International Civil Aviation Organization

THE NINTH MEETING OF THE SOUTHEAST ASIA AND BAY OF BENGAL SUB-REGIONAL ADS-B IMPLEMENTATION WORKING GROUP (SEA/BOB ADS-B WG/9)

Beijing, China, 30 October - 1 November 2013

Agenda Item 2: Review outcome of the AN Conf/12, ADS-B SITF/12 and APANPIRG/24

FOLLOW-UP ON RECOMMENDATIONS OF AN-CONF/12

(Presented by Australia, Hong Kong China and Singapore)

SUMMARY

This paper outlines outcomes of a review undertaken by a small working group comprising members from Australia, Hong Kong China and Singapore, with suggestion on following up the AN-Conf/12 recommendations related to the work of ADS-B SITF. The meeting is invited to review and discuss the suggestion on the follow-up actions to be taken by ADS-B SITF.

1. INTRODUCTION

1.1 During the ADS-B SITF/12 held in April 2013, the meeting reviewed the outcomes of the Twelfth Air Navigation Conference (AN-Conf/12), and identified a number of recommendations arisen from the Conference related to the work of the ADS-B SITF. The Chairman of ADS-B SITF proposed and the meeting supported to further study the recommendations for implementation in the APAC region. Australia, Hong Kong China and Singapore volunteered to take lead in jointly preparing a working paper with list of practical ADS-B related initiatives, and report in the coming ADS-B SITF/13.

1.2 During the APANPIRG/24 held in June 2013, the following Conclusion and Decision were endorsed to request States, International Organizations and Sub-groups of APANPIRG to study the recommendations arisen from AN-Conf/12, and initiate appropriate follow-up actions:

> **Conclusion 24/4 — Follow-up to AN-Conf/12 Recommendations by States and International Organizations**
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> "That, the States and International Organizations, on the basis of analysis contained in the Appendix A to Report on Agenda Item 2, takes follow-up action as appropriate on the applicable recommendations of the AN-Conf/12"

Decision 24/5 — Follow-up to AN-Conf/12 Recommendations by APANPIRG

"That the subgroups of APANPIRG study the recommendations of the AN-Conf/12, initiate appropriate follow-up actions and submit a report on the outcomes of these actions to APANPIRG/25"

1.3 This working paper outlines the outcomes of a review undertaken by a small working group comprising members from Australia, Hong Kong China and Singapore, with suggestion on following up the AN-Conf/12 recommendations related to the work of ADS-B SITF. To facilitate the CNS Sub-group to submit a report to APANPIRG/25, it is recommended that the ADS-B SITF to consolidate views of TF members regarding the suggestion on follow-up actions under purview of ADS-B SITF, and prepare a working paper for endorsement during the forthcoming ADS-B SITF/13.

2. DISCUSSION

2.1 Having conducted a review on the 56 nos. of AN-Conf/12 recommendations, it is proposed that the ADS-B SITF to provide response and actions to the following 16 nos. of AN-Conf/12 recommendations :

Recommendations 1/2, 1/7, 1/9, 1/11, 1/12, 2/2, 4/1, 4/2, 4/3, 4/5, 4/6, 6/1, 6/2, 6/6, 6/10 & 6/12

2.2 The detailed response and actions are given in Appendix 1. Actions required from ADS-B SITF are highlighted for consideration.

3. ACTION BY THE MEETING

3.1 The meeting is invited to review and discuss the proposed response and actions by ADS-B SITF in relation to AN-Conf/12 recommendations.

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Appendix 1

Recommendations Adopted by AN-CONF/12	Proposed Response/Actions by ADS-B SITF
Recommendation 1/2 – Implementation That ICAO: a) through its regional offices, **provide guidance and practical assistance to States** and regions and sub-regions when they decide to implement individual blocks or modules of the aviation system block upgrades; b) establish a group and improved mechanism for interregional cooperation to ensure harmonization of air traffic management; and c) **assist States and regions in training and capacity-building towards implementation** of the relevant modules of the aviation system block upgrades.	APANPIRG has already, and will continue, to provide guidance and practical assistance to States in our region regarding planning and implementation of ASBU modules related to ADS-B OUT and ADS-B IN. Since 2002, APANPIRG has established the "ADS-B Study & Implementation Task Force" (ADS-B SITF) which has been providing comprehensive guidance materials for ADS-B and numerous seminars and workshops on ADS-B before each meeting. APANPIRG has already proposed early implementation of ADS-B OUT technology and will continue to do so. This has been reflected in the Asia/Pacific Regional Surveillance Strategy document. B0-ASUR on "Initial Capability For Ground Surveillance" and B0-SNET on "Increased Effectiveness of Ground Based Safety Nets", which are dependent on ADS-B OUT technology, are amongst the highest priority ASBU implementation in the Asia Pacific region.
Recommendation 1/7 – Automatic dependent surveillance — broadcast That States:	APANPIRG has already proposed early implementation of ADS-B OUT technology, and will continue to do so.

Recommendations Adopted by AN-CONF/12	Proposed Response/Actions by ADS-B SITF
a) recognize the effective use of automatic dependent surveillance — broadcast (ADS-B) and associated communication technologies in bridging surveillance gaps and its role in supporting future trajectory-based air traffic management operating concepts, noting that the full potential of ADS-B has yet to be fully realized; and b) recognize that cooperation between States is key towards improving flight efficiency and enhancing safety involving the use of automatic dependent surveillance — broadcast technology; That ICAO: c) urge States to share automatic dependent surveillance — broadcast (ADS-B) data to enhance safety, increase efficiency and achieve seamless surveillance and to work closely together to harmonize their ADS-B plans to optimize benefits.	APANPIRG has encouraged ADS-B data sharing among States. Conclusions have been adopted under APANPIRG to urge States to share their ADS-B data and DCPC facilities. ADS-B data sharing is already operational in the region and further deployments are being planned. Besides, APANPIRG has also encouraged harmonized ADS-B implementation among States. Templates for harmonized ADS-B implementation, promulgation of harmonized ADS-B avionics equipage requirements, and guidelines for airworthiness and operational approval, have been developed and published.The dates of ADS-B mandates in many sub-regions were also aligned to take effect from 12 December 2013. APANPIRG has developed and published guidance materials on ADS-B data sharing and harmonized ADS-B implementation, and will continue to promote it at each APANPIRG and its contributory bodies' meetings.
Recommendation 1/9 – Space-based automatic dependent surveillance — broadcast That ICAO: a) support the inclusion in the Global Air Navigation Plan, development and adoption of space-based automatic dependent surveillance — broadcast surveillance as a surveillance enabler;	APANPIRG noted the development of space-based ADS-B. APANPIRG suggests that the highest cost benefit for this technology will be in the NAT region. We also note that the cost to ANSPs and the applicable lateral separations are not yet clear and that the technology is, as yet, unproven.

Recommendations Adopted by AN-CONF/12	Proposed Response/Actions by ADS-B SITF
b) develop Standards and Recommended Practices and guidance material to support space-based automatic dependent surveillance — broadcast as appropriate; and c) facilitate needed interactions among stakeholders, if necessary, to support this technology.	However, APANPIRG sees enormous potential for space-based ADS-B across the oceans of the region. The strategy being adopted by the region is to keep an eye on its development until there is clarity about technical success and about the cost of the services before committing to this technology. The Asia/Pacific Seamless ATM Plan has identified space-based ADS-B as one of the key areas that should be researched for future development, in order to continue pursuance of seamless ATM beyond ASBU Block 0 implementations and global interoperability.
Recommendation 1/11 – Automation roadmap That ICAO: a) develop a global roadmap for the evolution of ground air traffic management automation systems in line with aviation system block upgrade implementation; and b) develop performance-based system requirements for air traffic management automation systems so that: 1) where necessary these systems are interoperable across States and regions; and	APANPIRG should encourage States to ensure that all newly deployed air traffic management automation systems should support all applicable ICAO adopted surveillance technologies such as ADS-B / MLAT and Mode S DAPS (Mode S Enhanced Surveillance), and that when appropriate, existing air traffic management automation systems will be upgraded to have such capabilities. Besides, capabilities to allow ADS-B data sharing should be included. Depending on whether there will be operational benefits to States and the region, APANPIRG could consider to promulgate a time line of expected ADS-B / MLAT / Mode S DAPS capabilities in their air traffic management automation

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2) the function and operation of these systems will result in consistent and predictable air traffic management system performance across States and regions.	systems by say November 2018 (in line with the "Preferred ATM Service Levels" PASL Phase II in Asia/Pacific Seamless ATM Plan). Guidance materials regarding appropriate ADS-B / MLAT / Mode S DAPS functionalities are available in the published guidance documents including guidance on sharing of ADS-B data. However, guidance materials for ADS-B implementation in complex radar airspaces are yet to be developed. ADS-B SITF to consider enhancing guidance materials for implementation of Mode S DAPS, as well as ADS-B implementation in radar airspace if needed.
Recommendation 1/12 – Development of the aeronautical frequency spectrum resource That States and stakeholders: a) recognize that a prerequisite for the deployment of systems and technologies is the availability of adequate and appropriate radio spectrum to support aeronautical safety services; b) work together to deliver efficient aeronautical frequency management and "best practices" to demonstrate the effectiveness and relevance of the industry in spectrum management;	With the deployment of ADS-B consideration should be given to the decommissioning of radars to reduce frequency spectrum utilization. The sharing of DCPC facilities to support ADS-B operations could also lead to decommissioning of certain HF stations and thus releasing the associated HF frequencies. High ADS-B fitment rates may lead to the removal of primary radars in some states. The Regional Surveillance Strategy has encouraged States to reduce dependence on primary radars for area surveillance.

Recommendations Adopted by AN-CONF/12	Proposed Response/Actions by ADS-B SITF
2) demonstrate efficient use of the spectrum allocated through efficient frequency management and use of best practises;	
Recommendation 2/2 – Development of ICAO provisions for remotely operated air traffic services That ICAO provide: a) updates on additional guidelines for surveillance and air and ground communications systems; b) requirements for the use of sensors and display technologies to replace visual observation to air traffic in the provision of air traffic services; and	Due to the high Mode-S and ADS-B fitment and usage in the APAC region, trials of remotely operated ATS may be practical within the region earlier than other regions. APAC states should be encouraged to support these activities.
Recommendation 4/1 – Efficient management of airspace and improved flow performance through collaborative decision-making That States: h) accelerate the implementation of collaborative decision-making processes in the provision of services at the regional level, being guided by the principles set forth in the *Manual on Collaborative Air Traffic Flow Management* (Doc 9971) and the *Manual on Flight and Flow – Information for a Collaborative Environment* (Doc 9965); i) according to their operational needs, implement the aviation system block	CDM in some environments may be improved by separate organisations having a common view of the traffic. ADS-B data sharing between organisations may support better CDM.

Recommendations Adopted by AN-CONF/12	Proposed Response/Actions by ADS-B SITF
upgrade modules relating to network operations included in Block 0.	
Recommendation 4/2 – ICAO aviation system block upgrades relating to ground surveillance using automatic dependent surveillance – broadcast/multilateration, air traffic situational awareness, interval management and airborne separation. That the Conference: a) endorse the aviation system block upgrade modules relating to **interval management** included in Block 1 and recommend that ICAO use them as the basis of its work programme on the subject; b) agree in principle to the aviation system block upgrade modules relating to airborne separation included in Block 2 as the strategic direction for this subject; That States: h) according to their operational needs, to implement the aviation system block upgrade modules relating to ground surveillance, improved air traffic situational awareness and improved access to optimum flight levels included in Block 0.	APANPIRG supports and prioritizes deployment of ASBU B0-ASBU (Initial Capability for Ground Surveillance) using ADS-B OUT technology. Initially, this serves the needs of ground surveillance but will place the region in a good position for ADS-B IN applications listed in Block 0 and Block 1. APANPIRG could consider to further enhance the region's preparedness by all States agreeing that all **NEW** aircraft registrations must have ADS-B OUT capability in our region by say 2017. APANPIRG could consider to enhance safety & efficiency in the region by supporting further deployment of ADS-B IN capabilities available in Block 0, including : - B0-ASEP Air Traffic Situational Awareness (ATSA) - B0-OPFL Improved Access to Optimum Flight Levels Through Climb/Descent Procedures Using ADS-B (ITP)

Recommendations Adopted by AN-CONF/12	Proposed Response/Actions by ADS-B SITF
Recommendation 4/3 – ICAO aviation system block upgrades relating to airborne collision avoidance systems and ground-based safety nets That the Conference: a) endorse the aviation system block upgrade module relating to ground-based safety nets included in Block 1 and recommend that ICAO use it as the basis of its work programme on the subject; b) agree in principle to the aviation system block upgrade module relating to airborne collision avoidance systems included in Block 2, as the basis of the strategic direction for this subject; g) incorporate the new generation of airborne collision avoidance system (ACAS X) into its work programme; That States: i) according to their operational needs, to implement the aviation system block upgrade modules relating to airborne collision avoidance systems and ground based safety nets included in Block 0.	Depending on whether there will be operational benefits for States and the region, APANPIRG could further improve safety in the region by encouraging States in the region to implement: B0-SNET Increased Effectiveness of Ground Based Safety Nets States in the region could agree, based on ALARP principles, to replace / upgrade their ATC systems to include : - Short-term conflict alert (STCA) using data from available surveillance sensors such as Radar, WAM and ADS-B - Area proximity warning (APW) - Minimum safe altitude warning (MSAW) - Route adherence monitoring (RAM) - Cleared level adherence monitoring (CLAM) - Selected level mismatch (using Mode C, Mode S and ADS-B data) The Asia/Pacific Seamless ATM Plan has set target date for implementation of the ground-based safety nets by PASL Phase II (expected implementation by November 2018). This could be done at the same time as upgrading the ATC system to support ADS-B.

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	This recommendation supports ACAS-X which uses ADS-B to improve ACAS performance. An ADS-B fitment mandate across the APAC region would improve the effectiveness of these ACAS-X capabilities.
Recommendation 4/5 – Civil/military coordination/cooperation and sharing of airspace That States: a) planning and implementation regional groups, and ICAO to analyse the benefits that could be achieved through improved civil/military cooperation and sharing of the airspace serving international traffic flows and express the results of this analysis in terms of: 1) capacity increases and reduction in routine delays as measured by traffic volumes on major traffic flows; 2) document fuel savings and emission reductions through the use of the fuel savings estimation tools; and	APAC could consider encouraging the sharing of ADS-B data between civilian and military authorities, including those from neighbouring States, to support a common view of the airspace. Engagement of the military in ADS-B could lead to improved co-ordination and increased airspace sharing. Use of ADS-B data provided by the civilian authority could fill surveillance gaps in the military system (at least as far as civilian traffic is concerned). Guidance materials on advice to military authorities regarding ADS-B data sharing has been developed and published.

Recommendations Adopted by AN-CONF/12	Proposed Response/Actions by ADS-B SITF
3) other additional benefits;.	
Recommendation 4/6 – ICAO aviation system block upgrades relating to integration of remotely piloted aircraft into non-segregated airspace That the Conference: a) endorse the aviation system block upgrade module relating to remotely piloted aircraft included in Block 1 and recommend that ICAO use it as the basis of its work programme on the subject; b) agree in principle to the aviation system block upgrade modules relating to remotely piloted aircraft included in Blocks 2 and 3 as the strategic direction for this subject;	A key to the support of remotely piloted aircraft in civilian airspace is surveillance. It could be appropriate to insist that all **new** registered remotely piloted aircraft operating in civilian airspace are required to have appropriate ADS-B OUT or Mode-S capability. The APANPIRG publication of such a rule could avoid the costs of an expensive retrofit in the future. The time is right for ADS-B SITF to deliberate such a strategic move.
Recommendation 6/1 – Regional performance framework – planning methodologies and tools That States and PIRGs: a) finalize the alignment of regional air navigation plans with the Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP) by May 2014; b) focus on implementing aviation system block upgrade Block 0 Modules according to their operational needs, recognizing that these modules are ready for deployment;	APANPIRG should focus on implementing ASBU Block 0 Modules according to States' operational needs. ADS-B related ASBU Block 0 modules are ready for deployment including : - B0-ASUR (Initial capability for ground surveillance) using ADS-B/MLAT - B0-SNET Increased Effectiveness of Ground Based Safety

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c) use the electronic regional air navigation plans as the primary tool to assist in the implementation of the agreed regional planning framework for air navigation services and facilities; d) involve regulatory and industry personnel during all stages of planning and implementation of aviation system block upgrade modules; e) develop action plans to address the identified impediments to air traffic management modernization as part of aviation system block upgrade planning and implementation activities;	Nets - B0-ASEP Air Traffic Situational Awareness (ATSA) - B0-OPFL Improved Access to Optimum Flight Levels Through Climb/Descent Procedures Using ADS-B (ITP) The Asia/Pacific Seamless ATM Plan has set the priorities and timeline in implementing the above modules.
Recommendation 6/2 – Guidelines on service priority That: a) ICAO develop an appropriate set of operational and economic incentive principles to allow early benefits of new technologies and procedures, as described in the aviation system block upgrade modules, to support operational improvements, while maximizing safety, capacity and overall system efficiency; and b) States and international organizations contribute to this work.	APANPIRG could obtain some quick wins by promulgating a view that aircraft equipped with ADS-B have service priority over those that don't (i.e. better equipped, better served). This will increase the business case for equipage. The above has already been reflected in the ADS-B mandate published by States (e.g. non-ADS-B equipped aircraft is required to fly outside the ADS-B airspace)
Recommendation 6/6 – Use of multiple constellations That States, when defining their air navigation strategic plans and introducing new	ADS-B robustness would be improved if multiple constellations could be used.

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operations: a) take advantage of the improved robustness and availability made possible by the existence of multiple global navigation satellite system constellations and associated augmentation systems; b) publish information specifying the global navigation satellite system elements that are approved for use in their airspace; c) adopt a performance-based approach with regard to the use of global navigation satellite system (GNSS), and avoid prohibiting the use of GNSS elements that are compliant with applicable ICAO Standards and Recommended Practices; d) carefully consider and assess if mandates for equipage or use of any particular global navigation satellite system core constellation or augmentation system are necessary or appropriate;	APANPIRG could consider to request states to ensure that future ADS-B and GNSS mandates do not rely on a single constellation. ADS-B SITF could consider to develop guidance materials for use of multiple constellations to support ADS-B in APAC region.
Recommendation 6/10 – Rationalization of terrestrial navigation aids That, in planning for the implementation of performance-based navigation, States should: a) assess the opportunity for realizing economic benefits by reducing the number of navigation aids through the implementation of performance-based navigation; b) ensure that an adequate terrestrial navigation and air traffic management infrastructure remains available to mitigate the potential loss of global	APANPIRG could consider to: a) publish a list of the approvals available to operators in different States. Eg: GNSS NPA approvals without requiring a conventional alternate. This could encourage other states to increase the useability of GNSS systems

Recommendations Adopted by AN-CONF/12	Proposed Response/Actions by ADS-B SITF
navigation satellite system service in their airspace; and c) align performance-based navigation implementation plans with navigation aid replacement cycles, where feasible, to maximize cost savings by avoiding unnecessary infrastructure investment.	b) APANPIRG could promote the synergy between ADS-B and GNSS equipage. ADS-B requires a high performance GNSS system. The business case of ADS-B and GNSS combined is better than for either alone. ADS-B SITF could consider to develop guidance materials on this subject.
Recommendation 6/12 – Prioritization and categorization of block upgrade modules That States and PIRGs: a) continue to take a coordinated approach among air traffic management stakeholders to encourage effective investment into airborne equipment and ground facilities;	APAC States could agree to give higher service priority to ADS-B equipped aircraft than those that do not equip (i.e. better service, better served). States are encouraged to take a coordinated approach to implement ADS-B/WAM to bridge the existing surveillance gaps so as to apply end to end radar liked separation along major air routes. This can improve the business case for operators to equip. The above has already been reflected in the ADS-B mandate published by States (e.g. non-ADS-B equipped aircraft is required to fly outside the ADS-B airspace)

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