International Civil Aviation Organization

TWELFTH MEETING OF THE SOUTH EAST ASIA AND BAY OF BENGAL SUB-REGIONAL ADS-B IMPLEMENTAITON WORKING GROUP (SEA/BOB ADS-B WG/12)

Guangzhou, China, 08 – 10 November 2016

Agenda Item 2: Review the outcome of ADS-B SITF/15 and APANIRG/27 on ADS-B

OUTCOME OF ADS-B SITF/15 AND APANPIRG/27 ON ADS-B

(Presented by the Secretariat)

SUMMARY

This paper reviews the outcome of APANPIRG/27 on ADS-B and works accomplished by the Fifteenth meeting of ADS-B Study and Implementation Task Force, the First meeting of Surveillance Implementation Coordination Group and the Twentieth meeting of CNS Sub-group of APANPIRG.

1. INTRODUCTION

1.1 APANPIRG/27 meeting held from 5-8 September 2016 in Bangkok, Thailand reviewed the outcome of the Fifteenth Meeting of the Automatic Dependent Surveillance – Broadcast (ADS-B) Study and Implementation Task Force (ADS-B SITF/15) held from 18 to 20 April 2016 in Bangkok, Thailand including the work accomplished by the Eleventh meeting of the SEA and BOB ADS-B Working Group (SEA/BOB ADS-B WG/11) held in New Delhi, India from 17 to 19 November 2015. The meeting also noted the outcome of the First meeting of the Surveillance Implementation Coordination Group (SURICG/1). The report of APANPIRG/27 is posted at:
http://www2010.icao.int/APAC/Meetings/Pages/2016-APANPIRG27.aspx

1.2 Up to the last meeting of ADS-B SITF, the SEA/BOB ADS-B Working Group reports its outcome of discussion to APANPIRG through ADS-B Study and Implementation Task Force and CNS Sub-group of the ANPANPIRG. The complete reports of the ADS-B SITF/15 meeting and the SEA/BOB ADS-B WG/11 meeting are posted at:
http://www2010.icao.int/APAC/Meetings/Pages/2016-ADS-B-SITF15.aspx
http://www.icao.int/APAC/Meetings/Pages/2015-SEA-BOB-ADS-B-WG11--.aspx

1.3 The First Meeting of the Surveillance Implementation Coordination Group (SURICG/1), back to back with the Fifteenth Meeting of ADS-B Study and Implementation Task Force was held in Bangkok, Thailand, from 21 to 22 April 2016.
http://www2010.icao.int/APAC/Meetings/Pages/2016-SURICG1.aspx

1.4 The reports of Fifteenth Meeting of ADS-B SITF, Eleventh Meeting of the SEA/BOB Working Group and the First meeting of SURICG were reviewed by CNS SG/20 meeting held at ICAO Regional Office in Bangkok, Thailand in July 2016 and noted by ATM SG/4 meeting held in July 2016.

2. DISCUSSION

2.1 APANPIRG/27 meeting noted the updates of implementation activities by States and developments and some issues observed during implementation of ADS-B in the Region. The actions taken by APANPIRG/27 meeting on ADS-B related matters are highlighted below:

2.2 The ADS-B Implementation Status in the APAC Region updated by the Task Force is provided in **Appendix A** to this paper for review and further updates by the meeting.

Development and achievements by the SEA/BOB ADS-B Working Group

2.3 Some developments and achievements since SEA/BOB WG/10 meeting were highlighted below:

- In May 2015, India and Myanmar signed MOU on ADS-B data sharing;
- In October 2015, Singapore and the Philippines signed an MOU to share ADS-B data and VHF facilities. The project is expected to be completed by early 2017;
- Brunei and Singapore started discussions on data sharing; the MOU is expected to be signed in 2016; and
- Update on action being taken by Boeing mitigating ADS-B error from B787 fleet.

Regulator's Engagement in ADS-B Implementation

2.4 The meeting noted a lack of engagement by regulators in ADS-B implementation. Regulators need knowledge about the risks and benefits that ADS-B can bring to the safety of aviation. Nevertheless around the world, regulators seem slower than ANSPs to embrace the technology.

2.5 Importantly, the meeting considered that failure to deploy the safety improvements enabled by ADS-B could bring criticism and liability in the event of an adverse outcome. Whilst there are risks and mitigations required to deploy ADS-B, equally there are risks in doing nothing and continuing to rely on procedural ATC with its dependency on voice report of position. Accordingly, the meeting adopted the following Conclusion:

Conclusion APANPIRG/27/41: Regulators' active support and engagement with ADS-B Implementation and Data sharing	
Considering that:- a) any delay in ADS-B deployment and operational use brings risks, liability and additional regulator responsibility as traffic grows in FIRs without surveillance and automated safety nets; and b) the risks in doing nothing whilst continuing to rely on ATC procedures with dependency on voice position reports and lack of automation States (regulatory authorities) are urged to:	Expected impact: ☒ Political / Global ☐ Inter-regional ☒ Economic ☐ Environmental ☒ Ops/Technical

- actively engage with ANSPs to support the ADS-B implementation, in particular the examination of risks, hazards, mitigations and benefits; and - support the ADS-B data-sharing and collaboration among States to achieve harmonized implementation for maximizing benefits of ADS-B.	
Why: lack of engagement by regulators in ADS-B implementation.	
When: 30-Sep-16	Status: to be Adopted by PIRG
Who:☒Sub groups ☒APAC States ☐ICAO APAC RO ☐ICAO HQ ☐ Other:	

2.6 In response to a query, the Philippines advised that they were waiting for the completion of their CNS/ATM project in later 2016 or early 2017 before planning ADS-B data sharing with neighbouring FIR.

System Specifications for developing an ADS-B Monitoring System

2.7 In following up an action item of the SEA/BOB ADS-B WG/11 meeting, Malaysia provided the result of a survey that proposed a checklist for monitoring the ADS-B system. A checklist was developed based on the outcome of the survey picking up the most important common items/parameters for monitoring which are categorized into five main modules; Ground Station, Equipage, Avionics, Performance Level and ADS-B Display. The Ground Station module has three sub-modules, namely Site Monitoring, Remote Control & Monitoring and Logistic Support Monitoring. A checklist of options for developing an ADS-B monitoring system was considered useful.

Amendment to AIGD

2.8 The ADS-B SITF meeting identified the need to further update the AIGD based on the discussions on the information presented to the meeting. The consolidated amendment to AIGD is provided in Appendix M to APANPIRG/27-WP/9 which includes the following:

- A checklist for monitoring of ADS-B system (revised table attached to WP/09);
- Additional functional requirements ADS-B Integration from HMI perspective for consideration, based on the contribution of the SEA/BOB ADS-B WG/11 meeting. Some editorial changes were made considering that general requirement should be considered rather than applicable to specific ATM system only (Appendix B to ADS-B SITF/15 WP/3 refers);
- Guidance on updating ADS-B ground stations to support Version 2 (DO 260B) based on the sample of DF17/DF18 Format Type Code 29 which have been changed significantly between versions (ADS-B SITF/15 WP/6 refers);
- General recommendation on a technical solution of acquiring Mode 3/A code for DO-260 aircraft via Mode S downlink. (ADS-B SITF/15 WP/8 refers); and
- Updated list of known ADS-B avionics problems

In view of the foregoing, the meeting adopted the following Conclusion:

Conclusion APANPIRG/27/42: AIGD Amendments	
That, the consolidated amendment to the AIGD provided in Appendix M to APANPIRG/27-WP/9 is adopted.	Expected impact: ☒ Political / Global ☐ Inter-regional ☐ Economic ☐ Environmental ☒ Ops/Technical
Why: provide guidance to States/Administration for ADS-B implementation	
When: 30-Sep-16	Status: to be Adopted by PIRG
Who:☒Sub groups ☒APAC States ☐ICAO APAC RO ☐ICAO HQ ☐ Other:	

ADS-B Collaboration in the South China Sea Region

2.9 Singapore presented the developments of the ADS-B collaboration in the South China Sea region. Following the collaboration between Indonesia and Singapore and between Singapore and Viet Nam, the surveillance and DCPC gaps on L642, M771 and N892 are covered. The separation is now reduced to 30NM. A joint operational trial may be conducted with Viet Nam to assess the operational impact to reduce the separation to 20NM. Singapore will also work with Viet Nam and Malaysia to reduce separation on L625 and M758.

2.10 The Philippines and Singapore signed an ADS-B collaboration agreement in October 2015 to cover part of the surveillance gaps on routes N884 and M767. Discussions are on-going between Brunei and Singapore to cover the remaining gaps on N884 and M767. Singapore and Viet Nam are working on further collaboration to enhance the existing ADS-B coverage.

Implementation of ADS-B Avionics Problem Reporting Database (APRD)

2.11 The meeting noted the current status of the APRD development. ICAO Regional Sub Office in coordination with CAD Hong Kong China has developed testing site of the APRD. It was considered necessary to be hosted in ICAO APAC website as a project. The database still required some improvement. The meeting was also informed about the resource constraints in the ICAO Regional Sub Office. A number of States/Administration provided contacts of focal points for the operational testing including China, Hong Kong China, Indonesia, PNG and Singapore. Further follow-up action on this matter will be taken by SURICG.

2.12 In light of the resource constraints and the time being taken, the meeting agreed that the database should be started to use as soon as possible without waiting for it to be “perfect” or “fully functional”.

2.13 It was recalled that the Task Force had met 15 times in the past 13 years. A number of guidance materials in particular for the AIGD had been developed and adopted by APANPIRG to assist States in the planning and implementation of ADS-B. Noting most of tasks set out in the Terms of Reference of the ADS-B Study and Implementation Task Force had been completed and the outstanding tasks and identified issues had been transferred to SURICG, the meeting adopted the following Decision:

<table>
<tr><td colspan="3">Decision APANPIRG/27/43: Dissolution of ADS-B Study and Implementation Task Force</td></tr>
<tr><td colspan="2">That, the ADS-B SITF, having achieved the objective set out in its Terms of Reference, is dissolved.</td><td>Expected impact:
☐Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td colspan="3">Why: TOR for ADS-B SITF having been completed and the outstanding tasks and identified issues are transferred to SURICG which would cover broader surveillance technologies including ADS-B, SSR Mode S and Multilateration applications.</td></tr>
<tr><td>When: 30-Sep-16</td><td colspan="2">Status: to be Adopted by PIRG</td></tr>
<tr><td colspan="3">Who:☒Sub groups ☐ APAC States ☐ICAO APAC RO ☐ICAO HQ ☐ Other:</td></tr>
</table>

Note of appreciation

2.14 The meeting recorded its appreciation to the members of the ADS-B Study and Implementation Task Force for their contributions in enhancing the regional surveillance infrastructure in the Asia and Pacific Regions. The meeting expressed its appreciation and gratitude to those States/Administrations which had hosted the ADS-B Task Force Meetings and Seminars in the past 13 years i.e. Australia, China, Hong Kong China, Fiji, India, Indonesia, New Zealand, Republic of Korea, Singapore, Thailand and Viet Nam. The meeting thanked participants from States/Administrations, International Organizations and representatives from Industry for their active participation in activities of the Task Force and contribution to the achievements and outcome of the Task Force.

2.15 In particular, the meeting expressed appreciation and gratitude to Mr. Greg Dunstone, the Chairman of ADS-B Study and Implementation Task Force for his able leadership; to CAA. Singapore for its contribution towards the development of the modernized regional Surveillance infrastructure and promotion of data sharing in the South China Sea sub-region and to CAD Hong Kong China for its contribution to the development of the ADS-B Implementation and Operation Guidance Document (AIGD) for the APAC Region.

Outcome of First Meeting of the Surveillance Implementation Coordination Group (SURICG/1)

Information from Aeronautical Surveillance Working Group of the ICAO Surveillance Panel

2.17 The meeting noted the relevant outcomes of the Third Meeting of the Aeronautical Surveillance Working Group of the Surveillance Panel (SP-ASWG) held in London from 11 to 14 April 2012. The meeting considered that the information at global level which were relevant for the work programme of SURICG at regional level. Such information would avoid duplicated efforts at regional level and may contribute from APAC Region to the work at global level. The meeting also noted the future meetings schedule of ASWG. Noting that Australia, China, Japan and Singapore have been active participants at different times in the ASWG meetings, the meeting encouraged participants from APAC Region to contribute to the work and study at global level. Australia also encouraged APAC States/Administrations to participate in the work of RTCA.

Surveillance Strategy for the Asia/Pacific Region

2.18 The SURICG/1 meeting reviewed the Surveillance Strategy for the Asia/Pacific Region adopted by APANPIRG/24 in June 2013 and the proposed amendments at the CNS/SG/19 meeting in July 2015. The meeting established an ad hoc working group with members from Australia, Hong Kong China, New Zealand, Singapore, USA, Viet Nam and IATA for consolidating all proposed changes.

2.19 The meeting agreed to the revised regional surveillance strategy with all consolidated changes recommended by the SURICG and adopted the following Conclusion:

<table>
<tr><td colspan="2">Conclusion APANPIRG/27/44: Revised Surveillance Strategy for the APAC Region</td></tr>
<tr><td>That, the revised surveillance strategy for the APAC Region provided in Appendix N to APANPIRG/27-WP/9 is adopted.</td><td>Expected impact:
☒ Political / Global
☐ Inter-regional
☒ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td colspan="2">Why: provide guidance to States/Administration for implementation of Surveillance service</td></tr>
<tr><td>When: 30-Sep-16</td><td>Status: Adopted by PIRG</td></tr>
<tr><td colspan="2">Who:☒Sub groups ☒APAC States ☐ICAO APAC RO ☐ICAO HQ ☐ Other:</td></tr>
</table>

Actions Items referred to SURICG by ADS-B SITF

2.20 The meeting noted the initial list of task/action items referred to SURICG by ADS-B SITF (both list of outstanding issues and Action Items). The meeting also noted that SURICG considered it necessary to establish a working group to investigate the wider application of Mode S technology in the Asia/Pacific Region.

ADS-B implementation Status

2.21 The meeting noted the status of ADS-B and Multilateration implementation updated by Australia, Indonesia, Mongolia and Republic of Korea. The detailed information was provided in the attachment to WP/9.

ADS-B Out: Ensuring Preparedness for the 2020 Equipage Mandate (IP/05)

2.22 In addition to those ADS-B related information presented to ADS-B SITF/15 and CNS SG/20 meetings as reflected in the WP/9, USA provided an update on development of ADS-B implementation. The FAA published Federal Regulation 14 CFR 91.225 and 14 CFR 91.227 in May 2010 for ADS-B Out equipage after January 1, 2020. To ensure preparedness throughout the aviation community, and prevent any operational disruptions, the FAA is promoting awareness to the international community so that foreign aircraft intending to operate within the affected airspace will be sufficiently equipped with ADS-B Out technology by the time the requirements come into effect. States with operators that intend to operate within the U.S. affected airspace are encouraged to promote awareness of this upcoming requirement.

2.23 ADS-B in the U.S. NAS operates on two frequencies (links): 1090 MHz and 978 MHz. Equipment choices include either a Mode S transponder-based 1090 Extended Squitter (ES), or, a Universal Access Transceiver (UAT) operating on 978 MHz. Aircraft operating above FL180 (18,000 feet), must be equipped with a Mode S-transponder-based ADS-B transmitter. Aircraft operating below 18,000 feet and within U.S. airspace must be equipped with either a Mode S transponder, or UAT equipment.

2.24 Airplane manufacturers are upgrading GPS receivers across airplane models, but have said the upgraded receivers will not be available until 2018 to 2020. In such situations, operators must install ADS-B Out by January 1, 2020 using earlier-generation GPS equipment that has been qualified for ADS-B. The FAA approved a five year limited exemption, Exemption 12555. This exemption is applicable to both U.S. and foreign operators. Further detail can be found at: http://www.faa.gov/nextgen/equipadsb/exemption.

FAA AC numbering referenced in SUPPs Doc7030

2.25 The meeting noted that the amendments having been made to FAA's ADS-B provisions, the references to FAA AC numbering in the SUPPs Doc.7030 and mandate template adopted by APANPIRG need to be updated accordingly. SEA/BOB Sub-regional ADS-B Implementation Working Group was therefore requested to review relevant regional guidance document at its next meeting and make recommendations on changes required.

Australia's ADS-B equipage Mandate

2.26 The meeting noted that Australia's Mandate for ADS-B equipage of all IFR aircraft will be effective from 2nd of February 2017. The Australian aviation industry is making good progress – the following statistics apply to Australia-registered IFR aircraft with ADS-B equipage:

- 100% of flights (100% of aircraft) operated by major airlines above FL290;
- 94% of flights (87% of aircraft) operated by business jets above FL290;
- 98% of flights (96% of aircraft) operated by turboprops above FL290;
- 99.9% of flights (95% of aircraft) operating 500NM north and east of Perth; and
- 81% of flights (62% of aircraft) of all IFR for all levels.

ADS-B implementation in Mongolia

2.27 Mongolia has intention to mandate ADS-B equipage on certain routes by 2018. Currently CAAM installed 10 ADS-B stations along the main en-routes. They have been used for situation awareness since March 2016. It was observed that 93% of flights over Mongolian airspace are equipped with ADS-B. By 2017, additional 5 stations will be in operational.

ADS-B Performance Monitor Application

2.28 Indonesia monitored ADS-B Tier 1 implementation within Indonesian FIR. Actions have been taken to ensure ADS-B implementation to meet the baseline parameters. The monitoring systems were developed "in house", using local expertise, and making reference to the information on similar systems in Australia. The configuration of ADS-B Performance Monitoring Tools was introduced in the paper. The tool will be installed at ATC Supervisor and Engineer Supervisor position at both Jakarta Air Traffic Services Center (JATSC) and Makassar Air Traffic Services Center (MATSC). Indonesia invited other States to collaborate in the monitoring of Tier 1 ADS-B performance to acknowledge the benefits and ensuring safety deliveries.

Implementation of Multilateration in Republic of Korea

2.29 Republic of Korea plans to install Multilateration (MLAT) to supplement the existing surveillance system at Incheon International Airport (IIA). 30 ground stations will be installed by December 2016 as phase one and additional 5 units will be installed by August 2017 as phase two.

2.30 AIP supplements recently updated to notify the operators that Mode S transponder needs to be switched on during aircraft movement on the airfield. This would enable detection and identification of the aircraft as soon as it pushes back. Pilots are required to ensure that Mode S transponder are fully operational when aircraft is on the ground (Do not select off or STDBY function). Pilots should also keep mode A code assigned by ATC. IFALPA informed the meeting that some aircraft could not keep the transponder during push-back unless its first engine had started. It was further clarified by Korea that such procedure would be effective from June 2016.

USE of Mode S DAPS SFL and QNH Data

2.31 The intent of implementation of Mode S DAPS, specifically Selected Flight Level is to provide controllers with a "Selected Flight Level" (SFL) data extracted from aircraft equipped with Mode S Enhanced Surveillance transponders (EHS). The selected altitude is available from BDS Register (4,0) and is interrogated every 20 seconds by Airways MODE S radars and the Multilateration system or alternatively downlinked from ADS-B equipped aircraft with DO260A or DO260B transponders. The extracted data enables the Air Traffic Management system (ATMS) to generate a safety alert when the SFL chosen by the crew DOES NOT match the cleared altitude given by the controller, alerting the controller to take appropriate action to remedy the issue.

2.32 New Zealand updated CNS SG/20 that the project of introduction of MODE S DAPS data (specifically Selected Flight Level (SFL)) into its Skyline Air Traffic Management System was completed in May 2016 with the software going live on the night of 25 May 2016. On the first day of operation the use of SFL alerting stopped a possible loss of separation by indicating the crew had selected an altitude below their cleared level, which in this instance was occupied by other traffic. The Airways has begun on extracting DAPS QNH data to provide alerts to controllers when an incorrect QNH value is set by a flight crew. This initial worked commenced in late March 2016. DAPS QNH data extracted from BDS register (4,0) is intended to provide controllers with an alert when required. New Zealand noted a number of aircraft did not correctly report QNH DAPs data above the transition level. Such issues and applications should be further discussed at SURICG.

Requirement for ACAS/TCAS v7.1 equipage

2.33 The Secretariat reminded CNS SG/20 about the requirement for ACAS upgrading to ACAS/TCAS Version 7.1 from 1 January 2017. ICAO APAC Regional Office issued a letter of reminder with queries on status of implementation of the requirement by the States/Administrations. Until end of August 2016, only 8 replies to the survey had been received from States/Administrations. States were urged to comply with the requirement and keep ICAO Regional Office informed if difference exists.

2.34 The requirement as an ICAO Standard for mandatory equipage with ACAS V7.1 resulted from the amendment 85 to Annex 10 Volume IV which became applicable on 18 November 2010. The standard requires forward fit for TCAS/ACAS II V 7.1 equipage by 1st January 2014 and retrofit by 1st January 2017 (sections 4.3.5.3.1; 4.3.5.3.2 and 4.3.5.3.3 in Annex 10 Vol. IV refers).

Interim Report of APAC/NAT Inter-regional ADS-C RITF

2.35 The meeting noted the interim report of ICAO APAC/NAT Inter-regional ADS-C Reporting Interval Task Force. The first meeting of the Task Force (ADS-C RITF/1) was held from 21 to 23 June 2016 in the ICAO EUR/NAT Office Paris, France. A few teleconferences were held before the first meeting of the Task Force. The outcome of the first meeting including conclusions is highlighted in the Appendix O to APANPIRG/27-WP/9.

Review TOR of contributory bodies (Task Forces & Working Groups)

2.36 In accordance with *Decision APANPIRG/26/66*, the meeting reviewed TORs and their current status of those contributory bodies that report to APANPIRG through CNS SG of APANPIRG. The meeting noted that ADS-B SITF and ISTF have been proposed for dissolution. The meeting did not identify the need to amend the TOR of the rest contributory bodies that report to the CNS SG except the reporting path of SEA/BOB Sub-regional ADS-B implementation working group needs to be changed to Surveillance Implementation Coordination Group from ADS-B SITF. This change should be made by the working group at its next meeting in November 2016.

2.37 TOR for ACSICG, PBNICG and SURICG had been proposed for changes by the individual groups which were endorsed by the CNS SG. The meeting adopted the following consolidated Decision (SG/20-D2; SG/20-D6 and SG/20-D16) on the revised TORs of ACSICG, PBNICG and SURICG.

<table>
<tr><td colspan="2">Decision APANPIRG/27/46: Revised TOR of Aeronautical Communication Services Implementation Coordination Group – (ACSICG); Performance Base Navigation Implementation Coordination Group (PBNICG) and Surveillance Implementation Coordination Group (SURICG).</td></tr>
<tr><td>That, the Revised Terms of Reference of ACSICG, PBNICG and SURICG provided in Appendix C to APANPIRG/27-WP/9 is adopted.</td><td>Expected impact:
☐ Political /Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td colspan="2">Why: Result of review according to APANPIRG Decision 26/66</td></tr>
<tr><td>When: 30-Sep-16</td><td>Status: Adopted by PIRG</td></tr>
<tr><td colspan="2">Who:☒Sub groups ☐APAC States ☐ICAO APAC RO ☐ICAO HQ ☒APANPIRG ☐ Other:</td></tr>
</table>

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) review the outcome of the APANPIRG/27 and take any necessary follow-up actions;

b) note the amendments having been made to FAA's ADS-B provisions, the references to FAA AC numbering in the SUPPs Doc.7030 and mandate template adopted by APANPIRG need to be updated accordingly. SEA/BOB Sub-regional ADS-B Implementation Working Group was therefore requested to review relevant regional guidance documents at this meeting and make recommendations for the proposed changes;

c) note the reporting path of SEA/BOB Sub-regional ADS-B implementation WG having been changed to Surveillance Implementation Coordination Group from ADS-B SITF

d) update the information contained in **Appendix A** to this paper as necessary.

– – – – – – – – – – –

ADS-B IMPLEMENTATION STATUS IN THE APAC REGION

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
AFGHANISTAN	ADS-B & Multi Lateration system installed.				subject to safety assessment
AUSTRALIA	A total of 45 ADS-B ground stations and 28 WAM stations are operational (Total 73) ATC readiness since 2004 ADS-B data sharing with Indonesia operational since 2/2011. ADS-B data sharing planned with PNG ASMGCS using multilateration and ADS-B is operational in Brisbane, Sydney, Melbourne and Perth An additional 15 ADS-B ground stations are planned in 2017-2020 period. Onesky replacing the current ATM system is expected to be fully operational in 2020 period.	2009/effective date of mandating in upper airspace 12/12/2013. A forward fit ADS-B mandate also applies from 2/2014 for all IFR aircraft at all flight levels. An ADS-B mandate for all IFR aircraft applies from 2/2017.	At/above FL290 from 12/2013 for domestic & foreign aircraft. All airspace for IFR aircraft from 2/2017	3NM and 5 NM surveillance separation. 3/2016 - Manual of ATC updated to include 3 nautical mile separation using ADS-B in terminal control unit. Vectoring allowed using ADS-B Precision Runway Monitoring for Sydney WAM	WAM is operating in Tasmania since 2010 with 5 NM separation service. WAM is also operating in Sydney for 3 NM separation service in TMA and for precision runway monitoring function.

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
BANGLADESH	Bangladesh has a plan to commission four ADS-B ground stations to be installed at Dhaka, Cox's Bazar, Saidpur and Barisal Airports by 2019. ADS-B data will be integrated with new ATS system at Dhaka.				
CAMBODIA	3 ADS-B ground stations installed at Phnom Penh, Siem Reap and Stung Treng City since 2011 and able to provide full surveillance coverage for Phnom Penh FIR. Cambodia is willing to share data with others.				
CHINA	5 UAT ADS-B stations used for flight training at CAFUC to be upgraded to support 1090ES by 2017. 310 ADS-B stations nationwide will deployed as 1st phase by the end of 2017.	NOTAM issued on ADS-B trial operation			ADS-B signal alone won't be used for ATC separation

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	1 ADS-B station operational in Sanya FIR since 2008. Sanya ATC system ready since July 2009 to support L642 & M771. Additional 3 ground stations deployed in 2015. Chengdu-Jiuzhai project finished in 2008 with 2 ADS-B stations Chengdu - Lhasa route surveillance project completed with 6 ADS-B stations using 1090ES since 2010. Trials operated from May 2011. 9 ADS-B stations deployed on the routes H15 and Z1 in 2015.				
HONG KONG CHINA	A larger-scale A-SMGCS covering the whole Hong Kong International Airport put into operational use in April 2009. Data collection/	AIP supplement issued on 29 Oct.2013/12 Dec. 2013 as effective date.	L642/M771 ATS routes.	To be determined.	ADS-B signals being fed to ATC controllers under an operational trial programme. ADS-B

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	analysis on aircraft ADS-B equipage in Hong Kong airspace conducted on quarterly basis since 2004. ADS-B trial using a dedicated ADS-B system completed in 2007. ADS-B out operations over PBN routes L642 and M771 at or above FL 290 within HK FIR was effective in December 2013 and within HK FIR at or above FL 290 is planned for December 2016. ADS-B ground station infrastructure completed in 2013. ADS-B trial using ADS-B signal provided by Mainland China to cover southern part of Hong Kong FIR commenced in 2010.				operation in Hong Kong FIR re-scheduled for Dec. 2016. An AIP Supplement was issued on 29 Aug. 2014.
MACAO, CHINA	Mode S MSSR coverage				Airspace – ATZ only

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	available for monitoring purposes.				
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA	ADS-B has been used as back-up surveillance of SSR since 2008.				
FIJI ISLANDS	ADS- B /multilateration ground stations installed. Situations awareness service provided in 2013. BY EMAIL	ADS-B mandate commencing form 31st December 2013			
FRANCE ***(French Polynesia)***	ATM system is ready for ADS-B sensors/Installation of 5 first GS expected at beginning of 2017. 2nd stage with implementation of 7 GS and associated VHF coverage.			5 NM for airspace under coverage.	
INDIA	ASMGCS (SMR + Multilat) is operational at Delhi, Mumbai, Chennai, Kolkata, Bangalore and Hyderabad Airports. ASMGCS is also being installed at 05 more international airports.	AIP supplement issued on 17th April 2014 with effective date of implementation from 29th May 2014.			ADS-B in India to provide redundancy for radar and filling the surveillance gaps. ADS-B data trial operations commenced in 2015 in both Non-radar and

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	ADS-B Ground Stations were installed at 21 locations across continental airspace and including Oceanic airspace at Port Blair. Procurement of 10 more ADS-B Ground stations is under consideration in 2016.. ATM automation systems at 22 ATC Centres are capable of processing ADS-B data and provide the information on Display.				radar environment , in Enroute & Terminal phases of flight for ATC purposes. AIP SUP 18 of 2014 issued
INDONESIA	30 Ground Station successfully installed. Since 2009, ATC Automation in MATSC has capabilities to support ADS-B application. ADS-B Task Force team established to develop planning and action	On 24 July 2014 DGCA published AIRAC AIP Supplement No. 10/14 for using ADS-B for situation awareness effective from 18 Sep. 2014 to 25 June 2015. AIP Supplement on ADS-B Implementation (Tier-1)(mandate) being published with effective date on 25 June 2015.	Mandate from Janaury 2018 for Class A airspace from FL290 to FL460	Intended to use for 5 NM separation	

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	concerning ADS-B Implementation within Indonesia FIR ADS-B data sharing with Australia and Singapore.				
JAPAN	Multilateration Systems for surface monitoring have been implemented at eight airports PRM (WAM) has been implemented at Narita Airport. En-route WAM system is manufacturing and will be put into operation in FY2018 Plan to evaluate accuracy of ADS-B information and has intension to introduce ADS-B to the oceanic direction.				
LAO PDR.	2 ADS-B ground stations were installed in Vientiane and Luangprabang Int'l Airport in 2015 and the ADS-B data is fused with				

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	MSSR data target in the ATM Automation system. 3 additional ADS-B ground stations (DO-260B compliant) will be completed the installation at existing MSSR sites (Xiengkhouang, Savannakhet and Champasack) by 2016 to Q1 of 2017 to enhance the full ADS-B coverage of Lao FIR.				
MALAYSIA	Malaysia installing two (2) ADS-B ground stations in Genting Highland and Langkawi. The said ADS-B are expected to be commissioned by end of 2019. Malaysia revised the plan to start mandate ADS-B requirement for implementation of ADS-B service for exclusive airspace/route without radar coverage within KL FIR by the end 2022. Specific Routes	Revised Plan to issue mandate with target effective date by end of 2022.		ICAO approved surveillance separation.	

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	for ADS-B Implementation Plan: P574, N571, L510, P628, L645 & P627.				
MALDIVES	4 ADS-B stations installed in Nov. 2012 (2 at Male' Ibrahim Nasir Intl Airport, 1 at Kulhudhuffushi Island in the North and 1 at Fuah Mulah Island in the South to cover 95% of the FIR at/above FL290. Maldives' ADS-B is integrated with the ATM system (in November 2013), and under observation prior to commencing trials. Maldives has planned to share ADS-B data with its adjacent FIRs. Updated by email				Seaplane in Maldives equipped with ADS-B for AOC purpose. These seaplanes have ADS-B IN functions as well.
MONGOLIA	Ten ADS-B ground stations for combination SSR and filled the surveillance gaps implemented in 2015 and integrated with				

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	ATM system and trial operation in early 2016.				
MYANMAR	ADS-B ground stations to be installed at Sittwe, Co Co Island by end of 2014 as 1st phase Yango , Lashio and Myeik -2015 as 2nd phase; Kengteng, Myitkyina in 2016. Completion of integration to Euro Cat. C. in 2014. Agreed to share ADS-B data with India, agreement on sharing being negotiated.				Supplement radar and fill the gaps to improve safety and efficiency ADS-C/CPDLC integrated in Yangon ACC since 2010.
NEPAL	ADS-B feasibility study conducted in 2007.				
NEW CALEDONIA	Three ADS-B ground stations commissioned in 2010 to cover international traffic at La tontouta airport serving Tontouta ACC & APP. It is used for Situation awareness and SAR.				

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
NEW ZEALAND	MLAT and ADS-B data is being used from the WAM system centered in the Queenstown area to provide surveillance coverage and surveillance separation (5 nm) over the southern half of the South Island of New Zealand. Additionally MLAT data from the Auckland MLAT system is used to provide airport surface movements at NZAA. The New Zealand Navigation and Airspace and Air Navigation Plan "New Southern SKY" issued in May 2014	New Zealand has plans to introduce ADS-B OUT mandates as follows: ADS-B OUT equipment requirement for all aircraft operating in controlled airspace above FL 245 from 1 January 2019 ADS-B OUT equipment requirement for all aircraft operating in controlled airspace from 1 January 2022. A forward fit requirement for ADS-B equipage on all newly registered aircraft in 2017. The Rule will not specify particular Technical Standing Orders (TSO), or transponder GNSS receiver models for position input into ADS-B.		5 NM Surveillance Separation in en-route airspace, and 3NM surveillance separation in terminal airspace.	
PAKISTAN	Tender for procurement of 5 ADS-B stations issued to be installed at				

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	Pasni, Lakpass, Rojhan, Dalbandin and Laram-top. Contract expected to be finalized by end of 2015. These stations will be DO260B compliant and operational by end of 2017.				
PAPUA NEW GUINEA	Initially 8 ADS-B sites to be deployed across PNG to provide seamless coverage above FL285. First site to be installed May/June 2016, with remainder to be completed between May-July 2017. Up to an additional 7 sites to be rolled-out in the 2018/19 timeframe. Site location will be dependent on infrastructure, security and an analysis of Phase 1 site performance. In late 2016, PNGASL (ANSP) will be implementing a replacement ATM automation	An ADS-B mandate is on CASA PNG roadmap, however legislation yet to be developed. The Australian mandates will largely drive equipage for overflights (e.g. East-Asia to Australia/South Pacific). Expectation is that PNGASL (the ANSP) will lead development of ADS-B mandate framework. Initial steps may include mandate above F245 – but will depend on performance of Phase 1 ADS-B deployment. Country-wide mandate not envisaged before 2021/22.	None	**Air Traffic Control** Approach/Arrivals 2017 – 5NM 2018 – 3NM (approach) Upper Airspace (>FL245) 2017/18 – Situational awareness. 2018/19 – 5NM Note: Implementation dictated by training requirements and new ATM system transition priorities. **Flight Service** Directed Traffic (FIS) 2017 – Situational	

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	system. The system will support fusion of ADS-B and RADAR data. From 2017 onwards, PNGASL will be looking to share ADS-B data with Indonesia and Australia.			awareness	
PHILIPPINES	Four (4) ADS-B ground stations (Manila, Palawan, Pangasinan and Zambales) with target date tocomplete by end 2016. ATM Center expected to be available in 2016.				
REPUBLIC OF KOREA	ADS-B implemented 2008 for SMC in Incheon International Airport. ROK is developing ADS-B system since 2010 through R&D group. The testbed at Gimpor Airport supporting both 1090ES and UAT, undergoing operational testing (2013-16). At Incheon				

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	Intl Airport, promotion of surface surveillance (2014-17) In 2nd phase from 2015 to 2016, ADS-B ground stations will supplement to the radar in the terminal area and fill up the gap between radar coverage. The last phase from 2017 to 2020, ADS-B will be deployed for entire Incheon FIR.				
SINGAPORE	The airport MLAT system was installed in 2007 and "far-range" ADS-B sensor was installed in 2009. ATC system has been processing ADS-B data since 2013.	AIC was issued on 28 December 2010/effective from 12 Dec.2013. AIP supplement published in Nov 2013 to remind operators of ADS-B exclusive airspace implementation. AIP updated in Jan 2015 to remove the need for ops approval and to include the FAA standard as an additional accepted means to meet the equipage requirements.	L642 and M771. At and above FL290. Also affect the following ATS routes N891, M753, L644 & N892	40nm on ATS routes L642, L644, M753, M771, N891 and N892 30nm implemented on 26th June 2014 on ATS routes L642, M753, M771 and N892; 20nm planned for end 2016	Safety case was completed end of November. 2013.
SRI LANKA	Installation of five (05) ADS-B Ground Receiving stations have	Revised Date of Equipage mandate 31st Dec. 2016	All ATS Routes within Colombo TMA	Initially 5 nm within Approach Radar Coverage, 8	Reduction of Terminal/En-route separation

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	been re-planned to be completed by end of November 2016, with its commissioning & ATM System Readiness by end of December 2016.			nm within Area Radar Coverage & Procedural Separation minima outside Radar Coverage.	to 30 nm & Use of ADS-B alone for vectoring & separation only after safety assessment.
THAILAND	Multilateration implemented at VTBS in 2006, installed at VTBD in 2016 which to be implemented in 2017; and to be installed at VTCC and VTSP in 2017. ADS-B ground stations (DO-260B compliant) installed in Thailand for internal research & development project. Thailand is currently undergoing the operational approval process to have ADS-B as part of surveillance infrastructure. Nationwide WAM+ADS-B covering all en-route and	Plan to issue mandate with target effective date end of 2018.			

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	TMA airspace to be installed in 2017. New ATM System to be operational in 2017 will be capable of processing ADS-B and WAM data and integration of data from multiple sensor types.				
TONGA	Trial planned for 2017				
UNITED STATES	As of 1 April 2016, the "baseline" set of Service Volumes planned by the FAA in 2007 are operational, using data from over 600 radio sites installed by Harris. Since 2007, FAA has planned and funded activities to activate additional Service Volumes that Harris will service using additional radio sites; all but 16 of these radio sites have been installed and are operational as of 1 April 2016.	The U.S. ADS-B Out rule (14 CFR 91.225 and 14 CFR 91.227) was issued in May 2010 and specifies that the ADS-B Out mandate is effective on 1 January 2020.	Class A, B, and C airspace, plus Class E airspace above 10,000 ft MSL. See 14 CFR 91.225 for details.	The U.S. is using both terminal and en route (5nm) separation criteria, depending on the specific airspace and available surveillance information. Terminal separation includes the following separation criteria: - 3nm - 2.5nm - indepen-dent parallel approach operations down to 4300 ft centreline separation - dependent parallel approach	

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	As of 1 April 2016, 135 of the 226 U.S. air traffic control facilities are using ADS-B for ATC separation; all En Route Centers and major Terminal facilities are using ADS-B for ATC separation; all remaining facilities are planned to be using ADS-B by 2019.			operations down to 2500 ft centreline separation (currently 1.5 nm diagonal distance).	
VIET NAM	Two phases ADS-B implementation plan adopted. Phase 1 implemented in March 2013. Phase 2 commenced in 2015 for whole lower and upper Hanoi FIR and 2018 for Ho Chi Minh FIR	AIC issued on 20 June 2013/ADS-B mandating effective from 12 December 2013 in Ho Chi Minh FIR.	M771, L642, L625, N892, M765, M768, N500 and L628 At/above FL290.		Operators required to have operational approval from State of aircraft registry.

– – – – – – – – – – – – –