants and mentioned that although this task force could only have virtual meetings due to the impact of the Covid-19 pandemic, many significant achievements have been made, including the Terms of Reference, drafting the ATMAS Implementation and Operations Guidance Document, and continuously exchanging experiences in advanced technology applications, etc. She expressed deep gratitude to the CNS officers of ICAO APAC Regional Office and all States/Administrations for their hard work in preparing this meeting and great contribution to this task force and wished the meeting a complete success.

3.2 Mr. Kwek Chin Lin, Chief ATC Specialist (Systems Development), Civil Aviation Authority of Singapore, Co-Chair of ATMAS TF, extended a warm welcome to all participants. Mr. Kwek Chin Lin noted that even though all the meetings thus far were virtual, no effort had been spared and significant progress has been made by this task force, notably on the ATMAS IGD. He was happy to note that despite the COVID situation, the meetings were well attended with a very large number of attendees and sharing of information. He encouraged the participants of this meeting to actively participate in the discussions.

3.3 Mr. Luo Yi, Regional Officer CNS, reiterated that the ATM automation system is a critically important element among the enabling technical means in supporting air navigation, wished this meeting could benefit our civil aviation community through proactive actions in this area by contributing individual ideas from defining the agenda for the next meeting (ATMAS TF/4) in 2023, and also expressed deep gratitude for the support from industries.

4. Officers and Secretariat

4.1 Ms. Xie Yulan, Deputy Director General of North China Regional Air Traffic Management Bureau of Civil Aviation Administration of China, and Mr. Kwek Chin Lin, Chief ATC Specialist (Systems Development), Civil Aviation Authority of Singapore co-chaired the meeting.

4.2 Mr. Luo Yi, Regional Officer CNS, and Ms. Zhong Wenhan (Nancy), Regional Officer CNS, ICAO Asia and Pacific Regional Office, acted as the Secretaries for the meeting with the support of Mr. How Sze Lung, Regional Officer CNS, and Ms. Varapan Meefuengsart, the Programme Assistant of the same office.

5. Organization, Working Arrangements, Language and Documentation

5.1 The meeting was met as a single body during the meeting. The working language for the meeting was English inclusive of all documentation and this Report. The meeting considered Ten (10) Working Papers, Sixteen (16) Information Papers, One (1) Presentation, and One (1) Flimsy under its Eight (8) Agenda Items. A List of Working Papers, Information Papers, Presentation, and Flimsy is provided in **Attachment 2**.

6. Webinar on Implementation of ATM Automation System

6.1 The Webinar on Implementation of ATM Automation System was organized in conjunction with the ATMAS TF/3 meeting on 7 June 2022. The Webinar was opened by Mr. Luo Yi, on behalf of the ICAO APAC Regional Director, he welcomed the participants and colleagues responsible for ATM Automation systems in States/Administrations of APAC Region, and the industries. The Webinar was conducted in two sessions, the Session 1 focused on Practices Experience Sharing, while the Session 2 focused on System Integration and Interoperability. It provided the APAC region an update on the latest developments and practices related to ATM automation systems at global and regional levels. The Webinar received 8 comprehensive presentations from contributors as shown in the Webinar Program in **Attachment 3**.

6.2 Ms. Xie Yulan, Deputy Director General of North China Regional Air Traffic Management Bureau of Civil Aviation Administration of China, and Mr. Kwek Chin Lin, Chief ATC Specialist, Civil Aviation Authority of Singapore facilitated the Webinar as moderators.

6.3 The Webinar shared the views and practices in proactive ATM automation system implementation, including a regional perspective on ATM automation system implementation, research and realization of continuous operation on main and backup ATM automation systems in China, integrated tower system technologies for streamlining tower operation from Chinney, and practice sharing of A-SMGCS lighting guidance application in China.

6.4 The Webinar also introduced the ATM automation system interoperability and new technologies from ANSPs' and industries' perspectives, which includes ATM system interoperability - a Thales perspective, integrated AMAN/DMAN/SMAN technologies for enhancing ATC operational efficiency and airport security services from Frequentis, the journey towards digitalization in ATM from Saab, and application of forewarning based on CFL from China.

6.5 The presentations were all well received by the attendees and there was active participation from the attendees who raised a number of questions which were discussed and clarified by the presenters. The presentation materials can also be accessed by the following link: https://www.icao.int/APAC/Meetings/Pages/2022-ATMAS-TF3--.aspx

6.6 In closing the Webinar, Mr. Luo Yi extended sincere gratitude to Co-Chairs and the experts from Air Traffic Management Bureau for the excellent guidance and the sharing of knowledge and experience, and expressed appreciation for the support from industries.

7. Draft Conclusions, Draft Decisions and Decisions of ATMAS TF – Definition

7.1 ATMAS TF recorded its actions in the form of Draft Conclusions, Draft Decisions and Decisions within the following definitions:

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

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

Decisions of ATMAS TF that relate solely to matters dealing with the internal working arrangements of ATMAS TF.

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PART II - REPORT ON AGENDA ITEMS

Agenda Item 1: Adoption of Agenda

1.1. The provisional agenda presented in **WP/01** was adopted by the meeting as the agenda items for the meeting.

Agenda Item 2: Review of Outcomes of Relevant Meetings

Review of Relevant Meetings - Sec (WP/02)

2.1. The paper summarized relevant information and updates with the highlight on the reviewed outcomes of ATMAS TF/2, and relevant discussions of other meetings of CNS SG/25 and APANPIRG/32. The CNS SG/25 meeting adopted **Eight** (8) Conclusions and **Five** (5) Decisions. In addition, based on the outcome of discussions on various agenda items, the CNS SG/25 meeting developed Four (4) Draft Conclusions for consideration by APANPIRG/32 Meeting, which was adopted by APANPIRG/32.

2.2. The meeting noted the Conclusions/Decisions adopted by CNS SG/25, including Dissolution of APA TF (Decision CNS SG/25/16) and Revised ATMAS TF Terms of Reference (Decision CNS SG/25/17), and also reviewed the different Conclusions and Decisions adopted by APANPIRG/32 in December 2021 of interest to the task force and discussed the follow-up.

Outcomes of SURICG/7 – Sec (WP/09)

2.3. The Seventh Meeting of the Surveillance Implementation Coordination Group (SURICG/7) was held from *24 to 27 May 2022* via video tele-conference. The SURICG/7 meeting report, working papers, information papers, and other resources can be accessed by following link:
https://www.icao.int/APAC/Meetings/Pages/2022-SURICG-7.aspx

2.4. The SURICG/7 reviewed the outcomes of Mode S DAPs WG/5 and SURSG/2 meetings, the preliminary outcome of the survey on APAC Surveillance and DCPC Coverage, the implementation and co-ordination activities and sub-regional implementation plans, report on surveillance ground system and avionics performance monitoring and improvement in compliance as well as the potential cooperation opportunities with ICAO Surveillance Panel and industry stakeholders. The paper also reviewed the discussions relevant to ATMAS TF such as air traffic control surveillance activities in Australia, surveillance activities in New Zealand, electronic handover in complex transfer environment between adjacent ATC units in China, etc.

Update from RASMAG/26 – Sec (IP/02)

2.5. The Twenty-Sixth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/26) was held *from 20 to 23 September 2021* by Video Teleconference (VTC). The RASMAG/26 meeting reviewed the outcome of The Eleventh Meeting of the FANS Interoperability Team-Asia (FIT-Asia/11) held by video teleconference *from 23 to 26 August 2021*. The RASMAG/26 meeting also reviewed Vertical Safety Report on RVSM airspace risk by China Regional Monitoring Agency (China RMA), the Japan Airspace Safety Monitoring Agency (JASMA), and the Monitoring Agency for the Asian Region (MAAR), etc. during 2020.

2.6. The ICAO Secretariat provided a regional safety monitoring assessment summary, which highlighted the Hot Spot Summary in Table 19 in the RASMAG/26 meeting report as below:

Hot Spot	Involved FIRs	Identified	Remarks
A1	Kolkata/Chennai/Dhaka – Yangon	2015	Cat. E LHDs reducing
A2	Chennai – Kuala Lumpur	2015	Cat. E LHDs reducing

B	Incheon (AKARA Airspace)	2015	Cat. E LHDs
D	Manila – all adjacent FIRs	2015	Cat. E LHDs reducing Cat F LHDs emerging
F	Mogadishu – Mumbai	2015	Cat. E LHDs
G	Sanaa/Muscat – Mumbai	2015	Cat. E LHDs (Sanaa improved)
J	Jakarta – Singapore/Kota Kinabalu	2018	Cat. E LHDs, minor and reducing
M	Colombo - Melbourne	2019	Proposed to re-classify as non-hot spot
N	Oakland USA – Hawaii CEP	2019	Cat. E LHDs increasing

Table 19: LHD Hot Spots in the Asia/Pacific Region

2.7. The RASMAG/26 meeting also discussed other issues regarding Non-RVSM Approved Aircraft, Long Term Height Monitoring (LTHM) Burden Estimate, safety reporting, the APANPIRG ATM and Airspace Safety Deficiency List, etc.

Agenda Item 3: Global and Regional ATM Automation System Updates

Repository of the ATMAS in APAC – Indonesia and the Secretariat (WP/03)

3.1. The paper presented the Table of the ATMAS Status in APAC region proposed by ad-hoc group and invited States/Administrations to review and take necessary actions to make the regional repository. To follow up the Action Item 2-2 of ATMAS TF/2 to work out a revised repository of ATMAS implementation status in APAC, based on the draft table designed by Indonesia, the suggestions from ATMAS TF/2, and the latest version of the ATMAS IGD, the table of ATMAS status in APAC region was re-designed and re-formatted by the ad-hoc group led by Indonesia.

3.2. The table of ATMAS status in APAC region has been reviewed and adopted by the meeting which is provided in **Appendix A** to the report. While filling the table, the Member States are recommended to refer to the explanation of the table, and the corresponding chapter of ATMAS IGD to get further information. The ICAO Secretariat is requested to issue a State Letter in due course to circulate the table to collect information in order to build the repository of the ATM automation systems for APAC Region. **ACTION ITEM 3-1**

3.3. The meeting appreciated the work being done by Indonesia and the ICAO Secretariat. The meeting noted that the table can be easily filled in by selecting the choice from the drop-down list and the available options will support data statistics and analysis in the future.

Updates on Development of Air Traffic Management Automation System Problem Reporting Database (ATMAS PRD) – Hong Kong China (WP/10)

3.4. The paper presented the updates and the latest progress on the development of ATMAS PRD as a follow-up action to ACTION ITEM 2-3. Hong Kong China, in collaboration with China, has been working with the ICAO APAC Regional Office in developing the technical specifications for the ATMAS PRD. Further to discussion in ATMAS TF/2, it was considered more appropriate to separate the ATMAS PRD from ADS-B Avionics Problem Reporting Database (APRD), and with support from China, Hong Kong China has lined up with the software development resources from CAAC ATMB. The paper further invited the discussion on the database schemas for Report of ATMS-related issues and AIDC-related issues in Appendices 1 and 2 of the paper respectively. The ATMAS PRD will be hosted on a secured website which is accessible to States/Administrations. States/Administrations wishing to gain access to the ATMAS PRD were encouraged to nominate a point of contact for registration with the ICAO APAC Regional Office, and contribute to the development of ATMAS PRD.

3.5. Hong Kong China replied to an enquiry about the allowance made for proprietary information between the vendor and user that it would depend on whether States would like to disclose the proprietary information into the reporting database. Regarding the question of whether the software version is required for ATMAS PRD, Hong Kong China explained that the software version could help States that using the same software version from the same manufacturer to understand if the particular problem would be related to their system. The meeting was further informed that the design of the AIDC-related issues database schema was referred to the AIDC implementation issues table from the APA TF and the elements extracted from the original table could be easy to transfer and integrate into the new database. The meeting also discussed and agreed to use "required" to replace "mandatory", and "optional" instead of "desirable" in the proposed database schema. On the use of information on issues, New Zealand shared that the ATM vendors would normally address the issues raised specifically to the vendor in the regular user group meetings.

3.6. China expressed thankful to Hong Kong China for sharing and active contributions to ATMAS PRD. China recalled the history of the development of the APRD by China and expressed its willingness to continue contributing to this new task. In addition, China suggested that all the Member States could join together with China and Hong Kong China to study and design the ATMAS PRD requirements. After reaching a consensus, China would activate the software development.

3.7. Referring to the request by China for the ICAO APAC Regional Office to issue the State Letter to clarify the relevant task, the ICAO Secretariat shared that there are two challenges that need to be considered, including the cost of developing such a platform and the ICAO internal ICT security process. The meeting was informed that the cost of development of the APRD was overtaken by ATMB China, and the ICAO internal process with ICAO ICT would be necessary because the database is deemed to implement in the ICAO portal. If the meeting agrees to continue the development of this repository, the ICAO Secretariat would support this initiative and coordinate with ICT to find out a solution to continue our regional effort.

3.8. Regarding the level of the issues to be reported, it was recommended that States could decide whether they think these are meaningful issues or problems that could be shared and put somehow commonly seen or encountered by the State or Administration. Upon further enquiry, China suggested that issues reported could be classified and graded in terms of impact on users, and introduced the definitions of different types of fault to be reported for meeting's consideration.

- Type I Fault: The basic support function of the system is invalid and cannot provide support. For example: unacceptable HMI frequent crashes, frequent critical server crashes
- Type II Fault: The system or device has effective basic functions and provides basic protection, but its reliability or performance deteriorates. For example: an HMI crashes frequently (every 2 hours)
- Type III Fault: System partially fails to function, causing inconvenience to users but not affecting basic functions. For example: failure of the electronic handover

3.9. The meeting discussed and agreed to add one agenda item for the next meeting to encourage the States/Administrations to refer to the classifications of faults introduced by China and share valuable issues or problems encountered in ATM automation systems, and discuss the necessity of ATMAS PRD.

Agenda Item 4: ATM Automation System Implementation by States

4.1 ATMAS Implementation Status and Experience

Concept and Benefits of the Secure Data Bridge – Singapore (IP/03)

4.1. The paper presented Singapore's development of a prototype Secure Data Bridge (SDB) to extract historical and real-time data from the Air Traffic Management System (ATMS) that would be useful for ATM related functions and services. The paper also shared the concept of the SDB and the benefits of testing potential use cases safely outside of the ATMS.

4.2. To fully maximise the benefits of operational ATMS data, Singapore has developed a Secure Data Bridge (SDB) prototype under the auspices of the Aviation Innovation Research Lab (AIRLab) to design and build a proof-of-concept for passively tapping and streaming live operational data from the ATMS in an automated, safe and secure manner. The meeting was informed that the SDB prototype is connected to the ATMS via public Application Program Interfaces (APIs). Safe and secure extraction of live data from the ATMS was achieved using data diodes which provide a unidirectional secure gateway for the streaming of data. With the implementation of the SDB, real time operational ATMS data could be extracted, which could be used in the ATM Twin and other Open ATMS collaborations without modifying or impacting the existing ATMS, and training Artificial Intelligence (AI)/ Machine Learning (ML) models in the Digital ATCO prototype. Singapore also shared that the SDB has been successfully developed and validated, with an operational impact assessment indicating no performance, throughput, or stability issues on integration with the ATMS, which will permit early experimentation in the ATM Twin safely, using actual data that is collected from the current ATMS. Responding to a query, Singapore replied that extracting the data from the operational database would not have any impact on ATM system, and system security could be maintained by using the data diode and firewalls.

Exploration and Implementation of An Optimized MSAW – China (IP/04)

4.3. Based on the polygonal MSAW warning area, the paper summarized the empirical data of SIDs/STARs procedures and the approach procedures, and proposed a new optimized MSAW around the airport combining four regions layer by layer in China. Considering more dual runways or multiple runways are put into operation and the STARs and SIDs are becoming more complicated, the MSAW function relies on the polygonal warning areas and the mosaic warning areas will face more challenges. Through years of practical experience in China, the MSAW polygonal general warning areas, the MSAW safe pipeline areas based on the procedures of SIDs/STARs, APM (Approach Path Monitor) areas, and the MSAW inhibition zone have been established around the airport. The four regional segmentation settings, combined layer by layer, constitute the current optimal MSAW around the airport, and the advantages and disadvantages of each area alert have been elaborated. Furthermore, one brief example of the optimized MSAW application to remind the controller in time to avoid the incident of the aircraft hitting the ground has been shared. The meeting was informed that Civil Aviation Administration of China will continue to optimize the MSAW and other functions of the ATMAS, according to the operational needs of the site, to provide a more safe operation.

Introduction to Flight Inspection of Air Traffic Management Automation System – China (IP/05)

4.4. The paper shared the experience in flight inspection of Air Traffic Management Automation System (ATMAS) in the Civil Aviation Administration of China (CAAC). Usually, flight inspection is compulsory for brand new, relocation, or updated ATMAS major modules. In 2011, CAAC promulgated the ATMAS flight inspection technical requirements, which puts forward the requirements of flight inspection subjects, procedures, data analysis, report, etc., to follow and implement. The recommended preparatory work, subjects, implementation, and follow-up work of the flight inspection have been summarized in detail. China further introduced that flight inspection subjects are suggested to categorize into three types, including the surveillance coverage and the processing precision, functional verification of ATMAS regarding whether the key functions of the system are normal, and warning function inspection. Furthermore, it is recommended the flight inspection summary report of ATMAS, which matters whether the ATMAS is satisfied and authorized formal commission, includes flight time, route, subjects, data records, conclusions, etc.

China further explained the preparatory work and subjects of the flight inspection, as well as the methods to complete the flight inspection on STCA and MSAW, in response to queries addressed at the meeting.

4.5. Regarding the proposal to include the flight inspection into the ATMAS IGD as a reference manual, the ICAO Secretariat commented that the information in this paper is a general description and suggested China could continue to work on this paper to develop a more specific material with reference to ICAO provisions and Flight Inspection Guidance Material for APAC Region (Edition 2.0), and it could be considered as part of the guidance material when it is more mature.

Airways Design and Implementation of Its New Air traffic Management System – SkyLine-X – New Zealand (IP/10)

4.6. Airways presented an overview implementation history of the new Air Traffic Management System (ATMS) that will be introduced into operation in 2023 and also highlighted lessons learnt thus far. The concept of Operational Strategy created by Airways New Zealand through to 2028 was a shift from air traffic control (ATC) to air traffic management (ATM) via core deliverables, including common processes and complementary system support tools, enhanced contingency, enhanced resilience, safety enhancements, and one centre/two locations. Replacement of the current ATM systems with a system that could provide functionality to support the concept was critical. This approach relied on having an ATMS, including its enhanced functionality, ready by early 2020 to support the operational transition to the new Centres in 2021 and subsequent phases of implementation. The progress of requirements definition and system selection, development, and re-sized implementation under Covid-19 was shared in detail. New Zealand also summarized the lessons learnt in the program regarding validation, recognition of scope, and unforecast change.

Shared Experience of ATMAS Relocation and Transition upon Busy Airports – China (IP/15)

4.7. The paper analyzed the difficulties of ATM automation system transition under the overnight transition mode of Qingdao Jiaodong Airport formulates corresponding solutions, and finally successfully realized the relocation and transition of the new airport. The meeting was informed that Qingdao Jiaodong Airport has been put into use at 0:00 am on August 12, 2021, successfully realizing "overall relocation and overnight transition". With this successful experience, China shared the hurdles in transition and relocation, such as urgent demand for adaptive interaction of the ATMAS, defects in the native network architecture of the ATMAS, challenges to operation continuity of the ATMAS, and unknown risks in the operation of the ATMAS. Accordingly, the corresponding solutions have also been analyzed, including deploying data adaptive interaction to improve safety, optimizing the system network architecture, guaranteeing the operational continuity of control services, and addressing unknown risks to equipment operation. It was hoped that the paper could provide some reference for the transition and relocation to member countries in the Asia-Pacific region. The meeting was informed that China will continue in-depth research and optimization of ATM automation system transition solutions under various transition modes with the help of advanced technology and management methods.

GPS Week Rollover on Time Distribution System of Philippine ATM Center Automation System – Philippines (IP/16)

4.8. The paper presented the impact of GPS Week Rollover to the ATM Automation System at Philippine Air Traffic Management Center. Philippines introduced that the time architecture of the Philippine ATM system is a 3-tier solution involving the main Network Time Protocol (NTP) server called a Master clock (stratum 1) and a minimum of three (3) nominated servers (stratum 2) which gets its time reference to stratum 1, and the last tier synchronize themselves to stratum 2. In a global advisory, GPS week rollover will occur due to limitations of the maximum number of GPS weeks that the GPS time and position are still correct while the date will be wrong.

The meeting was informed that after August 21, 1999 and April 6, 2019, a vendor advisory was received due to its own internal rollover date for the year 2022. The built-in protection against sudden jump of time was further shared. To avoid the impact of GPS week rollover, the current time server has to be replaced before the internal rollover date. Based on this experience in using NTP servers, it is important to keep track of the hardware and/or software limitations as these may vary in the solution provided by the vendor.

4.2 Integration with External Systems

Technical Research on SWIM-Based Interoperability for ATM Automation System – China (IP/06)

4.9. The paper introduced the technical scheme of SWIM-based interoperability for ATM automation systems, built a test platform to verify the feasibility, and provided the summary of the research. In 2017, China began to try to apply SWIM on ATMAS, and cooperated with relevant manufacturers to carry out technical research work in two stages, and scientific research of the two stages had completed in 2021. The purpose of this research is to use SWIM as a framework to achieve flight data sharing and efficient interoperability between multiple systems using the concepts of Flight Object (FO) and interoperability (IOP) in the ED-133 document. Based on ICAO SWIM architecture, China introduced the SWIM-Based Interoperability Technical Solution in detail which adds SWIM node to each ATMAS, adopts FIXM data format, and modifies existing FDP.

4.10. According to the operation requirements, the basic interoperability processes and test results of the three interoperability scenarios have been elaborated, including interactions in homogeneous systems, heterogeneous systems, and degradation modes. China summarized that through the above studies and tests, SWIM-based interoperability of ATMAS is theoretically feasible. It was expected that practical exploration can be carried out in the real SWIM network environment in the future, and expand more interoperability scenarios (such as WIXM, AIXM) and other perspectives could be further researched.

Application of Data Exchange Platform in the ATM Information System – China (IP/11)

4.11. The paper presented the application of a data exchange platform among computer-based information systems related to air traffic services. Before the use of SWIM, Air Traffic Management Bureau (ATMB) of the Civil Aviation Administration of China (CAAC) try to establish a kind of data exchange platform in Beijing, for helping data exchange among the ATM information systems, which could not only avoid the massive physical link, repeated data input, and output among systems in traditional ways, but also help to reduce cost and resource consumption and increase the stability of the network and security.

4.12. Considering the requirements of ATS data sharing and consistency in different units, China set up the data exchange platform with four data exchange sub-platforms located in the different physical locations. The structure of the data exchange platform, including measures taken to ensure system stability and data security, and connection methods have been introduced. Furthermore, an application example of using sub-module of the data exchange platform in Capital Airport Tower has been shared. It was noted that 56.25% of physical link resources could be saved by establishing sub-platform of Capital Airport Tower, and ATM information systems can realize cross-location connections through the data exchange platform. China shared the plan for future development and informed that when ATMB is ready and decides to use SWIM technology, China will use SWIM instead of the current data exchange platform for standardized exchanging data formats among ATM information systems.

4.3 Development of New Technology

Singapore's Implementation Plan for Flight & Flow Information for a Collaborative Environment (FF-ICE) – Singapore (WP/08)

4.13. The paper presented Singapore's plans to implement FF-ICE/Release 1 (R1) and highlighted the key considerations in planning for the Filing Services and Flight Data Request Services. The early planning and exploration of FF-ICE implementation aim to uncover solutions to tackle challenges such as mixed-mode environment and interoperability of systems.

4.14. The meeting was informed that Singapore has commenced planning in 2020 and plans to introduce two FF-ICE services by 2026, including i) Filing Service and ii) Flight Data Request Service which are the minimum services required to support FF-ICE. The early implementation of the two FF-ICE services will allow Singapore to gain valuable experience in the FF-ICE domain and help lay the foundation to streamline internal and external processes before embarking on the other FF-ICE services. Singapore will be focusing on these three areas: i) mixed mode environment, ii) internal systems interoperability, and iii) stakeholders' engagement. Singapore opined that with increased participation by more ANSPs in introducing FF-ICE services, it will also mature faster and bring about more accurate and updated information exchanges allowing for a rich collaborative environment. The meeting was invited to explore opportunities to synchronize planning for FF-ICE implementation in the APAC region to achieve tangible benefits for all.

New Trends of the Controller Training System Development – China (IP/09)

4.15. The paper presented the new trends of controller training system development in circumstance of surging new technological applications. The meeting was informed that the novel controller training system is a platform, utilizing RedHat KVM to realize system virtualization, fully exerting the surplus performance of equipment, and allocating balanced resources, which is more efficient and economical. By extracting the real ATC data from ATM automation system, the script generator could create a scripted kinematic flight plan with reasonable elements, position height, and actual arrival time to a sector boundary. The airspace situation replaying system has been integrated by deploying NAS (network attached storage) center between the virtualized platform and the REC server with multiple types of Raid. In addition, the joint training script could be created in both TOWER-controller and ACC/TMA-controller training systems by utilizing specific protocol to exchange data, such as MH/T 4029.3. The meeting was informed that ATMB has plans to apply voice recognition and artificial intelligence in the control training system in the future.

4.16. To respond the question that whether the system could replicate common operational issues such as poor communications or hear back/read back errors, China further explained that China recommended a more precautious and prudential manner, and planned to actualize the function after abundant experiments in the future.

Optimization of Arrival Flight Runway Allocation in the Guangdong-Hong Kong-Macao Greater Bay Area – China (IP/12)

4.17. The paper introduced the arrival flight runway allocation optimization method in the AMAN aided decision-making function in the Guangdong-Hong Kong-Macao Greater Bay Area. The runway allocation optimization method based on the minimum intersection and ground taxiing time, and allocation priorities are in the following order: minimum crossing > minimum ground taxiing time > minimum air flight time. Through the analysis of operational data, compared with 2018, the Guangdong-Hong Kong-Macao Greater Bay Area in 2019 reduced the time of inbound flight and airport ground taxiing time after the application of the AMAN aided decision-making system, and improved the operation efficiency. The performance analysis of operational data analyzed from several aspects, such as flight time probability density, arrival delay time and Carbon Emissions, ground taxiing time, and arrival trajectory heat map, has been shared in detail in this paper. The meeting was informed that the application of this method can reduce air cross conflicts, controller workload and ground taxiing time.

Adapting the Approach Spacing Tool to Suit the Local Operational Environment at the Hong Kong International Airport – Hong Kong China (IP/13)

4.18. To assist air traffic controllers under the enhanced wake turbulence separation scheme to improve consistency in handling arrival traffic at the Hong Kong International Airport (HKIA), Hong Kong China is implementing an Approach Spacing Tool (AST) for assisting controllers in handling final approach operation under enhanced wake turbulence separation scheme and improving their consistency in delivering arrival traffic spacing. The AST has completed system acceptance testing in March 2022 and Hong Kong China is now adapting configuration of the system to fit it into the local operational environment.

4.19. The AST calculates and presents the optimal positions of aircraft along the approach path based on various factors in form of graphical AST Guidance Cues to be shown on the controller's situation display for the Initial/Intermediate Target Distance (ITD) and Final Target Distance (FTD), thus assisting the positioning of arrival aircraft along the final approach path. Further evaluation by controllers was conducted using historical and live traffic of the HKIA to determine the best setting of configurable display options to suit the local airspace environment. The results indicated that the Guidance Cues to be displayed along the planned flight path is more preferable than predefined common path. Hong Kong China shared the challenges in implementation in a complex airspace with multiple arrival streams and deviations during bad weather seasons in the paper. The AST is currently planned for operation in 2023.

4.20. Upon enquiry, Hong Kong China informed that the controllers could re-route the flight manually and easily in HMI in case of any great changes to the original route, and the AST incorporates the new enhanced wake turbulence separation.

ATMAS Cybersecurity Design in Brief – China (IP/14)

4.21. The paper presented the current cybersecurity status of Air Traffic Management Automation System (ATMAS) in China, and the brief design on 3 key aspects of cybersecurity in common between Air Traffic Management Security Manual (ICAO Doc 9985) and Chinese cyber security standard serial (GB/T 22239-2019).

4.22. With more amount of data connected to ATMAS, and increasing complexity network topology by interaction with other systems, the network security of ATMAS becomes a key problem to resolve against various potential attacks. In the past few years, the ATC operating lines of ATMB have successively carried out audit of ATM automaton systems cyber protection. To downgrade the risks of ATM automation system, the whole ATM automation system is divided into the following 6 logical security domains according to their functions: external signal zone, data segregation zone, core operation zone, security management zone, system maintenance zone, and remote subnet zone. Segregation measures and security policies between the 6 logical security zones have been shared emphasizing on hardening of the core operation zone and introduction of security management center. It is critical that on the security management center it must install well tested software rules, correlation intelligence and automated SOAR process as well tested by security experts specialized in ATMAS operation. The construction of network security's operation and maintenance (O&M) capability is the necessary means for security protection to achieve long-term safety and stability of ATM automation system. It is also necessary to track and analyze system security risks, and to monitor system's protection from laws, regulations, personnel control, and technology updates, to improve continuously system security level.

4.23. The meeting was informed that the concept of the design is completed and the design would be implemented starting with a complicated system to demonstrate the design is mature enough. The ICAO Secretariat proposed that this paper could be presented in the ICAO cybersecurity webinar in the future. In response to the question of whether the penetration testing has been completed as part of vulnerability analysis, the meeting noted that penetration testing would be performed during the detailed design phase.

Agenda Item 5: Review of Guidance Material of Implementation of ATM Automation System in Asia/Pacific Region (APAC ATMAS IGD)

Air Traffic Management Automation System Implementation and Operations Guidance Document – China, Hong Kong China & Singapore (WP/04)

5.1. The paper presented the revised draft (Edition 1.0) of the Air Traffic Management Automation System Implementation and Operations Guidance Document (ATMAS IGD). The new draft supplements the guidance material of the DMAN function and is revised according to the comments from States and prepared for consideration and endorsement by this meeting.

5.2. Following ATMAS TF/2 meeting ACTION ITEM 2-5, the ICAO APAC Regional Office issued the State Letter AP173-21 (CNS) to gather further inputs and comments for the draft of ATMAS IGD. Total 101 comments on the IGD were received from 4 States, including 7 from the USA, 4 from Singapore, 4 from Pakistan, and 86 from New Zealand. The ad-hoc group led by China, with the support of Hong Kong China, and Singapore, worked through comments and inputs for future improvement and polishing of the ATMAS IGD after receiving the comments from States. The main modifications regarding DMAN function, terminology, performance of surveillance data processing, and software version and requirement management have been summarized.

5.3. The meeting appreciated the contribution by China, Hong Kong China, and Singapore. Regarding the inquiry about the maintenance of this guidance document to align with the change in the ICAO high level documents, the ICAO Secretariat shared that the guidance document could consist of baseline part and dynamic part as AIGD, and could be reviewed and updated regularly according to need.

5.4. During the discussion, New Zealand provided additional comments and suggested that the wording used in the IGD should be more generic and proposed additional amendments to the ATMAS IGD. The ATMAS IGD was further updated by the ad-hoc group in accordance with New Zealand's comments for meeting review.

5.5. With aforementioned, the ATMAS TF/3 meeting agreed to formulate the following Draft Conclusion for consideration by CNS SG/26 meeting.

<table>
<tr><td colspan="2">Draft Conclusion ATMAS TF/3/1 - ATMAS IGD Edition 1.0</td></tr>
<tr><td>What: The Air Traffic Management Automation System Implementation and Operations Guidance Document Edition 1.0 provided in Appendix B to the Report be adopted</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: The revised draft has been added the DMAN function and reviewed/updated with inputs from various States</td><td>Follow-up: ☐Required from States</td></tr>
<tr><td>When: 10-Jun-22</td><td>Status: Draft to be adopted by Subgroup</td></tr>
<tr><td colspan="2">Who: ☒Sub groups ☐APAC States ☐ICAO APAC RO ☐ICAO HQ ☒Other: ATMAS TF</td></tr>
</table>

Agenda Item 6: ATS Inter-Facility Data - Link Communication Implementation by States

6.1 AIDC Implementation Status Update and Experience

Repository of AIDC Implementation Status in APAC – Sec (WP/05)

6.1. To follow up the ACTION ITEM 7-1 of APA TF/7, the ICAO Secretariat has worked on the table formatting and separated AIDC and ATM System Implementation columns from the ATN/AMHS/AIDC implementation table into a standalone table. However, considering the necessity of a comprehensive monitoring tool for AIDC implementation status in APAC region to support data statistics and analysis, the ICAO Secretariat designed a new table to maintain a common understanding between ATMAS TF and ACSICG on AIDC implementation, and eventually build up the regional repository of AIDC Implementation Status. The ACSICG/9 meeting has reviewed and adopted the format of AIDC repository in APAC region for ATMAS TF/3 consideration. According to the suggestions received from ACSICG/9, the ICAO Secretariat has incorporated the AIDC implementation status relevant information gathered before and filled into the draft table for supplements and validation by States/Administrations.

6.2. The ATMAS TF/3 further reviewed and adopted the table of AIDC Implementation Status in APAC region with the current status which is provided in **Appendix C** to this report. The meeting agreed that the ICAO Secretariat will issue a State Letter in due course to circulate the table to States/Administrations for supplements and validation. **ACTION ITEM 3-2**

6.3. The ATMAS TF/3 also updated the list of focal points for AIDC Implementation in the APAC Region which is provided in **Appendix D** to this report.

Progress of AIDC Implementation in China (IP/07)

6.4. The paper presented the status of the AIDC implementation in China, the progress of implementation with adjacent ATSUs in 2021, and the related issues and suggestions encountered during the implementation. The meeting was informed that by 2021, 63 AIDC groups within China's mainland are in operation, with an overall implementation rate of 79%, and China plans to fully implement AIDC electronic handover in domestic regional in the following two years. China further shared AIDC Implementation status between Sanya ACC and Guangzhou ACC with Hong Kong ACC, Shanghai ACC and Guangzhou ACC with Taipei ACC. Additionally, China updated the AIDC implementation status of Dalian ACC with Incheon ACC, Shenyang ACC with Khabarovsk ACC, Kunming ACC with Yangon ACC and Vientiane ACC, Beijing ACC and Lanzhou ACC with Ulaanbaatar ACC, Sanya ACC with Hanoi ACC and Ho Chi Minh ACC, Shanghai ACC with Incheon ACC, and Nanning ACC with Hanoi ACC and summarized in tabular format.

6.5. Regarding the AIDC technical test between Beijing ACC and Ulaanbaatar ACC started in 2018, China updated Beijing ACC has confirmed that they have the technical capability to carry out AIDC handover with the Ulaanbaatar ACC and is communicating with the Mongolian side to consider resolving the issues due to the functional limitations of the Ulaanbaatar ATMAS through an automated system upgrade. Furthermore, the trial run of AIDC between Kunming and Vientiane was conducted from January 12 to August 2021, and the average success rate was 81.18% (percentage of successful EST/ACP). There are two main reasons affecting the success rate AIDC handover, including the long ABI messages problem which has been solved by system update, and the need to add the grouping 18 information to ABI messages which will be addressed by the upgrade in 2022.

6.2 Review Implementation Issues Reported and Discuss Recommended Solutions

AIDC Implementation Issues Report- Indonesia, India, and Singapore (WP/07)

6.6. The paper presented the AIDC implementation issues reported by members States/Administrations. The aim of this information sharing is to become a lesson learned for other members States/Administrations and trying to find solutions for these issues. Indonesia updated to the meeting that new reported AIDC implementation issues provided in the ATMAS TF/3 was 7 new issues, including additional AIDC implementation issues reported from India (5 reports) and Malaysia (2 reports), while Indonesia, Australia, Philippines, Singapore, and New Zealand inform that there is no issue arise during the APA TF/7 to ATMAS TF/3 period. The number of AIDC implementation issues reported by members States/ Administrations, based on fault category are as shown in a table and chart:

Fault Categories	ATMAS TF/3 (2022)		
	Issues Reported	Closed	Open
a. Communication Link	9	6	2
b. ATM System	65	35	30
c. AIDC Message	23	14	9
d. Airspace Design/Procedures	13	7	6
e. Other	6	3	3
Total	**116**	**66**	**50**

6.7. Issues pertaining to Communication Infrastructure and Interfacing Equipage reported in detail as 6 cases of latency occurred among ACCs in India and with its adjacent ACC, 2 cases reported by Singapore, 1 case occurred between Ujung Pandang ACC and Brisbane ACC. The description of issues and current status were presented. Issues pertaining to ATM system parameters and Application Software reported as 6 cases reported by Australia, several Issues reported by India, Indonesia, Malaysia, Maldives, Philippines, and Singapore. The description of issues and current status were presented. Issues pertaining to Design Procedures, SOP, and Operator’s Training reported in detail by India, Indonesia, Malaysia, and Singapore.

6.8. The meeting was invited to update and elaborate on the AIDC implementation issues above, including resolution has been taken, and all States/Administrations are encouraged to continue reporting the AIDC implementation issues. The meeting also invited India to share the updates on the AIDC issues reported. A list of identified issues consolidated from States/Administrations after meeting review is attached in **Appendix E**.

The AIDC Implementation and Application in China (IP/08)

6.9. The paper presented the current AIDC implementation status of ATMAS in China, discussed the challenge of balancing AIDC packet delay and switching convenience when the main and fallback ATMAS are switched, and introduced further solutions.

6.10. The pros and cons of the two methods in the AIDC message transmission by shared AFTN link and dedicated link when main and fallback ATMAS are switched were elaborated. The meeting was informed that China initiated research into the problem and worked out the improvement solutions. To solve the transmission delay of AIDC packets in the AFTN shared link, China has put forward the functional requirements of the transmission system and network to establish a separate and direct routing between regions after test and verification. In order to simplify the dedicated line switching when the main and fallback ATMAS is switched, an AIDC dedicated line switcher can be used as a short-term solution. By establishing a direct route between the message transmission system, combined with the solution of realizing AIDC and AFTN message separation, it can guarantee 90% of the AIDC packets sent/received within 4 seconds delay, and 99.8% of the AIDC packets sent/received are less than or equal to 10 seconds. China will gradually transfer the AIDC transmission from a dedicated line to the shared AFTN line. It is emphasized that with the development of technology and in-depth research, China will continue to solve the challenge of balancing AIDC packet delay and switching convenience when the main and fallback ATMAS are switched, and promote the controller's work as more scientific and efficient.

Agenda Item 7: Review of the Terms of Reference (ToR) and Update Subject/Tasks List of ATMAS

CAAC Specification for ATMAS Part 3 Data Exchange – China (SP/01)

7.1. The presentation introduced the CAAC Specification for ATMAS Part 3 Data Exchange to follow up the ACTION ITEMS 2-4 (ATMAS TF/2) to translate the information on MH/T 4029.3 into English first for better understanding by other Member States/Administrations. China informed that the MH/4029.3 is intended to stipulate the requirements for flight data exchange between ATC and related systems. The advantages, applicable system, content composition, and system connections were shared in detail. Furthermore, China elaborated the application cases of the 3 categories of messages, including FDEXM, PSEXM, and FDECM.

Review Subject/Tasks List – Sec (WP/06)

7.2. The paper presented the Action Items arising from ATMAS TF/2 and integrated the outstanding Action Items arising from the dissolved APA Task Force for discussion and further updating by this meeting. To follow up the Action Item 2-6 of ATMAS TF/2 to consolidate Action Items arising from APA Task Force into ATMAS TF Action Item list, the ICAO Secretariat has revised the format of APA TF Action List from a word file into excel format to be consistent with the Action Item List with ATMAS TF, and supplemented the follow-up actions from the former APA TF meetings.

7.3. The meeting reviewed and updated the Action Item list, and agreed to combine the outstanding action items from APA TF into ATMAS TF action item list. The Action Item List updated by ATMAS TF/3 meeting is provided in **Appendix F** to this report.

Check List for ATMAS Project Management – China (Flimsy/01)

7.4. To follow up the Action Item 1-2 of ATMAS TF/1, China developed check list for ATMAS project management from scratch of planning, requirement definition, bidding, implementation to operational transition, and introduced the check list to the Member States in detail. The meeting discussed and agreed to further polish the check list.

Agenda Item 8: Next Meeting and Any Other Business

Date and Venue for the Next Meeting

8.1. The meeting discussed the provisional agenda for the next meeting. The meeting agreed to set up a half-day seminar to discuss the topics of interest by most member States, for example, FF-ICE, SWIM, system interoperability, etc., and invited Australia, Bangladesh, New Zealand, and other capable States/Administrations to share their experience in ATMAS TF/4.

8.2. China informed the meeting that ATMB had prepared to host the ATMAS TF/2 and ATMAS TF/3. China would like to host ATMAS TF/4 at the end of September or the second half of 2023 in Chengdu as well. The meeting appreciated the kind offer from China and agreed that the next ATMAS TF meeting would be considered in physical, hybrid, or online mode depending on the pandemic situation and travel restrictions. The actual dates and venue will be adjusted to fit the CNS meeting plan for 2023, and coordinated with Co-chairs and States concerned. Member States/Administrations will be informed in due course.

Note of appreciation

8.3. Ms. Xie Yu Lan and Mr. Kwek Chin Lin, Co-Chairs of ATMAS TF, expressed thanks to all participants from Member States/Administrations for their contributions and active participation in this task force and to the ICAO APAC Regional Office for their significant contributions in making the meeting a successful and fruitful one in this difficult times and wish for a face-to-face meeting next year. With the strong interest, dedication, and support from all, the ATMAS TF would upkeep our good work and momentum to continue taking a significant role in shaping the future direction of ATM automation system implementation for this region.

8.4. The ICAO Secretariat extended sincere gratitude to the leadership and ownership of the two Co-Chairs and the group, and also appreciated the sponsorship for the Webinar and ATMAS TF/3 meeting by Chengdu Civil Aviation Air Traffic Control Science and Technology Co. Ltd. (CDATC), THALES, Chinney, Frequentis, and Saab.

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LIST OF PARTICIPANTS

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	90.	Mr. MOHD RHEDWANSYAH SALINRI	Air Traffic Controller Civil Aviation Authority of Malaysia (CAAM)	rhedwansyah@caam.gov.my;	✓	✓
	91.	Ms. NOORASHIKIN HARON	Deputy Director Civil Aviation Authority of Malaysia (CAAM)	noorashikin@caam.gov.my;	✓	✓
	92.	Ms. Nik Afiqah Binti Abdullah	Air Traffic Controller Civil Aviation Authority of Malaysia (CAAM)	nikafiqah@caam.gov.my;	✓	✓
	93.	Ms. Dayang Zarina Abang Alli Abd Rahman	Deputy Director Civil Aviation Authority of Malaysia (CAAM)	dygzarina@caam.gov.my;	✓	✓
	94.	Mr. Iskandar Mizuar	Air Traffic Controller Civil Aviation Authority of Malaysia (CAAM)	iskandarm@caam.gov.my;	✓	✓
	95.	Ms. Nurul Ain Zhafarina Muhamad	CNS Officer Civil Aviation Authority of Malaysia (CAAM)	zhafarina@caam.gov.my;	✓	✓
11		**MONGOLIA (1)**				
	96.	Mr. Ganbaatar Puntsag	Senior inspector of ANS Civil Aviation Authority of Mongolia	ganbaatar@mcaa.gov.mn;	✓	✓
12		**NEW ZEALAND (3)**				

		STATE/NAME	TITLE/ORGANIZATION	E-MAIL	ATTENDANCE	
	97.	Mr. Dan Stevens	Policy and Standards Specialist Airways New Zealand	d.stevens@airways.co.nz;	✓	✓
	98.	Mr. Andy Alford	Senior ANS Operations (Surveillance) Specialist Airways Corporation Of New Zealand Limited Airways International Training Facilities	andy.alford@airways.co.nz;	✓	✓
	99.	Mr. Peter Blair	ANS Requirements Team Leader Airways Corporation Of New Zealand Limited	peter.blair@airways.co.nz;	✓	✓
13		**PAKISTAN (12)**				
	100	Mr. Asif Mahmood Akhtar	Senior Joint Director Pakistan Civil Aviation Authority	Asif.Mahmood@caapakistan.com.pk;	✓	✓
	101	Mr. Shabbir Ahmed	Additional Director AANS Pakistan Civil Aviation Authority	shabbir.atc@gmail.com;	✓	✓
	102	Mr. M. Asad Khan Niazi	Joint Director Radar Pakistan Civil Aviation Authority	mak.niazi@caapakistan.com.pk;	✓	✓
	103	Mr. Muhammad Asif	Senior Air Traffic Control Officer Pakistan Civil Aviation Authority	muhammadasif.atco@gmail.com;	✓	✓
	104	Mr. M Irfan Khan	JDS CNS Pakistan Civil Aviation Authority		✓	✓
	105	Engr Teerath Dass	Joint Director CNS Pakistan Civil Aviation Authority	teerathdass@gmail.com;	✓	✓
	106	Mr. Muhammad Aamir Mughal	Deputy Director ATS Pakistan Civil Aviation Authority	Aamir.m@live.com;	✓	✓

		STATE/NAME	TITLE/ORGANIZATION	E-MAIL	ATTENDANCE	
	107	Mr. Abdul Mannan	Deputy Director ATS Pakistan Civil Aviation Authority	Mannan.mba@hotmail.com;	✓	✓
	108	Ms. Kaniz Fatima	Senior Assistant Director CNS Pakistan Civil Aviation Authority	Kaniz_tc_011@yahoo.com; Kaniz.Fatima@caapakistan.com.pk;	✓	✓
	109	Engr M. Uzair Bilal	Senior Assistant Director CNS Pakistan Civil Aviation Authority	uzair.bilal@caapakistan.com.pk;	✓	✓
	110	Engr Muhammad Ehtasham	Senior Assistant Director CNS Pakistan Civil Aviation Authority	ehtashammuhammad@gmail.com;	✓	✓
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14		**PHILIPPINES (11)**				
	112	Mr. Norrick T. Baes	Acting Division Chief III, ANQMD Civil Aviation Authority of the Philippines (CAAP)	norrick_baes@caap.gov.ph;	✓	✓
	113	Mr. Julius Ruel D. Resquir	CNSSO V/ Area Field Office Chief NCR Civil Aviation Authority of the Philippines (CAAP)	julius.resquir@caap.gov.ph;	✓	✓
	114	Mr. Joe Marie Anthony Eligio	Acting Division Chief Civil Aviation Authority of the Philippines (CAAP)	joemarie_eligio.atscaap@yahoo.com.ph;	✓	✓
	115	Mr. Gilmar D. Tito	CNSSO IV, Manila CNS-ATM Facility Civil Aviation Authority of the Philippines (CAAP)	gilmar.tiro@gmail.com;	✓	✓
	116	Mr. Ireneo P. Bf,Leno III	CNSSO IV, ANPPDD Air Navigation Service Civil Aviation Authority of the Philippines (CAAP)	iunbeleno@yahoo.com;	✓	✓

		STATE/NAME	TITLE/ORGANIZATION	E-MAIL	ATTENDANCE	
	117	Mr. Sonnel M. Malantic	ATMO V, Manila ACC Air Traffic Service Civil Aviation Authority of the Philippines (CAAP)	enrouteradar24.7@gmail.com;	✓	✓
	118	Mr. Pablito C. Tigno, Jr	ATMO III, Manila ACC Air Traffic Service Civil Aviation Authority of the Philippines (CAAP)	Pablitotigno@yahoo.com;	✓	✓
	119	Ms. Helen Grace Fortes	ATMOII, MADCC Air Traffic Service Civil Aviation Authority of the Philippines (CAAP)	En.gracie@gmail.com;	✓	✓
	120	Ms. Criszel B. Casios	ATMO II, MADCC Air Traffic Service Civil Aviation Authority of the Philippines (CAAP)	Criszel_b@yahoo.com;	✓	✓
	121	Mr. Agustin Cabrera	Aviation Services Safety Inspector Civil Aviation Authority of the Philippines (CAAP)	avcabrera88@yahoo.com;	✓	✓
	122	Mr. ERNESTO JR DISCAYA	SUPERVISING AVIATION SERVICES SAFETY INSPECTOR Civil Aviation Authority of the Philippines (CAAP)	epdiscayajr@gmail.com;	✓	✓
15		**REPUBLIC OF KOREA (10)**				
	123	Mr. Jung Yoon Lee	Deputy Director Ministry of Land, Infrastructure and Transport (MoLIT)	ljyun@korea.kr;	✓	✓
	124	Ms. Mi Jin Jeong	Assistant Director Ministry of Land, Infrastructure and Transport (MoLIT)	mj.jeong@korea.kr;	✓	✓
	125	Mr. Kim Jinyoung	Assistant Director Seoul Regional Office of Aviation	kimjy7795@korea.kr;		✓

		STATE/NAME	TITLE/ORGANIZATION	E-MAIL	ATTENDANCE	
	126	Mr. Jeoung Kyuchang	Assistant Director Air Traffic Management Office (ATMO)	huinari@korea.kr;	✓	✓
	127	Ms. Han Kyeong Hye	Action Officer Air Traffic Management Office (ATMO)	hkh0326@korea.kr;	✓	✓
	128	Mr. So Ho Lee	Manager Korea Airports Corporation	lsh1208@airport.co.kr;		✓
	129	Ms. Yujin Kim	Assistant Director Ministry of Land, Infrastructure and Transport (MoLIT)	Kyjin22@korea.kr;	✓	✓
	130	Mr. Su Hyun Kim	Project Supervisor for ATM Upgrade Incheon International Airport Corporation	suhyun_kim@airport.kr;	✓	✓
	131	Mr. YOOL KIM	Director of Safety Management Division Air Traffic Management Office (ATMO)	rladbf22@korea.kr;	✓	✓
	132	Mr. Junuk Park	Assistant Director Ministry of Land, Infrastructure and Transport (MoLIT)	junuk0312@korea.kr;	✓	✓
16		**SINGAPORE (14)**				
	133	Mr. Joe Wee Jui Chua	Senior Chief (Systems Planning & Development Civil Aviation Authority of Singapore (CAAS)	joe_chua@caas.gov.sg;	✓	✓
	134	Mr. Kwek Chin Lin	Chief ATC Specialist (Systems Development) Civil Aviation Authority of Singapore (CAAS)	kwek_chin_lin@caas.gov.sg;	✓	✓

		STATE/NAME	TITLE/ORGANIZATION	E-MAIL	ATTENDANCE	
	135	Mr. Hong Heng Lim	Senior Principal Engineer (Air Traffic Management System Platform Integration & Cybersecurity) Civil Aviation Authority of Singapore (CAAS)	lim_hong_heng@caas.gov.sg;	✓	✓
	136	Mr. Tan Teck Guan	Senior Engineer (Air Traffic Management Programme & System Engineering Civil Aviation Authority of Singapore (CAAS)	tan_teck_guan@caas.gov.sg;	✓	✓
	137	Mr. Bernard Chan	Senior Manager Civil Aviation Authority of Singapore (CAAS)	bernard_chan@caas.gov.sg;	✓	✓
	138	Mr. Aloysius Ang	Air Traffic Control Manager (Systems Planning) Civil Aviation Authority of Singapore (CAAS)	Aloysius_ang@caas.gov.sg;	✓	✓
	139	Mr. David Shin Hwah Leow	Head (Air Traffic Management Software Engineering) Civil Aviation Authority of Singapore (CAAS)	david_leow@caas.gov.sg;	✓	✓
	140	Mr. Mohamed Ruzaini Bin Mohamed Ismail	Master Air Traffic Control Officer (System Development) Civil Aviation Authority of Singapore (CAAS)	mohamed_ruzaini_ismail@caas.gov.sg;	✓	✓
	141	Ms. Victoria Tan	Air Traffic Control Officer Civil Aviation Authority of Singapore (CAAS)	victoria_tan@caas.gov.sg;	✓	✓
	142	Mr. Wee Siang Tan	Master Air Traffic Control Officer (Systems Development) Civil Aviation Authority of Singapore (CAAS)	Tan_wee_siang@caas.gov.sg;	✓	✓
	143	Mr. Yicheng Zhang	Scientist Institute for Infocomm Research, A*STAR	zhang_yicheng@i2r.a-star.edu.sg;	✓	✓

		STATE/NAME	TITLE/ORGANIZATION	E-MAIL	ATTENDANCE	
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	145	Mr. Tan Teck Guan	Senior Engineer (ATM Programme & System Engineering) Civil Aviation Authority of Singapore (CAAS)	TAN_Teck_Guan@caas.gov.sg;	✓	
	146	Ms. Lucy Tan	Head (Operations and Implementation Support) Civil Aviation Authority of Singapore (CAAS)	Lucy_TAN@caas.gov.sg;	✓	
17		**SRI LANKA (7)**				
	147	Ms. Mihiri Yapa Pahalage	Senior Electronics Engineer Airport and Aviation Services (Sri Lanka) Ltd.	mihi.yapa@gmail.com;	✓	✓
	148	Mr. Chamara Liyanage	Senior Electronics Engineer Airport and Aviation Services (Sri Lanka) Ltd.	chamara.eane@airport.lk;	✓	✓
	149	Mr. Prasanna Wijeratne	Electronics Engineer Airport and Aviation Services (Sri Lanka) Ltd.	prasannaw.eane@airport.lk;	✓	✓
	150	Ms. Priyasha Hettiarachchi	Air Traffic Controller Airport and Aviation Services (Sri Lanka) Ltd.	priyasha.ans@airport.lk;	✓	✓
	151	Mr. Indika Bandupriya	Senior Manager ATS Airport and Aviation Services (Sri Lanka) Ltd.	banduatc.ans@airport.lk;	✓	✓
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	153	Mr. Upula Perera	Electronics Engineer Airport and Aviation Services (Sri Lanka) Ltd.	upula.eane@airport.lk;	✓	✓
18		**THAILAND (15)**				

		STATE/NAME	TITLE/ORGANIZATION	E-MAIL	ATTENDANCE	
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	155	Mr. Nattapol Witsuwat	CNS Oversight Division Officer Civil Aviation Authority of Thailand (CAAT)	nattapol.w@caat.or.th;	✓	✓
	156	Mr. Jirakrit Thamnarak	Air Traffic Oversight Division Officer Civil Aviation Authority of Thailand (CAAT)	jirakrit.t@caat.or.th;	✓	✓
	157	Mr. Buntoeng Megcha	Manager, Air Navigation Operations Management Department Civil Aviation Authority of Thailand (CAAT)	buntoeng.m@caat.or.th;	✓	✓
	158	Mr. Sikarate Tarasak	Officer Civil Aviation Authority of Thailand (CAAT)	sikarate.t@caat.or.th;	✓	✓
	159	Mr. Chaiwat Saekhew	Officer Civil Aviation Authority of Thailand (CAAT)	chaiwat.s@caat.or.th;	✓	✓
	160	Mr. Wongtawan Sawasdimongkol	Air Traffic Oversight Division Officer Civil Aviation Authority of Thailand (CAAT)	Wongtawan.s@caat.or.th;	✓	✓
	161	Mr. Kanin Kiwkasemsawasdi	Air Traffic Control Manager (Bangkok Area Control Center) Aeronautical Radio of Thailand Ltd.	kanin.ke@aerothai.co.th;	✓	✓
	162	Mr. Aram Lertlum	Air Traffic Control Manager (Bangkok Area Control Centre) Aeronautical Radio of Thailand Ltd.	Aram.le@aerothai.co.th;	✓	✓
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		STATE/NAME	TITLE/ORGANIZATION	E-MAIL	ATTENDANCE	
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	165	Mr. Sakon Sinlapakun	Senior Air Traffic Systems Engineer Aeronautical Radio of Thailand Ltd.	sakon.si@aerothai.co.th;	✓	✓
	166	Mrs. Sarinna Suwanrak	Air Traffic Control Manager Aeronautical Radio of Thailand Ltd.	sarinna.si@aerothai.co.th;	✓	✓
	167	Mr. Anucha Poombundit	Air Traffic Engineering Manager Aeronautical Radio of Thailand ltd.	sarinna.si@aerothai.co.th;	✓	✓
	168	Miss. Rachat Songcharoen	Air Traffic Systems Engineer Aeronautical Radio of Thailand Ltd.	Rachat.ra@aerothai.co.th;	✓	✓
19		**USA (2)**				
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	170	Mr. Shayne Campbell	Senior Air Traffic Representative Asia Pacific Federal Aviation Administration (FAA)	shayne.a.campbell@faa.gov;	✓	✓
20		**VIET NAM (1)**				
	171	Mr. Nguyen Hong Hiep	IT Specialist Viet Nam Air Traffic Management Corporation (VATM)	nguyenhonghiepbk@vatm.vn;	✓	✓
21		**CANSO (1)**				
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		STATE/NAME	TITLE/ORGANIZATION	E-MAIL	ATTENDANCE	
22		**IATA (4)**				
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	174	Mr. Michael Fahmer	Program Manager – Flight Planning Support American Airlines	Michael.fahmer@aa.com;	✓	✓
	175	Mr. Daniel Smith	Manager ATM Qantas Group	danielsmith@qantas.com.au;	✓	
	176	Mr. Imshik Shin	Deputy General Manager CNS Korean Air	Imshik.shin@koreanair.com;	✓	✓
23		**CDATC (1)**				
	177	Mr. Yusong Hao	Department Manager Chengdu Civil Aviation Air Traffic Control Science & Technology Co., LTD	haoyusong@cdatc.com;	✓	✓
24		**CHINNEY (4)**				
	178	Mr. Rob Cook	Consultant Chinney Alliance Engineering Limited	rob.cook@chinney-eng.com;	✓	✓
	179	Mr. KK Wong	Managing Director Chinney Alliance Engineering Limited	kk.wong@chinney-eng.com;	✓	✓
	180	Ms. Monica Yang	Director of Marketing Chinney Alliance Engineering Limited	monica.yang@chinney-eng.com;	✓	✓
	181	Ms. Megan Cham	Senior Project Coordinator Chinney Alliance Engineering Limited	megan.cham@chinney-eng.com;	✓	✓
25		**FREQUENTIS (4)**				

		STATE/NAME	TITLE/ORGANIZATION	E-MAIL	ATTENDANCE	
	182	Dr. Gotthard Boerger	Frequentis Orthogon	gotthard.boerger@frequentis.com;	✓	✓
	183	Mr. Florian Heiser	Frequentis Sinpagpore Pte Lte	florian.heiser@frequentis.com;	✓	✓
	184	Mr. Peter Gridling	Frequentis Sinpagpore Pte Lte	peter.gridling@frequentis.com;	✓	✓
	185	Mr. Martin Chaloupek	Frequentis Sinpagpore Pte Lte	martin.chaloupek@frequentis.com;	✓	✓
26		**SAAB (1)**				
	186	Mr. Fredrik Lindblom	VP Business Development Asia Pacific SAAB ATM	fredrik.lindblom@saabgroup.com;	✓	✓
27		**THALES (8)**				
	187	Mr. Li Fei	Innovation Director Aviation and Air Traffic Management, Thales China	fei.li@asia.thalesgroup.com;	✓	✓
	188	Mr. Adam Hogan	Director Projects & Digital Thales Australia	Adam.Hogan@thalesgroup.com.au;	✓	✓
	189	Ms. Thanh Truong	ILS Availability Engineer Thales Australia	Thanh.truong@thalesgroup.com.au;	✓	✓
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	191	Mr. Romain Pontida	Project Manager Thales Australia	Romain.Pontida@thalesgroup.com.au;	✓	✓
	192	Mr. Lionnel Wonneberger	Business Development Director Thales Australia	Lionnel.Wonneberger@thalesgroup.com.au;	✓	✓

		STATE/NAME	TITLE/ORGANIZATION	E-MAIL	ATTENDANCE	
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	195	Mr. Andrew Nabarro	Business Development Manager Thales Australia	Andrew.nabarro@thalesgroup.com.au;	✓	✓
28		**ICAO (7)**				
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	197	Ms. Soniya Nibhani	Regional Officer ANS (CNS) Implementation International Civil Aviation Organization Asia and Pacific Office	snibhani@icao.int;	✓	✓
	198	Mr. How Sze Lung, Derek	Associate CNS Officer International Civil Aviation Organization Asia and Pacific Office	show@icao.int;	✓	✓
	199	Ms. Zhong Wenhan	Associate CNS Officer International Civil Aviation Organization Asia and Pacific Office	wzhong@icao.int;	✓	✓
	200	Ms. Pornrudee Ruthapichairak (Paula)	Business Development Officer International Civil Aviation Organization Asia and Pacific Office	pruthapichairak@icao.int ;	✓	✓

		STATE/NAME	TITLE/ORGANIZATION	E-MAIL	ATTENDANCE	
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	202	Ms. Varapan Meefuengsart	Program Assistant International Civil Aviation Organization Asia and Pacific Office	vmeefuengsart@icao.int;	✓	✓

LIST OF WORKING/INFORMATION PAPERS, PRESENTATION, AND FLIMSY

WP/IP No.	Agenda	Subject	Presented by
WORKING PAPERS			
WP/01	1	Provisional Agenda	Secretariat
WP/02	2	Review of Relevant Meetings	Secretariat
WP/03	3	Repository of the ATMAS in APAC	Indonesia and Secretariat
WP/04	5	Air Traffic Management Automation System Implementation and Operations Guidance Document	China
WP/05	6.1	Repository of AIDC Implementation Status in APAC	Secretariat
WP/06	7	Review Subject/Tasks List	Secretariat
WP/07	6.2	AIDC Implementation Issues Report	Indonesia, India, and Singapore
WP/08	4. 3	Singapore's Implementation Plan for Flight & Flow Information for a Collaborative Environment (FF-ICE)	Singapore
WP/09	2	Outcomes of SURICG/7	Secretariat
WP/10	3	Updates on Development of Air Traffic Management Automation System Problem Reporting Database (ATMAS PRD)	Hong Kong China
INFORMATION PAPERS			
IP/01	-	Meeting Bulletin	Secretariat
IP/02	2	Update from RASMAG/26	Secretariat
IP/03	4.1	Concept and Benefits of the Secure Data Bridge	Singapore
IP/04	4.1	Exploration and Implementation of An Optimized MSAW	China
IP/05	4.1	Introduction to Flight Inspection of ATMAS	China
IP/06	4.2	Technical Research on SWIM-based Interoperability for ATM Automation Systems	China
IP/07	6.1	Progress of AIDC Implementation in China	China
IP/08	6.2	The AIDC Implementation and Application in China	China

WP/IP No.	Agenda	Subject	Presented by
IP/09	4.3	New Trends of Controller Training System Development	China
IP/10	4.1	Airways design and implementation of its new Air traffic Management System – SkyLine-X	New Zealand
IP/11	4.2	Application of Data Exchange Platform in the ATM Information System	China
IP/12	4.3	Optimization of Arrival Flight Runway Allocation in the Guangdong-Hong Kong-Macao Greater Bay Area	China
IP/13	4.3	Adapting the Approach Spacing Tool to Suit the Local Operational Environment at the Hong Kong International Airport	Hong Kong China
IP/14	4.3	ATMAS Cybersecurity Design in Brief	China
IP/15	4.1	Shared Experience of ATMAS Relocation Transition upon Busy Airports	China
IP/16	4.1	GPS Week Rollover on Time Distribution System of Philippine ATM Center Automation System	Philippines
LIST OF PRESENTATIONS			
SP/01	7	CAAC Specification for ATMAS Part3 Data Exchange	China
FLIMSY			
Flimsy/01	7	Check List for ATMAS Project Management	China

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ICAO Asia/Pacific Regional Webinar

Implementation of ATM Automation System in APAC Region

7th June 2022 (Indochina Time, UTC+7)

	Opening Session
09:00 – 09:15	**Opening Remarks** *Mr. Luo Yi, Regional Officer, CNS* **Administrative information** **Please download all documents/presentations here**
	Webinar Session-1
9:15 – 10:55	**Moderator-** *Ms. Xie Yulan* *Co-Chair of ATMAS TF* *Deputy Director General* *North China Regional Air Traffic Management Bureau* *Civil Aviation Authority of China* 1. **SP101 - A Regional Perspective on ATM Automation System Implementation – ICAO** *Ms. Zhong Wenhan,* *Regional Officer CNS, ICAO APAC Regional Office* **Abstract:** The goal of this presentation is to share the regional view on ATM automation systems implementation, including the ICAO provisions and requirements regarding ATM automation systems, relevant updates on the Sixth Edition Global Air Navigation Plan (Doc 9750) and APAC Seamless ANS Plan V.3.0 as well as expectations on the transition to future. **Question and Answer** 2. **SP102– Research and Realization of Continuous Operation on Main and Backup ATM Automation System in China** *Mr. Chen Xiaoyu,* *Expert of ATMAS* **Abstract:** ATM automation system is the core system of ATC operation. It is often required to maintain continuous operation in case of emergency. CAAC ATMB has launched a series of solutions and improvement plans for management, personnel, equipment and environment to promote the continuous operation of the Main and Backup ATM automation system. The objective of this presentation is to share the experience and solutions for continuous operation of ATM automation systems in China and provide reference for ICAO APAC. **Question and Answer**

ICAO Asia/Pacific Regional Webinar

Implementation of ATM Automation System in APAC Region

7th June 2022 (Indochina Time, UTC+7)

	3. SP103 - Integrated Tower System Technologies for Streamlining Tower Operation - Chinney *Mr. Rob Cook* *Senior Consultant, Chinney Alliance Engineering* **Abstract:** Integrated Tower System (ITS) is an advanced digital technology in ATC which digitizes, automates and integrates various operational data to bring benefits in enhancing safety and operational efficiencies. This presentation introduces evolution of such technology in its past and current state, and the future trend in the ITS. **Question and Answer**
	4. SP104 - Practice Sharing of A-SMGCS Lighting Guidance Application in China *Ms. Xie Xu* *Senior Expert of ATMAS* **Abstract:** The goal of this presentation is to provide the practice of A-SMGCS lighting guidance application in China. It also aims to provide experience for ANSPs in ICAO Asia Pacific region to promote the construction and implementation of A-SMGCS Level IV lighting guidance and provide support for the implementation of ICAO ASBU to improve the safety and efficiency of surface operations. **Question and Answer**
10:55 – 11:10	*Refreshment Break (Sponsor page from CDATC)*
Webinar Session-2	
11:10 – 12:50	**Moderator -** *Mr. Kwek Chin Lin* *Co-Chair of ATMAS TF* *Chief ATC Specialist (Systems Development)* *Civil Aviation Authority of Singapore* **5. SP201 - ATM System Interoperability - A Thales Prospect** *Mr. Li Fei,* *Innovation Director Aviation and Air Traffic Management Specialist, Thales* **Abstract:** This presentation aims to describe the importance of ATM system interoperability and some of the new technologies which are being developed to enable better system connectivity. After a short appreciation of traditional ATM system interoperability features, the presenter will describe details and features of newer modern ATM systems. Finally, new developments are discussed, giving the audience an appreciation of how ATM systems might interact in the near future using concepts such as SWIM. **Question and Answer**

ICAO Asia/Pacific Regional Webinar

Implementation of ATM Automation System in APAC Region

7th June 2022 (Indochina Time, UTC+7)

6. **SP202 - Integrated AMAN/DMAN/SMAN Technologies for Enhancing ATC Operational Efficiency and Airport Security Services - Frequentis**

   Dr. Gotthard Ernst Boerger

   Director, Products and Strategy, Frequentis

   Abstract: While Arrival and Departure Managers (AMAN & DMAN) focus on flight efficiency and sustainable operations, Surface Management (SMAN) provides additional airport security support services. The presentation gives an overview of the functions, possibilities and advantages of the individual tools. The complementary benefits of an Integrated AMAN/DMAN/SMAN (IADS) solution as recommended by ICAO RSEQ ASBU Level 3 will be presented in the session. At the end of the presentation an outlook will be given how future airport operations will benefit from IADS.

   Question and Answer

7. **SP203 - The Journey Towards Digitalization in ATM - Saab**

   Mr. Fredrik Lindblom

   Sales Director, Saab Air Traffic Management

   Abstract: Digitalization of the ATM industry is starting to move faster than ever and it is a paradigm we need to embrace. With increase in operational data being digitized and accessible, higher level of integration and automation will be at the forefront of ATM solutions to enable higher degree in operational efficiency, safety, scalability and flexibility. This presentation introduces the necessary technologies deployed to enable this journey towards tower digitalization and automation with a range of solutions today and for the future.

   Question and Answer

8. **SP204 –Application of Forewarning Based on CFL – China**

   Mr. Zhang Jun

   Senior Expert of ATMAS

   Abstract: With the rapid development of civil aviation in China, the pressure of air traffic control is gradually increasing. Potential conflicts need to be found earlier, so as to have enough time to deal with potential conflicts. A new warning method has been explored to detect the possibility of conflict through more perfect horizontal and vertical model prediction, and reduce the impact of 4D trajectory uncertainty. The forewarning based on the CFL can detect the possibility of conflict in the next 3-5 minutes from the horizontal and vertical directions which can be used as a supplement means of STCA and MTCD, and provide a more powerful and perfect warning function.

   Question and Answer

ICAO Asia/Pacific Regional Webinar

Implementation of ATM Automation System in APAC Region

7th June 2022 (Indochina Time, UTC+7)

Closing Session	
12:50 – 13:00	**Closing Remarks** *Mr. Luo Yi, Regional Officer, CNS*

NOTE: This tentative programme is subject to change.
All times indicated are in Local Bangkok Time

Explanation of the Table of ATMAS Status in APAC Region

Note: If the ATM Automation System has the capability on certain function listed below but not implement yet, please marked in red ; if the ATM Automation System has already implemented certain function listed below, please keep it in black.

Column	Element	Explanation	Reference Chapter in ATMAS IGD	Relevant ASBU Block
1.	State/Administration	Name of the State/Administration		
2.	FIR	Name of the Flight Information Region (FIR)		
3.	ATS Unit / Location	Location of the ATM Automation System		
4.	Number of ATS positions	Number of ATS positions in this ATM Automation System (to evaluate the system workload)		
5.	Manufacturer / Brand / Version	Manufacturer / Brand / Version of the system		
6.	System Status	the system is used as Main, Backup, or Emergency		
7.	Surveillance Data Processing Function (SDP)	Surveillance data can be processed by the system, including PSR, Mode A/C, Mode S, ADS-B, WAM, or others	Chapter 3.1.1 & 3.2.1	ASUR B0/1, ASUR B0/2
8.	Bypass Surveillance Data Processing（BSDP）	BSDP is a redundancy module of SDP, which can independently receive, process and distribute surveillance data independently to SDP. When the SDPs fail, the system will switch to BSDP automatically. When the system switches to bypass mode, the HMI should clearly indicate if controller is working in BSDP mode.	Chapter 3.1.3	
9.	Flight Data Communication Network	Type of Flight Data Communication Network used by the system (AFTN, AMHS, or both)		COMI B0/7
10.	Flight Data Processing Function (FDP)	The system can support flight data processing, including Flight Message Processing, Life Cycle Management, 4D Profile Trajectory Caculation, SSR Code Management, Sector Management and Posting Computation	Chapter 3.1.2	
11.	Flight Strip	The system can support print Paper Flight Progress Strip, display Electronic Flight Strip, or both		
12.	Mode S conspicuity code Identification	The flight plan with A1000 will use a 24-bit address or ACID to correlate with system tracks, and warnings/alerts should not be generated when SSR duplication occurs due to Mode S conspicuity code.	Chapter 3.1.2.4	
13.	Correlation of surveillance and flight data	The system can perform an automatic correlation between the flight plan and the system track based on the SSR code, aircraft 24-bit address, or Aircraft Identification (ACID)	Chapter 3.1.4 & 3.2.2	ASUR-B0/3
	Safety Net Function	Essential alerts or warnings can be generated automatically		
14.	Emergency code warning (7500,7600,7700)	Once the emergency codes were received, the system is suggested to process it and display the Emergency on the concerned positions.	Chapter 3.1.5.2	
15.	Short Term Conflict Alert (STCA)	The system will provide a separation alert for a potential or actual infringement of separation minima between aircraft as basic STCA, using aircraft intent parameters (Selected Flight Level), considering ATC practices (level-off prediction test and turn prediction test).	Chapter 3.1.5.3	SNET-B0/1 & SNET-B1/1 & SNET-B1/2
16.	Minimum Safe Altitude Warning (MSAW)	The system will assist controllers with alerts of the potential risk of an aircraft infringing a defined minimum safe altitude over a concerned region.	Chapter 3.1.5.4	SNET-B0/2
17.	Area Proximity Warning (APW)	The system will alert controllers of any potential or actual unauthorized penetration of aircraft into Special Use Airspaces (SUA).	Chapter 3.1.5.5	SNET-B0/3
18.	Approach Path Monitoring (APM) Warning	The system will monitor the aircraft's vertical and lateral deviation from the final approach profile in ATMAS, and generate visual and/or aural alerts when an aircraft exceeds or is predicted to exceed the defined tolerance of deviation.	Chapter 3.1.5.6	SNET-B0/4
19.	Route Adherence Monitoring (RAM)	The system will monitor if an aircraft (i.e., surveillance track) is following the planned route, as stated in the associate flight plan.	Chapter 3.2.3.4	FRTO B0/4
20.	Cleared Level Adherence Monitoring (CLAM)	The system will monitor the conformance of the Actual Flight Level (AFL) of an aircraft to the Cleared Flight Level (CFL) issued by the air traffic controller and provide warnings if the deviation between the two levels (i.e. Level Bust) was found after the aircraft has been level-off.	Chapter 3.2.3.5	FRTO B0/4
21.	Meteorological Information Processing	The system is capable of receiving, processing, and displaying meteorological information, including GRIB, QNH, and weather data derived from mono-radar, or other	Chapter 3.1.6	AMET
22.	Air Ground Data Link Function (AGDL)	The AGDL function mainly processes the information based on the data link communication, including ADS-C (Automatic Dependent Surveillance-Contract), CPDLC (Controller-Pilot Data Link Communication), and DCL (Departure Clearance).	Chapter 3.1.7	COMS
23.	System Parameter Management Function	The system is capable of managing the variable system parameters through a user/ops orientated adaptation interface used by trained adaptors.	Chapter 3.1.8	

Explanation of the Table of ATMAS Status in APAC Region

Note: If the ATM Automation System has the capability on certain function listed below but not implement yet, please marked in red ; if the ATM Automation System has already implemented certain function listed below, please keep it in black.

Column	Element	Explanation	Reference Chapter in ATMAS IGD	Relevant ASBU Block
24.	ATS Inter-facility Data Communication Function (AIDC)	The system can support ATS-related information exchanges within the ATMAS of adjacent Control Units and Flight Information Regions adopted in the Asia-Pacific region, including Handover and Coordination	Chapter 3.1.9	FICE B0/1
25.	Human Machine Interface Function (HMI)	Operational users can monitor air traffic situations and modify flight plans and other relevant information through physical peripherals and/or onscreen control interfaces.	Chapter 3.1.10	
26.	Recording and Playback Function	The system has the basic, enhancement, none, or both recording and playback function.	Chapter 3.1.11 & 3.2.8	
27.	System Monitoring and Control Function	The system can provide the monitoring and controlling function, and the failure of the monitoring and controlling function should not affect the operation of other modules.	Chapter 3.1.12	
28.	GNSS Time Synchronization	The system can synchronize with the external GNSS signals or not	Chapter 3.1.13	
	Extended Alerts and Warning			
29.	Departure No Transgression Zone (DTZ)	The DTZ 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. The DTZ function also may suppress improper STCA generate between two normal flights in DMA (Departure Monitoring Area).	Chapter 3.2.3.1	
30.	No Transgression Zone (NTZ)	The system will warn controllers of a predicted or actual unauthorized penetration of NTZ by aircraft during final approach.	Chapter 3.2.3.2	
31.	Medium Term Conflict Detection Warning (MTCD)	The system will provide warnings to controllers for potential conflict for "aircraft-to aircraft" or "aircraft-to-airspace" encounters up to a looking ahead time.	Chapter 3.2.3.3	FRTO B0/4
32.	Similar Callsign Advisory (SCA)	The system will provide advisory to alert controllers when an aircraft carries a similar callsign with another one in the same jurisdiction controlled by a controller.	Chapter 3.2.3.6	
33.	Reduce Vertical Separation Minimum (RVSM) Warning	The system will provide alerts to controllers when a non-RVSM approved/compliant aircraft is within or is predicted to enter RVSM airspace.	Chapter 3.2.3.7	
34.	Position Report Monitoring (PMON)	The system will monitor ATO/ETO and provide warnings to controllers accordingly.	Chapter 3.2.3.8	
35.	Last Known Position Display	Last Known Position Display occurs when correlated tracks, uncorrelated, or ADS-C tracks with critical alerts are lost.	Chapter 3.2.3.9	
36.	SSR Inconsistency Warning	For correlated flight plan tracks, when the Mode 3/A code in the surveillance data is inconsistent with the SSR code in the flight plan, the system is suggested to raise ASSR Inconsistency Warning.	Chapter 3.2.3.10	
37	PBN Capability Indication	The system will provide PBN indicator and/or PBN route mismatch indication for controllers in order to indicate whether the aircraft match the RNAV/RNP Route or Arrival.	Chapter 3.2.3.11	APTA
38	Downlink Aircraft Parameters Processing and Display	The system have the capability to process and display aircraft downlink aircraft parameters (DAPs) in Track Fusion, Related Warnings, or Downlink Data Window	Chapter 3.2.4	ASUR-B0/3
39	Integrated Technology	the system has integrated some new technologies, including Arrival Manager (AMAN), Departure Manager (DMAN), or Enhanced Wake Turbulence Separation and Pairwise Separation Tools, or None	Chapter 3.2.5 & 3.2.6 & 3.2.9	RSEQ, WAKE
40	System Log Management	The system is able to collect and manage operational logs and error messages.	Chapter 3.2.7	
41	Interoperability	The system supports exchange messages with other external systems, including Integrated Tower System, A-SMGCS, Tower Electronic Strip System, Others, or None, to implement information sharing		SURF, SWIM
42	Operational Data Synchronization	The system can synchronize operational data to the backup system when in master mode, including flight data, operational setting data.	Chapter 3.2.10	
43	Statistics and Analysis Function	The system can generate reports on the surveillance data, flight plan, alarm information and traffic flow data.	Chapter 3.2.11	
44	Remarks	Any other need to be mentioned		

ATM Automation System Repository in APAC Region

													Safety Net Function															Extended Alerts and Warning																	
State/Administration	FIR	ATS Unit / Location	Number of ATS positions	Manufacturer / Brand / Version	System Status	Surveillance Data Processing Function (SDP)	Bypass Surveillance Data Processing (BSDP)	Flight Data Communication Network	Flight Data Processing Function (FDP)	Flight Strip	Mode S conspicuity code Identification	Correlation of surveillance and flight data	Emergency code warning (7500,7600,7700)	Short Term Conflict Alert (STCA)	Minimum Safe Altitude Warning (MSAW)	Area Proximity Warning (APW)	Approach Path Monitoring (APM) Warning	Route Adherence Monitoring (RAM)	Cleared Level Adherence Monitoring (CLAM)	Meteorological Information Processing	Air Ground Data Link Function (AGDL)	System Parameter Management Function	ATS Inter-facility Data Communication Function (AIDC)	Human Machine Interface Function (HMI)	Recording and Playback Function	System Monitoring and Control Function	GNSS Time Synchronization	Departure No TRANSGRESSION Zone (DTZ)	No Transgression Zone (NTZ)	Medium Term Conflict Detection Warning (MTCD)	Similar Callsign Advisory (SCA)	Reduce Vertical Separation Minimum (RVSM) Warning	Position Report Monitoring (PMON) Warning	Last Known Position Display	SSR Inconsistency Warning	PBN Capability Indication	Downlink Aircraft Parameters Processing and Display	Integrated Technology	System Log Management	Interoperability	Operational Data Synchronization Function	Statistics and Analysis Function	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
State 1	FIR 1	ACC1/City1	40	INDRA Aircon 2100	Main	PSR+Mode A/C+Mode S+ADS-B+WAM	Yes	AFTN+AMHS	Flight Message Processing+ Life Cycle Management+ 4D Profile Trajectory+ SSR Code Management+Sec Manage&Posting Comput	Paper+Electronic	Yes	SSR code+24-bit Address+ACID	Yes	Basic+Aircraft Intention+ATC practices	Yes	Yes	Yes	Yes	Yes	QNH+mono-radar+GRIB	ADS-C+CPDLC+DLC	Online+Offline	Basic	Yes	Basic+Enhancement	Monitor+Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Track Fusion+Related Warnings+Downlink Data Window	AMAN+DMAN+PST	Yes	Integated Tower System+A-SMGCS+ Tower Electronic Strip System	flight data+ operational setting data	Yes	

ATMAS TF/3
Appendix B to the Report

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

AIR TRAFFIC MANAGEMENT AUTOMATION SYSTEM

IMPLEMENTATION AND -OPERATIONS GUIDANCE DOCUMENT

Edition 1.0-June 2022

~~**Edition 0.1-September 2021**~~

AMENDMENTS

The issue of amendments is announced, when an amendment has been agreed by a meeting of the ICAO Asia/Pacific Air Traffic Management Automation System Task Force (APAC ATMAS TF). The space below is provided to keep a record of such amendment.

RECORD OF AMENDMENTS

Amendment Number	Date	Amended by	Comments
0.0	Feb 2020	China	The framework of this document is firstly work out by China.
0.1	Sep 2021	China, Hong Kong China, Philippines	First completed draft based on the agreed document framework in ATMAS TF/1 for review and comment by States
1.0	Jun 2022	China, Singapore, Hong Kong China	Revised the draft according to the inputs from States.

Edition 0.2- June 2022 ~~0.1 September 2021~~ K – ii

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

ADS-B	Automatic Dependent Surveillance - Broadcast
ADS-C	Automatic Dependent Surveillance - Contract
ADEXP	ATS Data Exchange Presentation
AFTN	Aeronautical Fixed Telecommunications Network
AIDC	ATS Inter-facility Data Communication
AGDL	Air Ground Data Link
AMAN	Arrival Manager
ANSP	Air Navigation Service Provider
APP	Approach Center
APM	Approach Path Monitoring
APW	Area Proximity Warning
A-SMGCS	Advanced Surface Movement Guide Control System
AST	Approach Spacing Tool
ASTERIX	All-purpose Structured EUROCONTROL Radar Information Exchange Protocol
ATC	Air Traffic Control
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATMAS	Air Traffic Management Automation System
ATO	Actual Time Over
ATS	Air Traffic Service
ATSU	Air Traffic Service Unit
AWOS	Automatic Weather Observation System
BSDP	Bypass Surveillance Data Processing
CA	Conflict Alert
CFL	Cleared Flight Level
CLAM	Cleared Level Adherence Monitoring
CPDLC	Controller-Pilot Data Link Communications
CRC	Cyclic Redundancy Check
CWP	Controller Working Position
DAP	Downlink Aircraft Parameter
DBS	Distance-based Spacing
DCL	Data Link Departure Clearance
DMAN	Departure Management
DPM	Departure Path Monitoring
ELDT	Estimated Landing Time
ETO	Estimated Time Over
ETO	Expected Time Over
EUROCONTROL	European Organization for the Safety of Air Navigation
~~eWTS~~	~~enhanced Wake Turbulence Separation~~
FAA	Federal Aviation Administration
FDP	Flight Data Processing
FIR	Flight Information Region
GNSS	Global Navigation Satellite System

GRIB	Processed Meteorological Data in the Form of Grid Point Values Expressed in Binary Form
HMI	Human Machine Interface
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
LAN	Local Area Network
METAR	Aerodrome Routine Meteorological Report(in Meteorological Code)
MSAW	Minimum Safe Altitude Warning
MSP	Maintenance Service Provider
MTCD	Medium Term Conflict Detection
NTP	Network Time Protocol
NTZ	No Transgression Zone
PBN	Performance Based Navigation
PCA	Predicted Conflict Alert
PDC	Pre-Ddeparture Clearance
PMON	Position Report Monitoring
PSR	Primary Surveillance Radar
QNH	Altimeter Sub-scale Setting to Obtain Elevation When on the Ground
RAM	Route Adherence Monitoring
RVSM	Reduced Vertical Separation Minimum
SCA	Similar Callsign Advisory
SDP	Surveillance Data Processing
SID	Standard Instrument of Departure
SMAN	Surface Management
SMD	Software Management Department
SP	System Supplier
SPI	Special Position Identification
SSR	Secondary Surveillance Radar
STAR	Standard instrument Arrival
STCA	Short Term Conflict Alert
TBS	Time-based Spacing
TLDT	Target Landing Time
UTC	Universal Time Coordinated
VSP	Variable System Parameter
WAM	Wide Area Multilateration

1. INTRODUCTION

1.1 Purpose

Since the Air Navigation Conference held in 2012, ICAO has been exploiting a global roadmap in the A~~a~~viation S~~s~~ystem B~~b~~lock U~~u~~pgrades (ASBU) under its Global Air Navigation Plan (GANP), with a focus on harmonization and interoperability leading to a global ~~a~~Air ~~t~~Traffic ~~m~~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~~ focusing on technological and human performance.4

To facilitate and harmonize the provision of robust, safe, efficient and orderly ATM services in the region, it is considered necessary to develop regional guidance materials with recommendations on the development and implementation of Air Traffic Management Automation System (ATMAS).

This Air Traffic Management Automation System Implementation and Operations Guidance Document (ATMAS IGD) provides guidance for the planning, design, testing, and implementation of the ATMAS in the Asia and Pacific Regions, with the purpose of ensuring continuous and coherent development of the ATMAS that is harmonized with adjacent regions.

The system requirements and operational procedures for the ATMAS are detailed in the relevant States' projects and AIP. This ATMAS IGD is intended to provide guidelines on the primary ~~basic~~ and the most important function~~al~~ as well as performance requirements of the ATMAS, based on the operations and maintenance practices.

1.2 Background

1.2.1 ATM Operational Concept

The global ~~Aair Ttraffic Mmanagement (~~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 objective~~mission~~ of ATM is to provide safe, economic, efficient, and dynamic management of air traffic and airspace that includes~~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 1.2.2-1.

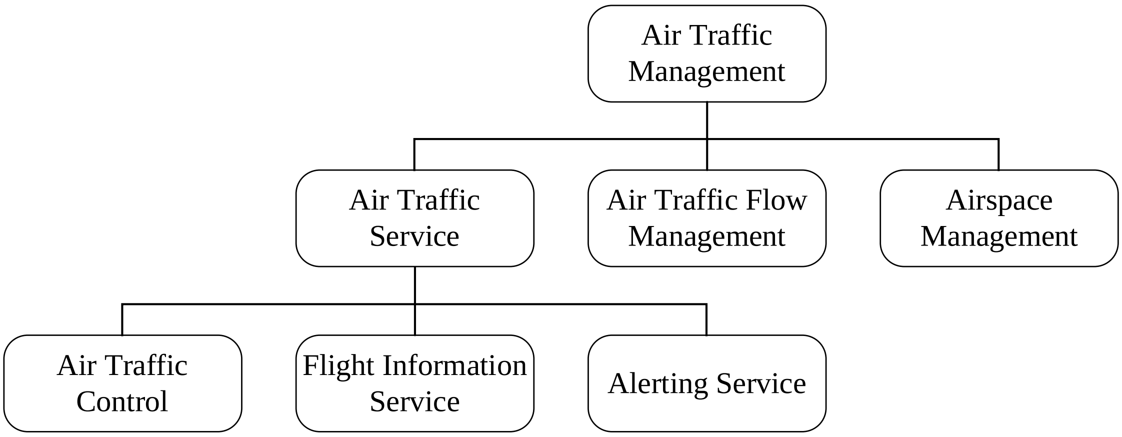

Figure 1.2.2-1 Composition of air traffic management

ATS is the central~~main~~ part of ATM, which includes A~~a~~ir T~~t~~raffic C~~c~~ontrol (ATC), F~~f~~light I~~i~~nformation S~~s~~ervice (FIS), and A~~a~~lerting S~~s~~ervice (ALRS).

The Objective of:

a. ATC is to prevent collisions between aircraft and, on the maneuvering area, collisions between aircraft and obstructions. ATC also expedites and maintains the orderly flow of traffic.

b. FIS is to give advice and information useful for the safe and efficient conduct of flights.

c. ALRS is to notify appropriate organizations regarding aircraft in need of search and rescue aid, and assist such organizations as required.

~~ATC is to prevent collision between aircraft and aircraft, and collision between aircraft and obstacle in maneuvering area. The objective 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 ATMAS

The ATMAS mentioned in this document is mainly applied in ATC service, ~~as well as~~an~~f~~d offer~~ings~~s assistance for ALRS and ATFM. It comprises a group of processing sub-systems dedicated to specific functions, which are integrated as one air traffic management system to provide functional capabilities to air traffic controllers in the Area Control Centers (ACC), Approach Control Unit, and Aerodrome Control towers. The ATMAS helps controllers keep~~ing~~ conformance monitoring, hazard monitoring, and assuring safety separation to air traffic flow.

~~Normally, t~~The ATMAS has a modular design and 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 high-capacity redundant LANs. 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~~safe operation of the dual computer groups is achieved by multiple computation redundancy~~,~~ (parallel operation of the computer), or hot stand-by redundancy, to provide ~~an~~ uninterrupted service to the controllers.

Typically, considering the safety and redundancy requirements, the ATMAS has two individual LANs, which are called working LANs, where the redundancy computers are connected. The working LANs keep sharing information ~~all the time~~ and function as main and fallback modes. Air traffic control airspace with high-density traffic is recommended to use a third LAN, which is called service LAN. The latter's primary ~~main~~ function is system trace collection, handling of recording and playback, etc.

1.2.4 Challenges and Solutions

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

a. The challenge for States to implement~~ing~~ technologies ~~ai~~as prescribed in the GANP and ASBU timeframes ~~—~~ particularly is innovative concepts such as 4D trajectory and seamless ATM across FIRs. The seamless ATM Plan requires the individual ATMAS sharing a common set of accurate information in a timely manner, which needs to interface with each other seamlessly~~,~~ and work interoperability.

b. Traditional ATMAS procurement processes deliver~~ing~~ systems that are not COTS but a baseline of core function and subsequent accumulation of bespoke design for previous ANSP applications. As the system functions and features continue to develop, the system is getting more and more complex. These cause long software/application development and practically, in most ~~often~~ cases, these functions/features are seldom used. Consequently, the system is getting hard to maintain and costly to deploy.

c. Increase scrutiny of costs for ANSPs due to various~~a variety of~~ reasons, -including ~~,~~ airspace user scrutiny, public oversight into spending, or constrained national budgets due to local or regional economic events. Significantly,~~Especially, t~~The public health emergencies have a devastating impact on the economy and the aviation industry worldwide. It will not be surprising that the ICAO member states, including those in the APAC Region, must reappraise both their capital and operational expenses (CAPEX and OPEX) in the coming years, including the expenditure in the ATMAS.

~~The solutioning is very specific and not the only way a State/ANSP can resolve the above issues – in fact, several States have avoided a common specification approach due to various reasons, including dominance by larger members influencing functional specification and priority, and specific environmental factors that could not be overcome.~~

~~The seamless ATM Plan requires the individual ATMAS sharing a common set of accurate information in a timely manner, which needs to interface each other seamlessly, and work interoperability.~~

To overcome the above challenges, it is important to come up with the ATMAS IGD that will provide the main functions and performances which is aimed at facilitating the implementation or provision of the robust, safe, efficient ATM automation systems. This will help the APAC region member states/CAAs/ANSPs to have an ATM automation system that shares common/core functions/performances while achieving seamless interoperability rather than investing more on CAPEX/OPEX to cope with future increase in air traffic. It is relatively more important to put focus on:

a. application of new/innovative technologies that would help make good business cases,

b. incorporating baseline/key optional features into their system design at an early stage, and

c. preparing for system completion affecting changes during low air traffic periods before full traffic recovery.

1.2.5 Outcomes and Endorsements

To ensure continuous and coherent development of the ATM automation systems~~ that are~~ 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 ATMAS have been focusing and discussing ~~fruiting~~ in APAC Region since 2018.

The ICAO Asia Pacific Regional ATMAS Symposium (APAC RATMS) held in Nanjing, China, from 22 to 23 November 2018 successfully addressed Action Item 54/13 of 54th DGCA Conference on ATMAS where it also suggested for 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 concerning 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 outcomes of the ICAO APAC Regional ATMAS Symposium (APAC RATMS) and other SURICG/4 papers relevant to ATMAS, 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) held at the ICAO Regional Office, Bangkok, Thailand, from 2 to 6 September 2019 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 ATMAS issue was also provided to ATM SG/7 meeting. Several States/Administrations expressed their willingness to support the work of the Task Force, including China, Hong Kong -China, India, Indonesia, Nepal, Singapore, Thailand, and the 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 that 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 ATMAS. The panel 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 ATMAS IGD

This ATMAS IGD consists of the following parts:

Section 1	Introduction
Section 2	Reference Documents
Section 3	System Functional Baseline
Section 4	System Design
Section 5	System Transition
Section 6	System Maintenance
~~Section 7~~	~~System Maintenance~~

1.4 Document History and Management

The framework of this document was first introduced in the first Working Group Meeting of ATMAS Task Force (ATMAS TF/1) of video conference, which wasis held in October 2020. The Meeting agreed to further develop based on the proposed framework into a complete document for approval as a regional guidance document. A working team~~,~~ consisting of volunteers from China, Hong Kong-China, India, Japan, Malaysia, Philippines, Singapore, Thailand, and Vietnam was established ~~by~~during the Meeting to contribute to document's content~~the content of the document~~. In August 2021, the completed draft of this document was ready for circulation among States for review and comment.

This document aims to~~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 conditions.~~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 concerning ~~in relation to~~ ATMAS.

1.5 Copies

Paper copies of this ATMAS IGD 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 sending an email of request to APANPIRG through the ICAO Asia and Pacific Regional Office.

1.6 Changes to ATMAS IGD

Whenever a user identifies a need for a change to this document, a Request for Change (RFC) Form (refer to Appendix A) should be completed and submitted to the ICAO Asia and Pacific Regional Office. 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. 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 ATMAS IGD will be prepared, with the changes marked by an "|" in the margin, and an endnote indicating the relevant RFC for the traceability of the change. If the change is in a table cell, the outside edges of the table will be highlighted, for example, as follows.

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

1.7 Editing Conventions

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2. 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 (Amendment 9 dated 5/11/20)	2020	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)	5thEdition	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	Pan Regional (NAT and APAC)Asia/Pacific Regional Interface Control Document (ICD) for ATS Interfacility Data Communications (PAN AIDC AIDC)	Version 31.0	20072014	ICAO PAN APAC	
20	ICAO Asia/Pacific Regional ADS-B Implementation and Operations Guidance Document (AIGD) The Revised ADS-B Implementation and Operations Guidance Document (AIGD) Adopted by CNS SG/23 — September	Version 13.0Version 12.0	April 20212019	ICAO APAC ICAO APAC	
21	ICAO Asia/Pacific Regional Mode S DAPs Implementation and Operation Guidance DocumentThe Mode S DAPs Implementation and Operation Guidance Document Adopted by CNS	Edition 3.0Edition 1.0	20212019	ICAO APACICAO APAC	

	~~SG/23 September 2019~~				

3. SYSTEM FUNCTIONAL BASELINE

The functional baseline, forming the core of the ATMAS, ~~are~~is 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.

3.1 System Essential Functions

In order to provide controllers with the display of air situation, the ATMAS is suggested with the following essential functions.

a. Surveillance Data Processing Function (SDP). Chapter 3.1.1 introduces the essential surveillance data processing function. For the processing of enhanced surveillance data such as ADS-B, please refer to chapter 3.2.1.

b. Flight Data Processing Function.

c. Bypass Surveillance Data Processing Function.

d. Correlation ~~Coupling~~ of Surveillance and Flight Data function. Chapter 3.1.4 introduces the essential correlation~~coupling~~ function with mode 3/A code. The processing of using 24-bit address code etc., as the condition for correlation~~coupling~~, please refer to chapter 3.2.2.

e. Safety Net Function. Chapter 3.1.5 introduces the essential Safety Net function. For the extended Safety Net function, such as Medium Term Conflict Detection Warning (MTCD), please refer to chapter 3.2.3.

f. Meteorological Information Processing Function.

g. Air~~-~~ Ground Data Link Function (AGDL).

h. Variable System Parameter (VSP) Management Function.

i. ATS Inter-facility Data Communication Function.

j. Human Machine Interface Function (HMI).

k. Recording and Playback Function. Chapter 3.1.11 introduces the essential data recording and playback function. For the video recording and playback function, please refer to chapter 3.2.7.

l. System Monitoring and Controlling Function.

m. Software Version Management Function.

n. GNSS Time Synchronization.

3.1.1 Surveillance Data Processing Function

SDP is one core function of ATMAS. SDP should be able to integrate multiple radars and process the received~~ surveillance~~ data to generate a unique system track. System tracks contain~~ing~~ accurate real~~-~~time positioning information, ~~are~~which ~~are used to~~ correlat~~ion~~es~~couple~~ with flight plans and is displayed on HMI with specific track symbols.

Usually,~~Normally,~~ SDP includes the following functions:

a. Access and process data from primary radar, secondary radar, primary and secondary combined radar, and weather data from PSR radars.

b. Pre-process the surveillance data to monitor the data quality.

c. Process mono-sensor surveillance data and generate mono-sensor track.

d. Process multi-sensor surveillance data and generate continuous and smooth system tracks adopting advanced tracking filtering algorithms.

e. Manage the altitude tracking and perform conversion of Mode C derived data according to QNH value.

f. Provide prompts in case of overload, filter received data, and discard extra data.

g. Process the special position identification pulse (SPI) and display using a~~n~~ unique indication.

h. Allow special area definition to improve system track accuracy.

3.1.1.1 Surveillance Data Pre-processing

The system is recommended to process standard radar formats, including ASTERIX format and ~~other~~ related standards. It should automatically identify the form~~at~~ of surveillance data, then decompose and extract the data items according to the corresponding format specifications.

The system is encouraged to be able to monitor the received data quality and filter out the abnormal data to ensure the data fusion quality.

The surveillance data quality check is suggested by considering the following factors~~taking following factors into consideration~~:

a. CRC error.

b. Data frame error.

c. North messages lost.

d. Radar sector crossing messages lost.

e. Track lost.

f. Time-stamp check.

3.1.1.2 Mono-radar Data Processing

The system is recommended to perform syntactic and semantic checks on the received data against specifications, including the target attributes ~~of target~~, identifier (SSR code, track number, address code, etc.), position, altitude, speed, time stamp, SIC/SAC, etc.

The system is suggested with time drift management to handle abnormal time stamping, and correct the timestamp by adding a time shift in received data.

~~It should perform coordination conversion and projection, as well as providinge mono-radar tracksing function.~~

The system handles target correlation for the purpose of generating a new track, or updating the existing, or deleting the dated, and then form a stable mono-radar track in the end.

3.1.1.3 Multi-radar Data Processing

The system fuses the accessed multi--radar to generate a stable system track by associating the targets of multiple radars, and forms a unique target identification mark. When the radar data are associated, the data and state attributes of radar, including position, secondary code, altitude, speed, track characteristics, and other data, are considered.

~~The system should generate stable system tracks by multi-radars data fusion, which includes correlation and tracking, and takes into account of radar bias settings.~~

~~After receiving data from multi-radars, the system handles target correlation process, which is taken into account of target characteristics, such as position, SSR, altitude and speed.~~

The system associate-s the existing system track for updating, or ~~with~~ establishes~~ing~~ a new ~~system~~ track ~~on the other hand so as~~ to ensure accuracy, continuity, and smoothing. Abnormal data derived from some radars should not impact system track quality. The system track is provided to alert calculation, correlation process, and HMI display. In the track fusion process, the system records the quality of every surveillance sensor t~~, so as t~~o estimate the quality of this sensor based on ~~the~~ historical and ~~the~~ real-time data. Abnormal data derived from some radars should not impact system track quality.

~~The system is suggested to further conduct target correlation with existing system track for updating, or with establishing new system track on the other hand so as to ensure accuracy, continuity and smoothing. Abnormal data derived from some radars should not impact system track quality.~~

In track fusion process, the system records the quality of every surveillance sensor, so as to estimate the quality of this sensor based on the historical and the real-time data.

The system tracks is normally used as the basic data of the entire system to support modules such as alarm calculation, plan correlationcouple processing, and human-machine interface.

During the period of fusion process, the system gathers statistics of each radar data quality. As a reference, system track updates.

As a result of fusion process, the system track is provided to alert calculation, correlationcoupling process and HMI display.

3.1.1.4 Target Altitude Tracking and Processing

The system is suggested to support QNH area definition and correct Mode C values into barometric altitudes for all aircrafts in a specific QNH area.

The system is suggested to provides altitude tracking, by extrapolating the flight level according to the current mode C value and altitude change rate.

The system should support QNH area definition and correct Mode C values into barometric altitudes for all aircraft in a specific QNH area.

The system should discards abnormal altitude reported by the surveillance source.

3.1.1.5 Special Pulse Identification Processing

When receiving SPI from radar track, the system is suggested to display a prompt on track identifier automatically.

3.1.1.6 Automatic Test Target Monitoring

The system is advised to be capable of monitoring the quality of radar via automatic Test Target Monitoring with fixed SSR Test Transponders.

3.1.1.53.1.1.7 Surveillance Data Overload Processing

The system should detect plots overload (i.e., the maximum number of plots per radar and per antenna revolution and the maximum number of plots per radar and per sector) in order to filter out excess plots.

The system is recommended to cope with surveillance data overloading processing as follows:

a. When the total number of targets processed by SDP reaches a certain threshold, the system will automatically generate a warning promptwill generates a warning prompt automatically.

b. When the total number of targets exceeds the load threshold, the system will gives prompts to users and considers filtering or discarding the extra data.

3.1.1.6 Special Pulse Identification Processing

When receiving SPI from radar track, the system is suggested to display a prompt on track identifier automatically.

3.1.1.7 Automatic Test Target Monitoring

The system is advised to be capable of monitoring the quality of radar via automatic Test Target Monitoring with fixed SSR Test Transponders.

3.1.1.8 Special Area Setting and Processing

The system is proposed to be capable of:

a. Defining areas of interest (AOI) for each sensor, and discarding reports outside the AOIs.

b. Defining inhibition areas for each sensor, and stoping track initialization but provide reports for exist track in the inhibition areas.

c. Defining distrust areas for each sensor, and discard reports in the areasDefining blanking areas for each sensor, and discarding reports in the blanking areas.

3.1.1.9 Real-time Quality Control (RTQC) of Radar

Real-time quality control (RTQC) is used to monitor and control the quality of radar signals received by the system,. IIt calculates the radar (sensor) correction factor and the fusion weight coefficient based on the results of monitoring and controlling. RTQC should manually and automatically compensates for the deviation in azimuth and distance of radars or sensors to improve the radar detection accuracy and provide the necessary fusion parameters for subsequent multi-radar tracking processing.

When the RTQC finds abnormal monitoring data, it gives a warning on the system monitor interface in the real--time. When the quality of one or more data sources is abnormal or interrupted, the system will isolate it to ensure the system tracks in a normal work state. The system judges the availability of the data according to the confidence coefficient of source surveillance data.

3.1.1.10 System Tracks Output

d. The system should output the system tracks according to various specified radar formats (such as ASTERIXcat062, etc.).

c.e. The update cycle of Tthe output system tracks can be adjusted within a reasonable range by modifying parameters, and its fastest update rate is the same as the track update cycle of ATMAS.

~~NOTE: This capability can be equipped in both surveillance sensors and the SDP. If the problem relevant to converged system tracks, it is better to configured in ATM AS. Otherwise, it is better to be configured in specific surveillance sensors.~~

3.1.2 Flight Data Processing Function

Flight data processing (FDP) is one core function of the ATMAS. Data relevant to~~which is relevant with~~ flight plan are received, stored, processed, and updated by FDP. FDP can also exchange data with other software modules.

Usually~~Normally~~, FDP includes the following functions:

a. ATS messages processing, which processes ICAO, AIDC, OLDI, and other format messages.

b. Flight plan life cycle management to the flight plan.

c. 4D profile trajectory computation, including route analysis, profile calculation and time estimation, SID /STAR /runway automatic allocation.

d. SSR code management, including SSR code automatic assignment ~~for inbound and outbound flights,~~ and manual SSR codes assignment by controllers;

e. Sector management and posting computation, post flight plans based on conditions, and provide electronic postings~~strip display~~ and paper flight strip printing at the designated position;

f. Flight plan data exchange with other external systems (such as Main/Fallback ATM automation systems, tower ATM automation systems, air traffic flow management systems, etc.). This part will be described in detail in section 5.7 of this document.

3.1.2.1 Flight Message Processing

The system should be capable of processing flight messages following ICAO PANS-ATM(Doc 4444) and AIDC and other related regulations, including FPL, CHG, CNL, DEP, ARR, DLA, CPL, EST, CDN, ACP, LAM.

The system is advised to perform semantic and syntactic checks on the received messages and create or update associated flight plans with correction. Messages that failed in semantic or syntactic checks are categorized and sent to the designated position for manual processing. Manually corrected messages will be~~are~~ processed again by the system.

The system is suggested to be designed with a messages manual transmission function~~,~~ and provide a default template for each type of message~~s~~ to be modified and confirmed by users.

The system is recommended to ~~automatically~~ transmit messages according to the pre-defined conditions and addresses automatically. At least the following ~~message~~types can be sent: FPL, DEP, ARR, CHG, DLA, CPL~~, and EST~~.

3.1.2.2 Life Cycle Management

The system shall be able to manage the life cycle of flight plans. Flight plan states could be generally defined as INACTIVE, PREACTIVE, COORDINATED, ACTIVE, FINISHED, etc. Users can adjust the above states according to the operation requirement.

The evolution of the flight plan states could be triggered automatically based on time, message, correlation~~coupling~~, etc., or by manual input.

Examples of the central ~~main~~ state transition conditions and processing are as follows:

a. INACTIVE

When created~~At creation~~, the flight plan state is INACTIVE.

Typically,~~Normally,~~ all flight plans in INACTIVE state support manual~~ly~~ modification or via ATS messages.

b. PREACTIVE

When the flight is approaching its execution and control airspace, the flight plan state will change to ~~the~~ PREACTIVE ~~state~~.

At PREACTIVE state~~pre-activation~~, the system is suggested to perform 4D trajectory and posting computation~~,~~ and send flight strips to relevant positions. The system could~~–~~ allocate SSR codes, departure runways, and SIDs for departure flights.

c. COORDINATED

When the flight is ready for control, the plan state will change to COORDINATED which can be~~. This coordination is~~ triggered by manual operations or system events.

The flight plan in the COORDINATED state is qualified for correlation ~~coupling~~ with system tracks.

d. ACTIVE

The flight plan state becomes ACTIVE when the flight is in the jurisdiction. ~~When the flight is in jurisdiction, the flight plan state becomes ACTIVE.~~

Generally, the system calculates and updates 4D trajectory based on surveillance data, air-ground data, and manual commands. The flight plan in the ACTIVE state is qualified for correlation~~coupling~~ with system tracks.

e. FINISHED

When the flight plan is no longer used to assist in controlling the actual flight, the plan state becomes FINISHED.

At the FINISHED state~~finishing~~, the system is suggested to:

- Release the SSR code.
- Stop the 4D trajectory calculation.
- Delete posting events and remove the electronic flight strip.
- Save the records for further analysis and statistics.

f. Other states

In addition to the above states, users can also define SUSPENDED, INHI~~N~~BITED, and other states according to operation requirements~~, which are used for flight plan suspension or inhibition~~. Under these states, FDP will stop updating the flight profile and suppress related alarms.

3.1.2.3 4D Profile Trajectory Calculation

It is recommended the system support 4D flight profile trajectory calculation. The profile calculation is continuous and generally divided into three stages: climb ~~take-off~~, level flight, and descent. The profile may start~~s~~ from the departure airport or the fixes before the FDRG entry, containing height and time information for each waypoint, and ends at the destination airport.

The profile calculation could refer to waypoint information, DEP/ARR airport, runway, requested altitude, cruise speed, aircraft performance parameter, GRIB, target position, ~~and~~ real-time data input by controllers, etc.

The profile updates could -be done at the change of flight attitude ~~or~~ , passing way points, sector boundary points, ~~or on~~ system events, or controller inputs.

The system is proposed to automatically allocate departure runways and SIDs for departure flight plans ~~as well as~~ and arrival runways and STARs for arrival flight plans. The system would provide the function of manual assignment, modification, and deletion to SID/STAR/runway.

3.1.2.4 SSR Code Management

~~Norma~~Usually, the system is capable of manually and automatically assigning SSR codes.

The system is recommended to adopt specific SSR code group and allocation rules according to the type of flights (inbound and outbound).

The system is suggested to perform an SSR code retention check and use the SSR code in received messages (e.g., DEP messages) if the code is available. If not accessible~~free~~, the system will allocate a new code from the free code list. In case of no free codes, the system could assign an SSR code from the ~~allocated~~given code list, and the earliest allocated code should have priority.

Generally, the system is not supporting special codes (such as 7700, 7600, 7500, etc.) assignment.

The SSR code will be released~~,~~ when the flight plan is finished.

The system is proposed to support manually modifying the flight plans' SSR. ~~The system is proposed to support manually modify the SSR of the flight plans.~~ If the input code is already occupied, a prompt is suggested to be produced.

It is recommended that the system uses A1000 as Mode S conspicuity code. The flight plan with that code will use a 24-bit address or ACID ~~for the~~ to correlate~~coupling~~ with system tracks, and warnings/alerts should not be generated when SSR duplication occurs due to Mode S conspicuity code.

3.1.2.5 Sector Management and Posting Computation

Normally, the system ~~is capable of~~can pre-configure the airspace into different sectors and enables the controllers to group or ungroup these sectors online.

The system is recommended to post the relevant electronic flight strip~~electronic strip~~ to the designated sector according to offline defined conditions. The electronic flight strip is suggested to display on the controlling sector and posted sector in specific colors.

The system is proposed to compute and insert posting events based on the way~~-~~points or sectors in the flight plan. Posting conditions are tightly linked with the operational concept and control procedures, including ~~:~~ way~~-~~points, altitude range, ACID, airport, runway, flight rule, flight type, etc.

The system is advised to support the manual and automatic transfer of jurisdiction. The automatic transfer could be computed based on offline rules to get the timing and the target sector. The mechanical~~automatic~~ transfer conditions are similar to posting conditions.

3.1.3 Bypass Surveillance Data Processing Function

To further enhance resilience, bypass surveillance data processing（BSDP）could be implemented according to the operational need. BSDP is a redundancy module of SDP, which can independently receive, process and distribute surveillance data independently to SDP. When the SDPs fail~~s~~, the system will switch to BSDP automatically. ~~Prior to~~When the system switch~~in~~esg to bypass mode, the HMI should clearly indicate if controller is working in BSDP mode.

~~The system is suggested to configure BSDP module according to operation requirement.~~ BSDP is recommended to be capable of directly accessing various surveillance sources, using a different tracking algorithm with SDP.

BSDP should at least provide mono-sensor tracking function. Multiple-sensor data tracking function and alarm functions, such as Special Codes alert, Short Term Conflict Alert (STCA), Minimum Safe Altitude Warning (MSAW), Area Proximity Warning (APW), etc., could be considered as part of BSDP.

~~Human Machine Iinterface (HMI) is proposed to support displaying effective alert mentioned above in bypass mode., functionssss~~

3.1.4 Correlation~~Coupling~~ of Surveillance and Flight Data

The objective of the surveillance and flight plan ~~coupling~~correlation function is to establish an association between a surveillance track and a flight plan ~~,~~ based on identifying codes and position checks. The way to develop~~establish~~ association includes automatic and manual ~~coupling~~correlation.

3.1.4.1 Automatic correlation~~Coupling~~

Usually,~~Normally,~~ the system performs an automatic ~~coupling~~correlation between the flight plan and the system track~~,~~ when pre-defined ~~-~~conditions are met, for example~~s~~:

a. Specific flight plan status.

b. Identical SSR code.

c. Passing position and altitude check.

The flight plan in the system has two kinds of SSR codes:

a. ASSR (Assigned SSR code): currently assigned to the flight plan within the FIR.

b. PSSR (Previous SSR code): used for inbound flight, which was used in the previous FIR or the previous code used in the case of a code change within the FIR.

The position and altitude checks will improve the accuracy of correlation. ~~shall include~~The method of position and altitude checks are suggested as follows:

a. Whether the track position is in the route model. The route model is composed of airports, way~~-~~points, and route corridors in the flight plan.

b. Whether the difference between the estimated flight plan position and the track position is within a certain range.

c. For take-off and landing system tracks, the altitude check~~-~~ is recommended to be- performed.

3.1.4.2 Manual ~~Coupling~~Correlation

The system is recommended to support manual correlat~~e~~ion~~coupling~~ of ~~of~~ a flight plan ~~to~~ with a track by controllers, for example, using mode 3/A code as a criterion~~criteria~~.

A warning message is suggested to be provided if the manual ~~coupling~~correlation is failed.

3.1.4.3 ~~Decou~~Cancel Correlation~~pling~~

The system is suggested to cancel correlation~~cancel thede coupling~~ if the correlation~~coupling~~ conditions are no longer~~t~~ met, and automatically generate a warning prompt to designated position except Emergency Settings.~~.~~

Under emergency settings, the system is advised to maintain the correlation~~coupling~~ when the SSR code is changed to 7500, 7600, and 7700.~~.~~

3.1.4.4 Correlation~~Coupling~~ Data Distribution

~~At the time of~~After ~~coupling~~correlation, the system is recommended to distribute ~~coupling~~correlation information to other modules and display correlated system tracks on the controller positions.

Usually, ~~Normally,~~ the system updates the flight profile according to the position and altitude information of the correlated~~coupled~~ surveillance track.

3.1.5 Safety Net Function

Safety Net Function serves to alert controllers of a potential, imminent or actual infringement of safety margins to prevent hazardous situations from developing into major incidents or even accidents. The aviation safety areas covered by Safety Net Function generally include:

a. Aircraft Separation.

b. Airspace Operation Requirement.

c. Conformance of Clearance.

d. Terrain Clearance.

e. Approach/Departure Path Conformance.

Alerts/warnings from Safety Net Function are generated based on different levels of severity of infringement and imminency with distinguishable visual and/or aural alarms with their prominence corresponding to the severity and imminency of the infringement.

During the planning stage, States/Administrations are encouraged to conduct a comprehensive study on the applicability of safety net features in ATMAS to their local environment ~~with consideration of~~considering system behavior, Human Machine

Interface (HMI) design, and operational procedures. By design, the Safety Net Function in the ATMAS should be configurable with various parameters on activation/deactivation/acknowledgement of alarm adjustable by the users. Where applicable, references, especially on test strategy and system parameters, to successful cases of Safety Net implementation by other States/Administrations are suggested.

For actual implementation of Safety Net Function, a progressive approach is suggested with potential advantages as below:

a. Reducing risks in implementation and operation of one safety feature at a time as compared to deployment of all planned safety features in one go;

b. Reducing demand ~~of~~for resources and staff workload involved in the evaluation of the safety features; and

c. More time for air traffic controllers to evaluate the safety features and fine-tune the parameters before ~~embarking on~~ further implementation.

A post-implementation review is recommended, including the collection of feedback~~s~~ and suggestions from frontline air traffic controllers, effectiveness and performance of the safety features (such as user-friendliness, alert timeliness, nuisance alerts), data analysis to gauge improvement in safety figures with a view to continuously fine-tuning of safety net parameters to reduce nuisance alerts.

3.1.5.1 Types and Priority

The system provides safety net~~serious alerts and warnings~~ to controllers with visual and aural indications, integrating surveillance data, flight plan data, and other operational data using ~~, by means of~~ different algorithms and rules.

~~The alerts and warnings are normally classified into emergency, alerts, and warnings, which the presentation is advised to consider indicators, display position, colors and audios etc.~~

The safety net includes ~~e~~Emergency, STCA, MSAW, APW, APMW, etc.

It is recommended that the system is capable of setting the priority of alerts. The priority of warning is higher than its corresponding pre-warning. The emergency should have the highest priority, including ~~hijack~~ Hijack (7500), ~~radio~~ Radio ~~failure~~ Failure (7600), ~~general emergency~~ Emergency (7700),~~,~~ etc.

~~Examples of alerts include STCA, MSAW, APW, APMW, etc.~~

~~Examples of warnings include SSR Code Duplication warnings, AIDC coordination prompt, SPI indication, etc.~~

~~It is recommended that the system is capable to set the priority of alerts, the priority of warning is higher than its corresponding pre-warning. Multiple warning indicators could be displayed on the label simultaneously according to the warning priority.~~

3.1.5.2 Emergency

~~At reception of~~Once the ~~e~~Emergency codes were received, the system is suggested to process it~~,~~ and display the ~~e~~Emergency on the concerned positions.

The emergency codes include:

a. 7500 (H~~h~~ijack).

b. 7600 (R~~r~~adio F~~f~~ailure).

c. 7700 (~~general~~ E~~e~~mergency).

Normally, the E~~e~~mergency is displayed until the received Mode 3/A code is different from the emergency code.

3.1.5.3 Short Term Conflict Alert

Short Term Conflict Alert (STCA) is an important safety net feature of ATMAS as collision avoidance tool, or to provide a separation alert for a potential or actual infringement of separation minima between aircraft ~~for alerting controllers of a potential or actual infringement of separation minima between aircraft to avoid collision~~. STCA can work between targets associated with an FPL and unknown targets without an FPL.

The STCA function in ATMAS generates visual and/or aural alerts to controllers in air situation display if any ~~pair of~~ aircraft is predicted to or is violating a pre-defined conflict or~~violating, or is predicted to, within a look-ahead time, which is a pre-defined~~ separation minimum~~minima~~ in the STCA settings of the ATMAS. Controllers would need to resolve the conflict immediately once the alert has been generated.

Surveillance, flight plan, and environmental data are required for generating STCA in ATMAS. The following list of information could be considered to include in the STCA processing:

a. Aircraft position

b. Pressure altitude

c. Cleared flight level

d. Flight rule

e. RVSM status

f. Concerned controller jurisdiction

g. Separation standards of STCA areas

h. Look-ahead time

The Flight plan is not obligatory. Flight plan data, i.e., cleared flight level, flight rule, and RVSM status of the aircraft, could help improve the relevancy of alert generation so as to reduce cases of nuisance alerts. In addition, the implementation of STCA inhibition could be considered based on a definition of inhibition zones, SSR code groups, callsign, or other conditions applicable to the local operati~~onal~~ng environment and needs.

The STCA processing cycle is recommended to be at a frequency not less than once per track update of ATMAS. States/Administrations could also consider implementing STCA with two stages of alerts based on the situation of predicted and actual infringements, i.e., Predicted Conflict Alert (PCA) and Conflict Alert (CA).

For complex airspaces with different separation standards for respective~~different~~ sectors, the design of ATMAS is recommended to allow the configuration of multiple STCA volumes~~ in which specific STCA parameters could be applied for a given STCA volume according to the operational needs. ~~. Users could apply specific STCA parameters for a given STCA volume according to operational needs.

The performance of STCA is highly dependent on the optimization of the conflict detection algorithm and adapted parameters for the local environment. States/Administrations are suggested to work closely with system manufacturers to adapt the STCA detection according to the local environment. For successful implementation, regular review with controllers on the performance is necessary~~ for fine-tuning of the STCA to local operational needs~~.

3.1.5.4 Minimum Safe Altitude Warning

Minimum Safe Altitude Warning (MSAW) is intended ~~for~~to assist~~ing~~ controllers with alerts of the potential risk of an aircraft infringing a defined minimum safe altitude over a concerned region.

The MSAW function monitors the position and altitude of an aircraft against defined MSAW regions and minimum safe altitudes. The MSAW region can be defined by height or polygon. When the altitude of an aircraft is found or predicted to be lower than the applicable minimum safe altitude within defined the MSAW region, a visual and/or aural warning would be generated to alert controllers to take necessary actions ~~on~~to resolv~~ing~~e the infringement.

For reference, examples of surveillance, flight plan, and environmental data are required for the MSAW functional module to generate alerts are:

a. Aircraft position.

b. Pressure altitude.

c. Cleared flight level.

d. Flight rule.

e. Concerned controller jurisdiction.

f. Terrain and obstacle model.

g. Look-ahead time.

To minimize nuisance alerts, flight rules and cleared flight levels in flight plan data can help improve the relevancy of MSAW alert generation. In addition, States/Administrations could consider implementing MSAW alert inhibition which suppresses MSAW alerts based on defined inhibition zones (such as final approach zones), SSR code groups, callsign, or other conditions applicable to the local operational environment.

The accuracy of MSAW alert is related to MSAW terrain/obstacle definition, look-ahead time setting, and inhibition strategy adopted for flights intentionally flying close to terrains/obstacles. Appropriate settings of the above are necessary for providing a reliable MSAW detection that controllers can rely on. Any unoptimized parameters would likely result in nuisance alerts or insufficient time for controllers to respond to the alert. It is important to perform tuning of MSAW parameters based on controllers' feedback for successful MSAW implementation.

3.1.5.5 Area Proximity Warning

Area Proximity Warning (APW) is a safety net for alerting controllers of any potential or actual unauthorized penetration of aircraft into Special Use Airspaces (SUA) including:

a. Danger airspace.

b. Prohibited airspace.

c. Restricted airspace.

d. Temporarily restricted airspace.

~~The system should provide the tool to draw SUA defining the airspace, the airspace could be defined.~~ Each SUA- volume could be defined in ATMAS as an area (e.g., circle, polygon, etc.) with upper and lower bounds on altitudes.~~The system according to APW rules provide pre-warning and warning.~~ The warning activation/deactivation of ~~warning in a~~each SUA could be triggered automatically according to an online-defined schedule or by the manual action of controllers. The system should provide APW inhibition function~~be~~ based on flight rules, SSR code groups, callsign, and other conditions applicable to the local environment and operational needs~~ provide APW inhibition function~~.

~~Area Proximity Warning (APW) is a safety net for alerting controllers of any potential or actual unauthorized penetration of aircraft into Special Use Airspaces (SUA) including:~~

~~a. Danger airspace.~~

~~b. Prohibited airspace.~~

~~c. Restricted airspace.~~

d. Temporarily restricted airspace.

Each SUA volume could be defined in ATMAS as an area (e.g. circle, polygon, etc.) with upper and lower bound on altitudes. The defined volumes would be assigned with unique names to facilitate identification by controllers. The activation/deactivation of warning in a SUA volume could be triggered automatically according to a defined schedule or by manual action of controllers. A pre-active stage of SUA volume with a configurable lead time before the scheduled activation could be further introduced to provide controllers with an early awareness of a planned airspace restriction.

To minimize nuisance warnings, States/Administrations could consider implementing APW inhibition in ATMAS to exclude the checking of certain aircraft flying into the SUA volumes. The inhibition could be implemented based on flight rules, SSR code groups, callsign and other conditions applicable to the local environment and operational needs.

3.1.5.6 Approach Path Monitoring Warning

Approach Path Monitoring (APM) is a safety net to alert controllers of a predicted or actual unsafe descending final approach profile (e.g., flying into terrains and obstacles) adopted by an aircraft to avoid accidents during the final approach.

The Approach Path Monitoring Warning (APMW) monitors the aircraft's vertical and lateral deviation from the final approach profile in ATMAS, and generates visual and/or aural alerts when an aircraft exceeds or is predicted to exceed the defined tolerance of deviation. The system should allow all set multiple groups of glide path monitoring parameters to be defined.

An APM zone would generally be defined in ATMAS for performing APMW processing on flights. Examples of parameters on the definition of APM zone are:

a. Runway name and direction.

b. Touchdown point on the runway.

c. Horizontal angular extend from the touchdown point.

d. Vertical angular extend from the touchdown point.

e. Distance from the touchdown point.

f. Glide slope elevation.

g. APMW inhibition zone.

Surveillance, flight plan, and environmental data are required for generating APMW. The APMW prompt will be given on the HMI when the alarm conditions are met.

To minimize nuisance alerts, checking flight rules could help improve the relevancy of warning generation. In addition, an aircraft flying close to terrains/obstacles during the final approach which could easily trigger MSAW alert due to nearby terrains/obstacles. States/Administrations could consider suppressing MSAW alert generation in ATMAS within the APM zone or via the definition of inhibition zones if an aircraft's descent profile is already under the monitoring by APMW.

The performance of APMW is highly related to adapted APMW parameters for the local environment, look-ahead time setting and inhibition strategy adopted for flights that intentionally deviated from the optimal final approach path. Regular review of the performance is crucial for the tuning of APMW parameters based on controllers' feedback to increase its effectiveness. ~~Approach Path Monitoring (APM) is a safety net to alert controllers of a predicted or actual unsafe descending final approach profile (e.g. flying into terrains and obstacles) adopted by an aircraft to avoid accidents during final approach.~~

~~The APM function monitors the aircraft's final approach profile for any vertical and lateral deviation from the optimal one. Visual and/or aural alerts would be generated when an aircraft exceeds or is predicted to exceed the defined tolerance of deviation. In such a case, controllers would need to respond to the situation and resolve the deviation.~~

~~In general, an APM zone would be defined in ATMAS for performing APM processing on flights. Examples of parameters on the definition of APM zone are:~~

~~a. Runway name and direction.~~

~~b. Touchdown point on the runway.~~

~~c. Horizontal angular extend from touchdown point.~~

~~d. Vertical angular extend from touchdown point.~~

~~e. Distance from touchdown point.~~

~~f. Glide slope elevation.~~

~~g. APM inhibition zone.~~

~~Surveillance, flight plan and environmental data are required for generating APM warning. The following list of information could be considered to include in the APM processing:~~

~~a. Aircraft position.~~

~~b. Pressure altitude.~~

~~c. Flight rule.~~

~~d. Concerned controller jurisdiction.~~

~~e. APM zone definition.~~

~~f. Look-ahead time.~~

~~To minimize nuisance alerts, the checking of flight rule could help improve the relevancy of warning generation. In addition, an aircraft flying close to terrains/obstacles during final approach which could easily trigger MSAW alert due to nearby terrains/obstacles. States/Administrations could consider to suppress MSAW~~

~~alert generation in ATMAS within APM zone or via the definition of inhibition zones if an aircraft's descent profile is already under the monitoring by APM.~~

~~The performance of APM is highly related to adapted APM parameters for local environment, look-ahead time setting and inhibition strategy adopted for flights intentionally deviated from optimal final approach path. Regular review of the performance is crucial for the tuning of APM parameters based on controllers' feedback for increasing its effectiveness.~~

~~3.1.5.7 SSR Code Duplication Warning~~

~~When detecting multiple aircrafts with the same SSR code in the certain area, the system is suggested to provide SSR Code Duplication warning to the controller.~~

~~3.1.5.8 AIDC Coordination Failure Warning~~

~~On failure of AIDC coordination, the system is advised to provide visual indications to controllers on track labels and electronic strips.~~

~~3.1.5.9 SPI Indication~~

~~At reception of SPI information transmitted by the aircraft, the system normally provides visual indications to controllers.~~

3.1.6 Meteorological Information Processing Function

Generally, the system is capable of receiving, processing, and displaying meteorological information, including GRIB, QNH, and weather ~~information~~data derived from mono-radar ~~derived weather information~~. The meteorological information should be applied in surveillance data and flight data processing.

The system could process GRIB messages from the meteorological information system, which contains upper wind and temperature for accurate calculation and estimation of flight plan profiles.

The system is recommended to automatically extract and process QNH data from METAR and SPECI messages, as well as ~~accept~~ manual input.

~~Considering about the weather situation awareness to controller, t~~The system is recommended to be capable ~~to~~of receiv~~e~~ing and processing mono-radar derived weather~~-~~ data~~information~~, and displaying it on the controller positions. From ~~the~~ experience, the categorization of weather echo display could be classified as no less than three levels. The parameters of display level and priority could be defined as required.

3.1.7 Air-Ground Data Link Function

The AGDL function mainly processes the information based on the data link communication, including~~:~~ ADS-C (Automatic Dependent Surveillance-Contract), CPDLC (Controller-Pilot Data Link Communication), and DCL (Departure Clearance), etc. States/Administrations could implement the Air~~-~~ Ground Data Link Function according to the operational needs.

3.1.7.1 ADS-C Data Processing

The ADS-C data processing is recommended as follows:

a. The system automatically determines whether the aircraft enters the ADS-C area according to route information.

b. The ADS-C connection could be initiated by pilots or controllers.

c. The system receives and processes ADS-C messages, including periodic contract, event contract, emergency, current location, etc.

d. The system updates and manages ADS-C tracks with received ADS-C messages.

3.1.7.2 CPDLC Data Processing

From experience, the system is suggested to provide the following functions for CPDLC data processing:

a. Display CPDLC position report and flight data.

b. Display a CPDLC dialogue window.

c. Determine whether the aircraft enters the CPDLC area according to route information.

d. Allow ~~to~~ initiatinge~~e~~ a CPDLC connection automatically or manually by the pilot or the controller.

e. Receive and process CPDLC downlink messages, send CPDLC uplink messages, and manage the message status.

f. Allow to search CPDLC historical messages and display the messages in chronological order.

g. Provide prompts to controllers in the following cases: correct message transmission and reception, manual operation, and successful logon.

3.1.7.3 DCL Processing

The system is recommended to provide the following DCL functions:

a. Receive, process, and send DCL messages (ARINC 623, EUROCAE ED-85A, etc.).

b. Identify and process the RCD message~~,~~ and automatically send error messages to controllers suggesting voice-clearance in case of invalid RCD message.

c. Correlate the RCD message with a specific~~certain~~ flight plan according to the callsign, departure airport, landing airport, and automatically reply with an FSM message.

d. Automatically send CLD messages according to the correlated FDR and manual input data and perform synthetic and semantic checks.

e. Check the compliance between the CDA and CLD message.

f. Be capable of ~~to~~ displaying RCD information, including the callsign, SSR code, CLD processing identification, and enable the edition and transmission of CLD messages.

3.1.8 System Parameter Management Function

For the convenience ~~to~~of system maintenance, the system is proposed to be capable of managing the variable system parameters through a user/ops orientated adaptation interface used by trained adaptors.~~dedicated positions.~~

3.1.8.1 Types of System Parameters

The system is recommended to be able~~should have the ability~~ to adapt system functional parameters for all functionality.

That parameters adaptation is highly preferential to software-code based system management, e.g., pre-set files.

Th~~at~~ose parameters are designed to accommodate future performance loads to avoid errors or limitations brought on by inflexible value limits.

That parameters- adaptation is orientated towards use by ATS operational orientated staff. Variables, their units of use, and values range should reflect the operational application.

Generally, the types of system parameters include the following:

a. Basic parameters: airspace, sectors, positions, routes, QNH areas, etc.

b. Surveillance data parameters: surveillance source parameters, fusion parameters, etc.

c. Flight data parameters: message processing and transmission rules, SSR code allocation rules, FDR parameters, etc.

d. System interface parameters: interface configuration parameters.

e. HMI parameters: sectorization parameters, electronic and paper flight strips formats, CFL popup values, system maps, etc.

f. Alert parameters: warning and inhibition area definition, warning condition parameters, etc.

g. Other maintenance parameters: recording parameters, warning messages, error messages, etc.

~~3.1.8.2 System Parameter Validations~~

~~,By experience, the system is suggested to support the following two validation modes:~~

~~a. Online validation: for parameters allowed to be configured, selected and validated online, without restarting the system.~~

~~b. Offline validation: for parameters to be validated after restarting the entire system or specific system modules.~~

~~3.1.8.3~~3.1.8.2 System Parameter Management

The system is recommended to support ~~the~~a graphical user interface tool, such as Database Management System (DBMS) to establish, delete, modify, display release, and validate the online/offline system parameters.

The DBMS tool is suggested to support accuracy check, provide error prompts and references according to parameters format, character length, and mold to ensure accuracy of parameters, and limit illegal input of the parameters. The system has the fallback function~~,~~. I~~i~~f a step of parameters setting goes wrong, you can go back to the previous step.

3.1.8.3 System Parameter Activation

In order to balance the efficiency and safety, by experience, the system is suggested to support the following two ways to let the system parameters go into effect:

a. Online generate: for parameters allowed to be configured, selected, and generated online, without restarting the system.

b. Offline generate: for parameters to be generated after restarting the entire system or specific system modules.

~~For the friendly to system user, the system is recommended to provide graphical user interface to establish, delete, modify, display, release and validate the online/offline system parameters.~~

~~At same time, the system is proposed to be capable of performing syntactic and semantic check, and providing error messages (such as the parameter function, format requirements, restrictions, etc.) to help data operator correction.~~

3.1.9 ATS Inter-facility Data Communication Function

The system is recommended to~~should~~ incorporate an AIDC application that supports the ~~following~~ ATS-related information exchanges ~~with similar application~~ within the ATMAS of adjacent Control Units and Flight Information Regions adopted in the Asia-Pacific region.

The AIDC function of the system should conform to the standards~~-~~ in the prevailing version of the following documents:

a. Pan Regional (NAT and APAC) PAN AIDC ICD~~Asia/Pacific Regional Interface Control Document (ICD) for ATS Inter-facility Ground/Ground Data Communications~~; and

b. Procedure for Air Navigation Services-Air Traffic Management (PANS-ATM) (ICAO Doc4444).

3.1.9.1 AIDC message transmission and processing

The system should support the core AIDC messages recommended in Asia/Pacific Regional ICD, such as ABI, CPL, EST, MAC, CDN, ACP, REJ, TOC, AOC, EMG, MIS, LAM, and LRM.

The system should be configurable in supporting variations in AIDC processing and messages ~~that are~~ dependent on the mutual agreements with each adjacent Control Unit or FIR.

Commonly, ~~Normally,~~ the system is recommended ~~to be able~~ to transmit AIDC messages automatically ~~and manually~~, and be capable ~~to~~of processing received AIDC messages automatically.

The system is suggested to transmit ABI, EST, PAC, and other messages automatically according to the AIDC handover conditions and the status of the flight plan.

The system is proposed to transmit ~~AOC,~~ TOC~~,~~ and EST messages manually through the HMI in specific cases. The flight data operation position (FDOP) is capable ~~to~~ of processing erroneous and irrelevant messages manually.

For received messages that failed syntactic and semantic checks, the system should send such messages to a message queue to process by controllers manually.

The system is expected to alert controllers of any unsuccessful transmission of AIDC messages due to communication fault, ~~or~~ rejection by the receiving adjacent Control Units or FIRs, or failure to receive an expected application response from the receiving Control Unit within a time threshold.

3.1.9.2 AIDC Handover

The system should be able to trigger AIDC handover automatically, depending on configured -AIDC handover parameters, which may include handover points, height, time, adjacent Control Unit, etc.

The system could allow controllers to initiate AIDC hand-over manually.

3.1.9.3 AIDC Coordination Process

Generally, the AIDC handover is mainly fulfilled by ~~the~~ exchanginge ~~of~~ a variety of messages. The AIDC procedure is composed of three phases forming a standard AIDC process:

a. Notification Phase;

b. Coordination Phase; and

c. Transfer of Control Phase.

The standard AIDC procedure could be simplified according to the handover agreement between adjacent Control Units. For example, taking advantage of ~~five~~several indispensable messages ~~,~~ regarding EST/PAC, ACP, TOC, AOC, and LAM, the handover could be simplified into two phases ~~of~~ coordination and handover. The procedure is shown in the figure ~~as~~ below:

AIDC phase	ATS Control Unit A	Direction	ATS Control Unit B
Coordination	Send EST/PAC N minutes before the handover point	→	
		←	Automatically Reply with LAM
		←	Automatically Reply with ACP
	Automatically Reply with LAM	→	
Transfer of Control	Send TOC automatically/manully before the handover point	→	
		←	Automatically Reply with LAM
		←	Automatically/manually reply with AOC
	Automatically Reply with LAM	→	

AIDC phase	ATS Control Unit A	Direction	ATS Control Unit B
Coordination	Send EST N minutes before the handover point	→	
		←	Automatically Reply with LAM
		←	Automatically Reply with ACP
	Automatically Reply with LAM	→	
Transfer of Control	Send TOC automatically/manully before the handover point	→	
		←	Automatically Reply with LAM
		←	Automatically/manually reply with AOC
	Automatically Reply with LAM	→	

Figure 3.1.9-1 Simplified AIDC procedure

The system could update the flight state of a flight as it transits through the AIDC coordination phases.

After~~ successful~~ completing ~~on of~~ a coordination process, the system could automatically update the concerned flight plan with the cleared flight profile.

The system is expected to alert controllers when coordination with an adjacent Control Unit or FIR is not completed ~~by~~within certain time thresholds before Estimated Time over Boundary RP, Estimated Time of Departure, etc.

3.1.10 Human Machine Interface Function

HMI (Human Machine Interface), as an important part of the ATMAS, is the medium for interaction and information exchange between the system and controllers. Operational users can monitor air traffic situations and modify flight plans and other relevant information through t~~he use of~~ physical peripherals and/or onscreen control interfaces. Technicians can monitor the status of the ATMAS and perform technical maintenance operations as well. HMI design of ATMAS should consider the day-to-day operation of air traffic controllers to provide a user-friendly interface for controllers to perform their duties effectively and efficiently. In general, the design should facilitate safe, efficient, and sustainable control of air traffic based on the following principles:

a. Accurate presentation of air traffic data

b. Timely presentation of air traffic data

c. Automatic data validity checking including operator input

d. Input options automatically limited to valid data selections

e. Allow a variety of user-friendly input methods (e.g., keyboard, number pads, mouse, etc.) for data entry by controllers

For friendly use,~~Considering about the user-friendly~~, ~~T~~the HMI function is recommended to include at least as follows:

a. Providing graphical interfaces and functions for different positions, such as~~:~~ supervisor position, controller position, flight data operator position, etc.

b. Providing multiple position modes (e.g.~~:~~, Normal, Degraded, Bypass, and Mono) if required.

c. Providing variable user modes ~~-~~(e.g.~~:~~, Operational, Free, Shadow, and Replay) if required.

d. Providing a complete set of HMI configuration, including track display, HMI layout, menu setting, color management, mouse/keyboard functional definitions, map management, etc.

e. Providing the operation interfaces for flight plan modification and control/management of onscreen information.

~~e.~~f. Providing warnings related to HMI.

3.1.10.1 Controller Position

The controller position provides controllers with relevant information required for air traffic control, helping the controller be fully aware of the situation and manage the aircraft~~s~~ in the responsible area. The specific functions are suggested as follows:

a. Display system tracks, multi-radar tracks, multi-ADSB tracks ~~(~~(if available~~if have)~~), multi-WAM tracks ~~(~~(if available~~if have)~~), flight plan tracks, and bypass tracks.

b. Enable interactive flight ~~interactive~~ operations such as aircraft handover and acceptance~~handover and accept of aircraft~~, manual ~~coupling~~correlation, level assignment, and coordination status.

c. Allow screen operations such as zoom in, zoom out, off-center, measurement, window movement, label rotation, etc.

d. Manage map display.

e. Display and edit Flight plans.

f. Post and display electronic flight strips/flight data list.

g. Display system information.

h. Personalize position parameters and display.

i. Other relevant information required for operations.

3.1.10.2 Supervisor Position

The supervisor position typically has~~normally has~~ the same display and operation interface as the controller position. In addition, the system is advised to provide other functions on the supervisor position, such as~~:~~ online operation parameters settings and management, SSR code management~~;~~, sector management~~;~~, ~~QNH setting;~~ automatic handover setting~~;~~, position alert management~~; ATFM function;~~ , ~~dangerous/restricted/inhibition area management;~~, temporary/global map setting, etc. ~~are usually provided on the supervisor position.~~

3.1.10.3 Flight Data Operator Position

The flight data operator position is capable of ~~to~~ displaying relevant flight plans in a flight list containing all the flight information fields, ~~in addition to~~and enabling~~e~~ the online flight plan editing function and AFTN message display, query, error correction, and sending function.

3.1.10.4 Technical Management Position

The technical management position provides a graphic interface enabling efficient system maintenance and software management. The specific functions of the position are generally as follows:

a. Technical parameters management.

b. Operational parameters management.

c. Software configuration and management.

d. User Management.

e. Map generator.

3.1.10.5 Position Mode Switch

The system could be designed to provide controller positions with various user modes to cater ~~for~~to different operational needs. Below ~~gives~~is an example of different user modes.

States/Administrations could define their own set of position modes according to the operational need.

a. Operational mode

The position in operational mode is allocated with sector and provid~~ing~~ es ATC service.

b. Free mode

The position in free mode is sector-free and functionally limited, such as read-only access to flight data.

c. Shadow mode

The position in shadow mode provides real-time monitoring of the operational position of specific sectors and the functionally limited, such as read-only access to flight data.

d. Replay mode

The system only provides playback function in replay mode~~,~~ and cannot be used for ATC service.

3.1.10.6 Track Display

The graphical representation of a track usually ~~normally~~ includes a track symbol located at the current position of the aircraft, a label, a label leader, a selectable velocity vector, and a selectable number of track history dots, etc.

The system should be able to display the accurate position of the track, generated and updated according to surveillance source.

From experience, the system ~~is capable of~~can customiz~~ation~~e of the display of information in different layout types to show information on the label in different levels of detail depending ~~of t~~on he operational needs.

The system is suggested to support label action such as CFL modification, handover request and acceptance, runway modification, STAR allocation, etc.

3.1.10.7 Map Display

The system is recommended to be capable of the offline definition of the system maps, the online creation of the local maps by individual controller position, and the online creation of the Global Map, temporary Restricted / Danger Area maps, etc. by the supervisor position.

The online created local map, global map, and temporary restricted / danger area maps could be saved and restored automatically during system restart.

Note: Controllers should use the online creation of maps with caution~~Online user creation of maps should be used with caution~~ to avoid safety impact.

3.1.10.8 Flight Plan Window

The flight plan window is suggested to support ~~the~~ displaying and modif~~ication~~ying of the flight plan ~~information d~~data fields such as SSR code, ACID, flight rule, aircraft type, wake category, departure airport, destination airport, requested flight level, route, field 18 data.

The flight plan window is recommended to enable at least the following flight plan functions: creation, deletion, modification, flight ~~coordination, handover, query, message sending,~~ strip printing, etc.

3.1.10.9 Electronic Flight Strip Function (if applicable)

Electronic Flight Strip Function could be implemented as a part of HMI function, from which controllers can access to do handover, acceptance, filtering, and sorting function. The electronic flight strips can be sorted and displayed by flight plan state, route fixes, time information, etc.

3.1.10.10 System Information Display

It is recommended to provide in the HMI system information, including device failure, operational data~~information~~, feedback of operation, system status information, etc., for controllers' awareness of system status.

3.1.10.11 Tracks Quick Search

It is recommended that the system has a quick search function to search a track with complete or partial search criteria of the callsign, SSR code, departure/destination airport, or other information. ~~M~~ The matching track will be highlighted to the controllers.

3.1.10.12 Track/Label Filtering

It is recommended that the system provides a track and/or label~~track~~ filtering function.

The system could filter tracks based on upper/lower limitation of level or SSR code~~.~~, and search the track label by part or entire of ACID.

Enabling and disabling the flight plan track display could also be achieved via the HMI.

3.1.10.13 Personalized Position Parameters Setting

The system is recommended to provide flexible configurations, including label layout, HMI colors, mouse and keyboard functions, color configurations of all elements, menus, and windows according to operational demand.

3.1.10.14 SSR Code Duplication Warning

When detecting multiple aircraft~~s~~ with the same SSR code in ~~the~~a certain area, the system is suggested to provide an SSR Code Duplication warning to the controller.

3.1.10.15 AIDC Coordination Failure Warning

On failure of AIDC coordination, the system is advised to provide visual indications to controllers on track labels and electronic flight strips.

3.1.10.16 SPI Indication

The system provides visual indications to controllers at the reception of SPI information transmitted by the aircraft.~~At reception of SPI information transmitted by the aircraft, the system normally provides visual indications to controllers.~~

3.1.11 Recording and Playback Function

The Recording and Playback function enables the recording of operational data ~~in~~of ATMAS~~–~~. It allows~~and allows~~ synchronized playback of the air traffic situation, controller-pilot communication, and controller actions in the air situation display for incident analysis and investigation. The recording and playback could be ~~considered to~~ implemented as part of ATMAS or via an external recording system. The design~~The design of recording and playback function in ATMAS~~ should aim at reconstructing the actual scenario as accurately as possible.

3.1.11.1 Recording Function

The Recording Function ~~of~~for ATMAS should maintain a continuous recording on all controller working positions. The following data and display could be considered to be recorded by the ~~S~~system:

a. Screen data of controller working positions, including an identical picture of windows, temporary maps, and any alert ~~and~~ /warning, etc.

b. Surveillance data, including SDP track output, radar data, ADS-B data, etc.

c. Controller input actions on keyboard or mouse.

d. Messages of external interfaces such as AIDC messages, meteorological messages such as GRIB, AFTN, ICAO messages (including flight plan data), ADEXP messages, data links such as PDC, CPDLC, ADS-C.

e. System data such as system event data, system performance data, system log, etc.

The recording of data and display is suggested to be synchronized with a deviation of less than 1 second or an acceptable tolerance according to the local operational needs. The deviation is suggested to be as minimal as possible to allow the best reconstruction of the recorded scenario during playback.

The Recording Function should ensure no loss of data at all times during the operation of ATMAS, and the recording process should not render any degradation to the performance of other functions of ATMAS. Recorded data should be retained for at least 31 days or a duration which satisfies local regulatory requirements. Some States may require a longer recording period for other purposes e.g., requests for data from other organisations. Periods of 90 or 120 days may be more applicable for such needs~~It is recommended for ANSPs to retain recorded data for a period longer than the regulatory requirement, e.g., up to 90 days or 120 days, if technically practicable.~~ . Appropriate warnings are needed for notifying maintenance personnel when storage capacity drops below a certain threshold so that appropriate action could be taken to resolve the situation.

3.1.11.2 Playback Function

The ATMAS or external recording system should allow the replay of recorded and archived data onto designated or idle controller working positions. In general, a playback session should be able to start up within a short period of time and allow continuous replay of recorded data for a considerable duration according to operational needs. The system shall support synchronized playback of voice data.

The following two modes of playback are~~is~~ suggested for implementation~~to implement~~ in ATMAS to cater ~~for~~to different investigation scenarios:

a. Passive Playback

The system replays what was on the screen of controller position with recorded and archived data at the period of recording without interaction

b. Interactive Playback

The system replays the air situation display of the controller' working position at the period of recording. Controller tools, such as change of display range,

range, and bearing line, separation probe, quick look, altitude filtering, map selection, etc., are allowed to be used interactively during playback.

For both of the above playback modes, the system should allow synchronized playback of voice data in order to provide a complete picture of events for investigation purpose. To facilitate the playback, the following controls are recommended to be included in the playback function of ATMAS or external recording system:

a. Start / Pause (Resume) / Stop of a playback session.

b. Selection of different playback speeds at least real~~-~~-time speed and a range of playback speeds faster than normal recording speed.

c. Allow to select a start time for playback in terms of minute.

d. Selection of playback mode.

The system is suggested to be capable of performing multiple playback sessions simultaneously to allow the playback of the same or different scenarios using different controller working positions. For the same playback session, synchronized replay of recording ~~of~~ multiple controller working positions could be considered as part of the playback function to facilitate the investigation of events involving multiple control sectors.

~~S~~The screen dump function is recommended ~~for~~ to captur~~inge~~e the screens during playback and stor~~inge~~e them as files for subsequent printing and exporting. ~~F~~The facility should be provided for exporting the screen dump file to external media using a common image format ~~which~~ that could be viewed ~~in~~on computers using non-proprietary software readily available in the market.

3.1.11.3 Data Archiving

Data Archiving function is needed in ATMAS or external recording system for transferring recording data onto removable media for the backup or impounding purpose. The archiving process could be initiated in the system via manual action or configured automatic process based on criteria, e.g., periodic archiving process at a defined time interval or when remaining storage dropped below a certain threshold.

In general, the archiving process should not interfere with normal recording and playback processes in the system as well as other system functions. Appropriate warnings should be given whenever there is an error, or the archiving media is full during the archiving process.

3.1.12 System Monitoring and Control Function

The system is recommended to provide the monitoring and controlling function, and the failure of the monitoring and controlling function should not affect the operation of other modules.

3.1.12.1 Monitoring Function

The system is suggested to monitor in real-~~-~~time the operational status of each module and display the significant ~~major~~ events. Alerts could be raised in levels according to severity, and log files are generated accordingly. The system should be able to search, print, and export logs by time. Usually, ~~Normally,~~ the system monitoring function mainly includes:

a. Interface status monitoring.

b. Hardware operation status monitoring.

c. Software operation status monitoring.

d. Network equipment operation status monitoring.

e. Database operation status monitoring.

f. System capacity and resource usage monitoring.

g. Important system events monitoring.

3.1.12.2 Control Function

In general, the system controlling function mainly includes the operations of start, stop, restart, and switch as follows:

a. Start and stop the entire system.

b. Start and stop single surveillance source.

c. Start and stop a single server.

d. Start and stop network.

e. Switch between redundant equipment and networks

f. Start and stop software modules.

~~3.1.13 Software Management Function~~

~~Thinking about friendly to system maintenance, the system is recommended to provide a software management tool, for installation, roll back, and backup operation to the software patch and version.~~

~~For the detail of Software Management, please refer to chapter 5.~~

~~3.1.14~~3.1.13 GNSS Time Synchronization

The system is suggested to be able to access ~~to~~ an accurate time source, synchronize external GNSS signals, and calibrate internal system time based on the NTP (Network Time Protocol), so that the system time is consistent with the UTC.

The system is capable of receiving multiple external clock sources and switching among them automatically or manually.

~~On the condition of~~If all the external clock signals are interrupted or lost, the system is proposed to ~~correspondingly~~ synchronize with internal time correspondingly.

Unified time within the system is recommended to be shown on the HMI and provided for surveillance data processing, flight data processing, monitoring and controlling, recording and playback, etc.

3.2 System Optional Function

3.2.1 Extended Surveillance Data Processing

Except f~~rom~~or PSR and mode A/C radar data, the extended surveillance data include Mode S radar data, ADS-B data, WAM, and other surveillance data, which contain~~ings~~s more target information, ~~for instance~~ such as DAP parameters and accuracy, etc.

The system is encouraged to be able to process the extended surveillance data to provide higher quality tracks and supplementary data.

~~**3.2.1.1 Extended Surveillance Data Interface**~~

~~The system could extend the capability to receive and process following extended surveillance data:~~

~~a. Mode S radar data：Data from a single Mode S radar，in ASTERIX CAT 034/048 or other standard formats.~~

~~b. ADS-B data：Data from ADS-B ground station or ADS-B data center，in ASTERIX CAT 021 format.~~

~~c. WAM data: Data from WAM system, in ASTERIX CAT 020 format.~~

~~d. Other ATMAS track data: Surveillance track data from other ATMAS, in ASTERIX CAT 062/065 or other standard format.~~

~~**3.2.1.2 Extended Surveillance Data Processing**~~

The systems should be able to receive, process and display~~, in an integrated manner,~~ data from all the connected sources in an integrated manner. When extended surveillance data is connected, in addition to the essential surveillance data processing requirements (see 3.1.1), the following additional requirements ~~shall~~is suggested to be met.

The system ~~be able to~~ can filter anomalous data according to the sensor type. Anomalous data filtering can be carried out during pre-processing, mono-sensor data processing, and multi-sensor data processing. Some suggested anomalous data filtering is as follows:

a. The system should check the integrity of mandatory data items in the ADS-B message. And only ADS-B messages containing all mandatory data items will be processed. Refer to ICAO APAC's~~C's~~ *GUIDANCE MATERIAL ON GENERATION, PROCESSING & SHARING of ASTERIX CATEGORY 21 ADS-B MESSAGES* for definitions of ADS-B mandatory data items.

b. The system should check the quality indicators of ADS-B data and position accuracy of WAM data~~,~~ to ensure that only the data meeting the operational requirements ~~be~~ is used for track tracking and fusion.

c. Downlink aircraft parameters rel~~iancey~~y on airborne equipment besides surveillance system, and their data quality is affected by more factors. It is recommended that the system should perform the validity and consistency check of downlink aircraft parameters.

d. Due to the anomalous Mode S SSR DAPs caused by BDS SWAP, it is recommended that the system performs additional verification for Mode S SSR DAPs, for example, cross-verification of SSR DAPs from different radar stations.

The system should be able to use the ICAO 24bit aircraft address and aircraft identification for track tracking and correlation.

The system should be able to process the extra emergencies beyond those indicated by codes 7500, 7600, and 7700, including lifeguard/medical, minimum fuel, and downed aircraft.

Note: DO-260 systems only transmit EMG and don't transmit a MODE A code. DO-260A systems broadcast Mode A information using a test message field. DO-260B systems can transmit the MODE A code. While emergency status can be transmitted by all version of ADS-B transponder. Considering aircraft equipped with DO-260/DO-260A ADS-B transponder in airspace covered only by ADS-B, ATMAS should be able to identify the aircraft's emergency status based on the emergency status of the ADS-B data only.

Mode S radar, ADS-B, and WAM systems can detect aircraft on the ground. The system should be able to process ground/air flags to filter unnecessary ground targets.

The ~~S~~system should be able to process Mode S conspicuity code. Mode S conspicuity code is a standard and non-discrete Mode 3/A code to tell the ATMAS that this is a Mode S equipped aircraft. ATMAS should not ~~make~~ use ~~of~~ Mode S conspicuity code to identify the aircraft、correlate the flight plans. Instead, the ATMAS should make of the Mode S interrogated information, such as aircraft identification or ICAO 24bit aircraft address, to identify the aircraft and correlate the flight plan. Asia Pacific region adopts "1000" as Mode S Conspicuity Code.

~~The system could extend the capability to receive and process multi-sensor extended surveillance data to generate a unique system track. The quality of multi-sensor tracks should not be lower than mono-sensor tracks.~~

~~Online selection of mono-sensor (multi radar tracks, multi ADS-B tracks or multi WAM tracks) or multi-sensor tracks is recommended.~~

~~3.2.1.3 Extended Surveillance Data Display~~

~~The system is suggested to have the capability to display:~~

a. ~~Single sensor tracks: generated by a single source data, for instance a single radar.~~

b. ~~Mono-sensor tracks: generated by one sensor type data.~~

c. ~~Multi-sensor tracks: tracks fused by data from several types of surveillance input specified.~~

~~The system could determine the type of a surveillance track and display with a specified track symbol according to the different sensor type components (radar, WAM, ADS-B) identified for the generation of this surveillance track.~~

~~ADS-B tracks are recommended to displayed with high-quality and low-quality track symbols.~~

~~The system is proposed to display extended surveillance data on the track labels, for instance target aircraft identification, target aircraft address and selected altitude etc.~~

~~Normally, the system should be able to define target aircraft address filter to suppress the display of all surveillance tracks whose target aircraft address corresponds to one target aircraft address in the filter.~~

~~The system will inhibit track display if ground bit is set in the position reports.~~

~~The system is suggested to generate emergency alarm if a report is received with emergency identification.~~

~~3.2.1.4 Extended Surveillance Data Output~~

~~The system could extend the capability to output system track data in a specified format, such as ASTERIX CAT062. Extended surveillance data will be present in the output data when available.~~

~~3.2.1.5 Quality Monitoring For Surveillance Data~~

~~The system is recommended to enable monitor the quality of extended surveillance data, for example:~~

a. ~~Via ASTERIX CAT034 messages for Mode S radar data.~~

b. ~~Via Automatic Test Target Monitoring with the fixed SSR Test Transponders of ADS-B and WAM data, in detail to check the link status.~~

c. ~~Via corresponding quality indicators according to ADS-B MOPS versions and ASTERIX CAT021 editions for ADS-B data.~~

3.2.2 Extended ~~Coupling~~Correlation

On the basis of the original automatic ~~coupling~~correlation conditions, the system could further perform ~~coupling~~correlation for a surveillance track and a flight plan based on the aircraft's 24-bit address or Aircraft Identification (ACID) provided by the aircraft downlink parameters.

The system is recommended to give prompts on the correlated~~coupled~~ track label when SSR codes, aircraft 24-bit address, or ACID of the flight plan mismatch the ones of the surveillance track.

3.2.3 Extended Alert, Warning, and Advisory Function

In addition to the Safety Net Functions stated in paragraph 4.1.5, States/Administrations could consider implementing the following extended set of alert, warning, and advisory functions in ATMAS according to the local environment and operational needs. These optional functions aim at enhancing ~~the~~ operational efficiency and possibly reduc~~e~~ing controller workload.

~~3.2.3.1 Departure Path Monitoring~~

~~Departure Path Monitoring (DPM) is used for alerting controllers of predicted or actual deviation from the planned departure path (e.g., flying too close to terrains and obstacles) of an aircraft to avoid accidents during the initial departure phase of the flight.~~

~~The DPM function monitors the departure flight's trajectory for any vertical and lateral deviation from the planned path. Visual and/or aural alerts would be generated when the flight exceeds, or is predicted to exceed the defined tolerance of deviation. Then controllers would need to be aware ofrespond to the situation and resolve the case.~~

~~DThe departure path for monitoring would be defined in ATMAS for performing DPM processing on flights. Examples of parameters on the definition of departure path are:~~

- ~~a. Runway name and direction.~~
- ~~b. Take-off point on the runway.~~
- ~~c. SID definition.~~
- ~~d. Climb gradient.~~
- ~~e. End detection point.~~
- ~~f. DPM inhibition zone.~~

~~Surveillance, flight plan, and environmental data are required for generating DPM warnings. The following list of information could be considered for inclusion into the DPM processing:~~

- ~~a. Aircraft position.~~
- ~~b. Pressure altitude.~~

c. SID.

d. Flight rule.

e. Concerned controller jurisdiction.

f. Departure path definition.

g. Look-ahead time.

To minimize nuisance alerts in DPM, the checking of flight rules (e.g., to exclude VFR flights from DPM) could help improve the relevancy of alert generation. In addition, aircraft could be close to terrains/obstacles during initial climbing after takeoff. This could lead to inappropriate MSAW alerts triggered and cause nuisances to controllers. States/Administrations could consider to suppressing MSAW alert generation along the defined departure path for DPM or via the definition of inhibition zones.

Similar to other safety net function, a successful DPM implementation would require careful tuning of the parameters according to the local environment. Adequate warning time is important to allow enough time for controllers to respond and resolve the alert. Regular review of the DPM performance with controllers is encouraged to assist in the tuning of DPM to increase its effectiveness.

3.2.3.1 Departure No Transgression TRANSGRESSION Zone (DTZ)

The Departure No Transgression Zone (DTZ) 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. The DTZ function also may suppress improper STCA generate between two normal flights in DMA(Departure Monitoring Area).

The Departure No Transgression Zone (DTZ) is an offline defined volume capturing the departure path of aircraft taking off between two extended runway center lines which aircraft is not allowed to penetrate. It shall be possible to define DTZ area off-line by specifying associated DMA (Departure Monitoring Area).

When a track is predicted to infringe an DTZ area within a predefined time interval, or has already infringed an DTZ area, the system shall provide DTZ warning.

a. The system shall generate DTZ warning for a track predicted to infringe an active DTZ area within a predefined time interval.

b. Visual and aural signals shall be provided on concerned controller positions on DTZ warning is raised. The system shall enable operators to acknowledge the raised warning to cancel the aural alarm.

c. The system shall be allowed to define multiple DTZ areas and activate or de-activate online.

d. The system shall have STCA filtering function within an active Departure Monitoring Area.

~~The DTZ function informs the controller if a track is predicted to infringe a Departure No Trangression Zone area within a predefined time interval, or has already infringed a Departure No Trangression Zone area.~~

~~The Departure No Transgression Zone (DTZ) is an offline defined volume capturing the departure path of aircraft taking off between two extended runway center lines which aircraft is not allowed to penetrate.~~
~~When a track is predicted to infringe an DTZ area within a predefined time interval, or has already infringed an DTZ area, the system shall provide DTZ warning.~~

- ~~The system shall generate DTZ warning for a track predicted to infringe an active DTZ area within a predefined time interval.~~
- ~~Visual and aural signals shall be provided on concerned controller positions on DTZ warning is raised. The system shall enable operators to acknowledge the raised warning to cancel the aural alarm.~~
- ~~The system shall be allowed to define multiple DTZ areas and activate or de-activate online.~~

3.2.3.2 No Transgression Zone Alert

In the context of parallel approaches, No Transgression Zone (NTZ) is generally ~~normally~~ defined as the corridor of airspace between two extended runway center-lines ~~which~~that aircraft ~~is~~are not allowed to penetrate. The purpose of the NTZ alert is to warn controllers of a predicted or actual unauthorized penetration of NTZ by aircraft during the final approach. An appropriate look-ahead of the predicted NTZ alert is important to allow enough time for controllers to respond to the situation.

When a track is predicted to infringe an NTZ area within a predefined time interval ~~,~~ or has already infringed an NTZ area, the system shall provide an NTZ warning.

~~a.~~e. The NTZ warning function includes two parts: NTZ pre-warning and NTZ warning.

~~b.~~f. The system shall generate a pre-NTZ warning for a track predicted to infringe an active NTZ area within a predefined time interval.

~~c.~~g. The system shall generate an NTZ warning for a track having infringed an active NTZ area.

~~d.~~h. Visual and aural signals shall be provided on concerned controller positions on which pre-NTZ or NTZ warning is raised. The system shall enable operators to acknowledge the raised warning to cancel the aural alarm.

~~e.~~i. The system shall be allowed to define multiple NTZ areas and activate or de-activate online.

3.2.3.3 Medium Term Conflict Detection Warning

Medium Term Conflict Detection (MTCD) is designed as a safety advisory tool ~~an extension of STCA concept~~ ~~which~~that provides warnings to controllers for potential conflict for"aircraft-to aircraft" or "aircraft-to-airspace" encounters up to ~~20 minutes~~a looking ahead time ~~(such as 20 minute)~~. The aim of MTCD is to proactively ~~resolve~~ provide possible conflict in advance during sector planning ~~so as~~ to reduce tactical workload.

States/Administration should consider the following factors to determine the applicability of MTCD to their local environment:

a. Suitability of local airspace structure to cater for long look-ahead time.

b. Local air traffic control procedures.

c. Whether ~~an~~ airspace is under Free Route Operation.

~~c.~~d. CNS capability to support application.

MTCD advisory could be considered ~~to~~ implemented in the following situation~~s~~:

Potential or risk conflict detected based on current track trajectory and trial clearance/probe. While a controller inputs a clearance, the MTCD will be calculated, and conflict information, if any, will be provided to the controller and prompt for a confirmation to proceed or abort. If a confirmation to proceed is received, an MTCD warning would be generated to concerned controllers with the jurisdiction where conflict may occur.

~~a. Potential Conflict: Conflict detected based on current track trajectory and clearance.~~

~~Risk of Conflict: Conflict detected based on current track trajectory and trial clearance/probe. When a controller inputs a clearance, the MTCD will be calculated, and conflict information, if any, will be provided to the controller and prompt for a confirmation to proceed or abort. If a confirmation to proceed is received, an MTCD warning would be generated to concerned controllers with the jurisdiction where conflict may occur.~~

~~b.~~ The MTCD function shall generate visual and/or aural alerts to controllers in air situation display if any pair of aircraft is violating within a look-ahead time, which is a pre-defined separation minimum in the MTCD settings. ~~Usually, the conflicts that are shown potential and may resolve themselves. Controllers shall response to resolve or observe the conflict once the alert has been generated considering time or severity. The performance of MTCD is highly dependent on the optimization of conflict detection algorithm and adapted parameters for the local environment.~~

If more than one type of conflict is implemented, different visual presentations are~~is~~ recommended for each type of conflict to avoid confusion of alerts. In addition, MTCD inhibition could also be implemented based on airspace, flight rule, SSR code groups, ACID, or other conditions applicable to the local environment and operational needs.

3.2.3.4 Route Adherence Monitoring

Route Adherence Monitoring (RAM) monitors if an aircraft ~~(~~(i.e., surveillance track~~)~~) is following the planned route, as stated in the associate flight plan. ~~the conformance of an aircraft to its flight route in the flight plan.~~

When an aircraft is detected to have deviated from the ATMAS~~cleared~~ trajectory ~~route~~ by more than a defined tolerance, a visual/or aural warning shall be generated to alert controllers to take action~~s~~ on the situation.

In the case of the RAM caused by an incorrect Flight route, the warning may be suppressed after the controller amends the flight plan route to reflect the actual flight path by a user-friendly route modification interface (e.g., Graphical Re-route function)~~-~~.

The RAM warning can be acknowledged manually.

The RAM route model could be defined by the width of the corridor~~,~~ and the radius of the waypoint. It is recommended that the system is designed to allow the definition of different route model parameters for specific route segments.

3.2.3.5 Cleared Level Adherence Monitoring

Cleared Level Adherence Monitoring (CLAM) monitors the conformance of the Actual Flight Level (AFL) of an aircraft to the Cleared Flight Level (CFL) issued by the air traffic controller and provides warnings if the deviation between the two levels (i.e., Level Bust) was found after the aircraft has been level-off. To reduce nuisance alerts, the system could allow an adaptable tolerance on the deviation of AFL from CFL.

States/Administrations can consider including the use of Mode S DAPs, Selected Altitude, in the CLAM detection logic. Selected Altitude is the altitude inputted by the pilot at the aircraft cockpit based on the clearance from controllers. The checking of Selected Altitude with CFL in the CLAM logic could allow early detection of potential Level Bust and alert controller in advance.

3.2.3.6 Similar Callsign Advisory

Similar Callsign Advisory (SCA) provides advisory to alert controllers when an aircraft carries a similar callsign with another one in the same jurisdiction controlled by a controller. According to the operational environment and local needs, SCA checking rules could be pre-defined or pre-programmed at the design stage of ATMAS implementation ~~according to the operational environment and local needs~~. Adaptable SCA checking rules or look-up tables are preferred to allow modification of similar callsign checking process based on the latest requirement and feedback from controllers.

3.2.3.7 Reduce Vertical Separation Minimum Warning

Reduce Vertical Separation Minimum (RVSM) Warning provides alerts to controllers when a non-RVSM approved/compliant aircraft is within~~,~~ or is predicted to enter RVSM airspace.

To provide the warning to controllers, the volume of RVSM airspace would need to be defined in the ATMAS, and the Field 10 of ICAO flight plan would be checked to see if the aircraft is RVSM-approved. Visual indication would be generated if the aircraft did not match ~~with~~ the airspace requirement on RVSM.

3.2.3.8 Position Report Monitoring

The ATMAS trajectory needs to update for every point inside the route model when the aircraft overflow this point. Position report permits a more precise calculation of the Estimated Time of Overflight (ETO) of subsequent points along the planned route. The Position Report shall also include intent information from Surveillance reports for use in trajectory estimation.

To make the maintenance staff aware of the inconsistency in position reports, Position Report Monitoring (PMON) monitors ATO/ETO ~~inconsistency in position report~~ and provides warnings to controllers when:

a. Actual Time Over (ATO) and/or Estimated Time Over (ETO) of the next report point differs from that calculated by the flight trajectory by more than a defined time interval

b. The ETO of the respective waypoint differs by more than a defined time interval

c. No position report is received for a defined time interval after the ETO missed the position report

3.2.3.9 Last Known Position Display

Last Known Position Display occurs when correlated~~coupled~~ tracks, uncorrelated~~coupled~~, or ADS-C tracks with critical alerts are lost.

The last known position of the track is displayed with a special track symbol to the dedicated position.

3.2.3.10 SSR Inconsistency Warning

For correlated~~coupled~~ flight plan tracks, when the Mode 3/A code in the surveillance data is inconsistent with the SSR code in the flight plan, the system is suggested to raise ASSR Inconsistency Warning.

NOTE: 24-Bit Code Mismatch Warning and Callsign Mismatch Warning, please refer to chapter 3.2.4.2.

~~3.2.3.11 Corrected Level Information Display prompt~~

~~The system is recommended to be capable toof displaying the Mode C level or QNH corrected barometric altitude on track labels with distinction.~~

~~When an aircraft is within a designated QNH area, in order to ensure safe operation, the system could perform altitude correction based on the QNH value to ensure safe operation.~~

~~3.2.3.12~~3.2.3.11 PBN Capability Indication

The PBN function shall provide PBN indicator and/or PBN route mismatch indication for controllers in order to indicate whether the aircraft match the RNAV/RNP Route or Arrival.

When the PBN indicator is presented in the flight plan message, the system is suggested to determine the PBN capability of the aircraft and inform controllers of the PBN capability.

It is proposed that the system could define different priorities of PBN capability display for each logical position.

The PBN function shall provide PBN route mismatch indication to the controllers:

a. When PBN route is mismatch between offline defined and PBN of flight plan message.

b. It shall be raised at offline define time prior to the route segments.

c. It shall be able to offline turn on or off.

~~3.2.3.13~~3.2.3.12 Downlink Aircraft Parameters Related Warnings

Please refer to section 3.2.4.2 for Downlink Aircraft Parameters related warnings.

3.2.4 Downlink Aircraft Parameter Processing and Display

It is recommended that the system have the capability to process and display aircraft downlink aircraft parameters (DAPs) from Mode S radars, ADS-B and/or WAM~~ADS-B~~ to help controllers have a more integrated view of the aircraft's flight status in the air.

~~The system is recommended to be able to use the processed DAPs in the computation of safety nets like STCA and MTCD etc.~~

3.2.4.1 DAPs in Consistency Check~~Track Fusions~~

The system is capable of making use of DAPs for report consistency checks, altitude and position tracking. The data in DAPs~~DAPs used in track fusion~~ include the magnetic heading, true airspeed, selected altitude, barometric vertical rate, geometric vertical rate, roll angle, track angle rate, track angle, and ground speed, etc.

3.2.4.2 DAPs Related Warnings

DAPs Related Warnings generally include:

a. 24-Bit Code Mismatch Warning

For the correlated track, the system can provide an ICAO 24-bit code mismatch warning and present to the responsible controller when the downlink 24-bit code does not match the CODE in field 18 of the FPL message.

~~The system is recommended to create an ICAO 24-bit code mismatch warning and present to the responsible controller when the downlink 24-bit code of the coupled track does not match the CODE in field 18 of the FPL message.~~

b. Callsign Mismatch Warning

For the correlated track, the system can provide a callsign mismatch warning and present it to the responsible controller when the downlink callsign does not match the callsign in field 7a of the FPL message.

~~The system is suggested to create a callsign mismatch warning and present to the responsible controller when the downlink callsign of the coupled track does not match the callsign in field 7a of the FPL message.~~

c. Predicted Level Mismatch Warning

The system is suggested to continuously monitor the consistency of Selected Altitude from the airborne equipment and the Cleared Flight Level from the controller~~,—~~. A~~a~~ predicted level mismatch warning will present to the responsible controller if the difference is greater than the pre-defined threshold.

~~It is recommended that the system is able to continuously monitor the consistency of Selected Altitude from the airborne equipment and the Cleared Flight Level from controller, and create a predicted level mismatch warning and present to the responsible controller if the difference is greater than the pre-defined threshold. This warning could be displayed to controllers immediately in the event of a change in Selected Altitude without any change in Cleared Flight Level by the controller.~~

d. Resolution Advisory (RA) alert indication

The system may provide a RA alert indication and present on the track label to the responsible controller when a RA report is received via the airborne~~the~~ ACAS system.

Note: The display of ACAS Resolution Advisory Report in ATM automation system can be turn on or turn off by user, and it is not recommended by IFATCA. The user is suggested to do the relevant safety evaluation before applying this function.

~~The system is proposed to process and create a RA alert indication and present on the track label of the responsible controller when a RA report is received~~

via DAPs. The system is suggested to make available the detail of the resolution advisory.

3.2.4.3 DAPs Display

The system is suggested to provide a downlink data window, which is used to display the downlink aircraft information. Displayable information is recommended to include: SSR code, Target aircraft address, Target aircraft identification, Magnetic heading, True airspeed, Selected altitude, Final state selected altitude, Barometric vertical rate, Geometric vertical rate, Roll angle, Geometric vertical rate, Track angle rate, Track angle, Ground speed, Velocity uncertainty, Position uncertainty, Indicated airspeed, Mach number, Barometric pressure setting, etc.

The information in the DAP Window can be configured per logical positions, such as the airborne downlink data to display and the unit of data items, etc.

The system is encouraged to be able to provide a downlink data window, which is used to display the downlink aircraft information. The information to be included (if applicable): SSR code, Target aircraft address, Target aircraft identification, Magnetic heading, True airspeed, Selected altitude, Final state selected altitude, Barometric vertical rate, Geometric vertical rate, Roll angle, Geometric vertical rate, Track angle rate, Track angle, Ground speed, Velocity uncertainty, Position uncertainty, Indicated airspeed, Mach number, Barometric pressure setting, etc. The information should be presented in a Downlink Data Window and/or accessed through the onscreen aircraft track label.

The information in the Downlink Data Window/track label is suggested to be configured through online and/or offline selection. The DAPs configuration could be offline assignable by logical positions and logical systems.

The system is recommended to define the units in which DAPs data are displayed in the downlink data window.

3.2.5 Arrival Manager Function

The purpose of Arrival Manager (AMAN) is an advisory tool to optimize the flight landing sequence by providing with suggested arrival intervala validated and conflict free sequence , and reduce flight holding time in the air, thus minimizing delay and providing control actions and advisories. These are achieved by considering factors such as airport runway configuration, runway rate, weather conditions, and stand arrangements, etc.

The essential functions of AMAN include flight sequencing, spacing, and delay advice.

a. Flight sequencing and spacing function

According to the calculated four-dimensional trajectory, AMAN calculation takes into account the metering point or runway spacing and performs a sorting calculation to obtain the target landing time (TLDT) and the arrival sequence. The tool recalculates the TLDT, when it obtains a new estimated landing time (ELDT), or when ATC reissues a request to revise the metering point or runway spacing.

b. Delay advice function

The delay advice generated by AMAN includes re-route, holding pattern, point merge system (PMS), and delay time indication. The system gives different delay advice according to the time of the delay.

AMAN may interact with ATFM or CDM system to follow a strategic plan to balance capacity and demand within different volumes of airspace and airport environments. There are many types of ATFM measures. Their lifetime typically spans the pre-tactical and tactical phases of the ATFM timeline. Fix balancing, Re-routing (mandatory or alternative), Level capping scenarios, and Collaborative trajectory options are included in the lateral aspect. For details and more information, please refer to DOC 9971.

~~It is normal that the basic functions of AMAN include four-dimensional trajectory prediction, flight sequencing, arrival route allocation, runway allocation, and delay advice, etc.~~

~~a. Four-dimensional trajectory prediction function~~

~~AMAN system takes in calculates the Estimated Time Over (ETO) at various points, such as handover points, merge points, etc. and the estimated landing time at the runway threshold (ELDT) based on flight plan data, surveillance data, aircraft performance models, meteorological data, and calculated path data.~~

~~b. Flight sequencing function~~

~~According to the calculated four-dimensional trajectory, AMAN calculates takes into accountconsiders the relevant constraints and performs a sorting calculation to obtain the target landing time (TLDT) and the arrival sequence.~~

~~c. Arrival route allocation function~~

~~According to the set restrictions, AMAN assigns a specific approach to the aircraft. The factors considered include runway aircraft constraints, airline stopping rules, parking spaces, runway load balancing, traffic distribution in different approach directions, etc.~~

~~d. Runway allocation function~~

~~In multi-runway airports, AMAN allocates runways for arrival flights based on actual conditions such as the local operating environment and runway configuration. The factors to be considered may include runway-aircraft type restrictions, airline parking rules, aircraft stand, runway load balance, and flow distribution in different directions of arrival.~~

~~e. Delay advice function~~

The delay advices generated by AMAN includes re-route, holding pattern, point merge system (PMS), and delay time indication. The system gives different delay advices according to the time of the delay.

3.2.6 Departure Manager Function

The basic function of DMAN shall include stakeholders to file Target Off-Block Time (TOBT) to a particular flight and ATC to calculate Target Take-Off Time (TTOT) which in turn issues a Target Startup Approval Time (TSAT). DMAN should also take in Calculated Take-Off Time (CTOT) from Flow Managers to apply ground delay programs.

The purpose of Departure Manager (DMAN) is to allow the operator to plan flights and share the planning decisions with other operators enabling Airport Collaboration Decision Making (A-CDM) to optimize departure sequence. This reduces fuel wastage by reducing taxing and waiting time on taxiways.

a. Filing TOBT

When operators and stakeholder to file a TOBT, it enables ATC to know when the aircraft will be ready for pushback. This enable better predictability of flight readiness

b. Calculating TTOT and TSAT

With a known TOBT, DMAN will calculate a take off time for this flight. If take off time is free of conflict, TSAT will be TOBT. If take off time is occupied by another flight, DMAN will find the next available take off time base on system set departure interval and wake constraint, forming the TTOT. TTOT will be back calculated by deducting taxing time to runway and pushback time deriving a TSAT. In this case, TSAT is not the same as TOBT thus a delay advice in gate is issued.

c. Taking CTOT into consideration

d. If ground delay program is needed, Flow Managers will issue a specific CTOT to a flight. This will then replace TTOT of the flight and DMAN will back calculate by deducting taxing time to runway and pushback time deriving a TSAT. This CTOT shall be within system configured constraint and other non CTOT flights to be sequenced around it.

DMAN can be enhanced by introducing Surface Manager (SMAN) which will feed taxing time to DMAN base on ground sensors rather than a fix system configured table.

~~3.2.6~~3.2.7 System Log Management

For the convenience of anomalies investigation, the system is recommended to be able to collect and manage operational logs and error messages. The operational logs include personnel commands, hardware logs, software logs, ~~and~~ external interface logs, etc. The error messages consist of software and hardware error messages, etc.

The system is suggested to be capable to:

a. Record operational logs and error messages.

b. Display necessary logs on the dedicated positions.

c. Store logs on the disk and ~~classif~~classif~~y~~ies by dependency. The user is allowed to sort logs by given conditions.

d. Backup logs automatically or manually, and the backup logs are readable.

e. Store logs on the disk for at least 31 days.

~~3.2.7~~3.2.8 Enhancement Recording and Playback Function

Considering ~~about~~ the convenience to user, the system is recommended to ex~~n~~tend the capability to integrally record the screenshots~~screenage~~ of the HMI by ~~the~~ way of frames and replay the recording onto designated positions and mobile devices in the form of video~~ as well~~.

3.2.8.1 Video Recording Function

The video record refers to the continuous footage derived from the controller's screen as exactly the same as shown. The video recording data is recommended to output as common video formats~~ as well~~.

The system is suggested to support the storage of video recording data ~~as~~over a period of time, such as 31 days. By reducing disk occupancy and transferring the data for the method, the system should not be impacted by storage overload.

3.2.8.2 Video Playback Function

It is recommended that the replay of the video record data could be performed on any designated controller position, and the video replay should be synchronized with the Audio.

The system is expected to be able to control the replay, including the selection of replay mode, retrieval replay, change replay speed, start, pause, forward, stop, etc.

~~3.2.8~~3.2.9 Enhanced Wake Turbulence Separation and ~~Approach~~Pairwise Separation~~pacing~~ Tools

~~The~~ Amendment 9 of the PANS-ATM (Doc 4444) introduces a new enhanced wake turbulence separation~~"enhanced Wake Turbulence Separation" (eWTS)~~ scheme with an alternative set of wake turbulence groups and associated wake turbulence separation minima for approach and departure phases of flights. The new ~~eWTS~~ scheme is based on the studies performed by Federal Aviation Administration (FAA) and European Organization for the Safety of Air Navigation (EUROCONTROL) on the wake generation and wake resistance characteristics of different aircraft types, which allows a reduction in wake turbulence separation between some aircraft pairs depending on the leading and the following aircraft type, as well as increases in wake turbulence separation for the smaller and more vulnerable aircraft type.

The ICAO Flight Plan is not required to be updated with the new wake turbulence groups, while air traffic controllers will have to consider seven wake turbulence groups instead of four categories when applying the new wake turbulence separation minima. States/Administrations are recommended to implement Pairwise Separation Tools ~~Approach Spacing Tool (AST)~~ function in ATMAS to assist air traffic controllers in the delivery of intended aircraft separation under the new ~~eWTS~~ scheme without memorizing all the separation pairs.

3.2.9.1 Wake Turbulence Groups~~eWTS Scheme~~ and Airspace

The harmonized ICAO wake turbulence group~~eWTS scheme~~ categorizes aircraft into seven~~the 7 wake turbulence~~ groups, Groups A to G, based on maximum certified take-off mass and wing span:

~~GROUP A~~	-	~~aircraft types of 136 000 kg or more, and a wing span less than or equal to 80 m but greater than 74.68 m;~~
~~GROUP B~~	-	~~aircraft types of 136 000 kg or more, and a wing span less than or equal to 74.68 m but greater than 53.34 m;~~
~~GROUP C~~	-	~~aircraft types of 136 000 kg or more, and a wing span less than or equal to 53.34 m but greater than 38.1 m;~~
~~GROUP D~~	-	~~aircraft types less than 136 000 kg but more than 18 600 kg, and a wing span greater than 32 m;~~
~~GROUP E~~	-	~~aircraft types less than 136 000 kg but more than 18 600 kg, and a wing span less than or equal to 32 m but greater than 27.43 m;~~
~~GROUP F~~	-	~~aircraft types less than 136 000 kg but more than 18 600 kg, and a wing span less than or equal to 27.43 m;~~
~~GROUP G~~	-	~~aircraft types of 18 600 kg or less (without wing span criterion).~~

For the implementation of enhanced wake turbulence separation scheme, ~~eWTS scheme,~~ States/Administrations have the flexibility to determine the scope of applicability to their airspaces. ~~of the new eWTS minima.~~ Also, States/Administrations can consider introducing the reduced minima in total, or in part as the first step, or a combination of these with fewer groups, or updating the local minima based on a partial set of enhanced wake turbulence separation~~eWTS~~ minima, whichever will provide the most benefit given the local traffic mixture.

To facilitate the transition from legacy to ~~eWTS~~new scheme by air traffic controllers, the design of ATMAS should allow the flexibility to adapt the mapping of~~ eWTS~~ wake turbulence groups (A-~~ ~~to G) to a custom set of abbreviations according to the local operational environment to minimize the impact to air traffic controllers in handling extra wake turbulence groups under the new scheme.

States/Administrations would need to define the specific volume of airspace that operates using ICAO enhanced wake turbulence separation~~ eWTS scheme~~, whilst other airspaces should continue to operate using legacy ICAO wake turbulence categories. For the implementation~~ of eWTS~~, the design of ATMAS should allow the use of both wake turbulence categories and groups~~schemes~~ in the system so that the appropriate wake turbulence categories/groups could be applied based on airspaces, controlling sectors, or controller's roles in accordance to operational needs.

3.2.9.2 Human Machine Interface of Wake Turbulence Groups

The abbreviation of wake turbulence categories/groups ~~are~~is normally displayed in the track labels of an aircraft in the HMI of ATMAS. Since the enhanced separation~~eWTS~~ would only be implemented in the designated volume of airspace, the ATMAS should be configurable to display the appropriate wake turbulence categories/groups to air traffic controllers in accordance with the applied wake turbulence scheme of that airspace. The ATMAS could determine the appropriate scheme by referring to the location of the aircraft and/or roles of the controllers.

In addition, States/Administrations can consider implementing~~to implement~~ electronic cue cards on the pair-wise aircraft separation under wake turbulence groups~~eWTS scheme~~ in ATMAS to assist controllers in identifying the required separation for aircraft pairs during operation.

3.2.9.3 AMAN Optimization

With the implementation of ICAO enhanced wake turbulence separation~~eWTS scheme~~, runway capacity is expected to increase in most cases due to a general reduction of wake turbulence separation in popular aircraft pairs of traffic mix. To benefit from the increase in runway capacity~~ due to eWTS~~the~~ scheme~~, the AMAN would need to be optimized to provide plans with arrival rate matching~~ with ~~the runway capacity. The optimization could involve a change in the AMAN logic on handling extra wake turbulence groups or fine-tuning of system parameters to increase the arrival rate of the landing sequence generated by AMAN ~~in order ~~to match with the theoretical runway capacity as far as possible.

3.2.9.4 Pairwise Separation Tools~~Approach Spacing Tool~~

To assist air traffic controllers in handling air traffic under enhanced wake turbulence separation and improve air traffic controllers' consistency in delivering the traffic according to the intended runway capacity, Pairwise Separation Tools are ~~Approach Spacing Tool (AST) is ~~recommended to be implemented. There are several examples of such tools in use, the following tool, namely Approach Spacing Tool (AST), provides an example of the function and application of such tools. The AST could project and present ~~graphically~~ the required spacing graphically between aircraft pairs along the approach sequence and provide advisories, in the form of graphical indicators on the Air Situation Display, to indicate the optimal positions of aircraft along the final approach path.

The AST could be operated in either Distance-based Separation (DBS) or Time-based Separation (TBS). Time-based Spacing could be helpful in safely managing the traffic without reduction in capacity when aircraft ground speed is generally reduced on the final approach due to strong and consistent headwinds. States/Administrations should assess separation standards by considering the performance/accuracy/reliability of local wind prediction, time-to-fly forecast, and other relevant ATC support tools.

Projection of Spacing

During the computation of spacing guidance, the AST should consider all the required separation criteria for a given aircraft pair, including wake turbulence separation minima, minimum radar separation, and dependent parallel approach separation. Then the tool would apply the most stringent criteria to ensure that none of the required separations is infringed.

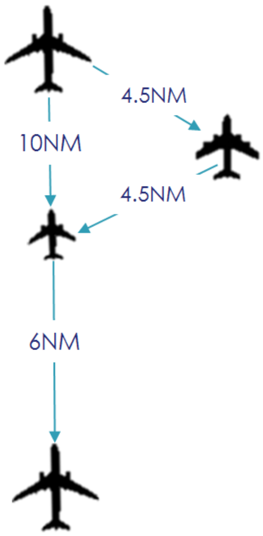


Figure 3.2.8-1 Minimum Separation

Apart from the required minimum separation, the AST would also consider other operational situations or parameters which could affect the optimal spacings between aircraft such as runway occupancy times, specific minimum separation defined for a runway, extra gap required between specific landing aircraft, etc. Together with the operational mode on the aircraft spacing and runway mode, the AST would consider all the above factors and provide spacing guidance in the form of graphical cues illustrated in the subsequent paragraphs.

AST Guidance Cues

Provision of visual guidance on the computed spacing, in the form of graphical indicators on the Air Situation Display, is recommended as part of the AST function. The purpose of visual guidance is to support air traffic controllers in delivering the traffic according to the intended capacity as far as practicable. Two guidance cues are recommended to be implemented by the AST:

a. Final Target Distance (FTD).

b. Initial/Intermediate Target Distance (ITD)).

Final Target Distance (FTD) is the appropriate position for the following aircraft behind a leading aircraft at the required minimum spacing applied at the runway threshold. The follower shall always be behind its respective FTD indicator along the final approach path.

Initial Target Distance (ITD) is the optimal distance for the following aircraft to be positioned behind a leading aircraft with the consideration of the required minimum spacing and the deceleration compression buffer. The ITD should be calculated based on the estimated 3D trajectory, the estimated speed profile, environment data (including wind, temperature, etc.), and the target FTD.

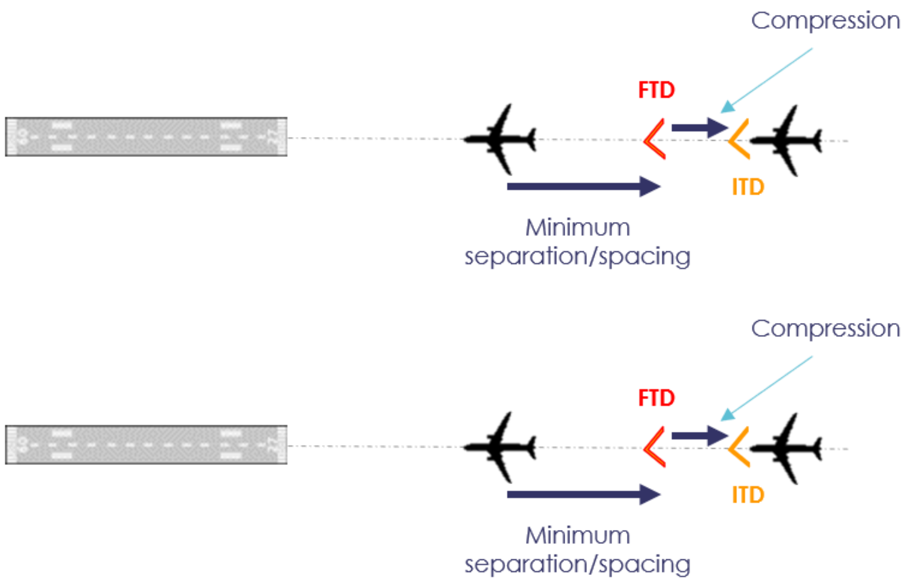
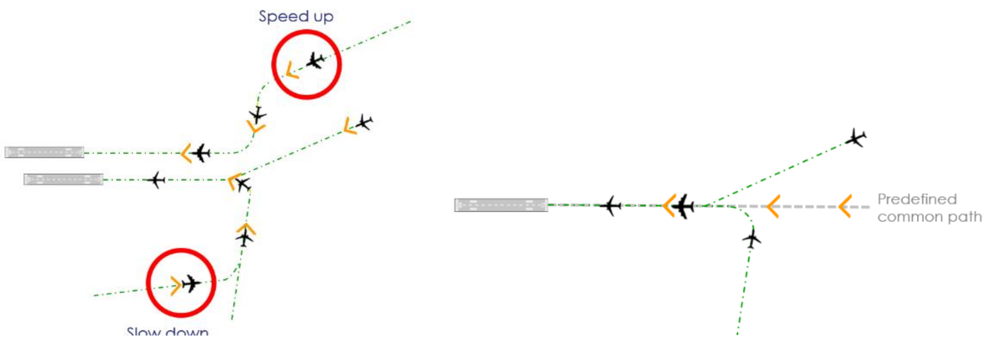


Figure 3.2.8-2 FTD and ITD Guidance

FTD and ITD guidance should be updated at every track updates of ATMAS. Depending on the actual operational environment, the position of the FTD and ITD guidance cues could be chosen to implement in AST along:

a. Planned trajectory of the flight.

b. Predefined common path.



(a) Planned trajectory of the flight (b) Predefined common path

Figure 3.2.8-3: Guidance Cues

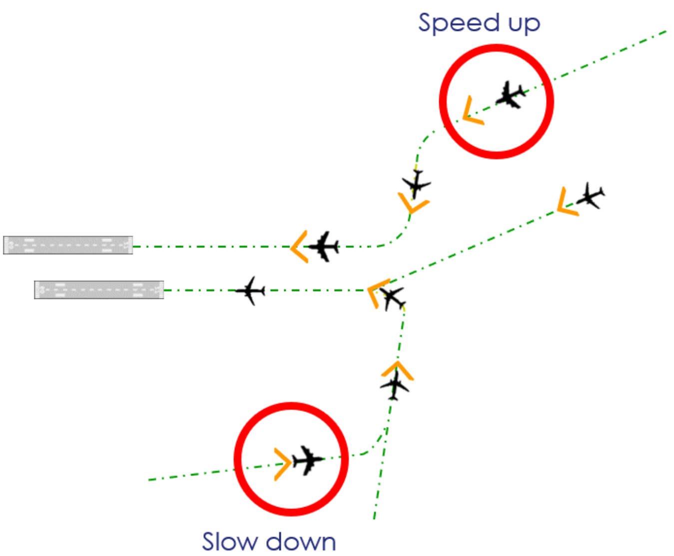


Figure 3.2.8-3: Guidance on the planned trajectory

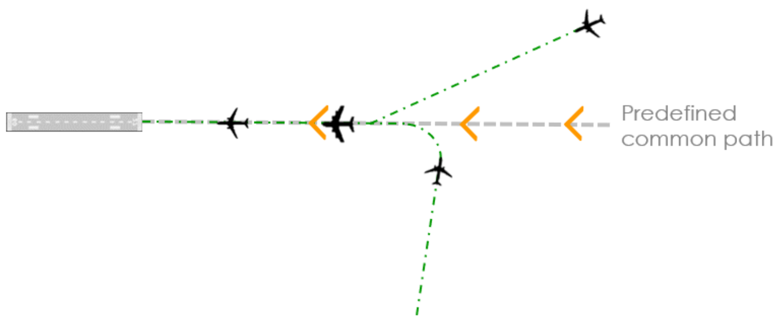


Figure 3.8.2-4: Guidance Cues on a predefined common path

Flexibility is recommended to allow each user to toggle online the on/off of FTD or ITD guidance according to the operational needs.

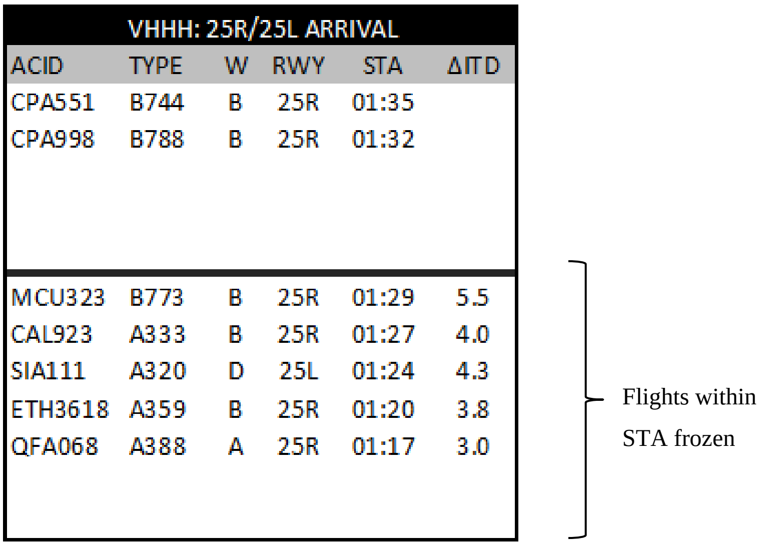
Final Approach Sequence Management

The planned Final Approach sequence is crucial in the generation of AST Guidance Cues by providing necessary information to the AST in determining the required wake turbulence separation between aircraft. Therefore, an accurately planned sequence is important for smooth AST operation.

If State/Administration has implemented Arrival Manager (AMAN) in its operation, its arrival sequence data would be the best candidate for processing by the AST. If AMAN is not available, an arrival sequence based on the flight trajectories from ATMAS would be an alternate option for AST processing.

~~To present controllers with the sequence of arrival flights, the AST should provide a sequence management list with flights listed in sequential order of arrivals for management by controllers. Depending on the runway modes (i.e. independent or dependent runway mode), controllers should be allowed to choose one or multiple sequence management lists to be displayed on the air situation display of AST.~~

~~Arrival flights in the sequence management list should be automatically sorted according to the Scheduled Time of Arrival (STA) from AMAN or the Estimated Time of Arrival (ETA) if AMAN data is not available. In case of sequence mismatch between the planned sequence and actual traffic pattern, the AST should allow controllers to alter the sequence by dragging the flights via the Human Machine Interface for sequence management. In addition, to prevent the manual actions by controllers from being overwritten by AMAN updates, AST should prevent changes to a flight's sequence when the STA/ETA falls within the frozen window based on current time.~~



~~Figure 3.8.2-.5: Sequence Management List~~

Monitoring Aids in Approach Spacing Tool

To ensure the appropriate spacing between arriving aircraft can be delivered, the following monitoring aids could be implemented for aircraft under management by AST for detecting catch-up scenarios, infringement of aircraft spacing, arrival sequence mismatch, speed non-conformance, etc..

~~:~~

~~a. FTD Catch-up Alert: when predicted trajectory of an aircraft infringe the FTD.~~

~~b. FTD Catch-up Alert: when predicted trajectory of an aircraft infringe the FTD.~~

~~c. FTD Infringement Alert (FTDA): when the FTD is infringed.~~

~~d. ITD Infringement Alert (ITDA): when the ITD is infringed.~~

~~e. Arrival Sequence Discrepancy Alert (ASDA): when the actual aircraft sequence differs from the planned arrival sequence, as computed by the Arrival Manager, or as manually sequenced by controllers.~~

~~f. Arrival Speed Conformance Alert (ASCA): when the aircraft speed differs by an adapted tolerance from the speed requirement in the STAR and approach procedure assigned to the aircraft within a defined distance from the runway threshold.~~

~~The alerts of monitoring aids should be displayed to air traffic controllers based on the jurisdiction and roles/positions with the flexibility of selecting visual and/or aural alerts by controllers.~~

~~3.2.9~~3.2.10 Operational Data Synchronization

In order to provide continuous ATM service in case of the ATMAS ~~in operational use~~ suffer~~ings~~ ~~with~~from technical problems, system failures, or other critical anomalies, some ATM centers are configured with two types of ATM automation systems, which work~~s~~ 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 the backup system when in master mode. This function also synchronizes the system when in backup mode with operational data from other master systems.

3.2.10.1 System Main/Fallback Mode

The system provided with the operation data synchronization function shall have two working modes at least: main and fallback mode. These two working modes can be switched manually.

In the main mode, all of the system functions ~~of the system~~ operate normally~~,~~ and output synchronization data in real-time.

In the fallback mode, the system receives and processes the synchronization data in real -time. System ~~F~~functions~~ of the system~~ run as usual, apart from the transmission of messages to external systems.

~~In the main mode, all of functions of the system are operating normally, and output initiatively synchronous data in real time.~~

~~In the fallback mode, the system receives and processes the synchronous data in real time, and all functions of the system are running as usual and stops automatically transmitting messages to external system.~~

3.2.10.2 Synchronous Data

Data synchronous data between the main and fallback systems is recommended to include basic flight data and operational setting data as follows~~, u~~. Users can adjust the data to be synchronized based on the operation needs:

a. Basic flight data comprises flight plan information, allocated runway, SID/STAR, etc.

b. Operational setting data includes sector allocation, airport runway status, position settings, online area creation or modification, etc.

3.2.10.3 Synchronization Trigger

Data synchronization is recommended to carry out periodically at a pre-defined time interval. In addition to the periodic data synchronization, the synchronization could be triggered by pre-defined events, for examples:

a. Each item in the flight plan information changed.

b. Each flight plan state changed

c. Each operational setting changed.

~~3.2.10~~3.2.11 Statistics and Analysis Function

Statistics and analysis function could be implemented for generating reports on the surveillance data, flight plans, alarm information, and traffic flow data.

Flight data that can be extracted from the ATMAS database at a minimum would have the following correlated data fields: aircraft ID[1], number of aircraft movements in the

[1]ICAO 2012 strictly enforces that this figure should be letters and numbers only, devoid of dashes, spaces, or other punctuation.

airspace sector and controlled airspace[2], flight rule[3], flight type[4], number of danger area infringements, number of rejected & accepted uplink messages, number of rejected & accepted downlink messages, number of uplink & downlink delivery timeouts, number of received and transmitted messages, number of AIDC messages [5] (transmitted, received, rejected, and accepted) and the total number of flights.

Presentation of correlated data fields would be in the form as shown in Appendix B: **Table 3.2.10-1A for Flight Specific Flight Data and Table 3.2.10-1B for Collective Flight Data,** where these are organized according to the date and/or time (in hour resolution[6]) of interest. The date and/or time window selection will allow flexibility in the period of data of interest. Hence, the correlated data will not be limited ~~on~~to fixed time periods, e.g., daily, weekly, or monthly. Nonetheless, a fixed time period can be the default setting and, in any case, the selected time period that defines the scope/coverage of the data that are being presented in the interface will always be visible to the user.

The data fields for **Collective Flight Data** will refer to the specified time periods. For example, data for the Total No. of Flights will be presented for the Day if the selected Time Period is set to Day; the Total No. of Flights will be shown in each sector for the Airspace Sector; and so on. Furthermore, the Total No. of Flights data need not ~~to~~ be equal to the Total No. of Flights in the Airspace Sector when the Total No. of Flights in each Airspace Sector is summed together for the reason that the flight may have traversed more than one Airspace Sector. The same principle is applied in the presentation of other correlated data fields.

Correctness and accuracy of the information in the presented data should be verified prior to deployment of the ATMAS into live operation. This can be arranged as one of the test cases for each data field that the vendor must be able to comply ~~to~~ verifying its performance.

Similarly, surveillance data correlated~~coupled~~ ~~to~~with flight data records can be retrieved from the ATMAS. These data are grouped into Flight Specific Surveillance Data.

Flight Specific Surveillance Data should be able to provide information on the type of surveillance track that is/are correlated~~coupled~~ to the flight. For instance, in a single flight data record, there is information if Secondary, Mode S, Multilateration and ADS-B tracks are correlated~~coupled~~ to the flight. This applies ~~for~~to an ATMAS interfaced ~~to~~with multiple surveillance technologies. For more than one source of the same type of surveillance technology, information about the source of that correlated~~coupled~~ track data should be provided, e.g., ADS-B Source: 2 (ADS-B track data taken from the second ADS-B sensor defined in the system). Furthermore, information about the

[2]sorted into ARR, DEP, Overflight, and Domestic Flights

[3] "I" for IFR, "V" for VFR, "Y" for when the flight will be initially IFR followed by one or more subsequent flight rules changes, and "Z" for VFR first with any number of subsequent changes.

[4] "S" for Scheduled Air Service, "N" for Non-scheduled Air Transport Operation, "G" for General Aviation, "M" for Military, and "X" for everything else

[5] applicable to flights involving the exchange of AIDC messages with adjacent FIR/ATS Unit

[6] the selection of time period will allow up to values in hour, e.g., 19 March 2021 0900-1000 UTC

surveillance track quality should also be provided if coasting, normal, low or high. This track information shall be based on the time stamped track at the time of track distribution. The time stamp shall be the reference of the ATMAS for generating the Flight Specific Surveillance Data after selecting the time period of interest. Appendix B **Table 3.2.10-2** illustrates the presentation of **Flight Specific Surveillance Data**.

Considering the number of surveillance tracks generated as system tracks for the ATMAS from a single source alone for one target, it will be quite irrelevant to gather **Collective Surveillance Data. Flight Specific Surveillance Data** would be more useful for the analysis of information generated by the ATMAS.

Data records should be retained for at least 301 days to allow for accident/incident investigation processes. These records should be made available on request to the relevant State safety authority. Where data is sought from an adjacent State, the usual State to State channels should be used. These recordings shall be in a form that permits a replay of the situation and identification of the messages that were received by the ATS system[7].

The data can be used for pre- and post-analysis of Air Traffic Management situation. Peri-analysis process will allow the ATC Supervisor to make the necessary adjustment(s) in the operations, while post-analysis can provide guidance in improving the operational processes and activities complementary to the technical aspect of the operations.

[7] The excerpts from Chapter 7.7.1 of the ADS-B IMPLEMENTATION AND OPERATIONS GUIDANCE DOCUMENT, Edition 8.0 – September 2015 is hereby adopted for all surveillance data sources.

4. SYSTEM DESIGN

4.1 System Architecture

In general, ATMAS should be equipped with adequate redundancy to ensure full availability for all critical, essential, and routine operational functions for air traffic control. Its system architecture should allow extra redundancy to be deployed whenever considered necessary. The architecture of ATMAS should follow the design and implementation principles below:

a. The ATMAS software should adopt modular design and distributed architecture to ensure robustness under adverse operating conditions. For the key function modules, such as FDP and SDP, they should be at least deployed on dual redundant servers in hot standby configuration to ensure a safe and uninterrupted service of ATMAS.

b. To minimize the number of single point failures due to hardware or software, multiple system redundancy and distributed system architecture are recommended.

c. System elements running simultaneously on multiple servers/computers should communicate over redundant networks and the failure of any element should not affect the operation of other system elements.

d. The network of ATMAS should be built on redundant network elements. Each main-stream operational data should be transmitted over independent links and networks. Failure of any network element would not affect the delivery of the main data stream within ATMAS.

e. For large-scale ATMAS designed for handling large traffic volumes, it is recommended to separate the transmission of different types of system data into dedicated networks. For example,

   - Operational Network: for handling the exchange of operational data, including surveillance data, flight plans, etc., between all controller working positions and operational servers.
   - Maintenance Network: for the transmission control & monitoring data, maintenance-related data, system log, replay data as well as distribution of new software and adaptation updates to system elements.
   - Direct Surveillance Access Network: for direct distribution of surveillance data from surveillance sources to controller working positions as the backup to the system track output of Surveillance Data Processor (SDP) of ATMAS.
   - Data Synchronization Network: for synchronizing data between

redundant systems of ATMAS.

f. High reliability through redundancy such that at least two identical system elements of the same function operate concurrently and the failure of either one should not affect the satisfactory operation of its counterpart and the system service.

g. Fault tolerant such that the system could continue its service, rather than failed completely, when some elements of the system failed.

h. With ~~failswitch over~~ fail safe capability such that the system operation should switch over to the fallback system elements after failure or abnormal termination of operational system elements.

i. Apart from having redundant elements within ATMAS, it is encouraged to implement a separate set of ATMAS as the fallback system to main operational system for maintaining air traffic services in case of catastrophic events happen~~ed~~ in the main system.

j. For ATMAS managing busy airspaces with high traffic volume, the main and fallback systems are recommended to be provided by different manufacturers to~~for~~ avoid~~ing~~ common software faults to both systems.

k. The main and fallback systems are suggested to be physically located at different sites to prevent any single-site accident affecting the operation of ATMAS.

l. External interfaces of the system (such as radar, AFTN, etc.) shall be redundantly configured and the system support automatic/manual switch to the redundant interface channels in case of partial failure.

4.2 Position Roles and Types

Based on functionalities, positions of ATMAS can be categorized into the different types, e.g.

a. Controller Working Position.

b. Flight Data Operator Position.

c. Flow Management Position.

d. Technical Maintenance Position.

e. Data Management Position.

f. Search and Rescue Position.

States/Administrations is suggested to review their operational needs during the design stage ~~i~~of ATMAS in order to adopt the suitable set of positions for their operational environment.

Working positions can be further categorized based on the user roles. For example, in ATC Center, controller working positions are categorized into roles of Supervisors, Executive Controller, Planning Controller, and Assistants under Enroute, Terminal, and Approach Control Streams. In ATC Tower, controller working positions are categorized into roles of Supervisor, Air / Ground Controls, Clearance Delivery, and Assistant~~s~~.

Access to different system functions by users would be controlled based on the assigned roles. Controllers would be assigned with controlling roles for flights under their jurisdiction, while maintenance engineers would be granted ~~with~~ monitoring and control permission on system components of ATMAS. All the roles and permissions should be off-line adaptable in the system database by authorized personnel. Once a role has been assigned to an individual, that person can access the data and functions based on the assigned permission.

States/Administrations could consider ~~to~~ strategically deploying extra controller working positions as spare in ATC Center and Tower. If a controller working position fail~~ed~~s for some reason~~s~~, controllers can quickly move to a spare controller working position and continue the ATC operation. The design of ATMAS should allow the restoration of air traffic situation display, flight data, electronic flight strips, display settings, and preferences after controllers move~~d~~ to another position to continue their works.

The type and number of positions shall be deployed on each site according to the operational requirement. For the functions of each position, please refer to section 3.1.10.

4.3 Main and Fallback System Configuration

States/Administrations are encouraged to implement ~~two sets of~~ ATMAS in Main and Fallback configuration ~~(Main and Fallback)~~ as the baseline in order to be capable of providing uninterrupted ATC service for their airspace. The Main and Fallback configuration can be achieved by two sets of ATMAS or redundant processors of the same system. The Fallback system should possess comparable system scale, configuration, and software functions with the Main system. In addition, the Main-Fallback data synchronization mechanism should be implemented to ensure the readiness of Fallback system for taking up the role as operational system for air traffic control in case of failures in Main system.

For ATMAS managing busy airspaces with high traffic volume, States/Administrations are encouraged to set up the Main and Fallback ATMAS with the same functionalities, capabilities, and capacities but in separated systems in order to enhance robustness and continuity in providing safe, efficient, and orderly ATC services. In busy airspaces, ATMAS failure could be a catastrophic event and cause disruption to air traffic. The Main and Fallback systems with data synchronization mechanism should allow the switch over between Main and Fallback systems seamlessly when needed. In addition, since the system switch over due to unexpected failure could be a rare event, States/Administrations are suggested to perform the switch over between Main and Fallback systems regularly to get air traffic controllers and engineers familiar with the process.

To further enhance resilience and mitigate risks of complete ATMAS failure, Main and Fallback systems are recommended to be provided by different manufacturers to avoid common software faults encountered in both systems simultaneously. If Main and Fallback systems with the same functionalities, capabilities, and capacities were supplied by the same manufacturer, a full-fledged Ultimate Fallback system from a different manufacturer would need to be implemented such that the Ultimate Fallback system could take up the operation as last resort in case of common software faults in Main and Fallback systems. The Ultimate Fallback should be designed to have the same level of functionalities, capabilities, and handling capacity as Main and Fallback systems in order to sustain possible prolonged control of the airspace.

For the case of (1) Main and Fallback systems from the same manufacturer or (2) redundant processors of the same system, ~~For the case of Main and Fallback systems from the same manufacturer~~ but without the deployment of Ultimate Fallback system, States/Administrations should conduct safety risk assessment on the overall system architecture to ensure that the risks of having common software faults in both Main and Fallback systems simultaneously have been mitigated to an acceptable level.

Real-time data synchronization function shall be implemented between the main and fallback systems~~,~~ to ensure the data consistency and smooth switch when technical failure. The operational data synchronization function can refer to section 3.2.9.

~~4.3~~4.4 System Operation Mode

4.4.1 Normal and Degraded Modes

The ATMAS should be capable of operating in normal and degraded modes. Under the normal mode of operation, all the system elements of ATMAS are running normally with full redundancy. Whenever there is any key system function (such as FDP or SDP) fail~~ed~~s, the ATMAS should maintain its service and automatically change to a degraded mode of operation. The degraded mode should allow controllers to maintain the provision of air traffic control service using limited system functionalities for a short period of time while the system issues are being fixed by maintenance staff or switching over to the Fallback system is still underway.

Under FDP failure, the ATMAS would be unable to process new incoming flight plans and existing flight data records in the system. Silent coordination across controller working positions may be unavailable as well. To mitigate the impact, controller working position should keep a local copy of system flight plan data at individual workstations so that flight plan association to the surveillance tracks could be maintained using local flight plan copy upon FDP failure. In this case, controllers could continue to identify tracks under their jurisdiction in their air situation display and maintain the control of traffic.

For SDP failure, the processed multi-surveillance track data from SDP would be unavailable in ATMAS. The system should maintain the display of air traffic situation to the controllers by automatically switching to direct surveillance access mode in which individual sources of surveillance data are directly fed to the controller working positions without the need ~~of~~for an SDP. In this case, controllers can continue the air traffic control operation using directly fed surveillance data while the SDP issue ~~are~~is being investigated and fixed by the maintenance team.

In case of other failures, the system should display impacted functions and operate smoothly in the absence of degraded functions. When the failed function recovers, controllers are allowed to manually upgrade to the normal mode on the position.

4.4.2 Main and Fallback Modes

For the case with Main and Fallback systems in place, the system should be capable of configuring between Main and Fallback modes. In the Main operation mode, the system would be responsible ~~to~~ for processing AFTN messages, assigning SSR codes, responding to controllers' input, communicat~~e~~ing with external systems, and synchroniz~~e~~ing data to the Fallback system. In the Fallback operation mode, the system would not process carry out the above processing but would receive~~s~~ synchronization data from the Main system and keep the system database up-to-date for operation switchover at any time. Since the Main-Fallback switchover involves the coordination across different controlling streams and technical maintenance team, it is suggested that user should manually switch the Main/Fallback modes ~~the Main/Fallback modes should be manually switched by the user~~ at the dedicated position of ATMAS for centralized coordination on the switchover.

Regarding the HMI design, the operational modes should be shown at the controller working positions and technical maintenance positions with prominent indications in case of any degradation of system functionalities. For cases with Main and Fallback systems in operation, the ATMAS should clearly indicate the current mode of operation, Main or Fallback, in its HMI to ensure that controllers are working at the correct system.

~~4.4~~4.5 Capacity and Performance

4.5.1 System Capacity

Normally, system capacity is used to describe the maximum processing capabilities, which is determined by the air traffic flow, operation requirements and system architecture, etc. It is suggested to include the following items at least:

a. System area.

b. Maximum number of sectors.

c. Maximum number of positions.

d. Maximum number of tracks displayed/correlated~~coupled~~/under-controlled.

e. Maximum number of flight plans existing in the system.

f. Maximum number of flight plans activated simultaneously.

g. Maximum number of surveillance sensor inputs.

h. Maximum number of adjacent centers with AIDC protocol.

4.5.2 Response Time

Response time is used to measure the speed, stability and resource usage of hardware and software in the system, the following recommended criteria are listed by experience, States/Administrations are encouraged to consider during the system planning stage.

a. The duration to start up a single node should be not more than 5 minutes.

b. The duration to cold start up whole system should be not more than 30 minutes.

~~c. The duration to start up a set of applications on single node should be not more than 1 minute.~~

~~d. The duration to start up all the application of the whole system should be not more than 10 minutes.~~

~~e.~~c. MTBF of surveillance data processing should be not less than 100,000 hours.

~~f. MTBF of flight data processing should be not less than 100,000 hours.~~

~~g.~~d. MTBF of a single workstation should be not less than 10,000 hours.

~~h. Maximum CPU usage of servers and workstations should be not more than 40%.~~

~~i. Maximum memory usage of servers and workstations should be not more than 50%.~~

~~j. Maximum disk usage of servers and workstations for playback and recording should be not more than 80% and for others, not more than 50%.~~

~~k. Maximum network load of servers and workstations should be not more than 60% of the total bandwidth.~~

~~l.~~e. Maximum deviation of clock synchronization should be not more than 100 milliseconds.

4.5.3 Performance of Surveillance Data Processing

Performance of surveillance data processing is used to measure the accuracy and ability of the system surveillance data processing, the following suggested values would be considered for system planning.

Adhering to the RSUR-5NMSEP_ER_Tier- A in the RSUR manual as attached in Appendix C, recommended surveillance performance requirements for 5 NM horizontal separation are mainly as follows:~~Recommended performance requirements for 5 NM horizontal separation provided by ATCO：~~

a. The surveillance Data Update Interval (DAT_{UI}) ~~Measurement interval for probability of update~~ should be less than or equal to ~~6~~ 5 seconds.

b. The Probability of ~~u~~Update (PoU) of horizontal position and pressure altitude should be greater than or equal to 97% ~~for 100% of the flights.~~.

c. The Horizontal ~~p~~Position RMS error (HPERMS) ~~for cruising flights~~ should be less than or equal to ~~3~~2~~5~~30 m or the Horizontal position error distribution at 95% (HPE95%) should be less than or equal to 400 m~~global and less than 385 m per flight~~.

~~d. Probability of update of pressure altitude with correct value should be greater than or equal to 96 % global.~~

d. The Pressure Altitude INTegrity (PAINT) and Mode A code Identity~~Forwarded pressure altitude average data age should be less than or equal to4 seconds~~. (IDINT) should be less than 0.1%.

e. -The Pressure Altitude INTegrity (PAINT).should be less than 0.1%.

~~e.~~f. Maximum Data Age of a parameter of Horizontal Position (HPMDA) should equal to 15s and Maximum Data Age of a parameter of Mode A code Identity. (IDMDA) should equal to 30s.

~~Pressure altitude unsigned error should be less than or equal to 200/300 ft in 99.9% of the cases for stable flights and less than or equal to 300 ft in 98.5% of the cases for climbing / descending flights.~~Adhering to the RSUR-3NMSEP_TMA_Tier- A in the RSUR manual as attached in Appendix C, recommended surveillance performance requirements for 3 NM horizontal separation are mainly as follows:

a. The surveillance Data Update Interval (DAT_{UI}) should be less than or equal to 5 seconds.

b. The Probability of Update (PoU) of horizontal position and pressure altitude should be greater than or equal to 97%.

c. The Horizontal Position RMS error (HPERMS) should be less than or equal to 150 m or the Horizontal position error distribution at 95% (HPE95%) should be less than or equal to 260 m.

d. The Pressure Altitude INTegrity (PAINT) and Mode A code Identity. (IDINT) should be less than 0.1%.

e. The Pressure Altitude INTegrity (PAINT).should be less than 0.1%.

~~f.~~ Maximum Data Age of a parameter of Horizontal Position (HPMDA) should equal to 15s and Maximum Data Age of a parameter of Mode A code Identity. (IDMDA) should equal to 30s.

~~Recommended performance requirements for 3 NM horizontal separation~~

~~provided by ATCO:~~

~~a. Measurement interval for probability of update should be less than or equal to 4 seconds.~~

~~b. Probability of update of horizontal position should be greater than or equal to 97% for 100% of the flights.~~

~~c. Horizontal position RMS error for cruising flights should be less than or equal to 210 m global and less than 230 m per flight.~~

~~d. Probability of update of pressure altitude with correct value should be greater than or equal to 96 % global.~~

~~e. Forwarded pressure altitude average data age should be less than or equal to 4 seconds.~~

f. ~~Pressure altitude unsigned error should be less than or equal to 200/300 ft in 99.9% of the cases for stable flights and less than or equal to 300 ft in 98.5% of the cases for climbing / descending flights.~~

4.5.4 Capacity of Recording and Playback

Generally, the capacity of recording and playback refers to the storage time of data in the system~~,—~~, and the following proposed values would be used as information during system design.

a. The minimum period for recording data archived in the system should be not less than 31 days.

b. The minimum period for system traces should be not less than 31 days.

c. The minimum period for raw surveillance data archived in the system should be not less than 7 days.

~~4.5~~4.6 External Interfaces

External interfaces are used to communicate with other systems, including receiving and transmitting messages.

The selection, configuration, and design of external interfaces can be determined by environmental conditions, operational requirements, and long-term schemes.

States/Administrations can determin~~ate~~e the external interface ~~to be interface with~~of the ATMAS. In general, ATMAS includes the following external interfaces:

a. Surveillance data interface

➢ Radar interface

The system is recommended to manage dual inputs from individual radar with ~~synchronous serial interface~~ serial ~~interface~~ or Ethernet interface and be able to receive and process the plots/tracks in a standard format, including ASTERIX.

➢ ADS-B interface

The system is suggested to manage dual inputs from individual ADS-B with serial interface or Ethernet and be able to receive and process ADS-B data in a standard ASTERIX CAT021format.

➢ WAM interface

The system is ~~proposed to be able~~recommended to manage dual inputs from WAM data processing center with Ethernet, and be able to receive and process ~~the~~ WAM data in a standard format, including ASTERIX CAT020from Ethernet.

~~The system is proposed to be able to receive and process the WAM data in a standard format, including ASTERIX CAT020from Ethernet.~~

b. ICAO message interface

The system should be able to receive and transmit the ICAO messages automatically in IA5 or ITA2 format with the asynchronous serial interface.

c. AIDC Interface

The system should be able to exchange the AIDC messages compliant with the standard AIDC protocol on the AFTN line and/or dedicated line. ~~dedicated line and AFTN line~~

d. Meteorological interface

➢ QNH interface

The system should be able to process the QNH data from the AWOS system with an asynchronous serial interface.

➢ GRIB interface

The system should be able to receive and process the GRIB message from Ethernet.

e. Data synchronization and exchange interface

➢ System track interface

The system should be able to receive and transmit the system tracks with serial interface and Ethernet in ASTERIX CAT 062.

➢ Flight data exchange interface

The system should be able to receive and transmit flight data with serial interface and Ethernet in the message format agreed.

- Audio playback interface

  The system is recommended to be able to provide the interface to synchronize the playback activities with the audio in an agreed data format through a serial interface or Ethernet, which can keep the playback of audio and situation awareness synchronization in time.

f. GNSS time interface

The system should be able to receive the GNSS time from the time reference system with Ethernet NTP protocol or serial interface.

g. CPDLC interface

The system is suggested to enable communicat~~e~~ion with external CPDLC equipment in compliance with the ~~ARINC,~~ FANS1/A, ATN B1 data formats through Ethernet or serial interface.

~~4.6~~4.7 Systems Interoperability

The system interoperability function enables ATMAS to exchange messages with other external systems to implement information sharing, and it is recommended to include the followings:

a. Data synchronization with fallback ATMAS

Please refer to Chapter 3.2.9.

b. Messages exchange with Tower systems

The system is recommended to be able to exchange messages with the integrated tower system, A-SMGCS, and tower electronic flight strip system~~,~~. T~~t~~he followings are the major exchanging messages:

- flight plan message

  Providing synchronization information of flight plan messages between ATM system and tower system, including flight plans creation, modification, deletion, cancellation and flight plan life evolution, etc.

- SSR assignment message

  Providing synchronization information of SSR allocation and release between ATM system and tower system.

- Runway operational state

  Providing synchronization information of runway operational states between ATM system and tower system, including DEP, ARR CLOSE, and additional information such as inspection and construction temporarily, etc.

~~4.7~~4.8 Cyber Threats and Mitigation

4.8.1 General Description

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~~ in protecting their critical infrastructure and manage potential risks arising from cyber security threats.

To address the growing concerns on cyber security threats, ICAO has extended its SARPs with Annex 17 on Security, with the supplement as in ICAO Doc 8973 "Aviation Security Manual" which sets out the aviation security requirements, including cyber security in ATMAS. In addition, ICAO published Doc 9985 "ATM Security Manual" setting out the principles and guidelines for protecting ATC system infrastructure from cyber attacks. States/Administrations are encouraged to pursue the appropriate level of compliance to the cyber security control requirements as stated in the ICAO documents and make collaborative efforts to effectively address cyber security threats. ICAO and other international organizations have been promoting the importance of cyber security in ATC systems via their web-site, such as ICAO's Thematic Website on Cyber security (www.icao.int/cybersecurity) and CANSO's website on Standard of Excellence in Cyber security.

4.8.2 Cyber Security Management

States/Administrations are encouraged to develop cyber security management, which adopts a proactive and systematic approach for protecting the increasing digiti~~s~~zation of ATS against cyber threats, through the establishment of Cyber Security Manual, Cyber Security Handbook and User Account Management Policy. The above-mentioned documents should be developed in accordance with relevant provisions in ICAO Annex 17 and Doc 9985 to provide protection of the safety-critical ATMAS against cyber threats and interference. Key elements of enhanced controls on cyber security are as follows for reference:

~~d.~~a. Cyber Security Policy

States/Administrations should establish ~~its~~their own Cyber Security Policy to mitigate cyber threat. Dedicated committee or working group on cyber security with regular meetings is encouraged to set up for reviewing policies and steering the implementation of cyber security control measures throughout the whole life cycle of ATMAS.

~~e.~~b. Network Infrastructure Protection

Interoperation among ATMAS and other ATS systems for information exchange is inevitable. Proactive protection of the backbone data network of ATMAS is essential to ensure its operation. Multi-tier defence-in-depth scheme for external TCP/IP unicast communication to other systems, comprising network equipment, firewalls, Network Intrusion Detection (NIDS) or Network Prevention System (NIPS), is suggested to strengthen the protection of the network ATMAS against cyber threats from external connections. To further strengthen the above-mentioned scheme, data diode gateway could be utilized to leverage on unidirectional communication for the dissemination of data from ATMAS to other systems.

During the project implementation stage of ATMAS, Virtual Private Network (VPN) is often suggested by the system manufacturer to allow their personnel to assist in~~ing~~ the installation and configuration of the system remotely. Since the system is not yet in operational use and is isolated from other operational ATC systems, an external VPN connection to ATMAS is considered acceptable in general for facilitating the project implementation. States/Administrations should assess the cyber security risks involved in remote VPN access during the integration of data interfaces to other ATC systems and ensure that all the security risks have been mitigated to an acceptable level.

After the ATMAS is put into operational use, external VPN access by the system manufacturer is, in general, not recommended. If there are operational needs to keep the VPN access by system manufacturer, States/Administrations should assess the cyber security risks and safety risks involved and implemented all the necessary measures to mitigate the risks to an acceptable level.

~~f.~~c. User Account Management

To protect the ATMAS from the cyber security risk of access control, States/Administrations should establish a systematic and traceable process for the administration of user accounts applicable to authorized access to ATMAS.

~~g.~~d. System Development Life Cycle

To achieve the viability and sustainability of cyber security protection, the protection from cyber threats in mind throughout the system life cycle of the development of ATMAS is indispensable. States/Administrations could formulate a project procedures handbook, which includes cyber security requirements, to safeguard against cyber threats from an early concept and design stage of a project. Besides, Independent Network Security Risk Assessment (INSA) for ATMAS is encouraged to conduct at a different stage of the project cycle to assess the adequacy of the cyber security measures applied to the system development.

~~h.~~e. Removable Media Control

Removable media provides a common route for importing malicious content into an information system. To mitigate the potential risk posed by the use of removable devices or media in ATMAS, States/Administrations should consider ~~to~~ refining~~e~~ ~~its~~their workflow to strengthen the security control, such that a removable media should be scanned for malicious content by the machine prior to uploading data to ATMAS.

~~i.~~f. Software Security Patch Management

Patching vulnerabilities for ATMAS is a key challenge ~~to~~ maintaining the balance between security and performance. States/Administrations could set up a scheme to work closely with system manufacturers to evaluate system patches when considered appropriate.

~~j.~~g. Physical Security Measures

While cyber security measures are in place for dealing with cyber threats, States/Administrations should implement physical security measures to physically protect the infrastructure of ATMAS from physical threats. The physical security provision includes facility management, security guards, CCTV surveillance, access control, physical lock, USB blocker, etc., from perimeter security down to console/rack level.

~~k.~~h. Response to Cyber Security Incidents

States/Administrations are encouraged to collaborate with the relevant local authority responsible for the investigation and prevention of cyber crime closely ~~closely collaborate with relevant local authority responsible for investigation and prevention of cyber crime~~. ~~D~~A direct reporting mechanism is recommended to establish in order to seek swift assistance from the local authority for handling cyber security incidents. States/Administration is encouraged to seek relevant authority for an independent assessment ~~on~~of cyber security measures implemented on ATMAS. Periodic drill exercises should be arranged to upkeep staff awareness and the robustness of the reporting mechanism

5. SYSTEM SOFTWARE MANAGEMENT

The system software management is a primary discipline of managing how software is modified through standardized procedures all over the life cycle in order to enhance system robustness, reliability, stability and safety and contribute to keep it running healthily. It is highly recommended to establish designated Software Management Department (SMD) specialized in system software management.

By experience, software management is recommended to cover requirement management, fault management and version & patch management. States/Administrations are encouraged to conduct different management stages for the practical requirement.SThe sthe an the SThe ss

5.1 System Requirement Management

System requirement management is intended to properly control the impact of changes throughout the software architecture, tracing back to the originating source of needs. The objective is to ensure a complete and consistent representation of the software requirements baseline, to satisfy with development of civil aviation, and to lead to high-quality and effectiveness.

SMD is responsible, with accordance to issued policies, to developing requirements database, guiding system construction, upgrading and tracking requirements realization.a ,the toforeings for investigating problem report or inspecting to investigate problem report or inspect the o ingeeingto ingeLOMG is responsible for handling system failures, reporting software problems, testing software releases in the local environment, and upgrading software changes on the operation system.LOMG is responsible to handle system failure, to report software problem, to test software release in local environment, and to upgrade software change on operation system.

5.1.1 Requirements proposal and application

System software requirements generally originate from changes relevant to work procedures, new techniques application, etc. At the beginning, a preliminary requirement scheme needs to be drawn up, including the following contents:

a. Necessity analysis.

b. Feasibility analysis.

c. Design specification.

d. Implementation time expected.

~~After determined and confirmed, requirement scheme shall be applied and submitted for approval.~~

~~5.1.2 Requirements assessment and approval~~

~~SMD is accountable for analyzing and assessing the scheme, considering the following factors at least:~~

- ~~a. Content integrity, reason sufficiency.~~
- ~~b. Adherence to standards and regulations.~~
- ~~c. Technical feasibility.~~
- ~~d. Influence on the system.~~
- ~~e. The scope of software baseline and corresponding impact (in case of multiple sets from different sites).~~
- ~~f. Uniformity across systems (if equipped with a fallback system).~~

~~The department shall feedback assessment results and reviews, archive them into the requirement database and follow up the progress of software requirements implementation.~~

~~5.2 System Fault Management~~

s, but anda which isthat isSThe ssthe s , fortoingededsionthe theingsthe foron,the d theySystem fault management mainly includes fault record, fault investigation, solution evaluation and troubleshooting arrangement. It is necessary to track the entire process of faults from occurrence to resolution, ensuring various faults resolved in an efficient and orderly way.

~~5.2.1 Fault record~~

~~The Maintenance Service Provider (MSP) is suggested to record all of faults happened on operation and handling processes, collect valuable logs and information for analysis, and register faults caused by defects. The content of fault registration includes basic system information (like manufacturer, operating site, and software version&patch number), the occurrence time, and detailed description of phenomenon. In addition, the severity and priority of the fault should be determined on the basis of the impact.~~

5.2.2 Fault investigation

Fault investigation requires a comprehensive analysis of the cause in the light of system performance, logging records and other information. Participants in the fault investigation are suggested to involve SMD, System Supplier (SP), SMP, and controllers. The SMD is advised to carry on the number to faults, follow up and manage them, as well as double check the severity and priority. The SP is required to check software codes, locate defects and provide analysis report with root cause.

Given that one fault might have an influence on the systems deployed on different sites and sharing the same software baseline, SMD is suggested to analyze the scope of the affected and release risk notification in time to each MSP. Countermeasures shall be supplied for the best preparation.

5.2.3 Defect correct plan

The defect repair plan is recommended to be discussed and formulated by the SMD, SP, SMP, and controllers. The content and consideration factors of the plan include:

a. According to the severity and priority, determine the software version&patch for each recovery.

b. According to the workload, formulate the schedule of software version&patch delivery.

SMD is suggested to follow up the progress of plan implementation and adjust as it stands.

5.3 Software Version& Patch Management

ssd of st e sare throughin thewereareare sthe ,Software version&patch management is a process of validating the software handed in by SP as expected and avoiding the appearance of new defects. The key of software version&patch management contains review and check, test and evaluation, and release. Based on the extent of the impact of changes on the system, the new release is divided into software version and patch.

5.3.1 Software delivery

The supplied software is suggested to include the compiled programs, software modification description and upgrading instruction. SP should provide check code for the programs to guarantee the correctness for fear of errors in the delivery process. Besides, for the benefit of software quality, SP is proposed to conduct factory test with specific cases and scenarios before delivery, and then submit test result and report.

5.3.2 Software review

From experience, it is recommended that the SMD register the software programs and review the factory test report. SMD verify the software programs with check code, install them on the test platform and validate the upgrading instruction. Moreover, SMD make sure that the integrity and accuracy of modification description contents requires are satisfied with expectation.

5.3.3 Software test

Based on the software modification, SMD is recommended to set up a test team, prepare a platform, and formulate a testing plan. Compared with patch test, software version test should consider broader testing scope, longer time, and more participants.

Controllers and MSP are suggested to deeply participate in the testing work and conduct a comprehensive test at aspect of functional improvements, main functional modules, regular operations on HMI and system stability. The test team is advised to write down test results in detail.

After the test is completed, test team is suggested to render a report that test process and result demands to be elaborated and analyzed, and then comes to conclusion.

5.3.4 Test reports evaluation and software release

The result of test is recommended to be evaluated by both SMD and MSP. Software which has passed the evaluation can be released for on-site installation, and otherwise returned to the manufacturer.

In addition, SMD and MSP are suggested to give full consideration to impact on operational environment, user experience and maintenance capability because of software evolution and changes.

~~6.~~5. System Transition

There are several scenarios in which ATMAS transition normally happens, ranging from minor to major changes, including:

~~a. Minor software corrections or patches for defects tracked under System Software Management (previous chapter) to enhance system robustness, reliability, stability, and safety.~~

~~b.~~a. ~~Moderate or~~ Major software and/or hardware upgrade, including operati~~on~~ng system upgrade and important modules upgrade such as SDP or FDP to provide new or enhanced functionalities. These cases may influence the system stability, so it is recommended to take a transition to guarantee the operation safely.

~~c.~~b. Overall system upgrade with new software and hardware equipment.

For a more complex transition that involves multiple stakeholders and equipment, change management, safety risk management, transition plan, rehearsal, and post-transition support are the key elements to ensure a smooth system transition.

5.1 Phases of System Transition

There are mainly four transition phases: transition preparation, transition rehearsal, system transition and post-transition operation.

a. Transition preparation: the necessary preparation for transition i~~I~~n this phase, transition scheme, safety assessment, equipment preparation, staff training, an manual update shall be completed.

b. Transition rehearsal: The main objective of this phase is to build confidence in~~on~~ the new changes and ~~fto f~~flag ~~out~~ any possible issues before the actual transition. It can be achieved by running an on-line test of the new system during off-peak hours or in the backup system in parallel with the operational system. During the on-line test, the new system could be connected with external interfaces and systems progressively. The operational users and engineering staff will test the main functions and interfaces, and record necessary optimization to the system as well as the rehearsal procedure. The frequency and duration of rehearsal shall be adjusted according to the complexity of the system transition.

c. System transition: In this phase, the new system will be put into operation. If the transition is complex with software and hardware upgrade, shadow operation is suggested, and the shadow operational period could last 1 or 2 weeks or even longer where appropriate. And according to the result of the shadow operation, the time point to start the transition shall be determined. If the transition fail~~ed~~s, a decision on whether to repeat or roll back needs to be made.

d. Observing operation: In this phase, the new system operates on line, and an observation period of one month or more is suggested, depending on the complexity of the changes.

5.2 Transition Preparation

5.2.1 Transition Scheme

~~The~~A complete transition scheme is necessary for a successful transition. Depending on the scale of the transition, the transition scheme is suggested to contain the followings:

a. The preliminary work to be finished, including:

- Review of acceptance testing results and equipment preparation.
- Review of the adequacy of change management and safety risk management.
- Review of training, including the competence of operational and engineering staff.
- Review of the change in ATC Procedures and update the operation manual.
- Other relevant work required.

b. Transition steps ~~plan~~, procedures, and key points.

c. Check-list: used to check the system transition operation and verify system functions and performance during transition rehearsal and system transition.

d. Decision mechanism: transition institution shall be established to determine on the transitional key point.

e. Contingency plan: used to cope with the emergency situations and include the decision-mechanism about roll back or transition delay, roll back plan, and the emergency support team.

5.2.2 Scheme Evaluation

The scheme evaluation is necessary and proposed to include scheme feasibility, scheme completeness, scheme presumption, equipment and staff preparation, the stability of the new system, and the solutions to bugs discovered during the on-site test. According to all these elements, some improved suggestions should be raised to make the scheme more perfect. After the evaluation, recheck should be made to ensure the implementation of the suggestions.

5.2.3 System Deployment

To ensure the system rehearsal and transition smoothly, the technical staff~~s~~ should validate the new software version on the test platform to ensure the new version can work well. And then, the system maintenance department should deploy the new software and hardware in advance. Makinge sure all the new software and hardware deployed in the system~~-~~ will shorten the time of transition sufficiently.

~~To ensure the system rehearsal and smooth transition, the new software and hardware should be sufficiently deployed.~~

5.2.4 Table Pre-rehearsal

Table-top exercise refers to the process in which the participants use maps, sand tables, flow charts, and other auxiliary means to interactively discuss and deduce the transition steps and emergency decision-making in the transition scheme.

Table-top exercise is recommended to ensure the feasibility of system switch steps, the smoothness of cooperation, the completeness of checklist, and the rationality of time arrangement.

~~For major transition, table-top exercise is recommended to ensure the feasibility of system switch steps, the smoothness of cooperation, the completeness of checklist and the rationality of time arrangement.~~

5.2.5 Other Preparations

The operational and engineering manual should be updated, including system information, technical manual, notification process, and emergency plan.

Before the rehearsal, thesystem maintenance department should train staff~~s~~ about the transition scheme and the updated manual to help them understand the system transition, collaboration matters among departments and system new functions. ~~Staff training is suggested to be completed to ensure familiarity of the new system.~~

5.3 System Rehearsal/Pre-Transition Verification

The transition scheme, including the detailed transition procedure and steps, should be made familiar to the team through training activities prior to the system transition. Depending on the complexity, several system rehearsals are suggested to be performed during the off-peak hours. The purpose of the system rehearsal is to verify the transition procedure as well as to validate the functionality, reliability, and stability of the new system in a real operational environment.

5.3.1 System Switch Steps Validation

The transition procedures are recommended to be validated according to the overall transition rehearsal scheme. The procedure to be validated includes at least the following: system switching steps, operating contents, transition team, and reasonability allocation, notification and reporting process. A checklist is suggested to be developed and optimized according to the result of each rehearsal. The optimization should be verified at the next rehearsal.

During the rehearsal, the time spent on each step is advised to be verified~~,~~ and ~~to~~ be used as a reference to support the decision making during the formal transition.

5.3.2 System Functions and External Interfaces Validation

The system functions and external interfaces are suggested to be tested~~-~~ and to ensure that they are functional as intended during the rehearsal. To ensure a smooth transition, the problems identified during the transition should be recorded in detail~~s~~ and corrected with the support of the SP.

5.4 System Transition

At the end of the above preparation activities, the transition management organization is suggested to decide to approve the date and time of the formal transition, based on the transition scheme evaluation report, the transition preparation status, and the result of the transition rehearsals.

For major system replacement or overall system upgrade transition, ~~a 1~2 weeks or longer~~ the shadow period~~-~~ is recommended to put the new system into operation during an off-peak time, to verify the system performance in a real operational environment, and to allow staff to gain familiarity and confidence in operating the new system. The duration of the shadow period is determined by controllers. 1~2 weeks shadow period is suggested to make every shift familiar with~~e~~ the new system. ~~-~~Appropriate rostering of staff is required such that all staff will be given the opportunity to gain ~~the~~ experience in operating the new system.

Finally, the transition is recommended to be performed based on the pre-defined procedure at the pre-defined transition time. The new system should be put into operational use after the verification of the functioning of the system is confirmed~~,~~ following its transition.

However, ~~if~~suppose there are blocking or critical issues,~~,~~ ~~e.g.~~ such as ssues affecting safe operation~~problem affecting safe operation~~ occurring during the transition~~,~~. In that case, decisions should be made according to the decision making strategy defined in the transition scheme, which may result in rollback or delay of the transition.

5.5 Post-Transition Operation

The post-transition operation phase is suggested as the run-in period of the system, which preferably requir~~ing~~ s additional staffing from the MSP as well as SP~~,~~ to resolve teething issues. The issues identified during this phase should be timely analyzed, corrected, and reviewed. In addition,~~,~~ the maintenance experience of the new changes will be accumulated.

The duration of the post-transition operation phase is recommended to be one month or longer. A formal assessment is suggested to be performed at the end of this phase. The assessment is proposed to include:

a. Issues reported during the observation period.

b. The cause analysis~~,~~ and possibly the avoidance and corrective methods of the issues.

c. Recommendations for future operation, matters-needs-attention, etc.

The system will enter ~~to~~ the stable operation phase after the observation period.

~~7.~~6. System Maintenance

The ATMAS goes to the system maintenance phase after being put into operation. System maintenance is necessary for the entire service life of the system. Critical functions and equipment should normally work ~~normally~~ even as the environment changes through~~by~~ planned and organized maintenance. The purpose of system maintenance is to guarantee ~~the~~ stable and continuous operation~~,~~ and to improve the performance of the system.

6.1 System Maintenance Participants

To handle the maintenance of complex and safety-critical ATMAS, ~~a~~ robust and systematic maintenance management, and practice should be set up with close cooperation among system suppliers, Maintenance Service Provider (MSP), and the Air Navigation Service Provider (ANSP) to ensure the operation of the system.

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

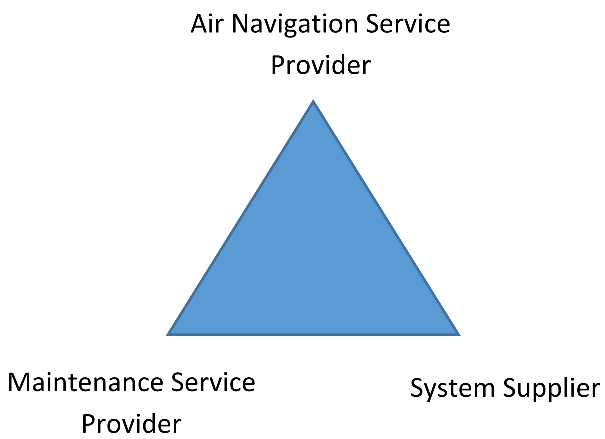


Figure7.1-1: Trio for Maintenance Framework

6.1.1 System Supplier

The design of system plays a critical role ~~on~~in the ease of maintenance during the operation stage of the system. Before system commissioning, the 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, including complete information for proper installation, set-up, use, operation, support, and maintenance of the system.

~~S~~The ystem supplier should provide documentation to the ANSP and MSP for aiding the use, application, and maintenance of the system and individual equipment, which should include:

a. Operation handbooks and user manuals for operating procedures and system functionalities for use by controllers, supervisors, assistants, and support specialists.

b. Technical literature for the 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.

c. 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 documentation~~s~~ should be reviewed and endorsed by the relevant authority prior to use.

~~S~~The system supplier should prepare training plans and training course materials ~~to~~for ANSP and MSP for review with sufficient 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, should set out the required training topics, which should be specific to different user groups, in the system contract.

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 the system supplier after commissioning on a regular basis, with more frequent training~~s~~/assessments during the start-up and run-in period after commissioning.

As ATMAS is a complex system, it is unavoidable that unexpected technical issues might emerge, especially teething issues during the early stage of operation. As such, the 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. Repeated faults should be handled and investigated with high priority by the system supplier to identify the root cause and implement corrective measures.

Since technology is changing rapidly, some system components might become obsolete and become difficult to source in the market. ~~S~~The system supplier should provide a list of obsolete equipment and its replacement models on a 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 the system supplier has to be regularly reviewed in suitable forums, such as performance review meetings in conjunction with ANSP and MSP representatives.

The ~~S~~system supplier could consider ~~to~~ forming user groups to allow sharing of users' experiences and gather feedbacks. ~~S~~The system supplier should facilitate regular hosting of user group meetings.

6.1.2 Maintenance Service Provider

~~E~~The engagement of an MSP to perform frontline maintenance under the supervision of ANSP is a practical solution in leveraging skill sets and the latest technology available in private sector in order to facilitate the 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 the system supplier's established procedures at recommended intervals, including health checks on the 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 practices with the recommendation from system supplier and expertise from MSP, together with close monitoring of system healthiness/system resources~~,~~ and housekeeping of servers/workstations on a regular basis to upkeep the system performance, should be in place.

There could be cases that due to the local specific environment/operational status of the ATMAS, it would require extra steps or more frequent maintenance, e.g., more frequent clean-up/reboot of servers and workstations, 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~~ in adapting the maintenance procedures to fit into the local needs after consulting the system supplier.

In addition, like any critical system~~s~~ running on a round-the-clock basis, ATMAS 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 training~~s~~/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 ATMAS.

Similar to system suppliers, 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 forums, such as operations & maintenance review meetings in conjunction with ANSP representatives to ensure maintenance provisions could meet the service needs.

6.1.3 Air Navigation Service Provider

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,. Tthe baseline maintenance requirements are set out in the contracts with these parties. Payment deduction might be incorporated into the contract to handle cases where performance does not meet requirements, but it might bear impacts on maintaining a good relationship with MSP or system supplier.

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

To allow ATC professionals to perform their work safely and satisfactorily, it is highly desirable for ANSP's engineering professionals to understand the operational needs such that the ATMAS could fully support their work. As such, constant communications with ATC professionals in addressing their needs via suitable steering forums and communication channels would be critical to the smooth operations onof ATMAS. Following the system commissioning, a technical team, comprising ANSP engineering professionals, system supplier, and MSP, could be established with ATC professionals to oversee system performance and deployment of new software builds and system data updates to ensure smooth operation of the ATMAS.

6.2 Resources Requirement

Necessary resources are mandatory for system maintenance, and the main considerations are as follows:

6.2.1 Staffing

MSP should ensure sufficient staffs areis employed to form a maintenance team and provide 24-hour operation and maintenance.

Before stepping into the system maintenance phase, MSP and ANSP should ensure the personnel areis fully trained by the SP or certified trainers. This ensures that the personnel involved in the maintenance work grasp knowledge and skills related to the system. It is also recommended to arrange on-site training by SP for MSP -and ANSP after system installation. Before the training, the training plans and training course materials should be fully reviewed by ANSP/ MSP in accordance with contract requirements, and define training topics for different users.

Before the system is put into operation, MSP and ANSP are recommended to send personnel to work in different phases for technical reserves in advance, and enhance their comprehension and familiarity with the system, which will be conducive to the subsequent maintenance work:

a. System design phase

MSP and ANSP are recommended to send personnel to participate in the design of the system to track the project development progress in SP factory, check the rationality and applicability of the design of each functional module of the system and put forward suggestions, and review technical documentation at the milestone, including the consistency of requirements, product design, handbooks, and acceptance test book.

b. Factory acceptance test phase

MSP and ANSP shall send personnel to participate in factory acceptance test in accordance with the contract requirement. MSP and ANSP personnel shall review the acceptance test books provided by SP in advance. The acceptance test shall be executed according to the approved test book in the test environment, such as platform, signal, instrument, etc., prepared by SP, and the result shall be recorded in the report.

c. Installation phase

After the work of on-site equipment installation starts, MSP should send personnel to participate in the whole process of hardware installation, software debugging, on-site acceptance tests,~~ and~~ flight inspection, etc. At this stage, personnel should be well familiar with important information such as equipment installation location, cabling, signal routing, position layout, label ~~and~~, signs, etc. They also need to learn software debugging and testing methods, and master the knowledge of system'~~'~~s functions and performance during on-site testing and flight inspection.

Besides above all, MSP and ANSP should set up their own maintenance personnel training systems, maintenance personnel access mechanism, and regular assessment of~~about~~ personnel skills to ensure that qualified personnel can perform the operation, maintenance, and management of the system.

6.2.2 Documents

Before the start of the system maintenance phase, MSP and ANSP should make sure necessary documents are in place~~d~~ to run the system. The documents should include at least the following:

a. System Design Specification: a set of technical documentation including system architecture, interface control documents, function module principle, etc.

~~a.~~b. Operational manual: an instruction manual that describes the function, performance, and user interface of the system software in detail~~,~~ so that the maintenance can understand how to use the operate the sy~~e~~stem.

~~b.~~c. Maintenance Manual: the service and maintenance manual includes system installation, parameters setting, maintenance suggestions, as well as troubleshooting procedures in hardware and software (it is recommended to provide a flow chart to locate and solve the problems~~,~~ and a method to identify the alarm and error, etc.)

d. User guides documentation: detailed description and operation guide of HMI for controllers, FIO, Flow.

~~e. User handbook: detailed description and operation guide of HMI for supervisors, controllers and coordinators.~~

~~d.~~e. Installation documentation: including details of each component of the system, cabinet layout, figure with data flow, mechanical and wiring schematic diagram, as-built drawing, etc.

f. Training documentation: including training materials or documents related to factory and on-site training.

g. Testing documentation: including achievement of acceptance criteria and identification of outstanding issues

~~e.~~h. Emergency response process documentation: in the event of sudden equipment failure, effective countermeasures can be taken in time to minimize the impact of equipment failure on air traffic control operations.

Besides, MSP and ANSP should work out their working procedures, maintenance plans, and contingency plan ~~of r~~for unning the system.

All documents should be reviewed and approved before application which should be updated continuously to keep the accuracy according to the changes ~~of~~in system behavior during the long-term operation.

6.2.3 Maintenance Tools

MSP and ANSP are recommended to be equipped with instruments and maintenance tools required for system maintenance, for example~~s~~, a~~the~~ simulator used to simulate track and message for system test, a software management tool for installation, rollback, and backup operation to software patch and release. Training for maintenance personnel shall cover the use of instruments, maintenance tools, and simulators by MSP and SP.

6.2.4 Spare parts

Sufficient hardware spare parts shall be reserved for the ATMAS, including servers, workstations, monitors, network equipment, etc. The percentage of spare parts is related to the scale of the system. The mechanism of spare parts management should be set up, including periodically testing and checking the reserve status to make sure that the spare parts are sufficient and available.

Since it is very common that computer hardware will be updated frequently, ANSP/MSP should review the list of hardware and confirm with the SP a list of obsolete hardware and replacement solutions regularly. The replacement hardware should be reserved as spare parts after finishing the site compatibility assessment.

If conditions- allowed, ATMAS Test and Validate System (TVS) is recommended to be deployed for supporting new software testing, system parameter adjustment, and personnel training, etc.

6.3 Maintenance Content

System maintenance is recommended to include the following at least:

6.3.1 Periodic maintenance

Periodic maintenance including daily, weekly and monthly, etc. Which maintenance matters should be worked out according to the real operational requirements,. Iit is recommended to cover the followings:

a. Check the running status of the system software, dual nodes redundancy.

b. Check the running status and health of the system hardware, including network load and the usage of resources such as CPU, memory, and disk of servers, workstations, and network devices. Please refer to section 4.5.2 for the inspection standards.

c. Check the validation of external data, including surveillance data, AFTN, AIDC, meteorological data, GNSS, and the status of data interaction with the external system, if any.

d. Check the integrity of the recorded data to prevent the data lost.

e. Check the status of basic function on bypass server.

f. Perform active/standby switch between the redundant servers to ensure both servers can operate normally.

g. Backup critical files and data periodically, including the system configuration parameters, database-,and log, etc.

h. Manually clean and reboot the server and workstation regularly.

i. Check the physical system operating environment regularly, including temperature, humidity, equipment grounding, electromagnetic environment, etc.

j. Switch the backup system to operational mode regularly to achieve a balanced use for both main and backup systems.

6.3.2 Troubleshooting

MSP should promptly execute troubleshooting, correct system errors, and ensure that the system work normally by replacing components, updating software or parameter configuration, and other methods.

SP should respon~~nse~~d in time to the requirements of MSP or ANSP after a failure occurs~~,~~ and assist MSP ~~to~~ in handl~~e~~ing and correcting the failure within the predetermined response time according to the severity.

MSP needs to record all the system problems in different kinds and problem-solving processes, and collect necessary system logs for analysis.

When a problem is judged as a software defect, MSP needs to register and track the problem. It is recommended to use a fixed PCRs form to register the system software problems, including supplier name, site location, software version number, failure time, failure content description, user investigation of relevant logs, the severity of the problem, etc.

After being confirmed by ANSP, MSP sends the PCRs to SP in time for problem analysis and software repair.

According to the information in PCRs, SP establishes the problem database, checks software code, locates and repairs software defects, and provides problem analysis reports.

The software defect repair plan is discussed by SP, MSP, and ANSP, and they jointly determine the delivery and implementation schedule of the software patch. ~~The detailed software defects management, please refer to section 5.2.~~

6.3.3 Software Version and Requirement Management

After the software is approved in site acceptance and put into operation, the software version and requirement management are managed by SP, MSP, and ANSP together throughout the service life of the system.

6.3.3.1 Baselines Establishment

Usually, SP will select a stable ATMAS software version defined as a Baseline, before SP develops a set of ATMAS based on the requirement of customers. The Baselines are defined for further software life cycle process activity and allow reference to, control of, and traceability between configuration items.

Baselines establishment is recommended to consider the factors as follows:

a. Baseline should be established for each set of ATMAS.

b. ATMAS Baseline is a stable software version that has been approved.

c. Once a Baseline is established, it should be protected from change.

d. In the service life of the system, the Baseline should have the check code and check method of the corresponding program to ensure the traceability consistency, and uniqueness of the program.

After the baseline version of the automation system is established, the customization of the automation system functions need to be fully discussed, researched, and agreed upon by SP, MSP, and ANSP. Then the SP carries out systematic research and development, and finally delivers the system software to users after passing factory acceptance and site acceptance.

6.3.3.2 System Requirement Management and Software Upgrade

The system function requirements usually come from the change of ATC procedures, the application of new technologies, etc., and the new functions are put into operation through software version upgrades.

ANSP may formulate a standard software requirements library according to operational needs, regularly maintain and update the requirements library, and guide the upgrading of software versions and the construction of new systems.

MSP is responsible for recording function requirements, analyzing and evaluating the description and scheme of the requirements, and submitting them to SP for development after being verified by ANSP.

SP completes the system software change and delivers it to MSP after passing the self-test, attaching the analysis of the impact scope of the software change.

MSP need to carry out functional improvement test and system stability test for software change. After ensuring that there is no defect, MSP shall jointly agree with ANSP on the effective time of software upgrade and implement the upgrade.

During the implementation of the software upgrade, MSP is recommended to backup the operating software. If there is any problem in the upgrading, MSP need to roll back the software to the previous version in time.

Note: If SP is responsible for the maintenance of system software throughout the service life of the system, the specific software maintenance contents may be defined in the contract which is agreed upon by all related parties.

Appendix A

ATMAS IGD Request for Change Form

RFC Nr:	

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 :			
8. AIGD EDITOR		**DATE REC'D :**	
9. FEEDBACK PASSED		**DATE :**	

Appendix B

Table 3.2.10-1A Flight Specific Flight Data

Aircraft ID	Traversed Sector/s	Controlled Airspace	Flight Rule	Flight Type	No. of Danger Area Infringements	No. of Uplink Messages		No. of Downlink Messages		No. of Delivery Timeouts	
						Rejected	Accepted	Rejected	Accepted	Uplink	Downlink

[Selected Time Period]

Aircraft ID	No. of AIDC Messages		No. of AIDC Messages	
	Rejected	Accepted	Transmitted	Received

Table 3.2.10-1B Collective Flight Data

Day/Week/Month	Total No. of Flights	Airspace Sector				No. of Danger Area Infringements	No. of Uplink Messages		No. of Downlink Messages		No. of Delivery Timeouts	
		N	W	E	S		Rejected	Accepted	Rejected	Accepted	Uplink	Downlink

Day/Week/Month	Controlled Airspace				Flight Rule				Flight Type				
	ARR	DEP	OVF	DOM	I	V	Y	Z	S	N	G	M	X

Table 3.2.10-2 Flight Specific Surveillance Data

[Selected Time Period]

Aircraft ID	Surveillance Track Type				Source of Surveillance Track				Quality of Surveillance Track			
	Secondary	Mode S	Multilat	ADS-B	Secondary	Mode S	Multilat	ADS-B	Secondary	Mode S	Multilat	ADS-B
	o	o	x	o	1	2	-	2	Coast	Normal	-	High

Appendix C

Performance of Surveillance Data Processing in RSUR

RSUR Specifications define technical performance requirements of ATS surveillance systems used in support of a particular ATS application in a given airspace.

The RSUR-5NMSEP_ER_Tier-C specification are applicable to the delivery of surveillance data at the output of a surveillance system that is used to support 5 NM Separation service in en-route environment as described in PANS ATM (Doc 4444) section 8.7.3 in a Tier C environment.

Table 3-1: RSUR_5NMSEP_ER_TIER-C

	RSUR specification 5NM-SEP_ER_TIER-C							
	Coherence		Integrity			Time		Reliability
DATA	Update Interval UI	Probability of Update	Core Error	Tail error	Integrity	Age	Delay	
2D Horizontal Position (HP)	$\mathbf{DAT_{UI}}$ ≤12s	**PoU** ≥97%	$\mathbf{HPE_{RMS}}$ <825m or $\mathbf{HPE_{95\%}}$ <1430m	$\mathbf{RNBE_{LB}}$= 2714m $\mathbf{RNBE_{UP}}$= 3644m	$\mathbf{HP_{INT}}$	$\mathbf{HP_{MDA}}$ = 36.3s	-	-
Pressure Altitude (PA)			-	-	$\mathbf{PA_{INT}}$ <0.1%	$\mathbf{PA_{MDA}}$= **30s**	-	-
Mode A code Identity (ID)			-	-	$\mathbf{ID_{INT}}$ <0.1%	-	$\mathbf{ID_{MUD}}$ = **48s**	-
Flight Status (emergency, SPI = FS)	-	-	-	-	-	-	$\mathbf{FS_{MUD}}$ = 24.2s	-
Time of applicability	With HP	-	-	-	-	-	-	-
Service	In defined OCV $\mathbf{HP_{RTD}}$ <0.3s		$\mathbf{FGT_{DEN}}$< 0.1% $\mathbf{SRV_{INT}}$ <10^{-5} per report					$\mathbf{SRV_{CNT}}$ = 0.999 /hour

The RSUR-5NMSEP_ER_Tier-B specification are applicable to the delivery of surveillance data at the output of a surveillance system that is used to support 5 NM Separation service as described in PANS ATM in en-route airspace (ICAO Doc4444) section 8.7.3 in a Tier B environment .

Table 3-2: RSUR-5NM SEP TIER B

	RSUR specification 5NM-SEP_ER_TIER-B							
	Coherence		Integrity			Time		Reliability
DATA	Update Interval UI	Probability of Update	Core Error	Tail error	Integrity	Age	Delay	
2D Horizontal Position (HP)	**DAT_{UI}** $\leq$8s	**PoU** $\geq$97%	**HPE_{RMS}** <540m or **$HPE_{95\%}$** <940m	**$RNBE_{LB}$=** 1776m **$RNBE_{UP}$=** 2384m	**HP_{INT}**	**HP_{MDA}** = 24s	-	-
Pressure Altitude (PA)			-	-	**PA_{INT}** <0.1%	**PA_{MDA}= 30s**	-	-
Mode A code Identity (ID)			-	-	**ID_{INT}** <0.1%	-	**ID_{MUD}** = 32s	-
Flight Status (emergency status, SPI = FS)	-	-	-	-	-	-	**FS_{MUD}** = 16s	-
Time of applicability	With HP	-	-	-	-	-	-	-
Horizontal Velocity			VEL_{RMS} =					
Vertical rate								
Flight status ground/airborne							**FS_{MUD}** = 16s	
Aircraft Identification							**ID_{MUD}** = 32s	
ACAS capability					CAP_{INT} <10^{-5}			
ADS-B version number					CAP_{INT} <10^{-5}			
Service	In defined OCV **HP_{RTD}** <0.3s		**FGT_{DEN}**< 0.005% **SRV_{INT}** <10^{-5} per report					**SRV_{CNT}** = 0.9999 /hour

The RSUR-5NMSEP_ER_Tier- A specification are applicable to the delivery of surveillance data at the output of a surveillance system that is used to support 5 NM Separation service as described in PANS ATM (ICAO Doc4444) in en-route airspace section 8.7.3 in a Tier A environment.

Table 3-3: RSUR_5NMSEP_ER_TIER-A

	RSUR specification 5NM-SEP_ER_TIER-A							
	Coherence		Integrity			Time		Reliability
DATA	Update Interval UI	Probability of Update	Core Error	Tail error	Integrity	Age	Delay	
2D Horizontal Position (HP)	**DAT_{UI}** $\leq 5s$	**PoU** $\geq 97\%$	**HPE_{RMS}** <230m or **$HPE_{95\%}$** <400m	**$RNBE_{LB}$**= 1262m **$RNBE_{UP}$**= 1695m	**HP_{INT}**	**HP_{MDA}** = 15s	-	-
Pressure Altitude (PA)			-	-	**PA_{INT}** <0.1%	**PA_{MDA}= 30s**	-	-
Mode A code Identity (ID)			-	-	**ID_{INT}** <0.1%	-	**ID_{MUD}** = 32s	-
Flight Status (emergency status, SPI = FS)	-	-	-	-	-	-	**FS_{MUD}** = 10s	-
Time of applicability	With HP	-	-	-	-	-	-	-
Horizontal Velocity			HVE_{RMS} < ?					
Vertical rate			VRE_{RMS} < ?					
Flight status ground/airborne							**FS_{MUD}** = 10s	
Aircraft Identification							**ID_{MUD}** = 32s	
ACAS capability					CAP_{INT} $<10^{-5}$			
ADS-B version number					CAP_{INT} $<10^{-5}$			
ADS-B in capability					CAP_{INT} $<10^{-5}$			
Data-link capability					CAP_{INT} $<10^{-5}$			
Resolution Advisory status						X_{MDA} <DAT_{UI} +2s		
Barometric pressure setting						X_{MDA} <DAT_{UI} +2s		
Expanded State vector (2.3.3.5)						X_{MDA} <DAT_{UI} +2s		
Service	In defined OCV **HP_{RTD}** <0.3s		**FGT_{DEN}**< 0.005% **SRV_{INT}** $<10^{-5}$ per report					**SRV_{CNT}** = 0.99999/h

The RSUR-5NMSEP_ER_Tier-C specification are applicable to the delivery of surveillance data at the output of a surveillance system that is used to support 3 NM separation service in TMA environment as described in PANS ATM (Doc 4444) section 8.7.3 in a Tier C environment.

Table 3-4: RSUR_3NMSEP_TMA_TIER-C

	RSUR specification 3NM-SEP_TMA_TIER-C							
	Coherence		Integrity			Time		Reliability
DATA	Update Interval UI	Probability of Update	Core Error	Tail error	Integrity	Age	Delay	
2D Horizontal Position (HP)	**DAT_{UI}** $\leq$5s	**PoU** $\geq$97%	**HPE_{RMS}** <450m or **$HPE_{95\%}$** <780m	**$RNBE_{LB}$=** 1478m **$RNBE_{UP}$=** 1985m	**HP_{INT}**	**HP_{MDA}** = 15s	-	-
Pressure Altitude (PA)			-	-	**PA_{INT}** <0.1%	**PA_{MDA}= 30s**	-	-
Mode A code Identity (ID)			-	-	**ID_{INT}** <0.1%	-	**ID_{MUD} = 20s**	-
Flight Status (emergency, SPI = FS)	-	-	-	-	-	-	**FS_{MUD}** = 15s	-
Time of applicability	With HP	-	-	-	-	-	-	-
Service	In defined OCV **HP_{RTD}** <0.3s		**FGT_{DEN}**< 0.1% **SRV_{INT}** <10^{-5} per report					**SRV_{CNT}** = 0.999 /hour

The RSUR Specification defines the performance of ATS surveillance systems used in the provision of Terminal Control Area TMA (see definition in PANS-ATM) (Doc4444) in Terminal Area section 8.7.3 in a Tier B environment.

Table 3-5: RSUR 3NMSEP_TMA_TIER-B

	RSUR specification 5NM-SEP_TMA_TIER-B							
	Coherence		Integrity			Time		Reliability
DATA	Update Interval UI	Probability of Update	Core Error	Tail error	Integrity	Age	Delay	
2D Horizontal Position (HP)	**DAT_{UI}** $\leq$5s	**PoU** $\geq$**97%**	**HPE_{RMS}** <300m or **$HPE_{95\%}$** <520m (556m ADS-B)	**$RNBE_{LB}$=** 987m **$RNBE_{UP}$=** 1326m	**HP_{INT}**	**HP_{MDA}** = 15s	-	-
Pressure Altitude (PA)			-	-	**PA_{INT}** <0.1%	**PA_{MDA}= 30s**	-	-
Mode A code Identity (ID)			-	-	**ID_{INT}** <0.1%	-	**ID_{MUD}** = 20s	-
Flight Status (emergency status, SPI = FS)	-	-	-	-	-	-	**FS_{MUD}** = 15s	-
Time of applicability	With HP	-	-	-	-	-	-	-
Horizontal Velocity (VEL)			VEL_{RMS} =					
Vertical rate (VR)								
Flight status ground/airborne							**FS_{MUD}** = 15s	
Aircraft Identification							**ID_{MUD}** = 20s	
ACAS capability					CAP_{INT} <10^{-5}			
ADS-B version number					CAP_{INT} <10^{-5}			
Service	In defined OCV **HP_{RTD}** <0.3s		**FGT_{DEN}**< 0.004% **SRV_{INT}** <10^{-5} per report					**SRV_{CNT}** = 0.9999 /hour

The RSUR Specification defines the performance of ATS surveillance systems used in the provision of Terminal Control Area TMA (see definition in PANS-ATM) (Doc4444) in Terminal Area section 8.7.3 in a Tier A environment.

Table 3-6: RSUR 3NM-SEP_TMA_TIER-A

	RSUR specification 5NM-SEP_TMA_TIER-A							
	Coherence		**Integrity**			**Time**		**Reliability**
DATA	Update Interval UI	Probability of Update	Core Error	Tail error	Integrity	Age	Delay	
2D Horizontal Position (HP)	**DAT_{UI}** $\leq$5s	**PoU $\geq$97%**	**HPE_{RMS}** <150m or **$HPE_{95\%}$** <260m	**$RNBE_{LB}$=** 1736m **$RNBE_{UP}$=** 988m	**HP_{INT}**	**HP_{MDA}** = 15s	-	-
Pressure Altitude (PA)			-	-	**PA_{INT}** <0.1%	**PA_{MDA}= 30s**	-	-
Mode A code Identity (ID)			-	-	**ID_{INT}** <0.1%	-	**ID_{MUD}** = 20s	-
Flight Status (emergency status, SPI = FS)	-	-	-	-	-	-	**FS_{MUD}** = 10s	-
Time of applicability	With HP	-	-	-	-	-	-	-
Horizontal Velocity			HVE_{RMS} < ?					
Vertical rate			VRE_{RMS} < ?					
Flight status ground/airborne							**FS_{MUD}** = 10s	
Aircraft Identification							**ID_{MUD}** = 20s	
ACAS capability					CAP_{INT} <10^{-5}			
ADS-B version number					CAP_{INT} <10^{-5}			
ADS-B in capability					CAP_{INT} <10^{-5}			
Data-link capability					CAP_{INT} <10^{-5}			
Resolution Advisory status						X_{MDA} <DAT_{UI} +2s		
Barometric pressure setting						X_{MDA} <DAT_{UI} +2s		
Expanded State vector (2.3.3.5)						X_{MDA} <DAT_{UI} +2s		
Service	In defined OCV **HP_{RTD}** <0.3s		**FGT_{DEN}**< 0.005% **SRV_{INT}** <10^{-5} per report					**SRV_{CNT}** = 0.99999/h

TABLE OF ATS INTER-FACILITY DATA COMMUNICATION (AIDC) IMPLEMENTATION STATUS IN APAC REGION

Explanation of the Table

Column		Explanation	Reason
1	State/Administration	Name of the State/Administration	
2	AIDC Implementation Status (Implemented or not)	AIDC has been implemented in the State/Administration or not (States have the technical capability implemented and at least one bilateral connection with adjacent ATS units in operational use will be regarded as implemented)	
3	Location of AIDC System ATSU1	the location of the AIDC end system under the supervision of State/Administration identified in column 1	
4	ATM Automation System	Make/Model of the ATM automation system used in this ATSU	
5	ATSU2 /Correspondent State/Administration – the correspondent AIDC System	ATSU2 – location of the correspondent AIDC end system Correspondent State/Administration – the name of the State/Administration responsible for management of the correspondent AIDC end system A "/" is placed between the ATSU2 and State/Administration	
6	Intraregional/Interregional	the connection is intraregional (inside APAC) or interregional	
7	Transmission Means	the transmission means used for the AIDC messages exchanged between the corresponding AIDC pair, AFTN, AMHS, etc.	The carriage of AIDC messages is facilitated through existing communication network (e.g. AFTN, AMHS, etc.). The type of network that will be used for AIDC message exchange will need to be defined, including the appropriate recovery/ contingency actions that will be adopted in abnormal situations
8	Frequency of Use (days in a week)	days of AIDC used in a week	to indicate how frequently the AIDC interface has been used
9	Main/Backup Circuit	the circuit is main or backup AIDC connection	if there is two circuits between the two ATSUs, it's better to identify which is main or backup
10	Communication Signal Speed	the communication signal speed for the AIDC messages exchanged (bps)	According to Pan Regional Interface Control Document (PAN ICD) for ATS Inter-facility Data Communications (AIDC) chapter 3.3.2.3, the communication signal speed between ATS systems using AFTN/AMHS should be greater than 2400 bps
11	Average Transmission Delay (One Trip Time Seconds)	the average transmission delay for exchanging AIDC messages	According to Pan Regional Interface Control Document (PAN ICD) for ATS Inter-facility Data Communications (AIDC), Average Transmission Delay (seconds) will influence the AIDC performance. In order to effectively use the AIDC application for the interchange of ATC coordination data, ATSUs should monitor the performance of the communication links to ensure the required performance is achieved. This monitoring should measure the latency of the AIDC message traffic between ATS systems in terms of the time measured between message transmission at the originating ATS system and receipt of the message at the receiving ATS system. The performance of the communications links should be such that 95% of all messages should be received within 12 seconds of transmission and 99.9% of all messages should be received within 30 seconds of transmission. In bilateral agreements, ATSUs, may agree on different performance requirements
12	Implementation Date or Target Date	date of implementation of the AIDC end system in the form of xQyyyy(quarter year), MON yyyy (Month) or yyyy	
13	Interface Status	the AIDC interface status, including Operational (already implemented), Testing (under progressing), Planned (under plan), No plan	
14	Interface Protocol /Version (OLDI or AIDC Version)	the AIDC service between the corresponding ATSUs	to show which AIDC version used and supported between two ATSUs and refer to Reason under Item 15

TABLE OF ATS INTER-FACILITY DATA COMMUNICATION (AIDC) IMPLEMENTATION STATUS IN APAC REGION			
Explanation of the Table			
Column		Explanation	Reason
15	List of AIDC Messages Applicable between the Two ATSUs	the AIDC messages can be exchanged between the two ATSUs, including ABI, EST, ACP, TOC, AOC, LAM, LRM, PAC, CDN, CPL, REJ, MAC; TRU, EMG, MIS, TDM, ASM, FAN, FCN; ADS	According to Asia/Pacific Seamless ANS Plan V3.0, PASL Phase II (expected implementation by 07 November 2019) and APANPIRG/24 CONCLUSION 24/16, ATS systems should enable AIDC (version 3 or later), or an alternative process that achieves at least the same level of performance as AIDC, between en-route ATC units and terminal ATC units where transfers of control are conducted consistent with FICE-B0/1, unless alternate means of automated communication of ATM system track and flight plan data are employed (Priority 1). As far as practicable, the following AIDC messages types should be implemented: • Advanced Boundary Information (ABI); • Coordinate Estimate (EST); • Acceptance (ACP); • TOC; and • Assumption of Control (AOC). Note: States should note the necessity to utilise Logical Acknowledgement Message processing (LAM) when implementing AIDC
16	Coordination by CDN or Voice	the method used in coordination phase	to show if the AIDC process a totally automatic or not
17	Automatic or Manual EST	the EST is sent out automatically or manually	to evaluate the automatic level of AIDC
18	A Warning Message to Controller in Case of AIDC Failure	the warning message for AIDC failure is capable or not	According to Pan Regional Interface Control Document (PAN ICD) for ATS Interfacility Data Communications (AIDC), failure to receive an operational response within timeout period Top should result in a warning message being displayed to the controller. Non receipt of a response to an ASM may indicate either a communication link failure or an ATC system failure. If an ATSU that has sent an ASM message does not receive an application response within a specified time, a warning message should be displayed at an appropriate position so that local contingency procedures can be executed
19	Remarks	any additional information describing the AIDC connection, including issues faced if any, mitigation, and limitation	

Table of AIDC Implementation Status in APAC

State/Administration	AIDC Implementation Status(Implemented or not)	Location of AIDC System ATSU1	ATM Automation System (Make/Model)	ATSU2 /Correspondent State – Administration	Intraregional/Interregional	Transmission Means	Frequency of Use(days in a week)	Main/Back up Circuit	Communication Signal Speed (bps)	Average Transmission Delay (One Trip Time Seconds)	Implementation Date or Target Date as MON yyyy or xQyyyy	Interface Status (Operational, Testing, Planned, No plan)	Interface Protocol / Version (OLDI or AIDC Version)	List of AIDC Messages Applicable between the Two ATSUs (ABI, EST, ACP, TOC, AOC, LAM, LRM, PAC, CDN, CPL, REJ, MAC; TRU, EMG, MIS, TDM, ASM, FAN, FCN; ADS)	Coordination by CDN or Voice	Automatic or Manual EST	A Warning Message to Controller in Case of AIDC Failure	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
State/Administration A	Implemented	ATSU 1	Raytheon ATM system	ATSU 2 / State/Administration 2	Intraregional	AMHS	7	Main	9600	2	Nov 2020	Operational	ICD V.3.0	ABI, EST, ACP, TOC, AOC, LAM, LRM, PAC, CDN, CPL,	CDN	Automatic	yes	
				ATSU 3 / State/Administration 3	Interregional	AFTN	2	Backup	4800	3	1Q2001	Operational	OLDI	ABI, EST, ACP, TOC, AOC, LAM, LRM	Voice	Manual	no	
						AMHS	5	Main	9600	2	Jan 2019	Operational	OLDI	ABI, EST, ACP, TOC, AOC, LAM, LRM	Voice	Automatic	no	
AFGHANISTAN		Kabul ACC		Kabul ACC /Afghanistan	Intraregional	AMHS												
				Karachi ACC/Pakistan	Intraregional	AFTN												
AUSTRALIA		Brisbane ACC		Oakland ARTCC /USA	Intraregional	AFTN						Operational						
					Intraregional	AMHS												
				Auckland ACC /New Zealand	Intraregional	AFTN						Operational	ICD V.1.0					
					Intraregional	AMHS												
				Melbourne ACC /Australia	Intraregional	AFTN						Operational						
				Ujung Pandang ACC /Indonesia	Intraregional	AFTN						Operational						
				Nadi ACC /Fiji	Intraregional	AFTN						Operational						
					Intraregional	AMHS						Operational						
				Port Moresby/PNG	Intraregional	AMHS					4Q2018							
		Melbourne ACC		Brisbane ACC /Australia	Intraregional	AFTN						Operational						
					Intraregional	AMHS												
				Jakarta ACC /Indonesia	Intraregional	AFTN						Operational						
					Intraregional	AMHS					4Q2019							
				Mauritius ACC /Mauritius	Interregional	AFTN						Operational						
					Interregional	AMHS												
BANGLADESH		Dhaka ACC		Kolkata ACC /India	Intraregional	AMHS					4Q2023							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.
				Yangon ACC /Myanmar	Intraregional	AMHS					4Q2023		ICD V.2.0					
BHUTAN												No plan						Currently not applicable. If required in the future, will decide after CRV implementation.
BRUNEI DARUSSALAM																		
CAMBODIA		Phnom Penh ACC		Bangkok ACC /Thailand	Intraregional	AMHS					4Q2019	Testing	ICD V.1.0					
				Vientiane ACC/Laos PDR	Intraregional	AFTN						Testing	ICD V.1.0					
				Ho Chi Minh ACC/Viet Nam	Intraregional	AMHS						Testing	ICD V.1.0					
CHINA		Beijing ACC		Ulaanbaatar ACC/Mongolia	Intraregional	AFTN						Testing						
		Sanya ACC		Hong Kong ACC / China	Intraregional	AFTN					Dec 2007	Operational						
				Hanoi ACC/Vietnam	Intraregional						Dec 2023	Testing						
				Ho Chi Minh ACC /Vietnam	Intraregional	AFTN					Dec 2023	Planned						
		Kunming ACC		Vientiane ACC/Laos PDR	Intraregional						Jan 2021	Operational						
				Yangon ACC /Myanmar	Intraregional	AFTN						Testing						
		Lanzhou ACC		Ulaanbaatar ACC/Mongolia	Intraregional							Planned						
		Lhasa ACC		Kathmandu ACC/Nepal	Intraregional	AFTN												
		Guangzhou ACC		Taibei ACC /China	Intraregional						Jan 2013	Operational						
				Hong Kong ACC / China	Intraregional	AFTN					May 2018	Operational						
		Taibei ACC		Hong Kong ACC /China	Intraregional	AFTN						Operational	ICD V.3.0					
				Fukuoka ATMC/Japan	Intraregional	AFTN						Operational						
				Manila ACC/Philippines	Intraregional	AFTN												
		Shenyang ACC		Khabarovsk/Russia	Interregional						Oct 2019	Operational	OLDI					
		Urumqi ACC		Lahore ACC /Pakistan	Intraregional	AMHS												
		Nanning ACC		Hanoi ACC/Vietnam	Intraregional						Dec 2023	Planned						
		Dalian ACC		Incheon ACC /Republic of Korea	Intraregional	AFTN					Oct 2016	Operational	ICD V.3.0 (trial operation)					
		Shanghai ACC		Taibei ACC /China	Intraregional						Jan 2013	Operational						
				Incheon ACC /Republic of Korea	Intraregional						Jun 2023	Planned						
HONG KONG,				Guangzhou ACC /China	Intraregional	AFTN					May 2018	Operational	ICD V.3.0					
		Hong Kong ACC	Raytheon ATM system	Sanya ACC /China	Intraregional	AFTN					Feb 2007	Operational	ICD V.3.0					

Table of AIDC Implementation Status in APAC

State/Administration	AIDC Implementation Status(Implemented or not)	Location of AIDC System ATSU1	ATM Automation System (Make/Model)	ATSU2 /Correspondent State – Administration	Intraregional/Interregional	Transmission Means	Frequency of Use(days in a week)	Main/Back up Circuit	Communication Signal Speed (bps)	Average Transimission Delay (One Trip Time Seconds)	Implementation Date or Target Date as MON yyyy or xQyyyy	Interface Status (Operational, Testing, Planned, No plan)	Interface Protocol / Version (OLDI or AIDC Version)	List of AIDC Messages Applicable between the Two ATSUs (ABI, EST, ACP, TOC, AOC, LAM, LRM, PAC, CDN, CPL, REJ, MAC; TRU, EMG, MIS, TDM, ASM, FAN, FCN; ADS)	Coordination by CDN or Voice	Automatic or Manual EST	A Warning Message to Controller in Case of AIDC Failure	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
CHINA		Hong Kong ACC	Raytheon ATM system	Manila ACC /Philippines	Intraregional	AFTN					May 2019	Operational	ICD V.3.0					
				Taibei ACC /China	Intraregional	AFTN					Nov 2012	Operational	ICD V.3.0					
MACAO, CHINA		Macao ATZ										No plan						
COOK ISLANDS																		
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA												Planned						
FIJI		Nadi ACC	Adacel ATM system	Auckland ACC /New Zealand	Intraregional	AFTN						Operational	ICD V. 2.0	ABI, EST, ACP, TOC, AOC, CDN, CPL				
				Brisbane ACC /Australia	Intraregional	AFTN						Operational	ICD V.1.0	ABI, EST, ACP, TOC, AOC, CDN, CPL				
				Oakland ARTCC /USA	Intraregional	AFTN						Operational	ICD V. 2.0	ABI, EST, ACP, TOC, AOC, CDN, CPL				
FRANCE FRENCH POLYNESIA NEW CALEDONIA		Papeete ACC	THALES EUROCAT	Auckland ACC /New Zealand	Intraregional	AFTN					2009	Operational	ICD V.3.0					
				Oakland ARTCC /USA	Intraregional	AFTN					2009	Operational	ICD V.3.0					
INDIA		Ahmedabad ACC	INDRA Aircon 2100	Karachi ACC /Pakistan	Intraregional	AFTN						Testing		ABI, EST				
		Chennai ACC	Raytheon Auto track-III +	Colombo ACC / Sri Lanka	Intraregional	AMHS					4Q2018	Planned						
				Jakarta ACC /Indonesia	Intraregional	AFTN					4Q2019	Planned						
				Kuala Lumpur ACC / Malaysia	Intraregional	AFTN					Jan 2021	Operational	ICD V.3.0	ABI, EST, TOC, AOC	Voice			
				Male ACC /Maldives	Intraregional	AFTN					Sep 2021	Operational						
				Yangon ACC /Myanmar	Intraregional	AFTN						Testing	ICD V.2.0					
		Delhi ACC	INDRA Aircon	Karachi ACC /Pakistan	Intraregional	AFTN					1Q2019	No plan						
				Lahore ACC /Pakistan	Intraregional	AFTN						Testing						
		Kolkata ACC	INDRA Aircon	Dhaka ACC /Bangladesh	Intraregional	AMHS					4Q2018	Planned						
				Yangon ACC /Myanmar	Intraregional	AFTN					4Q2018	Testing	ICD V.2.0					
				Kathmandu ACC /Nepal	Intraregional	AFTN												
		Mumbai ACC	Raytheon Auto track-III	Karachi ACC /Pakistan	Intraregional	AMHS					1Q2019	Planned						
				Male ACC /Maldives	Intraregional	AFTN					Nov 2021	Operational						
				Mogadishu ACC/Somalia	Interregional							Testing						
				Muscat ACC /Oman	Interregional	AFTN						Testing						
				Seychelles ACC / Mauritius	Interregional	AFTN												
		Trivandrum ACC	INDRA Aircon 2100	Male ACC/Maldives	Intraregional	AFTN					3Q2018							
		Varanasi ACC	INDRA Aircon 2100	Kathmandu ACC /Nepal	Intraregional	AFTN						Planned						
INDONESIA		Jakarta ACC		Melbourne /Australia	Intraregional	AFTN					2023	Testing						
				Colombo ACC / Sri Lanka	Intraregional	AFTN					2024	Testing						
				Singapore ACC /Singapore	Intraregional	AFTN					2022	Testing	ICD V.3.0					
				Kuala Lumpur ACC / Malaysia	Intraregional	AFTN					2024	Testing	ICD V.3.0					
				Kota Kinabalu ACC /Malaysia	Intraregional	AFTN					2025	Testing						
				Chennai ACC /India	Intraregional	AFTN					2022	Testing						
		Ujung Pandang ACC		Brisbane ACC /Australia	Intraregional	AFTN					July 2017	Operational						
				Oakland ARTCC /USA	Intraregional	AMHS						Planned						
				Port Moresby ACC/ PNG	Intraregional	AFTN					2Q2021	Operational						
				Kota Kinabalu ACC/Malaysia	Intraregional	AFTN						Testing						
				Jakarta ACC /Indonesia	Intraregional						3Q2022	Testing						
				Manila ACC/Philippines	Intraregional	AMHS					4Q 2020	Operational						
JAPAN		Fukuoka ATMC		Manila ACC /Philippines	Intraregional	AMHS					1Q2019							
				Anchorage ACC /USA	Intraregional	AFTN					2005	Operational	ICD V.2.0					
				Incheon ACC /Republic of Korea	Intraregional	AFTN					Jun 2009	Operational	ICD V.1.0					
				Oakland ARTCC /USA	Intraregional	AMHS					May 2017	Operational	ICD V.2.0					
				Shanghai ACC /China	Intraregional	AFTN						Planned						
				Taibei ACC / China	Intraregional	AFTN					2012	Operational	ICD V.3.0					
		Tokyo ACC		Incheon ACC /Republic of Korea	Intraregional						2010	Operational						
		Naha ACC		Taibei ACC / China	Intraregional	AFTN					2012	Operational	ICD V.3.0					
KIRIBATI																		
LAO PEOPLE'S DEMOCRATIC REPUBLIC		Vientiane ACC	THALES	Bangkok ACC /Thailand	Intraregional	AMHS					2020	Operational						
				Hanoi ACC /Veitnam	Intraregional	AMHS						Testing						
				Phnom Penh ACC /Cambodia	Intraregional	AFTN					2020	Operational						
				Yangoon/ Myanmar	Intraregional	AFTN					4Q2018	Testing	ICD V.2.0					
				Kunming ACC /China	Intraregional							Testing						
				Ho Chi Minh/ Vietnam	Intraregional	AMHS												
				Bangkok ACC /Thailand	Intraregional	AFTN					Mar 2020	Operational	ICD V.3.0	EST, ACP, LAM, LRM				

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAYSIA		Kuala Lumpur ACC		Singapore ACC /Singapore	Intraregional	AFTN					Nov 2019	Operational	ICD V.3.0	EST, ACP, LAM, LRM				
				Chennai ACC /India	Intraregional	AFTN					Apr 2020		ICD V.3.0	ABI, EST, ACP, LAM, LRM, CDN, REJ,MAC,TOC,AOC				
				Ho Chi Minh ACC /Vietnam	Intraregional	AFTN						Planned						
				Jakarta ACC /Indonesia	Intraregional	AFTN						Planned	ICD V.3.0					
		Kota Kinabalu ACC		Ujung Pandang ACC /Indonesia	Intraregional	AFTN						Testing		EST, ACP, LAM, LRM				
				Manila ACC /Philippines	Intraregional	AMHS					4Q2019	Testing		ABI, EST, ACP, LAM, LRM, TOC, AOC, MAC				
				Singapore ACC /Singapore	Intraregional	AMHS					Jul 2021	Operational	ICD V.3.0	EST, ACP, LAM, LRM				
				Jakarta ACC /Indonesia	Intraregional	AFTN						No plan		EST, LAM, LRM , ACP				
		Kuching ACC		Singapore ACC /Singapore	Intraregional	AFTN					Feb 2021	Operational	ICD V.3.0	EST, ACP, LAM, LRM				
				Jakarta ACC /Indonesia	Intraregional							Planned						
MALDIVES		Male ACC	SELEX	Mumbai ACC / India	Intraregional	AFTN					3Q2018	Testing						
				Chennai ACC /India	Intraregional	AFTN					3Q2018	Testing						
				Mauritius ACC/Mauritius	Interregional	AFTN												
				Melbourne ACC /Australia	Intraregional						2Q2019							
				Colombo ACC/Sri Lanka	Intraregional	AFTN					2018	Testing						
				Trivandrum ACC/India	Intraregional	AFTN					3Q2018	Testing						
MARSHALL ISLANDS																		
MICRONESIA (FEDERATED STATE OF)																		
MONGOLIA		Ulaanbaatar ACC	INDRA Aircon - 2100	Khabarovsk/Russia	Interregional						2016		OLDI					
				Beijing ACC/ China	Intraregional	AFTN					4Q2022	Testing						
MYANMAR		Yangon ACC	THALES Automation system (Topsky ATC)	Bangkok ACC /Thailand	Intraregional	AMHS					4Q2020	Testing	ICD V.2.0					
				Kolkata ACC /India	Intraregional	AFTN					4Q2018	Testing	ICD V.2.0					Existing ATM system are likely to be upgraded in Lahore and Karachi ACC.
				Chennai ACC /India	Intraregional	AFTN					4Q2018	Testing	ICD V.2.0					
				Kunming ACC /China	Intraregional	AFTN						Testing	ICD V.2.0					
				Vientianne ACC /Lao PDR	Intraregional	AFTN					4Q2018	Testing	ICD V.2.0					
				Dhaka ACC /Bangladesh	Intraregional	AFTN					4Q2018		ICD V.2.0					
NAURU																		
NEPAL		Kathmandu ACC	ATM system from NEC	Kolkata ACC /India	Intraregional	AFTN												
				Varanasi ACC/India	Intraregional	AFTN												
				Lhasa ACC /China	Intraregional	AFTN												
NEW ZEALAND		Auckland ACC	LEIDOS and ADACEL	Brisbane ACC /Australia	Intraregional	AFTN						Operational	ICD V.1.0	ABI, EST, ACP, TOC, AOC				
				Nadi ACC /Fiji	Intraregional	AFTN						Operational	ICD V.1.0					
				Oakland ARTCC /USA	Intraregional	AFTN						Operational	ICD V.2.0					
				Papeete ACC /French Polynesia	Intraregional	AFTN						Operational	ICD V.2.0					
				Chile		AMHS												
PAKISTAN		Karachi ACC	Indra AIRCON 2100 version-2	Mumbai ACC /India	Intraregional	AFTN					2018	Planned						
				Muscat ACC /Oman	Interregional	AFTN												
				Tehran ACC /Iran	Interregional	AFTN												
				Delhi ACC /India	Intraregional	AFTN						No plan						
				Ahmadabad ACC /India	Intraregional	AFTN					4Q2018	Planned						
				Kabul ACC /Afghanistan	Intraregional	AFTN												
		Lahore ACC	Indra AIRCON 2100 version-2	Delhi ACC /India	Intraregional	AFTN						Testing						
				Urumqui ACC /China	Intraregional	AMHS												
				Tajakistan ACC /Tajakistan	Interregional	AFTN												
PALAU																		
PAPUA NEW GUINEA		Port Moresby	Thales (TopSky-ATC)	Brisbane ACC/Australia	Intraregional	AMHS						Operational	ICD V.3.0					
				Ujung Pandang ACC/Indonesia	Intraregional	AFTN						Planned	ICD V.3.0					
				Oakland ARTCC /USA	Intraregional	AFTN						Testing	ICD V.3.0					
PHILIPPINES		Manila ACC	THALES	Hong Kong ACC /China	Intraregional	AFTN												
					Intraregional	AMHS					May 2019	Operational						
				Singapore ACC /Singapore	Intraregional	AMHS					Dec 2020	Operational						
				Taibei ACC/China	Intraregional	AFTN												
					Intraregional	AMHS					Dec 2019	Operational						
				Kota Kinabalu ACC /Malaysia	Intraregional	AMHS						Testing						
				Ho Chi Minh ACC /Viet Nam	Intraregional	AMHS						Testing						
				Oakland ARTCC /USA	Intraregional	AMHS						Planned						
				Fukoka ATMC /Japan	Intraregional	AMHS					1Q2019							
				Ujung Pandang ACC /Indonesia	Intraregional	AMHS					Dec 2020	Operational						
REPUBLIC OF				Fukoka ATMC /Japan	Intraregional	AFTN					2010	Operational	ICD V.1.0					

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
REPUBLIC OF KOREA		Incheon ACC	Rockheed Martin System	Shanghai ACC/China	Intraregional						2Q2023	Planned						
				Dalian ACC /China	Intraregional	AFTN					Nov 2016	Operational	ICD V.3.0 (Trial operation)					
SAMOA																		
SINGAPORE		Singapore ACC		Ho Chi Minh ACC /Vietnam	Intraregional	AMHS					Jul 2014	Operational						
				Manila ACC /Philippines	Intraregional	AMHS					Nov 2019	Operational	ICD V.1.0					
				Jakarta ACC /Indonesia	Intraregional	AMHS						Planned	ICD V.3.0					
				Kuala Lumpur ACC /Malaysia	Intraregional	AMHS					Nov 2019	Operational	ICD V.3.0					
				Kota Kinabalu ACC /Malaysia	Intraregional	AMHS					Jul 2021	Operational	ICD V.3.0					
			THALES	Kuching ACC /Malaysia	Intraregional	AMHS					Feb 2021	Operational	ICD V.3.0					
SOLOMON ISLANDS				Nadi ACC /Fiji	Intraregional													
				Port Moresby ACC/PNG	Intraregional													
				Brisbane ATSC /Australia	Intraregional													
SRI LANKA		Colombo ACC		Male ACC /Maldives	Intraregional	AMHS						Planned						
				Jakarta ACC / Indonesia	Intraregional	AMHS					4Q2019							
				Melbourne ACC /Australia	Intraregional							Planned						
			INTELCAN	Chennai ACC /India	Intraregional	AMHS					2018	Testing						
THAILAND		Bangkok ACC		Kuala Lumpur ACC /Malaysia	Intraregional	AFTN					Mar 2020	Operational	ICD V.3.0					
				Phnom Penh ACC /Cambodia	Intraregional	AMHS					Feb 2021	Operational						
				Vientiane ACC /Lao PDR	Intraregional	AMHS					Jul 2020	Operational						
			THALES	Yangon ACC /Myanmar	Intraregional	AMHS						Planned						
TIMOR LESTE																		
TONGA																		
TUVALU																		
VANUATU																		
UNITED STATES		Oakland ARTCC		Anchorage ARTCC /United States	Intraregional	AFTN						Operational	ICD V.2.0					
				Auckland OAC /New Zealand	Intraregional	AFTN						Operational	ICD V.2.0					
				Fukuoka ATMC /Japan	Intraregional	AFTN						Operational	ICD V.2.0					
				Nadi ATMC /Fiji	Intraregional	AFTN						Operational	ICD V.2.0					
				Brisbane ACC /Australia	Intraregional	AFTN						Operational	ICD V.2.0					
				Tahiti ACC /French Polynesia	Intraregional	AFTN						Operational	ICD V 2.0					
				Port Moresby/PNG	Intraregional	AFTN												
				Manila /Philippines	Intraregional	AMHS					1Q2019							
		Anchorage ARTCC		Ujung Padang/Indonesia	Intraregional	AMHS												
				Fukuoka ATMC /Japan	Intraregional	AFTN						Operational	ICD V.2.0					
				Oakland ARTCC /United States	Intraregional	AFTN						Operational	ICD V.2.0					
VIET NAM		Ho Chi Minh ACC		Sanya ACC /China	Intraregional	AFTN												
					Intraregional	AMHS												
				Phnom Penh ACC /Cambodia	Intraregional	AMHS						Testing						
				Vientiane ACC /Lao PDR	Intraregional	AMHS												
				Singapore ACC /Singapore	Intraregional	AMHS					Jul 2014	Operational	ICD V.1.0					
				Manila /Philippines	Intraregional	AFTN						Testing						
			THALES	Kuala Lumpur /Malaysia	Intraregional	AFTN												
		Hanoi ACC	Selex	Vientiane ACC/Lao PDR	Intraregional	AMHS						Testing						

LIST OF FOCAL POINT FOR AIDC IMPLEMENTATION

No.	States	Name/Title/Address	Tel/Fax/E-mail
1.	**Afghanistan**		
2.	**Australia**	Mr. Adam Watkin	Tel: Fax: E-mail: Adam.Watkin@AirservicesAustralia.com
3.	**Bangladesh**		
		Mr. Abdullah Al Faruk Assistant Director (ATM) Alternate Focal Point	Mobile: +880 1826 107 002 E-mail: mdfaruk3232@gmail.com
4.	**Bhutan**	Mr. Pema Tashi Superintendent of ANS Bhutan Civil Aviation Authority Paro International Airport Paro	Tel: +975 (8) 271 347 Ext. 107 Mobile: +975 1 762 2702 Fax: +975 (8) 271 944
5.	**Brunei Darussalam**		
6.	**Cambodia**	Ms. Heng Sovannrath Dy. Chief Bureau (CNS) Air Navigation Standard and Safety Department 44, Phnom Penh International Airport, Russian Federation Blvd., Phum Ta Ngoun, Sangkat Kakab, Khan Porsenchey, Phnom Penh	Tel: +855 (78) 961616 Mobile: +855 (23) 890102; 890108 E-mail: sovannrathheng@gmail.com
7.	**China**	Ms. Cao Susu Senior Electronics Engineer, CNS Division of Air Traffic Management Bureau, CAAC No.12 East Sanhuan Road Chaoyang District Beijing	Tel: +(86) 10877 86969 Mobile: +(86) 15801 682063 Email: caosusu_atmb@qq.com
		Mr.GuoWei Senior Electronics Engineer, Technical Center of Air Traffic Management Bureau of CAAC . No.12 East Sanhuan Road Chaoyang District Beijing	Tel: +(86) 10842 47263 Email: guowei7826@126.com
8.	**Hong Kong, China**	Mr. Michael Chu Senior Electronics Engineer (Technical Support) Civil Aviation Department of Hong Kong, China	Tel: +852 2910 6528 Fax: +852 2845 7160 E-mail: mmhchu@cad.gov.hk
9.	**Macau China**		
10	**Cook Islands**		
11	**Democratic People's Republic**		

No.	States	Name/Title/Address	Tel/Fax/E-mail
	of Korea		
12	**Fiji**		
13	**France:** **-New Caledonia** **-French Polynesia**		
14	**India**	Mr. Ritesh Kumar Gupta, Joint General Manager (CNS) Airports Authority of India CHQ Rajiv Gandhi Bhawan, New Delhi	Tel: Fax: E-mail: g.ritesh@aai.aero
		Mr. Indu Shekhar Joint General Manager (ATM) Airports Authority of India CHQ Rajiv Gandhi Bhawan, New Delhi	Tel: Fax: E-mail: indushekhar@aai.aero
15	**Indonesia**	Mr. Arian Nurahman Air Navigation Inspector Directorate General of Civil Aviation Karya Building 23rd Floor Ministry of Transportation Jl. Medan Merdeka Barat No. 8	Tel: +62 (21) 350 5550 Ext. 4049, 5143 Mobile: +62 856 95414428 Fax: +62 (21) 350 7569 E-mail: arian.nurahman@gmail.com
		Mr. Suryadi Joko Wiratmo ATS System Manager Airnav Indonesia Support Building Jl. Ir. H. Juanda Tangerang 15121	Mobile: +62 811 381 106 Fax: +62 (21) 5591 5100 E-mail: suryadi.wiratmo@airnavindonesia.co.id
16	**Japan**		
17	**Kiribati**		
18	**Lao PDR**	Mr. Maity Sylithammavoing Dy. Director of ATS Division Lao Air Navigation Services P.O. Box 2985 Wattay International Airport Vientiane	Tel: +856 (21) 512006 Mobile: +8562055414040 Fax: +856(21) 512216 E-mail: maitymt1975@gmail.com
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19	**Malaysia**	Mr. Sahrol Nizal Ab. Rashid Principal Assistant Director Civil Aviation Authority of Malaysia, Air Traffic Management Division, Jalan CTA3 (KLIA), Kuala Lumpur International Airport, 64000 KLIA, Sepang,	Tel : +603 8529 1306 Fax : +603 8529 1310 E-mail: sahrol@caam.gov.my

No.	States	Name/Title/Address	Tel/Fax/E-mail
		Selangor Darul Ehsan, Malaysia.	
		Ms. Dayang Zarina Abang Alli Deputy Director Civil Aviation Authority of Malaysia, Kuala Lumpur Air Traffic Control Centre, Jalan CTA3 (KLIA), Kuala Lumpur International Airport, 64000 KLIA, Sepang, Selangor Darul Ehsan, Malaysia.	Tel : +603 8529 1204 Mobile : +60 13 864 5376 Fax :+603 8529 1210 E-mail: dygzarina@caam.gov.my
20	**Maldives**	Mr. Ishag Abdulla Associate General Manager Maldives Airports Co., Ltd Velana International Airport Hulhule 22000	Tel: +960 795 7235 Fax: E-mail: ishag@macl.aero
21	**Marshall Islands**		
22	**Micronesia (Federated States of)**		
23	**Mongolia**	Mr. Khatanbold Jargalsaikhan CNS Officer of ATM Civil Aviation Authority of Mongolia	Tel: +976 (11) 283 069 Mobile: +976 8802 4499 Fax: +976 (11) 285 021 E-mail: khatanbold.j@mcaa.gov.mn
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		Mr. Aung Zaw Thein Assistant General Manager (ATM) Department of Civil Aviation, Myanmar	Tel: +95 (1) 533 268 Fax: +95 (1) 533 016 E-mail: azawthein@gmail.com
25	**Nauru**		
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		Mr. Shahid Hussain Sr. Joint Director (Comm.Ops) IIAP Islamabad	Tele +92-51-95550014 Mobile +92-3462890981 Email: shahid.hussain@caapakistan.com.pk
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29	**Palau**		
30	**Papua New Guinea**		
31	**Philippines**	Ms. Anna Joy C. Papag Facility-In-Charge, Manila Area Control Center Civil Aviation Authority of the Philippines Old Mia Road, Ninoy Aquino Avenue Pasay City, Metro Manila 1300	Tel: +63 (2) 944 2222 E-mail: ae_jae0627@yahoo.com
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32	**Republic of Korea**		
33	**Samoa**		
34	**Singapore**	Mr. Joe Chua Wee Jui Chief (Systems Planning) Air Traffic Services Division Civil Aviation Authority of Singapore P.O. Box 1	Tel: +65 8518 6300 Fax: E-mail: joe_chua@caas.gov.sg
35	**Solomon Islands**		
36	**Sri Lanka**		
37	**Thailand**	Mr. Sarawoot Rungruengwajiake Air Navigation Services Standards Officer Civil Aviation Authority of Thailand	Tel: +66 (2) 568 8800 Ext. 2510 Fax: +66 (2) 568 8847 Email: sarawoot.r@caat.or.th
		Mrs. Pantip Changpradit Air Traffic Management Network Manager Aeronautical Radio of Thailand Ltd 02 Ngamduplee Tungmahamek Bangkok 10120 Thailand	Tel: +66 (2) 228 78932 Fax: Email: pantip.ch@aerothai.co.th

No.	States	Name/Title/Address	Tel/Fax/E-mail
38	**Timor Leste**		
39	**Tonga**		
40	**Tuvalu**		
41	**USA**	Mr. Braks Etta Senior FAA/ATO Representative Asia Pacific 27 Napier Road Singapore 258508	Tel: +65 6476 9170 Fax: E-mail: braks.etta@faa.gov
42	**Vanuatu**		
43	**Viet Nam**	Mr. Nguyen Hong Hiep, IT team leader, CNS dept/VATM 119, Nguyen Son street Long Bien District, Ha Noi City	Tel: +84 (24) 38 723 600 Fax: +84 (24) 38 274 194 Email: guyenhonghiepbk@vatm.vn
		Mr. Vu Ngoc Tuan CNS Officer, Air Navigation Dept. Civil Aviation Authority of Viet Nam No. 199 Nguyen Son Street Long Bien District, Hanoi City	Tel: +84 (24) 3872 0199 Email: vungoctuan@caa.gov.vn

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AIDC Issue Form as of ATMAS TF/3

REFERENCE

Field	Title of Field	Description / *Instances*	Remark
1	Issue reference	*AIDC-ISSUE-1*	AIDC-ISSUE-n
2	Reporting State/ATSU	*Indonesia/Ujung Pandang ACC*	-
3	Pairing FIR1/FIR2	*UjungPandang/Brisbane*	-
4	Date of Reported	*2015-12-03*	-
5	Date of Occurence	*2015-10-10*	-
6	Fault Category	a. Communication Link, or	a. faults related to AIDC communication link (eg AFTN, direct connection, etc)
		b. ATM System, or	b. faults caused by ATMS software issues
		c. AIDC Message, or	c. faults related to AIDC messages headers, content, syntax, etc
		d. Airspace Design/Procedures, or	d. faults attributed to airspace configuration (eg: common shared boundary points on different ATS routes, etc)/ ATC procedures
		e. Others.	e. others
7	Description of Fault	Brief summary of fault in not more than 20 words	-
8	Frequency	a. Frequent, or	a. At least 1 reported case every 24 hours
		b. Occasionally, or	b. At least 1 reported case between 1 to 7 days
		c. Rare.	c. At least 1 reported case beyond 7 days
9	Priority (assessed by TF or RO)	High	-
		Medium	
		Low	
10	ATSU/ Vendor	*Ujung Pandang ACC / THALES*	-
11	Actions Taken/Updated Date	*It was a system's bug and the software has been upgraded/ 21Dec2015*	Sub information is separated by delimiter slash (/)
12	Status (Open/Closed)	*Closed*	-

AIDC Issue Form as of ATMAS TF/3

Issue reference	Reporting State/ATSU	Pairing FIR1/FIR2	Date of Reported	Date of Occurrence	Fault Category	Description of Fault	Frequency	Priority (assessed by TF or RO)	ATSU/ Vendor	Actions Taken/ Updated Date	
1	2	3	4	5	6	7	8	9	10	11	12
AIDC-ISSUE-1	Australia / Brisbane ACC Australia / Melbourne ACC	Brisbane / Melbourne	2016-01-02	-	b. ATM System, or	Limited AIDC V3 compliance (partial compliance on block levels only, no weather deviations or other optional formats)	Frequent	Low	Brisbane ACC & Melbourne ACC/ THALES	Software support for AIDC weather deviations expected in Q4 2022	**OPEN**
AIDC-ISSUE-2	Australia / Brisbane ACC Australia / Melbourne ACC	Brisbane / Melbourne	2016-01-02	-	b. ATM System, or	LRM may contain incorrect field number	Occasionally	Low	Brisbane ACC & Melbourne ACC/ THALES	Software limitation / 02Jan2016	**OPEN**
AIDC-ISSUE-3	Australia / Brisbane ACC Australia / Melbourne ACC	Brisbane / Melbourne	2016-01-02	-	b. ATM System, or	Limited CDN capability. Limited ability to transmit CDN messages, and cannot always correctly process received CDN messages	Occasionally	Low	Brisbane ACC & Melbourne ACC/ THALES	Software corrections for CDN processing expected in Q4 2022	**OPEN**
AIDC-ISSUE-4	Australia / Brisbane ACC Australia / Melbourne ACC	Brisbane / Melbourne	2016-01-02	-	b. ATM System, or	Unable to process a received CPL message	Occasionally	Low	Brisbane ACC & Melbourne ACC/ THALES	Software corrections for CPL processing expected in Q4 2022	**OPEN**
AIDC-ISSUE-5	Australia / Brisbane ACC Australia / Melbourne ACC	Brisbane / Melbourne	2016-01-02	-	b. ATM System, or	Only a limited number of characters (250) in Field 18 are supported.	Occasionally	Low	Brisbane ACC & Melbourne ACC/ THALES	Software limitation / 02Jan2016	**OPEN**
AIDC-ISSUE-6	Australia / Brisbane ACC Australia / Melbourne ACC	Brisbane / Melbourne	2016-01-02	-	b. ATM System, or	No support for AIDC messages developed in AIDC V2 and onwards (e.g. FAN, FCN, ADS, TRU etc.).	Frequent	Low	Brisbane ACC & Melbourne ACC/ THALES	Software limitation / 02Jan2016	**OPEN**
AIDC-ISSUE-7	India / Delhi ACC	Delhi / Lahore	2020-07-01	-	b. ATM System, or	Messages from Lahore to Delhi like ABI were rejected by Delhi system due to Error Message 61 (CRC Error). No AIDC messages being received from Lahore as per latest observation.	Frequent	High	Delhi ACC/ INDRA	Error is perhaps because Lahore System is generating extra spaces. Lahore should start the AIDC coordination with Delhi. There should be joint observation and exercise conducted to assess the status.	**OPEN**
AIDC-ISSUE-8	India / Delhi ACC	Delhi / Karachi	2020-07-01	-	b. ATM System, or	Messages from Karachi to Delhi like ABI were rejected by Delhi system due to Error Message 61 (CRC Error). Karachi has done changes through OEM. The problem still persists with majority of error message 61 and 57 as per latest observation.	Frequent	High	Delhi ACC/ INDRA	Karachi is no longer a pairing FIR with Delhi after FIR reorganization in Pakistan.	**CLOSED**
AIDC-ISSUE-9	India / Delhi ACC	Delhi / Varanasi	2020-01-07	-	a. Communication Link, or	Two test trials were conducted with good results.Trial operations are going on. AFTN latency issues observed at times. TOC and AOC msg not successfully handled by INDRA ATM system at Delhi..Hardware and software issues with ATC automation system at Varanasi. Issues with Flightplan also observed.	Occasionally	Low	Delhi ACC/ INDRA Varanasi ACC/ INDRA	No Latency Issues. TOC and AOC issues resolved	**CLOSED**
AIDC-ISSUE-10	India / Delhi ACC	Delhi / Nagpur	2020-07-01	-	a. Communication Link, or	Observational trials conducted in March 2020. AFTN latency issues observed at times. TOC and AOC message not successfully handled by INDRA ATM system at Delhi. Hardware and software issues with ATC automation system at Nagpur. Issues of missing FPL also observed.	Occasionally	Low	Delhi ACC/ INDRA Nagpur ACC/ INDRA	No Latency Issues. TOC and AOC issues resolved	**CLOSED**
AIDC-ISSUE-11	India / Delhi ACC	Delhi / Ahmedabad	2020-07-01	-	a. Communication Link, or	New LOA signed. Coordination between Ahmedabad and Delhi happening mainly through AIDC. AFTN latency issues observed at times. TOC and AOC messages not successfully handled by INDRA ATM system at Delhi. For some flights AIDC messages not generated. Hardware and software issues with ATC automation system at Ahmedabad.	Occasionally	Low	Delhi ACC/ INDRA Ahmedabad ACC/ INDRA	No Latency Issues. TOC and AOC issues resolved	**CLOSED**
AIDC-ISSUE-12	India / Ahmedabad ACC	Ahmedabad / Nagpur	-	-	a. Communication Link, or	AFTN latency issues observed at times. AFTN (AMSS) to be upgraded to support unimpeded AIDC message handling.	Occasionally	High	Ahmedabad ACC/ INDRA		**CLOSED**

Issue reference	Reporting State/ATSU	Pairing FIR1/FIR2	Date of Reported	Date of Occurrence	Fault Category	Description of Fault	Frequency	Priority (assessed by TF or RO)	ATSU/ Vendor	Actions Taken/ Updated Date	
AIDC-ISSUE-13	India / Ahmedabad ACC	Ahmedabad / Karachi	/06/2014 - 24/05/20	-	c. AIDC Message, or	ABI messages exchanged between two system and messages were rejected due route error and mismatch in coordination timing. Modification in airways was required for Ahmedabad and Karachi DBM. On 12 June 2014 required modification were made in airways (like imaginary points) for effectively acceptance of AIDC messages. ABI messages of some of the aircrafts were not correlated with FPL available in ATS automation system. Karachi has done changes through OEM. Re-testing is in progress. Message transaction rate is 100% for all AIDC messeges from Karachi to Ahmedabad. Message transaction from Ahmedabad to Karachi is unsuccessful. All messages are rejected from Karachi Automation System with unknown error no. 57,	Frequent	High	Ahmedabad ACC/ INDRA	Coordination protocol dialogue timeout was observed. Karachi AMSS-AFTN system time was also synchronized. Automatic time synchronization through GPS server in AMSS-AFTN system at Ahmedabad and Karachi was done for smooth exchange of AIDC messages. Rejection of AIDC messages have reduced / 30Nov2015	OPEN
AIDC-ISSUE-14	India / Varanasi ACC	Varanasi / Nagpur	-	-	b. ATM System, or	AFTN (AMSS) to be upgraded at Nagpur to support unimpeded AIDC message handling. Some HMI issues at both the stations.	Frequent	Low	Varanasi ACC/ INDRA Nagpur ACC/ INDRA	New AMSS installation at Nagpur has been proposed. Same is under process / 30Jan2018. The issues was observed during trial operations. The trials were not successful and hence AIDC is not operation. The issue may be removed from the list.	CLOSED
AIDC-ISSUE-15	India / Kolkata ACC	Kolkata / Varanasi	-	-	b. ATM System, or	Some HMI issues at Varanasi. AIDC has been suspended.	Frequent	Low	Kolkata ACC/ INDRA Varanasi ACC/ INDRA	Nil / 1July2020	OPEN
AIDC-ISSUE-16	India / Kolkata ACC	Kolkata / Nagpur	-	-	b. ATM System, or	AFTN (AMSS) to be upgraded to support unimpeded AIDC message handling. Some HMI issues at Nagpur. AIDC has been suspended	Frequent	Low	Kolkata ACC/ INDRA Nagpur ACC/ INDRA	New AMSS installation at Nagpur has been completed / 1July2020	OPEN
AIDC-ISSUE-17	India / Kolkata ACC	Kolkata / Chennai	-	-	a. Communication Link, or	LOA signed and AIDC Under trial phase. 1. The ICAO route truncation indicator is not supported by INDRA system. 2. Kolkata system does not support adaptation of multiple center name for one ACC. Therefore different AIDC parameters cannot be adapted for different sectors like OCC and ACC sectors posing operational problems.	Occasionally	Medium	Kolkata ACC/ INDRA Chennai ACC/ RAYTHEON	Chennai has supressed ABI transmission/reception processing.	OPEN
AIDC-ISSUE-18	India / Chennai ACC	Chennai / Nagpur	-	-	b. ATM System, or	The ICAO route truncation indicator is not supported by Aircon2100 system.	Occasionally	Medium	Chennai ACC/ RAYTHEON Nagpur ACC/ INDRA	New AMSS installation at Nagpur has been proposed. Same is under process. / 30Jan2018	OPEN
AIDC-ISSUE-19	India / Chennai ACC	Chennai / Colombo	2015-08-06 2015-10-06 2015-12-06	-	b. ATM System, or	Though the initial test in November 2014 was quite successful. The test in June 2015 were not successful, due to technical issues at Colombo. Re-testing have to be done after rectification at Colombo. The re-testing was done after rectification of identified technical issues at Colombo. Testing was successful. Will start trials for limited hours.	Rare	Low	Chennai ACC/ RAYTHEON	Nil / 30Jan2018	OPEN
AIDC-ISSUE-20	India / Chennai ACC	Chennai / Maldives	2014-11-25	-	c. AIDC Message, or	Trials were mostly successful barring some LRMs, like reference ID in ODF 3 is not as per ICD.	Rare	Medium	Chennai ACC/ RAYTHEON Maldives ACC/ SELEX	Message transaction rate is 100% and the message delivery was successful / 30Nov2015	CLOSED
AIDC-ISSUE-21	India / Chennai ACC	Chennai / Trivandrum	-	-	b. ATM System, or	Even after sending a rejection or counter coordination message by Chennai, the sending station continues to send the CDN message. The ICAO route truncation indicator is not supported by INDRA Aircon 2100 system.	Occasionally	Medium	Chennai ACC/ RAYTHEON Trivandrum ACC/ INDRA	Nil / 30Jan2018	OPEN

Issue reference	Reporting State/ATSU	Pairing FIR1/FIR2	Date of Reported	Date of Occurrence	Fault Category	Description of Fault	Frequency	Priority (assessed by TF or RO)	ATSU/ Vendor	Actions Taken/ Updated Date	
AIDC-ISSUE-22	India / Chennai ACC	Chennai / Mangalore	-	-	b. ATM System, or	Even after sending a rejection or counter coordination message by Chennai, the sending station continues to send the CDN message.	Occasionally	Medium	Chennai ACC/ RAYTHEON	Nil / 30Jan2018	**OPEN**
AIDC-ISSUE-23	India / Chennai ACC	Chennai / Trichy	-	-	b. ATM System, or	Even after sending a rejection or counter coordination message by Chennai, the sending station continues to send the CDN message.	Occasionally	Medium	Chennai ACC/ RAYTHEON	Nil / 30Jan2018	**OPEN**
AIDC-ISSUE-24	India / Chennai ACC	Chennai / Hyderabad	-	-	b. ATM System, or	The SSR Codes received through AIDC message are getting retained in Chennai FDPS for days and are not available for re-use. Controller have to use Chennai adapted pool of limited SSR codes for track correlation. As a result the adapted Chennai pool of SSR codes gets exhausted very soon. AIDC testing is temporarily suspended.	Frequent	High	Chennai ACC/ RAYTHEON Hyderabad ACC/ SELEX	SSR code issue at Chennai resolved / 29Mar2019	**CLOSED**
AIDC-ISSUE-25	India / Chennai ACC	Chennai / Bengaluru	2015-03-24	-	b. ATM System, or	The SSR Codes received through AIDC message are getting retained in Chennai FDPS for days and are not available for re-use. Controller have to use Chennai adapted pool of limited SSR codes for track correlation. As a result the adapted Chennai pool of SSR codes gets exhausted very soon. AIDC testing is temporarily suspended.	Rare	High	Chennai ACC/ RAYTHEON	SSR code issue at Chennai resolved / 29Mar2019	**CLOSED**
AIDC-ISSUE-26	India / Mumbai ACC	Mumbai / Ahmedabad	-	-	b. ATM System, or	Some HMI issues at Ahmedabad	Frequent	Low	Mumbai ACC/ RAYTHEON Ahmedabad ACC/ INDRA	Nil / 30 Jun 2020	**CLOSED**
AIDC-ISSUE-27	India / Mumbai ACC	Mumbai / Nagpur	-	-	b. ATM System, or	Some HMI issues at Nagpur.	Frequent	Low	Mumbai ACC/ RAYTHEON Nagpur ACC/ INDRA	Nil / 30 Jun 2020	**CLOSED**
AIDC-ISSUE-28	India / Ahmedabad ACC	Ahmedabad / Nagpur	-	-	b. ATM System, or	Some HMI issues at Nagpur.	Frequent	Low	Ahmedabad ACC/ INDRA Nagpur ACC/ INDRA	Nil / 30Jan2018	**CLOSED**
AIDC-ISSUE-29	India / Kolkata ACC	Kolkata / Chennai	-	-	e. Others.	Under trial phase. The acceptance of EST message is in manual mode.	Frequent	Low	Kolkata ACC/ INDRA Chennai ACC/ RAYTHEON	Nil / 30Jan2018	**OPEN**
AIDC-ISSUE-30	India / Chennai ACC	Chennai / Nagpur	-	-	b. ATM System, or	The ICAO route truncation indicator is not supported by INDRA Aircon 2100 system.	Frequent	Medium	Chennai ACC/ RAYTHEON Nagpur ACC/ INDRA	Nil / 30Jan2018	**OPEN**
AIDC-ISSUE-31	India / Chennai ACC	Chennai / Maldives	-	-	b. ATM System, or	Seconds field included in lat/long is received which is not as per ICD.	Frequent	Low	Chennai ACC/ RAYTHEON Maldives ACC/ SELEX	Message transaction rate is 100% and the message delivery was successful / 30Nov2015	**CLOSED**
AIDC-ISSUE-32	India / Chennai ACC	Chennai / Trivandrum	-	-	b. ATM System, or	The ICAO route truncation indicator is not supported by INDRA Aircon 2100 system.	Frequent	Medium	Chennai ACC/ RAYTHEON Trivandrum ACC/ INDRA	Nil / 30Jan2018	**OPEN**
AIDC-ISSUE-33	India / Chennai ACC	Chennai / Mangalore	-	-	b. ATM System, or	The ICAO route truncation indicator is not supported by INDRA Aircon 2100 system.	Frequent	Medium	Chennai ACC/ RAYTHEON	Nil / 30Jan2018	**OPEN**
AIDC-ISSUE-34	India / Chennai ACC	Chennai / Trichy	-	-	b. ATM System, or	The ICAO route truncation indicator is not supported by INDRA Aircon 2100 system.	Frequent	Medium	Chennai ACC/ RAYTHEON	Nil / 30Jan2018	**OPEN**
AIDC-ISSUE-35	India / Chennai ACC	Chennai / Nagpur	-	-	d. Airspace Design/Procedures, or	Airspace configuration issue.	Frequent	Medium	Chennai ACC/ RAYTHEON Nagpur ACC/ INDRA	Nil / 30Jan2018 25th April 2019	**CLOSED**
AIDC-ISSUE-36	India / Chennai ACC	Chennai / Trivandrum	-	-	d. Airspace Design/Procedures, or	Due to dynamic sectorization of UTV between Chennai and Trivandrum, no AIDC coodination is possible for overflying aircraft. But AIDC is possible for aircraft departing/arriving from/to destinations within the lateral limits of UTV. AIDC coordination not possible for level changes after the initial coordination. NOTIFIED (ABI), INITIAL COORDINATION (EST, CPL), TRANSFER OF CONTROL (TOC, AOC) is possible.	Frequent	Medium	Chennai ACC/ RAYTHEON Trivandrum ACC/ INDRA	The problem can be resolved by permanantly handing over UTV either to Chennai or Trivandrum / 30Jan2018	**OPEN**

Issue reference	Reporting State/ATSU	Pairing FIR1/FIR2	Date of Reported	Date of Occurrence	Fault Category	Description of Fault	Frequency	Priority (assessed by TF or RO)	ATSU/ Vendor	Actions Taken/ Updated Date	
AIDC-ISSUE-37	India / Chennai ACC	Chennai / Mangalore	-	-	d. Airspace Design/Procedures, or	Airspace configuration issue.	Frequent	Medium	Chennai ACC/ RAYTHEON	The issues was observed during trial operations. The trials were not successful and hence AIDC is not operation. The issue may be removed from the list.	CLOSED
AIDC-ISSUE-38	India / Chennai ACC	Chennai / Trichy	-	-	d. Airspace Design/Procedures, or	Airspace configuration issue.	Frequent	Medium	Chennai ACC/ RAYTHEON	The issues was observed during trial operations. The trials were not successful and hence AIDC is not operation. The issue may be removed from the list.	CLOSED
AIDC-ISSUE-39	India / Kolkata ACC	Kolkata / Chennai	-	-	a. Communication Link, or	AFTN latency issues observed at times.	Occasionally	Low	Kolkata ACC/ INDRA Chennai ACC/ RAYTHEON	Nil / 30Jan2018	OPEN
AIDC-ISSUE-40	Indonesia / Ujung Pandang ACC	Ujung Pandang / Brisbane	2015-12-03	2010-10-10	b. ATM System, or	The system does not rise notification or alert to Controller when the messages sent and not replied by LAM (no ULAM).	Frequent	Medium	Ujung Pandang ACC/ THALES Brisbane ACC/ THALES	It was a software issue and the software has been upgraded / 21Dec2015	CLOSED
AIDC-ISSUE-41	Indonesia / Ujung Pandang ACC	Ujung Pandang / Kinabalu	2015-12-28	2015-12-28	c. AIDC Message, or	Received wrong header of ODF3 from Kinabalu system	Occasionally	High	Ujung Pandang ACC/ THALES Kinabalu ACC/ LEONARDO	Investigation has been carried out by Ujung Pandang and Kinabalu and the issue has been solved since Kinabalu has completely upgrade their ATM system / 5Sep2019	CLOSED
AIDC-ISSUE-42	Indonesia / Ujung Pandang ACC	Ujung Pandang / Brisbane	2015-08-01	-	d. Airspace Design/Procedures, or	Ujung Pandang sent back some EST from Brisbane with different time of COP	Occasionally	Medium	Ujung Pandang ACC/ THALES Brisbane ACC/ THALES	It was a software issue and the software has been upgraded. And also there are some modifications in the dataset to solve this problem / 14Dec2015	CLOSED
AIDC-ISSUE-43	Indonesia / Ujung Pandang ACC	Ujung Pandang / Brisbane	2015-09-01	-	a. Communication Link, or	There are some AIDC messages between Ujung Pandang and Brisbane which have transit time more than 180 seconds (3 minutes). The AFTN line between Ujung Pandang and Brisbane is routing via Jakarta.	Occasionally	High	Ujung Pandang ACC/ THALES Brisbane ACC/ THALES	Since 10 March 2018 direct communication link (AFTN) has been connected. Need to test and trial in exchanging messages / 10Mar2018	CLOSED
AIDC-ISSUE-44	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Chennai	2016-03-01	-	e. Others.	We received a lot of complains that Chennai controller didn't respond to CDN.	Frequent	Medium	Kuala Lumpur ATCC/ SELEX Chennai ACC/ RAYTHEON	1)Call Chennai Oceanic to respond the CDN request / 29Jul2016 2)Open/need to evaluate the application of LOA and SOP in respective ACCs	OPEN
AIDC-ISSUE-45	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Chennai	2016-03-01	-	c. AIDC Message, or	Received LRM on ABI for Item 18 (LRM-RMK/48/18/)	Frequent	Medium	Kuala Lumpur ATCC/ SELEX Chennai ACC/ RAYTHEON	SELEX still investigate this problem. The same AFTN message with item 18 received through FDP system but no error detected. Showing that the ABI-AFTN message format is correct but AIDC system unable to process it / 29Jul2016	CLOSED

Issue reference	Reporting State/ATSU	Pairing FIR1/FIR2	Date of Reported	Date of Occurrence	Fault Category	Description of Fault	Frequency	Priority (assessed by TF or RO)	ATSU/ Vendor	Actions Taken/ Updated Date	
AIDC-ISSUE-46	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Chennai	2016-03-01	-	b. ATM System, or	AIDC system send more than three times CDN for time revision.	Frequent	Medium	Kuala Lumpur ATCC/ SELEX Chennai ACC/ RAYTHEON	This problem happen because we had set our AIDC system that CDN will send automatically if there is a time revision more than 3 minutes. Due to complain from Chennai, we stop the automatic send and instruct our Controllers to send all CDN message, including time revision manually / 29Jul2016	CLOSED
AIDC-ISSUE-47	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Chennai	2016-03-01	-	c. AIDC Message, or	Did not receive ACP on EST. After 180 seconds system triggered LRM	Frequent	Medium	Kuala Lumpur ATCC/ SELEX Chennai ACC/ RAYTHEON	This was due to latency of receiving the ACP message. Change the ACP parameter from 180 seconds to 255 seconds / 29Jul2016	CLOSED
AIDC-ISSUE-48	Maldives / Maldives ACC	Maldives / Melbourne	2014-09-17	-	c. AIDC Message, or	Melbourne reported a small number of messages contain a route designator in Field 15 prior to entry COP.	Occasionally	Medium	Maldives ACC/ SELEX Melbourne ACC/ THALES	Vendor investigated and provided updated software / 22May2015	CLOSED
AIDC-ISSUE-49	Maldives / Maldives ACC	Maldives / Colombo	2014-03-13	-	c. AIDC Message, or	Colombo reported Message ID out to VCCC had wrong ID sent from our system.	Frequent	High	Maldives ACC/ SELEX	Configuration corrected / 15Mar2014	CLOSED
AIDC-ISSUE-50	Maldives / Maldives ACC	Maldives / Colombo	2014-04-06	-	b. ATM System, or	When Male sends ABI message within Colombo domestic squawk range, it causes complication in their system.	Frequent	High	Maldives ACC/ SELEX	Colombo changed their domestic SSR code allocation / 16Mar2015	CLOSED
AIDC-ISSUE-51	Maldives / Maldives ACC	Maldives / Melbourne	2014-09-17	-	c. AIDC Message, or	Melbourne reported that Field 15 route information contains seconds in the latitude/longitude information generated from our system.	Occasionally	Medium	Maldives ACC/ SELEX Melbourne ACC/ THALES	Vendor investigated and provided updated software / 22May2015	CLOSED
AIDC-ISSUE-52	Maldives / Maldives ACC	Maldives / -	2014-11-25	-	c. AIDC Message, or	Reference ID of Optional Data Field 3 (ODF) is incorrect in message received by VOMM.	Frequent	Medium	Maldives ACC/ SELEX	Vendor investigated and provided updated software / 22May2015	CLOSED
AIDC-ISSUE-53	Maldives / Maldives ACC	Maldives / -	2014-11-25	-	c. AIDC Message, or	Chennai automation system rejected latitude/longitude represented with seconds (041627N0733138E).	Occasionally	Medium	Maldives ACC/ SELEX	Vendor investigated and provided updated software / 22May2015	CLOSED
AIDC-ISSUE-54	Maldives / Maldives ACC	Maldives / Colombo	2015-11-19	-	c. AIDC Message, or	Colombo reported LRM received from VRMM saying invalid SSR equipment in FPL.	Occasionally	Medium	Maldives ACC/ SELEX	Configuration changed / 23Feb2016	CLOSED
AIDC-ISSUE-55	Maldives / Maldives ACC	Maldives / Colombo	2015-11-19	-	c. AIDC Message, or	ABI and CPL message in ICAO 2012 FPL format sent from Colombo rejected.	Occasionally	High	Maldives ACC/ SELEX	Software updated / 23Feb2016	CLOSED
AIDC-ISSUE-56	Singapore / Singapore ACC	Singapore / -	2015-11-11	-	c. AIDC Message, or	Rejection of ABI message due to unknown point in route	Occasionally	Low	Singapore ACC/ THALES	Need to update ATMS dataset to include SIDs-STARs that may be filed by operator / 17Nov2015	CLOSED
AIDC-ISSUE-57	Singapore / Singapore ACC	Singapore / -	2015-11-11	-	d. Airspace Design/Procedures, or	Rejected EST message due to invalid flight plan state (coordinated) were queued in erroneous folder.	Occasionally	Low	Singapore ACC/ THALES	Air Traffic Control Support Officer would verify the information on the EST message against the coordinated flight plan. To follow up with the upstream ATSU if any discrepancies were discovered / 12Nov2015	CLOSED
AIDC-ISSUE-58	Singapore / Singapore ACC	Singapore / -	2015-11-11	-	a. Communication Link, or	Message time out parameter set too short whereby ACP messages from downstream ATSU were not processed. More prevailing with network was busy.	Occasionally	High	Singapore ACC/ THALES	Need to update ATMS dataset to increase the timeout parameter / 17Nov2015	CLOSED

Issue reference	Reporting State/ATSU	Pairing FIR1/FIR2	Date of Reported	Date of Occurrence	Fault Category	Description of Fault	Frequency	Priority (assessed by TF or RO)	ATSU/ Vendor	Actions Taken/ Updated Date	
AIDC-ISSUE-59	Indonesia / Ujung Pandang ACC	Ujung Pandang / Brisbane	2018-01-11	-	b. ATM System, or	Received abnormal EST message (sent back EST) from Brisbane for southbound traffic that previously Ujung Pandang has already sent the EST	Rare	Low	Ujung Pandang ACC/ THALES Brisbane ACC/ THALES	Brisbane has been modified dataset parameter / 12May2018	CLOSED
AIDC-ISSUE-60	Indonesia / Ujung Pandang ACC	Ujung Pandang / Brisbane	2018-01-11	-	b. ATM System, or	Received MAC message from Brisbane for flight from YSSY to YMML	Rare	Low	Ujung Pandang ACC/ THALES Brisbane ACC/ THALES	Brisbane has been modified dataset parameter / 12May2018	CLOSED
AIDC-ISSUE-61	Indonesia / Ujung Pandang ACC	Ujung Pandang / Brisbane	-	-	b. ATM System, or	No response messages LAM or LRM were received (blank) from receiving unit as a reply for previous sent messages.	Frequent	High	Ujung Pandang ACC/ THALES Brisbane ACC/ THALES	There was a poor (unstable) connection in Jakarta's AMHS in that period occurrence date. Had been solved / 16Nov2019	CLOSED
AIDC-ISSUE-62	Indonesia / Ujung Pandang ACC	Ujung Pandang / -	2017-03-10	-	b. ATM System, or	ACP message does not process correctly. Coordination status field of the strip remains "S" and the ACP message is displayed in "Message_In" window	Frequent	High	Ujung Pandang ACC/ THALES	Investigation has been carried out by Ujung Pandang and categorized this problem as software issue / 11Feb2017	**OPEN**
AIDC-ISSUE-63	Indonesia / Ujung Pandang ACC	Ujung Pandang / Manila	2016-03-10	-	c. AIDC Message, or	AOC message format from Ujung Pandang does not contain ODF 3	Frequent	Medium	Ujung Pandang ACC/ THALES Manila ACC/ THALES	Since Manila used new ATM System (TopSky-HE) last year there was no AOC issue related to ODF3. Last AIDC test with Manila used TopSky-HE was generally good / 21Mar2018	CLOSED
AIDC-ISSUE-64	Indonesia / Ujung Pandang ACC	Ujung Pandang / Manila	2017-05-17	-	c. AIDC Message, or	ABI message from Manila's Topsky-C contained incomplete route of flight	Frequent	High	Ujung Pandang ACC/ THALES	Since Manila used new ATM System (TopSky-HE) last year there was no ABI issue. Last AIDC test with Manila used TopSky-HE was generally good / 21Mar2018	CLOSED
AIDC-ISSUE-65	Indonesia / Ujung Pandang ACC	Ujung Pandang / Manila	2017-05-17	-	b. ATM System, or	Manila's Topsky-C was continuously sending unnecessary ABI and EST messages	Frequent	High	Ujung Pandang ACC/ THALES	Since Manila used new ATM System (TopSky-HE) last year there was not current issue anymore. Last AIDC test with Manila used TopSky-HE was generally good / 21Mar2018	CLOSED
AIDC-ISSUE-66	India / Trivandrum ACC	Trivandrum / Mangalore	-	-	e. Others.	AIDC coordination not possible for Level changes after the initial coordination. ABI, EST, CPL, TOC and AOC is possible.	Frequent	High	Trivandrum ACC/ INDRA	The issues was observed during trial operations. The trials were not successful and hence AIDC is not operation. The issue may be removed from the list.	CLOSED
AIDC-ISSUE-67	India / Trivandrum ACC	Trivandrum / Cochin	-	-	b. ATM System, or	AIDC coordination not possible for level changes after the initial coordination. ABI, EST, CPL, TOC and AOC is possible.	Frequent	High	Trivandrum ACC/ INDRA	The issues was observed during trial operations. The trials were not successful and hence AIDC is not operation. The issue may be removed from the list.	CLOSED
AIDC-ISSUE-68	Singapore / Singapore ACC	Singapore / Manila	2018-03-15	2018-03-12	b. ATM System, or	Link to ATMS is disabled after erroeous service message was received from message center	Frequent	Medium	Singapore ACC/ THALES Manila ACC/ THALES	Fault localized to physical link connection problem / 15Mar2019	CLOSED
AIDC-ISSUE-69	Singapore / Singapore ACC	Singapore / Kuala Lumpur	2018-03-15	2018-03-13	b. ATM System, or	Received *"LRM with error code"* upon transmission of messages	Occasionally	Low	Singapore ACC/ THALES Kuala Lumpur ATCC/ LEONARDO	Observation shared with Kuala Lumpur ACC for investigations / 15Mar2019	CLOSED
AIDC-ISSUE-70	Singapore / Singapore ACC	Singapore / Manila	2018-03-15	2018-03-12	b. ATM System, or	ABI message requirement for subsequent EST message processing	Frequent	High	Singapore ACC/ THALES Manila ACC/ THALES	Observation shared with Manila ACC for investigations / 15Mar2019	CLOSED
AIDC-ISSUE-71	Singapore / Singapore ACC	Singapore / Kuala Lumpur	2019-03-25	2018-12-14	b. ATM System, or	LRM messages recived 2 hours after initial AIDC message transmission	Occasionally	-	Singapore ACC/ THALES Kuala Lumpur ATCC/ LEONARDO	Observation shared with Kuala Lumpur ACC for investigations / 25Mar2019	CLOSED

Issue reference	Reporting State/ATSU	Pairing FIR1/FIR2	Date of Reported	Date of Occurrence	Fault Category	Description of Fault	Frequency	Priority (assessed by TF or RO)	ATSU/ Vendor	Actions Taken/ Updated Date	
AIDC-ISSUE-72	Singapore / Singapore ACC	Singapore / Kuala Lumpur	2019-03-25	2019-01-18	e. Others.	Invalid EST sent by ATMS	Rare	-	Singapore ACC/ THALES Kuala Lumpur ATCC/ LEONARDO	Fault traced to incorrect flight plan routing, causing FDP to designated the arrival flight as an re-entry flight / 25Mar2019	CLOSED
AIDC-ISSUE-73	Singapore / Singapore ACC	Singapore / Kuala Lumpur	2019-03-25	2019-01-22	b. ATM System, or	Non reception of EST messages	Occasionally	-	Singapore ACC/ THALES Kuala Lumpur ATCC/ LEONARDO	Investigations ongoing / 25Mar2019	CLOSED
AIDC-ISSUE-74	Singapore / Singapore ACC	Singapore / Kuala Lumpur	2019-03-25	2019-03-06	a. Communication Link, or	Unable to exchange AIDC messages	Occasionally	-	Singapore ACC/ THALES Kuala Lumpur ATCC/ LEONARDO	AFTN link outage / 25Mar2019	CLOSED
AIDC-ISSUE-75	Singapore / Singapore ACC	Singapore / Manila	2019-03-25	2019-02-20	b. ATM System, or	AOC/TOC message tranmission constraint	Frequent	-	Singapore ACC/ THALES Manila ACC/ THALES	Dataset settings on Manila ATMS for AOC/TOC messages / 25Mar2019	CLOSED
AIDC-ISSUE-76	Singapore / Singapore ACC	Singapore / Manila	2019-03-25	2019-03-11	b. ATM System, or	EST and ACP messages exchanged successfully but not reflected on controller display	Rare	High	Singapore ACC/ THALES Manila ACC/ THALES	Manila ATMS vendor has been informed on the observed issue. Investigations ongoing / 25Mar2019	CLOSED
AIDC-ISSUE-77	Indonesia / Ujung Pandang ACC	Ujung Pandang / Oakland	2019-04-10	2018-12-11	b. ATM System, or	REJ message was accepted but unable to display to Controller HMI and become rejected message in Flight Data HMI (filled in *AIDC_OTHER_QUE* window)	Rare	Medium	Ujung Pandang ACC/ THALES	Investigation has been carried out by Ujung Pandang and categorized this problem as software issue / 21Feb2020	**OPEN**
AIDC-ISSUE-78	India / Chennai ACC	Chennai / Hyderabad Chennai / Bengaluru	-	-	e. Others.	The SSR Codes received through AIDC message are getting retained in Chennai FDPS for days and are not available for re-use. Controller have to use Chennai adapted pool of limited SSR codes for track correlation. As a result, the adapted Chennai pool of SSR codes gets exhausted very soon.	Frequent	High	Chennai ACC/ RAYTHEON Bengaluru ACC/ SELEX Hyderabad ACC/ SELEX	SSR code issue at Chennai resolved 29-03-2019	CLOSED
AIDC-ISSUE-79	India / Kolkata ACC	Kolkata / Nagpur, Varanasi, Guwahati, Chennai	-	-	d. Airspace Design/Procedures, or	The route truncation is not supported by INDRA system , hence there is a likelihood of wrong route modification by ABI message in the accepting ATCC.	Frequent	High	Kolkata ACC/ INDRA Nagpur ACC/ INDRA Varanasi ACC/ INDRA Guwahati ACC/ INDRA Chennai ACC/ RAYTHEON		**OPEN**
AIDC-ISSUE-80	Maldives / Maldives ACC	Maldives / Colombo	-	-	b. ATM System, or	Colombo had an issue with their ABI message which was unsuccessful in all 7 AIDC test FPLs. Also their EST showed Error code 62. Rest of the other messages CPL, CDN, TOC, AOC are working perfectly.	Frequent	High	Maldives ACC/ SELEX	Colombo informed that they are consulting with their ATM vendor for the above errors.	**OPEN**
AIDC-ISSUE-81	India / Kolkata ACC	Kolkata / Yangon	2019-04-10	-	b. ATM System, or	Yangon trials in which ABI (from Kolkata to Yangon only) EST, TOC, AOC were successful. Kolkata system was not sending AIDC reference number in ACP messages for which Yangon system was rejecting it. But Kolkata rectified the issue with the support of vendor and ACP was successful. ABI from Yangon system sends the route from COP instead of one point before COP for which Kolkata system rejects the ABI	Frequent	Medium	Kolkata ACC/ INDRA Yangon ACC/ THALES	Yangon has been advised to rectify the issue through vendor/1Apr2019. Yangon has rectified the issue in last quarter of 2019. Further tests successful.	CLOSED
AIDC-ISSUE-82	Indonesia / Ujung Pandang ACC	Ujung Pandang / Manila	2020-05-25	2020-04-02	b. ATM System, or	Multiple EST message transmitted from Ujung Pandang to Manila	Occasionally	High	Ujung Pandang ACC/ THALES Manila ACC/ THALES	Investigation has been carried out by Ujung Pandang. Some modifications in dataset parameter related to message transmition value and condition has been changed / 22Nov2020	CLOSED

Issue reference	Reporting State/ATSU	Pairing FIR1/FIR2	Date of Reported	Date of Occurrence	Fault Category	Description of Fault	Frequency	Priority (assessed by TF or RO)	ATSU/ Vendor	Actions Taken/ Updated Date	
AIDC-ISSUE-83	Indonesia / Ujung Pandang ACC	Ujung Pandang / Manila	2020-07-09	2019-11-02	d. Airspace Design/Procedures, or	Ujung Pandang's controller activated flight data record prior to AIDC EST message transmitted by Manila. This occurrence happened due Manila verbally coordinated FL which is not accordance with FLAS (Flight Level Allocation Scheme).	Frequent	High	Ujung Pandang ACC/ THALES Manila ACC/ THALES	Published temporary SOP for Controller not to manually activate flight data record for which an AIDC EST is expected / 1Dec2019	CLOSED
AIDC-ISSUE-84	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Chennai	2020-07-07	2020-01-02	c. AIDC Message, or	ACP for Chennai EST & CDN were responded timely but Chennai responded with LRM-RMK/5/3.	Frequent	Medium	Kuala Lumpur ATCC/ LEONARDO Chennai ACC/ RAYTHEON	Request clarification from Chennai	OPEN
AIDC-ISSUE-85	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Chennai	2020-07-07	2020-01-02	c. AIDC Message, or	Chennai responded LRM-RMK/57/ (invalid message) for ABI/EST messages though ABI/EST sent were valid. this occurance only for TOC/AOC (2022 update reported)	Frequent	Medium	Kuala Lumpur ATCC/ LEONARDO Chennai ACC/ RAYTHEON	Request clarification from Chennai	OPEN
AIDC-ISSUE-86	Philippines / Manila ACC	Manila / Kinabalu	2019-10-22	2019-10-22	b. ATM System, or	Manila received multiple ABI of RBA635 and JAL720 during AIDC test with Kinabalu	Rare	Low	Manila ACC/ THALES Kinabalu ACC/ LEONARDO	Kinabalu has been advised this issue. Will be observed again in the next AIDC test /	OPEN
AIDC-ISSUE-87	Singapore / Singapore ACC	Singapore / Kinabalu	2021-02-01	2021-05-28	b. ATM System, or	Multiple FDRs exist, unable to complete AIDC transaction	Occasionally	Medium	Singapore ACC/ THALES Kinabalu ATCC/ LEONARDO	Ensure flightplan records in ATMS is up to date	CLOSED
AIDC-ISSUE-88	Singapore / Singapore ACC	Singapore / Kinabalu	2021-03-01	2021-05-28	b. ATM System, or	Message not compatible with FP state	Occasionally	Medium	Singapore ACC/ THALES Kinabalu ATCC/ LEONARDO	Ensure flightplan state is updated correctly	CLOSED
AIDC-ISSUE-89	Singapore / Singapore ACC	Singapore / Kinabalu	2021-04-01	2021-05-28	b. ATM System, or	ACT entry time outside window	Occasionally	Medium	Singapore ACC/ THALES Kinabalu ATCC/ LEONARDO	ATMS parameter reconfiguration/software change	OPEN
AIDC-ISSUE-90	Philippines / Manila ACC	Manila / Singapore	2020-01-27	2020-01-27	b. ATM System, or	No AIDC transfer was made due negative FPL (other aircraft)	Occasionally	Medium	Manila ACC/ THALES Singapore ACC/ THALES	Provide appropriate FPL entry	CLOSED
AIDC-ISSUE-91	Philippines / Manila ACC	Manila / Singapore	2020-02-26	2020-02-26	b. ATM System, or	No TOC was received from Singapore ACC for CEB538	Occasionally	Medium	Manila ACC/ THALES Singapore ACC/ THALES	Correcting time discrepancies on system FPL	CLOSED
AIDC-ISSUE-92	Philippines / Manila ACC	Manila / Singapore	2020-09-21	2020-09-21	b. ATM System, or	No EST message received	Occasionally	Medium	Manila ACC/ THALES Singapore ACC/ THALES	Provide appropriate FPL entry	CLOSED
AIDC-ISSUE-93	Philippines / Manila ACC	Manila / Hong Kong	2020-08-03	2020-08-03	b. ATM System, or	Failed EST for CPA104, CPA198 and CSN306. Voice transfer was made to Hong Kong.	Occasionally	Medium	Manila ACC/ THALES	Correcting time discrepancies on system FPL	CLOSED
AIDC-ISSUE-94	Philippines / Manila ACC	Manila / Hong Kong	2020-09-19	2020-09-19	b. ATM System, or	No AIDC transfer was made due negative FPL (Qatar Airlines)	Frequent	Medium	Manila ACC/ THALES	Corresponded with air operator to supply Manila with FPL	CLOSED
AIDC-ISSUE-95	Philippines / Manila ACC	Manila / Hong Kong	2020-10-13	2020-10-13	b. ATM System, or	Failed EST ACT entry time outside window	Occasionally	Medium	Manila ACC/ THALES	Correcting time discrepancies on system FPL	CLOSED
AIDC-ISSUE-96	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Chennai	2021-05-28	2021-01-11	b. ATM System, or	Calculated CRC was not tally with received CRC.	Frequent	High	Kuala Lumpur ATCC/ LEONARDO Chennai OCC/ RAYTHEON	Request clarification from Chennai	OPEN
AIDC-ISSUE-97	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Chennai	2021-05-28	2021-01-13	d. Airspace Design/Procedures, or	Late response by Chennai for CDN messages. Agreed response time by controller is 300 seconds.	Frequent	High	Kuala Lumpur ATCC/ LEONARDO Chennai OCC/ RAYTHEON	1)Call Chennai Oceanic to respond the CDN request 2)Open/need to evaluate the application of LOA and SOP in respective ACCs	OPEN
AIDC-ISSUE-98	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Chennai	2021-05-28	2021-02-14	b. ATM System, or	Chennai transmit second EST or ACP after a complete process cycle of first EST.	Occasionally	High	Kuala Lumpur ATCC/ LEONARDO Chennai OCC/ RAYTHEON	no more occurrence/ 2022-05-24	CLOSED
AIDC-ISSUE-99	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Chennai	2021-05-28	2021-04-06	b. ATM System, or	LRM transmitted in response to AOC received from Chennai.	Occasionally	High	Kuala Lumpur ATCC/ LEONARDO Chennai OCC/ RAYTHEON	Request clarification from Chennai	OPEN
AIDC-ISSUE-100	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Singapore	2021-05-28	2021-01-11	d. Airspace Design/Procedures, or	Singapore transmit TOC/AOC message although TOC/AOC is not included in operational implementation	Occasionally	Low	Kuala Lumpur ATCC/ LEONARDO Singapore ACC/ THALES	Request clarification from Singapore	OPEN
AIDC-ISSUE-101	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Singapore	2021-05-28	2021-04-05	b. ATM System, or	Singapore transmit second EST after a complete process cycle of first EST.	Rare	Medium	Kuala Lumpur ATCC/ LEONARDO Singapore ACC/ THALES	no more occurrence/ 2022-05-24	CLOSED
AIDC-ISSUE-102	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Bangkok	2021-05-28	2021-01-14	d. Airspace Design/Procedures, or	Bangkok transmit TOC/AOC message although TOC/AOC is not included in operational implementation.	Occasionally	Low	Kuala Lumpur ATCC/ LEONARDO Bangkok ACC/ THALES	Request clarification from Bangkok	OPEN
AIDC-ISSUE-103	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Bangkok	2021-05-28	2021-04-06	d. Airspace Design/Procedures, or	Bangkok transmit MAC message although MAC is not included in Operational Implementation.	Rare	Low	Kuala Lumpur ATCC/ LEONARDO Bangkok ACC/ THALES	Request clarification from Bangkok	OPEN

Issue reference	Reporting State/ATSU	Pairing FIR1/FIR2	Date of Reported	Date of Occurrence	Fault Category	Description of Fault	Frequency	Priority (assessed by TF or RO)	ATSU/ Vendor	Actions Taken/ Updated Date	
AIDC-ISSUE-104	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Bangkok	2021-05-28	2021-01-14	b. ATM System, or	Bangkok transmit second EST after a complete process cycle of first EST.	Rare	Medium	Kuala Lumpur ATCC/ LEONARDO Bangkok ACC/ THALES	Request clarification from Bangkok	**OPEN**
AIDC-ISSUE-105	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Bangkok	2021-05-28	2021-04-10	d. Airspace Design/Procedures, or	Bangkok transmit EST with incorrect COP due to incorrect FPL route was filed by the airline operator (Not following the Flight Planning)	Occasionally	High	Kuala Lumpur ATCC/ LEONARDO Bangkok ACC/ THALES	no more occurrence/ 2022-05-24	**CLOSED**
AIDC-ISSUE-106	India / Chennai OCC	Chennai / Kuala Lumpur	2021/09/01	2021/08/31	c. AIDC Message, or	Chennai system transmits correct AIDC EST messages, but the Kuala Lumpur controller reported that, the received AIDC EST time is incorrect.	Rare	High	Chennai / Raytheon Kuala Lumpur ATCC/ LEONARDO	-	**OPEN**
AIDC-ISSUE-107	India / Chennai OCC	Chennai / Kuala Lumpur	2021/09/23	2021/09/22	c. AIDC Message, or	Chennai system transmits correct AIDC EST message, but the Kuala Lumpur controller reported that, the received AIDC EST time is incorrect. The issue was earlier reported on 1st Sept 2021.	Rare	High	Chennai / Raytheon Kuala Lumpur ATCC/ LEONARDO	-	**OPEN**
AIDC-ISSUE-108	India / Chennai OCC	Chennai / Kuala Lumpur	2021/10/08	2021/10/07	c. AIDC Message, or	Kuala Lumpur system transmits CDN messages even for one minute revision in Estimates also.	Frequent	High	Chennai / Raytheon Kuala Lumpur ATCC/ LEONARDO	-	**OPEN**
AIDC-ISSUE-109	India / Chennai OCC	Chennai / Kuala Lumpur	2021/11/30	2021/11/26	c. AIDC Message, or	Chennai system transmits correct AIDC EST message, but the Kuala Lumpur controller reported that, the flight level received in AIDC EST message is incorrect. Similar issues were reported on 1st Sept 2021 and 23rd Sept 2021.	Rare	High	Chennai / Raytheon Kuala Lumpur ATCC/ LEONARDO	-	**OPEN**
AIDC-ISSUE-110	Malaysia / Kuala Lumpur ATCC	Kuala Lumpur / Chennai	2022-05-24	2021-01-16	c. AIDC Message, or	Chennai responded LRM-RMK/57/ (invalid message) for TOC message eventhough TOC was sent in valid format timely.	Frequent	Medium	Kuala Lumpur ATCC/ LEONARDO Chennai ACC/ RAYTHEON	-	**OPEN**
AIDC-ISSUE-111	Malaysia / Kota Kinabalu ATCC	Kota Kinabalu / Singapore	2022-05-24	2021-07-12	b. ATM System	Delayed in transmitting auto EST and No ACP received. Occasionally EST was not sent automatically.	Occasionally	High	Kota Kinabalu ATCC/ LEONARDO Singapore ACC/ THALES	EST sent manually instead of automatic. Changing ATM system to Thales TopSky 1/3/2022	**OPEN**
AIDC-ISSUE-112	India/ Kolkata	Kolkata/Yangoon	5/27/2022		e. Others.	AIDC testing successfully completed. LOA between India-Mayanmar is required to operationalize AIDC coordination between Kolkata and Yangoon.	to be update	proposed medi	Kolkata ACC/ INDRA Yangon ACC/ THALES		**OPEN**
AIDC-ISSUE-113	India/ Kolkata	Kolkata/Chennai	5/27/2022		c. AIDC Message, or	Kolkata ATS system has no route trucation feeture. It sends full route in ABI and canot process in coming ABI message with route truncation. Because of this issue ABI messages are not exchanged between Kolkata and Chennai.	to be update	proposed medi	Kolkata ACC/ INDRA Chennai ACC/ RAYTHEON		**OPEN**
AIDC-ISSUE-114	India/ Kolkata	Kolkata/Chennai, Kolkata/Nagpur	5/27/2022		b. ATM System, or	Airway 'MEPIP' is cordination points with both Nagpur and Chennai at levels F255 to F460. Kolkata ATS system dose not allow to adopt any point as coordination point with multiple ATC centers for same levels.	to be update	proposed high	Kolkata ACC/ INDRA Chennai ACC/ RAYTHEON Kolkata ACC/ INDRA Nagpur ACC/ INDRA		**OPEN**
AIDC-ISSUE-115	India/ Kolkata	Kolkata/Chennai	5/27/2022		b. ATM System, or	Multiple sectors of Chennai required to defined as separate control centers, but only one control center can be adapted for one ATC center having multiple sectors.	to be update	proposed high	Kolkata ACC/ INDRA Chennai ACC/ RAYTHEON		**OPEN**
AIDC-ISSUE-116	India/ Kolkata	Kolkata/Chennai	5/27/2022		b. ATM System, or	Different Control center names have been adoted in Chennai ATS system for AIDC and ADS-C/CPDLC, But in Kolkata ATS system there is no feature to adapt separate control name for adjoing control center.	to be update	proposed high	Kolkata ACC/ INDRA Chennai ACC/ RAYTHEON		**OPEN**

LIST OF ACTION ITEMS FOR ATMAS TF

Action Item	Subject	Forum Raised	Status / Target Date	Action Party	Status	Remarks / follow-up
1-2	Develop check list for ATMAS project management from the scratch of planning, requirement definition, bidding, implementation to operational transition.	ATMAS TF/1	ATMAS TF/3	Member States, ICAO Secretariat		This check list will be one of the appendix to APAC ATMAS IGD ATMAS TF/3: Presented by Flimsy/01, need further polish
2-3	Further progress the development of ATMAS PRD and consider to include AIDC as well.	ATMAS TF/2	ATMAS TF/3	Ad-hoc group Members: China, Hong Kong China, Indonesia, ICAO Secretariat	On-going	ATMAS TF/3: Updated by Hong Kong China through WP/10, the meeting agreed to further discuss.
3-1	The ICAO Secretariat will issue a State Letter to circulate the table of the ATMAS Status in APAC region to collect information from Member States in order to build the repository of the ATM automation systems for APAC Region.	ATMAS TF/3		Member States, ICAO Secretariat		
3-2	The ICAO Secretariat will issue a State Letter to circulate the table of AIDC Implementation Status in APAC region with the current status to States/Administrations for supplements and validation.	ATMAS TF/3		Member States, ICAO Secretariat		
3-3	For each group of common issues, identify in an ACTION PLAN which small working groups to be established when necessary and possible with invitation to aviation industry fo input. Develop an action plan for the identified ATSUs with priorities for implementation; Go-teams to assist when required (subject to funding available and requirement in place);	APA TF/1	January to June 2016	by the Task Force	On-going	APA TF/2: few small working group already in place to address some of the issues and established the target date of implementation. (in most case two parties). APA TF/4: Small working group (based on TOR) is considered not practical. Bilateral parties to address some of the issues and established the target date of implementation. (in most case two parties). ATMAS TF/3: From Action Item 1-2 of APA TF/1
3-4	Development of AIDC IGD Edition 1.0 in accordance with item C of TOR. Also need to maintain the AIDC IGD to current and update the consolidated list of issues.	APA TF/4		by the Task Force	On-going	APA TF4: This task link with item c) of ToR, work has been done by the ad hoc WG and endorsed by the Task Force adopted by CNS SG/21 in July 2017 on behalf of APANAPIRG. It may require maintaining the document by the Task Force as necessary. The updated list of consolidated issues is indicators for implementation progress and the list should be updated with items closed or open. APA TF/5: **The development of AIDC IGD completed and maintenance of the IGD** - On-going APA TF/6: States/Administrations may wish to provide recommendation for updates if necessary. ATMAS TF/3: From Action Item 4-1 of APA TF/4