



ICAO

*International Civil Aviation Organization*

**Fifth Meeting of the Surveillance Implementation  
Coordination Group (SURICG/5)**

Web-conference, 22 – 24 September 2020

**Agenda Item 6: Review Report of SEA/BOB ADS-B WG/15 Meeting and discuss possible options for future of SEA/BOB ADS-B WG**

**REVIEW REPORT OF SEA/BOB ADS-B WG/15 MEETING**

(Presented by Chairperson and the Secretariat)

**SUMMARY**

This working paper presents the progress achieved by the thirteenth meeting of the South-East Asia and Bay of Bengal Sub-regional ADS-B Implementation Working Group

**1. INTRODUCTION**

1.1 APANPIRG/18 in 2007 agreed to establish a South-East Asia sub-regional ADS-B implementation working group (SEA ADS-B WG) and adopted Conclusion 18/38.

1.2 The following meetings of the WG have been held:

- SEA ADS-B WG/1 15-16 November 2007 in Singapore
- SEA ADS-B WG/2 27-29 February 2008 in Bali, Indonesia
- SEA ADS-B WG/3 2-3 July 2008 in Putrajaya, Malaysia
- SEA ADS-B WG/4 9-10 February 2009 in Melbourne, Australia
- SEA ADS-B WG/5 21-22 January 2010 in Jakarta, Indonesia
- SEA ADS-B WG/6 24-25 February 2011 in Singapore
- SEA/BOB ADS-B WG/7 28-30 November 2011 in Chennai, India
- SEA/BOB ADS-B WG/8 5-7 December 2012 in Yangon, Myanmar
- SEA/BOB ADS-B WG/9 30 Oct. - 1 Nov. 2013 in Beijing, China
- SEA/BOB ADS-B WG/10 11-13 November 2014 in Singapore
- SEA/BOB ADS-B WG/11 17-19 November 2015 in New Delhi, India
- SEA/BOB ADS-B WG/12 8-10 November 2016 in Guangzhou, China
- SEA/BOB ADS-B WG/13 14-16 November 2017 in Colombo, Sri Lanka
- SEA/BOB ADS-B WG/14 7-9 November 2018 in Bangkok, Thailand
- SEA/BOB ADS-B WG/15 3-5 December 2019 in Singapore

1.3 The Fifteenth Meeting of the South East Asia and Bay of Bengal Sub-regional ADS-B Implementation Working Group (SEA/BOB ADS-B WG/15) was held at Swissôtel The Stamford in Singapore from 3 to 5 December 2019. The Meeting was hosted by the Civil Aviation Authority of Singapore (CAAS).

1.4 The meeting was attended by 41 participants from Bangladesh, Bhutan, China, Hong Kong China, India, Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand, USA, Viet Nam, CANSO, IATA and ICCAIA.

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1.5 A total of twelve (12) Working Papers, fourteen (14) Information Papers and one (1) Flimsy were considered and discussed by the meeting. The report and papers for the meeting are available at: <https://www.icao.int/APAC/Meetings/Pages/2019-SEA-BOB-ADS-B-WG15.aspx>

**2. DISCUSSION****Review of the Outcome of SEA/BOB ADS-B Implementation WG/14**

2.1 Through a secretariat paper, the meeting reviewed and updated the ADS-B implementation information, which was consolidated in the Table of *ADS-B Implementation Status in the APAC Region*, provided in **Appendix A** to this paper.

2.2 The ADS-B Data Sharing Implementation Status in the Asia/Pacific Region proposed and filled by SEA/BOB WG/14 meeting, which was reviewed by SURICG/4 meeting, and further reviewed and updated by this meeting to reflect significant development and achievements since the WG/14. The latest status is provided in **Appendix B** to this paper.

2.3 The meeting also reviewed the table of ADS-B ground stations that are able to receive Version 2 (ADS-B DO260B) compliant ADS-B data. Considering almost all ground stations having been complaint with Version 2, the meeting agreed that this historical table is no longer required for review at future meetings. (refer to Appendix B of WP04 for SURICG/5)

2.4 The meeting discussed that surveillance data to support ATFM beyond adjacent FIRs would be required however, real time of surveillance data for ATFM applications might not be that critical. Such requirement could be met by a surveillance data base.

**Implementation and co-ordination activities and issues observed**

2.5 The meeting noted the following updates and information on ADS-B implementation presented by States and ICCAIA:

- Surveillance Activities in Singapore (IP/10)
- Updates on ADS-B Implementation in China (IP/08)
- ADS-B current activities in Indonesia (IP/11)
- ADS-B Updates in Malaysia (IP/13)
- Ensuring Preparedness for the U.S. 2020 ADS-B Equipage Mandate (IP/07)
- Implementation of Space-Based ADS-B Services over Oceanic Region of Indian FIRs (IP/03)
- Space-Based ADS-B Update (IP/02)
- ADS-B Application in Beijing ATM Automation System (IP/04)
- Use of CRV for space-based ADS-B Surveillance Data distribution(IP/12)

2.6 Airports Authority of India (AAI) is planning to implement the Space-Based ADS-B to provide air traffic surveillance over entire oceanic region of Indian Flight Information Region. This information was also circulated as IP/09 at APANPIRG/30 meeting. Space-Based ADS-B data is available at Chennai and SAT 1 has been completed. The data is yet to be integrated. Next SAT 2 will be done after integration of data in Automation System by October 2020 after which, the operational use would be possible. Malaysia currently is evaluating space-based ADS-B as an alternative solution for data sharing to cover the small area of airspace within the Bay of Bengal that is without radar coverage.

2.7 Some performance issues were observed by China including duplicated aircraft addresses; mismatching on the aircraft status (airborne/on-the-ground); unavailability of Item 18 CODE/ in the flight plan and wrong Aircraft Identification (ACID) from the FMS system. China was invited to share the identified issues through the regional ADS-B database (APRD) which is available on the ICAO APAC website. China confirmed that they will input the identified issues into the database once further analysis and conclusions are made.

Recent ADS-B Avionics Issues Observed in the United States

2.8 USA provided information on four recent ADS-B avionics issues with 1090ES Version 2 systems:

- (1) Embraer 17x track jumping issue
- (2) Collins TSS 4100 Geometric Altitude Reporting as Pressure Altitude
- (3) B787 DO-260B/ED-102A track extrapolation issue
- (4) B787 NAC<sub>v</sub>=0 issue

2.9 The first three issues have been discussed at prior SEA/BOB or SURICG meetings. The cause of the first issue remains unknown, though the issue has not been observed in just over a year. The second issue is a rare condition for which a software fix has been issued by Collins.

2.10 With regard to the third issue, the State regulators of several B787 operators have still not notified the FAA that the appropriate Boeing Service Bulletin has been applied to their aircraft, per Airworthiness Directive 2017 NM 118 AD. The paper provided an updated listing of B787 operators which are listed on the FAA No Services Aircraft List (NSAL), and noted that such aircraft will not be in compliance with 14 CFR 91.225 (the U.S. ADS B mandate) after January 1, 2020. The paper reminded States of the proper procedures to have listed B787s removed from the NSAL.

2.11 The fourth issue is newly reported by the U.S. and also impacts compliance with the U.S. ADS-B mandate if not resolved. Boeing has issued guidance to B787 operators not to intermix certain Integrated Navigation Receivers (INRs) until a software fix has been implemented for the B787 Integrated Surveillance System (ISS). This guidance was provided in Boeing Multi Operator Message MOM-MOM-19-0612-01B (dated 01 Nov 2019) and Boeing Fleet Team Digest 787-FTD-34-19005 (dated Nov. 3, 2019). Boeing reported that a Service Bulletin with the ISS software fix is targeted for availability by the end of December 2019.

**India's Plan and Progress on Implementation of ADS-B Surveillance Data Sharing with Neighbouring States for Seamless ATM**

2.12 India presented information regarding ADS-B surveillance data sharing with neighbouring States, and the potential Seamless ATM benefits which was also presented to APANPIRG/30 meeting through WP/18.

2.13 ADS-B data sharing between Myanmar and India had been commissioned in 2018. A Letter of Agreement (LOA) on ADS-B data sharing was signed between Myanmar and India on 5 May 2015. As per the agreement, data from the Agartala and Port Blair ADS-B stations from India were being shared with Yangon while the ADS-B data from Sittwe and Coco Islands from Myanmar were shared with India.

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2.14 CANSO expressed congratulations for the successful implementation of data sharing between India and Myanmar and recalled that the agreement for the surveillance sharing between the two States was signed at a CANSO event in Japan few years ago. The meeting noted that Indian side is ready for ADS-B data sharing with Sri Lanka and Maldives.

2.15 The meeting noted that the ADS-B station at Campbell Bay was under installation and was not yet ready for data sharing with Indonesia and Malaysia.

2.16 The benefits for ADS-B implementation were highlighted including management of large scale deviations during monsoons, reduction of Large Height Deviations (LHDs), ATC situational awareness and improvement. As a consequence, India is ready to commence ADS-B data sharing with other States including Indonesia, Malaysia, Sri Lanka, Maldives and Bangladesh as and when possible.

2.17 An AIP Supplement had been promulgated on 25 October 2018 for mandating the carriage of ADS-B OUT equipment on all aircraft to fly between FL (flight level) 290 to FL 460 within Indian continental airspace, effective from 01 January 2020. In response to a query, India clarified that ADS-B mandate issued by DGCA India was for whole Indian airspace. ADS-B will be used for awareness purpose for the near term. Using ADS-B for reduction of separation minima would also require for air/ground COM capability such as DCPC and/or CPDLC.

**ADS-B Data Sharing between China/Myanmar & China/Laos PDR.**

2.18 China provided updates on their surveillance data sharing plan with Myanmar and Laos PDR. It was informed that more than 190 flights per day currently passing LINSO, the Entry-Exit Point between Kunming and Yangon FIR and 160 flights per day passing SAGAG, the Entry-Exit Point between Kunming and Vientiane FIRs. China considered to build several passages including multiple parallel air routes of Kunming-Myanmar, Kunming-Laos which would realize the separation of air flows and meet the increasing traffic demand passing through these areas.

2.19 Kunming FIR is provided with 56 ADS-B ground stations, 5 of which are able to provide coverage for the boundary areas between China/Myanmar and China/Laos PDR. A level-2 ADS-B Data Processing Center (ADC) has also been commissioned for collecting all ADS-B ground stations data within Kunming FIR, verifying and fusing the ADS-B data, and providing real and reliable ADS-B data output. The ADC could customize the output of each version of ASTERIX CAT021 (such as V0.26, V1.4, V2.1), and could define the output data for specific airspace for the data users. Currently the ADS-B data from ADC is used by Kunming's ATC automation system and fused with radar data for track calculation.

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

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

2.21 Myanmar informed the meeting that the ADS-B ground station and surveillance data processor at Lashio will be installed by the end of February 2020 then Myanmar will be ready for further discussion on surveillance data sharing with China in March 2020.

### **Outcome of Ad Hoc Groups on South East Asia (SEA) and Bay of Bengal (BOB) projects**

2.22 The meeting reviewed the reports on the Sub-regional ADS-B implementation plan/projects presented by SEA and BOB Ad Hoc working groups (Singapore was Rapporteur for SEA while India was for BOB). The discussions were based on the outcome of previous meetings of the SEA/BOB ADS-B WG/14 and information made available to the meeting. The outcome of discussions by Ad Hoc groups is provided in **Appendix C1** and **Appendix C2** to this paper which could serve as a basis for further development of the sub-regional implementation plans and follow-up actions for coordination by States/Administrations. States/Administrations concerned were urged to take follow-up actions to achieve early implementation of the identified projects. The Ad Hoc working groups had also consolidated information on the ADS-B data sharing projects in **Appendix B**.

2.23 The meeting appreciated the updates including some new projects on data sharing made by both Ad Hoc working groups led by Singapore and India. The meeting urged India, Bangladesh, Sri Lanka, Maldives, China and Myanmar for negotiation on MOU as soon as possible in order to progress implementation of ADS-B surveillance data sharing among States as early as possible.

### **Update on ADS-B Avionics Problem Reporting Database (APRD)**

2.24 Hong Kong China updated the meeting on the latest status of ADS-B Avionic Problem Reporting Database (APRD) after its deployment in ICAO APAC web site in 2017. The APRD could contain useful information of generic ADS-B avionics performance problem commonly encountered in the Region as well as specific avionics issues that States/Administrations need to pay attention during the ADS-B Implementation. However, the usage of APRD by States/Administrations appears to be low since its deployment. States/Administrations were encouraged to make best use of the database to improve the quality of avionics equipage in ADS-B mandated airspace, report and share avionics issues. APRD direct link: <https://applications.icao.int/ADSB-APRD/login.aspx>

2.25 The States/Administrations, which have yet registered for APRD, to nominate point of contact to ICAO Regional Office for accessing the APRD. States/Administrations were also urged to report problems of ADS-B avionics and sharing of experience through the APRD.

### **1090MHz Spectrum and 24-Bit Address Issues with UAS**

2.26 The secretariat presents a brief summary on regional activities on 1090 MHz spectrum and 24-bit aircraft address issues associated with unmanned aircraft. The meeting noted the topic was firstly presented to the region by Chairperson of the ICAO Surveillance Panel (SP) on APAC Aeronautical Surveillance Workshop in November 2018, further discussed in SEA/BOB ADS-B WG/14 through Working Paper 07 *Address and Spectrum Issues for Small UAS* and developed Draft Conclusion 14/02 – Small UAS Cooperative Surveillance Equipage which was adopted by CNS SG/23 meeting through Conclusion CNS SG/23/11.

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2.27 The meeting noted that on 8 November 2019, ICAO issued a State Letter on the Subject: 1090 MHz spectrum issues and proper management of 24-bit aircraft addresses associated with unmanned aircraft operating exclusively at very low level, Ref.: SP 44/2 - 19/77. ICAO member States are urged to note the ongoing ICAO initiatives to ensure the continued safe and reliable operation of aeronautical surveillance systems, and encouraging State to make use of the guidance material enclosed in the letter.

2.28 USA informed the meeting, in some congested airport, use of ADS-B and 24-bit aircraft address for the airport surface vehicles is not feasible. China informed the meeting that only 10 vehicles are assigned with ICAO 24-bit aircraft addresses at Da Xing airport in Beijing hence no problems had been observed so far. Singapore informed meeting that the Surveillance Panel is studying for a solution to those States with high volume of aircraft and traffic but with limited number in the current allocation scheme.

**High Precision Timing on ADS-B**

2.29 Singapore presented the usefulness of high precision timing in ADS-B messages for anti-spoofing purposes. Anti-spoofing can be done in a variety of ways. First method is to verify the ADS-B position against that reported by a “Wide Area Multi-lateration System”. Second method is to perform reasonableness check by checking the ADS-B reported position against the one using TDOA from two or more ADS-B stations from the same manufacturer. Third method is to perform reasonableness check by checking the ADS-B reported position against the one using TDOA from two or more ADS-B stations from different manufacturers. However, in this case, there is a need to perform a correction at the time stamping. After correction, the error on the TDOA position will be about 1.6nm, which is relatively large. However, it is still useful for anti-spoofing purposes. Even with a stand-alone receiver, it is possible to use dead-reckoning to determine whether the reported position is reasonable.

2.30 It was concluded from the examples given that high-precision time-stamping is key to TDOA for verification of ADS-B reported position. States are hence urged to request that high-precision timing field I021/074 of the ASTERIX CAT 21 be filled when purchasing ADS-B receivers.

**Mitigation of Spoofed/False ADS-B Reports**

2.31 India introduced a feasible concept and schematic for mitigating the effect of spoofed ADS-B reports on ATM Automation System which would enhance the civil aviation safety. It requires some research & development work regarding algorithms. Validated ADS-B reports are authentic and the integrity of the report will depend on NUC value only.

2.32 Spoofing of tracks becomes very dangerous when the unreal tracks with similar characteristics are flooded to ATM Automation system. To make ADS-B system spoofing proof, there are two techniques / concepts or schematics.

- a) First one is based on TDOA (time difference of arrived signal). It requires minimum 4 Ground receivers, geographically separated as per requirement, number of data links and one central processor for calculating distance and direction of the RF source to validate the real track. However, this technic is considered quite expensive; and
- b) The other one technique / concept is integrating UHF direction finder with ADS-B ground receiver using an external server with algorithms for validating the real track and transmitting ASTERIX CAT. 21 Data to ATM Automation System for ATM purpose.

2.33 Some States mentioned that no spoofed reports had been received yet. Back up procedure control might be used in case of flooding spoofed data received. Cost and benefits should also be put into consideration for the solution.

### **Oceanic Procedural Airspace Transition to Enroute Surveillance Airspace**

2.34 Singapore and Aireon (*a member of ICCAIA*) jointly presented the technology changes and discussed a way in which Oceanic Air Traffic Control could become the same or very similar to Air Traffic Control as used in continental surveillance airspace.

2.35 The surveillance technology is now operationally available and the achievement of this transition now depends on the improvement in pilot to ATC communication.

2.36 ICAO will examine and likely develop a separation standard for DCPC type of Satellite voice communication and ADS-B. Whilst satellite voice communication is not yet used as sole communications method to support 5 NM separation, increasing performance, reliability and capability is expected to lead towards this objective.

2.37 Singapore and Canada have successfully demonstrated delivery of satellite voice calls to the ATC sector responsible for the flight, as well as ATC initiation of calls to aircraft.

2.38 The eventual consequences of such a transition would lead to harmonization of Continental and Oceanic airspace resulting in

- Saving for airlines, as efficiencies of enroute procedures were brought to Oceanic Airspace. Capacity increases would be provided; and
- Removal of the need for separate “*Oceanic systems*”. This has already occurred in most Asia Pacific States. This will reduce hardware/software maintenance costs and potentially any remnant organizational silos.

2.39 The meeting reiterated the support to the Conclusion of APANPIRG/30/13 on the same subject. Consequently, the meeting urged States to review the use of new technologies to improve ATM and encouraged States/Administrations further evaluate satellite voice communication operational use scenarios and ICAO is invited to develop the relevant standards in this connection.

### **Space-based ADS-B and supporting Long Range Communications**

2.40 Singapore informed the meeting that Singapore had received the space-based ADS-B data from Aireon and had conducted flight checks. It was observed that using 125W transponder, the average Probability of Detection (based on 8 second update rate) is approximately 92%. As for commercial aircraft (with a transmitting power of around 200W), the Probability of Detection (based on 8 second update rate) is observed to be approximately 99%.

2.41 Singapore also shared with the meeting on the long range communication that can potentially be used with space-based ADS-B. With VHF, separation may be reduced to 5nm and 3nm. With CPDLC, separation can be reduced to 14nm. ICAO is currently evaluating the use of SATVOICE for radar-like separation. If space-based VHF is made available, radar-like separation may be applied.

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2.42 It was also noted that the ITU World Radio Conference in 2019 (WRC-19) had approved an agenda for allocation of frequency for space-based VHF (i.e. allowing VHF to be used in space) to be included for next WRC in 2023. Trials and evaluation will be carried out between 2019 to 2023.

2.43 Singapore also provided information on on-going developments of High-Altitude mobile stations and information on wide Band HF which might achieve RCP240 as estimated by the industry without provision of strong justifications.

2.44 Upon a query, it was clarified that no difference in accuracy between the data derived from ADS-B ground station and those received from space-based ADS-B as both are the same position report broadcasted by aircraft. However, initially, there were some error data indicating high-jack received from space-based ADS-B reports while actually no such data had been sent from aircraft. Regarding ADS-B data reports delay, the data from space-based ADS-B reports would take slightly longer deliver time than those from local ADS-B stations however, such data sometimes received earlier than those received from remote ADS-B stations via VSAT.

**Demonstration on spaced based ADS-B data and DCPC SATVOICE trials**

2.45 The meeting appreciated a brief demonstration presented by Singapore on the ADS-B data derived from space- based ADS-B and the audio recording of HF, VHF and DCPC type of SATVOICE conversations between ATC controllers and pilots for voice quality comparison. A processing server can filter the ADS-B data for the specified airspace for display or for onwards transmission to another user.

**Improvements in Spaced-based ADS-B Performance following Singapore iSAT**

2.46 Reference to PTT presentation of the results of flight check using 125 watt transponder (reduced to 125-watt minimum transmitting power) at iSAT Singapore (see the above paragraph 2.40). Improvement has been made by Airoen to enhance the probability of detection. A new flight testing will be conducted with CAA. Singapore to confirm.

**ADS-B data sharing with Space-based ADS-B**

2.47 ICCAIA (Aireon) introduced the concept of some alternatives for ADS-B data sharing using space-based ADS-B. The adjacent FIRs can share traffic information derived from space-based ADS-B. One way would be ANSP FIR1 send part or all of its Space based ADS-B data to FIR 2 if suitable contractual arrangements can be agreed with the supplier. Another possibility is to consider a number of ANSPs as a single “consortium” and the space-based ADS-B service provider could provide a consolidated ADS-B data to each member of the consortium. In response to a query, ICCAIA confirmed that it could provide space-based ADS-B data to its customers (ANSPs) as and when it received the relevant data or at any interval without any additional cost. It could also supply to any of its customers the ADS-B reports received from aircraft within 100 NM outside the customer’s FIR boundaries at no extra cost.

2.48 In response to a query, ICCAIA confirmed that when setting up a space based service, the customer can choose (at no extra cost) whether the Aireon data is sent:

- a. As it is received (called event driven) or
  - b. On a periodic basis
- These modes are described in ED129B

2.49 The meeting noted the proposed options and considered necessary to keep multi-layer of surveillance services to increase performance reliability at current stage.

### **Emerging ADS-B Development and Potential Data Sharing collaborations**

2.50 Singapore discussed how new technology can be used to help improve ADS-B coverage and/or provide additional layer(s) of surveillance services and other possible data sharing collaborations.

2.51 High altitude mobile stations (or high altitude unmanned aircraft) are being developed by various parties, including Loon, Thales and Airbus. Such stations are able to carry payloads to a height of 20km or more, over quasi-fixed locations. If ADS-B receivers are mounted on such platforms, ADS-B coverage can potentially be up to 420nm or more. Unlike space-based ADS-B which require many satellites to cover a particular area due to its orbit, high altitude mobile stations -based ADS-B only require minimal number of stations if the area to be covered is not too huge. The high altitude mobile stations-based ADS-B can form another surveillance layer, in addition to those of terrestrial and space-based ADS-B. These surveillance layers can back up each other to enhance the availability of surveillance data.

2.52 In addition to the usual benefits of situation awareness and minimizing large height deviations, the data may be used to enhance Air Traffic Flow Management (ATFM). These emerging technologies may be harnessed to enhanced ATM and surveillance services.

### **Possible ADS-B data sharing Collaborations**

2.53 Following the Conclusion CNS SG/23/10 (SURICG/4/1) - ADS-B and Flow Management, there is a need to share surveillance data to provide surveillance from “departure to destination”. One possible way to achieve it is to set up one or more centralized ADS-B data bases to collect such data from States who are willing to contribute the data. Contributing States will be allowed to retrieve the data in accordance with the governance rules. Alternatively, surveillance data could be shared among a group of States via System Wide Information Management (SWIM). It is possible for a few States to share ADS-B data in a multi-lateral manner instead of the current bi-lateral arrangement. Under this concept, a few States will make available their ADS-B data for other contributing States to access via SWIM.

2.54 Similar to the CRV procurement process, States from a region may collectively procure space-based or high altitude mobile station-based ADS-B data. Each of these States will receive the data of the entire region and sieve out whatever it needs. Without such collective procurement, sharing of space-based or high altitude mobile station-based ADS-B data with other states may require commercial arrangements with the respective data service providers.

2.55 Open data sharing, i.e., multi-lateral collaboration instead of the current bi-lateral collaboration, may be required to support new ATM applications such as ATFM.

2.56 States/Administrations were encouraged to consider the applications of various technologies to provide alternative ADS-B services and consider open data sharing to support new ATM applications in the near future.

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**Review Action Items and ToR of the WG**

2.57 The Secretariat presented the current TOR of the SEA/BOB ADS-B Implementation Working Group for review by the meeting. The meeting recalled the discussions on the future focus of the working group at the previous meetings of the WG. The meeting also reviewed current action items resulted from the previous meeting as part of its work programme of the Working Group. The meeting closed 5 action items and keep three outstanding action items. The potential actions items derived from the proposed amendment to the TOR of SEA/BOB ADS-B Working Group and the proposed TOR of the regional ADS-B Working Group is also included into the list of action items for consideration by SURICG. The consolidated list of task/action items is provided in **Appendix D** to this paper.

**Achievement and future of SEA/BOB ADS-B WG**

2.58 The meeting reviewed and discussed the paper jointly presented by Singapore, CANSO and the Secretariat. The meeting recalled that the SEA ADS-B WG was established by APANPIRG in 2007 through APANPIRG conclusion 18/38. In 2011, SEA ADS-B WG was renamed as SEA/BOB ADS WG. The meeting reviewed the achievements of the working group as listed below:

- a) Producing the cost sharing framework;
- b) Producing the draft data sharing agreement;
- c) Producing the templates for ADS-B mandates;
- d) Working out the sub-regional implementation plan;
- e) Harmonization of avionics requirement;
- f) Successful implementation of data sharing;
- g) Reduction of separation from Singapore to Hong Kong China; and
- h) Implementation of the ADS-B Avionics Problem Reporting Database;

2.59 The meeting discussed next step and the possible future work for the ADS-B WG including a number of new tasks identified in the proposed amendment to TOR. These new items include required harmonisation for a regional ADS-B mandate for upper airspace; studying and contributing to drafting of standards by RTCA, EUROCAE and ICAO Panels; and promotion of open sharing ADS-B data via a regional data base and/or SWIM over CRV.

2.60 The meeting further reviewed the proposed amendment to current TOR to incorporate the above added items in **Appendix E** to this paper. The meeting also discussed whether the SEA/BOB ADS WG should be closed and a new working group – regional ADS-B working group be established to deal with identified new subject/works specified in the TOR provided in **Appendix F** to this paper. The meeting further considered an option to merge the work of the working group into work programme of SURICG. The meeting discussed benefits and cost of each option. The member States which participated in meeting expressed their preference for one of the following options:

- a) Close SEA/BOB WG and transfer remaining tasks to SURICG:  
Supported by: Malaysia, China, Hong Kong China and Myanmar;  
(only one meeting per years – six-month interval, efficiency concerns)
- b) Continue SEA/BOB ADS-B Implementation WG:  
Singapore; Indonesia; Bangladesh; Bhutan; India (small groups more effective for discussions and focusing ADS-B related deliverable)

- c) Establish a new regional dedicated ADS-B WG meeting:  
Thailand; Viet Nam prefer for establishment of a new group to deal with ADS-B related matters including the surveillance data sharing.

2.61 As a result, the meeting agreed to bring the outcome of discussions for consideration by the SURICG for a decision on the way forward as some of members States of SEA/BOB ADS-B WG were not present at this meeting.

### **3. ACTION BY THE MEETING**

3.1 The meeting is invited to review and further update the ADS-B implementation status and ADS-B data sharing in the APAC region provided in **Appendix A** and **Appendix B** to this paper.

3.2 The meeting is invited to note the activities and efforts made by SEA/BOB ADS-B WG including the outcome of discussion by Ad Hoc groups provided in **Appendix C** to this paper.

3.3 The meeting is invited to review the action items from SEA/BOB ADS-B WG/15 provided in **Appendix D** to this paper, the amended TOR of SEA/BOB ADS-B WG provided in **Appendix E** to this paper, the newly proposed TOR for a regional ADS-B WG provided in **Appendix F** to this paper, and take appropriate action on the options in paragraph 2.60 of this paper.

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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
<b>AFGHANISTAN</b>	ADS-B & Multi Lateration system installed.				subject to safety assessment
<b>AUSTRALIA</b>	<p>A total of 50 ADS-B ground stations and 28 WAM stations are operational (Total 78)</p> <p>ATC readiness since 2004 ADS-B data sharing with Indonesia operational since 2/2011.</p> <p>ADS-B data sharing planned with PNG</p> <p>ASMGCS using multilateration and ADS-B is operational in Brisbane, Sydney, Melbourne and Perth</p> <p>An additional 10 ADS-B ground stations are planned in the 2019-2020 period.</p> <p>November 2016 – ADS-B converted to “radar like” Cat 48 for use in Melbourne Terminal Area and Perth Terminal Area in early 2017.</p> <p>CMATS replacing the current ATM system is expected to be fully operational in 2022 period.</p>	<p>2009/effective date of mandating in upper airspace 12/12/2013.</p> <p>An ADS-B mandate for all IFR aircraft applies from 2/2017.</p> <p>Some limited exemptions for foreign registered aircraft and some private operations.</p>	All airspace for IFR aircraft from 2/2017	<p>2.5NM, 3NM and 5 NM surveillance separations.</p> <p>3/2016 - Manual of ATC updated to include 3 nautical mile separation using ADS-B in terminal control unit.</p> <p>3/2017 – 2.5NM separation authorized using ADS-B when also used with radar.</p> <p>Vectoring allowed using ADS-B</p> <p>Precision Runway Monitoring for Sydney WAM</p>	<p>WAM is operating in Tasmania since 2010 with 5 NM separation service.</p> <p>WAM is also operating in Sydney for 3 NM separation service in TMA and for precision runway monitoring function.</p> <p>CASA is investigating the use of reduced specification ADS-B avionics to support ADS-B IN and ATC situational awareness.</p>
<b>BANGLADESH</b>	<p>Bangladesh has a plan to install four ADS-B ground stations to be installed at Dhaka, Cox’s Bazar, Saidpur and Barisal Airports by 2019.</p> <p>ADS-B data will be integrated with new ATM system at Dhaka.</p> <p>Bangladesh has also a plan to install MLAT stations to provide surface movement control at HSIA, Dhaka as well as TMA coverage as a backup and complimentary RADAR coverage to the Dhaka MSSR.</p>				Bangladesh is willing to share ADS-B data with neighbouring States to enhance the safety and surveillance capability in the sub-region.

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
<b>BHUTAN</b>	ADS-B ground infrastructure feasibility study will be completed in the middle of 2020.	Equipage mandate will be issued once after the completion of feasibility study.			
<b>BRUNEI DARUSSALAM</b>	<p>5 ADS-B ground stations with WAM functionality installed in 2015 and full operation in October 2016. ADS-B/WAM data are fused with radar data in the TopSky ATC Automation system (Thales) to enhance full radar surveillance coverage for Brunei Darussalam.</p> <p>Memorandum of Understanding (MOU) on ADS-B data sharing with Singapore and Brunei Darussalam is expected to sign in April 2019.</p>				
<b>CAMBODIA</b>	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.				
<b>CHINA</b>	<p>5 UAT ADS-B stations are used for flight training of CAFUC. The upgrade to 1090ES ADS-B stations project has already started in 2017, and the project is planned to finish by 2022.</p> <p>308 ADS-B stations nationwide have already finished installation and SAT by the end of 2018.</p> <p>4 ADS-B stations operational in Sanya FIR since 2008.</p> <p>Chengdu-Jiuzhai and Chendu - Lhasa route with 9 ADS-B stations.</p> <p>9 ADS-B stations deployed on the routes H15 and Z1 by the end of 2015.</p> <p>19 ADS-B stations at the small airport.</p>	The trial operation capability will be achieved by early 2019, and ADS-B operation will be implemented in the national airspace on October 1, 2019.			

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
<b>HONG KONG CHINA</b>	<p>A larger-scale A-SMGCS covering the whole Hong Kong International Airport put into operational use in April 2009.</p> <p>Data collection/ analysis on aircraft ADS-B equipage in Hong Kong airspace conducted on quarterly basis since 2004.</p> <p>ADS-B trial using a dedicated ADS-B system completed in 2007.</p> <p>ADS-B out operations over PBN routes L642 and M771 at or above FL 290 within HK FIR was effective in December 2013 and within HK FIR at or above FL 290 has been effective since December 2016.</p> <p>ADS-B ground station infrastructure completed in 2013.</p> <p>ADS-B signal provided by Mainland China to cover southern part of Hong Kong FIR commenced in 2010 and has been put into operational use after commissioning of the new ATMS since November 2016.</p>	AIP supplement issued on 29 Aug 2014 with 8 Dec 2016 as effective date.	HKFIR at or above FL290	5NM surveillance separation	Fully implemented ADS-B in HKFIR by phased approach to ensure safe and smooth integration of ADS-B into the Air Traffic Management System to provide aircraft separation service since November 2018.
<b>MACAO, CHINA</b>	Mode S MSSR coverage available for monitoring purposes.				Airspace – ATZ only
<b>DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA</b>	ADS-B has been used as back-up surveillance of SSR since 2008.				
<b>FIJI ISLANDS</b>	ADS- B /multilateration ground stations installed. Situations awareness service provided in 2013.	ADS-B mandate commencing from 31 <sup>st</sup> December 2013	Mandate for domestic registered aircraft.		

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
<b>FRANCE</b> <i>(French Polynesia)</i>	ATM system is ready for ADS-B sensors/Installation of 5 first GS expected at beginning of 2017. 2 <sup>nd</sup> stage with implementation of 7 GS and associated VHF coverage.			5 NM for airspace under coverage.	
<b>INDIA</b>	<p>ASMGCS (SMR + Multilat) is operational at Delhi, Mumbai, Chennai, Kolkata, Bangalore, Hyderabad, Jaipur, Amritsar, Lucknow, Ahmedabad and Guwahati Airports.</p> <p>ASMGCS(SMR+MLAT) proposed at Cochin and Bhubaneswar (VOCI&amp;VEBS) Expected to be completed by December 2019.</p> <p>ADS-B Ground Stations were installed at 21 locations across continental airspace and including Oceanic airspace at Port Blair. Installation of 10 more ADS-B Ground stations was completed.</p> <p>ATM automation systems at 22 ATC Centres are capable of processing ADS-B data and provide the information on Display.</p>	AIP supplement issued on 17 <sup>th</sup> April 2014 with effective date of implementation from 29 <sup>th</sup> May 2014.			<p>ADS-B in India to provide redundancy for radar and filling the surveillance gaps.</p> <p>ADS-B data trial operations commenced in 2015 in both Non-radar and radar environment, in En-route &amp; Terminal phases of flight for ATC purposes.</p> <p>AIP SUP 18 of 2014 issued</p> <p>ADS-B based APP approved at VOCL and VOCB</p>
<b>INDONESIA</b>	<p>All 30 ADS-B ground station have been met with DO260B in November 2019;</p> <p>The 18 new ADS-B ground stations, with DO260B capability, will be established to cover the traffic in terminal and area. The schedule of completion is in 2Q2020 for 7 ground stations, and in 4Q2020 for 11 ground stations.</p> <p>The ADS-B ground stations will be integrated to 12 locations of ATC systems in Indonesia accordingly.</p>	<p>Date of Issue &amp; Nr: 25 May 2017 AIP Supplement 18/17 ADS-B Implementation in Indonesia,</p> <p>Effective date on 20 July 2017.</p>	<p>Indonesia mandated ADS-B equipage in class A airspace, particularly from FL290 up to FL600, since 1<sup>st</sup> January 2018. SFC up to FL290 ADS-B transmitting equipment is</p>	Using 5 NM separation standard.	<p>ADS-B data sharing had been conducted by Indonesia with Australia and Singapore.</p> <p>LOA of collaboration in ADS-B data sharing has been achieved with India.</p>

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
			<p>remained optional.</p> <p>ADS-B will be mandated to all transport aircraft category flying at all level (SFC up to FL600) in 2 ACCs and particular TMAs in 2020.</p>		<p>LOA of collaboration in ADS-B data sharing are under reviewing by Malaysia, Philippines and PNG.</p>
<b>JAPAN</b>	<p>Multilateration Systems for surface monitoring have been implemented at eight airports</p> <p>PRM (WAM) has been implemented at Narita Airport.</p> <p>En-route WAM system is manufacturing and will be put into operation in FY2018</p> <p>Plan to evaluate accuracy of ADS-B information under RAD condition.</p>				
<b>LAO PDR.</b>	<p>2 ADS-B ground stations were installed in Vientiane and Luangprabang Int'l Airport in 2015 and the ADS-B data is fused with MSSR data target in the ATM Automation system.</p> <p>3 additional ADS-B ground stations (DO-260B compliant) will be completed the installation at existing MSSR sites (Xiengkhouang, Savannakhet and Champasack) by 2016 to Q1 of 2017 to enhance the full ADS-B coverage of Lao FIR.</p>				

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
<b>MALAYSIA</b>	<p>Ground Infrastructure: Kuala Lumpur FIR: 1. Installation of two (2) ADS-B GS in Langkawi and Genting has been completed in October 2017. 2. Upgrading of Kuala Terengganu ADS-B for ADS-B Version 2 capability is to be completed at the end of Sept 2019. 3. Operation of all three ADS-B in new Kuala Lumpur ATC System is to be completed in Sept 2019.</p> <p>Kota Kinabalu FIR: Four (4) new ADS-B will be installed in Kuching, Bintulu, Kota Kinabalu and Sandakan, to be completed in 2019.</p> <p>Implementation Plan: Phase 1: ADS-B services on specific ATS routes and Flight Levels within Kuala Lumpur FIR, target commencement date 31/12/19.</p> <p>Phase 2: ADS-B as secondary means of surveillance within the Kuala Lumpur FIR for en-route airspace. Target date: end of Dec 2022.</p> <p>Phase 3: ADS-B used as the primary means of surveillance for en-route airspace. (TBA)</p>	AIC Issued on September 2017.	Phase 1 (31/12/19) On ATS routes N571, P628, L510, P627, L645 and P574 at FL 290 to FL 410 within Kuala Lumpur FIR	ICAO approved surveillance separation.	
<b>MALDIVES</b>	<p>4 ADS-B stations installed in Nov. 2012 (2 at Male' Ibrahim Nasir Intl Airport, 1 at Kulhudhuffushi Island in the North and 1 at Fuah Mulah Island in the South to cover 95% of the FIR at/above FL290.</p> <p>Maldives' ADS-B is integrated with the ATM system (in November 2013), and under observation prior to commencing trials.</p> <p>Maldives has planned to share ADS-B data with its adjacent FIRs. Updated by email</p>				Seaplane in Maldives equipped with ADS-B for AOC purpose. These seaplanes have ADS-B IN functions as well.

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

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	part of Myanmar closed to the China-Myanmar border near the LINSO transfer point on A599 ATS route. After the installation finished, the ADS-B data sharing process can be proceeded between Myanmar and China.				
<b>NEPAL</b>	ADS-B feasibility study conducted in 2007.				
<b>NEW CALEDONIA</b>	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.				
<b>NEW ZEALAND</b>	<p>MLAT and ADS-B data is being used from the WAM system centred in the Queenstown area to provide surveillance coverage and surveillance separation (5 NM) over the southern half of the South Island of New Zealand.</p> <p>MLAT and ADS-B data from the Auckland MLAT system is used to support surface movement control at NZAA (Auckland).</p> <p>The New Zealand Navigation and Airspace and Air Navigation Plan “New Southern SKY” was issued in May 2014</p> <p>34 ADS-B ground stations have been installed.</p>	<p>New Zealand introduced the following ADS-B OUT mandate as follows: ADS-B OUT equipment requirement for all aircraft operating in NZZC FIR controlled airspace above FL 245 from 31 December 2018</p> <p>New Zealand has plans to introduce the following ADS-B OUT mandates: ADS-B OUT equipment requirement for all aircraft operating in any controlled airspace within the NZZC FIR from 31 December 2021.</p> <p>Since July 2018 all new aircraft registered in New Zealand, or any currently registered aircraft upgrading transponder(s) are</p>	All controlled airspace within the NZZC FIR above FL245	5 NM surveillance separation in en-route controlled airspace, and 3NM surveillance separation in terminal controlled airspace – where surveilled.	

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
		<p>required to install DO260B transponder(s) which meet the relevant NZCAA rule set.</p> <p>The Rule specifies the minimum Technical Standing Orders (TSO), or transponder GNSS receiver models for position input into ADS-B.</p>			
<b>PAKISTAN</b>	<p>Tender for procurement of 5 ADS-B stations issued to be installed at Pasni, Lakpass, Rojhan, Dalbandin and Laram-top. Contract expected to be finalized by end of 2016. These stations will be DO260B compliant and operational by end of 2017.</p>				
<b>PAPUA NEW GUINEA</b>	<p>Initially 7 ADS-B sites to be deployed across PNG to provide seamless coverage above FL285.</p> <p>Three (3) sites installed as of December 2017. Two (2) of these are operational. First site to be installed May/June 2017, with remainder to be completed in 2018.</p> <p>Additional 7 sites to be rolled-out in the 2018/19 timeframe. Site location will be dependent on infrastructure, security and an analysis of Phase 1 site performance.</p> <p>PNGASL (ANSP) will commence a transition to new ATM automation system in May 2018.</p> <p>The system will support fusion of ADS-B and RADAR data.</p> <p>5 mile separation to be provided using ADS-B and fused ADS-B/Radar from May 2018.</p>	<p>An ADS-B mandate is on CASA PNG roadmap, however legislation yet to be developed.</p> <p>The Australian mandates will largely drive equipage for overflights (e.g. East-Asia to Australia/South Pacific).</p> <p>Expectation is that PNGASL (the ANSP) will lead development of ADS-B mandate framework.</p> <p>Initial steps may include mandate above F245 – but will depend on performance of Phase 1 ADS-B deployment. Country-wide mandate not</p>	None	<p style="text-align: center;"><b>Air Traffic Control</b></p> <p><u>Approach/ Arrivals</u></p> <p>2018 – 5NM 2019 – 3NM (approach)</p> <p><u>Upper Airspace (&gt;FL245)</u></p> <p>2017/18 – Situational awareness.</p> <p>2018/19 – 5NM</p> <p>Note: Implementation dictated by training requirements and new ATM system transition priorities.</p>	

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
	From 2018 onwards, PNGASL will be looking to share ADS-B data with Indonesia and Australia.	envisaged before 2021/22.		<b>Flight Service</b>  <u>Directed Traffic (FIS)</u>  2019 – Situational awareness	
<b>PHILIPPINES</b>	<p>One ADS-B GS installed at the Manila ATM Center for situational awareness.</p> <p>One ADS-B Ground Station installed at Bataraza, Palawan for data sharing with Singapore.</p> <p>Additional ground stations are planned to be installed in Laoag Airport, Iba Zambales, Jomalig Island, Puerto Princesa Airport, Mt. Majic Mactan, and General Santos “Tambler” Airport.</p>				
<b>REPUBLIC OF KOREA</b>	<p>Currently, MLAT/ADS-B are being used for surface monitoring and situation awareness at some airports.</p> <p>For enroute surveillance , additional installation of 10 ADS-B Ground stations is now in progress. It will be completed by December 2019.</p> <p>95% of Korean national carriers are equipped with ADS-B Out transponder as of 2018.</p>	After trial operation in the first half of 2020, time for equipage mandate will be decided.	After trial operation in the first half of 2020, the scope of application will be decided .	After trial operation in the first half of 2020, separation criteria will be decided.	
<b>SINGAPORE</b>	<p>The airport MLAT system was installed in 2007 and “far-range” ADS-B sensor was installed in 2009.</p> <p>ATC system has been processing ADS-B data since 2013.</p>	<p>AIC was issued on 28 December 2010/effective from 12 Dec.2013.</p> <p>AIP updated in May 2018 to reflect the ADS-B equipment certified as meeting:</p> <p>a. EASA - (AMC 20-24), or</p> <p>b. EASA CS-ACNS</p>	L642 and M771. At and above FL290. Also affect the following ATS routes N891, M753, L644 & N892	<p>40nm on ATS routes L642, L644, M753, M771, N891 and N892</p> <p>30nm implemented on 26th June 2014 on ATS routes L642, M753, M771 and N892;</p> <p>20nm implemented on</p>	Safety case was completed end of November. 2013.

State/ Administration	ADS-B Ground Infrastructure and ATC System readiness or Implementation plan	Date of issue/ effectiveness date of equipage mandate	Mandated Airspace and/or ATS-routes	Intended separation criteria to be applied	Remarks
		<p>(Subpart D - Surveillance - SUR), or</p> <p>c. FAA - Advisory Circular No: 20-165A (or later versions), or</p> <p>d. The equipment configuration standards in Appendix XI of Civil Aviation Order 20.18 of CASA.</p>		10 Nov 2016 on ATS routes L642, M771, M753 and N892	
<b>SRI LANKA</b>	<p>Total of 5 ADS-B Ground Receiving Stations and 01 Central Processing Station have been installed in March 2017. ADS-B Data is fused with Multi-sensor Data, including MSSR and ADS-C in the ATM system at Colombo ACC Ratmalana was launched for operational used on 15 Nov. 2017. New ATM system planned for operational at APP Centre in 2018 will also be capable of fusing Multi-sensor Data, including MSSR and ADS-B</p>	<p>Revised Date of Equipage mandate would be 31st Dec 2020.</p> <p>Ref: AIC A02/16 (Initially AIC A02/14 was issued in November 2014)</p>	All ATS Routes within Colombo TMA	Initially 5 NM within Approach Radar Coverage, 8 Nm within Area Radar Coverage & Procedural Separation minima outside Radar Coverage.	On completion of a safety assessment, use of ADS-B alone for ATC separation purposes.
<b>THAILAND</b>	<p>Six ADS-B ground stations (DO-260B compliant) have been installed since 2015 for the research and development purpose. Installation of more ADS-B ground stations to provide coverage in terminal and airport areas is being assessed.</p> <p>The MLAT system have been implemented at VTBS and VTBD. At VTSP and VTCC, MLAT systems are being installed with expectation to be operational in 2020.</p> <p>Multiple surveillance sensor data such as Mode-S SSR, ADS-B, MLAT and WAM are integrated into the new ATM systems and expected to be operational in early 2020.</p>	Aircraft equipage mandate is expected to be issued in 2021 with the expected target effective date in 2026.			

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
	The ATS surveillance data sharing with the adjacent FIRs was approved in principle in October 2018.				
<b>TONGA</b>	Trial planned for 2017				
<b>UNITED STATES</b>	The “baseline” set of Service Volumes planned by the FAA in 2007 have been operational since 2014, 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 2 of these Service Volumes are operational as of 1 March 2019. As of 1 March 2019, 201 of the 225 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 the end of 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  - independent parallel approach operations down to 3600 ft centreline separation  - dependent parallel approach operations down to 2500 ft centreline separation (currently 1.0 nm diagonal distance).	The U.S. has implemented integrated WAM/ADS-B in the following terminal areas: Charlotte LAX  Implementation of integrated WAM/ADS-B is being considered for additional U.S. terminal areas.
<b>VIET NAM</b>	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.

ADS-B Data Sharing Implementation Status in the Asia/Pacific Region						
Related States/Administrations	ATS Route Served	Initiation Year	Agreement Date	Target Data Sharing Year	Implementation Status	Remarks/Challenges
Australia - Indonesia	Phase 1a L511, R592, G578, B349, M735, G326, A587, M768, A461, R340, B472, B473, G459	2010	2010	2010	Completed	SEA Report: Project 1
	Phase 1b M774, A458, J199, M766, G326, A587	2014	2014	2014	Ongoing	Browse Basin oil rig (Australia) awaiting acceptance testing
	Phase 2 L895, A585	2017	2019	2020	Ongoing	SEA Report: Project 2
Australia - Papua New Guinea	TBN				Ongoing	SEA Report: Project 6
Brunei - Singapore	M758, M768, M767	2015	2019	2019	Ongoing	SEA Report: Project 2
China – Hong Kong, China	Project 1 M771, L642	2010	2013	2013	Completed	
	Project 2 M771, L642, A1	2017		2018	Completed	Supplementary data sharing of Route A1
China - Lao PDR	A581 B465	2019		TBD	Ongoing	
China - Myanmar	A599	2019		2021	Ongoing	
India - Indonesia	B466, P574, N563	2018		2019	Ongoing	Data Sharing LoA on progress
India - Malaysia	N571, P628, L510, P627, L645, P574	2017		2021	Ongoing	
India - Myanmar	A201, A599, B465, G463, L507, P646, P762, G472, L524, M770, L759	2015	6/5/2015	2018	Completed	Myanmar side: Discussion with ATM manufacturer for operational use at ACC is needed. Indian side completed.
Indonesia - Papua New Guinea	R204, A215, B462, B456	2018	2019	2020	Ongoing	SEA Report: Project 6
Indonesia - Malaysia	B466, N571, P628, L510, P627, L645 and P574	2017		2021	Ongoing	
Indonesia - Philippines	A461, R590, B472	2018	2019	2020	Ongoing	SEA Report: Project 5
Indonesia - Singapore	G580, L504, M761 , M646, N875	2017		TBN	Ongoing	SEA Report: Project 2

<b>ADS-B Data Sharing Implementation Status in the Asia/Pacific Region</b>						
<b>Related States/Administrations</b>	<b>ATS Route Served</b>	<b>Initiation Year</b>	<b>Agreement Date</b>	<b>Target Data Sharing Year</b>	<b>Implementation Status</b>	<b>Remarks/Challenges</b>
Malaysia - Singapore	<b>Project 1</b> M758, M768, L649,	2017		2021	Ongoing	SEA Report: Project 2
	<b>Project 2</b> M904, M765, N875, N891	2018		2021	Ongoing	SEA Report: Project 2
Malaysia - Thailand	N571, P628, L510, P627, L645, P574	2018		2021	Ongoing	
Philippines - Singapore	N884, M522, M754, M767, M772, L649	2018		2018	Completed	SEA Report: Project 2
Singapore - Vietnam	<b>Project 1</b> N892, N891, M771, M753, M758, L642, L644	2007		2013	Completed	SEA Report: Project 2
	<b>Project 2</b> N892, N891, M771, M753, M758, M904, L642, L644	2014	2016	2018	Completed	SEA Report: Project 2

**REPORT FROM SOUTHEAST ASIA SUB GROUP**  
*Singapore, 3-5 November 2019*

**States Present**

China  
Hong Kong China  
Indonesia  
Malaysia  
Singapore  
Thailand  
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 previous meetings.

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

Phase 1a

Indonesia and Australia sharing ADS-B data from the following sites:

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

Data Sharing Agreement signed in Nov 2010;

Communications links between Australia and Indonesia were upgraded from VSAT to terrestrial links in Mar 2016. The service quality was improved.

Benefits

Data used for air situational awareness and safety nets.

Enhanced Safety at FIR boundary.

Operational service commenced by Australia in 2010.

Indonesia has been using the data for Tier 2 services since Sep 2014

Phase 1b

Indonesia and Australia sharing ADS-B data from the following additional sites:

- Timika (Indonesia) (Installed) - Commenced data sharing
- Kupang (Indonesia) (Installed) - Commenced data sharing
- Christmas Island (Australia) (Not yet installed)
- Browse Basin oil rig (Australia) (installed in 2018)

Data Sharing Agreement signed on 18 Jun 2014:

Indonesia announced the use of ADS-B for situational awareness on 24 July 2014. Indonesia announced on 30 Apr 2015 that ADS-B will be used for separation from FL290 to FL460 (tier-1) with effect from 25 June 2015. The carriage of ADS-B equipment for flights between FL290 and FL460 remain optional until Dec 2017. From 1 Jan 2018, Indonesia implemented ADS-B mandate from FL290 to FL600 in Jakarta and Ujung Pandang FIRs.

#### Phase 2

Data sharing between Australia and Indonesia already completed.

- Cilacap (Indonesia)

### **Project 2 – ADS-B Data Sharing In Southeast Asia**

#### Phase 1

Under the near term implementation plan, the parties have commenced ADS-B data sharing from the following sites:

- Singapore (Singapore provide data to Indonesia)
- Natuna (Indonesia provide data to Singapore)
- Matak (Indonesia provide data to Singapore)
- Con Son (Viet Nam provide data to Singapore)
- Sanya FIR (China provide fused data from four ADS-B stations to Hong Kong China)

VHF radio communication services (DCPC) were 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 Dec 2010.

ADS-B Data sharing and DCPC services agreement between Singapore and Vietnam signed in Nov 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 Viet Nam and have commenced on ADS-B operations since Dec 2013. Singapore commenced with 40nm separation and subsequently reduced to 30nm separation between Singapore and Ho Chi Minh FIR. Further reduction to 20nm longitudinal separation was implemented on 10 Nov 2016.

All 4 administrations (China, Hong Kong China, Singapore and Viet Nam) agreed that operational approval is not required.

### Initial Benefits

The above sharing/collaboration arrangements will benefit L642, M771, N891, M753, N892 and L644. Enhanced safety and reduced separation have been achieved. Mandate was effective in Singapore FIR from Dec 2013. China published the mandate in Oct 2019. Mandate for domestic fleet was effective on 10 Oct 2019. Mandate for international fleet will effective on 31 Dec 2020. Hong Kong China's ADS-B mandate was effective from Dec 2016 for aircraft at FL290 and above.

### Phase 2

The Philippines has installed ADS-B station at Manila ATM Centre. It will install six other ADS-B stations within Manila FIRs (Puerto Princesa-Palawan, Laoag, Jomalig, Mt Majic, General Santos Airport and Iba Zambales). These ADS-B stations are targeted to complete by 2020.

Singapore and the Philippines signed an MOU in Oct 2015 to make available ADS-B data and VHF facilities at Bataraza, Palawan for Singapore. The project was completed in Aug 2017.

The Philippines indicated that there is a surveillance gap at Northwestern part of Manila FIR and is studying acquisition of space-based ADS-B data to cover the surveillance gap.

China's four ADS-B ground stations deployed in Sanya FIR may be able to cover parts of the surveillance gap. China is prepared to share its ADS-B data, via its ADS-B data processor, with neighbouring states.

Brunei signed an MOU with Singapore in April 2019 where Brunei will share ADS-B data with Singapore and provide the VHF facilities for Singapore ATC use. Data sharing is expected to commence in 2020.

Singapore and Viet Nam signed an agreement in Jul 2016 to make available ADS-B data and VHF facilities at Ca Mau for Singapore. The facilities were commissioned in Nov 2018.

### Phase 3

Vietnam has ADS-B coverage at the Southern part of L625, N892, N884, M767 and M772 and Vietnam is willing to share the ADS-B data with the Philippines and Singapore. The discussion between Singapore and Vietnam is in progress.

The Philippines is studying the use of space-based ADS-B to cover its surveillance gaps.

In addition to sharing ADS-B data from its ADS-B station at Terrengganu, Malaysia is also willing to share the ADS-B data from its ADS-B stations at Kuchin, Bintulu, Kota Kinabalu, which are scheduled to be installed by 2021. The data from these three stations are also useful to Indonesia and will be shared under Project 3. Singapore will share data from its Singapore ADS-B station with Malaysia. It is noted that data sharing from Terrengganu can only be done after June 2020.

Malaysia and Singapore will initiate discussions after June 2020 on data sharing from the following sites:

- Terrengganu (Malaysia) (Installed)
- Bintulu (Malaysia) – To be installed by 2021
- Kota Kinabalu (Malaysia) – To be installed by 2021
- Kuching (Malaysia) – To be installed by 2021
- Singapore (Singapore) - Installed

Initial benefits

Enhanced Safety at FIR boundary and coverage redundancy

**Project 3 – ADS-B data sharing between Indonesia and Malaysia**

Indonesia and Malaysia are willing to share the ADS-B data from the following sites:

- Pontianak (Indonesia) – Installed
- Tarakan (Indonesia) - Installed
- Bintulu (Malaysia) – To be installed by 2021
- Kota Kinabalu (Malaysia) – To be installed by 2021
- Kuching (Malaysia) – To be installed by 2021

Malaysia and Indonesia are reviewing the collaboration agreement.

Initial benefits

Enhanced Safety at FIR boundary and coverage redundancy

**Project 4 – ADS-B data sharing between Cambodia, Thailand and Viet Nam**

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

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

Vietnam is planning to install stations in the HCM FIR from 2016 to 2020. Vietnam is willing to share data with Cambodia and Thailand.

Initial benefits

For redundancy

**Project 5 – ADS-B data sharing between Indonesia and the Philippines**

Indonesia and the Philippines initiated discussion in 2019 on data sharing:

Melonguane (Indonesia) (will be installed in 2020)

General Santos (The Philippines) (yet to install)

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) Not yet installed – Target to be installed by 2019
- Burns Peak – Port Moresby (PNG) (installed)
- Mt Robinson (PNG) (to be installed by 2018) or Mt Nauwein (to be installed by 2018)

Note that the above information was based on previous updates as both Australia and Papua New Guinea were not present at the meeting.

**Data Sharing between Indonesia and Papua New Guinea**

- Mt Nauwein (PNG) (to be installed by 2018)– Phase 1
- Merauke (Indonesia) (installed) – Phase 1
- Jayapura (Indonesia) (installed)– Phase 2

New ATM system installed in PNG.

The parties will probably sign direct bi-lateral agreements in 2020.

**General remark for all the above projects: As agreed at previous APAC ADS-B Task Force and WG meetings, sharing of ADS-B data should include sharing of VHF radio facilities/services, where possible**

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**REPORT FROM BAY OF BENGAL AD HOC WORKING GROUP**  
**SEA/BOB ADS-B WG/14**  
(Singapore, 3-5 December, 2019)

**States Presented:**

Bangladesh  
Bhutan  
China  
Indonesia  
Malaysia  
Maldives  
Myanmar  
Thailand  
India  
Sri Lanka

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

<b>Implementation Updates</b>
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**1. Bangladesh**

We are trying to modernize our systems through the implementation of ATM project. At first it was in PPP & now it is on G2G with France. This was under the process of government approval. Government approval is granted, and 5 ADS-B receivers will have been installed at detailed below,

Cox's Bazar, Barisal, Saidpur, Dhaka and Sylhet, there is another one for Extended Economic Zone at new area in the Bay of Bengal which is 200NM at south of the country.

**2. Bhutan**

Bhutan cannot join previous SEA/BOB ADS-B meeting as we do have plan to implement ADS-B, but now we are targeting to complete ADS-B feasibility study by mid of 2019 and now it is extended up to mid of 2020. We found out that feasibility study (Coverage and ground station location) is necessary as Bhutan is surrounded by mountain terrain.

As per the result of feasibility study we are going to implement installation of ground station.

Bhutan do not have any national policy or regulation about data sharing, so we will be sharing data with any neighbouring countries/states as per the regional norms and conditions.

**3. China**

China has been continuously promoting to push forward the application of ADS-B technology. China provided update on the installation and related activities regarding ADS-B surveillance system as follows:

- 5 UAT ADS-B stations are used for flight training of CAFUC. The upgrade to 1090ES ADS-B stations project has already started in 2017, and the project is planned to finish by 2022;
- 4 ADS-B station in operational in Sanya FIR since 2008;

- Chengdu-Jiuzhai and Chendu - Lhasa route with 9 ADS-B stations;
- 9 ADS-B stations deployed on the routes H15 and Z1 by the end of 2015;
- 19 ADS-B station at the small airport; and
- 308 ADS-B stations nationwide have already finished installation and SAT by the end of 2018. And there are 2 level-1 data processing centres working in main-standby mode for redundancy, 8 level-2 data processing centres to concentrate data from data stations within its area of responsibility, as well as 36 data stations to collect received data from GSs. All the installation and SAT of GSs, level-2 data processing centres and level-1 data processing centres have already complete. The trial operation has started from October 10, 2019 and the ADS-B mandate had also been published on October 1, 2019, which is effective from October 10, 2019.

#### **4. Indonesia**

Indonesia earlier informed that ADS-B ground station at Aceh is already operational and expressed willingness to share data with India (It was earlier decided to have Port Blair-Aceh data sharing, but for better coverage and usability it was suggested in the meeting to have data sharing of upcoming Campbell Bay ADS-B - Aceh when India is ready).

Indonesia now will share the data with Campbell Bay ADS-B – Aceh only.  
Campbell Bay ADS-B is installed.

Letter of Agreement between Indonesia and India regarding ADS-B data sharing is on progress  
Letter of agreement is agreed by Indonesia and India, yet to be signed.

#### **5. Malaysia**

Malaysia has completed the installation of the two new ADS-B ground station in Langkawi and Genting and will be integrated into the ATM system in 2018. Both stations are compliance with DO-260B with output data handling function as plot and tracks (ASTERIX CAT21 rev. 0.23, rev. 0.26 and rev. 2.1.)

Malaysia venturing to share data with Indonesia, India and Thailand. Data sharing from India (Port Blair or Campbell Bay ADS-B), or from Indonesia (Aceh ADS-B) or from Thailand will close the surveillance gap within the KL FIR.

Malaysia available ADS-B data through ADS-B central processing system is integrated to existing ATC Systems via temporary node and only capable for legacy data exchange format. With that limitation and unavailability of other essential hardware, the existing ATC is not capable for data sharing. The new ATC system is in progress and only expected to be completed by 2H2019, thus Data Sharing target has to be shifted to 2H2021. However, Malaysia is reviewing the sample agreement proposed by India in 2018, and will revert as soon as possible.

ATC system is in progress and only expected to be completed by 2Half of 2020. Data sharing will be clarified after that activity.

#### **6. Maldives**

Not present

Maldives started using ADS-B to enhance ATS surveillance capability in Male FIR on 7<sup>th</sup> February 2016.

With 4 ground stations (2 autonomous stations at Male; 2 unduplicated ground stations: 1 at an island in the North and the other in the South), the ADS-B provides coverage up to 90% of Male FIR above FL290.

ADS-B serves as the backup for Male radar and is in use for vectoring and 5NM separation commensurate with Radars

As part of the effort towards full implementation of ADS-B, from March 2017 aircraft imported for commercial air transport in the Maldives are required to be equipped with ADS-B Out, as published in AIP ENR 1.6-3.

The full implementation, which would require carriage of ADS-B Out, is targeted for the year 2020

Maldives is making efforts to complete the airworthiness approval for all locally registered aircraft, already equipped with ADS-B.

Out of the 73 aircraft registered for commercial air transport in the Maldives, 62 aircraft have given approval for ADS-B by Maldives Civil Aviation Authority (MCAA).

This include 55 seaplanes (Twin Otter aircraft with floats) conducting commercial air transport between Velana International and resort islands. These aircraft, although operate on VFR, are fitted with ADS-B out functionality combined with GPS to give highly accurate positional information.

## **7. Myanmar**

The 5 ADS-B ground stations have been installed in Myanmar. Among them, Sittwe and Co Co Island ground stations are installed in 2014 and they are DO260 compliant, and Yangon, Mandalay and Myeik airports ground stations are DO260B compliant and installation was finished in 2016.

All ADS-B data are fused with MSSR data target in the Top Sky ATC Automation system (Thales) in 2016, and using as MSSR backup and surveillance monitoring in Yangon ACC.

In addition, Myanmar have planned to install new ADS-B Station in the First quarter of 2020 at Lashio Airport located in north-eastern part of Myanmar closed to the China-Myanmar border near the LINSO transfer point on A599 ATS route. After the installation finished, the ADS-B data sharing process can be proceeded between Myanmar and China *after March, 2020*.

For the communication links between Yangon and Beijing, it can use the existing 2M E1 IPLC link which is now using for AFTN messaging and (AIDC Testing) Voice, and also can be used the existing Yangon-Beijing VSAT link as backup.

Myanmar also willing to participate the special coordination meetings to promote relevant works in terms of the surveillance data sharing among the countries to enhance the safety and surveillance capability in the sub-region.

Lashio installation will be completed by First quarter of 2020.

Redundant Communication link via Land line / CRV / V-SAT is proposed under discussion.

## **8. Thailand**

Thailand provided update on the installation and related activities regarding ADS-B and other related surveillance system as follows:

ADS-B Ground Infrastructure and ATC System Readiness or Implementation Plan

- MLAT has been in operation at VTBS since 2006 and has been installed at VTBD with the expectation to be operational in 2020. At VTCC and VTSP, M-LAT is being installed with expectation to be operational in 2020.
- Six ADS-B ground stations (DO-260B compliant) have been installed covering airspace at and above 20,000 feet primarily for research and development purpose and are being undergone the certification process by Civil Aviation Authority of Thailand (CAAT) with a target date by the end of 2020.
- Additional ADS-B ground stations are planned to be installed aiming at providing coverage from ground to 11,000 feet for TMA and Airport operations.
- Multiple surveillance sensor data including SSR, ADS-B and WAM are integrated into the new ATM systems and expected to be operational in early 2020.
- Legal assessment regarding ADS-B data sharing with other states has been underway.

Date of Issue/Effectiveness Date of Equipage Mandate

- Aircraft equipage mandate is expected to be issued in 2021 with the expected target effective date in 2026.

Data sharing

- ATS surveillance data sharing with adjacent FIRs was approved in principle in October 2018.
- User requirements, particularly ATS routes to be served, and communication link test plan are discussed in 2018-2019.

**9. India (no update provided in 2018)**

India informed that 21 ADS-B ground receivers have already been installed and the information has been promulgated through AIP SUPP 18/2014 to use ADS-B in the provision of ATS surveillance service. The data sharing agreement between India and Myanmar has been signed on 06<sup>th</sup> May 2015. India is willing to share ADS-B data with Indonesia, Malaysia and Sri Lanka. India has invited open tenders for procurement of ten more ADS-B Ground Stations for installation at Kadappa, Raipur, Pantnagar, Indore, Jabalpur, Bikaner, Goa, Aurangabad, Dhanbad and Campbell Bay (in Bay of Bengal near FIR boundaries of Chennai, Jakarta and Kuala Lumpur) is completed in third quarter of 2019. The objective is to provide ADS-B coverage in areas where there is no or limited Secondary Surveillance Radar (SSR) coverage. The data from the above ADS-B ground stations is integrated with existing ATM systems at different Area Control Centres. India expects the ground stations to be DO-260B compliant and operational by the end of 2018. The ADS-B receivers are capable of DO-260B, but not all the ATM Automation Systems are capable of DO-260.

**10. Sri Lanka (no update provided in 2018)**

Not Present

Sri Lanka has installed 5, ADS-B stations and data received by the stations have been integrated and available for sharing. The ADS-B coverage is approximately 350NM from Pidurutalagala, the highest mountain situated in central Sri Lanka. Sri Lanka is willing to share this data with India and Maldives.

India is requested to provide a soft copy of draft agreement for sharing of ADS-B data with Sri Lanka so as to enable Sri Lanka to look into the terms and conditions of draft agreement.

<b>ADS-B Data Sharing</b>
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### **Project 1 - ADS-B Data Sharing between China, Laos and Myanmar**

#### Phase 1 *China and Laos sharing ADS-B data from following:*

Kunming ADS-B data processing Centre (china), which can customize the output of ADS-B data in version, specific area and height range depend on Laos's requirement.

Route to be affected B465.

#### China and Myanmar sharing ADS-B data from the following sites:

Lashio (Myanmar) Not yet installed – Target to be installed by March 2020. Route to be affected A599

#### China and Myanmar sharing ADS-B data from the following:

Kunming ADS-B Data Processing Centre (China), which can customize the output of ADS-B data in version, specific area and height range depend on Myanmar's requirement.

#### Operational Status

N/A

#### Expected benefits

- Enhanced air navigation safety at FIRs boundary.
- Promoting air traffic control work efficiency.

### **Project 2 - ADS-B Data Sharing between India and Indonesia**

#### Phase 1

Aceh – Indonesia

Camp Bell Bay – India

Route to be affected B466, P574 and N563

#### Operational Status

Camp Bell to Chennai link BSNL is under testing. Indonesia waiting till CRV scheduled 1st quarter 2020. India is getting ready for CRV by the end of first quarter 2020 with PCCW.

#### Benefits

Enhanced safety by reduction in occurrences of LHDs and LLDs in BOB region.

### **Project 3 - ADS-B Data Sharing between India and Malaysia**

#### Phase 1

Port Blair/Campbell-Langkawi (2H2021)

Route to be affected N571, P628, L510, P627, L645 and P574

#### Operational Status

New ATM system installation in June 2020.

#### Expected benefits

Enhanced safety by reduction in occurrences of LHDs and LLDs in BOB region.

### **Project 4 - ADS-B Data Sharing between India and Myanmar**

#### Phase 1

The ADS-B data sharing between Kolkata and Yangon FIR was an initiative taken by India and Myanmar to enhance safety and reduce LHDs along Kolkata-Yangon FIR boundary.

In 6 May 2015, Myanmar and India have signed the MOU agreement for ADS-B data sharing between the two countries.

As per the data sharing agreement, ADS-B data sharing test between Agartala(India) and Sittwe (Myanmar) and Port Blair(India) and Coco Island(Myanmar) has been accomplished between technical teams since June 2018. Kolkata has integrated the ADS-B feed from Sittwe and Co Co Island in its Automation system. Presently the data is given in the back up automation system at Kolkata for test purpose and ADS B equipped aircrafts are tracked from as far as 250 nm west of Bangkok.

But for Myanmar side, India's data is just received to Yangon ACC technical management room and need to discuss with ATM Manufacturer (Thales) of Surveillance Display System to integrate India's ADS-B data to existing Surveillance Display System for operational use in Yangon ACC. Because the multicast address and port from India's ADS-B data are different with existing setup.

The communication link used for ADSB data transfer between Yangon and Kolkata is the existing E1 IPLC link which is used for DSC phone between the two ATS units.

Route to be affected A201, A599, B465, G463, L507, P646, P762, G472, L524, M770 and L759

#### Operational Status

Operationalized for situational awareness.

#### Expected benefits

Enhanced safety by reduction in occurrences of LHDs and LLDs in BOB region.

### **Project 5 - ADS-B Data Sharing between Indonesia and Malaysia**

#### Phase 1

Langkawi - Aceh (~~2H2019~~ 2H2021)

Route to be affected B466, N571, P628, L510, P627, L645 and P574

Operational Status

New ATM Automation system installation by June 2020 then data sharing.

Expected benefits

Enhanced safety at FIR boundary

**Project 6 - ADS-B Data Sharing between Malaysia and Thailand**

Phase 1

Langkawi - Phuket

General discussion about possibility to share ADS-B data for route N571, P628, L510, P627, L645 and P574

Operational Status

N/A

Expected benefits

- Enhanced visibility of surveillance targets in Bay of Bengal.
- Enhanced situational awareness at FIR boundary.

**Project 7 - ADS-B Data Sharing between India and Sri Lanka (no update provided in 2018, 2019)**

Phase 1

Trivandrum – Colombo (2H2018)

Trichy-Colombo (2H2018)

Route to be affected TBN

Operational Status

N/A

Expected benefits

Enhanced safety at FIR boundary

<b>Important Notes</b>
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1. Terminology used in the region should be standardised and consistent, and recognise what crew need to know.
2. States need to develop procedures for the use of DAPs in relation to operating procedures, for example the use of selected altitude information being displayed on the controllers' screens and related pilot practices: pilots and controllers need to be aware of each other's operating practices.

3. There is a need to consider the capture, storage, and potential uses of ADS-B data. For example, in some states those data might be used to draw premature conclusions about the causes of an accident or incident and result in inappropriate or unwarranted enforcement action. In addition, there were concerns about who can access ADS-B data and for what purposes. Examples of inaccurate data being used by members of the public to make complaints about aircraft flight paths and noise impost are a concern.

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SEA/BOB ADS-B WG/15  
Appendix D to the Report

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

No.	Subject	Forum Raised	Status / Target Date	Remarks / follow-up	Action Party
1.	<p>ATS operational letter of agreements between neighboring FIRs among South China Sea States for radar-like surveillance service</p> <p>(Operational agreement between Singapore and Viet Nam was signed first in Nov. 2013 and later updated in July 2014 for 30 NM separation, agreement for 20 NM was signed Oct. 2016)</p> <p>To further progress rest parts for major ATS Routes L642 and M771 to apply new separation criteria using ADS-B and other surveillance</p>	SEA ADS-B WG/6	<p>Ongoing – Reports at each meeting (need to coordination through SEACG for separation criteria to be applied)</p> <p>China, VN, are able to provide radar surveillance to L642,M771 within the relevant FIRs. (SEA/BOB WG/15)</p>	<p>Report progress</p> <p>Consistent separation to be applied in 4 FIRs, new action item for 4 parties. Refer surveillance capability to ATM SG.</p>	<p>China, Hong Kong China, Viet Nam and Singapore</p> <p>On-going needs seamless agreement for the minima – major traffic flow; Hong Kong/Sanya Sanya/Ho Chi Minh</p>
2.	<p>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.</p> <p>Status updated at WG/11</p> <p>A simple document containing projects for BoB data sharing to be prepared by India</p> <p>MOU for Bay of Bengal data sharing projects</p> <p>( Consolidated in SEA/BOB WG/15)</p>	<p>SEA/BOB WG/11</p> <p>SEA/BOB WG/13</p>	<p>Nov. 2018</p> <p>SEA/BOB WG/14</p>	<p>Develop and implement sub-regional ADS-B collaboration projects.</p> <p><b>On-going</b></p> <p>Have the MOU between India/Sri Lanka; India/Malaysia and India/Indonesia agreed.</p> <p><b>On going</b></p>	<p>Bay of Bengal States</p> <p>Detailed needs to be finalized by SEA/BOB</p> <p>India, Sri Lanka Malaysia and Indonesia</p>

SEA/BOB ADS-B WG/15  
Appendix D to the Report

No.	Subject	Forum Raised	Status / Target Date	Remarks / follow-up	Action Party
3.	Make proposals for ADS-B data sharing between China and Myanmar & China and Laos PDR.	SEA/BOB WG/13	March 2020	States concerned discuss for a concrete proposal for the data sharing	China, Myanmar and Lao PDR.
*The following items (4-8) are suggested by SEA/BOB WG/15					
4.	harmonization of mandates across the various FIRs	SEA/BOB WG/15	Ongoing		
5.	promotion of new means of data sharing (such as data sharing through a centralised data base or SWIM)	SEA/BOB WG/15	Ongoing		
6.	Study the potential applications and issues of new forms of ADS-B stations and Long Range Communications.	SEA/BOB WG/15	Ongoing		
7.	Sharing of innovative means to solve ADS-B related issues.	SEA/BOB WG/15	Ongoing		
8.	Consolidation of issues to be considered at other ADS-B related forum (e.g. Surveillance Panel, RTCA, EUROCAE), or by vendors.	SEA/BOB WG/15	Ongoing		

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### TERMS OF REFERENCE FOR SEA/BOB ADS-B WG

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 Surveillance Implementation Coordination Group.

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:
    - o 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
    - o 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;
    - o Timing of any equipage mandates.
    - o Timing of any ATC automation upgrades to support ADS-B.
    - o Timing of commissioning of any ADS-B data and associated VHF radio voice communication facilities.
  - consideration of major traffic flows
  - [harmonization of mandates across the various FIRs](#)
  - [promotion of new means of data sharing \(such as data sharing through a centralized data base or SWIM\)](#)
- (c) Coordination for implementation of the plan and identify implementation issues and solutions
- (d) [Consolidation of issues to be considered at other ADS-B related forum \(e.g. Surveillance Panel, RTCA, EUROCAE\), or by vendors.](#)
- (e) [Sharing of innovative means to solve ADS-B related issues.](#)
- (f) [Study the potential applications and issues of new forms of ADS-B stations and Long Range Communications.](#)

**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 Surveillance Implementation Coordination Group

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**DRAFT TERMS OF REFERENCE FOR ADS-B WG**

An ADS-B Working Group is to be established under the Surveillance Implementation Coordination Group. The outcome of the ADS-B Working Group will report to the Surveillance Implementation Coordination Group.

The ADS-B WG shall

- (a) Monitor and influence the developments of ADS-B related technologies and applications.
- (b) Develop an implementation plan for near term ADS-B technology and application, including provision of minimum layers of surveillance services.
- (c) Coordinate and monitor the implementation of ADS-B data sharing projects.
- (d) Promotion of new means of data sharing (such as data sharing through a centralized data base or SWIM)
- (e) Harmonization of mandates across the various FIRs
- (f) Sharing of implementation and operation issues, and innovative means to solve such issues.
- (g) Consolidation of implementation and operation issues and forward them to other ADS-B related forum (e.g. Surveillance Panel, RTCA, EUROCAE), or vendors for considerations.

**Composition:** The Group will be composed of experts nominated by States in Asia Pacific. IATA and CANSO.

**Reporting:** The Group will present its report to Surveillance Implementation Coordination Group

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