INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA AND PACIFIC OFFICE

REPORT
OF THE THIRD MEETING OF
AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B)
STUDY AND IMPLEMENTATION TASK FORCE (ADS-B/TF/3)

Bangkok, 21-25 March 2005

TABLE OF CONTENTS

HISTORY OF THE MEETING **Page**

SUMMARY OF DISCUSSIONS

APPENDIX:

ATTACHMENTS:

1. INTRODUCTION

1.1 The Third Meeting of Automatic Dependent Surveillance – Broadcast (ADS-B) Study and Implementation Task Force (ADS-B TF/3) was held from 23-25 March 2005. The ADS-B Seminar was held on 21-22 March in the Kotaite Wing of the ICAO Asia and Pacific Regional Office, Thailand in conjunction with the ADS-B TF/3 Meeting.

1.2 On behalf of Mr. L.B. Shah, Regional Director, ASIA/PAC Office, Mr. K.P. Rimal, Regional Officer CNS extended welcome to all participants to the Seminar. He informed the meeting that the Fifteenth Meeting of APANPIRG had noted with appreciation the progress made by this Task Force and adopted all the Conclusions and Decisions formulated by the Second Meeting of the Task Force. He highlighted the important tasks to be addressed by Task Force meeting. He informed the meeting that the Secretariat will extend full support to the meeting.

1.3 In his opening remarks, Mr. Greg Dunstone, Chairman of the Task Force, welcomed all the participants, highlighted work programme of the Seminar and the result of the Working Group Meeting held in Singapore in preparation for the Third Meeting of the Task Force.

2. ATTENDANCE

2.1 The meeting was attended by 52 participants from Australia, Bangladesh, China, Hong Kong China, Macao China, Fiji, Japan, India, Indonesia, Laos PDR, Malaysia, Mongolia, New Zealand, Philippines, Republic of Korea, Singapore, Thailand, IATA, SITA and representatives from five companies from industry. List of participants is at Attachment 1.

3. OFFICERS AND SECRETARIAT

3.1 Mr. Greg Dunstone, Senior Technical Specialist of Airservices Australia Chaired the Meeting. Mr. K.P. Rimal and Mr. Li Peng, Regional Officers, CNS acted as Secretaries. The meeting was assisted by Mr. Andrew H.Tiede, Regional Officer ATM of the ICAO Asia and Pacific Regional Office. The meeting was also assisted by Dr. Paul Hooper Regional Officer, Air Transport of ICAO Asia and Pacific Regional Office on the issues of cost and benefit analysis.

4. ORGANIZATION, WORKING ARRANGEMENTS AND LANGUAGE

4.1 The meeting met as a single body for the Seminar. An ad hoc group was established for review of the ADS-B Implementation and Operation Guidance Document. The working language was English only inclusive of all documentation and this Report. Lists of Working Papers and Information Papers presented at the Seminar and the Meeting are at Attachment 2.

Agenda Item 1: Adoption of Agenda

1.1 The agenda items developed based on the task list and work items were adopted by the meeting as follows:

1. Adoption of Agenda

2. Review of outcomes of:

   a) 41st DGCA Conference on ADS-B;
   b) APANPIRG/15 on ADS-B and result of 2nd Meeting of the ADS-B Task Force.

3. Review the progress made by ADS-B related ICAO Panels:

   a) OPLINK Panel on ADS-B activity; and
   b) SAS Panel ADS-B activity.

4. Review States' activities on trials and demonstration of ADS-B.

5. Review result of ADS-B Working Group Meeting.

6. Progress items due in 2005:

6.1 Review of the draft operational manual
- Progress report by New Zealand and USA

6.2 Review of the draft checklist for implementation of ADS-B prepared by Singapore

6.3 Review of draft material on ADS-B for amendment to Regional Plan for the CNS/ATM System.

6.4 Progress development of Regional Implementation Plan:

a) States to present their ADS-B plans including implementation dates, sites being considered and plan for mandate (if any);

b) States to present any significant progress in ADS-B planning or deployment.

6.5 Cost Benefit/Studies

7. Any other business.

Agenda Item 2: Review of outcomes of:

41st DGCA Conference on ADS-B

2.1 It was informed that the 41st Conference of Directors General of Civil Aviation (DGCAs), Asia and Pacific Regions held in Hong Kong, China from 1-5 November 2004 noted ADS-B related activities. In discussing working papers presented by Australia, USA and ICAO Secretariat on ADS-B, the Conference noted that this technology represented a quantum leap in the management of air traffic control, bringing with it significant safety benefits to the industry such as increased situational awareness as well as economic benefits. It will change the way in which air navigation had hitherto been carried out. The operational benefits have been recognized and its use is expected to be widely accepted in the Asia/Pacific region. The Conference noted that APANPIRG had identified ADS-B implementation as one of the important projects in the region and had been actively pursing. With a number of important trials being progressed, the ICAO Secretariat urged States in the region to collaborate with each other in the interest of international civil aviation. IATA fully supported its use globally and looked forward to its rapid expansion in 2006.

2.1.1 The meeting reviewed the following Action Item agreed by the Conference. The updated list of focal point of contact responsible coordinating, planning and implementation of ADS-B is provided at Appendix A to this Report.

> **Action Item 41/5** The Conference urged States which have not done so, to designate a focal point of contact responsible for coordinating, planning and implementation of ADS-B in each administration and provide contact details to the ICAO Asia and Pacific Regional Office.

APANPIRG/15 on ADS-B and result of 2nd Meeting of the ADS-B Task Force

2.2 The meeting reviewed actions taken by APANPIRG/15 on the result of Second Meeting of the ADS-B Study and Implementation Task Force. The meeting noted that the report of the Second Meeting of the Task Force was also reviewed by the Fourteenth Meeting of the ATM/AIS/SAR Sub-Group of APANPIRG held from 28 June to 2 July 2004 and by the Eighth Meeting of CNS/MET Sub-Group held from 12 to 16 July 2004. APANPIRG/15 adopted two Conclusions formulated by the Task Force and approved a tasks list for the ADS-B Task Force.

2.2.1 The meeting discussed the comments made by the Sub-groups of APANPIRG. The meeting noted the need to further carry out inter-regional coordination with neighboring regions as emphasized by the ATM/AIS/SAR Sub-group. The meeting agreed to identify an interface standard for the exchange of ADS-B data. The identified interface standard for ADS-B data exchange was discussed under agenda item 5. The meeting reconfirmed that the requirement for operational procedure for implementation of ADS-B as identified by ATM/AIS/SAR Sub-group of APANPIRG is essential. The meeting also agreed the comments made by CNS/MET Sub Group to encourage States and international organizations to make arrangement for ATM experts in addition to their CNS experts to participate the activities of ADS-B Task Force. Considering the fast track approach as suggested by CNS/MET SG/8, Australia agreed to submit amendment proposal to the Doc.7030 – the Regional Supplementary Procedures (SUPPs). The subject/task list in this regard would be amended accordingly. The meeting reviewed the Conclusion adopted by APANPIRG regarding a general survey by IATA for ADS-B equipage status. It was advised by IATA that benefit of such kind of survey would be limited at this stage as normally only 10 percent responses would get from airlines for a general survey. IATA further indicated that a global survey may be required with more specific list of query.

Agenda Item 3: Review the progress made by ADS-B related ICAO panels:

OPLINK Panel ADS-B activity

3.1 Australia presented a paper with a summary of the discussions by OPLINKP WG/A on the subject of the ADS-B. OPLINKP Working Group A met in Montreal from 14 to 18 February 2005 noted that, in parallel with the on-going development of Standards and Recommended Practices (SARPs), procedures and guidance material by various ICAO Panels, the ADS-B Task Force was undertaking the development of an ADS-B Guidance Material, intending to provide comprehensive guidance material to States implementing ADS-B. It was considered that the Manual would be of good use, not only to the States involved in the activities, but it also could possibly serve as a model for other States/Regions considering the implementation of ADS-B in the future. It was felt that the ADS-B concept of use had been put to good use, in the way that was originally intended. It was observed that some caution should be exercised when developing material such as the Operations Manual. APANPIRG could indeed produce guidance material, but it would be considered inappropriate to include specific requirements such documents. Such requirements should, and would necessarily, be placed in the appropriate Annex and PANS documents.

3.1.1 It was noted that OPLINKP WG/A continued its work on drafting amendments to PANS-ATM (Doc4444) and other documents to incorporate provisions for ADS-B. These amendments are now being finalised for consideration by the OPLINKP/1 Meeting, scheduled for September 2005.

3.1.2 In considering the comments on the draft manual made by OPLINKP WG/A, the meeting agreed to continue progressing the regional guidance material for implementation of ADS-B.

SAS Panel ADS-B activity

3.2 Secretariat informed meeting that the Sixth Working Group of the Whole Meeting of the Separation and Airspace Safety Panel (SASP) was held in Washington D.C. from 1 to 12 November 2004. During the meeting, the SASP Project Team 13 (ADS-B) met separately to progress ADS – B issues. It was informed that USA is developing the analysis to be used as the basis for the approval of a 3NM minimum. USA was developing a technical standard that would be validated using a radar reference system and comparative assessment methodology. Their analysis so far had confirmed that ADS-B was as good or better than the reference radar. In the case of terminal SSR, cross track accuracy for ADS-B at 40NM range was 18 to 60 times more accurate and, in the case of en-route SSR, cross track accuracy at 200 NM range for ADS-B was 90 to 300 times more accurate.

3.2.1 The SASP Team 13 considered the proposed amendments to PANS-ATM (Doc 4444), in particular Chapter 8 (proposed to be renamed from Radar Services to ATC Surveillance Services), presented by the Secretariat. With some comments for amendments, the SASP working group supported to merge Chapter 8 to combine radar and ADS-B provisions. It was intended to progress the work with a view to meet in November 2007 PANS-ATM amendment date. In this regard, it was expected that the proposed amendments to PANS-ATM should be ready for final review by the ANC during late 2006.

Comparative Assessment

3.2.2 Project Team 13 reviewed the documentation that comprised the comparative assessment between the radar reference system (SSR only) and ADS-B in accordance with the provisions of the *Manual on Airspace Planning Methodology for the Determination of Separation Minima* (Doc 9689) comparative assessment methodology. This material comprises the technical comparison that would be used to authorize the use of a 5 NM standard and would include, as an appendix, information regarding the hazards and mitigating options that had been identified by some States. The meeting recognized that the safety assessments were the responsibility of States and therefore the SASP safety analysis should be confined to technical issues. The 5NM minimum had been published as a long standing minimum and the SASP work was to assess whether it was technically possible to implement that existing minima using a technology that was as good or better than radar. The meeting was of the view that the technical comparison indicated that ADS-B was equal to or better than radar in a technical sense and that it could be used to provide a 5NM separation. However, the meeting also noted that there was still work to be completed with regard to supporting documentation. The Seventh Working Group of the Whole of the SASP has been scheduled for May 2005, in Montreal.

Airbus view regarding SCRSP/1

3.3 Airbus provided a paper on its view regarding the proposed amendment to Annex 10 - *Aeronautical Telecommunications*, Volume III — *Communication Systems* Part I- *Digital Data Communication System* Appendix of Chapter 5 *Mode S Data Link Surveillance* at the first meeting of the Surveillance and Conflict Resolution Systems Panel (SCRSP/1). Airbus stated that the amendment requires RTCA DO-260A MOPS for air-to-air ASAS applications. This is considered unnecessary by Airbus. Airbus believes that the proposed amendment to SARPs, if unchanged, would delay the implementation of ASAS applications. This view does not preclude implementers (avionics equipment, aircraft manufacturers, Air Navigation System Providers, etc) to select DO-260A for their products as considered useful for their needs (e.g. as to gain experience on NIC/NAC/SIL). It was noted that Airbus is committed to deployment of ADS-B applications for both air-ground surveillance service (ADS-B out) and air-air surveillance service (ADS-B in). The meeting noted that Airbus had already offered all aircraft types Mode S Extended Squitter based on ICAO Annex 10 Volume III Chapter 5 Amendment 77 (DO-260).

3.3.1 The meeting discussed the compatible problem, retrofit cost regulatory requirement, etc., that may be resulted from this proposed amendment from different perspectives. The expert from Japan who attended the SCRSP meeting in November 2004 clarified that the meeting had decided to include requirements for both DO260 and DO260A, and that there was no intent by SCRSP to exclude DO260 compliant avionics from all air-air application. In order to find out what performance problems that may exist, the expert from Japan was requested to prepare an introduction paper on this issue for consideration by the ninth meeting of CNS/MET Sub Group of APANPIRG to be held from 11-15 July 2005. Accordingly, the meeting formulated the following Decision:

Decision 3/1 - Performance impact on the introduction of DO260A MOPS

. That, the Task Force member from Japan prepare an information paper for consideration by the CNS/MET/SG/9 meeting on the issue of the proposed amendments to Annex 10 - *Aeronautical telecommunications*, Volume III — *Communication Systems* Part I- *Digital Data Communication System* Appendix of Chapter 5 *Mode S Data Link Surveillance* based on the result of SCRSP/1 and the outcome of the meeting to be held

in May 2005. The amendment requires RTCA DO-260A MOPS for air-air ASAS applications.

3.4 EUROCAE WG51 presented a paper expressing their view on the proposed amendment to Annex 10, which was on–line with Airbus's view on the same topic.

RFG Information on RFG

3.5 Australia provided an information paper regarding Requirement Focus Group (RFG) and its work that may have impact to ADS-B related activities in Asia Pacific region**.** The Requirements Focus Group was set up by FAA and Eurocontrol to harmonize ADS-B requirements between them. It was informed that its role was to developing the ADS-B documents and then delivering these documents to ICAO, Eurocae and RTCA – with the expectation that ICAO, RTCA & Eurocae will accept these as world wide interoperable documents based on which produce appropriate ICAO SARPs and Industry MOPS. The output of the group will be quite valuable since RFG is also supported by Boeing and Airbus as well. The established group has desire to leverage from the work that Australia and Asia Pacific has done. However, the ability of the group to produce useful deliverables in time for the "Non Radar application" seems remote. RFG would have a powerful influence on the future development of ADS-B especially air-to-air applications. It is required to stay connected with the RFG group to ensure that the needs of non USA/Europe interests are also protected. The group wish to have input from operational aspects as the group is largely consisted of technical people.

3.5.1 It was pointed out that safety case study needs to be conducted by each State to implement ADS-B. The document produced by RFG would be useful while dealing with this task. It was further informed that RFG would set up a interoperability group to update the document which was provided in the CD to all participants.

Agenda Item 4: Review States' activities on trials and demonstration of ADS-B.

Thailand

4.1 Thailand provided an updated information regarding the operational trial of ADS-B. The ADS-B operational trial in Thailand will mainly focus on assessing the system's performance in the local environment utilizing targets of opportunity in Bangkok Flight Information Region and the possibility to improve the Secondary Surveillance Radar (SSR) coverage using ADS-B as an additional source. If required, AEROTHAI may also consider equipping the existing flight calibration aircraft with ADS-B avionics. A single, non-redundant, ADS-B ground station will be installed. The sites under considerations for the installation of the ADS-B ground station will be located either in Bangkok or Phuket where an existing communication link and other necessary infrastructure are available. In December 2004, AEROTHAI approved the budget to conduct the ADS-B operational trial. AEROTHAI is currently in the procurement process and expects the installation of the equipment to be completed by the third quarter of 2005. The trial will be conducted as a standalone test system.

Japan

4.2 Japan informed the meeting of the status of evaluation of 1090MHz ADS-B and multilateration test conducted by the Electronic Navigation Research Institute (ENRI). The evaluation tests of ADS-B and multilateration have been conducted on surface and terminal areas since December 2003. The evaluation of multilateration takes priority over the ADS-B, because Japan Civil Aviation Bureau plans to introduce the multilateration system at Tokyo international airport for surface surveillance. ENRI was going to conduct an evaluation of multilateration at Tokyo international airport in the next fiscal year starting from April 2005.

4.2.1 The evaluation tests of multilateration on surface area conducted used the experimental vehicle. The test results were generally satisfactory in comparison with EUROCAE MOPS. The target losses observed in front of the terminal building and large errors observed at the left and right corners were caused by shielding and reflection from buildings or parking aircraft. To resolve these problems, height of an antenna was extended and a remote unit was added near the terminal building area. The tests with these improvements were conducted on September 2004. The comparison of tracking outputs near the terminal building was analyzed. It was confirmed that the problems of target losses and large errors were almost solved. It was clarified that some of the tests were conducted in the areas not covered by surface radar or the surface radar was not reliable. Therefore comparative result against radar was not expected not be available.

France

4.3 France informed the meeting of their ADS-B validation trials performed based on an 1090 MHz ES Ground station installed in Toulouse Airport within EUROCONTROL ADS-B validation activities called CRISTAL. CRISTAL Toulouse has started with the participation of consortium made of French DSNA, Airbus, Thales ATM and Alticode. It includes the installation of an ADS-B ground station with good coverage of the airport and of the surrounding airspace and validation activities through data collection and analysis. Equipped aircraft are detected with a very good detection quality at 200 NM at high altitude and sometimes up to 250 NM. The data are transmitted to DSNA facilities in Toulouse for recording and analysis. Validation of ADS-B data would be performed using already equipped commercial flights, Airbus flight tests aircraft, Airbus delivery and ferry flights, and vehicle equipped with transponders. It enables data collection, comparison with radar, separation minima assessment study and analysis of Airbus aircraft installation performances. For French DSNA, the study will also prepare the operational implementation of

ADS-B especially in La Réunion Island (Indian Ocean) by gaining confidence in ADS-B data and identifying potential issues. A final public report will be delivered to Eurocontrol and can be made available to the ADS-B community at the end of 2005.

4.3.1 French DSNA is also involved with EUROCONTROL, ENAV (Italy), AENA (Spain) and HCAA (Greece) in the CRISTAL MED project that will deploy an ADS-B 1090 MHz ES infrastructure for the Mediterranean airspace. A 1090 ES network will be deployed in addition to the existing surveillance infrastructure to support both mixed ADS-B/radar and ADS-B only operations. The operational scope is ATC ground surveillance for en route and TMA using aircraft derived data. ADS-B will be used to allow radar-like procedures with goal to provide radar like separation even in areas without radar coverage and currently under procedural control. Both IFR and VFR will be considered. It is also envisaged to use ADS-B ground stations for airport surface surveillance on some major airports close to the Mediterranean area where ADS-B data could support aircraft identification and vehicle tracking for A-SMGCS. It was clarified that each participating state will purchase their own equipment for the project according to an agreed common standard.

Australia

4.4 Australia provided an information paper on the progress of the development of a Cockpit Display of Traffic Information (CDTI) for general aviation and small regional aircraft. Airservices Australia's Research and Development Team is involved in a number of projects aimed at encouraging the development of ADS-B avionics for regional aircraft and the general aviation (GA) community. Cockpit Display of Traffic Information (CDTI) is a key element of the proposed Australian ADS-B Lower Airspace Program currently under consideration by the country's aviation industry. Airservices has begun testing two cockpit display systems that are designed to provide pilots with accurate position and altitude information on proximate traffic. The systems, supplied by Eurotelematik of Ulm, Germany, use GPS and Automatic Dependent Surveillance Broadcast (ADS-B) technology to provide pilots with navigation, terrain and traffic information on a moving map display. The information can be shown on Eurotelematik's certified CDTI 2000 multifunction display or, as a lower cost alternative, on a pocket PC. A 1090 MHz receiver produced by Filser Electronic provides ADS-B data to both types of displays.

ADS-Based In Trail Climb (ITC) procedures

4.5 Australia informed the meeting that Australia and NASA have been discussing the possibility of a trial of ADS-Based. Current FAA ITC procedures allow a trailing aircraft to climb through another aircraft based on the pilot of the trailing aircraft reporting that he is separated from the lead aircraft based on observation of a TCAS cockpit traffic display. The major difficulty experienced with the FAA approved procedure was that pilots had to ensure the identity of the aircraft displayed on their TCAS display. TCAS typically displays position and altitude but no identity. The ITC procedure requires the lead aircraft being requested to turn off the ATC transponder. The in trail aircraft observes the transponder switch off and switch back on – and this was used as the identification process. The use of ADS-B and its display on cockpit resolves this by displaying the broadcast flight ID.

4.5.1 NASA, CASA and Airservices Australia together with Australian operators are examining the possibility of trialing the use of ADS-B Trail Climb. The objectives of the trial would be to collect data to support the further widespread applicability of the procedure. Initially was proposed that the trial could take place in transcontinental airspace which is currently managed procedurally. This airspace should have direct VHF communications between the controller and trial aircraft, and would allow data from the Upper Airspace ADS-B ground stations to be recorded for analysis. These ADS-B ground stations are expected to be operational in 2005, with the last few

ground stations being completed in the first quarter of 2006. A second phase of the trial could be conducted in Oceanic airspace – probably the South Pacific, or Indian Ocean airspace, at least in the Australian FIR, might also be considered. It was proposed that training for controllers and any necessary CASA operational approvals for the trial could be completed to allow a trial potentially in the second half of 2006. It is looking for a commercial carrier that might agree to fit necessary equipment. Electronic Flight Bag (EFB) or Updated TCAS displays may be used as suitable display of "ADS-B in" information to allow a trial to be conducted.

4.5.2 However, it was informed by IFALPA that in the South Pacific Oceanic air space RNP4 has been used and there will not be several aircraft at the same altitude. Some kind of procedure would be required in place if RNP in these areas need further reduction.

Airbus Transponder Status

4.6 The meeting was informed that Airbus certified in 2003 three new Mode S transponders, capable of ELS (Elementary Surveillance), EHS (Enhanced surveillance) and 1090ES (Extended Squitter, first implementation of ADS-B out). These three Mode S transponders ELS/EHS/ES capable are:

- ACSS XS-950, P/N 7517800-10005
- Honeywell TRA-67A, P/N 066-01127-1402
- Collins TPR-901, P/N 822-1338-021

4.6.1 Basically, Airbus aircraft are equipped with Honeywell transponder P/N: 066-01127–1101, which is not ELS-EHS capable. However, through the RFC process, new Airbus customers have the possibility of install on their aircraft an ELS-EHS capable transponder from the list above. This RFC is free of charge for customers, and the installation of a new transponder capable of extended squitter does not imply add costs to customers.

4.6.2 Some concerns have been raised about the ability for Airbus transponders to provide the integrity parameter NUCp, coded by HIL value to ground stations. The current Airbus transponder status indicated that the principle of encoding NUCp value is in BDS 0.5 (Airborne position) and BDS 0.6 (Surface position) using HIL as the input.

4.6.3 It was concluded that

- Airbus Enhanced Surveillance wiring provisions provide HIL parameters to the transponder;
- The ACSS transponder –10005 mod A uniquely uses HIL to compute NUCp and that the Service Bulletin for this modification is free of charge to customers that have a –10005; and
- To continue supporting ADS-B programmes, Airbus is asking other transponder vendors to provide statement on their transponders functionality.

4.6.4 It was noted that the equipage of ADS-B in Australia is progressing. It was noted that Cathay Pacific Airways had announced that all its aircraft were expected to be equipped by end 2005. It is quite encouraging that Cathay Pacific Airlines is taking very positive approach in next five years to move in this direction. It was also informed that at the ISPACG meeting in Brisbane, United Airlines advised that they would equip all their international aircraft with ADS-B out. Based on the

information from Mark Watson, UK National Air Traffic Services - Corporate & Technical Centre, Technology & Programmes Division, UK NATS has been monitoring 1090 Extended Squitter ADS-B equipage and capability. The December 2004 data capture and analysis is showing a leap in ADS-B equipage in the 3 months from September.

Upper Airspace Project (UAP) update

4.7 Airservices Australia has committed to deploying a network of ADS-B ground stations across Australia during 2005 under the UAP. This project is expected to provide near-nationwide coverage above FL300, with significant coverage at lower levels.

4.7.1 The 28 new ground stations will be progressively deployed, with the first two UAP ground stations installed at Melbourne airport as the Airservices Australia Test & Evaluation unit and at Bundaberg. Integration of the high performance GPS engine in the ground station has been completed. The unit uses HPL to generate the site monitor NUC (integrity) value. The installation at remote sites will be progressively completed through the second half of 2005. Commissioning of the UAP network is expected to take place by the end of 2005.

4.7.2 A RAIM prediction system as a modification to the existing system has been purchased to provide predictions of when aircraft can be expected to report integrity values corresponding to HPL<0.5Nm. Formal testing of the Eurocat enhancements has commenced. An ADS-B bypass system had been developed which takes ADS-B data from the ADS-B ground stations and presents it to the controller workstation directly without centralised processing. ATC procedure development had commenced. Design safety case for the UAP had been completed. Preparation of the Implementation Safety case has commenced.

Lower Airspace Project (LAP)

4.7.3 The Australian Strategic ATM Plan also includes the use of ADS-B at lower levels and a second initiative, the Lower Airspace Project (LAP) has been proposed to provide even greater ADS-B coverage in areas currently not served by radar, as well as replacing the current enroute network of secondary surveillance radars at the end of their service life (in 2009) with ADS-B ground stations. Primary and secondary surveillance radars will be retained in the terminal areas for the foreseeable future.

ADS-B Trial and Implementation Regulatory Aspect

4.8 Australia provided an overview of regulatory activity undertaken to support three ADS-B related projects in Australia. For the Burnett Basin Operational Trial, the Civil Aviation Safety Authority (CASA) approved the use of a 5 NM minimum horizontal separation distance between trial aircraft on 5 December 2004. A copy of the instrument authorizing ADS-B separation in the trial is available at http://www.casa.gov.au/rules/miscinst/2004/CASA559.pdf

4.8.1 In support of the Upper Airspace Project, CASA will consider Design Phase and Implementation Phase Safety Cases presented by Airservices Australia. The Safety Case process will support an application from Airservices Australia for re-issue of its CASR Part 171 (aeronautical telecommunications and radionavigation service providers) certificate to approve the operation of ADS-B ground stations and supporting systems. The same Safety Case will also be considered in a review of the CASR Part 172 (air traffic services) Manual of Standards to include separation standards for ADS-B.

4.8.2 In support of the UAP and LAP, CASA has issued a Discussion Paper (DP) addressing the carriage and use of ADS-B. The DP seeks industry comment on various options that CASA could adopt in initiating regulatory changes, and can be viewed at http://rrp.casa.gov.au/download/04_dp.asp.

4.8.3 The DP was drafted with the assistance of a joint CASA/industry project team and makes a study of the issues surrounding ADS-B in Australia. The paper sets out four main regulatory options, and identifies that informal consultation to date suggests that a phased implementation of aircraft fitment requirements may prove most suitable. CASA considers that industry responses to the options discussed and the parallel development of a business case will be the key to the future development of rules and advisory material. It is expected that further consultation on, and promulgation of, operational rules will support the use of the UAP network at the end of 2005.

4.8.4 Recently, CASA has issued two Australian Technical Standard Orders (ATSOs) for the certification of ADS-B avionics. ATSO-C1004 is a standard for Mode A/C transponders capable of transmitting ADS-B 1090ES messages, while ATSO-C1005 is a standard for the certification of a stand-alone (non-transponder) ADS-B 1090ES transmitter. Copies of the two ATSOs are included as attachments to the Working Paper and are available at:
http://www.casa.gov.au/avreg/aircraft/ATSO.htm.

4.8.5 The meeting discussed the issue of mandatory equipage which shall be subject to airlines consultation and/or a decision made by the government. It was informed that for the proposed mandatory equipage requirement in Australia in 2009, no one has indicated that the timeframe set would be too critical. It was noted that Cathay Pacific is looking to get benefit to fly to Australia within the next five years. However, requirement for a mandatory equipage would need a regional support. There would be mechanisms to manage exceptions and exemption from the mandate.

Agenda Item 5: Review result of ADS-B Working Group Meeting

5.1 Under this agenda item, the meeting reviewed several information papers and the work accomplished by the Working Group of ADS-B Study and Implementation Task Force as provided in WP2. The Working Group meeting was held from 14-15 October 2004 in conjunction with ADS-B Seminar held on October 13 at the Singapore Aviation Academy. The meeting was attended by 46 participants from Australia, China, Hong Kong China, Fiji, India, New Zealand, Singapore, Thailand, United States, IATA, SITA, and representatives from four industries.

Development of Technical Standard

5.1.1 It was noted that the United States Technical Standard Order (TSO)-C166 for Extended Squitter ADS-B and TIS-B Equipment Operating on 1090 MHz became effective on 20 September 2004, which can be electronically downloaded at:
http://www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgTSO.nsf/MainFrame?OpenFrameSet

5.1.2 It was also noted the possibility that some aircraft may not be adequately equipped for Australian UAP operations. It was recommended to ensure that:

a) ACSS transponders apply the service bulletin 7517800-23-6010 to make the transponder –10005 Mod A;

b) Aircraft are configured to use HPL as the basis for generation of NUC (or NIC with DO260A equipage); and

c) ADS-B Safety cases take into account the remote possibility of errors from HFOM based integrity data being transmitted.

Traffic Densities

5.1.3 Thailand provided traffic statistics conducted for the period 1998-2003. The overall average annual growth of en-route traffic for Bangkok FIR was 1.79%. Discounting the outbreak of Severe Acute Respiratory Syndrome (SARS) and the return of the Area of Responsibility (AOR) to Cambodia, the overall average annual growth should have been at 3.77%. Based on this figure, the traffic over Bangkok FIR is expected to reach 450,000 by 2015. Typical traffic density over Bangkok International Airport is between 20 and 30 aircraft per hour based on a radial area of 250 NM. This rises to 40 aircraft per hour during festive seasons and long holidays.

5.1.4 The meeting noted a snapshot of traffic densities seen by Sydney airport terminal area radar on 27 September 2004 during a small 15 minutes period (WP/09). This method of traffic density capture may be used by other states as a simple and effective way of capturing current traffic densities in radar airspace. The numbers represent the maximum number of aircraft PER ANTENNA REVOLUTION, detected by the radar within the range shown.

ADS-B Data Sharing Policies

5.1.5 The meeting discussed a paper on ADS-B data sharing policy presented by Australia. The paper analyzed the characteristics of potential data sharing of radar, FANS 1 based ADS-C and ADS-B. It was stated that the following two levels of service could be adopted for sharing ADS-B data.

LEVEL 1: Use of the ADS-B data for radar like separation standards (eg. 5 NM). This requires availability, reliability, accuracy and integrity equivalent to that offered by radar.

LEVEL 2: Use of ADS-B data for situational awareness and perhaps some automated safety alerting features such as Cleared level adherence monitoring. For this service, integrity and accuracy are most important whilst lower standards could be tolerated for availability and reliability. Accuracy and integrity are determined in most part by the system design and by the avionics. Maintenance support is not as critical for this level of service.

5.1.6. Regarding the legal aspect of sharing ADS-B data, it was agreed that a LOA would always be required between the two states sharing ADS-B data. A sample data sharing agreement proposed by Eurocontrol in 1997 was provided to the WG meeting as a sample.

5.1.7 The meeting noted the U.S. activities concerning comparison of ADS-B vs. radar data and plan for a national 3 NM terminal ADS-B separation standard. These activities are documented in the *Plan to Obtain Approval for Automatic Dependent Surveillance - Broadcast (ADS-B) Terminal Area Separation Standards* (TermSepStdPlan). (FAA, Final Coordination v1.0, 31 August 2004). Analyses were performed on the horizontal position accuracy of ADS-B and radar targets reported to the ATC automation system. Comparing ADS-B accuracy to terminal SSR cross track accuracy at 40 NM from the radar, the data indicates that ADS-B is from 18 to 60 times more accurate. Comparing ADS-B accuracy to enroute SSR cross track accuracy at 200 NM, the data indicates that ADS-B is from 90 to almost 300 times more accurate.

5.1.8 Thailand informed the meeting that a cost estimate for provision of a 9600 bps communication link without ADS-B ground station between ADS-B site and the air traffic control centre in Thailand is about US$ 4,800 covering both additional hardware to accommodate an extra communication link and initial installation. The cost estimate was based on the assumption that the ADS-B system would be installed at a location which already has a communication infrastructure (VSAT Network). Annual maintenance costs are minimal as these will be shared with the other systems/applications using the existing infrastructure. The meeting noted that the cost could be different in the different environment.

5.1.9 IATA informed the meeting of the estimated costs of an airline fitting various types of aeroplanes with ATC transponders and other necessary equipment to enable ADS-B out using 1090ES. Airlines have been installing Mode A, C, S 1090 MHz Transponders with and without the capability for extended squitter. The recent European mandate of enhanced radar surveillance required these ATC transponders to be upgraded for extended squitter. There is an additional cost to further upgrade the aeroplane wiring and systems to enable ADS-B air-ground surveillance service using 1090 ES. It was indicated that the cost to do so is very dependent on the particular airframe, the number of aircraft in the fleet, the relationship between aircraft owner and the aircraft supplier and many other variables.

An Example of A-SMGCS Trial

5.1.10 Singapore updated meeting on activities and work carried out on ADS-B in the Singapore FIR. Singapore plans to implement ADS-B in 3 phases as follows:

(a) Phase 1 (2006/7) involves the tracking of ground movement of vehicles with ADS-B transponders and ADS-B equipped aircraft using sensors installed at Changi Airport. The ADS-B tracking will be displayed at the Advanced Surface Movement Guidance and Control System (A-SMGCS) at Tower.

(b) Phase 2 (2007/8), the ADS-B coverage will be extended up to 250 NM by installing a high-gain antenna in the airport vicinity, if required.

(c) Phase 3 (2009/10) we will integrate ADS-B data into the new ATC system for ATC operations.

5.1.10.1 In early October 2004, Singapore took the opportunity of flight inspection to long range radar to conduct a simple ADS-B trial (with the support from Singapore Engineering Software Systems Pte Ltd and Sensis Corporation) to assess performance of ADS-B. After analysis of the data captured during the radar flight check, the following results were observed:

a) Initial pick-up of aircraft

The ADS-B receiver (located at Changi) was able to track the flight check aircraft at Seletar Airport (about 13 KM away from Changi) while still on the ground. Due the fact that there is no line of sight between the long range radar and the flight check aircraft at Seletar Airport, the long range radar was able to pick up the flight check aircraft only after take-off;

b) At Changi Airport, touch and goes were conducted at the 4 runway ends. The long range radar performed accurately according to the specifications for all runway ends except for one probably due to blockage. In comparison, ADS-B was able to track the aircraft from arrival, touch-down to taxi-ing. At a certain point, the flight track was dropped probably due to the blockage by the terminal buildings.

c) ADS-B antenna cone of silence

At a certain distance from radar head, the radar would drop the flight check aircraft track. Flying at varying flight levels of FL 350, 330 and 290, it was observed that the cone of silence for the long range radar was 9, 8 and 7 NM radius respectively. For ADS-B, it was observed that the cone of silence was larger at 11, 10 and 9 NM radius. It was understood that the cone of silence of the ADS-B antenna was wide as a standard DME antenna was used for this trial.

d) Potential ADS-B coverage

The flight check aircraft was flying on a specific airway at 7000ft. It was observed that ADS-B could track the flight check aircraft all the way to 118 NM while the radar could only track the aircraft up to 130 Nm but intermittent detection started at around 120 NM.

e) Performance on specific SID/STAR and aircraft maneuvering

When the flight check aircraft flew along the SID/STAR, both radar and ADS-B provided comparative position reporting. At certain points of the aircraft maneuvering, we lost some ADS-B tracks. That was probably due to the fact that the aircraft was only equipped with 1 transponder antenna attached on the top of the aircraft. However, with the fast update rate of ADS-B, the track drop was recovered within 2 - 3 seconds. This fast update rate would be useful in improving the conflict alerts (ie reduce false alerts) in the ATC system.

5.1.10.2 From the few days of recordings, we managed to track about 20 aircraft per day which equates to about 3% of aircraft in the Singapore FIR (based on current traffic density). This figure is very promising as compared to the early days of FANS implementation.

5.1.10.3 Singapore informed the meeting that the total aircraft movement in the Singapore Flight Information Region (FIR) in 2003 was 251,573. Based on the ICAO forecast (which has been adjusted for SARS), the total aircraft movement in the Singapore FIR is envisaged to increase to 472,000 by 2015.

Options for Small Aircraft ADS-B Avionics and their Costs

5.2 The meeting noted the information provided by Australia on options and cost for small aircraft ADS-B avionics from various manufacturers. It was recommended that a nominal lowest value of $5,000 USD + $1000 USD = $6,000 be used as the price for low end General aviation avionics in the APANPIRG Cost Benefit study.

ATC Automation Costs

5.2.1 The meeting noted the information on the range of prices for changing ATC automation systems necessary to integrate ADS-B data. The cost for a single integration with ATC system would be US$50,000.- PC Based system and $5M-$10M for integration into an advance automation system. A medium automation system with radar capabilities could be expected to cost in the order of US$2M to $3M. It is impossible to define precisely the price as it depends on the specified optional functions and the level of requirements for integration, redundancy, training, logistic support etc.

Potential Area for using ADS-B

5.3 It was noted that IATA informed WG meeting that a requirement for using ADS-B can be identified in area between D.P.R. Korea and Russian fast east including Northern of Japan which would be potential area to use ADS-B technology serving those flights between Republic of Korea and Russia and beyond via DPR. Korea. There is minimal procedure airspace in DPR Korea and large part of military airspace in Northwest of Japan. In reviewing task given to IATA, it was informed that it is just premature to provide information at this meeting. IATA further informed the meeting that a visit in April 2005 to Pyongyang for upgrading ATS facilities and proposal would include both ADS-C and ADS-B. Therefore, IATA was requested to provide details information at next Task Force meeting listing advantage and benefits by extension of radar coverage with ADS-B ground station.

Decision 3/2 - Use of ADS-B in an air space of North Asia

That, Member from IATA prepare and present a paper on study of using ADS-B technology in an airspace of North Asia at next Task Force meeting.

Three city pairs

5.4 While the meeting agreed to continue efforts on the city-pair study and considering the result of study on three city pairs, the meeting agreed that the future study and implementation should be focus on an area along major traffic flow even for great circle routes rather than along one or two specific ATS routes. This approach would provide greater benefits and assist the cost/benefit analysis and broad business case. Such approach would also have the flexibility to support dynamic routes.

5.5 The possibility was also raised of sharing the costs and benefits between en-route applications (city pairs) and ground surveillance ASDE applications at the same site.

ADS-B Radar – Like Service with a Regional ADS-B Provider

5.6 To minimize capital investment by ANSPs and technical/commercial ANSP risk, SITA made a proposal for provision of the ADS-B service jointly with ANSPs. For example SITA will buy, install and maintain ADS-B ground stations and operate on existing SITA RGS sites or on ANSP sites. Example of ADS-B data sharing implementation sites could be at Norfolk Island and Christmas Island of Australia and Port Blair of India. The meeting was informed that SITA and Airservices Australia had become partner in providing ADS-B radar like service.

Sharing Experience of Implementation of ADS-B

5.7 While discussing the development and implementation plan of States, Australia and USA offered to share their ADS-B study and implementation experience with other States. The meeting recognized the need to use the resource available in the Region to help individual States who may wish to visit the ADS-B site for one or two days to share lessons learnt and experience gained.

Inconsistent Use of Flight Numbers by Flight Crew

5.8 Australia informed the meeting of an observed problem of inconsistencies in flight number/flight identification formats entered by flight crew in aircraft flight management systems. Typically, in air transport category aircraft, an ADS-B capable transponder will broadcast the flight identification entered by the flight crew in the FMS. When a match is found and the position information meets specified flight plan route criteria, a series of automatic events are triggered, including activation of the flight plan, target identification of the aircraft on controllers' display screens and the updating of "down stream" flight information.

5.8.1 Variations in flight identification formats observed in ADS-B reports received through the Bundaberg ground station. Typically, flight plan using ICAO three-letter designator plus the flight number, without leading zeros, eg. IAD12. The ATC service provider would therefore expect to receive ADS-B reports with target identification in the same format. A number of different flight number formats that do not match the corresponding flight plans are being observed in ADS-B reports as follows:

- IATA airline code and flight number, eg. “IC12”
- Flight number only, eg. “12”
- Flight numbers with leading zeros, eg. “IC012” or “IAD012”
- Something completely different, eg. “IC2312”

5.8.2 The meeting noted that this problem also existed for FANS 1/A operation. Pilots may have confused with radio call sign used. It was informed that no minimum number of digits for the call sign but now 3 digits is the minimum number. The meeting agreed that the problem should be brought to attention of ATM/AIS/SAR sub-group of APANPIRG. It was emphasized that the flight identification entered in the flight management system or transponder should match the aircraft identification (Item 7) in the ATS Flight Plan.

5.8.3 Australia informed the meeting that due to numerous errors in Flight ID, email letters have been sent to the Flight Operations staff of the concerned airlines in the form shown below following each error or collection of errors. As a consequence, the rate of Flt ID entry errors has diminished markedly. Incorrect FLT IDs are relatively rare now. The meeting noted that a specimen AIC on the topic of “ICAO 24-Bit Aircraft Addresses and Aircraft Identification Reporting issued by Eurocontrol . The meeting also noted the information sheet on the topic of entry of Flight ID was issued UK CAA.

5.8.4 In response to a decision made by the ADS-B Task Force, IATA had issued a general reminder to the Directors of flight operations of its member airlines to use correct flight identification format required to enter into FMS or transponder. However, no feed back have been received.

5.8.5 The meeting recognized that some regional aircraft are not equipped with equipment for 24 bit aircraft address. Rather than 24 bit address, the flight ID is used. Necessary operational procedure should be considered and specified in the operational manual. To monitor the improvement of this problem, States were encouraged to report any abnormal status of using flight ID to the Problem Reporting System.

Problem Report System.

5.9 An interim ADS-B problem and issue reporting database has been developed by Australia based on the proposal agreed by the Task Force. ADS-B related problems and issues may be submitted online using a data entry form on the Airservices Australia website at www.airservicesaustralia.com/adsb/issues with following user name and password. Members of the ADS-B Task Force were invited to provide any comments regarding the web page and the database.

User name: icao
Password: abit2004
Domain: *leave this field blank*

This will bring up the Problem and Issues data input form.

There are links on the page to detailed data entry form instructions and to the latest report from the Problem and Issues database.

Use the form to create a new problem or issue or to make comments relating to an existing issue or problem.

5.9.1 It was considered important that information that may have an impact on other parties be distributed to all users as soon as possible. In doing so, each party is made aware of problem already encountered by others. Each party may contribute further information to aid in the solution of these problems. The meeting reviewed the six problems report contained in the database.

5.9.2 It was suggested to classify the problems in the database into different groups as more problems may be received in the future. In order to get further comments on the reporting system, the meeting developed the following Decision:

Decision 3/3 - Comments on ADS-B problem report system

That, Members of the ADS-B Task Force provide comments to Australia on the web basd ADS-B Problem Report System.

ASTERIX Format for sharing ADS-B data

5.10 The meeting reviewed the result of a study carried out by members from Australia and USA on ATERIX Format selection for use in the Asia and Pacific region for sharing ADS-B data. In following up a decision made at ADS-B WG meeting members from Australia and the US took an action to coordinate a recommendation on ASTERIX format for ADS-B data exchange. It was noted that Eurocontrol maintains ASTERIX data format standards for data sharing between Air Traffic Control automation systems. The format which has worldwide acceptance by the ATM system manufacturing industry is called ASTERIX Cat 21 for ADS-B.

5.10.1 The USA, based on 4 years of operational experience has expanded upon ASTERIX 21, and created an ASTERIX 33 message format for use of ADS-B in United States ground automation systems. A summary table listing the differences in these formats was provided to the meeting. It was suggested that the US and Australia will work with Eurocontrol to amend the ASTERIX 21 format to include the additional data elements in ASTERIX 33. While that effort is ongoing, it was recommended for Asia Pacific to use ASTERIX 21 for sharing of ADS-B data to allow international harmonization while individual States may elect to use any format internally that meets their needs. However, it was advised that the data format for domestic use normally should be the same as it is important for quality control.

5.10.2 The meeting discussed the recommendation and recognized that the ASTERIX 21 format will evolve, and should consider the potential for future upgrades in their system designs. It was informed that the version number of ASTERIX21 data format are changed every three months. It was confirmed that version 0.23 was issued in November 2004. It was further informed that the versions are now backward compatible. The deficiency of non compliance of using WGS84 was cited as an example for important to have a common data exchange format crossing the FIR boundary.

5.10.3 After a lengthy discussion, the meeting concluded that that Asia Pacific needs an agreed ADS-B data exchange format so that states may specify and acquire ADS-B systems with confidence that they will be interoperable. The meeting further agreed that a baseline of the version number should be indicated in the ADS-B data exchange format and that Australia and USA to coordinate with Eurocontrol to request ongoing involvement by the Asia Pacific region in the future evolution of the Category 21 message standard.

5.10.4 The use of an Industry accepted standard will minimize deployment and data exchange costs. Eurocontrol exercises configuration control of the standard and version 0.23 is considered the current baseline for deployment of ADS-B systems. Accordingly the meeting formulated the following draft Conclusion:

Draft Conclusion 3/4 - ADS-B Data Exchange format

That,

1) the Eurocontrol Cat 21 version 0.23 or later message format be adopted for ADS-B data exchange in the Asia Pacific region.

2. ICAO seek agreement from Eurocontrol to use the Eurocontrol Asterix Cat 21 document in the Asia Pacific region as was done for radar data exchange in the region.

5.10.5 Like all standards, improvements to the Cat 21 will evolve over time and these evolutions can be reviewed for adoption by APANPIRG. Eurocontrol's Surveillance Task Force (STFRDE) which maintains the standard agreed in late 2002 (when the baseline was V0.20) that "future evolutions shall ensure their compatibility with this baseline"

Agenda Item 6: Progress items due in 2005

6.0 Under this agenda item, the meeting discussed the several issues including ADS-B implementation and operational guidance documentation (AIGD), updating the regional plan for the CNS/ATM system and cost/benefit studies.

ADS-B Implementation and operational Guidance Document (AIGD)

6.1 New Zealand presented a paper (WP/03) on the progress of the development of the Asia/Pacific Regional ADS-B operational manual (AOM). The AOM has been developed in accordance with a task given to New Zealand and the USA by the second meeting of the ADS-B Task Force meeting held in March 2004 to provide guidance material for States in ASIA/PAC region that intend to deploy ADS-B technology to enhance surveillance service. It will be a user friendly document with comprehensive information. The draft version of AOM incorporates material supplied by New Zealand and USA and was modelled on the FANS 1A Operations Manual (FOM). An updated draft version incorporated the comments made at the October 2004 Working Group meeting and the feedbacks from the subsequent exchanges with Task Force members.

6.1.1 The New edition of the draft AOM was provided to OPLINKP for comments at its February 2005. Considering the comments made by OPLINKP for the manual and concerns on the name of the manual expressed by the IFALPA and Secretariat based on the experience gained in adoption of using FANS Operation Manual, the meeting agreed to rename the AOM into the AIGD. The meeting also set up an ad hoc draft working group with Mr. Howard Anderson from New Zealand as rappoteur to review the document in details. The ad hoc working group consisting of experts, regulators, ATS service provider and the secretariat reviewed and updated the manual in a thorough and completed manner.

6.1.2 The meeting reviewed the structure of the draft AIGD and discussed the role of AIGD and its relation with PANS-ATM. The meeting considered that the AIGD should be a living document and it should keep consistency with PANS-ATM. The Task Force wishes to take steps ahead and provide input to OPLINKP for the global guidance material. The AIGD will continue to align with works being carried out by OPLINKP and SASP. The meeting recognized the complementary nature of the work by the Task Force to develop AIGD and the work by OPLINKP to develop amendments to the PANS-ATM.

6.1.3 The meeting reviewed and endorsed the updated version of the AIGD finalized by the ad hoc working group with understanding that updated material and editorial amendment would be incorporated based on the result of the SASP WG/WHL meeting scheduled for May 2005. Accordingly the meeting formulated the following draft Conclusion.

Draft Conclusion 3/5 - ADS-B Implementation and Operation Guidance Document (AIGD)

That, the ADS-B Implementation and Operation Guidance Document as provided in Appendix B be adopted and circulated to States in the Asia and Pacific region and International Organizations.

6.1.4 The meeting appreciated efforts made by New Zealand and USA in completing the draft AIGD. The meeting also thanked and congratulated the ad hoc working group for having done an excellent job in finalizing the guidance document during the meeting.

ADS-B Implementation Checklist

6.2 The implementation checklist prepared and provided by Singapore had been reviewed and incorporated in the AIGD.

Amendment to Regional Plan for the CNS/ATM System to include ADS-B

6.3 The meeting reviewed and endorsed the draft amendment proposal to the ASIA/PAC Regional Plan for CNS/ATM System to include ADS-B. The plan needs revision to include planning and implementation activities of ADS-B. The proposed changes are contained in the Chapter 5, Chapter 6 and Chapter 9 including timing of national implementation in the table 9-1 of the Plan.

6.3.1 As the term of ADS-B is introduced, the meeting agreed to replace ADS used in the document with ADS-C especially in the two chapters and in the bar chart. Accordingly the meeting formulated the following draft Decision:

Draft Decision 3/6 - Amendment to the Regional Plan for the CNS/ATM System to include ADS-B

That the ASIA/PAC Regional Plan for the CNS/ATM System be amended to include ADS-B element for the surveillance systems as indicated in the Appendix C to this report.

6.3.2 The meeting also reviewed the information contained in the Table CNS 4 of the ASIA/PAC air navigation plan FASID. It was noted that ADS-B was marked as emerging technology and listed as one system in the planning and implementation table. The meeting suggested that such remark should be removed as ADS-B has been identified by APANPIRG as one enabler for new ATM concept and system.

6.3.3 It was noted that the ASIA/PAC FASID serves as a planning tool to facilitate transition to the CNS/ATM system in an evolutionary manner. The FASID is, therefore, expected to be updated regularly to facilitate planning and implementation of the air navigation services and facilities in the region.

6.3.4 Considering that States were encouraged by APANPIRG to implement ADS-B at sub-regional bases with target date commencing from 2006 and information contained in the Regional Plan for the CNS/ATM System needs to be gradually transferred into the tables of FASID. The meeting updated information contained in the surveillance table. Accordingly, the meeting formulated the following draft Conclusion.

Draft Conclusion 3/7 – Amendment to Table CNS-4 – Surveillance System

That, the existing Table CNS-4 – Surveillance System provided in ASIA/PAC FASID, Part IV CNS be replaced with an updated Table contained in Appendix D to this Report in accordance with established procedure

Review of the revised BORPC for regional air navigation planning

6.3.5 The meeting reviewed the Surveillance part contained in the revised BORPC approved by Air Navigation Commission on 22 February 2005. The meeting discussed the role played by ADS-B in the surveillance system. ADS-B based air-ground surveillance has been identified by APANPIRG as one cost effective alternative to the radar system in remote continental airspace and

for backup or redundant surveillance system. ADS-B has also been identified as an enabler for the new ATM concept. The accuracy derived from ADS-B trial has confirmed more than ten times better than accuracy derived from Radar. Therefore, the meeting proposed to remove the last two sentences in the paragraph 7.2 starting from Primary and/or secondary. The proposed amendment to the revised BORPC relating the surveillance is provided in the Appendix E to this report. Accordingly, the meeting formulated the following draft Conclusion:

Draft Conclusion 3/8 - Amendment to Surveillance Part of BORPC

That, the paragraph 7.2 of the revised BORPC be amended as indicated in the Appendix E to this report.

Agenda Item 6.4: Progress development of Regional Implementation Plan

ADS-B Project study and Implementation Plan in Fiji

6.4.1 Fiji informed the meeting of the progress of ADS-B study and tentative plans for implementation of ADS-B in Fiji. The ADS-B core Project team was liaising with some of the Stakeholders to complete and Cost Benefit Analysis (CBA) study. The following tentative project plan had been developed to be provided with Cost Benefit Analysis report for approval by the State which leads us to implementation of ADS-B in Fiji.

1	CBA Study and presentation to the appropriate authorities for the State. ***If successful and approved then items 2 & 3 will be revised (if required) and confirmed.***	30 April 2005
2	Specification documentation, ROI, tender and sign contract.	31 October 2005
3	Equipment delivery, implementation, commissioning of systems and the ADS-B service in Fiji.	30 April 2006

6.4.1.1 Four VHF sites are being considered for initial location of the ADS-B Ground Stations including two remote sites at Delaikoro and Koro-o and two local sites at Nadi and Nausori Airports.

6.4.1.2 The meeting recognized that the ADS-B solution for surveillance capability in Fiji is a typical example for where no radar surveillance service being provided.

ADS-B System Implementation Activities in the Republic of Korea

6.4.2 The republic of Korea informed meeting that in the the 2nd phase construction of Incheon International Airport, ADS-B system has been considered to enhance surveillance capability for approaching aircrafts to the airport and moving vehicles on the ground by providing efficient RIMCAS (Runway Incursion Monitoring and Conflict Alert System) function and fostering smooth air traffic flow. Incheon International Airport, which is currently operating Ku-band ASDE (Airport Surface Detection Equipment) with a MRI (Multi Radar Tracking) function, will be improved by adding X-band ASDE to ensure a perfect ground system for CAT-IIIb operation during the 2nd phase construction.

6.4.2.1 Two aspects are identified to design ADS-B system during the 2nd phase construction of Incheon International Airport. First, ADS-B system will be established for interface with ASDE system in order to supplement the detection function which is easily influenced by blind area or by more than a 16 mm/h rainfall. Second, when an independent parallel runway operation is available, the ADS-B system is to be integrated with ARTS (Automated Radar Terminal System) in order to enhance precision approach monitoring for simultaneous parallel arrivals and departures. The information derived from ADS-B would be also provided to controllers on the screen of working stations. Four sets of ground ADS- B receivers are to be established at appropriate positions in the airport to secure sufficient visual range for detecting approaching and moving aircrafts and vehicles. The ADS-B system plan will be determined after review of expert committee with consideration of international standards and then the final decision will be made in the consultation with concerned authority and organizations about timeline, budget etc.

6.4.2.2 The SSR Mode S 1090 MHz ES will be used and the project is anticipated to be completed by 2008.

ADS-B Implementation for La reunion island

6.4.3 France informed the meeting of the ADS-B implementation plan for La Réunion Island. Traffic in Saint-Denis-Gillot TMA is composed with long range aircraft (over-flights, flights to Europe), regional aircraft (flights between islands especially between Mauritius and La Réunion), single engine and light twin engine VFR or IFR aircraft; helicopters. Most of these flights are climbing or descending in this airspace and the complexity of the situation has increased with the development of the second airport. This makes Air traffic control more and more difficult. The Air Navigation Directorate of the French DGAC recently decided to implement an ADS-B system in Reunion Island and has launched the definition study to prepare this implementation.

6.4.3.1 The Implementation study is addressing operational need, aircraft equipage policy, ADS-B ground station installation, ADS-B data processing and display system, cost and work breakdown. The study is based on the choice 1090 MHz ES ADS-B technology**.** A fleet survey has been made to assess the feasibility of having equipped traffic in this airspace. It has shown that about 40% of the traffic could be equipped based on enhanced surveillance requirement, aircraft renewal and voluntary retrofit. For other airlines only a regional implementation could justify their equipment investment. A regional mandate may be necessary to converge to a full equipped traffic situation. Ground station site survey and coverage simulation have been performed. The sites are existing VHF station sites that can host easily an ADS-B ground station. Three ground stations would satisfy the need for coverage of IFR traffic as identified in the operational need assessment.

6.4.3.2 The definition study is expected to completed by May 2005. Afterwards it is planned to issue a call for tender for the delivery of ADS-B ground stations in order to achieve a first installation in 4th Q of 2006. Operational validation will start early 2007 which would last about 2 years. Safety analysis including ADS-B separation standard will be conducted in order to achieve ADS-B separation procedures by 2009. The preliminary studies have shown that considerable efforts are still required on regulatory aspects such as aircraft equipage mandate and definition of separation.

ADS-B updated in Indonesia

6.4.4 Indonesia provided an information paper on the updated ADS-B update program in Indonesia. To extend the surveillance coverage within Indonesian airspace, in the Near-Term DGAC of Indonesia desires to install ADS-B ground station for use as complementary surveillance tool. In

the Long-Term will consider SSR replacement program and to explore other applications. In the near term, the installation would be divided into Phase-1 and Phase-2.

6.4.4.1 Phase-1

to install 11 ground stations with 3 stages at the following location to extend radar-like coverage and replace the unserviceable radar.

Stage-1: Jayapura, Timika, Merauke and Saumlaki
Stage-2: Ambon, Biak, Sorong and Ternate
Stage-3: Palu, Kupang and Natuna

6.4.4.2 Phase-2

to install the following 9 ground stations as a backup for the old SSR station which is appraoching their end-of-life cycle. The Makassar Automation Air Traffic System will have the capability to process ADS data.

No	**SSR Location**	**Inst.Yr.**
1	Semarang	1981
2	Tanjung Pinang	1981
3	Palembang	1981
4	Medan	1981
5	Jakarta Int'l	1985
6	Makassar	1986
7	Pekanbaru	1986
8	Banjarmasin	1987
9	Surabaya	1988

Thailand

6.4.5 Thailand informed the meeting that Thailand intends to initiate an operational trial of ADS-B for ATC surveillance from 2005 with the target time frame 2010 for full operation, operating in parallel with the existing Secondary Surveillance Radar (SSR). ADS-B is expected to provide improved radar like coverage for Bangkok FIR, as well as backup, or replace existing radar systems in Thailand.

Cost/Benefit Study

6.5 In introducing four papers presented under Agenda Item 6.5 the Chairman observed that the preparation of sound business cases incorporating cost-benefit analyses was an important task and one which the Task Force should now address as a high priority.

6.5.1 A representative from Japan presented Information Paper 7 – “Cost/Benefit Studies - City Pair 2: Hong Kong, China - Tokyo, Japan”. He explained the intended purpose of the proposed project, the environment in which it would be introduced and the assumptions that would be used in the cost-benefit analysis. The meeting was advised that the undertaking of the study did not imply any decision on the part of the Japanese Government to commit to the implementation of ADS-B on this route. However, the analysis would examine the implications of replacing some radar stations with ADS-B ground stations from 2018.

6.5.2 A representative from Hong Kong, China commended the study and informed the Task Force that trials of surface surveillance sensor had commenced at Hong Kong International Airport in January 2005. It was further observed that en route application of ADS-B would not proceed at least until it was demonstrated that the project is justified in a thorough cost-benefit study. Hong Kong, China offered its assistance in the assessment of the safety benefits associated with the project. Japan thanked Hong Kong, China for its offer of assistance and further advised that it had received permission from Eurocontrol to apply its standard parameters and data in the cost-benefit analysis.

6.5.3 The Secretariat observed that some of the parameters such as the value of travel time savings and the value of avoided fatalities and injuries could play a significant role in the analysis. The Secretariat noted that these parameters were estimated in a European context but that the characteristics of travelers in Asia/Pacific are different in important respects. Noting this, it was recommended that sensitivity tests be carried out on these parameters. A representative of Australia emphasized the commercial significance of safety benefits in terms of their impacts on reputation, insurance costs and operational benefits arising from fewer diversions of flights under extreme conditions.

6.5.4 A representative of IATA presented Information Paper 19 – "Business Case Analysis of Expanded Air Traffic Surveillance over Hudson Bay". IATA advised that this document was prepared by NAV Canada in March 2005 and that it had been sent to IATA for comment. The Task Force was advised that the report contained the results of what appeared to be a thorough business case analysis of extending NAV Canada's surveillance in the Hudson Bay area either using radar or ADS-B. Bearing in mind the significance of the topic and its conclusion in favour of radar, IATA had made available to the Task Force. IATA noted that the report did not explore the safety benefits of increased surveillance in great detail, but instead emphasized the quantifiable commercial benefits. It was acknowledged nonetheless that improving safety was a key rationale for proceeding with the project.

6.5.5 However, the representative from IATA raised questions about the parameters used in the study, particularly the construction and operations/maintenance costs associated with ADS-B, the number of ground stations required and equipage costs. The Task Force was informed that IATA had yet to formulate its views and respond to NAV Canada, but that further consideration would be given to these matters. A representative from Australia also questioned assumptions made about the costs of installing and operating ADS-B. He informed the Task Force that Australia's experience based on actual costs incurred was that ADS-B would prove to be significantly less costly than radar. Furthermore, Australia had found that the area covered by ADS-B was at least as great as radar and thus it was questioned why the NAV Canada study assumed that six ADS-B ground stations were required to match the four needed to install radar surveillance. Both IATA and Australia also questioned the study's assumptions that the effective life of the ADS-B equipment would be shorter than that of radar.

6.5.6 The Secretariat demonstrated a spreadsheet model that replicated the financial calculations contained in the NAV Canada report. It was noted that the analysis assumed that the project to install radar would take five years to complete whereas the ADS-B option could be commenced one year later. The Secretariat demonstrated that the net present value of the ADS-B project improved significantly by commencing it at the same time as the radar project, effectively generating benefits one year earlier. The Secretariat also noted that the NAV Canada used a real rate of discount of only 4 per cent whereas the Asian Development Bank, for example, uses rates of 10 to 12 per cent. A higher discount rate, it was shown, made the ADS-B option relatively more attractive. The Secretariat also noted that the NAV Canada report, while described as a business case was a form of cost-benefit analysis which normally would be one of the inputs to a comprehensive business case.

It was noted that a business case should identify each of the major stakeholders and show, for each one, how the project(s) would affect their finances and operations. The stakeholders, it was added, possibly include organizations providing funds and insurance.

6.5.7 A representative of Australia presented Information Paper 21 – "Cross Industry Business Case Study in Australia". The meeting was informed that the purpose of the study was to examine whether the introduction of the Lower Airspace Project benefited the aviation community as a whole taking into all Australian industry costs and identified benefits. Six scenario options were considered including the replacement of the existing en route radars. In all cases a conservative approach was taken to the estimation of benefits which would flow over the period 2008/09 to 2022/23 while costs were maintained at the higher level of expectation and mostly would be incurred in the initial years. The meeting was advised that a reputable firm of economic consultants had prepared the business case report which is currently being validated by stakeholders and is not yet available for wider distribution. However, Australia advised that the draft report is very encouraging and there is an expectation that the Lower Airspace Project will proceed.

6.5.8 In commenting on the study, the representative from Australia noted that one problematic area with the analysis was in the valuation of impacts of the project on national defence, which could be both positive and negative. Also, it was found that the airline operators were unable to provide reliable predictions about their fleet composition in 2009 and later periods. The Secretariat observed that the Australian study illustrated key features that should be addressed in a business case analysis. In particular, the attention given to identifying the key stakeholders and in assessing the various options from the perspective of each stakeholder was important. The possibility that some stakeholders might not derive positive net benefits had also been addressed in the cross-industry approach and in the cost-benefit analysis framework. As a result the study was well equipped to formulate mechanisms to ensure that all parties view the project favourably. The Secretariat also observed that any business case should be credible to the stakeholders and that the merits of employing an independent and reputable group to carry out the study is worthy of further consideration.

6.5.9 France and Fiji also noted that business cases were more than Cost/Benefit studies and needed to take into account non quantifiable benefits such as safety improvements. The non quantifiable benefits need to be considered.

6.5.10 The meeting discussed future actions. The Chairman noted the extensive discussions on the papers presented and the emerging consensus that there was a need now to establish sound business cases for specific projects. The meeting discussed the merits of sharing knowledge about parameters and costs used in financial and economic evaluations and the representatives of Australia agreed to develop a template of key parameters for continuing use and development by the Task Force. The meeting noted, however, that a sound evaluation of the ADS-B concept would facilitate future implementation. In particular, the aim of such an evaluation would be to justify the investment in necessary resources to carry out credible business case analyses for specific projects. Australia volunteered to prepare such an evaluation with support from the Secretariat.

Agenda Item 7: Any other business

7.1 The meeting reviewed the Subject/task list. The meeting considered the need to continue its efforts in cost benefit study. The sub-regional based ADS-B implementation plan and project should be developed and issues emerged during the trial and implementation stages should be appropriately addressed. The exchanging information and experiences gained during the trial and implementation of ADS-B should be further encouraged. Accordingly, the meeting formulated the following draft Decision for adoption of the updated subject/task list

Draft Decision 3/9 - ADS-B Task Force Subject/Task List

That, the updated subject/task list for ADS-B Task Force as provided in Appendix F be adopted.

7.1.1 The meeting also reviewed and updated the list of action items to be taken by the Task Force members. The updated Action Items is provided at Appendix G to this report.

7.2 In order to attract more participants from the Industry from other region, ADS-B air-to-air surveillance service should be addressed by the Task Force. It should be included in the Task list of the ADS-B.

7.3 The meeting expressed thanks to SENSIS and THALES ATM Pty Ltd and the Secretariat for the social events and satisfactory arrangement made for the meeting.

Time and Venue of Next Meeting

7.4 The exact date and venue of the next meeting of ADS-B Task Force will be coordinated through secretariat. The time frame for the next meeting will be at sometimes around end of October or early November 2005 as work on separation based on ADS-B would be completed by ICAO Panels.

7.5 States were requested to consider hosting the next ADS-B Task Force Meeting. The delegates from Fiji and the Philippines wished to seek government approval from their Administrations before offering to host the next meeting. It was agreed that States should notify the Secretariat upon getting the approval from their government.

Appendix A

List of Designated Contact Persons
Responsible for ADS-B Study and Implementation Task Force
in the ASIA/PAC Region

State/ Organization	Name/Address	Telephone/Fax	E-mail address
AUSTRALIA	Mr. Greg Dunstone Technical Specialist & ADS-B Programme Manager Airservices Australia GPO Box 367 Canberra, ACT 2601 **AUSTRALIA**	Tel: +61 (2) 6268-4286 Fax: +61 (2) 6268-5709	Greg.dunstone@airservicesaustralia.com
	Mr. Nick King Flying Operations Inspector Civil Aviation Safety Authority GPO Box 2005 Canberra, ACT 2601 **AUSTRALIA**	Tel: +61 (2) 6217-1193 Fax: +61 (2) 6217-1700	Nick.King@casa.gov.au
BANGLADESH			
BHUTAN			
BRUNEI DARUSSALAM			
CAMBODIA			
CHINA			
HONG KONG, CHINA	Mr. Thomas W.H. Fok Senior Electronics Engineer Engineering and Systems Division Civil Aviation Department 10/F, Commercial Building Airport Freight Forwarding Centre 2 Chun Wan Road Hong Kong Int'l Airport **HONG KONG, CHINA**	Tel: +852 2591-5009 Fax: +852 2845-7160	twhfok@cad.gov.hk
MACAO, CHINA			
COOK ISLANDS			
DPR. KOREA			

State/ Organization	Name/Address	Telephone/Fax	E-mail address
FIJI	Regulators: Mr. Norman H.Y. Yee Chief Executive Officer Civil Aviation Authority of Fiji Private Mail Bag NAP0354 Nadi Airport **FIJI**	Tel: +679 622-1555 Fax: +679 672-1500	ce@caaf.org.fj
	ATM Operations: The Chief Executive Officer Airports Fiji Ltd. Private Mail Bag Nadi Airport **FIJI** Attention: Mr. Ratu Sakiusa Tuisolia	Tel: +679 672-5777 Ext. 4700 Fax: -	sakiusast@afl.com.fj
	Mr. Petero K. Delai Development Engineer Airport Fiji Ltd. Private Mail Bag Nadi Airport **FIJI**	Tel: +679 673-1725 Mobile: 990-6101 Fax: +679 672-2492	peterod@afl.com.fj
FRANCE	Mr. Patrick Souchu Head of New CNS System Division DSNA-DTI/SO/3E 1,Avenue du Docteur Grynfogel BP 53584 31035 Toulouse Cedex 1 **FRANCE**	Tel : +33 (5) 6214-5868 Fax : +33 (5) 6214-5853	petrick.souchu@aviation-civile.gouv.fr
INDIA	ATM Operation: Mr. V. Somasundaram General Manager (ATM) Airports Authority of India Rajiv Gandhi Bhavan Safdajung Airport New Delhi 110003 **INDIA**	Tel: +91 (11) 2465-2648 Fax: +91 (11) 2461-1078	vsomasundaram@aai.aero gmatmchqnad@aai.aero
	Regulatory Function: Director General of Civil Aviation, India DGCA India Technical Centre	Tel: +91 (11) 2462-7830 Fax: +91 (11) 3467-1272	dgoffice@dgca.delhi.nic.in

State/ Organization	Name/Address	Telephone/Fax	E-mail address
INDIA (Cont'd)	Opp. Safdajung Airport New Delhi 110003 **INDIA**		
INDONESIA	Mr. Nanang Swastya Taruf Deputy Director System and Procedure for Air Navigation Directorate General of Air Communication Gedun Karya Lt. 23 Jl. Merdeka Barat No. 8 Jakarta 10110 **INDONESIA**	Tel: +62 (21) 350-6451 Fax: +62 (21) 350-7569	cns.atm@telkom.net
	Mr. Novie Riyanto R. Chief of Navigation and Calibration Section Directorate of Aviation Safety Jl., Merdeka Barat No. 8 Karya Building Floor 23rd Jakarta 10110 **INDONESIA**	Tel: +62 (21) 350-6451 Fax: +62 (21) 350-7569	novieriyanto@telkom.net
JAPAN			
KIRIBATI			
LAO PEOPLE'S DEMOCRATIC REPUBLIC	Mr. Mala Khamvanh Deputy Director of Aerotelecom Department of Civil Aviation Wattay International Airport P.O. Box 119 **LAO PDR**	Tel: +856 (21) 512-163 512-169 Fax: +856 (21) 512-164	laodca@laotel.com
MALAYSIA			
MALDIVES			
MARSHALL ISLANDS			
MICRONESIA FEDERATED STATES OF			
MONGOLIA			
MYANMAR			
NAURU			

State/ Organization	Name/Address	Telephone/Fax	E-mail address
NEPAL			
NEW ZEALAND	Mr. Len Wicks Aeronautical Services Officer ATS Civil Aviation Authority of New Zealand 10 Hutt Road, Petone P.O. Box 31-441 Lower Hutt **NEW ZEALAND**	Tel: +64 (4) 560-9454 Fax: +64 (4) 569-2024	wicksl@caa.gov.nz
PAKISTAN			
PALAU			
PAPUA NEW GUINEA			
PHILIPPINES	Mr. Andrew B. Basallote Acting Director I Airways Navigation Service Air Transportation Office MIA Road Passay City 1301 Metro Manila **PHILIPPINES**	Tel: +63 (2) 879-9189 Fax: +63 (2) 879-9165	-
	Mr. Inocencio T.Yncierto Officer-in-Charge Airways Navigation Service Air Transportation Office MIA Road Passay City 1301 Metro Manila **PHILIPPINES**	Tel: +63 (2) 879-9163 879-9164 Fax: +63 (2) 879-9165	-
REPUBIC OF KOREA	Mr. Kyun Do, Huh Deputy Director Airways Facilities Division Civil Aviation Safety Authority Ministry of Construction and Transportation 274 Gwahae-dong Gangseo-Gu Seoul 157-711 **REPUBLIC OF KOREA**	Tel: +82 (2) 2662-5263 Fax: +82 (2) 6342-7299	kdhuh@moct.go.kr
SAMOA			

State/ Organization	Name/Address	Telephone/Fax	E-mail address
SINGAPORE	CAAS: Mr. Yeo Cheng Nam (Technical) Senior Engineer (Surveillance) Civil Aviation Authority of Singapore Singapore Changi Airport P.O. Box 1 **SINGAPORE** 918141	Tel: +65 6541-2442 Fax: +65 6542-2447	Yeo_Cheng_Nam@caas.gov.sg
	Mr. Kwek Chin Lin (Operational) Project Officer (System) Civil Aviation Authority of Singapore Singapore Changi Airport P.O. Box 1 **SINGAPORE** 918141	Tel: +65 6541-2664 Fax: +65 6545-6252	kwek.chin@caas.gov.sg
	SIA: Mr. Voon Yih Meng (Technical) Manager Technical Services Mr. Joseph Phua (Operational)	Tel: +65 6541-6031	YihMeng_Voon@singaporeair.com.sg
SOLOMON ISLANDS			
SRI LANKA			
THAILAND	Mr. Choosit Kuptaviwat Director, Air Traffic Services Engineering Planning and Standards Department Aeronautical Radio of Thailand 102 Ngamduplee Tungmahamek, Sathorn Bangkok 10120 **THAILAND**	Tel: +66 (2) 285-9457 Fax: +66 (2) 287-8645	choosit.ku@aerothai.co.th
TONGA			
USA			
VANUATU, REPBULIC OF			
VIET NAM			

ADS-B Implementation and Operations Guidance Document

Edition 1.1

June 2005

Intentionally left blank

TABLE OF CONTENTS

1. INTRODUCTION

This ADS-B Implementation and Operations Guidance Document (AIGD) provides guidance material for the implementation and operational application of ADS-B technology in the Asia and Pacific Regions.

The procedures and requirements for ADS-B operations are detailed in the relevant States' AIP. The AIGD is intended to provide key information on ADS-B performance, integration, principles, procedures and collaboration mechanisms.

The content is based upon the work to date of the APANPIRG ADS-B Study and Implementation Task Force (SITF) and various ANC Panels developing provisions for the operational use of ADS-B. It should be noted that this edition of the document has been produced ahead of anticipated amendments to PANS-ATM (Doc 4444) and Annexes 2, 4, 11 and 15 to the convention. It is therefore likely that some amendment to the guidance material will be required as SARPs are published.

.

1.1 ARRANGEMENT OF THE AIGD

The AIGD consists of the following Parts:

Section 1	Introduction and Document Management
Section 2	Acronyms
Section 3	System Integrity and Monitoring
Section 4	ADS-B Data Message Set
Section 5	ADS-B Procedures
Section 6	Emergency and Non-Routine Procedures
Section 7	ADS-B Implementation
Section 8	Endnotes

1.2 DOCUMENT HISTORY AND MANAGEMENT

This document is managed by the APANPIRG. It was introduced as draft to the first Working Group meeting of the ADS-B SITF in Singapore in October 2004, at which it was agreed to develop the draft to an approved working document that provides implementation guidance for States. The first edition was presented to APANPIRG for adoption in August 2005. It is intended to supplement SARPs and relevant provisions contained in ICAO documentation, and will be regularly updated to reflect evolving provisions.

1.3 COPIES

Paper copies of this AIGD are not distributed. Controlled copies can be found at any of the following web sites: http://www.icao.int//apac/edocs/

Copies may be freely downloaded from the web sites in a zip file, or by emailing APANPIRG through the ICAO Asia and Pacific Regional Office who will send a copy by return email.

1.4 CHANGES TO THE AIGD

Whenever a user identifies a need for a change to this document, a Request for Change (RFC) Form (see Section 1.6 below) should be completed and submitted to APANPIRG through the ICAO Asia and Pacific Regional Office.

When an RFC has been approved by a meeting of the ADS-B Study and Implementation Task Force then a new version of the AIGD will be published, with the changes marked by an "|" in the margin, and an endnote indicating the relevant RFC, so a reader can see the origin of the change. If the change is in a table cell, the outside edges of the table will be highlighted; e.g.:

In those cases where a change is initiated by the editor and relates to document format rather than functional content, the change may not have an associated RFC, but the change will be marked and annotated in the same way.

1.5 EDITING CONVENTIONS

(Intentionally blank)

1.6 AIGD REQUEST FOR CHANGE FORM

RFC Nr:	

Please use this form when requesting a change to any part of this AIGD. This form may be photocopied as required, emailed, faxed or e-mailed to ICAO Asia and Pacific Regional Office (+66) 2 5378199 or icao_apac@bangkok.icao.int.

1. SUBJECT:			
2. REASON FOR CHANGE:			
3. DESCRIPTION OF PROPOSAL: [expand / attach additional pages if necessary]			
4. REFERENCE(S):			
5. PERSON INITIATING:		**DATE:**	
ORGANISATION:			
TEL/FAX/EMAIL:			

6. CONSULTATION		**RESPONSE DUE BY DATE:**	
Organisation	**Name**	**Agree/Disagree**	**Date**
7. ACTION REQUIRED:			
8. AIGD EDITOR		**DATE REC'D:**	
9. FEEDBACK PASSED		**DATE:**	

1.7 AMENDMENT RECORD

Amendment Number	Date	Amended by	Comments
0.1	24 December 2004	W Blythe H Anderson	Modified draft following contributions from ADS-B SITF Working Group members. Incorporated to TF/3 Working paper #3.
1.0	24 March 2005	H Anderson	Final draft prepared at ADS-B SITF WG/3
1.1	03 June 2005		Amendments following SASP WG/WHL meeting of May 2005.

2. ACRONYM LIST & GLOSSARY OF TERMS

2.1 ACRONYM LIST

ACID	Aircraft Identification
ADS-B	Automatic Dependent Surveillance - Broadcast
AIGD	ADS-B Implementation and Operations Guidance Document
AIP	Aeronautical Information Publication
AIT	ADS-B Implementation Team
AMSL	Above Mean Sea Level
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
ARINC	Aeronautical Radio Incorporate
ATC	Air Traffic Control (or Air Traffic Controller)
ATM	Air Traffic Management
ATS	Air Traffic Services
ATSP	ATS Provider
ATSU	ATS unit
CNS	Communications, Navigation, Surveillance
CRC	Cyclic Redundancy Check
CDTI	Cockpit Display Traffic Information
DAIW	Danger Area Infringement Warning
FIR	Flight Information Region
FLTID	Flight Identification
FMS	Flight Management System
FOM	Figure of Merit used in ASTERIX messaging
GPS	Global Positioning System (USA)
HPL	Horizontal Protection Level
ICAO	International Civil Aviation Organisation
MSAW	Minimum Safe Altitude Warning
MTBF	Mean Time Between Failures
MTCA	Medium Term Conflict Alert
MTTR	Mean Time To Restore
NAC	Navigation Accuracy Category
NIC	Navigation Integrity Category
PRS	Problem Reporting System
RAI	Restricted Area Intrusion
RAM	Route Adherence Monitoring
RAIM	Receiver Autonomous Integrity Monitoring
RFC	Request for Change
RNP	Required Navigation Performance
SIL	Surveillance Integrity Level
SITF	Study and Implementation Task Force
STCA	Short Term Conflict Alert

2.2 GLOSSARY OF TERMS

ADS-B In	An ADS-B system feature that enables the display of real time ADS-B tracks on a situation display in the aircraft cockpit.
ADS-B Out	An ADS-B system feature that enables the frequent broadcast of accurate aircraft position and vector data together with other information.
Asterix 21	Eurocontrol standard format for data message exchange
FOM (Figure of Merit)	A numeric value that is used to determine the accuracy and integrity of associated position data.
HPL (Horizontal Position Limit)	The containment radius within which the true position of the aircraft will be found for 95% of the time (See DO229c) .
NAC (Navigational Accuracy Category)	Subfield used to announce the 95% accuracy limits for the horizontal position data being broadcast.
NIC (Navigational Integrity Category)	Subfield used to specify the containment radius integrity associated with horizontal position data.
NUCp (Navigation Uncertainty Category)	A numeric value that announces the integrity of the associated horizontal position data being broadcast.
SIL (Surveillance Integrity Level)	Subfield used to specify the probability of the true position lying outside the containment radius defined by NIC without being alerted.

3. SYSTEM INTEGRITY AND MONITORING

3.1 INTRODUCTION

The Communications, Navigation, Surveillance and Air Traffic Management (CNS/ATM) environment is an integrated system including physical systems (hardware, software, and communication networks), human elements (pilots and controllers), and the procedures for use by pilots and controllers. ADS-B is a surveillance system that is may be integrated with other surveillance technologies or may also operate as an independent source for surveillance monitoring within the CNS/ATM system.

Because of the integrated nature of such system and the degree of interaction among its components, comprehensive system monitoring is recommended. The procedures described in this section aim to ensure system integrity by validation, identification, reporting and tracking of possible problems revealed during system monitoring.

These procedures **do not replace** the ATS incident reporting procedures and requirements, as specified in PANS-ATM (Doc 4444), Appendix 4; ICAO's *Air Traffic Services Planning Manual* (Doc 9426), Chapter 3; or applicable State regulations, affecting the reporting responsibilities of parties directly involved in a potential ATS incident.

3.2 PERSONNEL LICENSING AND TRAINING

Prior to operating any element of the ADS-B system operational and technical personnel shall undertake appropriate training as determined by the States, including compliance with the Convention on International Civil Aviation where applicable.

Notwithstanding the above requirement and for the purposes of undertaking limited trials of the ADS-B system, special arrangements may be agreed between the operator and an Air Traffic Services Unit (ATSU).

3.3 REFERENCE DOCUMENTS

Id	Name of the document	Reference	Date	Origin	Domain
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

3.4 SYSTEM PERFORMANCE CRITERIA FOR AN ATC SEPARATION SERVICE

A number of States have started to introduce ADS-B for the provision of Air Traffic Services, including 'radar-like' separation. The ICAO Separation and Airspace Safety Panel (SASP) has been assessing the suitability of ADS-B for various applications using a comparative assessment methodology and, together with the ICAO Operational Data Link Panel (OPLINKP), is drawing on the experience of early implementers to develop operational provisions. It is anticipated that PANS-ATM (Doc 4444) will be amended to include ADS-B separation minima in 2007.

States intending to introduce ADS-B separation minima not published in PANS-ATM or Regional Supplementary Procedures (Doc 7030) should comply with the provisions of Annex 11 paragraph 3.4.1. States should adopt the guidelines contained in this document unless conformance with PANS-ATM specifications requires change.

3.5 ATC SYSTEM VALIDATION

3.5.1 Safety Assessment Guidelines

To meet system integrity requirements, States should conduct a validation process that confirms the integrity of their equipment and procedures. Such processes shall include:

a) A system safety assessment for new implementations is the basis for definitions of system performance requirements. Where existing systems are being modified to utilize additional services, the assessment demonstrates that the ATS Provider's system will meet safety objectives.
b) Integration test results confirming interoperability for operational use of airborne and ground systems; and
c) Confirmation that the ATS Operation Manuals are compatible with those of adjacent providers where the system is used across a common boundary.

3.5.2 System safety assessment

The objective of the system safety assessment is to ensure the State that introduction and operation of ADS-B is safe. This can be achieved through application of the provisions of Annex 11 paragraph 2.26 and PANS-ATM Chapter 2. The safety assessment should be conducted for initial implementation as well as any future enhancements and should include:

a) Identifying failure conditions;
b) Assigning levels of criticality;
c) Determining risks/ probabilities for occurrence; and
d) Identifying mitigating measures.
e) Categorising the degree of acceptability of risks.
f) Operational hazard ID process

Following the safety assessment, States should institute measures to offset any identified failure conditions that are not already categorized as acceptable. This should be done to reduce the probability of their occurrence to an acceptable level. This could be accomplished through automation or procedures.

3.5.3 Integration test

States should conduct trials with suitably equipped aircraft to ensure they meet the operational and technical requirements. To provide an ATS alternatively, they may be satisfied by test results and analysis conducted by another State or organisation deemed competent to provide such service. Where this process is followed, the tests conducted by another State or organisation should be comparable (i.e. using similar equipment under similar conditions).Reference to Doc9689

3.5.4 ATS Operation Manuals

States should coordinate with adjacent States to confirm that their ATS Operation Manuals contain standard operating procedures to ensure harmonization of procedures that impact across common boundaries.

3.5.5 ATS System Integrity

With automated ATM control systems, data changes, software upgrades, and system failures can affect adjacent units. States shall ensure that:

a) A conservative approach is taken to manage any changes to the system.

b) Aircrew, aircraft operating companies and adjacent ATSU(s) are notified of any planned system changes in advance, where that system is used across a common boundary.

c) ATSUs have verification procedures in place to ensure that following any system changes, displayed data is both correct and accurate.

d) In cases of system failures or where upgrades (or downgrades) or other changes may impact surrounding ATS units, ATSUs should have a procedure in place for timely notification to adjacent units. Such notification procedures will normally be detailed in Letters of Agreement between adjacent units.

e) ADS-B surveillance data is provided with equal to or better level of protection and security than existing surveillance radar data.

3.6 SYSTEM MONITORING

During the initial period of implementation of ADS-B technology, routine collection of data is necessary in order to ensure that the system continues to meet or exceed its performance, safety and interoperability requirements, and that operational service delivery and procedures are working as intended. The monitoring program is a two-fold process. First, summarised statistical data should be produced periodically showing the performance of the system. This is accomplished through ADS-B Periodic Status Reports. In addition, as problems or abnormalities arise, they should be identified, tracked, analyzed and corrected and information disseminated as required, utilizing the ADS-B Problem Report.

3.6.1 Problem Reporting System (PRS)

The Problem Reporting System is tasked with the collection, storage and regular dissemination of data based on reports received from ADS-B SITF members. The PRS tracks problem reports and publish information from those reports to ADS-B SITF members. Problem resolution is the responsibility of the appropriate ADS-B SITF members.

The PRS Administrator shall:

a) prepare consolidated problem report summaries for each ADS-B SITF meeting;
b) collect and consolidate ADS-B Problem Reports; and
c) maintain a functional website (with controlled access) to manage the problem reporting function.

3.6.2 The monitoring process

When problems or abnormalities are discovered, the initial analysis should be performed by the organization(s) identifying the problem. In addition, a copy of the problem report should be entered in to the PRS which will assign a tracking number. As some problems or abnormalities may involve more than one organization, the originator should be responsible for follow-up action to rectify the problem and forward the information to the PRS. It is essential that all information relating to the problem is documented and recorded and resolved in a timely manner.

The following groups should be involved in the monitoring process and problem tracking to ensure a comprehensive review and analysis of the collected data:
a) ATS Providers;
b) Organizations responsible for ATS system maintenance (where different from the ATS provider);
c) Relevant State regulatory authorities;
d) Communication Service Providers being used;
e) Aircraft operators; and
f) Aircraft and avionics manufacturers.

3.6.3 Distribution of confidential information

It is important that information that may have an operational impact on other parties be distributed by the authorised investigator to all authorised groups that are likely to be affected, as soon as possible. In this way, each party is made aware of problems already encountered by others, and may be able to contribute further information to aid in the solution of these problems. The default position is that all states agree to provide the data which will be de-identified for reporting and record keeping purposes.

3.6.4 ADS-B problem reports

Problem reports may originate from many sources, but most will fall within two categories; reports based on observation of one or more specific events, or reports generated from the routine analysis of data. The user would document the problem, resolve it with the appropriate party and forward a copy of the report to the PRS for tracking and distribution. While one occurrence may appear to be an isolated case, the receipt of numerous similar reports by the PRS could indicate that an area needs more detailed analysis.

To effectively resolve problems and track progress, the problem reports should be sent to the nominated point of contact at the appropriate organisation and the PRS. The resolution of the identified problems may require:

a) Re-training of system operators, or revision of training procedures to ensure compliance with existing procedures;
b) Change to operating procedures;
c) Change to system requirements, including performance and interoperability; or
d) Change to system design.

3.6.5 ADS-B periodic status report

The ATS Providers should complete the ADS-B Periodic Status Report annually and deliver the report to the regional meeting of the ADS-B SITF. The Periodic Status Report should give an indication of system performance and identify any trend in system deficiencies, the resultant operational implications, and the proposed resolution, if applicable.

Communications Service Providers, if used, are also expected to submit Periodic Status Reports on the performance of the networks carrying ADS-B data at the annual regional meeting of the ADS-B SITF. These reports could also contain the details of planned or current upgrades to the network.

3.6.6 Processing of Reports

Each group in the monitoring process should nominate a single point of contact for receipt of problem reports and coordination with the other parties. This list will be distributed by the PRS Administrator to all parties to the monitoring process.

Each State should establish mechanisms within its ATS Provider and regulatory authority to:

a) Assess problem reports and refer them to the appropriate technical or operational expertise for investigation and resolution;
b) Coordinate with aircraft operators;
c) Develop interim operational procedures to mitigate the effects of problems until such time as the problem is resolved;
d) Monitor the progress of problem resolution;
e) Prepare a report on problems encountered and their operational implications and forward these to the PRS;
f) Prepare the ADS-B periodic status report at pre-determined times and forward these to the Secretary of the annual meeting of the ADS-B SITF; and
g) Coordinate with any Communication Service Providers used.

3.7 APANPIRG

APANPIRG shall oversee the monitoring process to ensure the ADS-B system continues to meet its performance and safety requirements, and that operational procedures are working as intended. The APANPIRG'S objectives are to:

a) review Periodic Status Reports and any significant Problem Reports;
b) highlight successful problem resolutions to ADS-B SITF members;
c) monitor the progress of outstanding problem resolutions;
d) prepare summaries of problems encountered and their operational implications; and
e) assess system performance based on information in the PRS and Periodic Status Reports.

3.8 LOCAL DATA RECORDING AND ANALYSIS

3.8.1 Data recording

It is recommended that ATS Providers and Communication Service Providers retain the records defined below for at least 30 days to allow for accident/incident investigation processes. These records should be made available on request to the relevant State safety authority. Where data is sought from an adjacent State, the usual State to State channels should be used.

These recordings shall be in a form that permits a replay of the situation and identification of the messages that were received by the ATS system.

3.8.2 Local data collection

ATS providers and communications service providers should identify and record ADS-B system component failures that have the potential to negatively impact the safety of controlled flights or compromise service continuity.

3.9 ADS-B PROBLEM REPORT

3.9.1 Report Form

			PRS #
Date UTC		**Time UTC**	
Registration		**Aircraft ID**	
Flight ID		**ICAO 24 Bit Code**	
Aircraft Type			
Flight Sector/ Location			
ATS Unit			
Description / additional information			
Originator		Originator Reference number	
Organization			

3.9.2 Description of Fields

Field	Meaning
Number	A unique identification number assigned by the PRS Administrator to this problem report. Organizations writing problem reports are encouraged to maintain their own internal list of these problems for tracking purposes. Once the problems have been reported to the PRS and incorporated in the database, a number will be assigned by the PRS and used for tracking by the ADS-B SITF.
Date UTC	UTC date when the event occurred.
Time UTC	UTC time (or range of times) at which the event occurred.
Registration	Registration number (tail number) of the aircraft involved.
Aircraft ID (ACID)	Coded equivalent of voice callsign as entered in FPL Field 7.
ICAO 24 Bit Code	Unique aircraft address expressed in Hexadecimal form (e.g. 7432DB)
Flight ID (FLTID)	The identification transmitted by ADS-B for display on a controller situation display or a CDTI.
Flight Sector/Location	The departure airport and destination airport for the sector being flown by the aircraft involved in the event. These should be the ICAO identifiers of those airports. Or if more descriptive, the location of the aircraft during the event.
Originator	Point of contact at the originating organization for this report (usually the author).
Aircraft Type	The aircraft model involved.
Organization	The name of the organization (airline, ATS provider or communications service provider) that created the report.
ATS Unit	ICAO identifier of the ATC Center or Tower controlling the aircraft at the time of the event.
Description	This should provide as complete a description of the situation leading up to the problem as is possible. Where the organization reporting the problem is not able to provide all the information (e.g. the controller may not know everything that happens on the aircraft), it would be helpful if they would coordinate with the other parties to obtain the necessary information. The description should include: • A complete description of the problem that is being reported • The route contained in the FMS and flight plan • Any flight deck indications • Any indications provided to the controller when the problem occurred • Any additional information that the originator of the problem report considers might be helpful but is not included on the list above IF NECESSARY TO CONTAIN ALL THE INFORMATION, ADDITIONAL PAGES MAY BE ADDED. IF THE ORIGINATOR CONSIDERS IT MIGHT BE HELPFUL, DIAGRAMS AND OTHER ADDITIONAL INFORMATION (SUCH AS PRINTOUTS OF MESSAGE LOGS) MAY BE APPENDED TO THE REPORT.

3.10 ADS-B PERFORMANCE REPORT FORM

Originating Organization			
Date of submission		**Originator**	
Report Period			

TECHNICAL ISSUES

OPERATIONAL ISSUES

GENERAL COMMENTS

4 ADS-B DATA:

The Eleventh ICAO Air Navigation Planning Conference recommended that States recognize ADS-B as an enabler of the global ATM concept bringing substantial safety and capacity benefits; support the cost-effective early implementation of it; and ensuring it is harmonized, compatible and interoperable with operational procedures, data linking and ATM applications.

APANPIRG has decided to use 1090MHz Extended Squitter data link for ADS-B data exchange in the Asia and Pacific Regions. In the longer term an additional link type may be required.

ADS-B data requirements for aircraft transmissions are contained in Annex 10 Vol IV. ADS-B data requirements for ground-ground messaging shall be determined by States. International exchange of ground-ground messaging should use ASTERIX 21 Version 0.23 format.

5 ADS-B PROCEDURES

5.1 INTRODUCTION

ADS-B involves the transmission of specific data messages from aircraft and vehicle systems. These data messages are broadcast at approximately 0.5 second intervals and received at compatible ground stations that relay these messages to ATSU(s) for presentation on ATS situation displays. The following procedures relate to the use of ADS-B data in ATS ground surveillance applications.

The implementation of the ADS-B system will support the provision of high performance surveillance, enhancing flight safety, facilitating the reduction of separation minima and supporting user demands such as user-preferred trajectories.

5.2 FACTORS TO BE CONSIDERED WHEN USING ADS-B

5.2.1 Use of ADS-B Level data

The accuracy and integrity of pressure altitude derived level information provided by ADS-B are equivalent to Mode C level data provided through an SSR sensor and subject to the same operational procedures as those used in an SSR environment. Where the ATM system converts ADS-B level data to display metric equivalent level data, the displayed data should not be used to determine vertical separation until the data is verified by comparison with a pilot reported metric level.

5.2.2 Position Reporting Performance

The ADS-B data from the aircraft will include a NUC/NIC/SIL categorization of the accuracy and integrity of the horizontal position data. This figure is determined from NIC/ NAC/ SIL values for DO260A compliant avionics and NUC values for DO260/ED102 compliant avionics.

In general, if the NUC is less than 5 (or NIC is less than 6, or SIL is less than 2) the data is unlikely to be of comparable quality to that provided by a single monopulse SSR. ADS-B data should not be used for separation unless a suitable means of determining data integrity is used.

ADS-B reports with low integrity may be presented on situation displays, provided the controller is alerted (e.g. by a change in symbology and/or visual alert) to the change and the implications for the provision of separation. An ANS Provider may elect not to display ADS-B tracks that fail to meet a given position reporting performance criterion.

5.2.3 GNSS Integrity Prediction Service

Early implementations of ADS-B are expected to use GNSS for position determination. As such, availability of GNSS data has a direct influence on the provision of a surveillance service.

ATS Providers may elect to use a GNSS integrity prediction service to assist in determining the future availability of useable ADS-B data. The integrity prediction service alerts users to potential future loss or degradation of the ADS-B service in defined areas. When these alerts are displayed, the system is indicating to its users

that at some time in the future the ADS-B positional data may be inadequate to support the application of ADS-B separation. It is recommended that the prediction service is made available to each ATSU that is employing ADS-B to provide a separation service, to ensure that air traffic controllers are alerted in advance of any predicted degradation of the GNSS service and the associated reduction in their ability to provide ADS-B separation to flights that are within the affected area. This is similar to having advance warning of a planned radar outage for maintenance.
ADS-B should not be used to provide separation between aircraft that will be affected by an expected period of inadequate position reporting integrity.

If an unpredicted loss of integrity occurs (including a RAIM warning report from aircrew) then;
(a) ADS-B separation should not be applied by ATC to the particular aircraft reporting until the integrity has been assured; and
(b) The controller should check with other aircraft in the vicinity of the aircraft reporting the RAIM warning, to determine if they have also been affected and establish alternative forms of separation if necessary.

5.2.4 Sharing of ADS-B Data

Member States should consider the benefits of sharing ADS-B data received from aircraft operating in the proximity of their international airspace boundaries with adjacent States that have compatible technology in an effort to maximize the service benefits and promote operational safety. Any agreement on the sharing of surveillance data should be incorporated in Letters of Agreement between the States concerned.

5.3 REPORTING RATES

5.3.1 General

The ADS-B system shall maintain a reporting rate that ensures at least an equivalent degree of accuracy, integrity and availability as for a radar system that is used to provide a similar ATC service. The standard reporting rate is approximately 0.5 second from the aircraft, but the rate of update provided to the ATM system (for the situation display) may be less frequent (e.g. 5 seconds), provided the equivalency with radar is preserved.
All safety net features (MSAW, STCA, MTCA, RAM and DAIW/ RAI etc) should possess the same responsiveness as equivalent radar safety net features.

5.4 SEPARATION

5.4.1 General

ADS-B data may be used in combination with data obtained by other means of surveillance (such as radar, flight plan track, ADS-C) for the application of separation provided appropriate minima as determined by the State are applied. It should be noted that the quality of communications will have a bearing on the determination of appropriate minima.

5.4.2 Identification Methods

Some of the methods approved by ICAO for establishing identification with radar, may be employed with ADS-B (see PANS-ATM chapter 8). One or more of the following identification procedures are suggested:

a) direct recognition of the aircraft identification in an ADS-B label;
b) transfer of ADS-B identification;
c) observation of compliance with an instruction to TRANSMIT ADS-B IDENT.

Note.— In automated systems, the "IDENT" feature may be presented in different ways, e.g. as a flashing of all or part of the position indication and associated label.

5.4.3 ADS-B Separation

ADS-B Separation minima will be promulgated by ICAO in PANS-ATM (Doc 4444), or in Regional Supplementary Procedures (Doc 7030),

In a mixed surveillance environment, States should use the larger separation standard applicable between aircraft in the conflict pair being considered.

5.4.4 Vertical separation

5.4.4.1 Introduction

The ADS-B level data presented on the controllers situation display shall normally be derived from barometric pressure altitude. In the event that geometric altitude data is presented on the situation display, the controller should be alerted to the fact that this data should not be used for vertical separation.

5.4.4.2 Vertical tolerance standard

The vertical tolerances for ADS-B level information should be consistent with those applied to Mode C level information.

5.4.4.3 Verification of ADS-B level information

The verification procedures for ADS-B level information shall be the same as those employed for the verification of Mode C level data in a radar environment.

5.5 AIR TRAFFIC CONTROL CLEARANCE MONITORING

5.5.1 General

ADS-B track data can be used to monitor flight path conformance with air traffic control clearances.

5.5.2 Deviations from ATC clearances

The ATC requirements relating to monitoring of ADS-B traffic on the situation display should be similar to those contained in PANS-ATM Ch.8.

5.6 ALERTING SERVICE

For ADS-B equipped aircraft, the provision of an alerting service should be based on the same criteria as applied within a radar environment.

5.7 POSITION REPORTING

5.7.1 Pilot position reporting requirements in ADS-B coverage

States should establish voice and/or CPDLC position reporting procedures consistent with those applicable with radar for aircraft that have been identified by ATC.

5.7.2 Meteorological reporting requirements in ADS-B airspace

ATSUs may promulgate in the AIP meteorological reporting requirements that apply within the nominated FIR. The meteorological reporting data required and the transmission methods to be used by aircrew shall be incorporated in these documents.

5.8 PHRASEOLOGY

5.8.1 Phraseology Standard

States should note the requirement for ADS-B specific phraseology equivalent to radar specific phraseology as well as the opportunity to use generic phraseology applicable to multiple systems.

Until such time as PANS ATM Chapter 12 is amended to include ADS-B provisions, the following phraseology is recommended for consideration by States:

ADS-B EQUIPMENT DEGRADATION

ADS-B OUT OF SERVICE *(appropriate information as necessary)*.

TO REQUEST THE CAPABILITY OF THE ADS-B EQUIPMENT

a) ADVISE ADS-B CAPABILITY;
*b) ADS-B TRANSMITTER *(data link)*;
*c) ADS-B RECEIVER *(data link)*;
*d) NEGATIVE ADS-B.
** Denotes pilot transmission.*

TO REQUEST RESELECTION OF AIRCRAFT IDENTIFICATION

REENTER [ADS-B or MODE S] AIRCRAFT IDENTIFICATION.

TERMINATION OF RADAR AND/OR ADS-B SERVICE

IDENTIFICATION LOST [*reasons*] *(instructions)*.

TO REQUEST THE OPERATION OF THE ADS-B IDENT FEATURE

TRANSMIT ADS-B IDENT.

TO REQUEST TERMINATION OF SSR TRANSPONDER AND/OR ADS-B TRANSMITTER OPERATION

a) STOP SQUAWK. [TRANSMIT ADS-B ONLY];
b) STOP ADS-B TRANSMISSION [SQUAWK *(code)* ONLY].

Note: In some cases the ADS-B transmitter cannot be operated independently of the SSR transponder and the loss of SSR and ACAS surveillance derived from the operation of the SSR transponder should be considered.

5.9 FLIGHT PLANNING

5.9.1 ADS-B Flight Planning Requirement – Flight Identity

The aircraft identification (ACID) must be accurately recorded in section 7 of the ICAO Flight Plan form as per the following instructions:

Aircraft Identification, not exceeding 7 characters is to be entered both in item 7 of the flight plan **and** replicated exactly when set in the aircraft (for transmission as Flight ID) as follows:

Either,

a) The ICAO three-letter designator for the aircraft operating agency followed by the flight identification (e.g. KLM511, BAW213, JTR25), when:

   in radiotelephony the callsign used consists of the ICAO telephony designator for the operating agency followed by the flight identification (e.g. KLM 511, SPEEDBIRD 213, HERBIE 25).

Or,

b) The registration marking of the aircraft (e.g. EIAKO, 4XBCD, OOTEK), when:

   1) in radiotelephony the callsign used consists of the registration marking alone (e.g. EIAKO), or preceded by the ICAO telephony designator for the operating agency (e.g. SVENAIR EIAKO),

   2) the aircraft is not equipped with radio.

Note 1 No zeros, dashes or spaces are to be added when the Aircraft Identification consists of less than 7 characters.

Note 2 Appendix 2 to PANS-ATM refers. ICAO designators and telephony designators for aircraft operating agencies are contained in ICAO Doc 8585.

5.9.2 ADS-B Flight Planning Requirements

5.9.2.1 Flight Notification

Until such time as amendments are made to the ICAO flight plan to incorporate ADS-B designators, a remark shall be entered in section 18 of the fight plan to indicate that the flight is capable of transmitting ADS-B messages via the Mode S Extended Squitter data link. The format of the remark should be:

RMK/ADSB

Note: Only flights with ADS-C capability should use the surveillance equipment indicator"D"and only flights with CPDLC capability should use the equipment indicator "J".

5.9.2.2 Aircraft Address (24 Bit Code)

Where required, the aircraft address (in hexadecimal format)_may be recorded in section 18 of the ICAO flight plan as per the following example:

CODE/7C432B

States should note that use of hexadecimal code may be prone to human error and is less flexible in regard to airframe changes for a notified flight.

6 EMERGENCY PROCEDURES

ATC surveillance systems should provide for the display of safety-related alerts and warnings, including conflict alert, minimum safe altitude warning, conflict prediction and unintentionally duplicated SSR codes and aircraft identifications].

The ADS-B avionics may transmit emergency status messages to any ADS-B ground station within coverage. The controller receiving these messages should determine the nature of the emergency, acknowledge receipt if appropriate, and initiate any assistance required. An aircraft equipped with ADS-B might operate the emergency and/or urgency mode as follows:

a) emergency;
b) no communications;
c) unlawful interference;
d) minimum fuel; and/or
e) medical.

Executive control responsibility

The responsibility for control of the flight rests with the ATSU within whose airspace the aircraft is operating. However, if the pilot takes action contrary to a clearance that has already been coordinated with another sector or ATSU and further coordination is not possible in the time available, the responsibility for this action would rest with the pilot in command, and performed under the pilot's emergency authority.

Emergency procedures

The various circumstances surrounding each emergency situation preclude the establishment of exact detailed procedures to be followed. The procedures outlined in PANS-ATM Chapter 15 provide a general guide to air traffic services personnel and where necessary, should be adapted for the use of ADS-B.

7 ADS-B IMPLEMENTATION

7.1 PLANNING

7.1.1 There are a range of activities needed to progress ADS-B from initial concept level to operational use. This section addresses the issues of collaborative decision making, system compatibility and integration, while the second section of this chapter provides a checklist to assist States with the management of ADS-B implementation activities.

7.1.2 Implementation team to ensure international coordination

7.1.2.1 Any decision to implement ADS-B by a State should include consultation with the wider ATM community. Moreover, where ADS-B procedures or requirements will affect traffic transiting between states, the implementation should also be coordinated between States and Regions, in order to achieve maximum benefits for airspace users and service providers.

7.1.2.2 An effective means of coordinating the various demands of the affected organizations is to establish an implementation team. Team composition may vary by State or Region, but the core group responsible for ADS-B implementation planning should

include members with multidiscipline operational expertise from affected aviation disciplines, with access to other specialists where required.

7.1.2.3 Ideally, such a team should comprise representatives from the ATS providers, regulators and airspace users, as well as other stakeholders likely to be influenced by the introduction of ADS-B, such as manufacturers and military authorities. All identified stakeholders should participate as early as possible in this process so that their requirements can be identified prior to the making of schedules or contracts.

7.1.2.4 The role of the implementation team is to consult widely with stakeholders, identify operational needs, resolve conflicting demands and make recommendations to the various stakeholders managing the implementation. To this end, the implementation team should have appropriate access to the decision-makers.

7.1.3 System compatibility

7.1.3.1 ADS-B has potential use in almost all environments and operations and is likely to become a mainstay of the future ATM system. In addition to traditional radar-like services, it is likely that ADS-B will also be used for niche application where radar surveillance is not available or possible. The isolated use of ADS-B has the potential to foster a variety of standards and practices that, once expanded to a wider environment, may prove to be incompatible with neighbouring areas.

7.1.3.2 Given the international nature of aviation, special efforts should be taken to ensure harmonization though compliance with ICAO Standards and Recommended Practices (SARPs). The choice of systems to support ADS-B should consider not only the required performance of individual components, but also their compatibility with other CNS systems.

7.1.3.3 The future concept of ATM encompasses the advantages of interoperable and seamless transition across flight information region (FIR) boundaries and, where necessary, ADS-B implementation teams should conduct simulations, trials and cost/benefit analysis to support these objectives.

7.1.4 **Integration**

7.1.4.1 ADS-B implementation plans should include the development of both business and safety cases. The adoption of any new CNS system has major implications for service providers, regulators and airspace users and special planning should be considered for the integration of ADS-B into the existing and foreseen CNS/ATM system. The following briefly discusses each element.

7.1.4.2 Communication system

7.1.4.2.1 The communication system is an essential element within CNS. An air traffic controller can now monitor an aircraft position in real time using ADS-B where previously only voice position reports were available. However, a communication system that will support the new services that result from the improved surveillance may be necessary. Consequently, there is an impact of the ongoing ADS-B related work on the communication infrastructure developments.

7.1.4.3 Navigation system infrastructure

7.1.4.3.1 ADS-B is dependent upon the data obtained from a navigation system (typically GNSS), in order to enable its functions and performance. Therefore, the navigation infrastructure should fulfill the corresponding requirements of the ADS-B application, in terms of:

a) Data items; and
b) Performance (e.g. accuracy, integrity, availability etc.).

7.1.4.3.2 This has an obvious impact on the navigation system development, which evolves in parallel with the development of the surveillance system.

7.1.4.4 Other surveillance infrastructure

7.1.4.4.1 ADS-B may be used to supplement existing surveillance systems or as the principal source of surveillance data. Ideally, surveillance systems will incorporate data from ADS-B and other sources to provide a coherent picture that improves both the amount and utility of surveillance data to the user. The choice of the optimal mix of data sources will be defined on the basis of operational demands, available technology, safety and cost-benefit considerations.

7.2 IMPLEMENTATION CHECKLIST

7.2.1 Introduction

The purpose of this implementation checklist is to document the range of activities that needs to be completed to bring an ADS-B application from an initial concept to operational use. This checklist may form the basis of the terms of reference for an ADS-B implementation team, although some activities may be specific to individual stakeholders.

7.2.2 Activity Sequence

The activities are listed in an approximate sequential order. However, each activity does not have to be completed prior to starting the next activity. In many cases, a parallel and iterative process should be used to feed data and experience from one activity to another. It should be noted that not all activities will be required for all applications.

7.2.3 Concept Phase

a) construct operational concept:
- 1) purpose;
- 2) operational environment;
- 3) ATM functions; and
- 4) infrastructure;

b) identify benefits:
- 1) safety enhancements;
- 2) efficiency;
- 3) capacity;
- 4) environmental;
- 5) cost reductions;
- 6) access; and
- 7) other metrics (e.g. predictability, flexibility, usefulness);

c) identify constraints:
- 1) pair-wise equipage;
- 2) compatibility with non-equipped aircraft;
- 3) need for exclusive airspace;
- 4) required ground infrastructure;
- 5) RF spectrum;
- 6) integration with existing technology; and
- 7) technology availability;

d) prepare business case:
- 1) cost benefit analysis; and
- 2) demand and justification.

7.2.4 Design Phase

a) identify operational requirements:
- 1) security; and
- 2) systems interoperability;

b) identify human factors issues:
1) human-machine interfaces;
2) training development and validation;
3) workload demands;
4) role of automation vs. role of human;
5) crew coordination/pilot decision-making interactions; and
6) ATM collaborative decision-making;

c) identify technical requirements:
1) standards development;
2) data required;
3) functional processing;
4) functional performance; and
5) required certification levels;

d) equipment development, test, and evaluation:
1) prototype systems built to existing or draft standards/specifications;
2) developmental bench and flight tests; and
3) acceptance test parameters; and
4) select and procure technology;

e) develop procedures:
1) pilot and controller actions and responsibilities;
2) phraseologies;
3) separation/spacing criteria and requirements;
4) controller's responsibility to maintain a monitoring function, if appropriate;
5) contingency procedures;
6) emergency procedures; and
7) develop AIP and Information documentation

f) prepare design phase safety case:
1) safety rationale;
2) safety budget and allocation; and
3) functional hazard assessment.

7.2.5 Implementation phase

a) prepare implementation phase safety case;

b) conduct operational test and evaluation:
1) flight deck and ATC validation simulations; and
2) flight tests and operational trials;

c) obtain systems certification:
1) aircraft equipment; and
2) ground systems;

d) obtain regulatory approvals:
1) flight operations; and
2) air traffic certification of use;

e) implementation transition:
1) Promulgate procedures and deliver training
2) continue data collection and analysis;

3) resolve any unforeseen issues; and
4) continue feedback into standards development processes;

f) performance monitoring to ensure that the agreed performance is maintained.

7.2.5.1 Once the implementation project is complete, ongoing maintenance and upgrading of both ADS-B operations and infrastructure should continue to be monitored, through the appropriate forums.

8 ENDNOTES

Intentionally Blank

Appendix C

Agreed draft for amendment Chapters 5, 6 and 9 of Regional Plan for CNS/ATM Systems

---

3.3 Asia/Pacific Regional CNS/ATM Planning and Implementation Structure

3.3.1 Within the Asia/Pacific Region APANPIRG is tasked with the planning and implementation for the new CNS/ATM systems and is supported by three sub-groups:

1) The ATM/AIS/SAR Sub-Group;
2) The COM/MET/NAV/SUR Sub-Group; and
3) ~~The CNS/ATM/IC Sub-Group.~~

3.3.2 While all these groups are responsible for CNS/ATM planning, it is the CNS/ATM/IC sub-group which has the responsibility within APANPIRG for the on-going co-ordination, development and maintenance for the regional CNS/ATM plan. Its current terms of reference are as follows: *(…….to be deleted)*

3.4 The Regional Process Description

3.4.1 The regional process for planning and implementation is described at Section 2.1.3, Chapter 2, Volume II of the global Plan and is at Appendix B to this chapter. This documentation provides the template for regional planning and is essential reading for those wishing to understand or participate in the regional planning process.

3.5 States' Plans

3.5.1 States have the responsibility for implementation of the new CNS/ATM systems within their areas of responsibility. It will however be necessary for each State within the Asia/Pacific Region to develop and publish its own CNS/ATM implementation plan after co-ordination with intra-regional plans.

3.6 Airlines' Plans

3.6.1 Airlines agree to incorporate the new CNS/ATM systems on an evolutionary basis. The path which airlines are taking in global planning follows the objective of achieving short and medium term goals, which provide improved airspace capacity and economy of operations. This path leads next to the operational use of existing CNS technology in aircraft and then to the evolution of new aircraft systems compatible with CNS/ATM global standards. During the transition phase to CNS systems, airlines plan to utilize developed datalink systems (ACARS) as the transitional means to enhance the development of operational ATN datalink systems in concert with the earliest implementation plans of ATC providers. This evolutionary approach to planning is accepted as providing the airlines and ATC providers with a financially viable programme for introducing the new CNS/ATM systems. The requirement to take advantage of new technologies and procedures as they become available to provide benefits to airspace users as soon as possible, is therefore a cornerstone of airline planning. IATA publishes

User Driven CNS/ATM Implementation Plans, which are intended to complement the ICAO Regional Planning Process.

CHAPTER 5. CURRENT STATUS AND REGIONAL STRATEGY – CNS/ATM SYSTEMS

5.5 Surveillance

5.5.1 The Asia Pacific Region is characterised by the use of:

a) SSR Mode A/C and, in the near further, Mode S in some terminal and high-density continental airspace;

b) ADS in some parts of the Region; and

c) The diminishing use of primary radar; and

d) Early deployment of ADS-B for delivery of radar like services

5.5.1.1 Automatic Dependent Surveillance-Contract (ADS-C) is becoming available over the oceanic and continental airspace of the Asia and Pacific Regions. SSR (augmented as necessary with Mode S) will continue to be used in terminal areas and in some high density airspace. The use of primary radar will diminish.

5.5.1.2 The introduction of air-ground data links, together with sufficiently accurate and reliable aircraft navigation systems, present the opportunity to provide surveillance services in areas which lack such services in the present infrastructure, in particular oceanic areas and other areas where the current systems prove difficult, uneconomic, or even impossible, to implement. ADS is a function for use by ATS in which aircraft automatically transmit, via a data link, data derived from on-board navigation systems. As a minimum, the data should include the four-dimensional position. Additional data may be provided as appropriate. The ADS data would be used by the automated ATC system to present information to the controller. In addition to areas which are at present devoid of traffic position information other than pilot provided position reports, ADS will find beneficial application in other areas, including high-density areas, where ADS may serve as an adjunct and/or back-up for secondary surveillance radar and thereby reduce the need for primary radar. Also, in some circumstances, it may even substitute for secondary radar in the future. As with current surveillance systems, the full benefit of ADS requires supporting complementary two-way pilot-controller data and/or voice communication (voice for at least emergency and non-routine communication).

5.5.1.3 Automatic Dependent Surveillance Broadcast (ADS B) is becoming available over the continental airspace of the Asia and Pacific Regions. SSR (augmented as necessary with Mode S) will continue to be used in terminal areas and in some high density airspace. ADS-B offers the potential to provide ATC surveillance where none is available today. Furthermore, some states are considering the future decommissioning of existing enroute SSR only radar systems to be replaced by ADS-B.

5.6 CNS System Evolution

5.6.1 The new CNS concept is very flexible in that each State has the choice of implementing specific system elements to meet its individual requirement for forming a complete, operable CNS/ATM system. Thus, the communication elements can be implemented using any or all or any combination of satellite, VHF or SSR Mode S. States with high traffic density airspace would probably use all of these, but small States with continental airspace could implement the CNS/ATM concept by communications and ADS on VHF alone.

Chapter 6 ..

Airspace organization and management

.....

Air traffic services

- The implementation and application of automation and other advanced technologies, while necessary to increase efficiency and regularity, should maintain and where possible, improve the controller's work environment.

- The implementation of an improved air navigation system should be supported by improvements in the communication, navigation and surveillance systems and by advanced automation functions.

- Airspace capacity increases should not cause a concurrent increase in controller workload.

- Automation aids such as conflict prediction and resolution advisory functions should be introduced to assist the controller where practicable. The accuracy of these systems must be assured.

- As the use of automation increases, full advantage should be taken of the ensuing safety benefits.

- Automation aids which improve planning data accuracy and reduce the necessity for controller interventions to resolve conflicting situations, must contain provisions which allow for required controller awareness in relation to the traffic situation.

- The ATM system will allow for a transfer of responsibility of some separation functions from ground to airborne systems under specific circumstances. The trend may continue based on advancements in cockpit situational awareness, however, the ground system should remain as the overriding authority in all cases where arbitration is required.

- Data link application should take place in an early stage of the transition phase based on the availability of any of the foreseen data link systems.

- Application of data link should aim for a reduction of voice communication load and also for an improvement in the provision of flight data (short-term intent and four-dimensional profile data for the entire flight route) by providing flight management system (FMS) data to the ground ATC system.

- Communications networks between ATM facilities within a State and ATM facilities in adjacent States should be established if they do not already exist.

- States and/or regions should co-ordinate to ensure that where ATC applications supported by aeronautical mobile-satellite service (AMSS) such as automatic dependent surveillance (ADS-C) are to be introduced, they should be introduced approximately simultaneously in adjacent fight information regions (FIRs) through which there are major traffic flows.

- States should develop operational procedures, in collaboration with neighbouring FIRs for the implementation of new systems such as ADS-C and ADS-B within airspace under their control, where such application would be advantageous.

- Rules and procedures should facilitate the operation of aircraft with different equipment in the same ATM environment.

- States and/or regions may consider segregating traffic according to CNS capability, and granting preferred routes/flight levels to aircraft with improved capabilities.

- States and/or regions should co-ordinate to ensure that separation standards and procedures for appropriately equipped aircraft are introduced approximately simultaneously in each FIR through which major traffic passes.

- Systems or other provisions must allow the controller to ensure safe separation in the event of system failures.

- Implementation of new functions should be maintained or improve existing or basic functions rather than just replace them and should relieve rather than worsen controller functions.

- Rules and procedures should be developed to facilitate the transfer of aircraft between adjacent systems which provide different levels of services.

- Rules and procedures for the sharing of responsibility between the ground ATC system and the flight management system for calculating and maintaining flight profiles should be clearly defined prior to implementation.

- All the future automation specifications for ATC systems should provide for functional coherence between air traffic flow management and air traffic control systems.

…….

CHAPTER 9. SURVEILLANCE

9.1 General

9.1.1 The surveillance systems presently in use can be divided into two main types: dependent surveillance and independent surveillance. In dependent surveillance systems, aircraft position is determined on board and then transmitted to ATC. The current voice position reporting is a dependent surveillance system in which the position of the aircraft is determined from on-board navigation equipment and then conveyed by the pilot to ATC by radiotelephony. Independent surveillance is a system which measures aircraft position from the ground. Current surveillance is either based on voice position reporting or based on radar (primary surveillance radar (PSR) or secondary surveillance radar (SSR)) which measures range and azimuth of aircraft from the ground station.

9.1.2 The surveillance systems of the new CNS/ATM systems include not only those above but also Automated Dependant Surveillance (ADS), its derivative ADS-broadcast (ADS-B) and the Airborne Collision Avoidance System (ACAS).

9.1.3 Detailed information regarding the surveillance elements of CNS/ATM systems is provided at Chapter 7 of the Global Plan.

9.2 Transition Guidelines

9.2.1 Guidelines for transition to the future systems encourage equipage by users for the earliest possible accrual of systems benefits. Although a transition period of dual equipage, both airborne and ground, is often necessary to ensure the reliability and availability of a new system, the guidelines are aimed at minimizing this period to the extent practicable. The Global Plan, Vol. I, Chapter 7, Appendix B lists the guidelines that States, regions, users, service providers and manufacturers should consider when developing CNS/ATM systems or planning for implementation of such systems. These guidelines are reproduced below for ease of reference and is support of regional planning:

GUIDELINES FOR TRANSITION TO SURVEILLANCE SYSTEMS

- States should, as necessary, develop operational procedures, in accordance with ICAO SARPs, procedures and guidelines, for the implementation of ADS within airspace under their control.

- Transition to ADS-C should initially begin in oceanic airspace and in continental en-route airspace with low-density traffic.

- Transition to ADS-B should initially begin in en-route airspace with low-density traffic.

- Development of ADS-B plans should attempt to optimise coverage using the minimum number of necessary ground stations. States should attempt to share the data from ADS-B ground stations and perhaps share the costs of establishing and maintaining these ground stations in cases where that is appropriate. States should consider the deployment of ADS-B to provide surveillance coverage at FIR boundaries to maximise FIR crossing coordination and safety for both FIRs

- States and/or regions should ensure that ADS is introduced in a co-ordinated fashion in adjacent FIRs traversed by major traffic flows.

- Where different surveillance methods are employed in adjacent FIRs, commonality or compatibility of systems should be ensured to enable a service which is transparent to the user.

- During the transition period in which ADS position reporting is introduced, the current levels of integrity, reliability and availability of existing position reporting systems must be maintained.

- States and/or regions should take action within the ICAO framework to ensure that implementation of changes due to ADS-C and ADS-B and other systems result in more efficient use of airspace.

- During the transition to ADS, suitably-equipped aircraft should be able to derive benefits from the use of preferred routes without penalizing non-ADS-equipped aircraft.

- ADS should be introduced in incremental phases.

- ADS equipment should be implemented in accordance with standards and procedures in such a way as to permit the use of ADS as a backup for other surveillance methods.

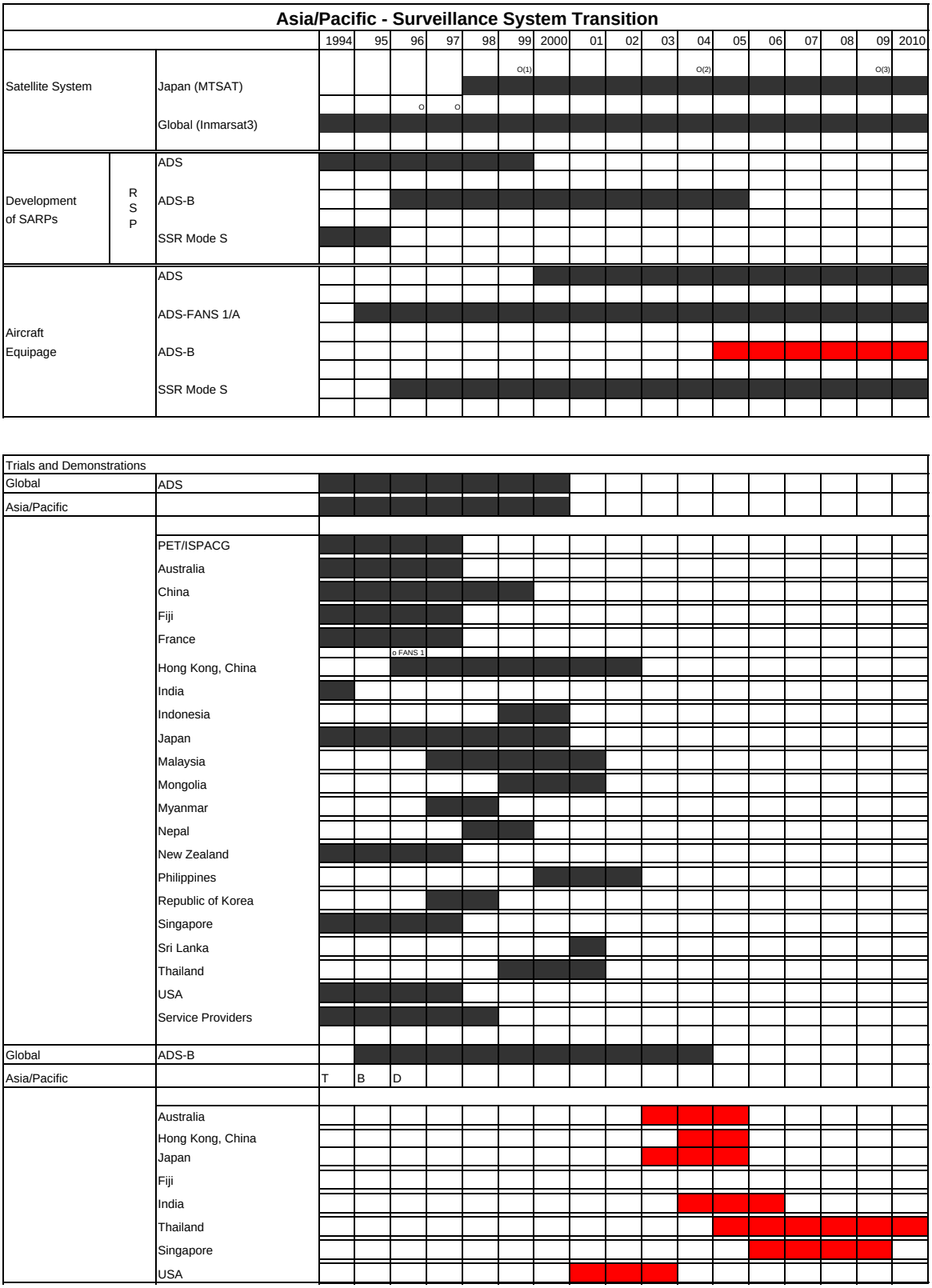
9.3 Asia/Pacific Transition Timescale

9.3.1 The key Global and Asia/Pacific events in the transition to the new surveillance systems are shown in Table 9-1. The timescales for the occurrence of the key events are based on currently available information from States and international organisations and will be revised as updated information becomes available.

9.3.2 The table is formatted in the same style as the Global Plan, Volume II, Chapter 8, for ease of reference, standardization and amendment action as is required from time to time. It is essentially divided into three sections. The first section provides detail regarding the **Satellite System**, the **Development of SARPs** and **Aircraft Equipage**. The last two sections detail, respectively, generic global and specific regional information on **Trials and Demonstrations** and **Implementation and Operational Use**.

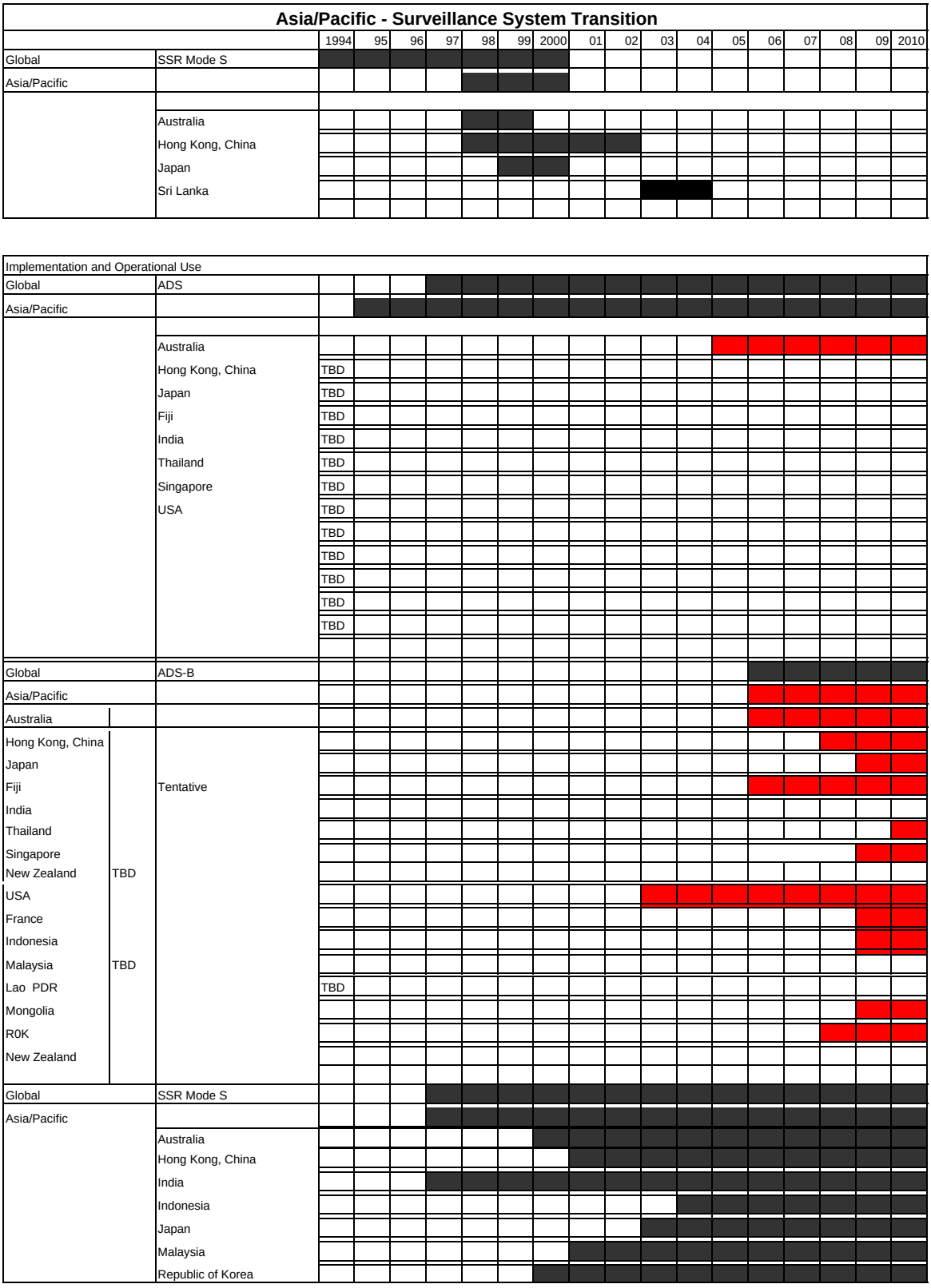
9.3.3 The single minor variation from the Global Plan is the inclusion of satellite system information relevant to the Asia/Pacific in the first section.

(Refers to Excel file for the timelines)


Asia/Pacific - Surveillance System Transition
1994
95
96
97
98
99
2000
01
02
03
04
05
06
07
08
09
2010
Satellite System
Japan (MTSAT)
O(1)
O(2)
O(3)
O
O
Global (Inmarsat3)
Development of SARPs
R S P
ADS
ADS-B
SSR Mode S
Aircraft Equipage
ADS
ADS-FANS 1/A
ADS-B
SSR Mode S
Trials and Demonstrations
Global
ADS
Asia/Pacific
PET/ISPACG
Australia
China
Fiji
France
o FANS 1
Hong Kong, China
India
Indonesia
Japan
Malaysia
Mongolia
Myanmar
Nepal
New Zealand
Philippines
Republic of Korea
Singapore
Sri Lanka
Thailand
USA
Service Providers
Global
ADS-B
Asia/Pacific
T
B
D
Australia
Hong Kong, China
Japan
Fiji
India
Thailand
Singapore
USA

Asia/Pacific - Surveillance System Transition																		
		1994	95	96	97	98	99	2000	01	02	03	04	05	06	07	08	09	2010
	Indonesia																	
	Lao PDR	TBD																
	Mongolia																	
	France																	
	New Zealand																	

Asia/Pacific - Surveillance System Transition



Asia/Pacific - Surveillance System Transition																	
		1994	95	96	97	98	99	2000	01	02	03	04	05	06	07	08	09	2010
	Sri Lanka																	
	Thailand	TBD																
	USA																	

Note: Modern radar systems are capable of being upgraded to Mode S. Thailand and Hong Kong, China are planning to upgrade their current systems.

Appendix D

TABLE CNS-4 – SURVEILLANCE SYSTEMS

Explanation of the Table

Column

1 Name of country and location of the facility of FIR.

2 Air Traffic Services Unit served by the facility or FIR.

3 PSR – Primary Surveillance Radar.

4 Coverage of Primary Surveillance Radar in nautical miles.

5 SSR – Secondary Surveillance Radar and Modes implemented will be indicated within Brackets, namely Mode A, C & S.

6 Coverage of Secondary Surveillance Radar in nautical miles.

7 ADS-B Automatic Dependent Surveillance Broadcast.

8 ADS-C Automatic Dependent Surveillance Contract.

9 SMR – Surface Movement Radar.

10 PAR – Precision Approach Radar.

11 Remarks.

Note:

I – Required and implemented. For column 5.
I stands for implementation using conventional SSR while MI stands for implementation using Monopulse SSR.
X – Required but not implemented status not determined
N – Required but not implemented
A – Existing facility provided to supplement or substitute the requirement
F – Future Plan
< - Year planned commissioning year to be used as appropriate in conjunction with 'F' & 'N'
> - Year planned decommissioning year to be used as appropriate in conjunction with 'A' & 'I'

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
AUSTRALIA										
Hans Tableland	Cairns ACC			I(A/C)	250					
	Cairns APP									
	Cairns TWR									
Redden Creek	CairnsACC	I	50	I(A/C)	250					
	Cairns APP									
	Cairns TWR									
Tabletop	Brisbane ACC			I(A/C)	250					
Swampy Ridge	Brisbane ACC			I(A/C)	250					
Mount Alma	Brisbane ACC			I(A/C)	250					
Mount Hardgrave	Brisbane ACC			I(A/C)	250					
	Coolangatta APP									
	Coolangatta TWR									
Brisbane airport	Brisbane APP	I	50	I(A/C)	250					
	Brisbane TWR									
Mount Sommerville	Coolangatta APP	I	50	I(A/C)	250					
	Coolangatta TWR									
Round Mountain	Brisbane ACC			I(A/C)	250					
	Sydney APP									
Mount Boyce	Melbourne ACC			I(A/C)	250					
	Sydney APP									
	Brisbane ACC									
	Melbourne ACC									
Sydney airport	Sydney APP	I	50	I(A/C)	250					
	Sydney TWR							I		
Mount Majura	Canberra APP	I	50	I(A/C)	250					
	(in Melbourne)									
	Canberra TWR									
Mount Bobbara	Melbourne ACC			I(A/C)	250					
	(in Melbourne)									
	Canberra APP									
	Canberra TWR									
Mount Macedon	Melbourne ACC			I(A/C)	250					
	Melbourne APP									
	Melbourne TWR									
Gellibrand Hill	Melbourne ACC	I	50	I(A/C)	250					
	Melbourne APP									
	Melbourne TWR									
Summertown	Adelaide ACC			I(A/C)	250					
	Adelaide APP									
	Adelaide TWR									
	Melbourne ACC									

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
Adelaide airport	Adelaide ACC	I	50	I(A/C)	250					
	Adelaide APP									
	Adelaide TWR									
Kalamunda	Perth ACC			I(A/C)	250					
	Perth APP									
	Perth TWR									
Perth airport	Perth ACC	I	50	I(A/C	250					
	Perth APP									
	Perth TWR									
Darwin (military ATC facility)	Brisbane ACC			I(A/C)	160					SSR data only
Tindal (military ATC facility)	Brisbane ACC			I(A/C)	250					SSR data only
Oakey (military ATC facility)	Brisbane ACC			I(A/C)	250					SSR data only
East sale (military ATC facility)	Melbourne ACC			I(A/C)	250					SSR data only
Darwin	Brisbane ACC			F(A/C)	250					
Bundaberg	**Brisbane ACC**				**250 Nm**	**2006**				
Balgo Hill	**Brisbane ACC**				**250 Nm**	**2006**				
Caiguna	**Melbourne ACC**				**250 Nm**	**2006**				
Doongan	**Brisbane ACC**				**250 Nm**	**2006**				
Esperance	**Melbourne ACC**				**250 Nm**	**2006**				
Jackson	**Brisbane ACC**				**250 Nm**	**2006**				
Thursday Island	**Brisbane ACC**				**250 Nm**	**2006**				
Ayers Rock AP	**Melbourne ACC**				**250 Nm**	**2006**				
Birdsville	**Melbourne ACC**				**250 Nm**	**2006**				
Broken Hill	**Melbourne ACC**				**250 Nm**	**2006**				
Mornington Island	**Brisbane ACC**				**250 Nm**	**2006**				
West Gap (Alice Springs)	**Brisbane ACC**				**250 Nm**	**2006**				
Warburton	**Melbourne ACC**				**250 Nm**	**2006**				
Broome	**Brisbane ACC**				**250 Nm**	**2006**				
Leonora	**Brisbane ACC**				**250 Nm**	**2006**				
Longreach	**Brisbane ACC**				**250 Nm**	**2006**				
Telfer	**Brisbane ACC**				**250 Nm**	**2006**				
Meekatharra	**Brisbane ACC**				**250 Nm**	**2006**				
Mt Barrow	**Melbourne ACC**				**250 Nm**	**2006**				
Mt Isa (DCA Hill)	**Brisbane ACC**				**250 Nm**	**2006**				
Newman	**Brisbane ACC**				**250 Nm**	**2006**				

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
Oodnadatta	**Brisbane ACC**				**250 Nm**	**2006**				
Tennant Creek	**Brisbane ACC**				**250 Nm**	**2006**				
Karratha	**Brisbane ACC**				**250 Nm**	**2006**				
Mt Oxley	**Melbourne ACC**				**250 Nm**	**2006**				
Nullabor	**Melbourne ACC**				**250 Nm**	**2006**				
Woomera	**Melbourne ACC**				**250 Nm**	**2006**				
Billabong	**Melbourne ACC**				**250 Nm**	**2006**				
				<1998						
BANGLADESH										
Dhaka	Dhaka APP			I(A/C)	200					
BHUTAN										
BRUNEI DARUS-SALAM										
Brunei airport	Brunei APP	I	120	I(A/C)	150					
Berakas	Brunei APP	I	80	F(A/C) <1997	256					Mode S when required
CAMBODIA										
CHINA										
Beijing-1	Beijing TWR Beijing APP Beijing ACC			MI(A/C)	200					Mode S when required
Beijing-2	Beijing TWR Beijing APP Beijing ACC	I	60	MI(A/C)	200					
Beijing-3	Beijing TWR Beijing APP Beijing ACC	I	200	MI(A/C)	250					
Tianjin	Tianjin TWR			MI(A/C)	200					
Taiyuan	Taiyuan TWR Taiyuan ACC	I	60	MI(A/C)	200					
Hohhot	Hohhot TWR Hohhot ACC			MI(A/C)	200					

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
Guangzhou-1	Guangzhou TWR	I	60	MI(A/C)	200					
	Guangzhou APP									
	Guangzhou ACC									
Guangzhou-2	Guangzhou TWR	I	60	MI(A/C)	200					
	Guangzhou APP									
	Guangzhou ACC									
Shenzhen	Shenzhen TWR	I	60	MI(A/C)	200					
	Guangzhou APP									
	Guangzhou ACC									
Zhuhai	Zhuhai TWR	I	60	MI(A/C)	200					
	Zhuhai APP									
	Zhuhai ACC									
Sanya	Sanya TWR	I	150	MI(A/C)	250					
	Sanya APP									
	Sanya ACC									
Haikou	Haikou TWR	I	60	MI(A/C)	200					
	Haikou ACC									
Changsha	Changsha TWR	I	60	MI(A/C)	200					
	Changsha ACC									
Enshi	Enshi TWR			MI(A/C)	200					
	Wuhan ACC									
Wuhan	Wuhan TWR	I	60	MI(A/C)	200					
	Wuhan ACC									
Zhengzhou-1	Zhengzhou TWR	I	60	I(A/C)	200					
	Zhengzhou ACC									
Zhengzhou-2	Zhengzhou TWR	I	60	MI(A/C)	200					
	Zhengzhou ACC									
Guilin -1	Guilin TWR			I(A/C)	200					
	Guilin ACC									
Guilin - 2	Guilin TWR	I	60	MI(A/C)	200					
	Guilin ACC									
Nanning	Nanning TWR			MI(A/C)	200					
	Nanning ACC									
Zhanjiang	Zhanjiang TWR			F(A/C)<2001	200					
	Zhanjiang ACC									
Shantou	Shantou TWR	I	60	MI(A/C)	200					
	Shantou ACC									
Kunming	Kunming TWR	I	60	I(A/C)	200					
	Kunming ACC									
Chengdu	Chengdu TWR	I	60	I(A/C)	200					
	Chengdu ACC									
Guiyang - 1	Guiyang TWR			I(A/C)	200					
	Guiyang ACC									
Guiyang - 2	Guiyang TWR	I	60	MI(A/C)	200					
	Guiyang ACC									

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
Chongqing	Chongqing TWR	I	60	MI(A/C)	200					
	Chongqing ACC									
Shanghai-1	Shanghai TWR	I	60	MI(A/C)	200					
	Shanghai APP									
	Shanghai ACC									
Shanghai-2	Shanghai TWR	I	60	I(A/C)	200					
	Shanghai APP									
	Shanghai ACC									
Jinan	Jinan TWR			MI(A/C)	200					
	Jinan ACC									
Qingdao	Qingdao TWR			MI(A/C)	200					
	Qingdao ACC									
Hefei	Hefei TWR	I	60	MI(A/C)	200					
	Hefei ACC									
Nanjing	Nanjing TWR	I	60	MI(A/C)	200					
	Nanjing ACC									
Lianyungang	Lianyungang TWR			MI(A/C)	200					
	Lianyungang ACC									
Nanchang	Nanchang TWR	I	60	I(A/C)	200					
	Nanchang ACC									
Fuzhou	Fuzhou TWR	I	60	MI(A/C)	200					
	Fuzhou ACC									
Xiamen	Xiamen TWR	I	60	MI(A/C)	200					
	Xiamen ACC									
Shenyang	Shenyang TWR	I	60	MI(A/C)	200					
	Shenyang ACC									
Dalian	Dalian TWR	I	60	I(A/C)	200					
	Dalian ACC									
Harbin	Harbin TWR	I	60	MI(A/C)	200					
	Harbin ACC									
Xi'an	Xi'an TWR	F<2000	60	I(A/C)	200					
	Xi'an ACC									
Lanzhou	Lanzhou TWR			MI(A/C)	200					
	Lanzhou ACC									
Urumqi	Urumqi TWR	I	60	MI(A/C)	200					
	Urumqi ACC									
HONG KONG, CHINA						2008				
Beacon Hill	Hong Kong ACC	I	60	I(A/C)	250					
	Hong Kong APP									
	Hong Kong TWR									
Mount Parker	Hong Kong ACC	I	200	I(A/C)	250					
	Hong Kong APP									
	Hong Kong TWR									

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
Tai Mo Shan	Hong Kong ACC	I	140	I(A/C)	250					
	Hong Kong APP									
	Hong Kong TWR									
Sha Chau	Hong Kong APP	I	80	I (A/C)	250					
	Hong Kong TWR									
Hong Kong Int'l Airport	Hong Kong APP								F<2000	
	Hong Kong ACC					F<2007	F<2003			
	Hong Kong TWR							I		
MACAU, CHINA										
Macau	Macau TWR	I	60	I(A/C)	250					
COOK ISLAND										
DPR KOREA										
	Pyongyang ACC		60	I(A/C)	200					
	Pyongyang APP		60							
FEDERATED STATES OF MICRONESIA										
FIJI						2006				
FRENCH POLY-NESIA						2009	1999			
INDIA										
Ahmadabad		I	60	I	256					
Trivandrum		I	60	I	256					
Hyderabad		I	60	I	256					
Guwahati		I	60	I	256					
Calcutta		I	60	I	256		I			
Chennai		I	60	I	256		I			

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
Delhi		I	60/220	I	256			I		TAR=60NM RSR=220NM
Mumbai		I	60/220	I	256			F		"
Mangalore				F<2001	256					
Berhampur				F<2001	256					
Varanasi				F<2001	256					
Nagpur				F<2001	256					
INDONESIA										
Banda Aceh	Medan ACC			I(A/C)	240					
	Jakarta ACC			F<2000						
Medan	Medan ACC	I	90	I(A/C)	240					
	Medan APP									
	Jakarta ACC			F<2000						
Natuna	Jakarta ACC			MI(A/C)	250					
Tanjung Pinang	Tanjung Pinang APP	I	90	I(A/C)	240					
	Jakarta ACC			F<2000						
Pontianak	Jakarta ACC	I	90	I(A/C)	250					
	Pontianak APP									
Pekanbaru	Medan ACC	I	90	I(A/C)	240					
	Pekanbaru APP									
	Jakarta ACC			F<2000						
Palembang	Jakarta ACC	I	90	I(A/C)	240					
	Palembang APP									
	Jakarta APP									
	SoekamoHatta TWR									
Jakarta/Cengkareng	Jakarta ACC	I	90	I(A/C)	240	2009	I			Monopulse SSR F<2000
	Jakarta APP									
	SoekamoHatta TWR									
Jakarta/Halim	Jakarta ACC	I	90	I(A/C)	240					
	Jakarta APP									
	Halim TWR									
Semarang	Jakarta ACC			I(A/C)	240					
Banjarmasin	Ujung Pandang ACC	I	90	I(A/C)	240					
	Banjarmasin APP			F<2000						
	Jakarta ACC									
Balikpapan	Ujung Pandang ACC	I	90	I(A/C)	240					
	Balikpapan APP									
Yogyakarta	Yogyakarta APP	I	90	I(A/C)	240					
	Jakarta ACC			F<2000						
Surabaya	Bali ACC	I	90	I(A/C)	240					
	Surabaya APP									
	Jakarta ACC			F<2000						

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
Bali	Bali ACC	I	90	I(A/C)	240					
	Bali APP									
Waingapu	Bali ACC			I(A/C)	240					
Ujung Pandang	Ujung Pandang ACC	I	90	I(A/C)	240	2009				
	Ujung Pandang APP									
Manado	Ujung Pandang ACC	I	90	I(A/C)	240					
Kendari	Ujung Pandang ACC			I(A/C)	240					
JAPAN										
Narita airport	Narita TWR					2009		I		
Haneda airport	Haneda TWR							I		
Nagoya airport	Nagoya TWR							I		
Osaka airport	Osaka TWR							I		
Kansai airport	Kansai TWR							I		
Naha airport	Naha TWR							I		
	Naha APP	I	60	I(A/C)	60					
Hakodate airport	Hakodate APP	I	60	I(A/C)	60					
Sendai airport	Sendai APP	I	60	I(A/C)	60					
Narita airport-1	Narita APP	I	60	I(A/C)	60					
Narita airport-2	Narita APP	I	60	I(A/C)	60					
Handeda airport-1	Tokyo APP	I	60	I(A/C)	60					
Handeda airport-2	Tokyo APP	I	60	I(A/C)	60					
Niigata airport	Niigata APP	I	60	I(A/C)	60					
Nagoya airport-1	Nagoya APP	I	60	I(A/C)	60					
Nagoya airport-2	Nagoya APP	I	60	I(A/C)	60					
Osaka airport-1	Osaka APP	I	80	I(A/C)	80					
Osaka airport-2	Osaka APP	I	80	I(A/C)	80					
Kansai airport-1	Kansai APP	I	80	I(A/C)	80					
Kansai airport-2	Kansai APP	I	80	I(A/C)	80					
Hiroshima airport	Hiroshima APP	I	60	I(A/C)	60					
Takamatsu air- port	Takamatsu APP	I	60	I(A/C)	60					
Kouchi airport	Kouchi APP	I	60	I(A/C)	60					
Fukuoka airport-1	Fukuoka APP	I	60	I(A/C)	60					
Fukuoka airport-2	Fukuoka APP	I	60	I(A/C)	60					
Nagasaki airport	Nagasaki APP	I	60	I(A/C)	60					
Oita airport	Oita APP	I	60	I(A/C)	60					
Kumamoto airport	Kumamoto APP	I	60	I(A/C)	60					
Miyazaki airprot	Miyazaki APP	I	60	I(A/C)	60					
Kagoshima airport-1	Kagoshima APP	I	60	I(A/C)	60					
Kagoshima airport-2	Kagoshima APP	I	60	I(A/C)	60					
Naha airport	Naha APP	I	60	I(A/C)	60					
Shimojishima airport	Shimojishima APP	I	60	I(A/C)	60					
Kushiro	Sapporo ACC		200	I(A/C)	200					

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
Yokotsudake	Sapporo ACC	I	200	MI(A/C)	200					
Hachinohe	Sapporo ACC	I	200	I(A/C)	200					
Jobonzan	Sapporo ACC	I	200	I(A/C)	200					
	Tokyo ACC									
Oginojo	Sapporo ACC	I	200	MI(A/C)	250					
	Tokyo ACC									
Yamada	120	I	200	I(A/C)	200					
Hakone	Tokyo ACC	I	200	I(A/C)	200					
Mikawa	Tokyo ACC	I	200	I(A/C)	200					
Mikuniyama	Tokyo ACC	I	200	I(A/C)	200					
Hirata	Tokyo ACC	I	200	I(A/C)	200					
	Fukuoka ACC									
Imanoyama	Tokyo ACC	I	200	I(A/C)	200					
	Fukuoka ACC			MI(A/C)	F(250)					
Kaseda	Fukuoka ACC	I	200	I(A/C)	200					
	Naha ACC									
Sangunzan	Fukuoka ACC	I	200	I(A/C)	200					
Amami	Fukuoka ACC	I	200	I(A/C)	200					
	Naha ACC			MI(A/C)	F(250)					
Miyakojima	Naha ACC	I	200	I(A/C)	200					
Yaedake	Naha ACC	I	200	I(A/C)	200					
				MI(A/C)	F(250)					
Iwaki	Tokyo ACC			MI(A/C)	250					
Hachijo	Tokyo ACC			MI(A/C)	250					
Fukue	Fukuoka ACC			MI(A/C)	250					
Nihonkai	TBD			MI(A/C)	F(250)					
KIRIBATI										
LAO PDR										
MALAYSIA										
Langkawi airprot	Langkawi APP	I	60	MI(A/C)	200					
	Kuala Lumpur ACC									
Subang airport	Kuala Lumpur ACC	I	60	MI(A/C)	200					
	Kuala Lumpur APP									
Subang airport (transportable radar)	Kuala Lumpur ACC	I	60	I(A/C)	200					
Genting Highlands	Kuala Lumpur ACC			MI(A/C)	200					
Senai Johor	Kuala Lumpur ACC			MI(A/C)	200					
Kota Kinabalu	Kinabalu ACC	I	60	MI(A/C)	200					
	Kinabalu APP									

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
Kuching	Kuching APP	I	60	MI(A/C)	200					
	Kuching ACC									
Kota Bahru	Kuala Lumpur ACC			F(A/C)	200					
				<2000						
Kuala Lumpur Airport-Sepang	Kuala Lumpur ACC	I	60	MI(A/C)	200					
	Kuala Lumpur TWR									
Sandakan	Sandakan APP	F<2000	60	F(A/C)	200					
	Kinabalu ACC			<2002						
Miri	Miri APP	F<2000	60	F(A/C)	200					
	Kinabalu ACC			<2002						
MALDIVES										
MARSHALL ISLANDS										
MONGOLIA						2009				
MYANMAR										
Yangon	Yangon APP			F(A/C)	250					
	Yangon ACC	I		I						
NAURU										
NEPAL										
Kathmandu	Kathmandu APP	I	60	I (A/C)	200					
NEW ZEALAND										
Auckland	Auckland ACC	I	80							
Ruaotewhenua	Auckland ACC			I(A/C)	250					
Teweraiti	Auckland ACC			I(A/C)	250					
Balance	Ohakea ACC			I(A/C)	250					
Hawkins Hill	Christchurch ACC	I	80	I(A/C)	250					
Mt. Robertson	Christchurch ACC			I(A/C)	250					
Christchurch	Christchurch ACC	I	80							
Cass Peak	Christchurch ACC			I(A/C)	250					
PAPUA NEW GUINEA										
Jacksons airport	Jacksons APP	I	60	I(A/C)	200					
	Moresby ACC									

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
PHILIPPINES										
Manila	Manila APP	I	70	I(A/C)	70					
Tagaytay	Manila ACC	X	250	I(A/C)	250					
Mactan	Mactan APP	I	70	I(A/C)	70					
Subic Bay	Subic APP	I	70	I(A/C)	70					
Laoag	Manila ACC			MI(A/C)	250					
Mt. Majic	Manila ACC			MI(A/C)	250					
REPUBLIC OF KOREA										
Jeiju	Jeiju TWR	I	60	I(A/C)	200					
	Jeiju APP									
Cheongju	CheongjuTWR									
Incheon	Incheon TWR				200					
	Seoul APP		60	3 (A/C)						
	ACC	I—	200	8 I (A/C)	200	2008				
Gimhae	Gimhae TWR							I		
	Gimhae APP	I	60	I(A/C)	200					
Gimpo	Gimpo TWR	I						I		
Yangyang	Yangyang TWR									
SINGAPORE										
Singapore	Singapore ACC	I	230	I(A/C)	256	2009	I			
ATC Center	Singapore APP	I	70	I(A/C)	200					
	Singapore TWR					2009		I		
Singapore airport-2	Singapore APP	I	70	I(A/C)	200					
SOLOMON ISLANDS										
SRI LANKA										
Bandaranaike airport	Colombo APP	I	80							
Mt. Piduruthal-agala	Colombo ACC	I	200	I(A/C)	200					
THAILAND										
Bangkok	Bangkok APP	I	80							
	Bangkok ACC					2010				
Bangkok	Bangkok APP			I(A/C)	250					
	Bangkok ACC									
Chiang Mai	Chiang Mai APP	I	60	I(A/C)	250					
	Bangkok ACC									

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
Ubon	Bangkok ACC			I(A/C)	250					
Surat	Bangkok ACC			I(A/C)	200					
	Hat Yai APP									
	Phuket APP									
Hat Yai	Hat Yai APP	I	60							
Phuket	Phuket APP	I	60							
Bangkok	Bangkok TWR									
Mae Hong Son	Mae Hong Son APP			F(S)<1997	250			F<2000		
Phitsanulok	Phitsanulok APP	F<1998	60							
Hua Hin	Hua Hin APP	F<1998	60							
U Taphao	U Taphao			F(A/C) <1997	200					
TONGA										
UNITED STATES										
Alaska	ACC					2003				
Hilo, Hawaii	ACC			I(A/C)	200					
	APP	I	60							
	TWR									
Honolulu,	ACC			I(S)						
Hawaii	APP	I	60							
	TWR									
Kahului,	APP	I	60	I(A/C)						
Hawaii	TWR									
Kokee, Hawaii	ACC	I	200							
Lihue, Hawaii	APP	I	60	I(A/C)						
	TWR									
Mt. Kaala Hawaii	ACC	I	200	I(A/C)						
Pahoa, Hawaii	ACC			I(A/C)						
Kunianiau, Hawaii	ACC			I(A/C)						
Guam	ACC	I	200	I(A/C)						
Mt.Santa Rosa, Guam	APP	I	60	I(A/C)						
	TWR									
Mt.Santa Rosa, Guam	ACC	I								
Kona, Hawaii	ACC			F(A/C)	200					
Mt. Kaala, Hawaii	ACC	F	250							
Mt.Santa Rosa, Guam	ACC	F<2000	250	F(S)<2000	250					

Country/Location	ATS Units Served	PSR	Coverage of PSR (NM)	SSR(A/C/S)	Coverage of SSR/ADS-B (NM)	ADS-B	ADS-C	SMR	PAR	Remarks
1	2	3	4	5	6	7	8	9	10	11
VANUATU										
VIET NAM										
Hanoi/Noibai	Hanoi ACC	I	200	I(A/C)	200					
	Hanoi ACC	F<2001	80	F<2001 (A/C)	250					
Danang/Sontra	Ho Chi Minh ACC	I	80	I(A/C)	250					
	Danang APP									
Qui Nhon	Ho Chi Minh ACC			I(A/C)	250					
	Hanoi ACC									
Ca Mau	Ho Chi Minh ACC			F<2001 (A/C)	250					
Nghe An/Vinh	Hanoi ACC			F<2001 (A/C)	250					

Appendix E

Proposed Amendment to the Revised Statement of Basic Operational Requirements and Planning Criteria (BORPC) for Regional Air Navigation Planning

(The proposed deletion in the paragraph 7.2 is indicated with strikethrough)

---

7. SURVEILLANCE

7.1 Surveillance systems should provide adequate support to all phases of flight and meet ATM requirements. A table of surveillance facilities/services (including radars, automatic dependent surveillance (ADS) and automatic dependent surveillance – broadcast (ADS-B)), together with an associated chart, is considered to be a useful tool in the planning and implementation of surveillance systems.

7.2 Surveillance should be provided as an integral part of air traffic control where practicable and desirable or necessary in the interest of safety, efficiency and economy of operations, in particular for those areas where traffic density and/or the multiplicity or complexity of ATS routes creates constraints. ~~Primary and/or secondary surveillance radar systems may be used to fulfill this requirement. Subject to availability and cost effectiveness and provided that the required level of safety is maintained, ADS and ADS-B may be used in airspace where surveillance by radar is impracticable or cannot be justified.~~

7.3 Provision should also be made for the use of surveillance systems for the purpose of monitoring air traffic and identifying civil aircraft in areas where they might otherwise be intercepted.

Note: *This requirement does not constitute a justification or operational requirement for installation of new radars. Since interceptions would normally only take place under existing military radar control, this should be interpreted as a requirement for a State to make better use of existing measures and to improve civil/military coordination.*

Appendix F

Subject Task List of the ADS-B Study and Implementation Task Force

No.	Ref.	Task	Priority	Action Proposed/In Progress	Target
1	APANPIRG Concl.13/19 TOR	Subject: Selection of links for near term and long term Task: 1) Select near term link; 2) Select long tern link.	A	1) SSR Mode S 1090 ES has been selected for the near term 2) Additional data links may be specified as necessary	Completed TBD
2	APANPIRG Concl.14/21	Subject: Guidance material for implementation of ADS-B in Asia and Pacific regions Task: Develop a guidance package	A	1) Sample Business case component; 2) Based on OPLINK Concept of use and other ICAO Docs for ADS-B air-ground surveillance service	2006 Completed
3	APANPIRG Concl. 14/21	Subject: Report of ADS-B problem. Task: Establish a problem reporting system	A	Develop a database and a form of report	Completed
4		Subject: Draft amendment proposal to SUPPs 7030 Regional Supplemental Procedures Task: Prepare a draft for consideration by ATM/AIS/SAR Sub Group of APANPIRG	B	Prepare a draft for amendment to Doc7030 for implementation of ADS-B in the Asia and Pacific regions pending separation criteria developed by relevant ICAO panel.	2005/Australia

No.	Ref.	Task	Priority	Action Proposed/In Progress	Target
5	APANPIRG Concl.14/21	Subject: ASIA/PAC ADS-B operational manual Task: Develop operational procedure manual for using ADS-B.	A	Develop a draft operational manual (include material on NOTAM and available manual data)	Completed
6	APANPIRG Concl. 14/21	Subject: Coordination between States at planning level Task: Coordination for timing of implementation and designate focal point of contact, points of contact for regulators, airframes & ground systems.	A	1) Develop an coordinated implementation plan by cities pairs; 2) Inform ICAO regional office names of designated focal point of contact.	2005/States concerned Completed
7	APANPIRG Concl. 14/21	Subject: Regional implementation plan Task: Develop a Regional implementation plan taking into account the individual national plans in accordance with a coordinated plan between cities pairs.	B	1) States present their ADS-B plans (including any necessary associated air ground voice communication) as WPs to ADS-B study and implementation Task Force. 2) Implementation date, sites being considered and plans for mandates (if any) should be specified. 3) Develop optimal regional plan based on State inputs	2005
8		Subject: Number of airframes fitted Task: Report on number of airframes fitted	A	Collect and report to the Task Force information on types, operators (numbers of each) and NUC (NIC/NAC/SIL)	2005/USA

Appendix G

UPDATED ACTION ITEMS

Serial No.	Work Items	Action to be taken by	Target date
1	Ascertain timing with FAA for the issue of DO260A based TSO	USA	Completed
2	Research maximum traffic densities now & expected in 2015	All members	2005
3	Report organizational policy on ADS-B data sharing with neighbors	All members	2005
4	Make available radar ADS-B comparison analyses	USA	2004
5	Distribute analyses on use of GPS TSO129 vs TSO145/6 avionics for ADS-B (Lee & Moody papers)	USA	2004
6	Prices: • GS prices (any ground station provider); • Communication and ATC automation costs (each State); • Big Aircraft & regional aircraft avionics prices: • Small GA aircraft avionics prices.	 Industry All members IATA Australia	 Completed Completed Completed Completed
7	Coordinate examination of sites for city pairs (existing route structure: aim for capacity increase): • Australia - Singapore • Hong Kong, China - Tokyo • Singapore - Delhi	 Singapore Japan India	 Continuing Continuing Continuing

Serial No.	Work Items	Action to be taken by	Target date
9	States are to provide information to support the APANPIRG Regional plan. This can be in the form of comments and additional required changes to incorporate ADS-B into the regional CNS/ATM plan including timing of national implementation into relevant tables of the Plan. Australia will collate these and present to the next Task Force Meeting.	ALL and Australia	Completed
10	Draft regional procedure to amend SUPPs –Doc7030 - for use of ADS-B from aircraft greater than 12 NM offshore.	Australia	March 2005
11	Rewrite the draft ADS-B operations Manual (AOM) and distribute it in December 2004 to TF members and is to be provided to OPLINK in FEB 05. Singapore Decision 1/7	New Zealand/ USA	Completed
12	Identify an existing ICAO definition of low-density airspace.	Thailand	Completed
13	Coordinate a recommendation to the next Task Force, recommending an ASTERIX format message set to be used for sharing of ADS-B data in the Asia Pacific region	Australia / USA	Completed
14	Prepare a Business case matrix or template (checklist) Singapore Decision 1/4	Singapore and New Zealand	Completed
15	Develop specific appropriate ADS-B implementation project proposals for which benefits and costs can be calculated. Singapore Decision 1/5	City Pair coordinators	March 2005
16	Continue a survey of fitment plans and will report at the next TF meeting.	IATA	Completed
17	Encourage airlines to attend the next Seminar.	IATA	Completed
18	IATA issue a reminder to directors of flight operations of its member airlines for the correct flight identification format required to enter into FMS or transponder.	IATA	Completed

Serial No.	Work Items	Action to be taken by	Target date
19	IATA will prepare and present a paper on study of using ADS-B technology in airspace in the North Asia. Singapore Decision 1/6	IATA	March 2005
20	Contact Eurocontrol (John Law) to find out the approach taken by Europe to avoid Flight ID entry problems during the deployment of Elementary surveillance in Europe and report at the next meeting.	Australia	Completed
21	Members to consider hosting the October 2005 meeting. The objective is to maximize the exposure of ADS-B to as large an ATM provider community as possible.	ALL	Completed

The ADS-B Seminar and the Third Meeting of ADS-B Study and Implementation Task Force (ADS-B TF)
Bangkok, Thailand 21-25 March 2005

Attachment 1 to the Report

LIST OF PARTICIPANTS

STATE/NAME/DESIGNATION	ADDRESS	TEL/FAX/-EMAIL
AUSTRALIA		
Mr. Greg Dunstone Technical specialist & ADS-B Program Manager (Seminar & ADS-B TF)	Airservices Australia GPO Box 367 Canberra, ACT 2601 **AUSTRALIA**	Tel: +61 (2) 6268-4286 Fax: +61 (2) 6268-5709 greg.dunstone@airservicesaustralia.com
Mr. Stefan Jerga Manager Commercial Strategy (Seminar & ADS-B TF)	Airservices Australia GPO Box 367 Canberra, ACT 2601 **AUSTRALIA**	Tel: +61 (2) 6268-4428 Fax: +61 (2) 6268-5688 stefan.jerga@airservicesaustralia.com
Mr. Nick King Flying Operations Inspector Airspace Air Traffic and Aerodrome Standards Branch (ADS-B TF)	Civil Aviation Safety Authority GPO Box 2005 Canberra ACT 2601 **AUSTRALIA**	Tel: +61 (2) 6217 1193 Fax: +61 (2) 6217 1700 Nick.King@casa.gov.au
BANGLADESH		
Mr. Mohammed Ali Reza Khan Director (ATS & AERO) (ADS-B TF)	Civil Aviation Authority of Bangladesh Kumitola Dhaka – 1229 **BANGLADESH**	Tel: +880 (2) 8911125 Fax: +880 (2) 8913322 arkhan@agni.com
Sk. A. K. Rafique Ahmed Senior Aerodrome Officer (ADS-B TF)	Civil Aviation Authority of Bangladesh Operation Building ZIA International Airport Dhaka **BANGLADESH**	Tel: +880 (2) 8156916
CHINA		
Mr. Shi Jianhua Engineer (Seminar & ADS-B TF)	Air Traffic Management Bureau 12#East San-huan Road Middle Chaoyang District Beijing **PEOPLE'S REPUBLIC OF CHINA**	Tel: +86 (10) 8778-6915 Fax: +86 (10) 8778-6910 shijianhua@atmb.net.cn
Mr. Wu Xian Engineer (Seminar & ADS-B TF)	Air Traffic Management Bureau 12#East San-huan Road Middle Chaoyang District Beijing **PEOPLE'S REPUBLIC OF CHINA**	Tel: +86 (10) 8778-6915 Fax: +86 (10) 8778-6910

STATE/NAME/DESIGNATION	ADDRESS	TEL/FAX/-EMAIL
Mr. Wong Wo-Ching Electronics Engineer (Seminar)	Civil Aviation Department 10/F, Commercial Building Airport Freight Forwarding Centre 2 Chun Wan Road Hong Kong International Airport **HONG KONG, CHINA**	Tel: +852 2591-5031 Fax: +852 2845-7160 hcwong@cad.gov.hk
Mr. Thomas Fok Senior Electronics Engineer Engineering and Systems Division (ADS-B TF)	Civil Aviation Department 10/F, Commercial Building Airport Freight Forwarding Centre 2 Chun Wan Road Hong Kong International Airport **HONG KONG, CHINA**	Tel: +852 2591-5004 Fax: +852 2845-7160 twhfok@cad.gov.hk
Mr. Li Siu Chung, Daniel Electronics Engineer (Seminar)	Civil Aviation Department 10/F, Commercial Building Airport Freight Forwarding Centre 2 Chun Wan Road Hong Kong International Airport **HONG KONG, CHINA**	Tel: +852 2591-5023 Fax: +852 2845-7160 dscli@cad.gov.hk
MACAU CHINA		
Mr. Sun Shabo Consultant – Telecommunication and Radio Navigations (Seminar)	Civil Aviation Authority of Macau, China Rua Dr. Podro José, Lobo 1-3 Edif. Luso International 26° - andar **MACAU, CHINA**	Tel: +853 511-213 Fax: +853 338-089 aacm@aacm.gov.mo
Mr. Lo Veng Tong, Freeman Technical Officer – Telecommunication and Radio Navigations (Seminar)	Civil Aviation Authority of Macau, China Rua Dr. Podro José, Lobo 1-3 Edif. Luso International 26° - andar **MACAU, CHINA**	Tel: +853 511-213 Fax: +853 338-089 freemanlo@aacm.gov.mo
FIJI		
Mr. Joe Tagicakibau Manager Quality (Seminar & ADS-B TF)	Strategic Air Services Ltd. Fiji P.O. Box 9230 Nadi Airport, **FIJI**	Tel: 679- 672-5080 Fax: +679-672-4600 atmproject@afl.com
Mr. Petero Kaveni Delai Development Engineer (TELS) (Seminar)	Airports Fiji Ltd (AFL)\ Private Mail Bag Nadi Airport **FIJI**	Tel: +679 6731-595 Fax: 679-6731-515 peterod@afl.com.fl
Mr. David McDonald Radio Engineering Inspector (ADS-B TF)	Fiji Island Civil Aviation Authority Private Mail Bag NAP 0354 Nadi Airport **FIJI**	Tel: +679 672-1555 Fax:+679 672-1500 rei@caaf.org.fj
FRANCE		
Mr. Patrick Souchu Head of New CNS System Division (Seminar & ADS-B TF)	FRANCE/DSNA STNA 1AV Docteur Maurice Grynfogel 31035 Toulouse Cedex **FRANCE**	Tel: + 33 (5) 6214-5868 Fax: +33 (5) 6214-5853 patrick.souchu@aviation-civile.gouv.fr

STATE/NAME/DESIGNATION	ADDRESS	TEL/FAX/-EMAIL
INDIA		
Mr. V. Somasundara General Manager (ATM) (Seminar)	Airports Authority of India Rajiv Gandhi Bhavan Safdarjung Airport New Delhi 110003 **INDIA**	Tel: Fax:
Mr. S.K. Kakkar General Manager (Seminar & ADS-B TF)	Airports Authority of India Rajiv Gandhi Bhavan Safdarjung Airport New Delhi 110003 **INDIA**	Tel: +91 (11) 2469-2821 Fax: +91 (11) 2469-2821 skkso@rediffmail.com
Mr. Anil Kumar Dutta Deputy General Manager (ATM) (Seminar & ADS-B TF)	Aiports Authority of India Principal, Civil Aviation Training College Bamrauli, Allaahabad U.P. 211012 **INDIA**	Tel: +05 32 258-0786 Fax:+ 91532 258-0457 akdutt0907@yahoo.com
INDONESIA		
Mr. Novie Riyanto R. Chief of Navigation and Calibration Section (Seminar & ADS-B TF)	Directorate of Aviation Safety DGAC Indonesia JL. Merdeka Barat No. 8 Karya Building Floor 23rd Jakarta **INDONESIA**	Tel: +62 (21) 350-6451 Fax: +62 (21) 350-7569 novierianto@telkom.net
Mr. M. Hasan Bashory Staff of Navigation and Calibration Section (Seminar & ADS-B TF)	Directorate of Aviation Safety DGAC Indonesia JL. Merdeka Barat No. 8 Karya Building Floor 23rd Jakarta **INDONESIA**	Tel: +62 (21) 350-6451 Fax: +62 (21) 3507-569 bazz@telkom.net
JAPAN		
Mr. Hideo Watanabe Special Assistant to the Director (Seminar & ADS-B TF)	Japan Civil Aviation Bureau Ministry of Land, Infrastructure and Transport 2-1-3, Kasumigaseki, Chiyoda-ku Tokyo, 100-8918 **JAPAN**	Tel: +81 (3) 5253-8742 Fax: +81 (3) 5253-1663 watanabe-h2pt@mlit.go.jp
Mr. Fumiki Horikoshi Special Assistant to the Director (Seminar & ADS-B TF)	Japan Civil Aviation Bureau 2-1-3, Kasumigaseki, Chiyoda-ku Tokyo, 100-8919 **JAPAN**	Tel: +81 (3) 5253-8756 Fax: +81 (3) 5253-1663 horikoshi-f2cv@mlit.go.jp
LAO PDR		
Mr. Mala Khamvanh Deputy Director of Aerotelecom (Seminar & ADS-B TF)	Department of Civil Aviation Wattay International Airport P.O. Box 119 **LAO PDR**	Tel: +856 (21) 512-163 Fax: +856 (21) 512-164 laodca@laotel.com

STATE/NAME/DESIGNATION	ADDRESS	TEL/FAX/-EMAIL
Mr. Douangboupha Samay Deputy Chief of Aeronautical Radio Maintenance (Seminar & ADS-B TF)	Department of Civil Aviation Wattay International Airport P.O. Box 119 **LAO PDR**	Tel: +856 (21) 512-006 Fax: +856 (21) 512-216 laodca@laotel.com
MALAYSIA		
Mr. Vausu Dev Varma Instructor/Air Traffic Controller (ADS-B TF)	Civil Aviation Department Level 3, Block D5, Parcel D Federal Government Administrative Centre 62502 PUTRAJAYA **MALAYSIA**	Tel: +60 (3) 78465233 Fax: - vausuv@yahoo.com
MONGOLIA		
Mr. Ganbaatar P. Manager of Policy and Foreign Relations Department (Seminar & ADS-B TF)	Mongolian Civil Aviation Authority MCAA, Buyant-Ukhaa Airport Ulaanbaatar 34 **MONGOLIA**	Tel: +976 11 982-065 Fax: +976 11 379-640 ganbaatar@mcaa.gov.mn
NEW ZEALAND		
Mr. Len Wicks Aeronautical Services Officer (ATS) (Seminar & ADS-B TF)	Civil Aviation Authority of New Zealand P.O. Box. 31-441 Lower Hutt Wellington 6315 **NEW ZEALAND**	Tel: +64 (4) 560-9454 Fax: +64 (4) 569-2024 wicksl@caa.govt.nz
Mr. Howard Anderson ANS Specialist (Seminar & ADS-B TF)	Airways New Zealand P.O. Box 14131 Christchurch **NEW ZEALAND**	Tel: +64 (3) 357-2830 Fax: +64 (3) 357-2807 howard.anderson@airways.co.nz
PAKISTAN		
Mr. Fareed Ahmed General Manager Air Traffic Services (Seminar)	HQ. Civil Aviation Authority Terminal – 1 Jinnah International Airport Karachi – 75200 **PAKISTAN**	Tel: +92 (21) 924-8756 Fax: +92 (21) 924-8758 gmats@caapakistan.com.pk
Mr. Rashid Rasheed Zuberi Corporate Manager ATS (Seminar)	HQ. Civil Aviation Authority Terminal – 1 Jinnah International Airport Karachi – 75200 **PAKISTAN**	Tel: +92 (21) 924-8756 Fax: +92 (21) 924-8758 gmats@caapakistan.com.pk
PHILIPPINES		
Mr. Inocencio T. Yncierto Office in Charge – Airways Navigation Services (Seminar & ADS-B TF)	Director General of Civil Aviation Air Transportation Office Department of Transportation and Communications Mia Road Pasay City, Metro Manila 1301 **PHILIPPINES**	Tel: +63 (2) 879-9164 Fax: +63 (2) 879-9165

STATE/NAME/DESIGNATION	ADDRESS	TEL/FAX/-EMAIL
Mr. Andrew B. Basallote Assistant Chief, Airways Navigation Service (Seminar & ADS-B TF)	Director General of Civil Aviation Air Transportation Office Department of Transportation and Communications Mia Road Pasay City, Metro Manila 1301 **PHILIPPINES**	Tel: +63 (2) 879-9164 Fax: +66 (2) 879-9165 abasallote@ato.gov.ph
REPUBLIC OF KOREA		
Mr. Jong Hoon Baek Assistant Director, Airway Facilities Division (Seminar & ADS-B TF)	Civil Aviation Safety Authority 274, Gwahae-dong Gangseo-gu Seoul 157-711 **REPUBLIC OF KOREA**	Tel: +82 (2) 2669-6419 Fax: +82 (2) 6342-7299 baek81@moct.go.kr
Mr. Il Hee Ahn Manager, Air Navigation Department (Seminar & ADS-B TF)	Korea Airports Corporation 274 Gwahaedong Gangseogu Seoul 157-711 **REPUBLIC OF KOREA**	Tel: +82 (2) 2660-2968 Fax: +82 (2) 2660-4200 ilsus@airport.co.kr
Mr. Myung Ho, Bu Assistant Manager/NAVAIDS Department (Seminar & ADS-B TF)	Incheon International Airport Corporation 2850 Unseo-dong, Jung-gu Incheon 400-700 **REPUBLIC OF KOREA**	Tel: +82 (32) 741-2764 741-5261 Fax: +82 (2) 741-2615 magmagz@airport.or.kr
SINGAPORE		
Ms. Ng Mei Chin Engineer (Surveillance) (Seminar & ADS-B TF)	Civil Aviation Authority of Singapore Singapore Changi Airport P.O. Box 1 **SINGAPORE** 918141	Tel: +65 6541-2402 Fax: +65 6542-2447 ng_mei_chin@caas.gov.sg
Mr. Kwek Chin Lin Project Officer (Systems) (Seminar & ADS-B TF)	Civil Aviation Authority of Singapore 60 Biggin Hill Road **SINGAPORE** 509950	Tel: +65 6541-2664 Fax: +65 6545-6252 kwek_chin_lin@caas.gov.sg
THAILAND		
Mr. Surasit Jitourtrakul Senior Electrical Engineer (Seminar & ADS-B TF)	Airport Standards and Air Navigation Facilitating Division Department of Civil Aviation 71 Soi Ngarmduplee Rama IV, Road Bangkok 10120 **THAILAND**	Tel:+ 66 (2) 287-3194 Fax: +66 (2) 287-3194 jsurasit@aviation.go.th
Mr. Choosit Kuptaviwat Director, Air Traffic Services Engineering Planning and Standards Department (Seminar & ADS-B TF)	Aeronautical Radio of Thailand Ltd. 102 Ngamduplee Tungmahamek Bangkok 10120 **THAILAND**	Tel: +66 (2) 285-9457 Fax: - choosit.ku@aerothai.co.th
Mr. Chanyoot Janprasong Engineering Manager (Seminar & ADS-B TF)	Aeronautical Radio of Thailand Ltd. 102 Ngamduplee Tungmahamek Bangkok 10120 **THAILAND**	Tel: +66 (2) 287-8636 Fax:+66 (2) 287-8180 chanyoot.ja@aerothai.co.th

STATE/NAME/DESIGNATION	ADDRESS	TEL/FAX/-EMAIL
Mr. Chainan Chaisompong Senior Systems Engineer (Seminar & ADS-B TF)	Aeronautical Radio of Thailand Ltd. 102 Ngamduplee Tungmahamek Bangkok 10120 **THAILAND**	Tel: +66 (2) 287-8391 Fax: +66 (2) 287-8180 chainan.ch@aerothai.co.th
Mr. Piyawat Cheesakul Executive Officer, Systems Engineering (Seminar)	Aeronautical Radio of Thailand Ltd. 102 Ngamduplee Tungmahamek Bangkok 10120 **THAILAND**	Tel: +66 (2) 285-9580 Fax: +66 (2) 285-9253 piyawat.ch@aerothai.co.th
Ms. Pornpen Pongladda Senior Systems Engineer (Seminar)	Aeronautical Radio of Thailand Ltd. 102 Ngamduplee Tungmahamek Bangkok 10120 **THAILAND**	Tel: +66 (2) 285-9580 Fax: +66 (2) 285-9253 pornpen.po@aerothai.co.th
Mr. Thanet Suvongse Manager, Flight Technical Engineering Department (Seminar)	Flight Operations Department Thai Airways International Public Co., Ltd. 89 Vibhavadee Rungsit Road Bangkok 10900 **THAILAND**	Tel: +66 (2) 545-2805 Fax: +66 (2) 545-3851 thanet.s@thaiairways.com
Mr. Manu Danwungderm Aircraft Engineer, Avionics System Group (Seminar)	Technical Department Thai Airways International Public Co., Ltd. 89 Vibhavadee Rungsit Road Bangkok 10900 **THAILAND**	Tel: +66 (2) 563-8263 Fax: +66 (2) 504-3360 manu.d@thaiairways.com
INTERNATIONAL ORGANIZATION		
IATA		
Mr. Neil Jonasson Assistant Director (Seminar & ADS-B TF)	International Air Transport Association 77 Robinson Road #05-00 SIA Building **SINGAPORE** 068896	Tel: +65 6239-7262 Fax: +65 6536-6267 jonassonne@iata.org
IFALPA		
Captain Stuart Julian IFALPA Regional Vice President for the South Pacific (Seminar & ADS-B TF)	IFALPA 12 Chiania Place Howick, Auckland **NEW ZEALAND**	Tel: +64 27 277-4572 Fax: +64 9 524-4525 stujulian@xtra.co.nz
SITA		
Mr. Lindsay Norrish Aircom CNS Services (Seminar)	SITA 7 Burnham Street Wellington, 6003 **NEW ZEALAND**	Tel: +64 (4) 972-0507 Fax: - Lindsay.Norrish@sita.aero
SERVICE PROVIDER		
BECKER		

STATE/NAME/DESIGNATION	ADDRESS	TEL/FAX/-EMAIL
Mr. Yang Li Director (Seminar)	Becker Avionics Systems China Office B105-A9, FESCO Build No. 14 South Chaoyangmen Street Beijing 100020 **CHINA**	Tel: +86 (10) 6415-8855 Fax: +86 (10) 6415-8800 leigh.yang@beckerchina.com
Mr. Wilhelm Dahm Sales and ADS-B Product Manager (Seminar)	Becker Avionics Systems Germany Becker Flugfunkwerk GmbH Baden-Airpark B 108 77836 Rheinmünster **GERMANY**	Tel: +49 7229 305 212 Fax: +49 7229 305-217 dahm@becker-avionics.de
Mr. S.J. Limm General Manager (Seminar)	Becker Electronics Taiwan Co., Ltd 8A, Li Kung Street, Peitou Taipei, Taiwan **CHINA**	Tel: +88 (62) 2891-9390 Fax: +88 (62) 2891-9391 limm@becker.com.tw
BOEING		
Mr. John Allin Brown Senior Analyst Ops & Human Factors (ADS-B TF)	P.O. Box 3707 MC 07-25 Seattle WA 98124-2207 **USA**	Tel: +1 (425) 266-8979 Fax: +1 (425) 294-1944 John.a.brown@boeing.com
FIKO		
Mr. Attila S. Fiko Chief Executive Officer (Seminar & ADS-B TF)	Aeronautical Software Lab and Technologies 201/24 Moo 5 T. Faham, A. Muang Chiang Mai 50000 **THAILAND**	Tel: +66 (053) 852-954/ 852-955 Fax: +66 (053) 852-954 Ext. 8 attila@aslt.org
RAYTHEON		
Mr. Mike Wakefield Director Marketing Asia (Seminar & ADS-B TF)	Raytheon 501 Orchard Road #19-02 Wheellock Place **SINGAPORE** 238880	Tel: +65 6734-9271 Fax: +65 6732-2279 michael_wakefield@raytheon.com
SENSIS CORPORATION		
Mr. Keith Tebby (Seminar & ADS-B TF)	SENSIS Corporation 5793 Widewaters Parkway De witt, New York, 13214 USA	Tel: +65 9857-4138 Fax: +65 32 713-7590 ktebby@iee.org
THALES ATM		
Mr. Michel Procoudine – Gorsky Business Development Manager (Seminar & ADS-B TF)	Thales ATM 19 Rue de la Fontaine 92220 BAGNEUX **FRANCE**	Tel: +33 (1) 4084-1346 Fax: +33 (1) 4084-1748 michel.procoudine@thalesatm.com
Mr. Mark Palmer ATM Applications Specialist (Seminar)	Thales 630 Church Street Richmond Vic 3121 **AUSTRALIA**	Tel: +61 (3) 9425-7634 Fax: +61 (3) 9429-5711 mark.palmer@thalesatm.com

STATE/NAME/DESIGNATION	ADDRESS	TEL/FAX/-EMAIL
ICAO		
Mr. K.P. Rimal Regional Officer, CNS	International Civil Aviation Organization 252/1 Vibhavadee Rangsit Road Ladyao, Chatuchak Bangkok 10900 **THAILAND**	Tel: +66 (2) 537-8189 Ext. 155 Fax: +66 (2) 537-8199 krimal@bangkok.icao.int
Mr. Li Peng Regional Officer, CNS	International Civil Aviation Organization 252/1 Vibhavadee Rangsit Road Ladyao, Chatuchak Bangkok 10900 **THAILAND**	Tel: +66 (2) 537-8189 Ext. 158 Fax: +66 (2) 537-8199 pli@bangkok.icao.int
Mr. Andrew H. Tiede Regional Officer, ATM	International Civil Aviation Organization 252/1 Vibhavadee Rangsit Road Ladyao, Chatuchak Bangkok 10900 **THAILAND**	Tel: +66 (2) 537-8189 Ext. 152 Fax: +66 (2) 537-8199 atiede@bangkok.icao.int

International Civil Aviation Organization

SEMINAR ON ADS-B AND THE THIRD MEETING OF ADS-B STUDY AND IMPLEMENTATION TASK FORCE (ADS-B TF/3)

Bangkok, Thailand, 21-25 March 2005.

WP, IP & SP No.	Agenda Item	Subject	Presented by
LIST OF WORKING PAPERS			
1	-	Provisional Agenda	Secretariat
2	5	Working Group Meeting of ADS-B Study and Implementation Task Force	Secretariat
3	6.1	Draft ASIA/PAC Regional ADS-B Operation Manual	New Zealand
4	6.2	ADS-B Implementation Checklist	Singapore
5	2	Outcome of APANPIRG/15 on Matters Relating with ADS-B	Secretariat
6	2	41StDGCA Conference on Matters Relating with ADS-B	Secretariat
7	7	Cost Benefits Study – City Pair 2: Hong Kong, China – Tokyo, Japan	Japan
8	6	Review on FASID Table CNS 4 – Surveillance Systems	Secretariat
9	5	ASTERIX Format for Sharing ADS-B Data in ASIA/PAC Region	Australia
10	6.4	Development of Draft Material to Amend ASIA/PAC Regional Plan for the New CNS/ATM System	Australia
LIST OF INFORMATION PAPERS			
1	-	Meeting Bulletin	Secretariat
2	4	Evaluation Status of ADS-B and Multilateration at ENRI	Japan
3	4	Progress in the Preparation for ADS-B Operational Trial	Thailand
4	3 b)	Separation and Airspace Safety Panel (SASP) Summary of Recent Activity In Relation to ADS-B	Secretariat & Australia
5	6	Revised Statement of Basic Operational Requirements And Planning Criteria (BORPC) For Regional Air Navigation Planning	Secretariat

Attachment 2 - 2

WP, IP & SP No.	Agenda Item	Subject	Presented by
6	6 b)	ADS-B Systems Implementation Activities in the Republic Of Korea	Republic of Korea
7	4	ADS-B Validation Trials in France	France
8	6 b)	ADS-B Implementation for La Reunion Island	France
9	3 a)	OPLINKP Working Group Meeting	Australia
10	4	Development of Cockpit Display of Traffic Information (CDTI)	Australia
11	4	Possible in Trail Climb Procedure Trial Using ADS-B	Australia
12	5	Airbus Transponder Status	Australia
13	5	Entry of Flight ID Update	Australia
14	4	Aircraft Equipage Update	Australia
15	3	RFG Progress	Australia
16	4	Australia Upper Airspace Project Update	Australia
17	4	ADS-B Regulatory Activity in Australia	Australia
18	5	Problem Reporting Data Update	Australia
19	6.5	Business Case Analysis of Expanded Air Traffic Surveillance over Hudson Bay	IATA
20	6 b)	ADS-B Project Study and Implementation Plan in Fiji	Fiji
21	6.5	Cross Industry Business Case Study in Australia	Australia
22	6.5	Fuel Penalties that are Averages for Jet Operations for the Calculation of Cost Benefit	IFALPA
23	3	Airbus View Regarding the Approval of ICAO Annex 10 SCRSP/1 Amendments	Chairman
24	4	ADS-B Update from Indonesia	Indonesia
LIST OF SEMINAR PAPERS			
1	-	ADS-B Introduction	Australia
2	-	Review History of ADS-B Study and Implementation Task Force and ADS-B Related Development by AN/Conf 11 and APANPIRG	Secretariat
3	-	ADS-B for Airport Surveillance	Sensis

WP, IP & SP No.	Agenda Item	Subject	Presented by
4	-	Rising to the IATA Challenge – a Window of Opportunity for Optimizing ADS-B Cost Benefits for Airspace User	SITA
5	-	Update on ADS-B Australian Activity	Australia
6	-	The Future of Alert	Thales
7	-	Raytheon ADS-B	Raytheon
8	-	ADS-B Perspective – March 2005	Rockwell Collins
9	-	Company's View on ADS-B Development	Becker
10	-	ADS-B Solutions	Euro Telematik