



**INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE**

**REPORT OF
ADS-B SEMINAR AND THE FIFTH MEETING OF
AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B)
STUDY AND IMPLEMENTATION TASK FORCE (ADS-B SITF/5)**

New Delhi, India, 3-7 April 2006

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1. Introduction

1.1 The Fifth Meeting of Automatic Dependent Surveillance – Broadcast (ADS-B) Study and Implementation Task Force (ADS-B SITF/5) hosted by the Airport Authority of India (AAI) was held from 5-7 April 2006 at Hotel Ashok, New Delhi, India. An ADS-B Seminar was held in conjunction with the Meeting from 3 to 4 April 2006. The Seminar was inaugurated traditionally by lighting the lamp by the dignitaries.

1.2 Mr. Praveen Seth, Member (Ops) of the Airports Authority of India welcomed all the participants and the guests. Mr. Seth noted that the Seminar will not only provide an opportunity to the Indian aviation community in understanding the new technology but also proves the commitment, support and co-operation of India in adopting the new technology for a global solution.

1.3 In his opening remarks, Mr. Greg Dunstone, Chairman of the Task Force noted the significant changes that ADS-B would bring to air traffic management. He recalled history of ADS-B and recent developments by the ADS-B Task Force. He emphasized that ADS-B had been in aircraft before 1994 and that the aviation community need to implement and deliver benefits to aviation customers as soon as possible. He indicated that lessons would be learnt along the way but through co-operation and co-ordination from each other. The work should progress efficiently.

1.4 Mr. Sudarshan, Regional Affairs Officer from ICAO HQ Montreal, while congratulating India for playing a vital role both at the Global and Regional levels in enhancing the air navigation infrastructure, expressed his deep appreciation to Airports Authority of India for hosting this ADS-B Seminar and Task Force Meeting in Delhi.

1.5 On behalf of Mr. Lalit B. Shah, ICAO Regional Director, Mr. Li Peng, Regional Officer CNS expressed appreciation and gratitude to the government of India and the Airports Authority of India for hosting the event and for the excellent arrangement made for the ADS-B Seminar and the Meeting. He expressed his thanks to all the participants and guests for attending this event. He highlighted the latest civil aviation developments and achievements in the region and major events that took place in the last decade. He informed the Meeting that APANPIRG/16 noted with appreciation of the progress made by the ADS-B Task Force and the trial and implementation progress of ADS-B made by States. He emphasized the important role of the Seminar in exchanging ADS-B related information and encouraged that implementation of ADS-B shall be in a harmonized. He also thanked all contributors and experts for supporting the seminars conducted in past few years.

1.6 Mr. K. Gohain, Officiating DGCA, India, in his opening remarks congratulated Airports Authority of India for taking initiative of conducting ADS-B trials in Chennai. He noted that the Seminar and Meeting in Delhi were very timely and would further enhance the implementation efforts. He briefed the meeting the recent developments in the civil aviation in India.

1.7 Dr. Ramalingam, Chairman of Airports Authority of India thanked ICAO for holding the Meeting in New Delhi. He recognized that Communication, Navigation and Surveillance (CNS) techniques have undergone tremendous changes so as to provide the necessary support for an efficient ATM system to cope up with the challenges posed on account of steady growth of air traffic and airspace user requirements. Satellite based CNS technique combined with matching airborne equipment capabilities in the aircraft has immensely enhanced the capability of both aircraft operation and ATM systems. With such technological advancement, it is not only the safety that is ensured but also the system efficiency has improved significantly. He noted the ADS-B technology has been widely acknowledged and recognized by the aviation industry as the low cost surveillance tool, application of the technology to derive its potential benefits are yet to be exploited by the airline industry and air traffic service providers. A collaborative and coordinated approach in planning and implementation is considered essential to carry forward for a harmonious and universal application. He expressed his pleasure in hosting this Meeting in New Delhi. He extended warm welcome to all participants and wished all participants a successful Seminar followed by Task Force Meeting. He also inaugurated the live ADS-B demonstration organized jointly by Airports Authority of India and Thales ATM at the Meeting venue.

1.8 Mr. Srikrishan, Executive Director ATM, Airports Authority of India extended vote of thanks to the dignitaries and delegates for their support and co-operation.

2. Attendance

2.1 The Seminar was attended by 125 participants and the Meeting was attended by 58 participants from Australia, Bhutan, Brunei Darussalam, Cambodia, China, Hong Kong-China, Fiji, France, India, Indonesia, Japan, Malaysia, Nepal, New Caledonia, Philippines, Republic of Korea, Singapore, Thailand, USA, IATA, IFALPA, SITA and representatives from 8 industries. List of participants is at **Attachment 1**.

3. ADS-B Seminar

3.1 The ADS-B Seminar was organized in conjunction with the ADS-B SITF/5. The objective of the Seminar was to provide information to the participants on ADS-B planning and implementation. The Seminar was presented with 24 presentations covering a comprehensive list of topics on the ADS-B as follows:

- Basic ADS-B Concept, applications
- Global Air Navigation Plan on surveillance
- APANPIRG ADS-B Decisions and ADS-B TF activities
- ADS-B Performance
- Ground stations and Service provider
- ATC Automation and ADS-B
- Avionics products review
- Airframe manufactures plans
- States and ANSP trials, projects and deployment plan
- Air-Air applications
- Regulatory Considerations
- ADS-B & Navigation strategy
- Trial and Deployment Plans

3.2 During the Seminar, a number of speakers from various States and Industries provided valuable information on the ADS-B. The ADS-B Seminar was well received by all participants who expressed that such seminars should be organized in the future.

3.3 A live demonstration on ADS-B ground station using 1090 ES link was provided by Thales ATM during the Seminar. A demonstration on the Air-Air application was given by NASA, USA.

4. Officers and Secretariat

4.1 Mr. Greg Dunstone, Senior Technical Specialist of Airservices Australia Chaired the Seminar and the Meeting. Mr. Li Peng, Regional Officer CNS, ICAO Asia and Pacific Office and Mr. H. Sudarshan, Technical Officer, Regional Affairs Office, ICAO Headquarters acted as Secretaries. The Seminar and Meeting was also facilitated by Mr. V. Somasundaram, General Manager ATM, and Mr. Dutta, Deputy General Manager ATM, the Airports Authority of India.

5. Organization, working arrangements and language

5.1 The Meeting met as a single body for the Seminar and the Meeting. The working language was English inclusive of all documentation and this Report. List of Working Papers and Information Papers presented at the Seminar and the Meeting is at **Attachment 2**.

Agenda Item 1: Adoption of Agenda

1.1 The agenda items adopted by the meeting were as follows:

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| Agenda Item 1: | Adoption of Agenda |
| Agenda Item 2: | Review the outcome of the Fourth Meeting of ADS-B Study and Implementation Task Force |
| Agenda Item 3: | Review the guidance of revised global air navigation plan and progress made by ADS-B related ICAO panels |
| Agenda Item 4: | Review Subject/Tasks List and List of Action Items |
| Agenda Item 5: | Review States' activities and inter-regional issues on trials and implementation of ADS-B |
| Agenda Item 6: | Develop regional strategy for the implementation of surveillance systems |
| Agenda Item 7: | Review items from ADS-B Problem report database |
| Agenda Item 8: | Discuss issues observed during the trial and implementation of ADS-B |
| Agenda Item 9: | Progress preparation of the sample business case |
| Agenda Item 10: | Cost benefit study and sub-regional based ADS-B implementation plan. <ul style="list-style-type: none">- Reports by city pair teams;- Review recommendations of city pair teams;- Consider cost/benefit of city team pair proposals |
| Agenda Item 11: | Initial discussions on ADS-B air-to-air surveillance service for use in the Asia Pacific regions. |
| Agenda Item 12: | Any other business. |

Agenda Item 2: Review the outcome of the Fourth Meeting of ADS-B Study and Implementation Task Force

2.1 Under this agenda item, the meeting reviewed the report of the Fourth Meeting of Automatic Dependent Surveillance – Broadcast (ADS-B) Study and Implementation Task Force held from 26 to 28 October 2005 in Fiji Islands.

2.2 It was informed that in accordance with APANPIRG's Procedural Handbook, a brief summary would normally suffice when there is no meeting of the APANPIRG before the next scheduled meeting of its contributory body. A consolidated report for both meetings may be prepared covering more than one meeting. Accordingly, a consolidated report of the Fourth and the Fifth ADS-B Task Force Meeting will be prepared by the Secretariat for review by the ATM/AIS/SAR/SG/16 Meeting to be held from 26 to 30 June and CNS/MET/SG/10 Meeting to be held from 17 to 21 July 2006. The result of review by the Sub-groups will be presented to APANPIRG/17 Meeting for consideration which will be held from 21 to 25 August 2006.

2.3 The meeting reviewed the status of actions items progressed since the Fourth Meeting of the Task Force. The follow-up actions updated by the task members were as follows:

2.3.1 Amendment proposal processed to update FASID Table CNS 4 – Surveillance system with available ADS-B related planning information verified by the Fourth Meeting of the ADS-B Task Force had been approved in February 2006.

2.3.2 As requested by the Secretariat, Eurocontrol agreed on 8 March 2006 that ASTERIX Cat021 Edition 0.23 can be used for ADS-B data exchange in the Asia and Pacific regions. Furthermore, Eurocontrol welcomed such initiative which was considered as a further step in the global harmonization of ATM/CNS. It was informed that 0.23 Edition was used for the validation exercise in the European Region as well. It was further informed that ASTERIX Cat021 was still a draft form. It is expected that it will become mature for release only after the ADS-B validation exercise has been completed.

2.3.3 The following action items had been progressed:

- Australian ASTRA GNSS Implementation Team (GIT) GPS related papers were collected and provided to the Fifth Meeting;
- The working group with members of the Task Force from Australia, Mongolia, New Zealand, Singapore and Thailand had completed a draft regional strategy for surveillance system;
- Data sheet and fields of parameters for ADS-B data collection had been prepared by Thailand;
- Several regional documents containing abbreviation of ADS only have been identified; and
- The list of designated contact persons responsible coordinating, planning and implementation of ADS-B and ADS-B TF was further updated. The updated list of focal point of contact is provided at **Appendix A** to this Report.

2.4 The meeting further discussed the issue regarding wide area multilateration (WAM) system which was proposed to be added into Table CNS 4 of FASID. It was informed that neither SARPs nor guidance material on WAM system had been developed by ICAO though it was proposed that SCRS Panel (ASP) should start looking into it. Therefore, it might not be mature enough to add it into the regional planning documents. As a result of discussion, the meeting agreed to include it in the proposed new TOR of ADS-B Study and Implementation Task Force.

2.5 IATA informed the meeting of the status of the potential implementation of ADS-B in the north Asian region particularly the Republic of Korea and DPR Korea. It was informed that DPR Korea had decided to install ADS-B, but no operational date was finalized. The Republic of Korea already has a new "Thales" ATC system in the Incheon ACC that can receive ADS-B. IATA has requested both Republic of Korea and DPR Korea to consider three new ATS routes that would benefit greatly from ADS-B coverage and 5 NM separation minima adjoining the Incheon SSR coverage.

2.6 While reviewing the status and progress made in following up the action items, it was considered necessary to develop and issue with the next meeting bulletin, a Checklist for participants to confirm that they had adequately prepared for the next meeting.

Agenda Item 3: Review the guidance of revised global air navigation plan and progress made by ADS-B related ICAO panels

3.1 Under this agenda item, the meeting reviewed several papers presented by the Secretariat on the development of second amendment of Global Air Navigation Plan for Communications, Navigation, and Surveillance/Air Traffic Management (CNS/ATM) Systems (Global Plan), modernization of air navigation systems and updates on ADS-B related panels.

Global Air Navigation Plan

3.2 It was informed that in 1998, the Global Plan was issued and followed by the first amendment in 2001. In light of the outcome of the Eleventh Air Navigation Conference (AN-Conf/11) in 2003 and the Sixth Meeting of the Air Navigation Commission Consultation with Industry in May 2004, the second amendment to the Global Plan was prepared in January 2006.

3.3 A comprehensive presentation on the draft second amendment of the Global Air Navigation Plan was presented to the meeting which addressed past and future work associated with achieving a global ATM system; the Global Plan Initiatives (GPIs); the performance-based approach to measuring success with implementation; and the process of carrying out regional integration and transition. The revised planning process would be facilitated through planning tools, an electronic air navigation planning database, project and programme management techniques and new reporting methodologies. The revised Global Plan would not cause major changes to the work already in progress in the regions since the objective was to harmonize work programmes, improve reporting processes and help to ensure interoperability and seamlessness between regions. It would also introduce methods to ensure that performance objectives were developed and measured.

3.4 The meeting in discussing GPIs noted that deployment of ADS-B has the potential to impact most GPIs. It was recommended that a separate sentence or paragraph be added to the Global Plan at appropriate place to make this potential impact clear:

“Worldwide deployment of ADS-B can be expected to have a profound impact on air traffic management and hence on most GPIs. Consequently all projects should consider the potential impact of ADS-B in the planning phase.”

3.5 For effective planning and implementation of GPIs, the meeting was apprised that the Secretariat would review the data presented in the tables contained in the regional air navigation plans (ANPs) so as to facilitate integration of the GPIs into the planning process and to maximize their usefulness as part of the ANP searchable database. Additionally, in light of the ATM operational concept and the GPIs, the Secretariat will revisit the Statement of Basic Operating Requirements and Planning Criteria (BORPC) contained in the regional ANPs. Furthermore, this second amendment addresses the elements beyond CNS and ATM systems and includes additional systems covering the aeronautical information service (AIS), aerodromes, air routes and ground aids (AGA), meteorological (MET) areas. Therefore, the document has been renamed “Global Air Navigation Plan”, which also allows for a more logical alignment with the regional ANPs.

3.6 Subsequent to the initial review of the amended version of the Global Plan by the Commission, the meeting noted that the ICAO Secretariat was consulting States and also sought the views of ALLPIRG/5 Meeting held in Montreal in March 2006. Consequent to this coordination process, the revised draft second amendment is scheduled to be presented to the Air Navigation Commission for its final review in October 2006, and subsequently to the Council for its approval in November 2006.

3.7 The meeting, recognizing that the evolution continues from a systems-based to a performance-based approach to planning and implementation of the air navigation infrastructure, noted that the Global Plan is a significant component in the development of regional and national plans and that, together with the global ATM operational concept, it provides an effective architecture for achieving a harmonized and seamless Global ATM system.

Modernization of air navigation systems

3.8 The meeting was presented with an overview of the Global and Regional developments in the modernization of air navigation systems. The meeting noted that through the Panels of the Air Navigation Commission and the Secretariat, assisted by Study Groups, ICAO has made substantial progress in the development of SARPs, PANS and guidance material. The meeting among other things noted the development status of Standards and Recommended Practices and guidance material, work programmes of various panels and Study Groups engaged in CNS/ATM related activities, the outcome of recent PIRG meetings and the comparative analysis of regional developments in air navigation systems.

Work programme of Surveillance and Conflict Resolution Panel

3.9 The meeting was apprised that on 2 June 2005, the Air Navigation Commission requested the Panel to prepare a complete list of work items showing their impact on safety, regularity, efficiency and/or security of international civil aviation, priorities and completion dates. Accordingly, the working group of the ANC on Panels in February 2006 considered the newly proposed work programme that was developed on the basis of the list presented by the panel, recent reports of planning and implementation regional groups (PIRGs) and other available information. In the preparation of the proposed work programme, the meeting noted that only tasks with clear and near-term deliverables that support or facilitate the implementation work were proposed and a time span of two years was estimated for the completion of all the identified tasks.

3.10 Recent trials and implementations of multilateration systems, which use 1 090 MHz signals emitted from aircraft to determine its position, have been promising. Technical issues associated with design, implementation and operation of multilateration systems need to be investigated in order to enable the Organization to decide on the timing and extent of any necessary standardization activity.

3.11 The increasing radio frequency (RF) pollution on 1 030/1 090 MHz can have detrimental effects on the operation of all relevant systems and therefore merits thorough investigation in order to develop mitigation strategies. Another issue associated with the increasing number of ground surveillance systems is the question of how to merge various derived aircraft positions (with different latencies, accuracies, etc.) into one (the best) plot/track suitable for air traffic control (ATC) display. A closely related issue is the establishment of appropriate ICAO provisions for sharing surveillance data.

3.12 The meeting noted that the term ASAS is gradually being replaced by “airborne surveillance applications (ASA)” thus reflecting less emphasis on “separation” and more attention to other operational benefits. Recognizing that there is currently no universal agreement on the merits of all such applications, it was noted that ICAO would establish a roadmap for the development, operational use and evolution of ASA to serve as a framework for the development of further ICAO provisions on the subject.

3.13 In relation to technical provisions for ACAS, although they have become quite mature and stable, occasional updates thereto may become necessary in light of operational experience. Finally, as the name of the panel infers a degree of emphasis on “conflict resolution” and its acronym, SCRSP, is rather difficult to pronounce, the meeting noted that the working group on Panels had proposed that it be changed to “Aeronautical Surveillance Panel (ASP)” which is simple and generic.

3.14 The newly proposed work programme of the Panel, which has been agreed by the ANC WG on Panels. The meeting noted that the working group is scheduled to present this new work programme of the Panel to the Commission for approval during its session of April-June 2006.

3.15 As for the extended squitter, updated SARPs and associated technical specifications are currently being processed. Similarly, as operational experience is gained, those provisions may need to be updated. Existing provisions for 1 090 MHz extended squitter only cover the airborne side. Therefore, the meeting noted the need to establish similar radio frequency characteristics for 1 090 MHz ground receiving (for air-ground ADS-B) and transmitting stations (for traffic information service - broadcast (TIS-B).

3.16 Noting ASP and Eurocae are developing specifications for ground stations, concern exists that the specifications may be unnecessarily complex or expensive to implement for some ADS-B applications and in some environments. The Task Force recommended that the emphasis of this work be on guidance material and lessons learned rather than specifications. The absolute minimum of requirements should be specified.

Review of activities of ICAO Panels related to ADS-B

3.17 The meeting reviewed activities and progress made by ADS-B related ICAO Panels including OPLINK Panel and SAS Panel. The meeting noted that, the OPLINKP/1 Meeting (Montreal, 12 to 23 September 2005) made a recommendation to amend Annexes 2, 4, 11 and 15, the PANS-ATM and PANS-ABC, ATS Data Link Applications (Doc 9694) and Annex 10 (Volume III) concerning ADS-B. The report of OPLINKP/1 was reviewed by the Air Navigation Commission (ANC) working group for Panels and later by ANC in February 2006. It was noted that the Doc 9694 would be amended with the caveat that duplication of material should be avoided. The Commission also agreed to the publication of the Manual on CPDLC.

3.18 The work on the development of RCP completed and a manual has been prepared which would be placed soon on the ICAO-NET. Furthermore, the Commission agreed that the work of the OPLINK Panel has been completed and that the Panel to be dissolved.

3.19 Consultation with States on proposed amendments could be expected at the end of April 2006 and States would have until the end of July to reply. The final review by Air Navigation Commission of the proposed amendments in the light of comments received would be in early October then the amendments will be presented to the Council for approval. The applicable date for these amendments and changes will be likely in November 2007.

3.20 In relation to the work of SASP, the meeting noted that the development of a comparative assessment of ADS-B performance compared with a single monopulse SSR for a horizontal separation of 9.3 km (5.0 NM) has been completed. Also, SASP had finalized a safety case document that captured all the relevant arguments, information and documentation in support of 9.3 km (5.0 NM) separation.

3.21 The SAS Panel, OPLINK Panel and the Surveillance and Conflict Resolution Systems Panel (SCRSP) agreed on amendments to some relevant ICAO documents. These amendments will allow the application of a 5 NM ADS-B Separation Standard. On 24 February 2006, the package of amendments comprising the Comparative Assessment, the ADS-B Implementation Roadmap, Amendments to Doc 4444 and the ICAO Annexes was reviewed by the ANC. ICAO will publish the ADS-B/Radar Comparative Assessment and ADS-B Implementation Roadmap as an ICAO Circular in the near future.

Agenda Item 4: Review Subject/Tasks List and List of Action Items**Terms of Reference (TOR) and Subject/Tasks List**

4.1 The meeting reviewed the revised Terms of Reference (TOR) proposed by the Fourth Meeting of the Task Force. The meeting further agreed to propose to add multilateral related study in addition to the air-air applications related study into the Term of Reference. Accordingly, the meeting reaffirmed the draft Decision 4/1 as follows:

Draft Decision 5/1 – Revision of the Terms of Reference of the ADS-B Study and Implementation Task Force

That, the revised Terms of Reference of the ADS-B Study and Implementation Task Force be adopted as shown in **Appendix B** to the Report of ADS-B SITF/5.

4.2 The meeting reviewed and further updated the Subject/Tasks List of the ADS-B SITF approved by APANPIRG/16 under Decision 16/38. The updated Subject/Tasks list is provided at **Appendix C** to this Report. The meeting also updated the list of action items to be taken by the Task Force members.

Aircraft data report form

4.3 In following up Decision 4/3 of the ADS-B Task Force, an aircraft ADS-B data report form and a data sheet with associated fields of parameters for ADS-B data collection were presented to the meeting by Thailand. The data fields and data collection form were developed in order to enable the collection and analysis of data from aircraft with ADS-B capability currently operating in the Asia/Pacific Region. The collected and processed information, by States currently planning to or are in the process of conducting ADS-B trials, would provide a regional picture on the readiness of the aircraft for use by States in its planning process. The data sheet with fields of parameters and data collection form agreed by the meeting are provided in the **Appendix D** to this Report.

4.3.1 As a written form would be cumbersome and time consuming and hard to manipulate the collected data, Thailand proposed the collection of data in electronic form using a spreadsheet as data collected can be more easily manipulated.

4.3.2 The meeting agreed that a Task Force member from Thailand be designated as a focal point of the Task Force member to collect, process, analyze, report and maintain the collected data with a database. The meeting also adopted a Procedure for submission of ADS-B Aircraft Data collected as shown in **Appendix E** to this Report. It was agreed that the collected data sent to the designated focal point by e-mail at 6 months intervals. Accordingly the meeting made a decision as follows:

Decision 5/2– Aircraft ADS-B Data Report Form and collection procedure

That, the data sheet with fields of parameters and data collection form provided in the **Appendix D** to this Report be used by ADS-B SITF member for Aircraft ADS-B Data collection; and the Procedure for Submission of ADS-B Aircraft Data as shown in **Appendix E** to this Report be used by the Task Force member to provide collected data for a consolidated report and analysis.

Air-report MET data

4.4 It was recalled that the Ninth Meeting of the CNS/MET Sub-group of APANPIRG had requested ADS-B Task Force to study the use of 1 090 MHz extended squitter (ES) ADS-B for automatic MET air-reporting in the Asia/Pacific Region. It arose from APANPIRG Conclusion 14/44. The METLINK SG had been invited to consider the application of the Mode-S datalink in automatic air-reporting as an alternative to ADS over areas covered by surveillance radars and to consider ways to facilitate its implementation in the Asia/Pacific Region. This task was to address the problem of the lack of automated aircraft observations of MET elements – wind, temperature, turbulence (if available) and humidity (if available).

4.4.1 On the other hand, CNS/MET Sub-group noted that there was currently no intent to implement Mode S in the near-term in the Region. It therefore appeared that in the Asia/Pacific Region, ADS-B (using 1 090 MHz ES) would be more likely to become widely implemented, and for that reason, it might be more suitable for automated MET air-reporting. The CNS/MET SG/9 Meeting agreed that it had always been the intent of using ADS-B for automated MET air-reporting but in view of the need to confirm the technical details on implementation, the following Decision was formulated:

Decision 9/41 – Use of 1 090 MHz extended squitter (ES) ADS-B for automatic air-reporting

That, the Automatic Dependent Surveillance-Broadcast (ADS-B) Study and Implementation Task Force be requested to study the use of 1 090 MHz extended squitter (ES) ADS-B for automatic MET air-reporting in the Asia/Pacific Region.

4.4.2 There was a general discussion at the Fourth Meeting of the Task Force on this issue. One observation was that if the MET air-report information is able to delivered by ADS-C, ADS-B should also be able used for downlinking such information. However, general concern expressed was where such MET data would affect the normal transmission of the other data used for separation purpose. Additional cost that would be evolved on the avionics is another point of doubt.

4.4.3 In response to an action item developed at the Fiji meeting, the meeting discussed a working paper 9 (WP/9), prepared by Chairman of the Task Force and examined the use of 1 090 ES for automatic MET air-reporting. Hong Kong, China commented that although the current 1 090 ES design did not support the automatic air-reporting, the requirement to downlink the data available from the MET sensors as listed in Annex 3 should be pursued, perhaps through other appropriate forum. As a result of discussion, the meeting was of the view that technically speaking it was possible to use 1 090 ES for the downlink of MET data. However there were some concerns that inclusion of MET data may distract and delay ADS-B deployment. How to integrate relevant registers on board with ADS-B-out capable transmitter would be another issue of concern. The Task Force accordingly recommended that the development of SARPS be undertaken by the Aeronautical Surveillance Panel after an initial business case is prepared. The meeting agreed to provide above result of study back to CNS/MET Sub-group of ANPANPIRG together with WP/9 including the recommendations proposed in the paper for further consideration.

Agenda Item 5: Review States' activities and inter-regional issues on trials and implementation of ADS-B**Update on the upper airspace programme transition**

5.1 The meeting noted the progress of the Upper Airspace Programme (UAP) which will be conducted in three stages over a transition period of approximately 12 months. The first stage of the transition process starting from March 2006 will see the continuation of ADS-B services in the Burnett Basin region of Queensland using UAP-supplied ground station hardware and new ATC system software. The new ATC software links to flight plans using ADS-B flight ID as highest priority and avoids the use to 24 bit address by ATC & pilots.

5.2 During second transition stage starting from June 2006 to May 2007, ADS-B ground stations will progressively be installed at remote locations across the country over a 12-months period. Because of delays in Telecommunications Infrastructure Network Replacement (TINR) Programme, four ground stations located at Bourket, Esperance, Longreach, and Woomera will be commissioned using interim communication links in June 2006. As ATC sector groups of controllers are trained, the associated ground stations will be connected to the ATC system. During this stage, ADS-B will be used to monitor and verify procedural separation standards. Pilot position reporting will not be required whilst identified in ADS-B airspace. ATC "safety net" alerting functions such as short term conflict alert and route and altitude conformance monitoring based on ADS-B data will also be implemented. With the exception of 5 nautical mile separation services, all "end-state" ADS-B procedures and phraseologies will be introduced at the beginning of this stage. Aircraft operators must demonstrate that ADS-B aircraft meet technical standards defined by the Civil Aviation Safety Authority and must also conduct relevant ADS-B training for dispatchers and flight crew. 5 nautical mile separation services introduced in the first stage will continue in the Burnett Basin for ADS-B trial participants during this stage of the transition.

5.3 The final stage of ADS-B implementation is scheduled to commence in early June, 2007 when all ground stations are operating in their final configuration and all controllers have been trained in ADS-B radar-like separation services. The full range of radar-like surveillance services, including 5 nautical mile separations, will be provided nationally for ADS-B equipped aircraft operating within upper level ADS-B coverage.

Australia's ADS-B programme

5.4 Australia provided an update on its the ADS-B activities progressed recently in Australia. The ADS-B trial at Bundaberg comprises a single duplicated ADS-B ground station that receives ADS-B transmissions. The system presents ADS-B data on Australian ATC displays and is in full operational use. In late 2005, approval by the Australian aviation regulator (CASA) was issued allowing the provision of ADS-B 5 nautical mile separation services to Boeing 737-800 aircraft of Virgin Blue and Airbus A320 aircraft belonging to Jetstar. Following airline pilot training, 5 nautical mile separation services for jet operations commenced in early 2006. The meeting further noted the progress of ground station installation, systems, ATC standards, Procedures, Training, ATLAS Project (http://www.airservicesaustralia.com/tenders/rfp_adsbavionics/default.asp), WAM & ASMGCS and ADS-B research and development programmes.

GPS only navigation

5.5 It was noted that after several year of work, the Australian regulator has approved the use of GPS as a Primary Means of Navigation in Australian airspace. For some type of aircraft and operation this allows GPS to be used as the only means of navigation. An AIC has now been published in Australia. The complete document is available on the web at <http://www.airservicesaustralia.com/publications/current/aip/gen/15118.pdf>

5.6 For appropriately equipped aircraft, a flight may be planned and conducted under IFR, without requiring any ground Navigation Aid. Thus, there is no longer a need to carry fuel to allow diversion to an airport with an ground navaid (NDB, VOR, ILS). The minimum aircraft fitment required to fly IFR aircraft is now TSO-C145a/146a avionics; there is no longer required to carry and maintain conventional navigational avionics. The Approval has a Dispatch Requirement that a prediction indicating that TSO-C145a/146a RAIM FDE will be available during the approach be obtained from an approved RAIM Prediction Service. The prediction service takes into account GPS satellite availability and geometry to predict whether adequate GPS service will exist at the expected time of the NPA approach. Typically, RAIM outages for TSO146a receivers will occur infrequently and for a short duration. The prediction service allows departure time to be varied to avoid any outage, or the carriage of additional fuel to hold during the predicted outage. In this case the additional fuel may be less than that required for travel to an alternate.

5.7 Since GPS supports both navigation and the provision of positional data to ADS-B, the availability of GPS only navigation opens the possibility of equipping the general aviation fleet with TSO-C146a GPS and ADS-B out in one package. By installing both systems at the same considerable cost savings occur. The availability of GPS only navigation supports the reduction in scale of the conventional navaids infrastructure. The one business case can be used to support both navigation and ADS-B and take advantage of the obvious synergy between the two technologies.

5.8 While noting the significance of the milestone achievements, concerns were expressed that currently ADS-B relied on GPS. If the GPS service is lost to an aircraft the ADS-B based surveillance could also be lost. In response to the concern, some States indicated that they would retain a degree of radar coverage in the higher traffic areas, and that this issue should be considered during the deployment of ADS-B systems. It should be noted that similar risks are addressed and mitigated when single radar coverage is provided (i.e.: dependence on a single radar site). Similarly in the navigation domain certain risks associated with the failure modes of NDB and VOR are also accepted. In the future Galileo may be the satellite system providing redundancy although it would take several years (even after 2010) for common receivers to be developed.

GPS papers from Australia's ASTRA

5.9 A number of GPS/GNSS working papers from the Australian ASTRA Meetings to provide some insight into the Australian considerations of GPS operation were introduced. The GNSS Implementation Team (GIT) Sub-group of ASTRA meets approximately every 3 months. The meeting reports and papers are available at: http://astra.aero/GIT/meeting_reports.aspx. The papers provided to the meeting for reference were as follows:

- GIT10-IP002-GPS_Monitoring_Results.pdf
- GIT10-IP003-GPS_Constellation%20Availability.pdf
- GIT09-IP005-GPS_Availability_Prediction_Results.pdf
- GIT08-IP010-Legality_of_using_GPS.pdf
- GIT08-IP005_GPS_RAIM_Rediction_Service_support_for_TSO-C145-6a1.pdf
- GIT08-IP003-GPS_Monitoring_results.pdf

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- GIT08-IP008_Development_of_RNAV_and_RNP_Operational_Authorisations.pdf
 - GIT08-IP002-GPS_Constellation_Availability_Study.pdf

ADS-B regulatory developments

5.10 Australia provided information on the ADS-B related regulatory developments to support the implementation of ADS-B in Australia which is expected to start providing a service to equipped aircraft in June 2006. To initiate this service, Civil Aviation Safety Authority (CASA) will be required to re-issue of Airservices Australia's CASR Part 171 (Aeronautical telecommunications service and radio-navigation service providers) Operational Certificate. CASA has already promulgated a 5 nautical mile separation standard through amendment of the CASR Part 172 (Air traffic service providers) Manual of Standards. This amendment and amendments to AIP currently being drafted reflect the amendments to ICAO documentation proposed by OPLINKP and recently reviewed by the Air Navigation Commission.

5.11 Avionics standards are also being published and draft Advisory Circular AC21-45 *Airworthiness Approval of Airborne Automatic Dependent Surveillance Broadcast Equipment* has recently been published. This AC will supplement the technical standard orders ATSO-C1004 and ATSO-C1005 already published by CASA. The AC is included in this information paper as Attachment A, and is also available on the CASA website at [http://rrp.casa.gov.au/drafts/DRAFTac021-45\(0\)_0603.pdf](http://rrp.casa.gov.au/drafts/DRAFTac021-45(0)_0603.pdf).

Australian transition to satellite technology (ATLAS)

5.12 In support of the UAP and ATLAS, CASA issued a discussion paper (DP) addressing the carriage and use of ADS-B in December 2004. The DP was intended to seek industry comment on various options that CASA could adopt in initiating regulatory changes. The paper sets out four main regulatory options, and identifies that informal consultation to date suggested that a phased implementation of carriage requirements may prove most suitable. The DP is available at http://rrp.casa.gov.au/download/04_dp.asp.

5.13 In September 2005, CASA published a Summary of Responses (SOR) that presented CASA's evaluation of the comments received on the DP, together with the consequent disposition. CASA is now preparing draft rules for the carriage and use of ADS-B for further consultation with the aviation community. A copy of the SOR is available at http://rrp.casa.gov.au/sor/sor0410as_v3.pdf. It is expected that a Notice of Proposed Rule Making (NPRM) addressing carriage and use of ADS-B avionics will be issued by CASA in the near future.

5.14 The meeting appreciated Australia for sharing the information on regulatory activities for ADS-B which provides good examples and experiences for consideration by other States.

ADS-B programme office roadmap

5.15 The United States provided an information paper on Federal Aviation Administration (FAA) Programme Plan for the deployment of Automatic Dependent Surveillance – Broadcast (ADS-B) technology across the National Airspace System (NAS). It provides information on recent ADS-B programme activities including the decision by the Joint Resources Council (JRC) of the FAA to establish the Surveillance and Broadcast Services Programme Office and the issuance of the subsequent decision memoranda. Introduction was also provided to the meeting regarding the structure of the programme office, its interrelation with the Joint Planning and Development Office

and alignment with the Next Generation Air Transportation System vision established under Vision 100 by the Secretary of Transportation.

5.16 In order to further the goals of the NGATS plan, the FAA had transitioned the development work of ADS-B technology into an execution phase. This transition and approval of the ADS-B business case has been approved by the Joint Resource Council that authorizes spending in the FAA. This decision is detailed in the Record of Decision issued on 9 September 2005. The cost effectiveness and superior surveillance performance of the ADS-B system allows the FAA to meet demands for a responsive air traffic system that provides surveillance services in locations that do not currently have these capabilities. The ability of the ADS-B system to support a range of applications that improve shared situational awareness between controllers and pilots opens up new possibilities for safety and efficiency procedures that will radically change how air traffic is managed. If the benefits of ADS-B manifest themselves as anticipated, it will fall to the Surveillance and Broadcast Services Programme Office to deploy the technology across the NAS and to coordinate with ICAO and other international aviation organizations to achieve a harmonious transfer of flights between nations.

5.17 In response questions, it was clarified that in 10-15 years SSR will be still required. Both UAT and Mode ES will be used. UAT link will be needed for general aviation and vehicles also for TIS-B link. The United States will not use VDL Mode 4. In answering a question of timing for mandate, it was informed that law exists for listening to views of public and industry which would take 2 years and 9 months for the mandate to become effective. It is expected to take years until 2018 - 2019 before full compliance is achieved.

ADS-B trials at Chennai

5.18 India informed the meeting of an ADS-B trial conducted at Chennai Airport from 29 November to 1 December 2005. One of objectives of the trial was to gain familiarity with the system. The system used for the trial was provided by M/S Thales and Infrastructure was provided by Airports Authority of India (AAI). ADS-B was being considered as one of the options for surveillance. A number of systems had been installed and were in various stages of validation and use.

5.19 A temporary M/S Thales system was installed at Chennai Airport with the antenna installed on Air Traffic Control Tower roof to gain the range. The Ground Station of the system was located in the Control Tower itself and the ADS-B data was provided to a RCMS in the ACC located in the main Air Traffic Control Center. The system was demonstrated from 29 November to 1 December, 2005 and the trials concluded with the presentation of results from the data collected over the period of trials. Presentations of live data provided good education for the AAI professionals. Outcome from the trial are listed below:

- a) Air Traffic Controllers could monitor the aircraft in various stages of flight and even during their movement over the aerodrome maneuvering surfaces right up to the gate;
- b) Air Traffic Controllers could compare ADS-B presentation with the RADAR data presentation; and
- c) The Maintenance personnel could assess the maintenance requirements for such systems.

5.20 Some of the significant observations made during the trial are listed below:

a) Domestic Airlines

- i. All Kingfisher Airlines and Air Deccan Airbus A 320 aircraft in Chennai TMA were ADS-B equipped;
- ii. Some of the Jet Airways and Spice Jet Boeing 737 aircraft in Chennai TMA observed during the period of trial were also observed to be ADS-B Equipped; and
- iii. Indian Airlines and Sahara Airways aircraft were not equipped to use ADS-B.

b) International Airlines

- iv. Some of the aircraft belonging to British Airways, Emirates, Ethiad Airways, Gulf Air, Lufthansa, Singapore Airlines, Sri Lankan, Thai Airways and Yemini Air were observed to have ADS-B equipped; and
- v. It was observed that only 10.5% of the total traffic handled in Chennai TMA from 28 November to 2 December, 2005 was equipped with ADS-B compatible airborne system.

5.21 With the small low gain antenna (1.5m, 8dB) installed on top of the Control Tower, the maximum range observed was less than 80 nautical miles. Some level of masking was also observed in the directions, where the obstructions are close to the Air Traffic Control Tower. As on the day of trial, only 10.5% of the total air traffic handled in Chennai TMA was equipped to use ADS-B. The system can provide track information in various phases of flight (ground movement included). Track accuracy depends upon the accuracy of the airborne system. The accuracy of display also depends upon the accuracy of the map provided. India was proposing to conduct a trial for longer time.

5.22 The meeting appreciated the encouraging trial conducted by India and the experience gained and lessons learned.

ADS-B in Fiji

5.23 Following the ADS-B Seminar and Meeting held in Fiji in October 2005, there has been strong support from the Regulatory Authority and airlines for the ADS-B solution. The advent of ADS-B is preferable to radar and will definitely provide the much needed surveillance component in the Fiji domestic airspace.

5.24 Recent event associated with SAR reaffirmed the need for ADS-B. It is envisaged that ADS-B will be operational in the Fiji domestic airspace during last quarter of 2007. ADS-C has been operational in Nadi FIR for several years.

Agenda Item 6: Develop regional strategy for the implementation of surveillance systems**A regional surveillance strategy**

6.1 Under this agenda item, the meeting discussed the draft strategy for the implementation of surveillance systems in the Asia/Pacific Region presented by the Rapporteur of a working group established under Decision 4/6 of the Fourth Meeting of ADS-B SITF.

6.2 The meeting recalled that the Fourth Meeting of ADS-B SITF agreed to develop a regional strategy for surveillance systems and have it listed in the Tasks List. Task Force members from Australia, Mongolia, New Zealand, Singapore and Thailand agreed to draft such a strategy for review by the next Task Force meeting.

6.3 In preparation for the Fifth Meeting of the Task Force, members from Australia, Mongolia, New Zealand, Thailand and Singapore have corresponded through e-mails on the development of a regional surveillance strategy. In developing the strategy, the group has sought and received valuable advice from Regional Officers of the ICAO Regional Office.

6.4 The draft strategy agreed by the meeting is provided at **Appendix F** to this Report. Accordingly, the meeting formulated the following draft Conclusion:

**Draft Conclusion 5/3 - Strategy for the implementation of surveillance systems
in the Asia/Pacific Region**

That, the strategy for the implementation of surveillance systems in the Asia/Pacific Region be adopted.

6.5 The meeting appreciated excellent task completed by the working group.

Agenda Item 7: Review items from ADS-B Problem report database**Problem reporting database update**

7.1 Australia provided an update on the problem and issue reporting process and explanation to the problems recorded in the database. The database, initially maintained by Airservices Australia was established in accordance with a decision made by the Second Meeting of the Task Force.

7.2 It was informed that ADS-B problems and issues may be submitted online using a data entry form on the Airservices Australia website at www.airservicesaustralia.com/adsb/issues. The data in the entry form will then be incorporated into an Access database – and a report made available on the same website regularly. There is no need for a password. There are links on the page to detailed data entry form instructions and to the latest report from the Problem and Issues database. States and users of ADS-B service were encouraged to use the form to create a new problem or to make comments relating to an existing issue or problem. It is important that information having impacts on other parties be distributed to all users as soon as possible. In this way, each party is made aware of problems already encountered by others and may be able to provide further information to aid in the solution of these problems. It was agreed that before dissemination of information to third parties, all references that could identify particular party must be removed.

7.3 The meeting reviewed the eleven problems reports currently recorded in the database. Several comments were provided at the meeting for the existing problems. According to Decision 1/2 made by the Task Force at Singapore meeting, members of the Task Force were encouraged to input problems observed during the trials and implementation projects and/or provide comments or support to resolve the issues reported.

Agenda Item 8: Discuss issues observed during the trial and implementation of ADS-B**Amendment of ADS-B Implementation and Operations Guidance Document (AIGD)**

8.1 The meeting reviewed and endorsed a draft amendment of the ADS-B Implementation and Operations Guidance Document (AIGD) proposed by Australia. It had been identified desirable editorial changes to improve the readability of the document. The proposed amendment also includes procedure of amendment process as specified in the Document. The meeting accordingly formulated following draft Conclusion:

Draft Conclusion 5/4 - the First Amendment to the AIGD

That, the amended ADS-B Implementation and Operations Guidance Document (AIGD) as provided in the **Appendix G** to the Report of ADS-B SITF/5 be adopted.

The training needs

8.2 Malaysia presented an information paper to draw the attention of the Task Force to the needs of a training programme for some of the Asia/Pacific member States. The resources both in human technical and capital of some members is limited. The combined efforts of the delegates at this Task Force meeting can help formulate a plan to form the basis of ADS-B implementation in individual member States. Knowledge of the implementation programme would help overcome the resistance to change, as to some States these new technologies are largely unknown. The fact that this is a part of ICAO's Global Plan makes it more relevant that the Task Force looks into establishing a basic training format for use by member States. The manufactures' input especially in the technical aspects would aid the selection of the right people for the right roles.

8.3 The Secretariat informed the meeting that a human resource planning and training manual was being progressed and would be provided to States for CNS/ATM system implementation by the end of 2006.

Detected aircraft

8.4 Thailand informed the meeting of the number of ADS-B capable aircraft detected operating in Thailand. Based on two twenty-four hours recording in January and March 2006, a total of 160 different aircraft was detected by the ground station installed at AEROTHAI's Head Office in Bangkok, Thailand. The aircraft detected were operated by the following aircraft operators:

8.4.1 Thai Airways International, Bangkok Airways, Singapore Airlines, Gulf Air, South African Airlines, Air China, Uzbekistan Airways, Kuwait Airways, China Airlines, Druk Air, Emirates, Qatar Airways, China Eastern Airlines, Air Astana, Royal Dutch Airlines, AHK Air Hong Kong, Scandinavian Airlines, MALEV Hungarian Airlines, Korean Airlines, Royal Jordanian Airlines, El Al Israeli Airlines, Northwest Airlines, Tiger Airways, Martinair, Sri Lankan Airlines, JALWays, Jetstar Asia Airways, Qantas Airways, EVA Airways, Air France, Vietnam Airlines, LTU International Airways, United Parcel Service, Turkish Airlines, Ethiopian Airlines, Lufthansa, Siem Reap Airways, Swiss International Airlines, British Airways, Cathay Pacific Airways, Dragon Air, Federal Express, Cargolux Airlines International, Etihad Airlines and Nippon Cargo Airlines.

8.4.2 The aircraft types detected were A306, A310, A319, A320, A321, A332, A333, A342, A343, A345, A346, B733, B737, B742, B744, B752, B762, B763, B772 and B773.

8.4.3 The number of ADS-B capable aircraft detected operating within Bangkok FIR represented approximately 10% of the daily traffic. This is based on the year 2005 statistics which is approximately 900 flights per day.

8.5 The meeting was also informed that a number of incorrect entries of flight identity were observed. It was noted that two aircraft were observed to be broadcasting 20-bit aircraft address rather than the 24-bit aircraft address as stipulated by ICAO.

8.6 Members of the ADS-B Study and Implementation Task Force were requested to prepare details of each country's ADS-B data sharing policy and presented at next meeting of the Task Force. This task was included in a checklist for participants to the next meeting.

Status of ADS-B equipage observed in Hong Kong, China

8.7 Hong Kong, China made a presentation on their quarterly survey of aircraft ADS-B equipage conducted in Hong Kong, China. In May 2004, a mini-scale trial system using multilateration-based technology was installed at Hong Kong International Airport for Surface Movement Guidance & Control System (SMGCS) operational evaluation. The mini-scale SMGCS trial system consists of 9 remote units, which are also capable of receiving and decoding the Mode S Extended Squitter messages. Since November 2004, Hong Kong Civil Aviation Department has made use of one of these 9 remote units to collect statistics on ADS-B equipage of the aircraft flying close to Hong Kong International Airport. A total of 6 batches of statistics were collected during the period November 2004 - March 2006. The statistical survey results showed that the ADS-B equipage were gradually increased from the initial 4% in November 2004 to 22% in March 2006. Apart the on-going quarterly survey, the coming ADS-B activities in Hong Kong, China included to carry out positional accuracy comparison among the ADS-B data, multilateration data and SMR data of the airfield vehicles and aircraft moving on ground. Moreover, it is planned to install a dedicated ADS-B sensor and upgrade the existing ADS/CPDLC trial system with ADS-B capability so as to facilitate technical evaluation on the performance of the ADS-B target reports broadcast from the suitably equipped aircraft flying within Hong Kong Flight Information Region.

ADS-B self test unit

8.8 It was noted that there appears to be considerable concern regarding the potential cost of testing ADS-B avionics – mainly from the General Aviation community. It has been proposed that ADS-B avionics calibration should be carried out on the same schedule as SSR ATC transponder calibration, i.e. every 24 months. Self testing could perhaps reduce or eliminate the need for bi-annual testing. A possible self test device which could be installed at major General Aviation airports would enable a pilot to verify the operation of the ADS-B avionics installed in his aeroplane. The pilot would be required to position the aircraft near the device (which would be an ADS-B receiver). The receiver would then check some parameters and provide feedback to the pilot regarding the data received. It is recognised that not all parameters could be tested, but a simple go/no-go test may warrant an increase in the interval between formal tests. It was considered possible to develop a self test unit for General Aviation airports. However, several issues need to be resolved including regulators' acceptability.

ADS-B monitoring

8.9 Analysis on the raw ADS-B reports from aircraft monitored by two UAP ADS-B ground stations was presented to the meeting. These reports since 2005 were collected and lumped into one large file per calendar month. Two UAP ADS-B ground stations located at Melbourne Airport and at the Bundaberg site are being used for technical training and test purposes, but also provide a useful source of data for analysis. The NUC value in all the reports was examined and the

results tabulated for aircraft with Australian registration. Aircraft which always report NUC=0 were removed for the analysis since these aircraft are considered to be not ADS-B capable. Number of aircraft sorted by "State" as identified from the 24 bit aircraft address was indicated in a graphic. The number of aircraft detected only includes those with transmitted positional data and with a NUC>4. Almost 37 million samples were collected over a 4 month period. For each aircraft the number of messages with each NUC value were recorded.

8.10 The result of monitoring concluded that the number of aircraft with ADS-B capability continues to climb. If one considers the Jet aircraft on the Australian register, 21% are currently equipped with ADS-B. Considering ADS-B capable aircraft, where positional data is delivered based on GPS, good positional data with NUC > 4 is provided for 99.8 % of reports. The values of poor NUC are believed to be due to GPS HPL values dropping below the required value of 0.5 nautical mile at times.

ADS-B avionics problem

8.11 It was noted that a problem with the encoding of ADS-B aircraft position in one manufacturer's equipment results in apparent jumps in the aircraft's longitudinal position. The investigation of the problem revealed a position encoding problem within the transponder. The result was a jump of about 3 degrees in the aircraft's longitude determined by the receiving station. The decoded latitude was correct. Airservices Australia modified their ADS-B ground stations to prevent incorrect reports from being sent to controllers.

8.12 In order to make the transmission of position in extended squitter ADS-B messages more efficient, a technique known as Compact Position Reporting (CPR) is used. In CPR, the encoding of longitude is dependent on the aircraft's latitude. At each latitude, there are a number of "longitude zones". Each longitude zone runs parallel to the equator and is roughly 360 nautical miles in length. The number of longitude zones decreases from 59 at the equator to 1 at the poles. Transitional latitudes are points where the number of longitude zones changes from one value to another (e.g. at +/- 10.4704713 degrees the number of longitude zones changes from 59 to 58). To correctly encode the aircraft's longitude, the transponder must determine the number of longitude zones at the aircraft's latitude. The aircraft's position within the longitude zone is then encoded as a 17-bit binary number where the maximum value represents 360 nautical miles.

8.13 It has been found that the transponders with this problem incorrectly calculate the number of longitude zones when the aircraft is very close to transition latitude [i.e. within 1 LSB of the transition latitude or 16.7 feet (5m)]. This causes the wrong number of longitude zones to be used, and therefore the longitude is incorrectly encoded, resulting in an apparent jump in the aircraft's longitude when the information is decoded. The incorrect position report is easily detected because of its large distance from the aircraft's true position. Investigation by a manufacturer revealed that their transponders use an early version of the CPR encoding algorithm. In the early version of the algorithm, however, the aircraft's latitude in the airborne position message was encoded using 19 bits, and the two lowest order bits were discarded. In the current version of the CPR algorithm the aircraft's latitude is encoded using 17 bits, rounded to the nearest LSB. Comparison of these two methods shows that they will sometimes produce a difference of 1 bit in the encoded latitude. Changes to standards are being considered to ensure this problem is detected during equipment testing.

ADS-B pilot education

8.14 It was informed that the Civil Aviation Safety Authority (CASA) and Airservices Australia are producing a complementary set of products to provide education on the new technology and service to pilots, air traffic controllers and others. In addition to amendment of the AIP and other

documents, a significant amount of education material has been compiled to support the introduction of ADS-B. The material draws upon experience in the Burnett Basin Trial, the outcomes of hazard identification workshops, and a variety of other sources. CASA has determined that for ADS-B, like SSR and ADS-C, there is no requirement for a specific pilot qualification to receive Air Traffic Services based on a particular form of surveillance. Training on ADS-B will be incorporated into the normal pilot training syllabus. For trained pilots, a self-education approach has been developed as a basic first step. Education material has therefore been developed to educate all pilots on the safe introduction of this technology. CASA will provide a general information booklet to all pilots, along with a 'quick reference' card containing essential new information for use in the cockpit. The material is targeted at pilot self-education, but is also expected to be used by air traffic controllers and aircraft maintenance engineers, ensuring common understanding and terminology across the specialist disciplines. To assist operators in developing their own training modules for flight crew and ground personnel, Airservices Australia has developed an on-line information package containing material on key issues related to the ADS-B Upper Airspace Program. The on-line package may be accessed after 20 April 2006 at: <http://www.airservicesaustralia.com/pilotcentre/projects/adsb/operatortraining.asp>

“Off Track” ADS-B position reports

8.15 It was noted from Europe of aircraft transmitting incorrect and misleading positional data. The reports are that on landing, the aircraft are displayed on the ADS-B display as landing on the incorrect runway. Analysis of ADS-B data provided has shown that the aircraft positional data was indeed incorrect and the aircraft was transmitting data slightly offset from the correct position. Further analysis showed that in the example provided, data was transmitted with NUC (HPL) = 0 whilst airborne and NUC =6 whilst on ground. NUC=0 indicates that the data has no integrity when airborne NUC=6 indicates that the data has no integrity when on ground. This can be caused by the transponder not receiving HPL and not receiving HFOM. Any reasonable ATC display system would not present the data as “reliable data”. This phenomena is observed regularly in Australia and it is believed due to the following: the ATC transponder is ADS-B capable and wired for elementary/enhanced surveillance. Therefore, the aircraft transmits the flight ID and many aircraft also transmit the velocity vector. However, there is no data transmission from the GPS MMR (multimode receiver) to the transponder. The transponder cannot receive HPL and hence, the transponder transmits NUC=0. The velocity information is provided to the transponder via a wire from the FMS/INS. This bus provides velocity and INS position, but no integrity data. Transponders operating in accord with ARINC 718A (Mark IV transponders) have a priority system for ADS-B transmission. If no GPS, the offset position display is INS positional data.

Cross FIR ADS-B data sharing arrangements

8.16 Australia presented a paper which highlighted that sharing of real time operational flight data between States would increase airspace safety and operational efficiency. To provide operational certainty, it is necessary to implement formal data sharing mechanisms between States. This paper identifies the key elements of ADS-B (or other flight data) data sharing policies and agreements between States. The paper provided some issues to consider. States were encouraged to make greater effort to define policy.

8.17 A concern of liability issue for using exchanged data was discussed. As result of discussion, the meeting requested participant from the United States to find out the impact of sharing data derived from FANS 1/A based ADS-C. Members from Australia agreed to undertake to prepare a draft data sharing Memorandum of Understanding (MOU) and participant from France undertakes to get copies of European data sharing agreements for consideration at next meeting.

Agenda Item 9: Progress preparation of the sample business case

Agenda Item 10: Cost benefit study and sub-regional based ADS-B implementation plan.

- **Reports by city pair teams**
- **Review recommendations of city pair teams;**
- **Consider cost/benefit of city team pair proposals**

(Agenda Item 9 and Agenda Item 10 were considered and discussed together)

10.1 It was informed by the Secretariat that an ICAO based business case guidance document will be made available by ICAO by July 2006.

10.2 City pair co-coordinators reported several difficulties that were hampering their attempts to establish dot point and subsequently more complete business cases including:

- lack of resources and appropriate skills to perform complex business case, cost and benefit modeling;
- involved States on the city pair route not responding; and
- uncertainty regarding allocation of costs, especially costs of ADS-B avionics fitment:
 - aircraft fly many routes and costs cannot be allocated to a single route
 - avionics costs vary widely depending on aircraft type and age (from almost zero to perhaps \$400K)
 - uncertainty regarding the age of the aircraft and hence the period of time that “legacy aircraft” would be retained. It was noted that new aircraft are typically already equipped
 - difficulty in quantifying real benefits such as safety, reduced fuel burn etc.
 - continuing difficulty in accessing confidential data from other parties (for fuel cost data from Airlines)

10.3 It was decided that the Secretariat would write to some States requesting support for the city pair activities.

10.4 There was discussion on whether the Task was too difficult for members to complete. However, members agreed to focus their efforts to produce city pair studies. It was decided that the Task Force would attempt to use the ICAO guidance business case.

10.5 It was advised by United States that they had performed extensive modeling of costs and benefits. The FAA offered to make this information available on request.

10.6 It was then suggested that a fourth city pair be added (Sydney – Los Angeles). The United States members volunteered to lead this group.

10.7 Japan presented a draft business case showing the costs and benefits of ADS-B on the city pair route. Members felt that consideration should be given to the following factors:

- the expected lifetime of aircraft may allow avionics fitment at a lower cost;
- mandates may bring benefits (and fitment costs) forward in time; and
- the CDTI cost should not be included unless CDTI benefits are also quantified.

10.7.1 It was pointed out that businesses cases also need to cover strategic benefits and not simply cost benefit analysis.

10.7.2 The paper identified that different surveillance systems need to be retained in dense/important airspace and this was accepted by the meeting as applying to the near-term. It was also indicated that the costs of ADS-B equipage could not be applied to simply the city pair route, and should apply to multiple routes & city pairs. This was agreed by the meeting. It was agreed that the Secretary would consult Regional Officer Air Transport of the ICAO Asia Pacific Office, on an appropriate way to treat this matter.

10.8 Australia presented an information paper which provided an initial “checklist” of Airline benefits and costs (from an airline perspective) for consideration in the business cases.

Agenda Item 11: Initial discussions on ADS-B air-to-air surveillance service for use in the Asia Pacific Regions**Remote and Oceanic ADS-B in-trail procedure**

11.1 The United States informed the meeting of a proposed remote and oceanic ADS-B in-trail procedure (ITP), its operational concept, the potential benefits to airline operators and the potential for conducting an operational trial of the procedure in the South Pacific Region. It was informed that on 16 February 2006, the ACAS/TCAS oceanic ITC/ITD procedure trials introduced in 1996 in the Oakland and Anchorage FIRs were officially terminated because of the transponder cycling procedure and the need for the flight identification (ID) from the leading aircraft.

11.2 During 2004, in coordination with several operators and avionics vendors, examining the use of airborne ADS-B to overcome some of the limitations observed and concerns identified during the previous trial of the ACAS oceanic ITC/ITD procedure was started. The proposed Remote and Oceanic ADS-B In-Trail Procedures (ITP) would use the same criteria (minimum range and maximum closure rate) authorized by the FAA for the ITC/ITD trial using ACAS. Additionally, it will retain ACAS as an independent safety system. Because ADS-B has a much greater range than ACAS, the ADS-B ITP may be initiated at greater distances between the aircraft, thereby significantly increasing the percentage of time when an aircraft could utilize this procedure.

11.3 Detailed benefits analyses for the ADS-B ITP have been performed. These focused on savings that could be achieved in the North Atlantic Organized Track System (NAT OTS), the South Pacific Region and on flights that operate between the west coast of the United States and Australia or New Zealand (SOPAC routes). The analyses for South Pacific operations looked at savings that could be realized in where various separation criteria were applied including 10 minute Mach Number Technique (MNT), 50 NM lateral/50 longitudinal separations (50/50) and 30 NM lateral/30 longitudinal separations (30/30). The benefits were predicted to be significant in all environments studied and ranged from 100,000 USD to 200,000 USD per aircraft per year (using 2004 fuel prices). It was also informed that several steps must be completed prior to the initiation of an ADS-B ITP operational evaluation. There are also a number of areas where this operational evaluation could be conducted. These could include Australian domestic airspace, portions of the Indian Ocean and South Pacific routes between the western United States and Australia. An ADS-B ITP operational evaluation could be implemented in as early as 12-18 months.

Developing ADS-B in-trail climb/descent procedures

11.4 Australia provided an information paper outlining a low risk and data rich process for the validation of **In-Trail Climb/Descent** Procedures (ITP) based on ADS-B surveillance. ADS-B has the advantage that aircraft flight identification is regularly broadcast by every “ADS-B out” equipped aircraft. A Cockpit Display of Traffic Information (CDTI) based on reception of ADS-B data (“ADS-B in”) from other aircraft can automatically provide the position and flight ID of each aircraft within range. In Trail Climb procedures using an ADS-B CDTI may prove much more satisfactory than those based on TCAS, particularly if the CDTI display can be used to display not only flight ID but also separation distance and rate of closure relative to a selected lead aircraft, updated one or two times a second. It was proposed to conduct a trial of revised In-Trail Climb procedures based on ADS-B. These procedures are expected to be derived from the previously approved TCAS procedures, with different identification procedures. After a period of operation on a trial basis, and the analysis of data collected during the trial, it is expected that the procedure could eventually be approved for general use. The trial is planned to be implemented in phases. It is envisaged that several countries with adjacent airspace could participate in the oceanic trials. In the Indian Ocean it could include Mauritius and UAE (with Emirates Airline). In the South Pacific it

could include Australia, Fiji, New Zealand and USA. For these phases several Administrations will have to approve the trial procedures.

Draft Conclusion 5/5 – Support of ITP trials

That, States capable to do so are encouraged to conduct In-Trial Procedure (ITP) in this region to gain experience, identify problems and to establish operational procedures.

ACAS and ADS-B IN

11.5 It was noted that the ACAS traffic display sometimes do not provide a clear picture of the traffic situation as the display gives only partial information, has limited accuracy, limited range, and is based upon a moving reference. Australia's CASA has published an article on these issues at: <http://www.casa.gov.au/fsa/2005/aug/37-39.pdf>

11.6 ADS-B data used on the ACAS traffic display could improve the interpretation of ACAS information. In particular, the presentation of ADS-B based flight identity, velocity vector and more accurate position could improve the situational awareness of the pilot. Some ADS-B applications could be deployed if ADS-B data could be displayed on ACAS Traffic display. Limited cockpit space makes the traffic display an ideal candidate for ADS-B applications in some aircraft. One vendor has tested and validated this capability on B767 aircraft belonging to United Parcel Service (UPS), USA.

11.7 The use of existing hardware in the aircraft could reduce overall installation and maintenance costs of ADS-B IN - and hence the business case of ADS-B overall. It was recommended that taking into account the importance and benefit of ADS-B IN applications and the role this will have in the final business case especially for airlines and noting the limited display space available in cockpits; the fact that ADS-B IN and ACAS could use the same antenna and receiver; the fact that multiple software applications can share the same hardware platform; the fact that regulators have identified human factors issues with ACAS traffic advisory due to the lack of flight identity and velocity vector display and the fact that ADS-B provides a longer range traffic display

11.8 In light of foregoing considerations, it is recommended that APANPIRG requests the ASP to consider these issues and expedite work to define and support the use of ACAS hardware and traffic displays to present ADS-B based data especially flight identity and velocity vector. Accordingly, the meeting formulate the following draft Conclusion:

Draft Conclusion 5/6 - Investigation and expedition of way to present ADS-B data using ACAS hardware

That, ICAO be requested to:

- a) take into account the importance and benefit of ADS-B in applications and the role it will have in the final business case; and
- b) define and support the use of ACAS hardware and traffic displays to present ADS-B based flight identity and velocity vector.

Agenda Item 12: Any other business

Note of appreciation

12.1 The meeting expressed its appreciation and gratitude to the Airports Authority of India (AAI) for hosting the ADS-B Seminar, the excellent arrangements made for the meeting and for activities organized during the meeting.

ADS-B Demonstration

12.2 The meeting appreciated the live demonstrations on ADS-B provided by Thales ATM and air-air applications including ITP provided by NASA, USA.

Time and Venue of Next Meeting

12.3 The next meeting of ADS-B Study and Implementation Task Force is scheduled to be held in Seoul, Republic of Korea from 23 to 27 April 2007. It was agreed that the next Task Force Meeting be preceded by two days Seminar.

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**List of Designated Contact Persons
Responsible for ADS-B Study and Implementation Task Force
in the Asia/Pacific Region**

State/ Organization	Name/Address	Telephone/Fax	E-mail address
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	Mr. Nick King Flying Operations Inspector Civil Aviation Safety Authority GPO Box 2005 Canberra, ACT 2601 <u>AUSTRALIA</u>	Tel: +61 (2) 6217-1193 Fax: +61 (2) 6217-1500	Nick.King@casa.gov.au
BANGLADESH	Mr. Md. Shahidullah Director CAAB Headquarters Kurmitola Dhaka 1229 <u>BANGLADESH</u>	Tel: +880 (2) 891-1011 Fax: +880 (2) 891-3322 +880 (2) 891-4709	dircom@accesstel.net
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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 <u>HONG KONG, CHINA</u>	Tel: +852 2591-5009 Fax: +852 2845-7160	twhfok@cad.gov.hk
MACAO, CHINA			
COOK ISLANDS			
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	<u>Regulatory Function:</u> Director General of Civil Aviation DGCA India Technical Centre Opp. Safdajung Airport New Delhi 110003 <u>INDIA</u>	Tel: +91 (11) 2462-7830 Fax: +91 (11) 3467-1272	dgooffice@dgca.delhi.nic.in

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TOR of ADS-B STUDY AND IMPLEMENTATION TASK FORCE

TERMS OF REFERENCE

Complete an industry wide ADS-B cost/benefit study for the near term use of ADS-B throughout the ASIA/PAC region.

Develop an implementation plan for near term ADS-B applications in Asia Pacific including target dates taking into account available equipment standards and readiness of airspace users and ATS providers.

Study and identify applicable air to air applications of ADS-B in the Asia and Pacific Region.

Study and identify applicable multilateration applications in the Asia and Pacific Region.

Note:

1. The Task Force, while undertaking the task, should take into account of the work being undertaken by OPLINK, SAS, SCRS AS and AC Panels with a view to avoid duplication.
2. The Task Force should report to the APANPIRG ~~meeting to be held in 2004 and subsequent~~ meetings.

SUBJECT TASKS 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 term 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) Guidance package based on OPLINKP Concept of use and other ICAO Docs for ADS-B air-ground surveillance service (AIGD).	2006-7 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.	Closed as progress has been made in PANS-ATM (applicable in 2007)
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

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No.	Ref.	Task	Priority	Action Proposed/In Progress	Target
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 (Sydney-Singapore made progress in 2005 and rest cities pairs in 2006); 2) Inform ICAO regional office names of designated focal point of contact.	2006/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	2006-7
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)	On-going

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	On – going – 2007
3	Report organizational policy on ADS-B data sharing with neighbors	All members	2007
4	Distribute analyses on use of GPS TSO129 vs TSO145/6 avionics for ADS-B (Lee & Moody papers)	Australia to seek updates	2007
5	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
6	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

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Serial No.	Work Items	Action to be taken by	Target date
7	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 members and Australia	Completed
8	Draft regional procedure to amend SUPPs –Doc7030 - for use of ADS-B from aircraft greater than 12 NM offshore.	Australia	Closed
9	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
10	Identify an existing ICAO definition of low-density airspace.	Thailand	Completed
11	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
12	Prepare a Business case matrix or template (checklist) Singapore Decision 1/4	Singapore and New Zealand	Completed
13	Develop specific appropriate ADS-B implementation project proposals for which benefits and costs can be calculated. Singapore Decision 1/5	City Pair coordinators	2007
14	Continue a survey of fitment plans and will report at the next TF meeting.	IATA	Completed
15	Encourage airlines to attend the next Seminar.	IATA	Completed

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Serial No.	Work Items	Action to be taken by	Target date
16	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
17	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	Status updated and to be continued in 2007
18	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
19	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 members	Completed

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Proposed Data Fields

Country of Registration	Airline Operators	Aircraft Registration	Aircraft Type	ICAO 24-Bit Aircraft Address	Type of Aircraft Operation	Link Technology	Data Format	Data Transmitted by the Aircraft							ADS-B Ground System			Date of First Detection	Origination Organization	Reported By	Date of Submission	Comments
								NUC	NIC	NAC	Position	Identity	Velocity	Altitude	Location	Coverage	Link Technology					

Data Fields Description

	Data fields	Data field description	Information required to be filled in	Remark
1. Information on Aircraft Operator	1.1 Aircraft Operator	The aircraft operating agency.	Name of aircraft operator. <u>Example:</u> Thai Airways International	This group of information would allow assessment to be made on the number of aircraft operators currently operating ADS-B aircraft and for what type of operation i.e. commercial, military etc. Military and General Aviation aircraft has been included as they are part of the airspace users. The information on the type of aircraft operation would be useful from an operation point of view. For example, if the statistics indicates that a high percentage of military are not equipped with appropriate ADS-B avionics, ATC procedures would need to be put in place to handle mixed aircraft equipage levels. (ADS-B equipped and non-equipped aircraft).
	1.2 Type of Aircraft Operation	The type of operation, i.e. whether the aircraft is used for commercial or military purposes etc.	Commercial, Military or General Aviation.	
2. Information on the Aircraft	2.1 Aircraft Registration	The registration of the aircraft.	Aircraft registration <u>Example:</u> HS-TGF	The ICAO 24-bit aircraft address and the aircraft registration uniquely identifies a particular aircraft. The number of aircraft addresses and/or aircraft registrations would indicate the number of aircraft currently operating with ADS-B capability (only true for aircraft squitting positional data).
	2.2 Country of Registration	The country where the aircraft was registered	Country Name	
	2.3 Aircraft Type	ICAO aircraft type designators	ICAO aircraft type designator. <u>Example:</u> Boeing 747-400 – B744	
	2.4 ICAO Aircraft 24-Bit Code	ICAO unique 24-bit aircraft address	Aircraft address (in Hexadecimal) <u>Example:</u> HS-TGF – 88006D	In addition, knowing the total number of aircraft in the fleet for a particular aircraft operator (information generally available on the internet for commercial airlines), the information on the number of ICAO 24-bit aircraft addresses, together with the information on the aircraft type and the aircraft operator, the level of equipage for that particular aircraft operator can be determined down to by aircraft type.

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	Data fields	Data field description	Information required to be filled in	Remark
3. Information on the Data Link Technology and Data Format used by the Aircraft	3.1 Data Link Technology	Link technology used by the aircraft to downlink ADS-B data.	Link technology used <u>Example:</u> 1090 ES or UAT or VDLMode4	The information is required to assess the data link technology and the data format used by the different aircraft operating in the Asia/Pacific Region. In addition to Mode S 1090 ES, which has been chosen as the initial data link technology for ADS-B, UAT and VDL Mode4 have been included for future collection of statistics when the need arise.
	3.2 Data Format	The data format used for broadcasting ADS-B data.	The data format type. <u>Example:</u> DF17 or DF18 or DF19	
4. Information on the ADS-B Data transmitted by the Aircraft	4.1 NUCp	Navigation Uncertainty Category (Position) broadcasted by the aircraft.	Yes or No for numerical value of NUC of 4 or more. Applicable only for aircraft complying with DO-260.	The aim of this section is to assess whether a particular aircraft is transmitting ADS-B position and the quality of its position data, identity, altitude and velocity. Only these data were chosen as it would be desirable for ADS-B to provide similar data to that being provided by radar as a minimum for different ATC purposes. Radar is capable of providing position (measured), altitude, identity, velocity vector (computed from successive position determinations).
	4.2 NIC	Navigation Integrity Category	Yes or No. Applicable only for aircraft complying with DO-260A.	
	4.3 NAC	Navigation Accuracy Category	Yes or No. Applicable only for aircraft complying with DO-260A.	
	4.4 Position	Position data of the aircraft.	Yes or No	
	4.5 Identity	The flight identity of the aircraft. <u>Example:</u> THA996	Yes or No	
	4.6 Altitude	Barometric altitude of the aircraft.	Yes or No	
	4.7 Velocity	Velocity vector of the aircraft.	Yes or No	

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	Data fields	Data field description	Information required to be filled in	Remark
5. Information on the ADS-B Ground Station	5.1 Ground Station Location	The location of the ADS-B ground station that first detected the aircraft	Place/Country Name	This group of information is aimed at collecting information on the location, the link technology used and the coverage range of the ground station that detected the aircraft with ADS-B capability.
	5.2 Link Technology Supported	The link technology that is supported by the ADS-B ground station	Link technology <u>Example:</u> 1090 ES or UAT or VDLMode4	
	5.3 Coverage Range	The coverage range of the ADS-B ground station that detected the aircraft	Value of Coverage Range (Unit: Nautical Miles)	
6. Information for Administrative Purposes	6.1 Date of aircraft first detection	The date that the aircraft was first detected	Day/Month/Year	This group of information is for administrative purposes. The information would allow the data on the aircraft submitted to be traced back to the originating organization, the name and contact details of the person reporting the data and the date of submission of data.
	6.2 Originating Organization	The organization reporting the data.	Organization name	
	6.3 Reported by	The name of the person reporting the data.	Name (format: Name, Surname)	
	6.4 Date of Submission	The date of submission of the data on the aircraft	Date (format: day/month/year).	
	6.5 Email	Email of the contact person that provided the data.	Email address.	

Procedure for Submission of ADS-B Aircraft Data

1. Submission of data

Members of the Automatic Dependent Surveillance – Broadcast (ADS-B) Study and Implementation Task Force should submit the collected data, using the approved template, containing all the required data fields to the following focal point:

Mr. Chainan Chaisompong – email address: chainan.ch@aerothai.co.th.

2. Data Fields and Data Reporting Template

The adopted data reporting template is available in the Appendices xx and xx to the report of ADS-B SITF/5. Its soft copy is also available upon request through the email above.

3. Frequency of Data Submission

Members of the Task Force are requested to submit the collected data once a year, preferably a month prior to the scheduled the ADS-B Study and Implementation Task Force Meeting, to the contact details provided above.

4. Participation

Participation in the collection of data is open to all Members of the ADS-B Study and Implementation Task Force as well as any other interested parties.

5. Reporting of Results

The results of the analysis will regularly presented to the ADS-B Study and Implementation Task Force meetings.

STRATEGY FOR THE IMPLEMENTATION OF SURVEILLANCE SYSTEMS IN THE ASIA/PACIFIC REGION

Considering that:

1. ICAO contracting States are now implementing CNS/ATM systems to gain safety and efficiency benefits, and have endorsed the move toward satellite and data link technologies;
2. Regional planning is key to timely and successful implementation of a seamless global air traffic management system;
3. Safety and efficiency will be increased through harmonisation of technology and applications;
4. The 11th Air Navigation Conference endorsed the use of ADS-B as an enabler of the global air traffic management concept and encouraged states to support cost-effective early implementation of ADS-B applications;
5. APANPIRG has decided to use the 1090MHz Extended Squitter data link for ADS-B air-ground and air-air applications in the Asia and Pacific Regions, noting that in the longer term an additional link type may be required;
6. SSR, ADS-C and ACAS will continue to meet many critical surveillance needs for the foreseeable future;
7. Initial SARPS, PANS and guidance material for the use of ADS-B have been developed;
8. ADS-B avionics and ground systems are available;
9. ADS-B aircraft-based surveillance applications are under study in the region;
10. Multilateration shows promise as an emerging technology that will complement the introduction of ADS-B for ATS in both wide area and airport surface surveillance applications; and
11. The future air traffic environment will require increased use of aircraft derived surveillance information to allow for development and implementation of a seamless automated air traffic flow management system.

The general strategy for the implementation of surveillance systems in the Asia/Pacific region is to:

1. Minimise the reliance upon pilot position reporting, particularly voice position reporting, for surveillance of aircraft;
2. Provide maximum contiguous ATS surveillance coverage of international air routes using 1090MHz Extended Squitter ADS-B and Mode S SSR;

3. Maximise the use of ADS-B for ATS on major air routes and in terminal areas, including consideration for mandatory carriage of ADS-B transmitters by ICAO Contracting States from 2010 with consideration to airspace users in providing sufficient transition time for equipage;
4. Make use of ADS-C where technical constraint or cost benefit analysis does not support the use of ADS-B, Multilateration or SSR;
5. Make full use of SSR Mode S capabilities where radar surveillance is used and reduce reliance on 4 digit octal codes;
6. Make use of Multilateration for surface, terminal and area surveillance where appropriate as an alternative or supplement to other surveillance systems;
7. Increase pilot situational awareness and the effectiveness of aircraft-based surveillance systems through the mandatory carriage of ADS-B transmitters and voluntary carriage of ADS-B receivers and cockpit display systems;
8. Increase the effectiveness of collision avoidance systems through greater mandatory carriage of pressure altitude reporting transponders and ACAS;
9. Improve safety through sharing of ATS surveillance data across FIR boundaries;
10. Ensure provision of communication, navigation, and data management capabilities necessary to make optimal use of surveillance systems; and
11. Enhance ATM automation tools and safety nets through the use of aircraft derived data such as flight identification, trajectories and intentions.

PROPOSED AIGD AMENDMENTS

1.4 CHANGES TO THE AIGD

Proposal: Amend the procedure as shown.

Whenever a user identifies a need for a change to this document, a request 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. ~~The Regional Office will collate RFCs for consideration by the ADS-B Study and Implementation Task Force.~~

When an ~~RFC~~ amendment has been ~~approved~~ agreed by a meeting of the ADS-B Study and Implementation Task Force then a new version of the AIGD will be ~~published~~ prepared, 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.:

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~~Final approval for publication of an amendment to the AIGD will be the responsibility of APANPIRG.~~

2.1 ACRONYM LIST

Proposal: Add the following acronyms to support their use in section 5.4.

~~ADS-C Automatic Dependent Surveillance - Contract~~
~~MSAW Minimum Safe Altitude Warning~~

3.1 INTRODUCTION

Proposal: Delete the word “is” as shown.

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.

3.3 REFERENCE DOCUMENTS

Proposal: Add the following documents to the table (currently empty).

Annex 2
Annex 4
Annex 10 Vol IV
Annex 11
Annex 15
PANS-ATM (Doc 4444)
Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689)

3.5.1 Safety Assessment Guidelines

Proposal: Replace “.” with “;” as shown.

- 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-;
-

3.5.2 System safety assessment

Proposal: Amend formatting of list as shown.

- 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-; and
f) Operational hazard ID process.
-

3.5.3 Integration test

Proposal: Move words from beginning of second sentence to end of first sentence as shown.

Proposal: Reformat reference as shown.

States should conduct trials with suitably equipped aircraft to ensure they meet the operational and technical requirements **to provide an ATS**. ~~To provide an ATS alternatively~~ 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~~ Refer also to the *Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689)*.

3.9.2 Description of Fields

Proposal: Add bullet points to the list in the “Description” row as shown.

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.
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5.4.2 Identification Methods

Proposal: Add text for clarity of meaning as shown.

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 on a situation display;
 - b) transfer of ADS-B identification;
 - c) observation of compliance with an instruction to TRANSMIT ADS-B IDENT.
-

5.4.3 ADS-B Separation

Proposal: Replace “,” with “.” as shown.

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

6. EMERGENCY PROCEDURES

Proposal: Remove extra square bracket.

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[†].

**ADS-B SEMINAR AND THE FIFTH MEETING OF ADS-B STUDY AND
IMPLEMENTATION TASK FORCE (ADS-B SITF/5)**

New Delhi, India, 3-7 April 2006

Attachment 1 to the Report

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AUTOMATIC DEPENDENT SURVEILLANCE - BROADCAST (ADS-B) SEMINAR
New Delhi, India, 3-4 April 2006

Attachment 1 to the Report

Additional List of Participants

1.	Mr. M. K. Bhatnagar Director MET India Meteorological Department, Mausam Bhavan, Lodi Road New Delhi INDIA	9.	Mr. S. P. Pandey ASSTT. GM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
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3.	Mr. Asha Ram Executive Director (Aviation Safety) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	11.	Mr. M. K. Verma ADDL. GM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
4.	Mr. V.K. Yadava GM (ATC) Chief Instructor ATS CATC Bamrauli, Allahabad INDIA	12.	Mr. K. Ganesan ADDL. GM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
5.	Mr. Jyoti Prasad GM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi – 110003 INDIA	13.	Mr. Madan Lal ASSTT. GM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
6.	Mr. N.S. Dagar DGM (Aviation Safety) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	14.	Mr. Motilal SM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
7.	Mr. O. S. Ekka DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	15.	Mr. P.K Gupta SM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
8.	Mr. N. Shankar ADDL. GM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	16.	Mr. V. Mohan SM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA

17.	Mr. G. S. Rao DGM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	26.	Mr. Sudhamay Maiti ASSTT. GM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
18.	Mr. Muneer Maampat SM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	27.	Mr. P. Shambharkar DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
19.	Mr. P K Singhal GM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	28.	Mr. S. S. Verma ADDL.GM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
20.	Mr. Viswanath GM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	29.	Mr. N. Ganesh DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
21.	Mr. Jagdish Kumar DGM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	30.	Mr. K. S. L. Narasimman DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
22.	Mr. M. L. Chakraborty DGM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	31.	Mr. K. Vasudevan DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
23.	Mr. Y K Kaushik ASSTT.GM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	32.	Mr. T. F. Moosa DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
24.	Mr. R. P. Sharma GM (AVN Safety) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	33.	Mr. Kalyan Choudhary DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
25.	Mr. Govind Ram GM (AERO-REGION) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	34.	Mr. Shankar Mardi DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA

35.	Mr. Chanden Sen DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	44.	Mr. Y Agarwal GM (OPS) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
36.	Mr. M. S. Nimje DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	45.	Mr. J.P. Alex DGM (ATM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
37.	Mr. V. N. Chandran DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	46.	Mr. V.K. Tripathi SM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
38.	Mr. D. Ghosh DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	47.	Mr. S. K. Saha GM (AIS) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
39.	Mr. A. K. Jain DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	48.	Mr. B. N. Prasad GM (IPC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
40.	Mr. M. G. Junghare GM (AERO) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	49.	Mr. Arjun Singh DY GM (CNS) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
41.	Mr. Ram Lal DGM (ATC) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	50.	Mr. J.M. Jolly DY GM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
42.	Mr. P. K Kapoor General Manager (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	51.	Mr. H.K. Narula ADDL GM (Carto) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA
43.	Mr. Pan Singh DGM (COMM) Airports Authority of India Rajiv Gandhi Bhawan New Delhi INDIA	52.	Mr. Wg. Cdr. Sudhakar JT Director (OPS ATS) IAF Air Hqtrs, Vayu Bhawan New Delhi INDIA

53.	Mr. S. P. Dhingra Instructor Tech & Training Air India Old Airport Kalina, Santacruz (E) Mumbai INDIA	58.	Mr. M. T. Bokade DY.DIRECTOR OPS Directorate General of Civil Aviation, Technical Centre, Opp. Safdarjung Airport New Delhi INDIA
54.	Mr. Sanglikar P.P. SM TECH Air India Old Airport, Kalina, Santacruz (E) Mumbai INDIA	59.	Mr. Bharat Bhushan DY.DIRECTOR OPS Directorate General of Civil Aviation Technical Centre, Opp. Safdarjung Airport New Delhi INDIA
55.	Capt. Yazad J Bacha Fleet Manager 737 Jet Airways India Ltd. S M Centre, Andheri Kurla Road, Andheri East, Mumbai INDIA	60.	Mr. V. P. Singh ASSTT. DIR (O) Directorate General of Civil Aviation Technical Centre, Opp. Safdarjung Airport New Delhi INDIA
56.	Mr. D. C. Sharma DY.DIRECTOR OPS Directorate General of Civil Aviation Technical Centre, Opp. Safdarjung Airport New Delhi INDIA	61.	Mr. A.K. Kapoor ASSTT. GM (COMM) Airports Authority of India New Delhi INDIA
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International Civil Aviation Organization

**AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST
(ADS-B) SEMINAR AND THE FIFTH MEETING OF (ADS-B) STUDY
AND IMPLEMENTATION TASK FORCE (ADS-B SITF/5)**

New Delhi, India, 3-7 April 2006.

LIST OF INFORMATION PAPERS

IP No.	Agenda Item	Subject	Presented by
1	-	Seminar and Meeting bulletin	Secretariat
2	8	Organizational Needs in a Business Case Study	Vausu D. Varma, Malaysia
3	8	Number of ADS-B Capable Aircraft Observed Operating in Thailand	Thailand
4	11	Remote and Oceanic ADS-B In-Trial Procedure	NASA, USA
5	3	Proposed New Work Programme of the Surveillance and Conflict Resolution Systems Panel (SCRSP)	Secretariat
6	8	ADS-B Self Test Unit	Greg Dunstone, Airservices Australia
7	5	Upper Airspace Programme Transition Plan	Bob Browne Greg Dunstone, Airservices Australia
8	8	ADS-B Monitoring in Australia	Greg Dunstone, Airservices Australia
9	5	Australia's ADS-B Programme	Greg Dunstone, Airservices Australia
10	5	Australia's Regulator has approved GPS only Navigation	Greg Dunstone, Airservices Australia
11	5	GPS Papers from Australia's ASTRA	Greg Dunstone, Airservices Australia
12	7	Problem Reporting Database Update	Greg Dunstone, Airservices Australia
13	8	ADS-B Avionics Problem	Kojo Owusu Greg Dunstone, Airservices Australia
14	8	ADS-B Pilot Education	Nick King, Australia
15	5	ADS-B Regulatory Developments in Australia	Nick King, Australia
16	3	Latest Developments and Progress Made by OPLINK and SAS Panels	Secretariat
17	5	ADS-B Programme Office Roadmap	USA
18	8	"Off Track" ADS-B Position Report	Greg Dunstone, Airservices Australia
19	10	ADS-B Business Case Considerations for Airlines	Katrin Hewitt Greg Dunstone, Airservices Australia
20	11	Developing ADS-B In-Trial Climb/Descent Procedures	Bob Peake Greg Dunstone, Airservices Australia

IP No.	Agenda Item	Subject	Presented by
21	8	Quarterly Survey of ADS-B Aircraft Equipage Conducted by Hong Kong, China	Thomas Fok, Hong Kong, China
22	8	Cross FIR ADS-B Data Sharing Arrangements	Greg Dunstone, Airservices Australia

LIST OF WORKING PAPERS

WP No.	Agenda Item	Subject	Presented by
1	-	Provisional Agenda	Secretariat
2	2	Review the Outcome of the Fourth Meeting of ADS-B Study and Implementation Task Force	Secretariat
3	3	Second Amendment to the Global Air Navigation Plan for CNS/ATM Systems (Doc 9750)	Secretariat
4	3	Report of the Developments in Modernization of Air Navigation Systems	Secretariat
5	8	Amendment of the ADS-B Implementation and Operations Guidance Document (AIGD)	Adam Watkin Nick King, Australia
6	4	TOR, Subject/Tasks List and List of Action Items	Secretariat
7	6	A Regional Surveillance Strategy	Nick King, Australia
8	4	ADS-B Data Report Form	Thailand
9	4	Use of Mode S Extended Squitter (ES) in Automatic MET Air-Reporting	Greg Dunstone, Airservices Australia
10	8	Cost/Benefit Study – City Pair Team: Hong Kong, China – Tokyo Japan	Japan
11	5	Observations from ADS-B Trials, Chennai from 29 November to 1 December 2005	Airports Authority of India (AAI)
12	12	ACAS and ADS-B IN	Greg Dunstone Nick King, Australia

LIST OF SEMINAR PAPERS

SP No.	Subject	Presented by
1	ADS-B Introduction – Tutorial	Greg Dunstone, Airservices Australia
2	Global Air Navigation Plan	Secretariat
3	ADS-B Related Development by AN Conf/11 and APANPIRG	Secretariat
4	ADS-B Applications	Greg Dunstone, Airservices Australia
5	ADS-B Performance	Greg Dunstone, Airservices Australia
6	Regional ADS-B Service Provision	Philip Koh, SITA
7	ADS-B Ground Station, Simple, Reliable, Maintainable and Affordable	Michel Procoudine, Thales ATM
8	EUROCAE WG51 Information	Secretariat
9	Wide Area Multilateration ADS-B	Russell Hulstrom, Rannoch Corporation

SP No.	Subject	Presented by
10	ADS-B Application in ATM	Grant Williams, Thales ATM
11	1 090 MHz Extended Squitter ADS-B/TIS-B Airborne System	Gianluca Gabatel, Selex Communications
12	Avionics Solutions for ADS-B IN	Dr. Thomas Wittig, Euro Telematik
13	ADS-B – ATSAW Airborne Traffic Situational Awareness	Laurent Vidal Airbus
14	ADS-B Programme Management Plan	USA
15	ADS-B Demonstration – Chennai	Greg D’Crus, Thales ATM
16	ADS-B Implementation in India Ocean	France
17	UAP & ATLAS Updates	Greg Dunstone, Airservices Australia
18	Overview of NASA Langley Air Traffic Management Research	Kenneth M. Jones Bryan Barmore Tom Graff, NASA, USA
19	Position on Assistance System (ASAS)	Boeing
20	ADS-B Regulation	Nick King, Australia
21	ADS-B and Navigation Strategy	Greg Dunstone, Airservices Australia
22	ADS-B and Performance Based Navigation	C. Henry Naverus
23	ADS-B Validation Cristal Toulouse	France
24	Automation and Ancillary Systems	Greg Dunstone, Airservices Australia