INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

REPORT OF

THE SEMINAR ON SPACE-BASED ADS-B AND THE TENTH MEETING OF THE SOUTH EAST ASIA AND BAY OF BENGAL SUB-REGIONAL ADS-B IMPLEMENTATION WORKING GROUP

(SEA/BOB ADS-B WG/10)

Singapore, 11 to 13 November 2014

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1. INTRODUCTION

1.1 The Seminar on Space-based ADS-B and the Tenth Meeting of the South East Asia and Bay of Bengal Sub-Regional ADS-B Implementation Working Group (SEA/BOB ADS-B WG/10) were held in Singapore from 11 to 13 November 2014. The events were hosted by the Civil Aviation Authority of Singapore (CAAS) at the Grand Copthorne Waterfront Hotel.

2. ATTENDANCE

2.1 70 Participants participated in the seminar and the meeting. They were from Australia, Bangladesh, China, India, Indonesia, New Zealand, Pakistan, Singapore, Sri Lanka, Thailand, Viet Nam, CANSO, IATA and IBAC. Representatives from ENAV and NAVCANADA contributed the events. Industry from Aireon, Thales Alenia Space and COM Space also provided input to the Seminar. List of participants is at **Attachment 1**.

3. OPENING OF THE EVENTS

3.1 On behalf of the ICAO Regional Director Mr. Arun Mishra, Mr. Shane Sumner, Regional Officer ATM expressed appreciation to CAAS for hosting the Seminar and recalled relevant outcomes from ICAO on spaced based ADS-B. Mr. Lo Weng Kee, Deputy Director (Engineering Operations) CAAS and moderator for the Seminar extended warm welcome to all the participants and highlighted the objective of the Seminar.

3.2 On behalf of CAAS, Mr. Soh Poh Theen, Deputy Director General (ANS) opened the Working Group meeting and highlighted the rapid development of civil aviation and importance to enhance air navigation systems to cope with the requirement. Mr. Li Peng, Regional Officer CNS thanked the host and Administrations for their continuous support to ICAO regional activities.

3.3 Mr. Yeo Cheng Nam, Director (Aeronautical Telecom & Engineering) CAAS was the moderator for the meeting. Mr. Li Peng and Mr. Shane Sumner from ICAO Asia and Pacific Office provided the Secretariat support.

4. ORGANIZATION, WORKING ARRANGEMENTS AND LANGUAGE

4.1 The meeting met as single body through the meeting except the last session of the first day of the meeting, when that 2 Ad Hoc working groups established to deal with the SEA and BOB Sub-regional activities met.

4.2 The working language was English only inclusive of all documentation and this Report. A total of Twelve (12) Working papers and Six (6) Information papers were considered by the meeting. A List of Working Papers, Information Papers and Seminar Presentations for the eventsis at **Attachment 2.**

Seminar on Space-based ADS-B

0.1 The following subjects were covered by the Seminar:

- System concept and performance of space based ADS-B;
- CONOPS and ATM applicability of space based ADS-B;
- Introduction on Satellite Payload for Space-based ATS;
- Case study by Navcanada;
- Case study by ENAV, Italy;
- Introduction on space with ADS-B with COMX-1 satellite mission;
- Australia's position on space based ADS-B.

Main outcome of seminar was recorded as follows:

1) Space-based ADS-B has been endorsed by ICAO, so it is good to learn more about it and be updated about its status as well as upcoming activities. It is appropriate to have this Seminar, one day before the 10th meeting of the ICAO South-East Asia and Bay of Bengal Sub-Regional ADS-B Implementation Working Group Meeting so that meeting participants could be updated about this surveillance alternative/tool with great potential.

2) Aireon gave 2 presentations, sharing with the participants about its development and schedule of space-based ADS-B. Full surveillance coverage is expected by end 2017, with test validation possible to be carried out in late 2016. Aireon also shared with the participants about its Cost-Benefits Analysis (CBA). From the subsequent Seminar discussion, it could be seen that individual State would have to do its own CBA, taking into account its own requirements, FIR and airspace configurations, terrain, etc. as there would not be a one-size- fits-all template relevant to all States.

3) Thales Alenia Space gave a presentation about its satellite payloads for space-based Air Traffic Services (ATS), among which include space-based ADS-B with communications infrastructure. The participants were informed that an European Satellite Operator is now looking into the use of Thales' space-based ATS payloads on board its satellites.

4) GomSpace also presented the first results of its space-based ADS-B with the GOMX-1 satellite mission, which were encouraging. Participants were informed about possibility of having custom-built space-based ADS-B coverage with the GomSpace's satellites.

5) Airservices Australia presented its approach to Space Based ADS-B which was to encourage those with strong business cases and to consider carefully the use of ADS-B from space taking into account performance , risks and costs.

6) Nav Canada and ENAV of Italy, pioneer users of satellite-based ADS-B also shared with the participants about their considerations and approaches in adopting this new surveillance technology.

7) On behalf of the participants, the Seminar moderator thanked the industry partners, ANSPs, airlines, international organisations for coming all the way to Singapore to share the latest happenings about space-based ADS-B. Moderator also thanked ICAO Regional Officers and CAAS for organising this informative Seminar.

Agenda of the SEA/BOB WG/10 Meeting

1.1 The agenda item presented in WP/01 was adopted without change.

Agenda Item 2: Review the outcome of ADS-B SITF/13 and APANIRG/25

Outcomes of ADS-B SITF/13 and APANPIRG/25 (WP/02)

2.1 The meeting reviewed the outcomes of the 25th Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/25, 8-11 September 2014), which had reviewed the outcomes of CNS SG/18 meeting including the 13th Meeting of the Automatic Dependent Surveillance – Broadcast Study and Implementation Task Force (ADS-B SITF/13, Hong Kong China, 22 – 25 April 2014) and the outcomes from SEA/BOB ADS-B WG/9.

2.2 The meeting noted the Conclusions agreed by APANPIRG and follow-up action taken by the Secretariat as follows:

Conclusion 25/40 – revised ADS-B Implementation and Guidance Document

*That, the revised ADS-B Implementation and Guidance Document (AIGD) provided in APANPIRG/25/**WP09, Appendix T (including T2)** be adopted.*
(Follow-up State Letter T 8/10.21:AP146/14 (CNS) dacted 1 October 2014)

Conclusion 25/41 – Flight Plan Item 10 ADS-B Indicators

That, That, ICAO be invited to consider to amend relevant contents in Doc 4444 PANS/ATM Appendix 2 (A2-7) and Appendix 3 (A3-13) as shown below:

- *E Transponder — Mode S, including aircraft identification, pressure-altitude and ~~extended squitter (~~ADS-B out~~)~~ capability*
- *L Transponder — Mode S, including aircraft identification, pressure-altitude, ~~extended squitter (~~ADS-B out~~)~~ and enhanced surveillance capability*
- *B1 ADS-B ~~with dedicated 1 090 MHz ADS-B~~ "out" capability using 1 090MHz extended squitter*
- *B2 ADS-B ~~with dedicated 1 090 MHz ADS-B~~ "out" and "in" capability using 1 090MHz extended squitter.*
  (to be reviewed by ANC by the end of 2014)

Conclusion 25/42 – Regulations for Compliance of ADS-B Transmissions

That, States be urged to implement regulations to give effect to Regional Supplementary Procedure Serial APAC-S12/10 – MID/Asia 5-3 to ensure that all aircraft transmitting ADS-B are compliant with the standards.

(Note: This is 1st half of draft Conclusion 18/18 of CNS SG based on Draft Conclusion 13/4 of the ADS-B SITF)

2.3 APANPIRG/25 formed an ad hoc working group to further consider Conclusion 13/4 of ADS-B SITF. The outcomes of the ad hoc group were further discussed under Agenda Item 3 WP/04.

2.4 In response to the CNS and ATM sub-groups' consolidated report on proposed follow-up actions to the recommendations of the 12th Air Navigation Conference (An-Conf/12, Montreal, 19 – 30 November 2012) APANPIRG/25 adopted the following Conclusion:

Conclusion APANPIRG 25/27 – AN-Conf/12 Recommendations

*That, the regional response to the Recommendations of the AN-Conf/12, in APANPIRG/25/**WP09 Appendix A and flimsy 2** be adopted as guidance for consideration by the States.*

2.5 The APANPIRG future work programme recorded that New Zealand had offered to host the ADS-B Seminar and ADS-B SITF/14, scheduled for 14-17 April 2015. New Zealand advised the meeting that the SITF meeting would be held in Christchurch.

Agenda Item 3: Review implementation and coordination activities and sub-regional implementation plans

ADS-B and MLAT Implementation Plan in Bangladesh (IP/02)

3.1 The meeting was informed that Bangladesh had undertaken a Public – Private Partnership project that included installation of primary and secondary surveillance radars (PSR and SSR) at Dhaka and Chittagong, and 4 ADS-B ground stations at Dhaka, Cox's Bazaar, Barisal and Saidpur. The ADS-B installations were intended as both a backup to current and proposed radar systems, and to fill the surveillance coverage gap in the Bay of Bengal area.

3.2 The project also included a Multilateration (MLAT) system at Dhaka to provide surveillance for surface movement control, supplemental TMA coverage and as a backup to SSR.

3.3 Surveillance data from ADS-B, PSR/SSR and MLAT systems would be integrated with the new ATM automation system. The project was expected to be completed by December 2017.

3.4 Bangladesh was willing to share ADS-B data and VHF air/ground communications with neighboring States.

Update on ATC Surveillance Activities in Australia (IP/03)

3.5 Australia provided updates on ATM surveillance activities including the Australian Mode S Terminal Area Radar Replacement (AMSTAR) project and En-Route Radar Replacement Project (ERRP), the Wide Area Multilateration (WAM) systems in Tasmania and Sydney, and the Advanced Surface Movement Guidance and Control Systems (A-SMGCS) at Melbourne, Sydney and Brisbane.

3.6 33 ADS-B sites were currently operational, and additional ADS-B data was received from operational WAM systems. 13 new ADS-B ground stations were planned to be installed from 2014 to 2016, together with improvements to the digital communications network carrying ADS-B data from the ground stations to ATC centres.

3.7 The Defense Radar Filter (DRF) Project was progressively transitioning data from military-operated radars that were used for civilian ATC purposes to a new IP-based radar data communications system.

3.8 An update was provided on ADS-B equipage rates for aircraft operating above F285 before and after the effective dates of equipage mandates (**Table 1**), and for aircraft operating at all levels in the period August 2011 to July 2014 (**Figure 2**)

ADS-B Flights Planned Above FL285	02 Dec 2013	10 Mar 2014	13 Sep 2014
Major Airlines	95%	99%	99%
Biz Jets	39%	62%	73%
Turboprops	39%	63%	90%

Table 1: ADS-B Equipage Before and After Mandates

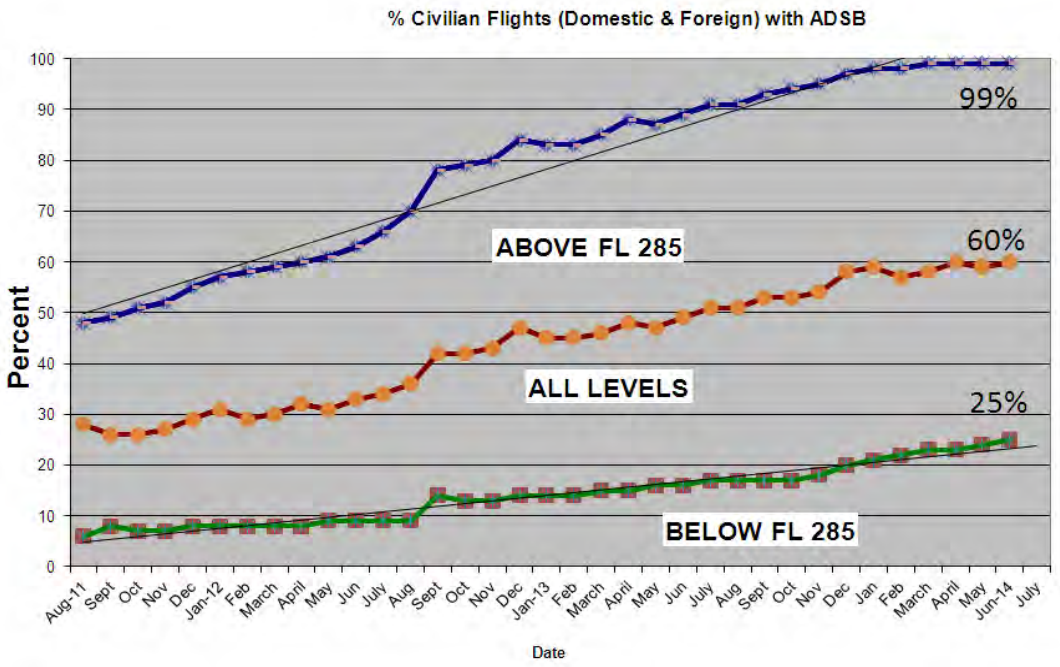

Figure 2: Increase in ADS-B Equipped Flights

3.9 The next significant date would be the introduction of a a mandate for the carriage and use of ADS-B for all aircraft operating within 500NM East/North of Perth to enhance ATC services in Western Australia, and for all aircraft operating at A-SMGCS airports to have Mode S. This applies in Australian airspace (domestic and foreign aircraft) from 4th February 2016.

3.10 Information was also provided on the total program of current and future requirements for the carriage and use of Mode S and ADS-B, flight planning and detection of Mode S capability, operational use of Flight ID from radar, and the use of Mode S Downlinked Aircraft Parameters (DAPs) to enhance current and future ATM in Australia.

ADS-B Implementation Plan in Sri Lanka (IP/05)

3.11 The meeting was informed of Sri Lanka's ADS-B implementation plan, including the establishment of 5 ADS-B ground stations. A central processor for distribution of received ADS-B data, including the capability for sharing ADS-B data with neighbouring States, was also planned. Stand-alone Air Situation Displays (ASDs) would initially be used, with ADS-B data later integrated into the Colombo Area Control Centre and Bandaranaike International Airport ATM systems.

3.12 It was estimated that the ground stations and central processor would be ready for operational trials by 4th Quarter 2014. An AIC on the introduction of ADS-B services within TMA of Colombo FIR had been issued on 10 November 2014 (A02/14) with effective date from 1 September 2015.

ADS-B Implementation in Sanya FIR (IP/06)

3.13 China informed the meeting that in order to provide ADS-B based surveillance capability for ATS routes L642 and M771 to achieve seamless implementation, China undertook an implementation ADS-B project in Sanya FIRs. The project includes four ADS-B ground stations, ATM Automatic system upgrading, ADS-B information network and GPS RAIM system. The structure and configuration of the system was introduced. It was also clarified that ADS-B trial operations was provided and the ATM Automatic System was being upgraded to be integrated with ADS-B input. It was further informed that Sanya FIR was covered by SSR.

Indonesia Updates

3.14 It was informed that Indonesia planned to mandate ADS-B equipage from 25 June 2015 for 3 ATS routes: B472, M768, R592, subject to safety assessment process. IATA commented that this was different from the existing AIP SUPP (for a defined air space), and urged Indonesia to at least issue a NOTAM to promulgate the amended requirements.

Update on the ADS-B Collaboration Project in the South China Sea (WP/12)

3.15 Singapore presented the progress of the South China Sea collaboration project among Indonesia, Singapore and Vietnam and announced that it has been operationalised. The separation between aircraft were reduced from 50NM to 40NM on 12 Dec 2013 and further reduced to 30NM on 24 Jul 2014. It is expected that the separation will be further reduced in 2015. Singapore also highlighted some issued faced during the implementation. These issues include the difficulties faced when doing the safety case for ADS-B under radar environment.

Outcomes of the Ad-Hoc Working Group on the Review of APANPIRG Conclusions Relating to ADS-B (WP/04)

3.16 ADS-B SITF/13 had developed a draft Conclusion *inter alia* proposing that Administrations may elect to either require or not require the operational approval of the State of Registry for aircraft transmitting ADS-B data and receiving an ADS-B service. In considering the draft Conclusion, APANPIRG/25 had formed an ad-hoc group to reach a consensus on the requirement or otherwise for aircraft operators to have operational approval for ADS-B from the State of Registry.

3.17 The meeting discussed the outcomes from the Ad Hoc Working Group which had met by web-conference on 4 November 2014, and agreed to the following Draft Conclusions:

Draft Conclusion SEA/BOB ADS-B WG 10/1– Airworthiness and filtering process for ADS-B Avionics Equipage

That, considering the need to harmonize States' practices regarding Airworthiness and Operational Approval for ADS-B Avionics Equipage, and the outcomes of the Ad hoc working group on the review of the APANPIRG Conclusions 21/39, 21/40 and 20/54, and specifically that:

i) in the light of experience, an operational approval from the State of Registry is neither an efficient nor a sufficient safety barrier against avionics transmitting misleading or non-compliant ADS-B;

ii) in the light of experience, ADS-B data compliant with ICAO Annex 10, but transmitted from airframes having no operational approval from the State of Registry, contribute to the safety and efficiency of ATS services and provide concerned users with a better service;

iii) both APANPIRG Conclusion 25/42 on regulations for Compliance of ADS-B Transmissions, urging States to implement regulations to give effect to Regional Supplementary Procedure Serial APAC-S12/10 – MID/Asia 5-3 to ensure that all aircraft transmitting ADS-B are compliant with the standards, and Conclusion 20/54 about Regional ADS-B Equipage Requirement and the certification process, constitute a first safety barrier to misleading and non-compliant ADS-B transmissions;

iv) in the light of experience, a monitoring of misleading and non-compliant ADS-B transmissions and reactive filtering out of concerned aircraft (black list), and necessary follow-up with concerned operators, and their state regulators for the foreign registered aircraft, is an efficient second safety barrier to misleading and non-compliant ADS-B transmissions;

v) in the light of experience, that air crew are already experienced in correct operation of ATC transponder and GPS systems, and that there is no ADS-B OUT specific action that the flight crew can take, and that whilst desirable, ADS-B OUT training has minimal (if any) impact on the safety and efficiency of ADS-B OUT based operations; and

vi) in the light of the similarity of ADS-B systems to ATC transponder systems, and the fact that ATC transponder systems do not require operational approval.

States be urged to:

a) consider that no operational approval for ADS-B OUT operations is required while reminding airlines, operators, manufacturers and industry of their obligations including training and maintenance aspects;

b) monitor ADS-B transmissions from aircraft and take action to ensure compliance with Regional Supplementary Procedure MID/ASIA Section 5.5; and

c) provide capabilities to either

- reject ADS-B data from aircraft which are known to transmit misleading ADS-B data until corrective actions have been successfully conducted; or

- implement procedures to ensure that such aircraft are safely managed;

Draft Conclusion SEA/BOB ADS-B WG 10/2 – Template for promulgation of ADS-B Avionics Equipage Requirements

That, based on APANPIRG Conclusion 20/54, States intending to implement ADS-B based surveillance service for a defined airspace and having not published regulations be urged to promulgate mandating rules for ADS-B Avionics Equipage Requirements as soon as possible using the following template:

On and after dd/mm/yyyy, if an aircraft operates on airways (insert routes)……at or above FLXXX…….(or in defined airspace boundaries ……. at or above FLXXX):

the aircraft must carry serviceable ADS-B transmitting equipment that has been certificated as meeting EASA AMC 20-24, or FAA AC No. 20-165A – Airworthiness Approval of ADS-B, or meets the equipment configuration standards in Appendix XI of Civil Aviation Order 20.18 of the Civil Aviation Safety Authority of Australia;

An aircraft carrying 1 090 MHz extended squitter (1090ES) ADS-B equipment shall disable ADS-B transmission unless:

a) the aircraft emits position information of an accuracy and integrity consistent with the transmitted value of the position quality indicator; or

b) the aircraft always transmits a value of 0 (zero) for one or more of the position quality indicators (NUCp, NIC, NAC or SIL); or

c) the operator has received an exemption granted by the appropriate ATS authority.

Note: This Conclusion supersedes APANPIRG Conclusion 21/39

Draft Conclusion SEA/BOB ADS-B WG 10/3 – Guidelines for Airworthiness Approval for ADS-B Avionics Equipage

That, States be advised to use the guidelines provided in **Appendix A** for Airworthiness Approval for ADS-B Out Avionics Equipage.

Note: This Conclusion supersedes APANPIRG Conclusion 21/40

Benefits of Cross Border ADS-B Data Sharing (WP/10)

3.18 Singapore presented the benefits of cross-border data sharing. The benefits include improved situation awareness for ATC as the controller is able to detect unreported deviations and get better traffic information. With the implementation of ADS-B, longitudinal separation between suitably

equipped aircraft has been reduced from 50NM to 30NM. More aircraft is assigned their optimum heights. Less greenhouse gases were emitted due to better fuel efficiency.

3.19 The meeting recalled that previously, CANSO together with CAAS, FAA and IATA conducted a cost benefit study on the South China Sea collaboration project, based on projected figures and several assumptions. In view that the project is now operational, the meeting recommended that a similar cost benefit study should be done based on actual figures.

3.20 Accordingly, Singapore agreed to work with CANSO, FAA and IATA to examine the previous cost-benefit study with a view to quantifying the benefits and dis-benefits of the ADS-B mandate **(ACTION ITEM 1).**

Outcome of the SEA/BOB ADS-B WG/9 (WP/05)

3.21 The meeting reviewed the outcomes of SEA/BOB ADS-B WG/9, States were requested to update the ADS-B Implementation Status and further coordinate implementation actions based on the agreed items at previous meeting.

Review of outcome of South East Asia (SEA) and Bay of Bengal (BOB) Sub-regional Projects

3.22 The meeting reviewed the updates of the Sub-regional ADS-B implementation projects as presented by the Ad Hoc working groups at SEA/BOB WG/10 meeting. The discussions were based on the outcome of previous meetings of the SEA/BOB WG/9. The outcome of discussions by Ad Hoc working groups is provided in **Appendix B** to this Report which could serve as a basis for further development of the sub-regional implementation plans at its next meeting.

3.23 The meeting urged India and Myanmar to sign the agreement on data sharing by the end of 2014.

3.24 IATA suggested that Philippines' intentions for ADS-B implementation were not clear, and that this was a significant component of South China Sea surveillance improvement. The Secretariat would correspond with Philippines to obtain firm information on their plans for ADS-B ground-station installations **(ACTION ITEM 2).**

3.25 The meeting also reviewed the ADS-B Implementation Status in the APAC Region. The updated status is provided in the **Appendix C** to this Report.

Agenda Item 4: Report on ground system and avionics performance monitoring and improvement in compliance

Monitoring of the ADS-B stations and the avionics (WP/11)

4.1 Singapore presented her monitoring of the ADS-B stations and the avionics. It was observed that while the performances of the ADS-B stations are good enough for operations, the performance is nowhere close to the theoretical figure. Singapore shared that, about 90% of the airframes were equipped with DO-260 avionics, about 6% were equipped with DO-260A avionics and 4% were equipped with DO-260B avionics.

4.2 In October, an aircraft indicated good NUC while the showing misleading position data. It was observed that initially, the ADS-B data reflected the correct position. When the aircraft made a turn at a way-point, the ADS-B data indicated that the aircraft was still travelling straight. The transponder corrects this error only after more than 30NM of misleading data. Air service Australia has

reported the problem to Boeing and Boeing is conducting the investigation with the support of Australia, Canada and Singapore. Australia advised that this anomaly was had been observed in one new aircraft only, and had been rectified by replacement of the aircraft's integrated surveillance equipment. The relevant avionics parts were sent back to Boeing for analysis. (Action Item, provided feedback to States/Administrations).

ATC Procedures for Surveillance Anomalies (WP/07)

4.3 Australia presented the paper sharing their operational ATC procedures to ensure overall system integrity through the systematic identification and reporting of radar or ADS-B anomalies.

4.4 Australia agreed to prepare working papers and a tutorial on the reporting and analysis processes, and recommendations, for consideration by next meeting of the ADS-B SITF **(ACTION ITEM 3).** The meeting also discussed the need to update the Regional ADS-B Implementation and Operations Guidance Document (AIGD). Australia, Singapore and Thailand would jointly address this task, with Singapore agreeing to take the lead role.

ADS-B Implementation Related Issues (WP/08)

4.5 India identified some issues in the working paper related to regulatory approval for use of ADS-B. While analysis of ADS-B data had indicated that the latest ATM automation systems were equipped with robust checking and alerting functions, the regulatory authority's interpretations of potential vulnerabilities had impeded ADS-B implementation.

4.6 India suggested that those States that had approved ADS-B for operational use could share their experience in the context of potential vulnerabilities, to best practices to be considered by other States seeking regulatory approval. The meeting was invited to consider that ADS-B SITF should develop guidance material addressing potential vulnerabilities, to support States' regulatory framework for operational use of ADS-B.

4.7 The meeting discussed security vulnerabilities, including the need to ensure that the safety benefits of ADS-B were not sacrificed for overly conservative responses to perceived vulnerabilities that already existed in other surveillance systems. It was further mentioned that State laws should have already provided legal protecting safety services from security threats.

Updates on ADS-B Implementation in Hong Kong China (IP/04)

4.8 Hong Kong China was unable to participate in the meeting. The following updates on the latest development were provided to the meeting through the Secretariat.

4.9 Implementation of ADS-B operation in Hong Kong FIR was re-scheduled to December 2016. An AIP Supplement was issued on 29 August 2014 to notify airspace users on the change.

4.10 Regarding the proposal to establish an ADS-B Avionics Problem Reporting Database (APRD) for sharing of monitoring results of avionics performance of ADS-B aircraft for the region, Hong Kong China has been working with the ICAO RSO to develop detailed specifications of the database, as well as a prototype to illustrate the look-and-feel of the database, with inputs/comments from Singapore and Australia. During the CNS SG/18 meeting held in July 2014, Hong Kong China presented a working paper outlining the proposal and progress in establishing the APRD with a view to enhancing aviation safety for the Region, which gained support and endorsement from the meeting. A Discussion Paper would be presented in the coming 51st DGCA Conference to provide the latest update while seeking support from the Conference.

Agenda Item 5: Review of ToR of the SEA/BOB ADS-B Working Group

Future Focus of the Working Group (WP/09)

5.1 A proposed future direction for the SEA/BOB ADS-B WG was presented by Singapore. The paper noted that while many States had either implemented or commenced implementation of ADS-B, the progress of regional collaboration was slow. Since establishment of the Working Group 7 years ago it had identified at least 8 collaboration projects. Only 4 collaboration agreements had been made and implemented, involving only 6 Administrations (Australia, China, Hong Kong China, Indonesia, Singapore and Viet Nam).

5.2 The Working Group discussed the possible areas of focus for the Working Group in future. It was noticed that while several data-sharing projects were identified in the past, the implementation progress has been slow. Data sharing is the key to provide seamless ATM and is therefore important. The Working Group discussed and was of the view that it would be useful if ICAO could highlight the importance of data-sharing to the top management of administrations. The Working Group hence formulated the following Recommendation:

That, ICAO Secretariat is invited to highlight the importance and the very slow progress of cross-border ADS-B data sharing during the DGCA conference

5.3 The meeting also noted that there were a lack of separation minima standards for ADS-B with CPDLC and ADS-B with "DCPC" type (i.e., without operators) of Satcom voice, in remote areas. The availability of such standards would provide benefits to the aviation community. In view of this, the Working Group formulated the following draft conclusion:

Draft Conclusion SEA/BOB ADS-B WG 10/4 – Need guidance on separation Minima

That, ICAO (SASP) be invited to study the separation minima that can be applied using ADS-B with CPDLC and ADS-B with "DCPC" type (i.e., without operators) of Satcom voice in remote area space outside the range of VHF voice communications of the responsible ATC unit.

5.4 With the emerging of space-based ADS-B, it would also be useful to study its application in the Asia Pacific region. For benchmarking individual system's performance, it would be necessary to work out the required ADS-B performance standards. The Working Group formulated the following draft Decision:

Draft Decision SEA/BOB ADS-B WG 10/5 – Study the application of space based ADS-B

That, the ADS-B SITF Task Force be invited to

a) study the application of space-based ADS-B in the Asia Pacific region; and

b) develop recommendations on the required performance standards for ADS-B.

5.5 It was noted in the paper that some States may have faced a number of challenges including political, resource, ATC automatic system upgrading and communication between ANSPs.

5.6 It was also informed that OPLINK Panel (Operational Data Link working group) was developing the concept of Performance Based Communications and Surveillance (PBCS), for which the Working Group or the ADS-B Study and Implementation Task Force could establish a list of

Required Surveillance Performance (RSP) specifications for ADS-B, with consequent monitoring of performance against the specifications. Navcanada recommended that the WG may also consider to develop operational concept of using combinations of different communication means with ADS-B such as CPDLC and SATCOM Voice which would contribute study by relevant panel at global level.

5.7 The member Administrations participated meeting provided their view on the future direction and focus of the WG. Some common points included the following:

- *Based on current TOR, focusing on phase II of South China Sea. Documented case studies of successes and of problems and solution;*
- *Addressing of operational approval for using ADS-B based surveillance service issues with DGCA;*
- *Continue efforts on data sharing and collaborations projects;*
- *Identification of implementation issues and solutions;*
- *Clear distinction of roles between WG and SITF, and ensuring WG won't do unnecessary duplication work with other groups;*
- *Better documentation of the challenges and successes for the benefit of other States that could learn from the world-leading work of Asia/Pacific;*
- *Need to study using ADS-B to replace SSR, with a view to making recommendations to States with little resources.*

5.8 The meeting discussed the need for greater understanding and engagement by regulatory authorities. It was recommended that a seminar oriented specifically towards regulator education and guidance should be organized.

Review of Terms of Reference of the SEA/BOB ADS-B Working Group (WP/03)

5.9 The meeting reviewed the ToR of the SEA/BOB ADS-B Working Group. Based on the discussions on WP/09, the meeting agreed to slightly amend the ToR to include "to identify implementation issues and propose solutions for the identified issues". Accordingly, the meeting made following Decision:

Decision SEA/BOB ADS-B WG 10/6 - Revised ToR of the SEA/BOB ADS-B Working Group

That, the revised TOR of SEA/BOB ADS-B Working Group provided in **Appendix D** to this Report be adopted.

Review Action Items for the SEA/BOB ADS-B WG (WP/06)

5.10 The meeting reviewed the actions items resulted from the SEA/BOB ADS-B WG/8 and WG/9 meeting, most of which were completed by ADS-B SITF/13 meeting. The list of action items updated by the meeting is provided at **Appendix E**.

5.11 Australia was requested to provide clarification on applicability of ICAO Circular 326 AN188 in complexity air space including the definition of the low-complexity **(ACTION ITEM 4).**

Agenda Item 6: Date and venue for the next meeting and any other business

6.1 The meeting identified the need to organize another meeting to progress implementation of the sub-regional plan. The Secretariat will coordinate with member States of the Working Group for hosting the next SEA ADS-B WG meeting in late 2015. The exact dates will be informed to the members States by the Secretariat at due course.

6.2 IATA indicated that a WP on data sharing over FIR boundaries using potential spaced based ADS-B will be prepared for the next meeting of ADS-B Study and Implementation Task Force in April 2015.

Note of appreciation

6.3 The meeting expressed its appreciation and gratitude to the Civil Aviation Authority of Singapore for hosting the events and the excellent arrangement made for the participants including a visit to the new air traffic management system at the Singapore Air Traffic Control Centre.

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Guidelines for Airworthiness ~~and Operational~~ Approval for ADS-B Avionics Equipage

a) The airworthiness compliance of the aircraft under the airframe OEM Type Certificate approval in the Airplane Flight Manual, in an AFM supplement or other appropriate airworthiness documentation is normally accepted by the State of Registry. If the aircraft does not have an existing certification, compliance with Appendix XI of CASA CAO 20.18 specified requirements needs to be established; http://www.casa.gov.au/wcmswr/_assets/main/download/orders/cao20/2018.pdf

b) The continuing airworthiness of ADS-B system must be assured. Existing established maintenance practices or a proposed maintenance programme for the aircraft needs to be reviewed to ensure that it meets relevant requirements. This is typically a demonstration that ADS-B is included as part of the normal maintenance process in the documentation provided; (NB: most ADS-B systems comprise transponder & GPS systems already the subject of existing maintenance and ongoing airworthiness programs);

c) The Minimum Equipment List needs to reflect the functional requirements of the ADS-B system;

d) Appropriate flight operations training programme and operational procedures are established to ensure that pilots are knowledgeable about their onboard operational equipment. This is typically a demonstration that all used aircraft systems are included in the training process and operational documentation including Flight Dispatch considerations; and

e) In light of the fact that usually there are no ADS-B specific actions that the flight crew can take, and that whilst desirable, ADS-B OUT training has minimal (if any) impact on the safety and efficiency of ADS-B OUT based operations, it is not considered essential that flight crew have been trained explicitly on ADS-B.

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REPORT FROM SOUTHEAST ASIA SUB GROUP

(Singapore, 12-13 November 2014)

States Present
Australia
China
Indonesia
Thailand
Singapore
Vietnam

Previously Identified Projects

The South East Asia Group provide an update on the near term implementation of the following projects that were identified in the last task force meeting.

Project 1 – ADS-B Data Sharing Between Australia and Indonesia

Phase 1a
Indonesia and Australia sharing data from the following stations:

- Saumlaki ADS-B (Indonesia) (Installed)
- Merauke ADS-B (Indonesia) (Installed)
- Waingapu ADS-B (Indonesia) (Installed)
- Kintamani - Bali (Indonesia) (Installed)
- Thursday Island ADS-B (Australia) (Installed)
- Gove ADS-B (Australia) (Installed)
- Broome ADS-B (Australia) (Installed)
- Doongan ADS-B (Australia) (Installed)

Data Sharing Agreement signed in November 2010.

Benefits
- Data used for air situational awareness and safety nets;
- Enhanced Safety at FIR boundary;
- Operational service commenced by Australia in February 2011; and
- Indonesia has published their ADS-B mandate in 2013 to be effective after 2015.

Phase 1b
Indonesia and Australia sharing data from the following additional stations:
- Semarang (Indonesia) (Installed)
- Alor (Indonesia) (Installed)
- Timika (Indonesia) (Installed)
- Kupang (Indonesia) (Installed)
- Christmas Island (Australia) (Not yet installed)
- Timor Sea oil rig (Australia) (Not yet installed)

Data Sharing Agreement signed on 18 June 2014.

Project 2 – ADS-B Data Sharing In South China Sea

Phase 1
Under the near term implementation plan, China, Hong Kong China, Indonesia, Singapore and Vietnam would share the ADS-B data from the following stations:

- Singapore ADS-B (Singapore provide data to Indonesia) (Installed)
- Natuna ADS-B (Indonesia provide data to Singapore) (Installed)
- Matak ADS-B (Indonesia provide data to Singapore) (Installed)
- Con Son ADS-B (Viet Nam provide data to Singapore) (Installed)
- Sanya ADS-B (China provide data to Hong Kong China) (Installed)
- Three more Sanya ADS-B (China provide data to Hong Kong China) (To be installed by end 2014)

VHF radio communication services (DCPC) would be provided from the following stations to Singapore and Hong Kong China. This is to enable implementation of radar-like separations in the non-radar areas within the Singapore FIR as well as routes L642 and M771.

- Natuna VHF (Install for Singapore by Indonesia) (Installed)
- Matak VHF (Install for Singapore by Indonesia) (Installed)
- Con Son VHF (Install for Singapore by Viet Nam) (Installed)
- Sanya VHF (Install for Hong Kong China by China) (Installed)

ADS-B Data sharing and DCPC services agreement between Singapore and Indonesia signed in December 2010.

ADS-B Data sharing and DCPC services agreement between Singapore and Vietnam signed in November 2011.

DCPC services agreement between China and Hong Kong, China signed in 2005.

ADS-B Data sharing agreement between China and Hong Kong China signed in 2013.

Operational Status
Singapore agreed on separation minima with Vietnam and have commenced on ADS-B operations.

All 4 Administrations (China, Hong Kong China, Singapore, Viet Nam) recommend that there should not be a need for operational approval.

Initial Benefits
The above sharing arrangement will benefit L642, M771, N891, M753 and L644. Enhanced safety and reduced separation has been applied. Mandate was effective in 2013.

Phase 2
The Philippines CNS ATM project includes Manila ADS-B stations.

Singapore signed an MOU with the Philippines to share ADS-B data from Quezon Palawan.

Brunei previously in-principle agreed to share ADS-B data with Singapore and provide the VHF facilities for Singapore. The Brunei CNS ATM project includes ADS-B stations. The locations of the stations are yet to be determined.

China can share the data from the ADS-B data processing sub-centre in Sanya FIR with neighbouring States. Technical details will be discussed further.

Phase 3
Vietnam has ADS-B coverage at the Southern part of L625 and N892 and Vietnam is willing to share the ADS-B data with the Philippines and Singapore.

Project 3 – ADS-B data sharing between Indonesia and Malaysia (No updates, info based on previous reports)

Indonesia is willing to share the ADS-B data from the following stations:

- Aceh ADS-B (installed) - to help cover Kuala Lumpur FIR
- Tarakan ADS-B (installed) - to help cover Kota Kinabalu FIR
- Pontianak ADS-B (installed) - to help cover Kota Kinabalu FIR.

The project is still under discussion between Malaysia and Indonesia.

Initial benefits
Enhanced Safety at FIR boundary

Malaysia currently has 1 ADS-B station at Terengganu. Malaysia plans to install more ADS-B stations before 2020. The stations may be shared in future.

Project 4 – ADS-B data sharing between Cambodia, Thailand and Viet Nam (No updates, info based on previous reports)

Cambodia is willing to share the ADS-B data from the following stations:

- Phnom Penh International Airport ADS-B (installed)
- Siem Reap International Airport ADS-B (installed)
- Stung Treng City ADS-B (installed)

Viet Nam is planning to install stations in the south of HCM FIR from 2015 to 2016. Viet Nam is willing to share with Cambodia and Thailand.

Discussions between the three States are on-going.

Initial benefits
For redundancy

Project 5 – ADS-B data sharing between Indonesia and the Philippines (No updates, info based on previous reports)

Indonesia is willing to share the ADS-B data from the following stations:

- Manado ADS-B (installed)
- Galela ADS-B (installed)
- Tarakan ADS-B (installed)

Where possible, Indonesia would like to receive ADS-B data from the Philippines from ADS-B stations near the Manila FIR – Ujung Pandang FIR boundary

Currently, the Philippines has no plans to install ADS-B stations at the Southern part of Manila FIR.

The project is still under discussion between Indonesia and the Philippines.

Initial benefits
Situational awareness

Project 6 – ADS-B data sharing between Australia, Indonesia and Papua New Guinea

Data Sharing between Australia and Papua New Guinea

- Thursday Island (Australia) (installed)
- Gove (Australia) (installed)
- Kintore (Australia) (installed)
- Burns Peak – Port Moresby (PNG) (tender awarded)
- Mt Dimo Dimo (PNG) (tender awarded)
- Mt Robinson (PNG) (tender awarded)

Data Sharing between Indonesia and Papua New Guinea

- Burns Peak (PNG) (tender awarded)
- Mt Nauwein (PNG) (tender awarded)
- Mt Robinson (PNG) (tender awarded)
- Merauke (Indonesia) (installed)
- Timika (Indonesia) (installed)
- Biak (Indonesia) (installed)

The project is still under discussion between Australia, Indonesia and Papua New Guinea.

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Harmonization Plan for L642 and M771			
No.	**What to harmonize**	**What was agreed**	**Issue / what needs to be further discussed**
1	Mandate Effective	SG, HK, VN: 12 Dec 2013 CN: Dec 2015.	
2	ATC Operating Procedures	No need to harmonize	Refer to SEACG for consideration of the impact of expanding ADS-B surveillance on ATC Operating Procedures including Large Scale Weather procedures.
3	Mandate Publish Date	No need to harmonize	To publish equipment requirements as early as possible.
4	Date of Operational Approval	Recommended to do without operational approval	Pending endorsement by APANPIRG
5	Flight Level	SG, HK, VN, CN: - At or Above FL290 (ADS-B airspace) - Below FL290 (Non-ADS-B airspace) SG: AIC issued 28 Dec 2010, AIP Sup issued 6 Nov 13 VN: AIP Sup issued 31 Oct 13 HK: AIC issued 24 May 2011, AIP Sup issued 29 Oct 13	
6	Avionics Standard (CASA/AMC2024)	SG - CASA or AMC2024 or FAA (ES) HK - CASA or AMC2024 or FAA (ES) VN - CASA or AMC2024 or FAA (ES) CN - CASA or AMC2024 or FAA (ES)	Indonesia will consider and have a willingness to upgrade their stations shared with other States.

		SG, HK and VN confirmed that their ADS-B GS can accept DO260, DO260A and DO260B.	
7	Aircraft Approval		
7a)	Procedures if Aircraft Not Approved or Aircraft without a Serviceable ADS-B Transmitting Equipment before Flight	SG: FL280 and below. HK, CN, VN: Dependent on situation. ADS-B equipped aircraft will be given priority to operate above FL280.	
7b)	Aircraft Approved but Transmitting Bad Data (Blacklisted Aircraft)	For known aircraft, treat as non ADS-B aircraft. (China, Hong Kong - China and Singapore)	Share blacklisted aircraft among concerned States/Administration.(Hong Kong China, Singapore and Vietnam) China to be confirmed.
8	Contingency Plan		
8a)	Systemic Failure such as Ground System / GPS Failure	Revert back to current procedure.	
8b)	Avionics Failure or Approved Aircraft Transmitting Bad Data in Flight	Provide other form of separation, subject to bilateral agreement. From radar/ADS-B environment to ADS-B only environment, ATC coordination may be able to provide early notification of ADS-B failure.	Address the procedure for aircraft transiting from radar to ADS-B airspace and from ADS-B to ADS-B airspace.
9	Commonly Agreed Route Spacing	SEACG	Need for commonly agreed minimal in-trail spacing throughout.

REPORT FROM BAY OF BENGAL AD HOC WORKING GROUP
(Singapore, 12-13 November, 2014)

States Presented:

Bangladesh
India
Indonesia
Pakistan
Sri Lanka
Thailand

Maldives and Myanmar were not present in the WG meeting.

The participants met to update the status of implementation of ADS-B and possible Data sharing between the neighboring States.

1. Bangladesh has planned to install ADS-B ground stations at four locations i.e. Dhaka, Barisal, Saidpur and Cox's Bazar by 2H2016. Bangladesh is willing to share ADS-B data with India and Myanmar.

2. India informed that 21 ADS-B ground receivers have already been installed and AIP SUPP has been prepared to use ADS-B in the provision of ATS surveillance service. The AIP Supplement will be issued once the approval for operational use of ADS-B data for surveillance is obtained from the regulator. The data sharing agreement between India and Myanmar can be signed by 2H2014. India is willing to share ADS-B data with Bangladesh, Indonesia, Maldives and Sri Lanka.

3. Indonesia informed that ADS-B ground station at Aceh is already operational and will share data with India (Portblair – Aceh) by 2H2015.

4. Maldives has installed and commissioned ADS-B ground stations at three locations. The integration of data to the ATM systems has already been completed. Maldives is willing to share ADS-B data with India and Sri Lanka (Expected date: 2015). Also, Maldives has planned to implement exclusive ADS-B airspace at and above FL290 by 2016.

5. Nepal is planning to install ADS-B ground stations in future. New MSSR system is going to install and the project will be completed by 2015. MLAT is under the process for a tender.

6. Pakistan has informed the meeting that most of the Pakistan airspace currently is already under RADAR surveillance; some gaps in the West, Northern mountain regions and some portion in the South and the South-West airspace need to be brought under positive feasibility or surveillance. PCAA considers ADS-B, a potential option to fill up the gaps in radar surveillance and also considers using ADS-B to provide partial back-up to the existing radar. Regarding data sharing neighboring countries will be coordinated through PCAA.

7. Sri Lanka is planning to install ADS-B ground stations at five locations and the system will be ready for test operations by October, 2015. AIC has been recently issued. Sri Lanka is willing to share data with India and Maldives.

8. Thailand informed that a new ATM system with capability of processing ADS-B data is expected to be operational in 2017.

REPORT FROM BAY OF BENGAL AD HOC WORKING GROUP
(Singapore, 12-13 November, 2014)

ADS-B DATA SHARING

The following locations for data sharing were agreed upon during the sub-group (Ad hoc) Meeting:

INDIA – BANGLADESH
Agartala and Dhaka (2H2016)

BANGLADESH – MYANMAR
Coxs Bazaar and Sittwe (2H2016)

INDIA – MYANMAR
Agartala – Sittwe (2H2015)
Portblair – Coco Island (2H2015)

INDIA – INDONESIA
Portblair – Aceh (2H2015)

INDIA – MALDIVES
Trivandrum – Kulhudhuffushi (2H2015)

MALDIVES – SRI LANKA
Male – Colombo (2H2016)

INDIA – SRI LANKA
Trivandrum – Colombo (2H2016)

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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 33 ADS-B stations and 28 WAM stations are currently used. ATC system readiness since 2004. ADS-B data sharing with Indonesia operational since 2/2011. ASMGCS using multilateration is operational in Brisbane, Sydney & Melbourne. It is being installed in Perth. Additional 13 ADS-B stations from 2014-2016. OneSKY replacing current ATM system is estimated for full operational around 2020.	2009/effective date of mandating in UAP 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 for all IFR aircraft applies from 2/2017.	at/above FL290 UAP from 12/2013 for domestic & foreign aircraft. Mandates for additional flight level are considered for 2015 & 2017. WAM is operating in Tasmania since 2010 delivery 5 Nm separation service. WAM is also operating in Sydney for 3 Nm separation service in TMA and for precision runway monitoring function.	5 NM 3 NM SYDWAN	

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 2016. ADS-B data will be integrated with new ATS system at Dhaka.				
CAMBODIA	3 ADS-B ground stations have been installed in Cambodia since 2011 and able to provide full surveillance coverage for Phnom Penh FIR.				
CHINA	5 UAT ADS-B sites are used for flight training of CAFUC. 8 ADS-B stations installed by end of 2012. 200 ADS-B stations nationwide will deployed as 1st phase. 1 ADS-B station operational in Sanya FIR since 2008. Sanya ATC system ready since July 2009 to support L642 nd M771. Chengdu-Jiuzhai project finished in 2008 with 2 ADS-B stations and additional site is planned to enhance the surveillance	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
	coverage. Chengdu - Lhasa route surveillance project completed with 5 ADS-B stations using 1090ES since 2010. Trials planned from May 2011. 1 ADS-B site installed in Sanya FIR since 2008. 3 additional ground stations planned, Trial planned for Jun, 2011.				
HONG KONG CHINA	A larger-scale A-SMGCS covering the whole Hong Kong International Airport put into operational use in April 2009. Data collection/ 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 are planned in December 2013 and within HK FIR at or	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 operation in Hong Kong FIR re-scheduled for Dec. 2016. An AIP Supplement was issue don 29 Aug. 2014.

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
	above FL 290 in December 2014. 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.				
MACAO, CHINA	Mode S MSSR coverage 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 will be provided in 2013.				
FRANCE *(French Polynesia)*	Project launched to install 9 ADS-B stations. 2 stations to be installed in 2014; 3 in 2015 and 4 will be installed in 2016.			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	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.

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
	more international airports. ADS-B Ground Stations installed at 14 locations in phase one across continental and Oceanic airspace at Port Blair. 07 more ADS-B Ground stations in phase two in 2014. ATS systems at 12 ACCs are capable of processing ADS-B data and provide the information on Display. Wide area Multilateration pilot project is being planned in Kolkata TMA to augment the surveillance coverage.				Currently study the integrity of ADS-B data and evaluating in both Non-radar and radar environment for ATC purposes.
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 concerning ADS-B Implementation within Indonesia FIR				ADS-B Task Force Team is considering a mandate in 2016. Mandate for 3 ATS routes: B472, M768, R592 from 25 June 2015 subject to safety assessment process.

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 data sharing with Australia and Singapore.				
JAPAN	Multilateration Systems for surface monitoring have been implemented at seven airports and are being implemented at another one airport. PRM (WAM) is planned to be implemented at Narita Airport. (Operation will start in 2014). Basic design of en-route WAM system completed in FY2013. Plans to start manufacture in FY2014 and estimated operational in FY2018. Plan to evaluate accuracy of ADS-B information and has intension to introduce ADS-B to the oceanic direction.				
MALAYSIA	Malaysia planned to start mandate ADS-B requirement in KL FIR in 2018 and full implementation of ADS-B service at specific routes/exclusive airspace by end of 2020.	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
	Plan to install two ADS-B stations at Pulau Langkawi and Genting Highland by 2016. Data sharing with neighbouring by mid. 2017.				
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 plan to share ADS-B data with its adjacent FIRs.				Seaplane in Maldives equipped with ADS-B for AOC purpose. These seaplanes have ADS-B IN functions as well.
MONGOLIA	Five ADS-B ground stations for combination with SSR will be implemented first quarter of 2013. Full coverage for surveillance gaps will be implemented by 2015-2016.				
MYANMAR	ADS-B ground stations to be installed at Sittwe, Co Co Island by end of 2014 as 1st phase Yango ,				Supplement radar and fill the gaps to improve safety and efficiency.

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
	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.				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.				
NEW ZEALAND	MLAT being used in Queenstown area (WAM) and Auckland (airport surface movements). ADS-B data available from all MLAT & SSR sites. New Zealand Navigation and Airspace and Air Navigation Plan "New Southern SKY" issued May 2014			5 NM 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
PAKISTAN	Feasibility study for using ADS-B is in hand. One station was installed at ACC Karachi and evaluation is in progress.				
PAPUA NEW GUINEA	Legislation mandating ADS-B and guidelines for aircraft equipage and operational approval to be issued by 31/12/2011 with target mandatory date by mid-2015 and plans to provide ADS-B service above FL245 within Port Moresby FIR and also in specific higher traffic areas domestically.				
PHILIPPINES	One (1) ADS-B ground station in Manila ATM Center will 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 Intl Airport, promotion of surface surveillance (2014-17) In 2nd phase				

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
	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 December 2013. AIP supplement published in Nov 2013 to remind operators of ADS-B exclusive airspace implementation.	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 planned for 26th June 2014 on ATS routes L642, M753, M771 and N892; 20nm panned for end 2015	Safety case was completed end of November. 2013.
SRI LANKA	ADS-B Trials planned for 2012 and implementation in 2013. 5 ADS-B ground station was planned and willing to share ADS-B data with neighbouring States through a cenral processor which is ready for trial in 4th Quarter 2014.				An AIC on ADS-B services with TMA of Colombo FIR issued on 10 Nov. 2014 (A02/14) with effective 1 Sep. 2015.
THAILAND	Multilateration implemented in 2006 at Suvarnbhumi Int'l. Airport.				

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 have been installed in Thailand for internal research and development project. ADS-B is planned to be part of future surveillance infrastructure. New ATM System to be in operational in 2017 will be capable of processing ADS-B data.				
TONGA	Trial planned for 2017				
UNITED STATES	As of 31 March 2014, 634 radio sites had been installed; these sites cover the "baseline" set of Service Volumes planned by the FAA in 2007. Since 2007, FAA has planned and funded activities to activate additional Service Volumes that will constitute an additional 29 radio sites. Approximately 100 of the 230 U.S. air traffic control facilities are using ADS-B for ATC separation; all facilities are planned to be using ADS-B by 2019.	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	

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
				separation - dependent parallel approach 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 for whole lower and upper airspace of Ha Noi and Ho Chi Minh FIR to be completed by 2016.	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.

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TERMS OF REFERENCE

SOUTHEAST ASIA AND BAY OF BENGAL SUB-REGIONAL ADS-B IMPLEMENTATION WORKING GROUP

Terms of Reference

APANPIRG18 Conclusion 18/38 agreed to the establishment of a sub-regional ADS-B implementation Working Group in the South-East Asia area (SEA ADS-B WG) by the end 2007 to develop the ***terms of cooperation*** and an ***implementation plan*** for near-term ADS-B applications in the sub-region.

APANPIRG/22 Decision 22/34 agreed to rename the Southeast Asia Sub-regional ADS-B Implementation Working Group to "South East Asia and Bay of Bengal Sub-regional ADS-B Implementation Working Group" and tasked the new Working Group to develop a revised Terms of Cooperation and work programme in the sub-regions.

The outcome of the ADS-B Working Group will report to APANPIRG through the ADS-B Study and Implementation Task Force.

The SEA/BOB ADS-B WG shall

(a) Develop **Terms of Co-operation** which will include :

- establishing model documents for possible use by States when :
  - Agreeing to share ADS-B data, and DCPC (such as VHF radio voice communication) capability between adjoining States for various ADS-B applications (including a sample letter of agreement); or
  - Establishing ADS-B avionics fitment mandates
- identifying optimum coverage for ADS-B ground stations and associated VHF radio voice communication in the sub-regional FIR boundary areas.

(b) Develop an **implementation plan** for near term ADS-B application which will delivery efficient airspace and increased safety on a regional basis that include :

- schedule and priority dates to bring into effect ADS-B based services taking into account;
  - Timing of any equipage mandates.
  - Timing of any ATC automation upgrades to support ADS-B.
  - Timing of commissioning of any ADS-B data and associated VHF radio voice communication facilities.
- consideration of major traffic flows

(c) Coordination for implementation of the plan and identify implementation issues and solutions

Composition: The Group will be composed of experts nominated by States in the Sub-region including: Australia, Bangladesh, Brunei Darussalam, China, Hong Kong China Cambodia, India, Indonesia, Malaysia, Maldives, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam, IATA and CANSO.

Reporting: The Group will present its report to ADS-B Study and Implementation Task Force.

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LIST OF ACTION ITMES (COMPLETED ACTION ITEMS HAVE BEEN REMOVED)

No.	Subject	Forum Raised	Status / Target Date	Remarks / follow-up	Action Party
1.	Prepare a paper on the plans for and status of ADS-B data sharing between Indonesia-Malaysia	SEA ADS-B WG/4	Updated in ADS-B SITF/8 ; SEA/BOB WG/10	On-going	Malaysia
2.	To examine existing air-ground communication and surveillance capability in the boarder area between China and Myanmar and identify the need and possibility for sharing ADS-B data from potential ADS-B ground station at Lashio. (China and Myanmar has established new dataline to support voice com. between ACCs of Kunming and Yangon)	SEA ADS-B WG/6	On going ADS-B WG/10	Report status and position At ADS-B SITF/14	China & Myanmar
3.	To exam possibility of sharing ADS-B data from potential ADS-B ground station from Coco and Sittwe. The agreement on sharing will be signed by end of 2014.	SEA ADS-B WG/6	On going ADS-B WG/10	Report status and possibility Completed	Myanmar & India
4.	ATS operational letter of agreements between neighboring FIRs among South China Sea States for radar-like surveillance service (Operational agreement between Singapore and Viet Nam was signed first in Nov. 2013 and later updated in July 2014 for 30 NM separation)	SEA ADS-B WG/6	Ongoing – Reports at each meeting	Report progress	China, Hong Kong China, Viet Nam and Singapore
5.	India to coordinate with Bangladesh Maldives and Sri Lanka for ADS-B data sharing	SEA ADS-B WG/7	On-going revised target SEA/BOB WG/10	Coordination Initiated and on-going	India
6.	Harmonize process of detection bad TX for inclusion into "Blacklist"	SEA/BOB ADS-B WG/8	ADS-B SITF/14	Review and update on the monitoring mechanism	Singapore & Hong Kong China

LIST OF ACTION ITMES (COMPLETED ACTION ITEMS HAVE BEEN REMOVED)

No.	Subject	Forum Raised	Status / Target Date	Remarks / follow-up	Action Party
7.	ADS-B data sharing agreement for BOB	SEA/BOB ADS-B WG/8	ADS-B SITF/14	Report progress ADS-B SITF14	Myanmar, India
8.	Update "harmonization Framework Document" for BOB	SEA/BOB ADS-B WG/8	ADS-B SITF/14 (31 Dec. 2012)	Report progress – on going	India, Myanmar
9.	Explore possibility for installation of an ADS-B ground station on the Nicobar Islands to cover eastern gateway of BOB Sub-region (seeking alternate location nearby)	SEA/BOB ADS-B WG/8	ADS-B SITF/14	Report result of study	India
10.	In MEL not included the effect of GNSS failure on ADS-B output which should be included.	SEA/BOB WG/9		Contact Boeing and Airbus through operators	IATA and Hong Kong China
11.	Develop and implement regional collaboration project for ADS-B out operational use including data sharing in Bay of Bengal area and report on implementation progress. Status reported at WG/10		May 2015	Develop and implement sub-regional ADS-B collaboration project.	Bay of Bengal States
12.	States to advise when their ground stations can be upgraded to receive ADS-B DO260B compliant ADS-B data. A survey was conducted during ADS-B SITF/13 (Appendix E). On-going bases	SEA/BOB WG/9	On-going	Further updates the Table and report to ADS-B SITF	
13.	General ADS-B Avionics Problem Reporting Database (APRD) (being implemented)	SEA/BOB WG/9	Specification and database at ADS-B SITF/14		Hong Kong China and RSO

LIST OF ACTION ITMES (COMPLETED ACTION ITEMS HAVE BEEN REMOVED)

No.	Subject	Forum Raised	Status / Target Date	Remarks / follow-up	Action Party
14.	Examine the previous cost-benefit study to quantify the benefits and dis-benefits of the ADS-B mandate	WG/10	SEA/BOB ADS-B WG/11	Conduct the Study	Singapore, CANSO, IATA and FAA.
15.	Correspond with Philippines through an official letter to obtain firm information on their plan for ADS-B ground station deployment	WG/10	SEA/BOB ADS-B WG/11	Update the deployment plan	Secretariat
16.	Reporting and analysis processes and recommendations on the ADS-B anomalies	WG/10	ADS-B SITF/14	Prepare a Paper	Australia
17.	Provide clarification on applicability of Cir. 326 in the complexity air space	WG/10	SEA/BOB ADS-B WG/11	Prepare a Paper	Australia

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SEMINAR ON SPACE BASED ADS-B AND
THE TENTH MEETING OF THE SOUTH EAST ASIA AND BAY OF BENGAL
SUB-REGIONAL ADS-B IMPLEMENTATION WORKING GROUP
(SEA/BOB ADS-B WG/10)

Singapore, 11 – 13 November 2014

ATTACHMENT 1 TO THE REPORT

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International Civil Aviation Organization

THE TENTH MEETING OF THE SOUTH EAST ASIA AND BAY OF BENGAL SUB-REGIONAL ADS-B IMPLEMENTATION WORKING GROUP (SEA/BOB ADS-B WG/10)

Singapore, 11 - 13 November 2014

LIST OF WORKING AND INFORMATION PAPERS

WP/IP No.	Agenda	Subject	Presented by
		LIST OF WORKING PAPERS	
1	-	Provisional Agenda	Secretariat
2	2	Outcome of ADS-B SITF/13 and APANPIRG/25 on ADS-B	Secretariat
3	5	Review of Terms of Reference of the SEA/BOB ADS-B Working Group	Secretariat
4	3.6	Outcomes of the Ad-hoc Working Group on the Review of APANPIRG Conclusions relating to ADS-B	Secretariat
5	3.7	Outcome of the Ninth Meeting of South East Asia Bay of Bengal Sub-regional ADS-B Implementation Working Group (SEA/BOB ADS-B WG/9)	Secretariat
6	5	Review Action Items for the SEA/BOB ADS-B WG	Secretariat
7	4	ATC Procedures for Surveillance Anomalies	Australia
8	4	ADS-B Implementation related Issues	India
9	5	Future Focus of the Working Group	Singapore
10	3	Benefits of Cross Border ADS-B Data Sharing	Singapore
11	4	Performance of ADS-B Stations and Avionics in Singapore FIR	Singapore
12	3	Update on the ADS-B Collaboration Project in the South China Sea	Indonesia, Singapore and Viet Nam
		LIST OF INFORMATION PAPERS	
1	-	Meeting Bulletin	Secretariat
2	3.1	ADS-B and MLAT Implementation Plan in Bangladesh	Bangladesh

Attachment 2 to the Report

WP/IP No.	Agenda	Subject	Presented by
3	3.4	Update on ATC Surveillance Activities in Australia	Australia
4	4	Implementation of ADS-B in Hong Kong, China	Hong Kong, China
5	3.4	ADS-B Implementation in Sri Lanka	Sri Lanka
6	3	Update of ADS-B Activities in the South China Sea	China

LIST OF PRESENTATIONS

SP/01	ADS-B Global Coverage	Aireon
SP/02	ADS-B Everywhere	Aireon
SP/03	Satellite Payloads for World-wide Air Traffic Surveillance	Thales
SP/04	Case Study: Aireon ADS-B Out Implementing a Game Changer	Nav Canada
SP/05	Case Study: Space Based ADS-B	ENAV
SP/06	First Results of Space Based ADS-B with the GOMX-1 Satellite Mission	GomSpace
SP/07	Airservices Australia and Space Based ADS-B	Australia

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