INTERNATIONAL CIVIL AVIATION ORGANIZATION

REPORT OF THE TENTH MEETING OF THE REGIONAL AIRSPACE SAFETY MONITORING ADVISORY GROUP (RASMAG/10)

BANGKOK, THAILAND, 15 – 19 DECEMBER 2008

The views expressed in this Report should be taken as those of the RASMAG and not of the Organization.

Adopted by the RASMAG
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HISTORY OF THE MEETING

1. Introduction

1.1 The Tenth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/10) was held in Bangkok, Thailand from 15 to 19 December at the Kotaite Wing of the ICAO Asia/Pacific Office.

2. Attendance

2.1 The meeting was attended by 33 participants from Australia, China, India, Japan, New Zealand, Republic of Korea, Singapore, Thailand, United States and Viet Nam. A list of participants is at **Appendix A** to this report.

3. Officers & Regional Office

3.1. Mr. Robert Butcher, Manager Human Factors & Analysis, Safety Management Group, Airservices Australia, chaired the meeting.

3.2. Mr. Andrew Tiede, Regional Officer ATM, Asia and Pacific Office, was the Secretary for the meeting.

4. Opening of the Meeting

4.1 The meeting was opened by Mr. Andrew Tiede on behalf of Mr. Mokhtar A. Awan, Regional Director of the Asia/Pacific Regional Office. Mr. Tiede welcomed all delegates to the Regional Office and outlined the substantial work programme that lay ahead. A great deal of work had already been accomplished off-line in the weeks before the meeting, which needed to be reviewed and endorsed by RASMAG. This included a review of the interim edition of the Regional PBN Implementation Plan which had been adopted by APANPIRG/19 and further work on the SMA Handbook. Also of interest to RASMAG was the implementation of the amended flight level arrangements in the South China Sea area during July 2008 and the implementation of RNP 10 based 50NM lateral and longitudinal separation on ATS route M771 and L642, also in July 2008. Additionally, the one year review of the implementation of RVSM in China had been completed by RVSM/TF/34 in early December, completing the work programme of the RVSM Task Force which had now been dissolved. Mr. Tiede congratulated the China RMA who had formally been granted APANPIRG approval as an Asia/Pacific RMA by APANPIRG/19 (September 2008), bringing the number of approved RMAs serving the Asia/Pacific region to five.

4.2 In welcoming participants to the meeting, Mr. Butcher commented that it was pleasing to see the large number of State participants who were present given the current global economic crises and impacts within the aviation industry. He particularly commented that it was pleasing to see representation from South Korea, and the return of representatives from Vietnam. He reflected the opening remarks of the Secretary noting the significant achievements for RASMAG over the last year and that he was hopeful, that with the support of participants a number of important work items, such as a review of the Regional PBN Plan and finalization of the SMA Handbook and the Long Term Height Monitoring impact statement, could be progressed during the meeting.

5. Documentation and Working Language

5.1 The working language of the meeting as well as all documentation was in English.

5.2 Twenty three (23) Working Papers, Nine (9) Information Papers and one (1) Flimsy were considered by the meeting. A list of papers is included at **Appendix B** to this Report.

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REPORT ON AGENDA ITEMS

Agenda Item 1: Adoption of Agenda

1.1 The following agenda was adopted by the meeting:

Agenda Item 1: Adoption of Agenda

Agenda Item 2: Review outcomes of related meetings

Agenda Item 3: Reports from Asia/Pacific RMAs and EMAs

Agenda Item 4: Airspace safety monitoring documentation and regional guidance material

- SMA/EMA Handbook
- PBN Regional Implementation Plan
- Regional Impact Statement for RVSM long term height monitoring

Agenda Item 5: Airspace safety monitoring activities/requirements in the Asia/Pacific Region

Agenda Item 6: Review and update RASMAG Task List

Agenda Item 7: Any other business

Agenda Item 8: Date and venue of the next RASMAG Meeting

Agenda Item 2: Review outcomes of related meetings

Technical Meeting of Asia/Pacific RMAs

2.1 The first day of the RASMAG/10 meeting was conducted as a technical meeting for Asia/Pacific RMAs. The intent of this meeting was to give the RMAs an opportunity to focus discussions on technical issues, identify resolutions to these issues and standardize regional processes.

2.2 As part of the meeting, the RMAs provided a brief overview of their activities since the last meeting and identified issues and problems that they were confronting. Points of discussion included:

- Continued lack of LHD data from Papua New Guinea made the ability to assess risk difficult to the extent that the few reports received by the AAMA from Airservices Australia, the high duration times applicable to those reports and the low annual hours flown resulted in an unrealistic risk value. Discussion on this issue led to the AAMA agreeing to assess a combination of data for Port Moresby, Honiara and Nauru FIRs.

- PARMO staff had met with European monitoring agency to pursue the progression of the RMA Manual however this work is further delayed.

- A new ground-based monitoring unit has been installed on the west coast of the United States which will provide more effective monitoring of aircraft transiting between the United States and the Pacific airspace.

- No effective process was available to some RMAs to follow up LHDs provided to them by other RMAs, but which were not reported by relevant States.

- MAAR plans to obtain two additional EGMUs to support the long term height-keeping monitoring requirements.

- As with other RMAs, JCAB RMA regards Category E LHDs as the major issue to be resolved. They regarded the implementation of AIDC as an effective means to control these types of errors and as a result Japan is planning to implement AIDC with other adjacent States in an effort to enhance regional safety.

China RMA support to DPRK RVSM implementation

2.3 The Secretariat advised that DPR Korea had informed the RVSM/TF/34 meeting (December 2008) that RVSM operations would be implemented in the Pyongyang FIR in July 2009. As the RVSM Task Force was to be imminently dissolved, China had informed RVSM/TF/34 that with the expertise and experience gained from China's recent implementation of RVSM, China would be willing to provide the necessary technical support for RVSM implementation in the Pyongyang FIR. China had suggested to RVSM/TF/34 that the General Administration of Civil Aviation of DPR Korea should make formal contact with ATMB, CAAC and commence coordination with ICAO Bangkok Office on this matter.

2.4 China updated the meeting, confirming their willingness to assist DPR Korea with implementation of RVSM, including provision by China RMA of safety assessment and monitoring services for the mid 2009 implementation. The MAAR, who was normally assigned RMA responsibility for the Pyongyang FIR, thanked China RMA for their offer to lead the assistance to DPR Korea and would be willing to provide support to China RMA in meeting these objectives.

2.5 The meeting thanked China RMA and MAAR for their gracious and cooperative efforts and agreed that it would be appropriate for China RMA to lead the technical assistance to DPR Korea, with support from MAAR and RASMAG if necessary. The Secretariat would officially relay the offers of support from China RMA, MAAR, RASMAG and the Regional Office to DPR Korea and request their thoughts on the proposal. The Regional Office would coordinate any outcomes to the ATMB for formal consideration by China.

RMA Manual and RVSM Minimum Monitoring Requirements (MMRs)

2.6 The First Edition (May 2004) of the ICAO *Manual of Operating Procedures and Practices for Regional Monitoring Agencies in relation to the use of a 300m (1000 ft) Vertical Separation Minimum above FL290* (the RMA Manual) had been developed in order to provide guidance to Regional Monitoring Agencies (RMAs) in the performance of their functions associated with RVSM operations. These include aspects of system performance monitoring during implementation planning and post-implementation operational use of RVSM and the consideration of aircraft technical and operational requirements for RVSM operations. The RMA Manual has been posted as an unedited version to the ICAO Net and is in work with the SASP PT-2 with the objective of finalizing and publishing the Manual as an ICAO document.

2.7 The RVSM minimum monitoring requirements (MMRs) recommended by ICAO at that time were contained in the RMA Manual. The meeting recalled that there were slight differences between the MMRs in the RMA Manual and the MMRs currently used in the Asia/Pacific region. Accordingly, RASMAG/3 (June 2005) had agreed that the updated MAAR MMRs which became effective from1 July 2005 would form the basis for MMRs for the Asia/Pacific RMAs. RASMAG/3 had also agreed that upon the alignment of the MAAR/PARMO MMRs with the RMA Manual, Asia/Pacific RMAs should adopt the MMRs contained in the RMA Manual, as amended from time to time, for regional application.

2.8 More recently, in recognition of the need for long term global monitoring of RVSM height-keeping performance, deliberations by the ICAO Separation and Airspace Safety Panel (SASP) and actions by the ICAO Air Navigation Commission (ANC) have resulted in the addition of long-term RVSM monitoring requirements to Annex 6, with the effective date of the requirements planned for November 2010. The following text was adopted by the ANC for Annex 6, Parts I and II, Chapter 7:

> *7.2.7 The State of the Operator that has issued an RVSM approval to an operator shall establish a requirement which ensures that two aeroplanes of each aircraft type grouping of the operator have their height-keeping performance monitored, at least once every two years or within intervals of 1 000 flight hours per aeroplane, whichever period is longer. If an operator aircraft type grouping consists of a single aeroplane, monitoring of that aeroplane shall be accomplished within the specified period.*

2.9 As a result of the adoption of the Annex 6 Standards above, the SASP agreed that a revision to the provisions in Annex 11 would be helpful in clarifying the regional component of RVSM monitoring requirements and supporting the monitoring goals of Doc 9574 (the RVSM Manual). Accordingly SASP had recommended the following change to Annex 11, which was currently being reviewed by ICAO Secretariat and the ANC:

> *3.3.4.1 For all airspace where a reduced vertical separation minimum of 300 m (1 000 ft) is applied between FL 290 and FL 410 inclusive, a programme shall be instituted, on a regional basis, for monitoring the height-keeping performance of aircraft operating at these levels, in order to ensure that the implementation and continued application of this vertical separation minimum meets the regional safety objectives. The ~~coverage of the~~ regional height-monitoring ~~facilities provided under this~~ programme shall be adequate to permit monitoring of all ~~the relevant~~ aircraft types and all ~~of~~ operators that operate in RVSM airspace. The scope of regional monitoring programmes shall be adequate to conduct analyses of aircraft group performance and evaluate the stability of altimetry system error.*
>
> ~~*Note. — The number of separate monitoring programmes should be restricted to the minimum necessary to effectively provide the required services for the region.*~~
>
> *3.3.4.2 Arrangements shall be put in place, through inter-regional agreement, for the sharing between regions of data from monitoring programmes.*

2.10 In reviewing the circumstances, the meeting understood that the Annex 6 provisions would take effect in about 2 years time, from November 2010, so were not presently applicable. Also, as the RMA Manual was further delayed, the status of the MMRs in the RMA Manual was questionable. However, the meeting recognized that the MAAR MMRs had only slight differences from the MMRs in the RMA Manual and were always at least equal to or more exacting than the Annex 6 requirements. Consequently, the meeting agreed that, in the interim, the MAAR MMRs that that been adopted by RASMAG/3 (**Appendix C** refers) should continue as the basis of MMRs used by Asia/Pacific RMAs. However, the meeting also recognized that the monitoring of an airframe was a significant burden to the operator and that monitoring therefore should be at the minimum rate necessary. Accordingly, the matter

would be kept under review, with the objective of utilizing the Annex 6 provisions as the basis for regional MMRs insofar as possible. The meeting agreed that the amendment to Annex 11 proposed by SASP was essential to provide necessary flexibility for the region in dealing with local circumstances as they eventuated.

2.11 Recognizing that APANPIRG had not formally adopted MMRs and noting the extended delays in finalization of the RMA Manual and the 2010 effective date for the Annex 6 provisions, the meeting drafted the following conclusion:

Draft Conclusion RASMAG 10/1 – Adopt RVSM Minimum Monitoring Requirements

That, recognising that publication of the ICAO RMA Manual had been further delayed and that the Annex 6 provisions for the global long term monitoring of airframes used in RVSM operations would not take effect until November 2010, the Asia RVSM Minimum Monitoring Requirements adopted by RASMAG and promulgated by the Monitoring Agency for Asia Region (MAAR) be adopted by Asia/Pacific RMAs as the basis for RVSM monitoring requirements in the Asia and Pacific Region.

2.12 The China RMA highlighted that they had been observing increased presence of aircraft type ERJ190 (EMB190) in their data. This type was a sophisticated 100+ seat twin jet manufactured by Embraer of Brazil, approximately similar to the B737/A320. Initial information provided by the AAMA suggested that aircraft of this type in Australia is being monitored as for Category 1 in the MMR, while the PARMO advised that the information available to it suggested that these aircraft are being monitored as Category 2 in the United States. Additionally while the PARMO had height monitoring data for this type of aircraft, this data had not been presented or reviewed by RASMAG, and therefore the meeting agreed there was no basis on which to recommend a change to the MMR to accommodate the ERJ170/190 aircraft fleet. As a result the AAMA and PARMO agreed to gather more information to present to RASMAG/11 so that a more informed decision to amend the MMR could be made. An item was added to the Task List in this respect

Update FIR to RMA assignments

2.13 The meeting noted that, because the RMA Manual had been drafted a number of years ago, the Table of Flight Information Regions (FIRs) and their allocation to responsible RMAs was significantly out of date. The Asia/Pacific region had also gained two new RMAs recently, the JCAB RMA and the China RMA and this information also still had to be incorporated into the RMA Manual. Noting the continuing delays in finalizing the RMA Manual, the meeting agreed that regional RMAs would work together by correspondence to create an up-to-date table in time for RASMAG/11 that accurately reflected the FIR/RMA assignments for the Asia/Pacific region. An item was added to the Task List in this respect

2.14 The meeting considered that inclusion of this document as an appendix to the Regional Impact Statement on the effects of global long term height monitoring provisions would be beneficial in enabling States to easily understand which RMA they should be dealing with for each airspace.

Adopt common traffic sample data template

2.15 The meeting noted that each regional RMA had adopted a template format that was distributed to States for the submission of the annual December traffic sample data (TSD). The meeting agreed that, in the interests of harmonization, a review of the various templates should be conducted by RMAs, with the objective of adopting one standardized template that would be used by all Asia/Pacific RMAs. Specifically, the meeting agreed that in order to assist with identifying the level of the problem of

aircraft that were erroneously notifying RVSM approval in flight notification, that the standardized TSD template should include provision to identify the RVSM approval status indicated in the flight notification. In conducting the review of the TSD template, the RMAs were encouraged to take in to account the existence of horizontal monitoring agencies and the expanded use of data proposed in paragraphs 5.28 to 5.31 below. Accordingly, the standardized template should include provision for input as "En-route PBN Approval type" and "ATS Route" as well as the normal data parameters required by RMAs. RMAs would work by correspondence with a view to presenting a standardized data template for review during RASMAG/11 in June 2009. An item was added to the Task List in this respect.

Taxonomy of RMA terms

2.16 The AAMA raised the issue of under –reporting of large height deviations by some States and referred to previous meetings of RASMAG where similar issues had been identified and discussed by the RMAs. Specifically, the AAMA informed the meeting that it was their belief that a major part of the problem was a lack of understanding by many States of the exact meaning of some of the descriptions for LHD types detailed in the current RASMAG approved LHD category descriptions. The AAMA stated that their observations led them to the conclusion that some States did not understand what types of operational error should be reported as Category D ATC loop errors as the taxonomy was not clear. As a matter of course the AAMA would expect that loss of separation reports would be included in this category, but this was not necessarily clearly stated. Additionally, there did not seem to be a common understanding of how loss of separation incidents were to be reported as no common definition existed in the Region. To this extent the meeting was informed that the Civil Air Navigation Service Organization (CANSO) was working to achieve a common reporting taxonomy for safety related incidents, including loss of separation.

2.17 Commenting further on these issues, the AAMA identified that it was probable that some States in the region, were actually reporting operational errors relevant to RVSM airspace within their SMS systems, but had not made the link to the LHD taxonomy and reporting requirements to the relevant RMA. In other words their internal safety reporting taxonomy had not been effectively mapped against the LHD taxonomy. As a result the internally captured reports were not being forwarded to the RMAs for assessment in some cases and hence under-reporting is the outcome. While not suggesting that the LHD category descriptions needed to be amended to any great extent, the AAMA proposed that RASMAG should review the descriptions of the reporting categories to ensure the reporting intent is clear. For ATC loop errors and other operational errors, a common taxonomy should be developed for specific types of operational errors.

2.18 The meeting agreed that the current LHD taxonomy was possibly a source of confusion on the part of some States as to what types of incidents should be reported to RMAs in terms of being an LHD. MAAR particularly indicated that their experience had been similar to that of the AAMA. The AAMA agreed to review the LHD taxonomy descriptions and to develop a draft taxonomy for operational errors specifically for ATC loop errors. This material would be presented to RASMAG/11 for further consideration. The meeting also considered that inclusion of such taxonomy as an appendix to the Regional Impact Statement on the effects of global long term height monitoring provisions would be beneficial in educating States about the work of RMAs. An item was added to the Task List in this respect.

Attendance at Global RMA meetings

2.19 The meeting discussed at length the burden carried by RMAs in attending two RASMAG meetings each year as well as supporting the recent Global RMAs meeting in Montreal, Canada. The intention to continue with an annual Global RMAs meeting for the foreseeable future meant that RMAs would need to attend three meetings each year. The meeting recognized that the Global RMAs meetings

had an important role in supporting a standardized implementation of the long term monitoring provisions which take effect from 2010.

2.20 A proposal was made by the Secretariat to reduce to one RASMAG meeting per year, allowing RMAs to service only two meetings rather than three. However, the meeting considered that the workload on RASMAG was such that two meetings each year were essential and recognized that the need for an annual Global RMAs meeting would reduce after November 2010. Therefore Asia/Pacific RMAs would persist with the 3 meetings per year for the next year or so. The matter would be kept under review.

Possible differences in applying the CRM

2.21 The meeting recalled that the method used to evaluate collision risk in the Asia Pacific Region is by applying the Reich Collision Risk Model (CRM). This method is recommended by the International Civil Aviation Organization (ICAO) and accepted globally.

2.22 Discussion during the course of the meeting had identified that there were potentially some differences in the way that some of the RMAs were applying aspects of the CRM. A differing methodology for assessing the durations of LHD events was used amongst the RMAs and the meeting considered that efforts should be made to harmonize, to the extent possible, all aspects of the application of the CRM. RMAs agreed to prepare for discussion of this nature during the RMAs combined technical meeting at the start of the RASMAG/11 meeting in June 2009. An item was added to the Task List in this respect.

Review of APANPIRG/19

2.23 The Nineteenth meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/19) was held from 1-5 September 2008. As well as reviewing progress on Conclusions and Decisions raised by previous APANPIRG meetings, APANPIRG/19 raised a total of 57 new Conclusions and Decisions for regional action.

2.24 APANPIRG/19 reviewed a consolidated report of the Eighth and Ninth Meetings of the Regional Airspace Safety Monitoring Advisory Group of APANPIRG (RASMAG/8 and 9), held in December 2007 and May 2008, respectively. The meeting expressed its appreciation for the many tasks that had been addressed by RASMAG since reporting to APANPIRG/18 last year.

2.25 Recognizing that, with the exception of the Pyongyang (DPRK) and Ulaanbaatar (Mongolia) FIRs, RVSM has been implemented throughout the Asia/Pacific Region the meeting reviewed a summary of the most up to date safety assessments of RVSM operations in the widespread airspaces of the region. APANPIRG/19 recorded concerns in relation to probable under reporting of Large Height Deviations in the Bay of Bengal airspace and reminded the States involved of the need to strengthen their incident reporting systems.

RVSM Non - Approved Operators Using RVSM Airspace

2.26 APANPIRG/19 expressed serious concern in relation to flights that were apparently using RVSM airspace when they did not have the State approvals to do so. In agreeing that this issue ultimately required regulatory intervention, the meeting requested RASMAG to continue its investigations in this regard with the objective of providing a more comprehensive briefing to APANPIRG/20 (2009) in relation to this issue**.**

2.27 In this context, RASMAG/10 discussed a number of possible methods to identify non-approved operators. The most readily available method was to compare flights in the annual December

traffic sample data against the approvals databases maintained by regulatory authorities. This was already a normal method used by regional RMAs, and RMAs agreed to ensure diligence in this approach.

2.28 The AAMA described a simple software application that enabled an audit of AFTN messages to be made on a frequent basis to identify flight plan messages in which 'W' had not been filed. Australia ran the software application on a monthly basis and the process had been beneficial in identifying cases of apparent non compliance, many of which had turned out to be database errors. The AAMA offered to make the software application available to other RMAs on request.

2.29 Regional RMAs would continue to study the problem and provide feedback to the next meeting, for consolidation and submission to APANPIRG. An item was added to the Task list in this respect.

China – Approved as APANPIRG RMA

2.30 APANPIRG/19 was pleased to support the recommendation from RASMAG that the China RMA be endorsed as an APANPIRG RMA, adopting the following Conclusion:

Conclusion 19/14 – Approval of China RMA as Asia Pacific RMA

That, having met all requirements established by the Regional Airspace Safety Monitoring Advisory Group (RASMAG), the China RMA be approved as an APANPIRG Asia/Pacific RVSM Regional Monitoring Agency with responsibility for all sovereign RVSM airspaces in China.

2.31 RASMAG/10 relayed their congratulations to China on this outcome and noted the significant work that had been completed on monitoring matters by the China RMA since the last RASMAG meeting.

Global Long Term Height Monitoring

2.32 APANPIRG/18 had recognized that the 2010 implementation of Annex 6 global long term monitoring requirements for airframes used in RVSM operations would have significant impacts in the way regional monitoring was managed, including the need for widespread regional height monitoring infrastructure capability to be made available. Under the terms of Conclusion 18/4, APANPIRG had tasked Asia/Pacific RMAs in conjunction with RASMAG to prepare a regional impact statement summarizing the estimated consequences for the Region, including consideration of the numbers of airframes required to be monitored and ground infrastructure required.

2.33 APANPIRG/19 agreed that effective coordination arrangements between States and RMAs was a critical first step and adopted the following Conclusion:

Conclusion 19/15 – Enhanced communications between States and RVSM RMAs

That, noting the Annex 6 provisions for the global long term monitoring of airframes used in RVSM operations and the critical role of Asia/Pacific RVSM Regional Monitoring Agencies (RMAs) in monitoring the safety of RVSM operations, the Regional Office draw the attention of States to the Long Term Height Monitoring Actions promulgated by RASMAG. In particular, States are encouraged to immediately strengthen relationships with their respective RMAs to ensure that information in relation to RVSM approval status is continuously available to RMAs.

Establishment of Singapore SMA – SEASMA

2.34 APANPIRG/19 was informed that, recognizing that safety assessment and monitoring capability was urgently necessary to enable the implementation of 50NM lateral/50NM longitudinal reduced separations on RNAV routes L642 and M771 in the South China Sea, Singapore (in coordination via RASMAG) committed to establishing an SMA for the South China Sea, with the objective of providing full SMA services from 1 July 2008. Singapore has adopted the title "South East Asia Safety Monitoring Agency" (SEASMA) as the name for the SMA and has taken steps to procure the URL www.seasma.com for the SEASMA website which is expected to be operational before the end of 2008.

2.35 Following finalization of implementation strategies by the RNP-SEA/TF, successful implementation of reduced horizontal separations on L642 and M771 occurred in conjunction with the 3 July 2008 AIRAC. Hong Kong, China led APANPIRG/19 in congratulating Singapore in this achievement. The additional SMA capability provided by Singapore was welcomed by the meeting and Singapore was invited by APANPIRG/19 to consider expanding the provision of SMA services beyond the South China Sea in due course.

Deficiencies List

2.36 APANPIRG/18 (September 2007) had raised Conclusion 18/2 requiring that, as a result of the non-provision of safety related data to RMAs, Fiji, Lao PDR, Myanmar, Papua New Guinea and Tahiti be included in the APANPIRG List of Deficiencies in the ATM/AIS/SAR Field.

2.37 In reviewing this situation, APANPIRG/19 was pleased to note that Fiji, Lao PDR and Tahiti had provided appropriate TSD for December 2007 and had established a reliable record of providing the monthly LHD reports, including 'NIL' reports, to Asia/Pacific RMAs as required by APANPIRG Conclusion 16/4. Accordingly, the meeting accepted RASMAG's recommendation that Fiji, Lao PDR and Tahiti be removed from the APANPIRG list of deficiencies.

2.38 Regrettably, APANPIRG/19 noted that there was no change in the circumstances for Myanmar, and they were retained on the deficiency list. Although Australia was working closely with Papua New Guinea (PNG) and it was anticipated that the safety data problems would be overcome as a result of this relationship, PNG was also retained on the deficiencies list. APANPIRG/19 was informed by RASMAG that, unfortunately, data provision from Bangladesh, Philippines and Sri Lanka had ceased recently. RMAs and the Regional Office would attempt to follow up to obtain the required data however, in the absence of improvement, APANPIRG would be obliged to include these States on the deficiencies list.

Review of 45th DGCA Conference

2.39 The 45th Conference of Directors General of Civil Aviation (DGCAs), Asia and Pacific Region was hosted by the Department of Civil Aviation, Malaysia in Kuala Lumpur from 24 – 28 November 2008. The Conference was attended by 228 delegates from 34 States/Administrations and 5 International Organizations and agreed to 11 Action Items for regional action.

2.40 In reviewing the outputs from the Conference, the meeting noted that there were no specific actions required by RASMAG in supporting the Action Items from the Conference.

Review of RVSM/TF/34

2.41 The 34th meeting of ICAO RVSM Implementation Task Force (RVSM/TF/34) was held in Beijing, China from 1 to 3 December 2008. The objective of the meeting was to conduct the one year post-implementation review of China RVSM.

2.42 The China RMA presented the periodic safety report which is submitted twice a year to CAAC and ICAO. The report contained a summary of large height deviation (LHD) reports received by the China RMA for that time period and an update of the vertical collision risk for sovereign Chinese airspace. All the analyses conducted were based on one month traffic sample data (TSD) collected in December 2007 and the latest 12-month LHD reports. The periodic report from the China RMA demonstrated that RVSM operations in the sovereign airspace of China continued to satisfy the regional target level of safety.

2.43 RVSM/TF/34 was pleased to confirm that all the tasks to introduce RVSM in China have been fully and successfully completed. The China RMA would take responsibility for ongoing safety monitoring in accordance with RASMAG requirements. RVSM/TF/34 reviewed the Terms of Reference (TOR) of RVSM/TF and confirmed that the TOR assigned by APANPIRG had been fully met. Accordingly, the RVSM/TF was dissolved in accordance with the following APANPIRG Decision:

Decision 19/5 – Dissolution of the RVSM/TF

That, following the widespread and safe implementation of RVSM throughout the Asia/Pacific Regions over a 10 year period, the Asia/Pacific RVSM Implementation Task Force (RVSM/TF) be dissolved, with effect from the close of the RVSM/TF/34 meeting (one year review of China RVSM) in late 2008, and any residual work items be allocated to the ATM/AIS/SAR Sub-Group.

Note: In dissolving the RVSM/TF, APANPIRG places on the record its highest commendation and appreciation to all parties associated with the RVSM/TF for the continuous implementation of RVSM and the very positive and quantifiable beneficial effects on safety, efficiency and the environment that have resulted directly from the work of the RVSM/TF.

Review of WPAC/SCS RSG/5

2.44 The Fifth Meeting of the Western Pacific/South China Sea RVSM Scrutiny Working Group (WPAC/SCS RSG/5) was held from 14 to 16 October 2008, to conduct the 90-day post implementation review of the revised flight level arrangements that had been implemented in the Western Pacific and South China Sea areas on 2 July 2008. This was a complex and widespread implementation that had affected a large number of different parties.

2.45 WPAC/SCS RSG/5 noted that in general terms, the implementation had proceeded smoothly without major problem. This was attributed to the thorough preparations made by States and operators and the meeting commended all involved for their careful and comprehensive work in this regard.

2.46 Many States reported improvements in terms of safety, capacity, efficiency and ATC and pilot workload, with positive benefits from the reduced numbers of RVSM transitions served by some States. Singapore informed that some operators had advised, because of the changed flight levels on the parallel routes, that there was an impact to aircraft operations as flights that were not able to be displaced by 1000ft were not able to operate at or close to optimum flight level due to the 3,000ft vertical separation

instead of 2,000ft previously. This was also reported by IATA, who would continue to study this issue and provide follow up information to the next meeting.

2.47 The 'Typhoon Season' in the South China Sea area is typically for about a six month period each year, commencing in April/May. Implementation of the revised flight level arrangements had occurred over a period of adverse weather conditions which had complicated the implementation. A number of days of very bad weather had been experienced. WPAC/SCS RSG/5 considered that a review of Large Scale Weather Deviation (LSWD) arrangements was a very high priority and included an action of the Task list to ensure progress on this issue.

Safety Assessment

2.48 The Monitoring Agency for the Asia Region (MAAR) provided WPAC/SCS RSG/5 with results of the airspace safety assessment for the RVSM implementation in the Western Pacific/South China Sea (WPAC/SCS) airspace based on the new FLAS.

2.49 WPAC/SCS RSG/5 recognized that only two months data (July and August 2008) was available since the implementation of the revised flight level arrangements on 2 July 2008. As such, it was probably too early to draw any reliable conclusions about the effect of the new flight level arrangements on the overall RVSM safety performance. However the meeting noted that there had not been a spike increase in LHDs associated with the implementation, suggesting that the transition had been smooth. Also, the 8 minutes of LHD duration recorded for August 2008 was the lowest for the 12-month period. The relatively higher LHD durations recorded in October and December 2007, as well as March, April and May 2008 before the implementation were noted.

2.50 However, the overall risk estimate, at 5.89×10^{-9}, exceeded the agreed Target Level of Safety (TLS) value of 5.0×10^{-9} fatal accidents per flight hour due to all causes. The main cause contributing to this infringement was the significant number of operational errors, which derive from a series of significant LHD occurrences. WPAC/SCS RSG/5 was concerned to note the exceedance of the TLS and recognized that the large numbers of LHDs attributable to errors in ATC Unit-to-ATC Unit coordination were still driving the risk estimate and needed to be corrected.

Agenda Item 3: Reports from Asia/Pacific RMAs and EMAs

AAMA's RMA activities

Australian airspace

3.1 Australia presented the results of the safety assessments of the Australian Domestic, Tasman Sea and Indian Oceanic Airspaces undertaken by the Australian Airspace Monitoring Agency (AAMA). The meeting was informed that the assessment covered the 12-month period ending on 30 November 2008, using a traffic sample data for the period March/April 2008 due to technical difficulties in obtaining the December 2007 data.

3.2 In the case of the Australian FIRs, the AAMA assessed operational errors and large height deviations (LHDs) identified through the Airservices Australia Electronic Safety Incident Reporting system. The total number of minutes calculated for the period 1 December 2007 to 30 November 2008 was 380.5 (a decrease of 39 minutes over the previous month) drawn from 83 assessed non-NIL reports. The meeting noted that the calculated risk value has reduced in comparison to the previous months. Australia informed the meeting that this reduction primarily resulted from a review of operational error data held in the twelve month sample. The Australian report summarized the large height deviation reports as follows:

- The most significant type of LHD in terms of number of reports continues to be Category E – ATC-ATC coordination errors. There was an overall decrease of 9 minutes in the total duration of these types of reports.

- L Category LHDs also saw a reduction this month with the total assessed time decreasing by 15 minutes. However L category reports still have a high total duration even though the actual number of risk-bearing reports and their contribution to the total risk, in this category remains relatively low.

3.3 The meeting was informed that the assessment for the Australian airspace resulted in an estimation of the total risk as 10.4×10^{-9} fatal accidents per flight hour, which does not satisfy the agreed TLS values of no more than 2.5×10^{-9} (technical risk) and 5.0×10^{-9} (overall risk) fatal accidents per flight hour due to the loss of a correctly established vertical separation standard of 1,000 ft and to all causes, respectively.

3.4 **Table 1** below summarizes the results of the airspace safety oversight in terms of the technical, operational, and total risks for the RVSM implementation in the Australian airspace.

Australian RVSM Airspace – estimated annual flying hours = 422 070 hours *(note: estimated hours based on March/April 2008 traffic sample data)*			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
Technical Risk	0.024×10^{-9}	2.5×10^{-9}	Satisfies Technical TLS
Operational Risk	10.4×10^{-9}	-	-
Total Risk	**10.4×10^{-9}**	5.0×10^{-9}	**Does not satisfy Overall TLS**

Table 1: Risk Estimates for the RVSM Implementation in Australian Airspace

3.5 In addition, **Figure 1** below presents the trends of collision risk estimates for each month using the appropriate cumulative 12-month interval of LHD reports since 1 December 2007.

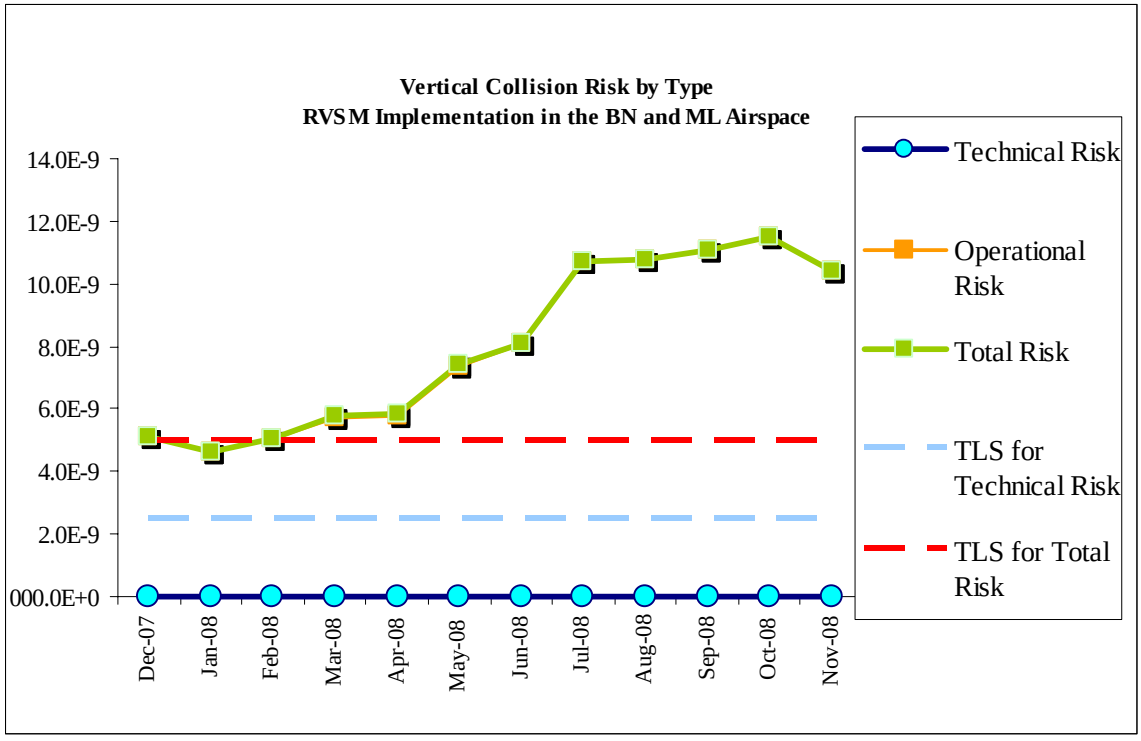

Figure 1: Trends of Risk Estimates for the Australian RVSM Airspace

3.6 The meeting was informed that in an attempt to better understand the drivers behind the increased risk in the Australian FIRs, the AAMA has commenced assessing LHDs (specifically operational errors) from the perspective of individual occurrence contribution to total risk. Additionally as a consequence of monthly assessments undertaken by the AAMA, it is possible to establish a monthly risk value that provides a real-time picture of actual risk without the affect from historical high-time errors resident within the 12-month data sample.

3.7 The meeting was informed that the AAMA had been able to assess RVSM risk by month and show individual LHD contribution to that monthly risk as detailed in **Figure 2** below. Of significance is that May and July (2008) together have three incidents that contribute heavily to the total risk. These incidents occurred in Domestic airspace.

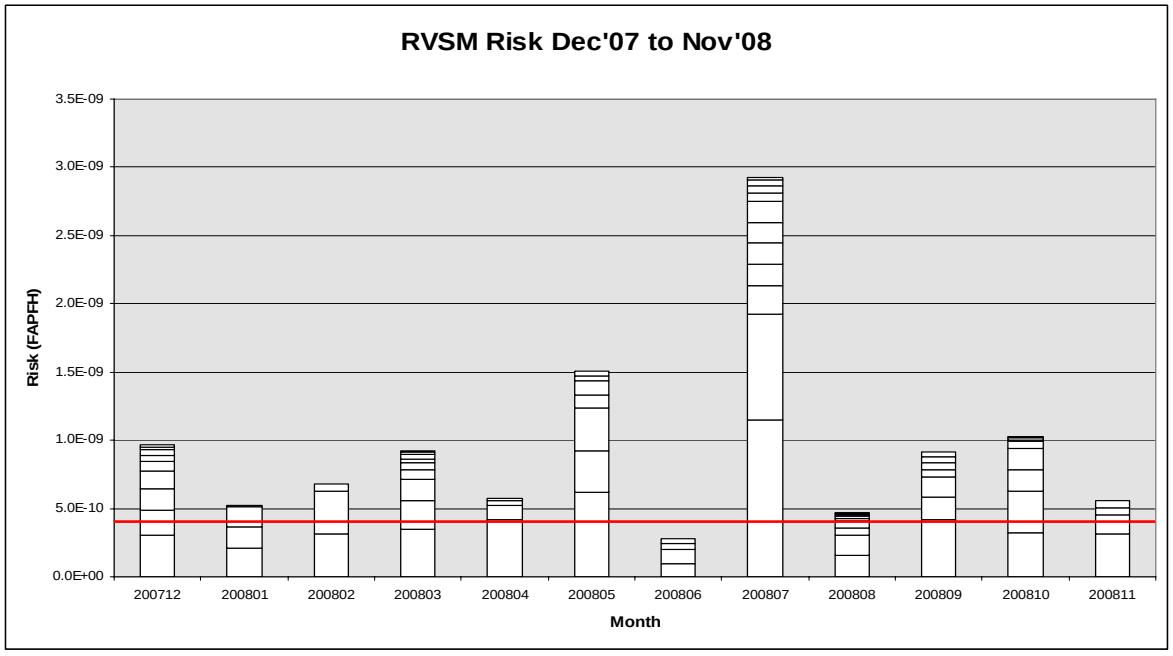

Figure 2: Monthly Risk Estimates for the Australian RVSM Airspace

3.8 Australia informed the meeting that to put the individual LHD contributions into perspective, the largest- risk single LHD in July contributes more risk than any month except May, and adding July and May together almost reaches the TLS of 5 x 10^{-9}.Only one month (June 2008) lies beneath the averaged 'monthly TLS' line (shown in red) in Figure 2 above.

3.9 **Figure 3** below shows all the LHDs for the year, ranked from highest to lowest risk. The data is colour-coded by traffic region. The greatest risk incidents occur on Domestic two-way routes, followed by Tasman two-way routes, with the risk clearly dominated by Domestic operational errors.

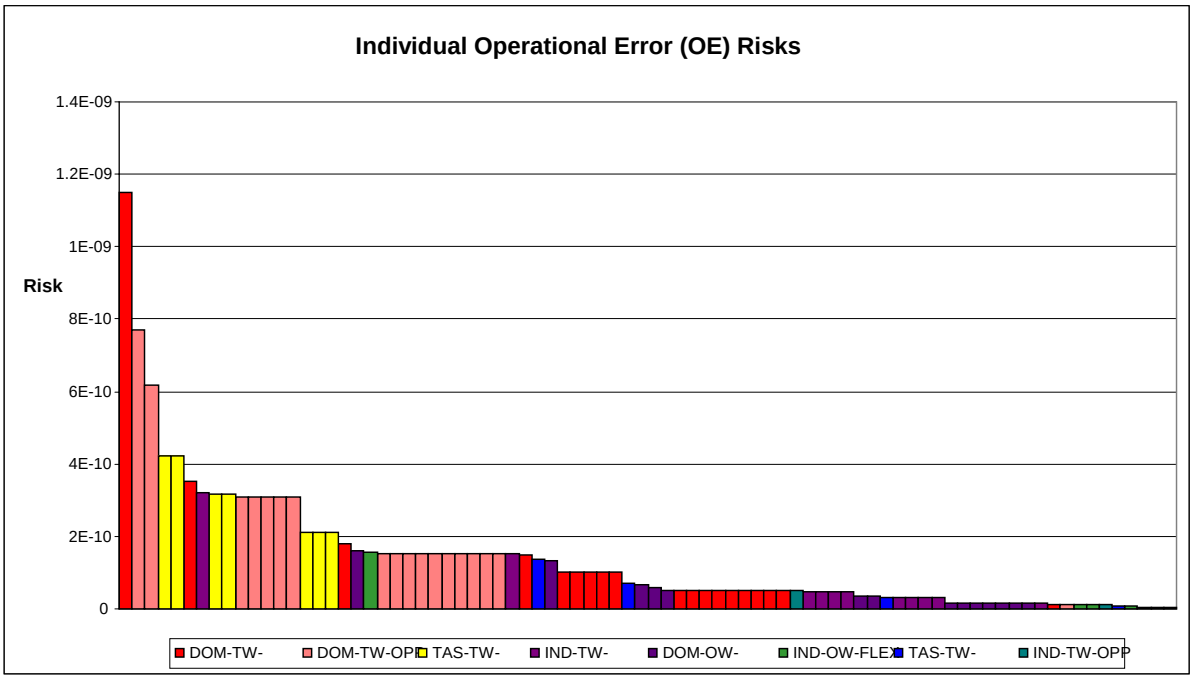

Figure 3. Ranked individual OE risk contributions (year ending November 30, 2008).

(Note: OEs are colour-coded by traffic region as given in the legend.
(TW = two-way; OW = one-way).

3.10 The meeting noted the outcome for the Australian airspace in terms of estimated risk noting the trend had started to decrease since October 2008 and that the AAMA expects this trend to continue over the coming reporting period. The meeting also thanked the AAMA for the detailed way in which it was now able to assess the individual risk contribution for LHDs and expressed its desire to see this type of reporting continue.

Indonesian Airspace

3.11 Australia presented the results of an initial safety assessment undertaken by the AAMA for the Indonesian airspace. The meeting noted that this was the first assessment of the Jakarta and Ujung Pandang FIRs undertaken by the AAMA following the transfer of responsibility for these FIRs from MAAR. Australia informed the meeting that the assessment covered the 12 month period ending on 30 November 2008, using traffic sample data for the month of December 2007.

3.12 The meeting was informed that in undertaking the assessment, the AAMA had received a number of LHD reports from the Indonesian Air Navigation Service Providers and also from MAAR. Additionally the AAMA had access to a number of reports provided by Australia that included possible risk bearing LHDs relative to the Jakarta and Ujung Pandang FIRs. Assessment of these reports was made from the perspective of their impact within the Indonesian airspace. In determining the duration of some of these reports, the AAMA had to make some assumptions on likely scenarios and factors within the airspace. To date some of these assumptions have not been fully validated and therefore there is a slight level of uncertainty regarding the final risk value determined for the airspace.

3.13 The meeting was informed that a total of 179.0 minutes duration was assigned to the 15 non-NIL LHDs identified and these were summarized as follows:

- A noticeable spike for December is due to two non-NIL LHDs, one assessed as 25 minutes duration and the other assessed as 75 minutes. The 25 minute report involved a coordination error on the part of the Ujung controller and the AAMA assumed it was likely the aircraft was maintaining the incorrect level without the controller being aware. The 75 minute report involved an aircraft transiting the airspace operating on a flight plan that indicated RVSM approval. The Brisbane FIR controller challenged the aircraft's RVSM approval status and it was ascertained the aircraft was not approved. The AAMA assessed that it was possible that Indonesian ATS was aware the aircraft was not RVSM. However, given the second flight plan indicated 'W', any knowledge of change to that status if known, should have been coordinated and new details sent.

- One L category report was identified and concerned an aircraft not notifying its correct RVSM approval status and is described in the paragraph above.

- Six Category E – ATC coordination error reports were identified. One was of 25 minutes duration and is described in the paragraph above. Another significant report was where Jakarta identified an aircraft within their FIR which had not been coordinated from the previous FIR. MAAR had initially assessed the duration of this report as 9 minutes. As is the case with RVSM assessments from other RMAs, Category E reports are the most common and can be significant in terms of individual risk contribution.

3.14 The meeting was informed that the assessment for the Indonesian airspace resulted in an estimation of the total risk as 3.43×10^{-9} fatal accidents per flight hour, which satisfies the agreed TLS values of no more than 2.5×10^{-9} (technical risk) and 5.0×10^{-9} (overall risk) fatal accidents per flight hour due to the loss of a correctly established vertical separation standard of 1,000 ft and to all causes, respectively.

3.15 **Table 2** below summarizes the results of the airspace safety oversight in terms of the technical, operational, and total risks for the RVSM implementation in the Indonesian airspace.

Indonesian RVSM Airspace – estimated annual flying hours = *(to be determined)* hours *(note: estimated hours based on December 2007 traffic sample data)*			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
Technical Risk	0.0264×10^{-9}	2.5×10^{-9}	Satisfies Technical TLS
Operational Risk	3.41×10^{-9}	-	-
Total Risk	**3.43×10^{-9}**	5.0×10^{-9}	**Satisfies Overall TLS**

Table 2: Risk Estimates for the RVSM Implementation in Indonesian Airspace

3.16 The meeting thanked Australia and particularly the AAMA for what is seen as a milestone report, noting that it was pleasing to see that the estimated risk value for Indonesian airspace met the TLS. The meeting joined Australia in expressing thanks to MAAR in assisting with an effective transfer of responsibility for the Indonesian airspace to the AAMA.

Enhancement of capabilities of China's RMA

3.17 China implemented RVSM in Beijing, Guangzhou, Kunming, Lanzhou, Shanghai, Shenyang, Urumqi and Wuhan FIRs and Sector 01 (airspace over the island) of the Sanya FIR at 1600UTC on 21 November 2007. China had established the China RMA (website www.chinarma.cn), which was approved by APANPIRG/19 to take RMA responsibility for these airspaces. China has continued strong efforts in enhancing the capabilities of the China RMA to provide long term monitoring

and safety assessment services and expressed willingness to provide technical support to DPR Korea for the implementation of RVSM in the Pyongyang FIR during 2009.

3.18 China RMA recently completed the GPS monitoring system and post-flight data processing training with the assistance of the FAA Technical center and CSSI, Inc. China RMA has started to provide height-keeping monitoring services to the domestic Chinese airlines and has already monitored up to six aircraft in four monitoring groups from three different domestic operators. Recognizing the necessity for long-term monitoring and China's widespread geographical area of responsibility, China RMA has commenced feasibility studies into the use of ground-based height monitoring.

3.19 To further clarify and regulate the work flow of relevant work in RVSM safety assessment and aircraft monitoring in China RMA and other departments in CAAC, an Advisory Notice has been drafted since June, 2008. Additionally, to educate airspace users as to the roles and functions of an RMA and coordinate with the domestic operators and CAAC inspectors, a seminar was held on October 22 and 23 in Kunming, China. Participants from CAAC, Air Traffic Management Bureau (ATMB), regional administration bureau, regional Air Traffic Management Bureau and Chinese domestic operators were invited. Matters in relation to aircraft RVSM approvals and aircraft height-keeping performance monitoring with China RMA were discussed. The final version of a monitoring timetable has been announced to all the domestic operators and will be implemented from December, 2008.

China RMA's activities

Chinese sovereign airspace

3.20 China RMA had recently updated the vertical collision risk estimates in order to determine whether the target level of safety (TLS) continued to be met in Chinese RVSM airspace, thus supporting the ongoing safe application of RVSM. The TSD of December 2007 and the continuous LHD reports in the sovereign Chinese airspace between November 2007 and October 2008 were used to produce the risk estimates below. Each monthly risk estimate was 'weighted' by the factors proportionate to the total number of flight hours in Chinese RVSM airspace.

3.21 **Table 3** below provides the results of the airspace safety oversight, as of October 2008, in terms of the technical, operational, and total risks for the RVSM implementation in the sovereign Chinese RVSM airspace.

Chinese sovereign RVSM Airspace – estimated annual flying hours =2 175 860 hours *(note: estimated hours based on December 2007 traffic sample data)*			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
Technical Risk	1.707×10^{-10}	2.5×10^{-9}	Satisfies Technical TLS
Operational Risk	2.007×10^{-9}	-	-
Total Risk	**2.17×10^{-9}**	**5.0×10^{-9}**	**Satisfies Overall TLS**

Table 3: Risk Estimates for the RVSM implementation in sovereign Chinese RVSM airspace - October 2008

3.22 **Figure 4** below provides the vertical collision risk estimates by type (e.g. technical, operational, and total) for each month during the current reporting period based on recent Large Height Deviation reports.

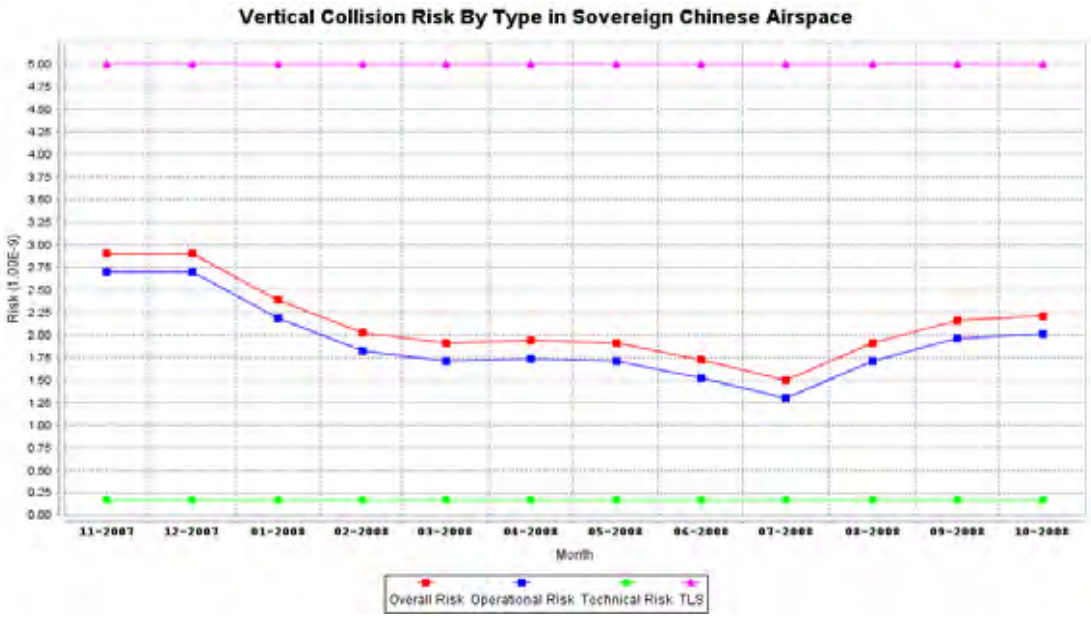

Figure 4: Trends of Risk Estimates for the RVSM Implementation in Sovereign Chinese Airspace

3.23 Therefore, the estimates of both technical and total risks from the available TSD and LHD reports satisfy the agreed TLS value of no more than 2.5×10^{-9} and 5.0×10^{-9} fatal accidents per flight hour. However, a "climbing" trend of total risk in the recent months can be observed from Figure 4 above. This results from the relatively higher reporting of LHDs over the last 3 months. The ATMB has concentrated on this phenomenon and sent a specialist group to investigate the details of the events. Since most of these events were categorized as ATC operational errors, ATMB of CAAC has requested all of the regional ATMBs to enhance the training and safety oversight to controllers. China RMA will keep tracing the progress and provide advice to ATMB to take remedial action when necessary.

3.24 The meeting thanked the China RMA for the detailed report provided, noting the satisfactory value of the risk estimate in relation to the TLS. The meeting commended the work being done in terms of enhancing the capabilities of the China RMA.

JCAB's RMA activities

Fukuoka FIR airspace

3.25 The Japan Civil Aviation Bureau RMA (JCAB RMA) presented the meeting with the result of the most recent RVSM airspace safety assessment for the Fukuoka FIR. The meeting noted that during the period of 12 months from October 2007 to September 2008, JCAB RMA received 50 LHD reports in connection with the Fukuoka FIR. Of the 50 reports, 34 LHD occurrences were attributable to operational errors and 16 were attributable to technical errors, as shown in **Table 4** below.

<table>
<tr><td colspan="4">Number of LHD Occurrences</td></tr>
<tr><td rowspan="3">Total LHD reported
(50)</td><td>Technical risk
(16)</td><td>-</td><td>-</td></tr>
<tr><td rowspan="2">Operational risk
(34)</td><td rowspan="2">Coordination error in the ATC-unit-to-ATC-unit transfer of control responsibility
(30)</td><td>Within the Japanese airspace
(17)</td></tr>
<tr><td>Outside the Japanese airspace
(13)</td></tr>
<tr><td></td><td>Other
(4)</td><td>-</td></tr>
</table>

Table 4: Summary of LHD Occurrences by categories (technical risk, operational risk, occurring outside of the Japanese airspace)

3.26 Analysis of the 16 large height deviations that contribute to technical risk showed that 8 deviations were reported as pilot response to Traffic Alert and Collision Avoidance System (TCAS) or Airborne Collision Avoidance System (ACAS) resolution advisories. The causes of 4 deviations were reported to be turbulence or other weather-related causes. The causes of 3 deviations were airborne equipment failure leading to unintentional or undetected change of flight level (including auto pilot issues). The cause of the final event was unknown; it was categorised as "Other".

3.27 Of the 34 LHDs reported to the JCAB RMA during the reporting period that contribute to operational risk, analysis showed that 13 events occurred outside the Japanese airspace. Overall, the largest contributor to risk-bearing large height deviations in the Japanese airspace is coordination error in the ATC-unit-to-ATC-unit transfer of control responsibility as a result of human factors issues (category E), with 30 of the 34 operational risk events being attributed to this category.

3.28 **Table 5** below presents the estimates of vertical collision risk for the Japanese airspace. The technical risk is estimated to be 0.42×10^{-9} fatal accidents per flight hour. The operational risk estimate is 4.14×10^{-9} fatal accidents per flight hour. The estimate of the overall vertical collision risk is 4.56×10^{-9} fatal accidents per flight hour. This estimate is below the regionally agreed TLS value of 5.0×10^{-9} fatal accidents per flight hour. This new estimate is based on the most recent 12 months of large height deviation reporting and recently updated collision risk parameters based on the December 2007 traffic samples collected.

Japanese RVSM Airspace – estimated annual flying hours = 966 566 hours *(note: estimated hours based on December 2007 traffic sample data)*			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
Technical Risk	0.42×10^{-10}	2.5×10^{-9}	Satisfies Technical TLS
Operational Risk	4.14×10^{-9}	-	-
Total Risk	**4.56×10^{-9}**	**5.0×10^{-9}**	**Satisfies Overall TLS**

Table 5: Risk Estimates for the RVSM implementation in the Japanese airspace – September 2008

3.29 **Figure 5** below presents the trends of collision risk estimates by type (e.g. technical, operational, and total) for each month using the appropriate cumulative 12-month of LHD reports during reporting period.

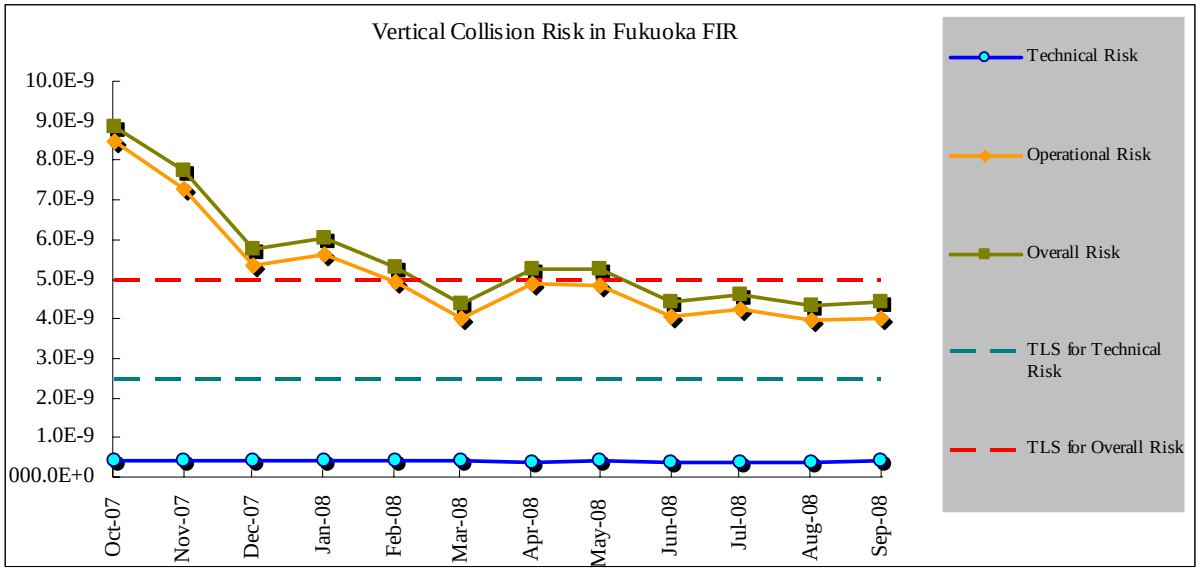

Figure 5: Trends of Risk Estimates for the RVSM Implementation in the Japanese airspace

3.30 The meeting recalled the history of the risk estimates for the Fukuoka FIR, noting previous safety assessment results as follows:

RASMAG/7 (Jun 2007) = 8.61 x 10^{-9}
RASMAG/8 (Dec 2007) = 11.4 x 10^{-9}
RASMAG/9 (May 2008) = 11.4 x 10^{-9}
RASMAG/10 (Dec 2008) = 4.56 x 10^{-9}

3.31 Accordingly, the Fukuoka FIR was now satisfying the TLS and the meeting commended Japan for this improvement in RVSM safety performance. The work of the JCAB RMA had been important in identifying where the problems were and where improvements could be made. Over time, Japan had worked diligently to implement directed remedial measures. These had included a number of ATC procedures changes, re-sectorisations, ATS route realignments, institution of an LHD MOU with neighbouring States and strong participation in the work of the Western Pacific South China Sea RVSM Scrutiny Group. In aggregate, all of these actions had acted to show an improvement in the safety estimates.

3.32 As part of it analysis, the JCAB RMA had plotted 3 years of data (October 2005 to August 2008) showing transfer errors between Japan and the Philippines against an hourly breakup over a 24-hour daily period. Predominant traffic flows and volumes were also included on the graph, as shown in **Figure 6** below. The meeting noted the relative increase in transfer errors during the hours of the day when there was increased bi-directional traffic activity, as opposed to when traffic was predominantly flowing in one direction.

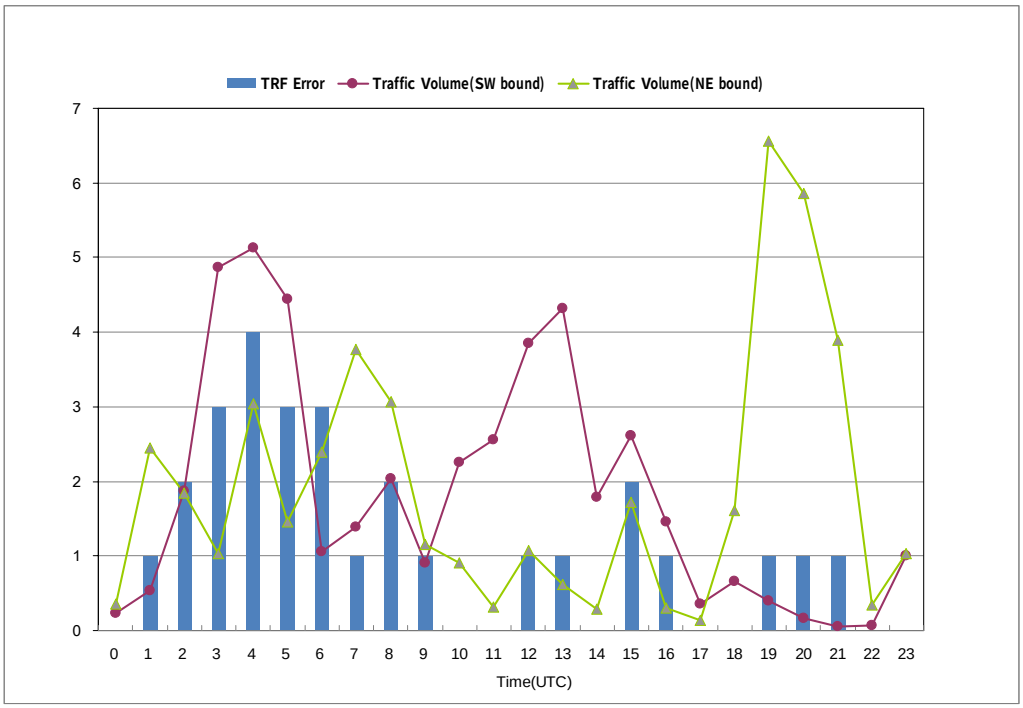

Figure 6. Hourly number of TFR error occurred between Japan and Philippines (total data during 3 year period from Oct 2005 to Aug 2008) with traffic volume per day

3.33 The meeting thanked JCAB RMA for the report and noted the improvement in relation to the TLS. Additionally the meeting encouraged JCAB RMA to continue its diligent activity in identifying and resolving factors underlying LHD reports.

EATMCG/2 Meeting

3.34 One of the remedial actions adopted by Japan was to establish the Informal East Asia ATM Coordination Group (EATMCG). The EATMCG/2 meeting was held Naha, Okinawa, Japan from 24 to 26 September 2008 and was attended by 30 experts of the civil aviation authorities and air traffic service providers from Hong Kong China, Japan, Philippines, Taiwan, the Air Traffic Control Association Japan (ATCA-Japan) and the international organization of International Federation of Air Traffic Controllers (IFATCA).

3.35 The JCAB RMA reported on activities regarding LHD events, especially coordination errors in the ATC-unit-to-ATC-unit transfer of control responsibility. Analyses were made on the causal factors, the error trends, distribution of occurrence in relation to traffic volume and hours of the day. Causes have been identified as follows:

a) Sending unit did not send the revised transfer of control message even after changing flight level,
b) Missing or lack of transfer of control message,
c) Error in transcribing JCAB Flight Data Processing System (FDPS) message,
d) Read back error / hear back error, and
e) Controller did not issue clearance to aircraft to change flight level as scheduled.

3.36 Deeper analysis by JCAB highlighted that:

a) It should be recognized that,

- Main cause of transfer error is that sending unit did not send the revised transfer of control message even after changing flight level,
- Coordination error in the ATC-unit-to-ATC-unit transfer of control responsibility tends to re-occur unless controllers are periodically reminded of the agreed remedial actions in accordance with JCAB SMS requirements, and
- Coordination error in the ATC-unit-to-ATC-unit transfer of control responsibility tends to occur at specific times of the day.

b) Radar assists controllers in reducing coordination errors in the ATC-unit-to-ATC-unit transfer of control responsibility, and

c) AIDC is the most practical tool to prevent human errors.

MAAR's RMA activities

3.37 In providing updated safety assessment reports for the Bay of Bengal and Western Pacific/South China Sea areas, the Monitoring Agency for the Asia Region (MAAR) placed on record its appreciation for the effort and cooperation from those States providing safety related data for analysis. However, noting that some data was still missing, late, and/or presented in the wrong format, MAAR encouraged States to use the most updated traffic sample data and large height deviation templates to facilitate analysis. The most updated forms and templates are available for download on the website at http://www.aerothai.co.th/maar. Also, the meeting was advised that MAAR would be appreciative if States could strictly follow the instructions provided for the traffic sample data collection and large height deviation report. Any questions or comments should be directed to MAAR at maar@aerothai.co.th.

Bay of Bengal Airspace

3.38 MAAR provided a summary of airspace safety oversight for RVSM implementation in the Asia Region, focusing on the Bay of Bengal (BOB) airspace**.** The RVSM safety oversight had been conducted based on a one-month traffic sample data (TSD) collected in December 2007 and the most recent rolling 12 months of Large Height Deviation (LHD) reports between October 2007 and September 2008 submitted by relevant States in the BOB Region. LHD data provided by the neighbouring RMAs is reviewed and used in the analysis where applicable.

3.39 MAAR advised that annual flight hours, calculated based on the December 2007 TSD, were 1,001,073 hours for the BOB airspace and that LHD occurrences in the BOB RVSM airspace could be summarized as follows:

- Compared to the last 6 monthly assessment, the number of LHD occurrences has increased from 5 to 10 occurrences while total LHD duration increased from 28 to 76 minutes
- Average duration of large height deviation occurrence is 7.6 minutes with maximum of 38 minutes

- Significant portion of large height deviation occurrence (4 of 10 occurrences) as well as duration (54 of 76 minutes) is attributable to coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues (Category E)

3.40 **Table 6** below summarizes the results of the airspace safety oversight as of May 2008 in terms of the technical, operational, and total risks for the RVSM implementation in the BOB airspace.

Bay of Bengal RVSM Airspace – estimated annual flying hours = 1 001 073 hours *(note: estimated hours based on December 2007 traffic sample data)*			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
Technical Risk	0.84×10^{-9}	2.5×10^{-9}	Satisfies Technical TLS
Operational Risk	2.40×10^{-9}	-	-
Total Risk	**3.24×10^{-9}**	**5.0×10^{-9}**	**Satisfies Overall TLS**

Table 6: Risk Estimates for the RVSM Implementation in BOB Airspace

3.41 In addition, **Figure 7** below presents the graphical trends of collision risk estimates for each month using the appropriate cumulative 12-months of LHD reports since October 2007.

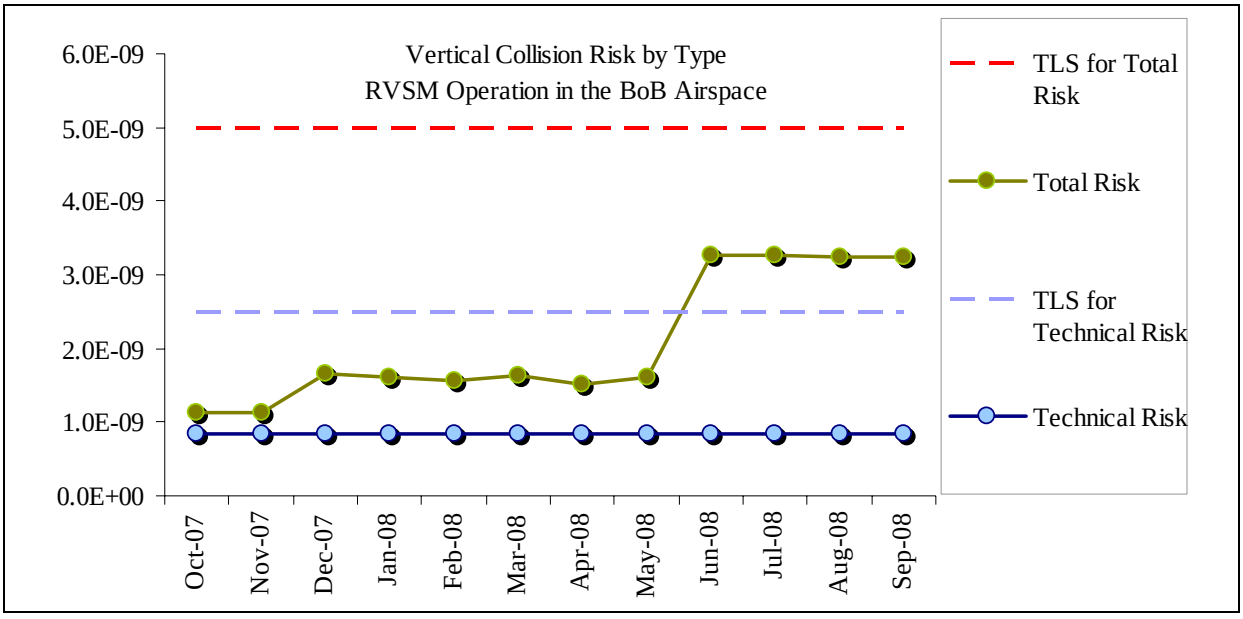

Figure 7: Trends of Risk Estimates for the RVSM Implementation in BOB Airspace

3.42 Based on these collision risk estimates, both technical and total risks for the Bay of Bengal area based on the available TSD and LHD reports, satisfy the agreed TLS value of no more than 2.5×10^{-9} and 5.0×10^{-9} fatal accidents per flight hour due to the loss of a correctly established vertical separation standard of 1,000 ft and to all causes, respectively.

3.43 MAAR reported that, based on available data from States and RMAs, it could be inferred that States may not entirely comprehend the significance and meaning of Large Height Deviation occurrences. In preparing this assessment, MAAR had experienced a number of situations where relevant data had been provided by neighbouring AAMA about risk bearing incidents in the MAAR area of responsibility that had not been reported to MAAR. This clearly supported the concerns previously expressed by RASMAG in relation to under reporting of LHDs by Bay of Bengal States. The meeting strongly recommended that Bay of Bengal States review the definition and reporting requirements for

Large Height Deviations and faithfully provide relevant information to facilitate a statistically reliable safety assessment for this area.

Western Pacific/South China Sea Airspace

3.44 MAAR also provided a summary of airspace safety oversight for RVSM implementation in the Western Pacific/ South China Sea (WPAC/SCS) area. The RVSM safety oversight had been conducted based on a one-month traffic sample data (TSD) collected in December 2007 (with modification according to the new FLAS implemented on 2 July 2008) and the most recent rolling 12 months of Large Height Deviation (LHD) reports between October 2007 and September 2008 submitted by relevant States in the WPAC/SCS region. LHD data from neighbouring RMAs is also reviewed and used in the analysis where applicable.

3.45 The meeting was informed that annual flight hours, calculated based on the December 2007 TSD, were 929,385 hours for the WPAC/SCS airspace, and that LHD occurrences in the WPAC/SCS RVSM airspace could be summarized as follows:

- Compared to the previous 6 monthly assessment, the total LHD duration increased from 154 minutes to 194 minutes and the number of LHD occurrence increased from 49 to 84 occurrences
- Average duration of large height deviation occurrence is 2.31 minutes with maximum of 10 minutes
- Significant portion of large height deviation occurrence (74 of 84 occurrences) as well as duration (175 of 194 minutes) is attributable to coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues (Category E)

3.46 **Table 7** below summarizes the results of the airspace safety oversight, as of May 2008, in terms of the technical, operational, and total risks for the RVSM implementation in the WPAC/SCS airspace.

Western Pacific/South China Sea RVSM Airspace – estimated annual flying hours = 929 385 hours *(note: estimated hours based on December 2007 traffic sample data)*			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
Technical Risk	0.72×10^{-9}	2.5×10^{-9}	Satisfies Technical TLS
Operational Risk	6.16×10^{-9}	-	-
Total Risk	**6.88×10^{-9}**	**5.0×10^{-9}**	**Does not satisfy Overall TLS**

Table 7: Risk Estimates for the RVSM Implementation in WPAC/SCS Airspace

3.47 In addition, **Figure 8** below presents the trends of collision risk estimates for each month using the appropriate cumulative 12-month of LHD reports since October 2007.

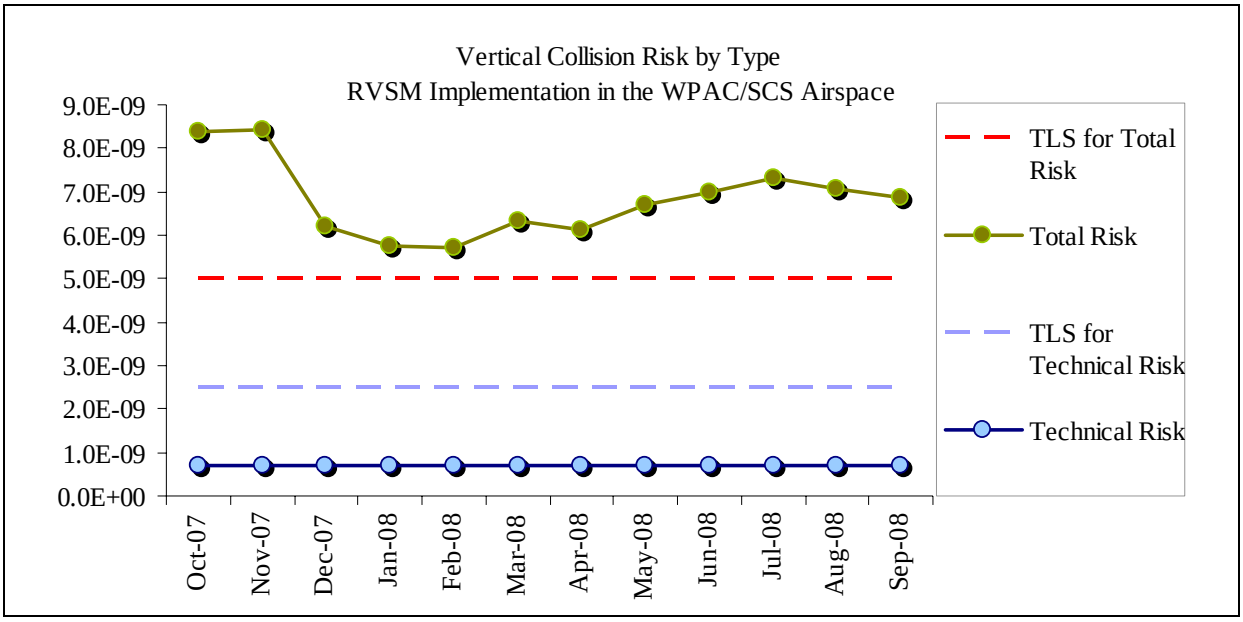

Figure 8: Trends of Risk Estimates for the RVSM Implementation in WPAC/SCS Airspace

3.48 Based on these collision risk estimates, although technical risks from the available TSD and LHD reports satisfy the agreed TLS value of no more than 2.5 x 10^{-9}, total risk does not satisfy the overall TLS of 5.0 x 10^{-9} fatal accidents per flight hour due to the loss of a correctly established vertical separation standard of 1,000 ft and to all causes, respectively. The number of large height deviations related to coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues remains excessive.

3.49 The meeting expressed concern that the TLS was not being satisfied, but recognized that only three months data (July, August and September 2008) was available since the implementation of the revised flight level arrangements on 2 July 2008. As such, it was probably too early to draw any reliable conclusions about the effect of the new flight level arrangements on the overall RVSM safety performance. However the meeting noted that the aggregate LHD duration being reported over the three months was moderate and also noted the relatively higher LHD durations recorded in October and December 2007, as well as March and May 2008 before the implementation of the new flight level arrangements.

PARMO's RMA activities

3.50 The Pacific Approvals Registry and Monitoring Organization (PARMO) provided an update to the meeting including a summary of large height deviation reports, results of traffic data analysis, and an estimate of vertical risk for the airspaces under their responsibility. The report covers the current reporting period from 1 October 2007 through 30 September 2008. The meeting noted that there were thirty four reported large height deviations occurring within Pacific and a portion of North East Asia RVSM airspace during the assessment period.

3.51 Two of these reports were large height deviations that contributed to technical risk. The cause of one deviation was reported to be turbulence or other weather-related causes. The cause of the other deviation was an incorrect setting on the altimeter that led to an overshoot of assigned flight level by 400 feet.

3.52 Reports of thirty-one large height deviations contributing to operational risk were provided to the PARMO with eighteen of these events reported for Pacific airspace and thirteen for a portion of North East Asia airspace.

3.53 Twenty-six of the events that contribute to operational risk were related to air traffic control, thirteen of which occurred in the Pacific airspace and thirteen in the portion of North East Asia airspace. The cause of twenty-two of the twenty-six events were related to errors in coordination of control between ATC facilities, either due to a lack of coordination or an error in the coordination from one ATC to the next. Nine events related to coordination errors occurred in Pacific airspace, and 13 events related to coordination errors occurred in North East Asia airspace. All but one of these twenty-two events were related to human factors issues.

3.54 Two events related to air traffic control were ATC loop errors, these errors occurred in Pacific airspace. Another event related to air traffic control occurred because the controller re-entered the original flight plan flight level information into the ATC automation system instead of the cleared flight level information. The last event related to air traffic control occurred because the controller misunderstood communication from the crew (via satellite phone), understanding it to be the transitioning ATC relaying a request from the aircraft.

Pacific Airspace

3.55 In reviewing the outcomes of the Pacific airspace, the meeting noted that the estimated flying hours in the Pacific is estimated to be 1,508,395 hours per year. The technical risk was estimated to be 0.095×10^{-9} fatal accidents per flight hour. The operational risk estimate is 1.608×10^{-9} fatal accidents per flight hour. The estimate of the overall vertical collision risk was 1.703×10^{-9} fatal accidents per flight hour, which easily satisfies the regionally agreed TLS value of 5.0×10^{-9} fatal accidents per flight hour. This estimate utilizes the most recent 12 months of large height deviation reporting and recently updated collision risk parameters based on the December 2007 traffic samples collected and is shown in **Table 8** below.

Pacific RVSM Airspace – estimated annual flying hours = 1 508 395 hours *(note: estimated hours based on December 2007 traffic sample data)*			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
Technical Risk	0.095×10^{-9}	2.5×10^{-9}	Satisfies Technical TLS
Operational Risk	1.608×10^{-9}	-	
Total Risk	**1.703×10^{-9}**	**5.0×10^{-9}**	**Satisfies Overall TLS**

Table 8: Vertical Collision Risk Estimates for Pacific Airspace

3.56 **Figure 9** below provides a graphical representation of the updated risk estimates for Pacific RVSM airspace based on the recent 12 months of large height deviations.

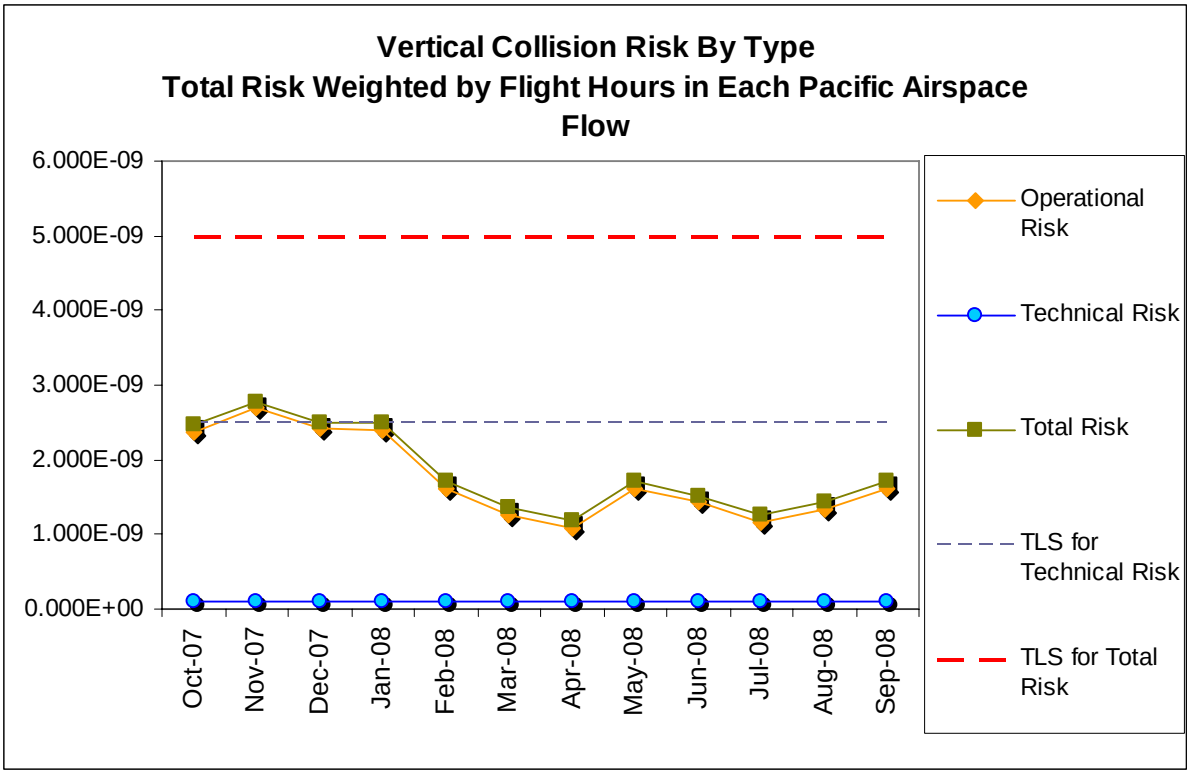

Figure 9: Vertical Collision Risk for Pacific RVSM Airspace

North East Asia Airspace

3.57 In the North East Asia airspace the technical risk is estimated to be 0.177.x 10^{-9} fatal accidents per flight hour. The operational risk estimate is 5.855 x 10^{-9} fatal accidents per flight hour. The estimate of the overall vertical collision risk is 6.033 x 10^{-9} fatal accidents per flight hour. This estimate does not satisfy the regionally agreed TLS value of 5.0 x 10^{-9} fatal accidents per flight hour and is attributable to the numbers and durations of LHDs being reported, of which 100% result from errors in ATC unit-to-ATC Unit coordination. This estimate utilizes the most recent 12 months of large height deviation reporting and recently updated collision risk parameters based on the December 2007 traffic samples collected and is shown in **Table 9** below.

Portion of NE Asia RVSM Airspace – estimated annual flying hours = 112 000 hours *(note: estimated hours based on December 2007 traffic sample data)*			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
Technical Risk	0.177 x 10^{-9}	2.5 x 10^{-9}	Satisfies Technical TLS
Operational Risk	5.855 x 10^{-9}	-	
Total Risk	**6.033 x 10^{-9}**	**5.0 x 10^{-9}**	**Does not satisfy Overall TLS**

Table 9: Vertical Collision Risk Estimates for North East Asia Airspace

3.58 **Figure 10** below provides a graphical representation of the updated risk estimates for North East Asia RVSM airspace based on the recent 12 months reports of large height deviations.

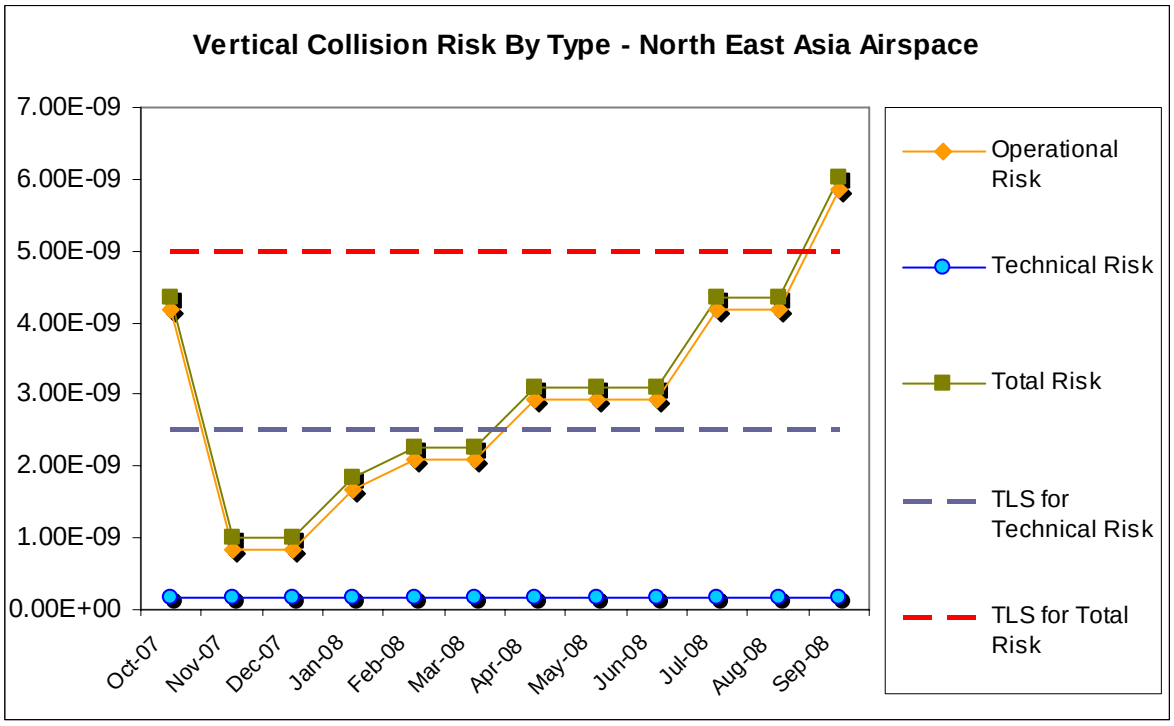

Figure 10: Vertical Collision Risk for North East Asia RVSM Airspace

3.59 In observing that the TLS was not being satisfied for the North East Asia airspace, the meeting recognised that the Incheon FIR was a relatively small airspace and the aggregate flying hours were therefore not large in comparison to the numbers of flights transiting the airspace. This meant that any LHD had a correspondingly higher impact on the TLS because of the lower total hors flown. Additionally, most of the ATS routes involved were bi-directional, meaning that the passing frequency was relatively higher in this airspace. PARMO was conducting investigations into aspects of the FLAS in use with the objective of verifying the parameters being applied and would update the next meeting. The meeting also noted the plans to implement AIDC between Republic of Korea and Japan in the near future which was expected to mitigate some of the ATC Unit-to-ATC Unit coordination errors leading to LHDs in this airspace.

South East Asia SMA (SEASMA) activities

3.60 The SEASMA is responsible for supporting continued safe use of the six major ATS routes in South China Sea international airspace. Accordingly, SEASMA provided an update to the meeting, comprising the periodic examination of flight operations on the six major South China Sea routes to assess compliance with the APANPIRG agreed TLS values for the maintenance of lateral and longitudinal separation standards. APANPIRG/12 (August 2001) under Decision 12/41, agreed "That, a target level of safety of 5 x 10^{-9} fatal accidents per flight hour per dimension be established for en-route systems in the Asia/Pacific Region where a TLS is required for implementation of separation minima.".

3.61 The six South China Sea routes – L642, M771, N892, L625, N884 and M767 – were introduced in November 2001 in order to relieve congestion in the airspace. Radar monitoring of horizontal plane navigational performance was initiated with introduction of the RNAV routes. The enabling Letter of Agreement (LOA) – signed by China, Hong Kong China, Indonesia, Malaysia, Singapore, Thailand, Vietnam, and Philippines – specified details concerning the categories of errors to be monitored and reported to Singapore on a monthly basis. In anticipation of horizontal-plane separation changes being pursued by the ICAO South-East Asia RNP Task Force (RNP-SEA/TF), the LOA was revised in 2008 to formalize certain monitoring activities which had been carried out previously on an

informal basis. The specifics of error-reporting are shown in **Table 10** below. As will be noted, monitoring systems include automatic dependent surveillance – contract (ADS-C) and position reports, in addition to radar.

Type of Error	Category of Error	Criterion for Reporting
Lateral deviation	Individual-aircraft error	15NM or greater magnitude
Longitudinal deviation	Aircraft-pair (Time-based separation applied)	Infringement of longitudinal separation standard based on routine position reports
Longitudinal deviation	Aircraft-pair (Time-based separation applied)	Expected time between two aircraft varies by 3 minutes or more based on routine position reports
Longitudinal deviation	Individual-aircraft (Time-based separation applied)	Pilot estimate varies by 3 minutes or more from that advised in a routine position report
Longitudinal deviation	Aircraft-pair (Distance-based separation applied)	Infringement of longitudinal separation standard, based on ADS, radar measurement or special request for RNAV position report
Longitudinal deviation	Aircraft-pair (Distance-based separation applied)	Expected distance between an aircraft pair varies by 10NM or more, even if separation standard is not infringed, based on ADS, radar measurement or special request for RNAV position report

Table 10 - Reporting Criteria for South China Sea Horizontal Monitoring Program

3.62 The monitoring criteria in Table 10 were chosen to support eventual work by the RNP-SEA/TF to introduce PBN separation standards, specifically RNAV 10-based 50NM lateral and longitudinal separation and RNP 4-based 30NM lateral and longitudinal separation. On 3 July 2008, the first of these separation reductions was introduced; the lateral separation standard between L642 and M771 was changed to 50NM and the preferred basis for longitudinal separation on these routes was changed to distance from time, with the minimum longitudinal separation standard between co-altitude pairs reduced to 50NM.

Reports of Large Lateral Deviations (LLDs) for November 2007 to October 2008 Monitoring Period

3.63 During November 2007, the Singapore Area Control Centre (ACC) reported a lateral deviation of roughly 15NM to the right of L625 detected in an ADS-C report. During December 2007, the Ho Chi Minh ACC reported an approximate 30NM lateral deviation to the left of L625 without clearance.

3.64 The callsigns of the flights involved in the two LLDs were the same. When informed by Singapore about the reported deviations, the operator determined that the crew had entered incorrect routing into the flight management system in one instance, and in the other example the flight had deviated around weather without ATC clearance. The operator would ensure that these scenarios would be the subject of a training session for its crews.

3.65 No further LLDs were reported for the operator, or any other flight, during the monitoring period.

Reports of Large Longitudinal Errors (LLEs) for November 2007 to October 2008 Monitoring Period

3.66 No ANSP reported an LLE in any of the categories shown in Table 10 above during the monitoring period.

Compliance with Lateral TLS

3.67 Lateral compliance was assessed using a sequential sampling technique. Using this approach, examination of the cumulative number of LLDs and corresponding cumulative number of flights observed at any time during the monitoring program leads to one of three conclusions about TLS compliance:

(a) the frequency of occurrence of LLDs implies TLS compliance, or
(b) the frequency of occurrence of LLDs implies non-compliance with the TLS, or
(c) the number of flights monitored is not large enough to conclude whether or not there is TLS compliance.

3.68 **Figure 11** shows a chart which has been updated to reflect the latest available 16 months of monitoring program results for all six RNAV routes. The chart presents a plot of the cumulative number of monitored flights by month beginning on 1 July 2007 and ending on 31 October 2008 together with the corresponding number of cumulative number of reported LLDs. The two parallel sloped lines shown in Figure 111 divide the chart into 3 regions. The region below the lower line corresponds to all combinations of cumulative LLDs and cumulative flights monitored for which it can be concluded that the lateral TLS is met, as is shown by the label in this region. As can be seen, the South China Sea RNAV route performance complies with the lateral TLS.

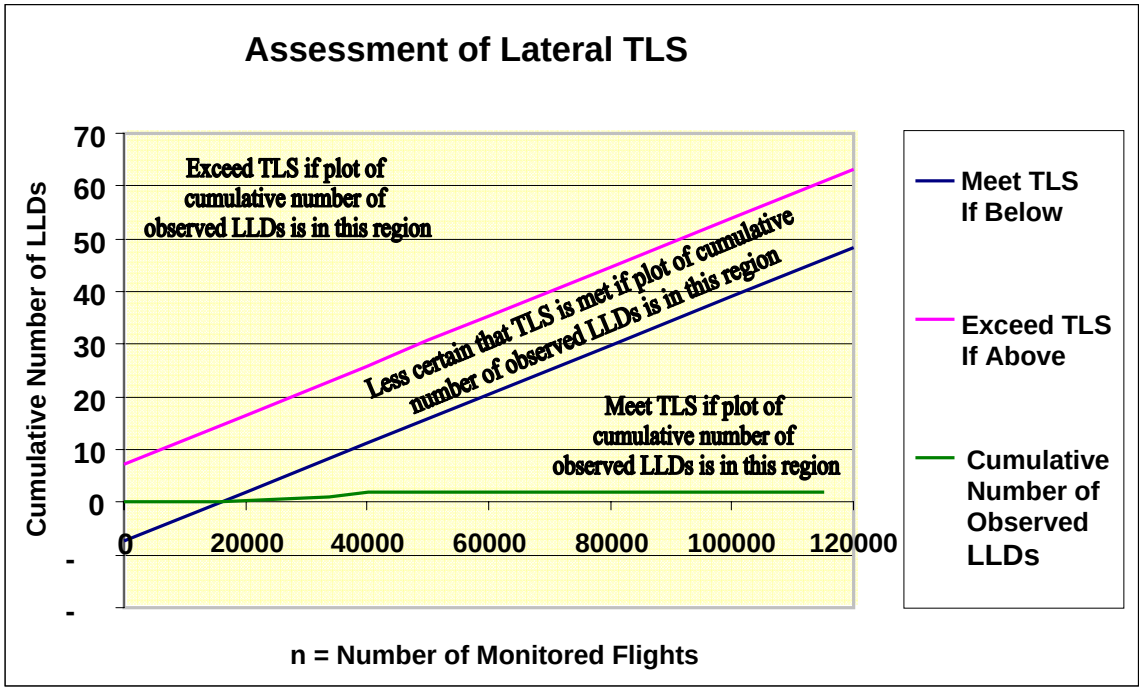

Figure 11 - Assessment of Compliance with Lateral TLS Based on Cumulative Number of LLDs Observed During South China Monitoring Program

Compliance with Longitudinal TLS

3.69 There have been no LLEs reported for any of the longitudinal-separation categories of Table 10 (above) reported since the inception of the South China Sea monitoring program in November 2001. The safety assessment presented at RASMAG/9 used this fact to take a conservative approach to estimating the frequency of individual-aircraft 3-minute or greater unexpected longitudinal errors at compulsory reporting points to produce a cautious estimate of longitudinal collision risk for operations on L642 and M771 which was about 57 percent of the longitudinal TLS value.

3.70 Using the same conservative approach with the latest monitoring program results would result in a risk estimate even less than that presented in the safety assessment at RASMAG/9. As a result, the outcome of longitudinal collision risk is that the longitudinal TLS is met.

3.71 The meeting was pleased to note the SEASMA findings that safety performance on the six parallel RNAV routes in the South China Sea area satisfies the regional TLS for both the lateral and longitudinal dimension. The meeting recognized that the SEASMA assessment covered all of the six parallel routes, not just the two routes (L642 & M771) where 50 NM/50 NM reduced separations had already been implemented. As such, the safety assessment demonstrated that it was possible to move to 50 NM/50 NM implementation throughout the parallel route structure as soon as appropriate ground based infrastructure was available to support such implementation.

Acknowledge work of monitoring agencies

3.72 The meeting expressed strong appreciation for the continuous work conducted by the RMAs and EMAs serving the region. Assessment and monitoring activities had reached an evident level of maturity which led to valuable insight into the underlying causes of the problems being reported and implementation of useful remediations. RASMAG relayed its thanks to the agencies concerned for their professionalism and hard work. Noting that in many cases costs for operating these agencies were

absorbed by a few States on behalf of many others, RASMAG also acknowledged the valuable and ongoing commitment to regional civil aviation operations exhibited by these States.

Agenda Item 4: Airspace safety monitoring documentation and regional guidance material

SMA/EMA Handbook

4.1 In an effort to support expansion of horizontal monitoring capabilities, some time ago RASMAG had commenced preparation of a regional handbook (hereinafter 'SMA Handbook') and/or guidance material for regional SMAs that would undertake safety assessment and monitoring in the horizontal plane. Review of an advanced draft of the SMA Handbook during RASMAG/9 recognized the need for additional material to be included and the RASMAG drafting team was requested to continue work on the document with the objective of enabling RASMAG/10 to accept a final version for review and recommendation to APANPIRG in due course as regional guidance material.

4.2 The discussions held by RASMAG/10, as described in paragraphs 5.1 to 5.7 below, led to a change in name from SMA to En-route Monitoring Agency (EMA). Accordingly, the meeting updated the advanced draft of the Handbook to reflect the name change to EMA and considered that the version shown as **Appendix D** comprised a functional final draft of the Handbook. Subject to a comprehensive editorial makeover, this version would be finally updated by RASMAG/11 and recommended to APANPIRG/20 during September 2009 for adoption as regional guidance material. In making such recommendation, the meeting recognized that this was the first such document in the region and that, as experienced developed in horizontal plane monitoring, further development and amendment to the Handbook would be necessary.

4.3 The meeting agreed that the small drafting team doing this work would complete remaining editorial work prior to the next meeting, with the objective of presenting a final version of the document to RASMAG/11. The meeting encouraged participants to further review the EMA Handbook prior to the RASMAG/11 meeting in June 2009 as, at that time, the APANPIRG Conclusion to adopt the Handbook would be drafted by RASMAG.

PBN Regional Implementation Plan

4.4 The Ninth Meeting of RASMAG (RASMAG/9, May 2008) studied the outcomes of the PBN TF/1 and TF/2 meetings (January and April 2008, respectively) and noted the excellent progress being made by the Task Force towards drafting the Regional and State PBN Implementation Plans. RASMAG/9 proposed a draft inclusion as Section 9 *Safety Assessment and Monitoring Requirements* of the Regional PBN Implementation Plan for consideration by the next PBN/TF meeting.

4.5 PBN/TF/3 (July 2008) reviewed the text proposed by RASMAG/9, noting that the text summarized the ICAO requirements. Accordingly, PBN/TF/3 incorporated the draft text from RASMAG as Section 9 of Regional PBN Implementation Plan.

4.6 PBN/TF/3 also requested APANPIRG to consider incorporating all the assessment and monitoring requirements and activities for PBN applications into the RASMAG role. The CNS/MET/SG/12 meeting (July 2008), also discussed the proposals from PBN/TF/3 that APANPIRG task RASMAG with the conduct of the assessment and monitoring for PBN implementation.

4.7 APANPIRG/19 recognized that as the PBN/TF/3 meeting had been held in July 2008, after RASMAG/9 in May 2008 and ATM/AIS/SAR/SG/18 in June 2008, these two Sub-Groups had not had the opportunity to review the proposed Regional PBN Plan. Consequently, APANPIRG/19 considered it more appropriate to adopt the regional plan as an 'interim' edition, pending review by

RASMAG and ATM/AIS/SAR/SG. APANPIRG/19 adopted the interim edition under Conclusion 19/25 and urged States to review the interim plan, provide feedback to ICAO Regional Office and use the interim plan as a basis for developing national PBN Implementation Plans.

4.8 The meeting reviewed the interim edition of the regional PBN plan and proposed additional text for Section 9 - *Safety Assessment & Monitoring Requirements* to clarify that the responsibility for safety assessment and ongoing monitoring lies with the implementing States, not with RASMAG. States are encouraged to coordinate with RASMAG regarding the en-route safety assessment and monitoring requirements and methodologies. The meeting also proposed a number of editorial updates, as shown in **Appendix E,** and requested that the Secretariat provide the RASMAG proposals as a working paper to the PBN/TF/4 meeting scheduled in March 2009 for their consideration.

Regional Impact Statement for RVSM long term Height Monitoring

4.9 The meeting recalled that as a result of its review of these matters, APANPIRG/18 had recognised that the pending implementation of global long term monitoring requirements would have significant impacts in the way regional monitoring was managed, including the need for widespread regional height monitoring infrastructure capability to be made available. Under the terms of Conclusion 18/4, APANPIRG had tasked Asia/Pacific RMAs in conjunction with RASMAG to prepare a regional impact statement summarizing the estimated consequences for the Region, including consideration of the numbers of airframes required to be monitored.

4.10 RASMAG/8 had commenced work in this regard, identifying six Long Term Height Monitoring (LTHM) Actions which had subsequently been circulated by ICAO State Letter (Ref: T3/10.1.17 – AP018/08 ATM) during January 2008. Regrettably, as a result of high workloads on all the RMAs and the Regional Office, work had stalled in respect to the formulation of a regional impact statement. The meeting agreed that APANPIRG/19 in September 2008 should be informed about the 6 LTHM Actions agreed by RASMAG/8 and that RASMAG was still attempting to progress work in this respect.

4.11 The meeting reviewed reports from some of the RMAs that provided data on likely monitoring burdens resulting from the Annex 6 requirements, and plans to implement monitoring activity. It was evident that useful progress had been made and agreement was reached that a drafting sub-group led by the AAMA would draft the monitoring impact statement for consideration by RASMAG/11. The meeting agreed that the sub-group would be made up of single representatives from each of the 5 RMAs (namely Mr Butcher, Mr Tang Jinxiang, Mr Yanpirat, Mr Oseto, and Ms Falk), the Secretary and Mr Farmer from New Zealand. A first draft would be provided by the AAMA for review by the drafting sub-group by the end of February with a mature draft available for distribution to RASMAG members by email at the end of April 2009 so that the document can be reviewed prior to RASMAG/11.

RASMAG List of Competent Airspace Safety Monitoring Organizations

4.12 RASMAG is required by its terms of reference to recommend and facilitate the implementation of airspace safety monitoring and performance assessment services and to review and recommend on the competency and compatibility of monitoring organizations. Accordingly, the meeting reviewed and updated the *"RASMAG List of Competent Airspace Safety Monitoring Organizations"* (shown at **Appendix F**) for use by States requiring airspace safety monitoring services.

Agenda Item 5: Airspace safety monitoring activities/requirements in the Asia/Pacific Region

Horizontal safety assessment and monitoring – Matters for clarification

5.1 RASMAG had long recognized that although arrangements for monitoring in the vertical plane (RVSM) using RMAs were comparatively advanced, there was a need to further develop regional safety assessment and monitoring capability in the horizontal plane (i.e. lateral and longitudinal). A number of areas required clarification, covering both the administrative and technical aspects of horizontal monitoring. The issue had been brought to APANPIRG's attention previously, resulting in the following Decision, taken during August 2005:

APANPIRG Decision 16/1 – Safety Monitoring Agency (SMA)

That, the term Safety Monitoring Agency (SMA) be used to describe an organization approved by regional agreement to provide airspace safety monitoring and implementation services for international airspace in the Asia/Pacific region for implementation and operation of reduced horizontal separation.

5.2 It was clear that the intent of this decision was that Asia/Pacific SMAs would be *"approved by regional agreement"* i.e. an APANPIRG approval in a similar manner to the process adopted for RVSM RMAs. In relation to vertical monitoring, the meeting recognized that the RMA requirements were precipitated, in part, by the Standard in Annex 11 that required RVSM monitoring to be conducted on a 'regional' basis – Annex 11, paragraph 3.3.5.1 refers. However, although horizontal monitoring was also required under ICAO provisions, the stipulation that the monitoring be conducted on a regional basis was not made – meaning that each State could conduct the monitoring on an individual basis. Notwithstanding, the meeting recognized that, for many of the States with smaller airspaces, to conduct monitoring individually would not be as efficient and effective as working together in a sub regional manner.

5.3 However, adopting such an approval mechanism could mean that APANPIRG would essentially need to replicate the mechanisms that were in place for RVSM safety assessment and monitoring throughout the region – with the associated time, administrative and cost burdens. The meeting recognized that horizontal safety assessment capability was essential in implementing reduced horizontal separations, but sought to avoid the additional and onerous aspects that could potentially result from adoption of an "APANPIRG Approval" process for SMAs.

5.4 Recognizing that there was no primary ICAO provision requiring regional approval for horizontal safety matters, RASMAG was of the view that a suitable 'approval' process could be adequately managed under the auspices of RASMAG. Accordingly, RASMAG would recommend to APANPIRG that requirements for the regional agreement of SMAs, as described in Decision 16/1, be set aside. Instead, RASMAG would take responsibility for ensuring that horizontal assessment and monitoring matters proceed appropriately in the region, based on the collaborative activities and working methods already established and followed so successfully by regional RMAs. Appropriate horizontal monitoring agencies would be included on the RASMAG *List of Competent Airspace Safety Monitoring Organizations* once RASMAG was satisfied that their capabilities were adequate.

5.5 In relation to technical matters, the meeting noted the excellent progress that had been made with the draft SMA Handbook, as recorded in Agenda Item 4 above. Safety aspects of the recent implementation of 50 NM/50 NM separation on L642 and M771 in the South China Sea had been very capably managed by the SEASMA hosted by the Civil Aviation Authority of Singapore and the documentation prepared and experiences gained had been recorded in the SMA Handbook.

5.6 The meeting noted that the term Safety Monitoring Agency, which had been adopted under Conclusion 16/1 for regional horizontal monitoring agencies, also had a meaning in common English language which applied equally to all safety monitoring agencies, be they for vertical, horizontal, data link or other safety monitoring. The Secretariat reported that this had caused confusion in a number of forums and required regular explanation. The meeting agreed that a more suitable name would be appropriate for horizontal monitoring agencies and, in order to clarify that the function presently intended and supported by RASMAG was confined to horizontal aspects of en-route operations, the meeting agreed to discard the term SMA and replace it with the term En-route Monitoring Agency (EMA).

5.7 In order to bring to APANPIRG's attention the recommendations from RASMAG that the requirement for horizontal monitoring agencies to be approved by regional agreement be set aside and the naming convention be clarified by adoption of the term En-route Monitoring Agency, RASMAG agreed to the draft Decision below. It is the intention of RASMAG that this Decision replaces APANPIRG Decision 16/1

Draft Decision RASMAG/10-2 – En-route Monitoring Agency (EMA)

That the term En-route Monitoring Agency (EMA) be used to describe an organization providing airspace safety assessment, monitoring and implementation services for international airspace in the Asia/Pacific region to support implementation and operation of reduced horizontal (lateral and longitudinal) separation.

Management of 100 foot misalignment between metric/imperial FLAS

5.8 IATA had drawn the attention of the RASMAG/9 meeting to the fact that following the implementation of RVSM in China using a unique FLOS, operational errors between a Chinese FIR and an adjacent FIR applying the traditional ICAO RVSM FLOS could result in the aircraft being misaligned by 100 feet. For example, an aircraft that was required to transition to FL331 from FL330 (or vice versa) but failed to do so would be misaligned by plus (or minus) 100 feet.

5.9 Based on the information to hand, RASMAG/9 concluded that:

a) The misalignment of 100 feet was an operational error and therefore should be identified and addressed by State and airline safety management systems, with remedial measures applied accordingly, and

b) The globally recognized collision risk model applied for the RVSM had been developed over a long period of time and used an empirical basis coupled with robust mathematical methodologies to exclude height deviations of less than 300 feet for the assessment of operational errors. However, the technical risk component considers all errors, including 100 foot errors, in its assessment. This determination of the assigned altitude deviation (AAD) is statistically combined with the altimetry system error (ASE) and assures that the total vertical error (TVE) distribution includes estimates of this nature of behavior, complete with its relative proportion.

5.10 RASMAG/9 considered that as any individual occurrence of this type of event was eligible for resolution under normal State and airline safety management processes, there was no cause for concern in relation to current operations. However, it was recognized that there was absence of accurate information about the number and circumstances in which these types of events were occurring and further study should be conducted.

5.11 The China RMA informed the meeting about the outcomes from an extensive study and quantitative analysis recently completed by China in relation to this issue. China RMA had identified that the misalignment would influence the 'Probability of Vertical Overlap' parameters in the Reich collision Risk model.

5.12 Radar data from Upper Control Area of Beijing, Guangzhou, Shanghai (include Shanghai, Zhengzhou, Jinan, Qingdao and Xiamen) was collected for the month of August 2008. These regions include much of eastern of China, are the busiest regions of China's airspace and include many of the transition areas between the metric FLAS and imperial FLAS. The total number of flights in the data set used in the analysis is 46266 flights, which China RMA considered to be an adequate sample size.

5.13 Using the Chinese Altimetry System Errors which were estimated by FAA Technical Center during the Chinese pre-implementation safety assessment and applying techniques also use by the FAA, China RMA calculated the frequency histogram of Assigned Altitude Deviation, as presented in the following Table:

Deviation (ft)	Computed Chinese Frequency	US Post Frequency from FAA
-500	0	2142
-400	2	2070
-300	16	3266
-200	32	80353
-100	21305	9339382
0	1924960	497378912.
100	20719	8152080
200	62	52540
300	26	7187
400	6	2889

Table 11: AAD histogram Computed Form Collected Radar Data, Compare with the US AAD histogram

5.14 The AAD histogram in the right row of Table 11 above is the US post AAD which were obtained from the FAA Technical Center. It was noted that the shape of the Chinese and US post AAD histogram are similar, with the percentage of zero feet deviation being about 97.86% and 96.57%, and the sum percentage of -100,0,+100 feet deviation is more than 99.9% both in Chinese and US post AAD histogram.

5.15 Additional analysis techniques were also applied by the China RMA, including Folded Goodness of Fit Plots based on the Chinese AAD histogram and a Modeled Distribution, using a logarithmic scale. Recalculation of the of the risk estimates based on the parameters derived during analysis resulted in essentially the same outcome as the methodology applied, demonstrating that the risk estimates continue to satisfy the TLS.

5.16 The meeting thanked China RMA for their additional efforts in investigating this issue so thoroughly, noting that based on the quantitative analysis, fitting distribution and technical risk comparison the analysis into the misalignment of 100 feet does not demonstrate any influence (positive or negative) on safety performance for the sovereign Chinese airspace and that the China RMA therefore does not recommend reporting these events as LHDs.

5.17 The meeting also noted that no reports of operational errors involving a 100 foot misalignment situation had been received by Asia/Pacific RMAs in the 12 months since the RVSM implementation in China. Discussion amongst the RMAs led to agreement that, based on the evidence to

hand, the 100 foot misalignment did not pose a safety risk and, although such situations should be treated under normal safety management system processes, they should not be reported as LHDs.

5.18 The China RMA would continue to carefully monitor this situation and would bring any concerns to the attention of RASMAG.

Use of ADS-B data for monitoring Altimetry System Error (ASE)

5.19 The meeting recalled that previous meetings of RASMAG had received information from both the AAMA and PARMO regarding research being undertaken by those organizations to establish the validity of using ADS-B data for ASE monitoring. PARMO informed the meeting that the FAA Technical Center presented a working paper to the Fourteenth Meeting of the Separation and Airspace Safety Panel Working Group of the Whole (SASP-WG/WHL/14) with details of initial test flights conducted to investigate the use of Automatic Dependent Surveillance – Broadcast (ADS-B) data for the estimation of aircraft ASE. The results of these initial test flights showed that the use of ADS-B for estimating aircraft ASE appeared promising. However, all of the initial test flights were completed using GPS receivers equipped with Wide Area Augmentation System (WAAS) corrections. The FAA Technical Center conducted additional test flights with the WAAS corrections disabled. The purpose of these additional test flights was to determine whether ADS-B derived aircraft geometric height data obtained from a GPS receiver with WAAS corrections or without WAAS corrections are sufficient for estimating aircraft ASE.

5.20 Initial results showed that the ADS-B derived aircraft geometric height data obtained from both ADS-B data sources (UAT and 1090 ES) are sufficient for estimating aircraft ASE. Since the WAAS enabled ADS-B source of aircraft geometric height was proven to be as good as the same obtained from the EGMU, a source that has been proven reliable in the estimation of aircraft, comparisons between the WAAS enabled and WAAS disabled ADS-B sources with the truth data were examined from the additional test flights. WAAS corrections may not always be applied in a 1090 ES system, which may lead to differences in the geometric heights collected by the system.

5.21 Three additional test flights were conducted by the FAA Technical Center with the WAAS corrections disabled to determine whether the ADS-B aircraft geometric height obtained from all 1090 ES systems are suitable for estimating aircraft ASE. The additional analysis is critical because the operations conducted within RVSM flight levels, FL290 through FL410, require periodic monitoring for ASE performance. If aircraft geometric height data obtained from ADS-B were used for the RVSM operations, the data would be in the 1090 ES format. For the additional test flights, aircraft geometric height data were collected from a total of 10 level flight segments. The results from the three additional test flights, with the WAAS corrections disabled are shown in Figure12 below. The box plots in Figure 12 show the ranges of the data sets. The horizontal bars above and below the boxes represent the highest and lowest value of the data sets respectively. The bottom and top of each red box is the lower and upper quartile respectively. The distance between the lower and upper quartile, the inter-quartile range, provides a measure of the spread of the distribution. The white line in the center of the red box is the median of the data.

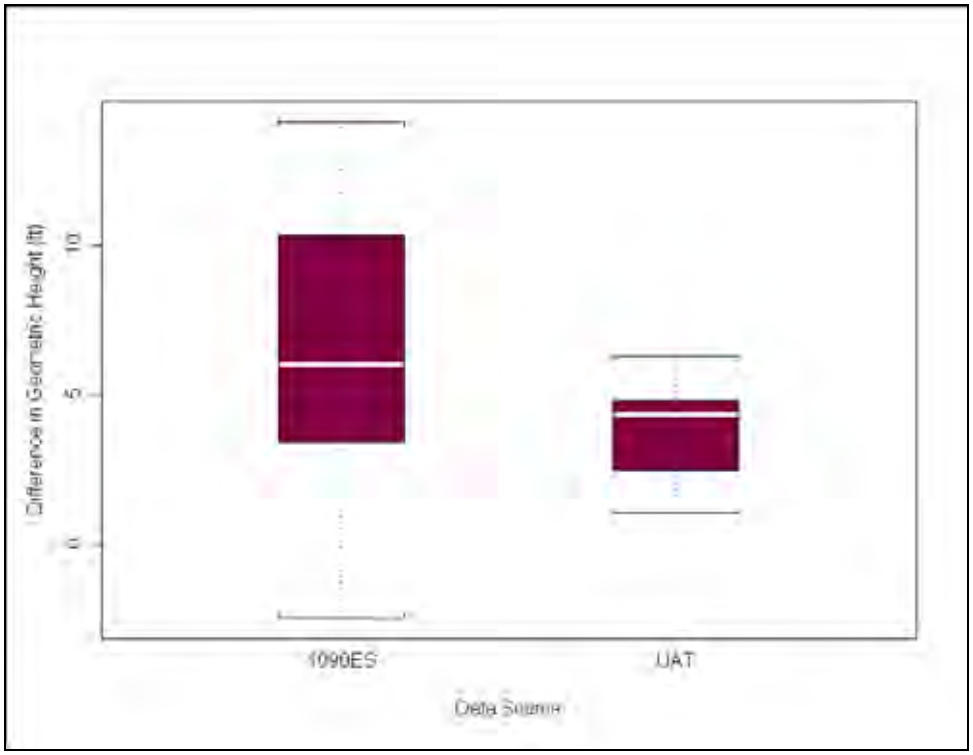

Figure 12. Box Plots of the 1090 ES and UAT Aircraft Geometric Height Differences from Truth Data for Test Flights with WAAS Corrections Disabled (1090ES) and Enabled (UAT)

5.22 The results of this test indicate the means of the 1090 ES without WAAS corrections and the UAT with WAAS corrections are not significantly different. Therefore, the successful comparisons with the UAT system are enough to demonstrate that the WAAS disabled, or aircraft geometric height data obtained from a system without WAAS corrections is sufficient for estimating aircraft ASE. While further research and validation is still required, the meeting noted with confidence that ADS-B was a possible means by which ASE monitoring can be achieved and encouraged the United States and Australia to progress this work.

Installation of HMUs in Japan

5.23 Japan informed the meeting that projects to install ground-based height monitoring units (HMUs) and introduce height monitoring systems (HMS) are currently underway for the purpose of monitoring of aircraft height-keeping performance. Japan plans to install three ground-based height monitoring units (HMUs) in the Japanese airspace. The first HMU will commence operations in the second quarter of 2011, the second and the third HMUs will commence operations in the second quarter of 2012. At the moment, development of HMU specifications and system design is going on.

5.24 The proposed location of HMUs is described in **Figure 13** below. These locations were decided in consideration of traffic volume and a level flight segment for most affected flights.

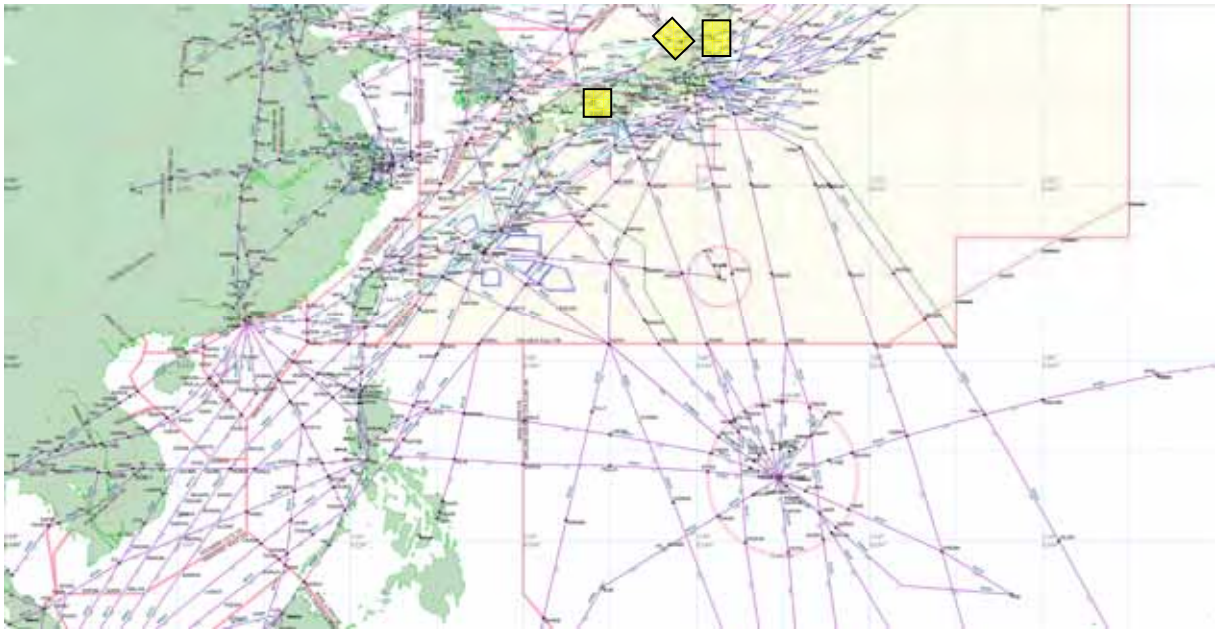

Figure 13: Proposed locations of HMUs in Japan

5.25 There is a slight possibility that the beginning of HMU operations will fail to meet the target date of 18 November 2010 Annex 6 amendment. Countermeasures against this problem e.g. an expedited installation schedule, are being developed to address this possibility.

Traffic Sample Data – State Letter

5.26 The meeting recalled that in considering the requirements for routine safety assessment, RASMAG/2 (October 2004) agreed that an annual provision by States of Traffic Sample Data (TSD) as well as ongoing provision of Large Height Deviation (LHD) and Gross Navigational Error (GNE) reporting – including NIL reporting -was sufficient for vertical and horizontal safety analysis. Under Conclusion 16/4 APANPIRG/16 (August 2005) agreed that the month of December every year be adopted as the standard sample period for vertical and horizontal traffic sample data collection, commencing from December 2005.

5.27 In this regard the Regional Office had issued State Letter Ref.: T3/10.0, T3/10.1.17 – AP169/08 (ATM), dated 26 November 2008, requesting submission of December 2008 TSD to relevant regional monitoring agencies before the end of January 2009. A copy of the letter is included as **Appendix G.**

Expand December TSD for airspace planning

5.28 The ICAO Asia/Pacific Air Traffic Flow Management (ATFM) Seminar/Workshop was held in Fukuoka, Japan from 7 to 9 October 2008. The ATFM Seminar/Workshop recognized the fundamental and critical need for accurate and timely data to be continuously available to support implementation and ongoing ATFM operations. This was essential in two aspects:

a) Static data identifying historical traffic loadings, for use as strategic planning and trend analysis, and

b) Dynamic real time data that was used for the tactical management of traffic in terms of commencement of ATFM measures

5.29 The ATFM Seminar/Workshop recognized that as a result of the Annex 11 provisions requiring that RVSM monitoring be conducted on a regional basis, APANPIRG/16 had endorsed the use of a standardized approach to the sampling of vertical and horizontal traffic data under the terms of Conclusion 16/4, adopting the month of December every year for the collection of a one month traffic sample data by all Asia/Pacific States. Although this data was currently used exclusively for airspace safety monitoring purposes, the ATFM Seminar/Workshop considered it likely that this annual traffic count would provide a very useful source of data for airspace planning purposes in general and specifically to identify peak traffic loadings for ATFM purposes.

5.30 Consequently, the ATFM Seminar/Workshop recommended that RASMAG review the situation, with the objective of expanding the use of the annual December RVSM data collection for airspace implementation planning and implementation in general (ATFM, PBN, ATS routes etc) and, under supervision of the Regional Office, enabling this data to be made available to implementation groups as required to support all regional ATM implementations.

5.31 After considering this proposal the meeting gave in-principle agreement to the concept. However, beyond agreeing to a standardized template for the annual December traffic sample data gathering that also included a column to record the en-route PBN approvals status of each flight (as discussed in paragraph 2.15 above), regional RMAs were not able to accommodate extra workload or responsibilities in gathering and managing data. Release of data would need to be authorized by an appropriate oversight body, such as the Regional Office. Additionally, RMAs also preferred that wherever possible implementing agencies obtained data directly from the States or parties involved in each implementation. The meeting agreed to the following draft Decision in this respect:

Draft Decision RASMAG/10-3 – Expand use of safety monitoring data

That the arrangements for annual month of December traffic sampling by all States to satisfy airspace safety monitoring analysis as called for by APANPIRG Conclusion 16/4 be expanded to enable this data to also be used for airspace planning and implementation purposes. This will apply only where such data is not otherwise available to regional or State implementing bodies and only with specific authority of the ICAO Asia/Pacific Regional Office.

Agenda Item 6: Review and update RASMAG Task List

6.1 In reviewing the RASMAG task list, the meeting was informed about the status of items considered complete and suitable for closure as well as those remaining open, noting the progress that had been made. Arising from the discussions during the meeting, a number of additional work items were added to the list. The meeting agreed that the updated task list included as **Appendix H** accurately reflected the work programme of RASMAG.

Agenda Item 7: Any other business

Review of AIDC implementation status

7.1 The meeting reviewed information on the status of regional implementation of ATS Interfacility Data Communications (AIDC), noting that the most up to date information was contained in the FASID Table CNS – 1E, *ATS Inter-facility Data Communication (AIDC) Implementation Plan.*

7.2 APANPIRG expressed concern that coordination errors across FIR boundaries remain the most crucial aspect of APAC regional RVSM operations, and identified automation using AIDC as a means of mitigating errors observed in controller to controller verbal communication. APANPIRG was of the opinion that introduction of AIDC between ATS facilities would significantly reduce the coordination errors observed in controller to controller verbal communication across FIR boundaries. APANPIRG/19 reiterated that States should work towards implementation of compatible AIDC capabilities between neighboring ATS facilities as soon as possible in accordance with the regional air navigation plan and the available ICAO guidance material on AIDC including the Asia/Pacific AIDC ICD. In view of the foregoing, APANPIRG/19 adopted the following Conclusion:

Conclusion 19/19 - Implementation of AIDC in Asia and Pacific Regions

That, States be urged to expedite implementation of AIDC between neighboring ATS facilities in accordance with the Regional Air Navigation Plan and the Asia/Pacific AIDC ICD.

Status of implementation of ADS-B In-Trail Procedures

7.3 The United States FAA Surveillance and Broadcast Services (SBS) programme has, *inter alia*, been developing a number of airborne ADS-B applications that should provide benefits to operators who chose to equip their aircraft with appropriate avionics including "ADS-B In" (i.e., the ability to receive, process and display ADS-B data from surrounding aircraft). One such airborne ADS-B application being developed is known as ADS-B In-Trail Procedures (ITP).

7.4 Aircraft operating in airspace without ATC surveillance are frequently held at non-optimal flight levels due to conflicting traffic either at the optimal flight level or flight levels between the existing flight level and the optimal flight level. Traffic conflicts can be more common in non-surveillance airspace because of the large separation standards in use. ADS-B ITP will enable flight level changes for aircraft equipped with ADS-B receivers and on-board automation and has been under development for more than 4 years.

7.5 ADS-B ITP is comprised of a set of six flight level change geometries with the specific geometry dictated by whether the ITP aircraft desires to climb or descend and its proximate relationship with the other aircraft:

- Leading climb
- Following climb
- Combined climb
- Leading descent
- Following descent
- Combined descent

7.6 For ADS-B ITP the maneuvering (trailing or leading) aircraft obtains the flight identification (ID), altitude, position and ground speed of the non-maneuvering (leading or trailing) aircraft from ADS-B data. Based on the ADS-B data from the non-maneuvering or reference aircraft, a pilot can make an ITP altitude change request to ATC. The controller, who maintains separation responsibility at all times, would verify that the ITP flight and the reference aircraft were same track and that the maximum closing mach differential was not exceeded. This check is to account for potentially unsafe closure rates due to abnormal, adverse wind gradient conditions. If the controller determines that

standard separation minima will be met with all aircraft other than the ITP reference aircraft, a clearance for the climb or descent may be issued.

7.7 Work has been ongoing in the ICAO Separation and Airspace Safety Panel (SASP) since the tenth meeting of the SASP working group of the whole (WG/WHL/10) held in Australia in November 2006. The SASP agreed that there was a need to develop procedures and material for inclusion in Doc 4444 PANS-ATM in addition to work being undertaken concurrently to establish the separation minima by collision risk modeling. To this end, the longitudinal subgroup of SASP has developed a PANS-ATM amendment with the intent that these will set the requirements for the implementation of ADS-B ITP by Regions or States. The results of this work can be found in a recently completed ADS-B ITP Circular approved by SASP. Additionally, both RTCA and EUROCAE have recently approved and published safety, performance and interoperability requirements documents for ITP which are contained in documents DO-312 and ED-159, respectively.

7.8 The United States desires to lead an operational evaluation of ADS-B ITP along South Pacific (SOPAC) routes within the next two years. The FAA is in the early stages of forming a partnership that would be focused on performing the work necessary to conduct this operational evaluation. These steps include, but are not limited to, development and certification of onboard systems that provide the ADS-B ITP criteria and display that information to the pilot. A variety of retro-fit system interface options are being evaluated by the FAA and a number of avionics vendors. Other work required will include performing all required safety analyses, obtaining FAA aircraft certification and flight standards approvals, and working with the international community on the development and approval of applicable separation standards.

Oceanic Separation Reduction Working Group (OSWRG) Scrutiny Group

7.9 The United States presented a summary of recent system performance related to the operational trial of 30 NM lateral / 30 NM longitudinal separation standards in the Oakland Oceanic Flight Information Region (FIR) and the application of the 50 NM longitudinal separation standard in the Anchorage Oceanic FIR. The summary data were prepared for the Oceanic Separation Reduction Working Group Scrutiny Group, which evaluates performance of various system components that support the reduced separation minima. Included in the review were summaries of data link service provider performance, observed weather deviation practices, and anomalies or unanticipated differences in certain aspects of system performance.

7.10 Currently, there are approximately 19,000 flights per month, or 630 flights per day transiting the airspace contained within the Oakland FIR. Of these flights, approximately 45 percent use ADS-C to report position and 55 percent use HF radio to report position. From the roughly 250 flights per day that utilize ADS-C, approximately 35 and 65 percent had filed RNP 4 and RNP 10, respectively, in their flight plans. The Ocean21 system automatically sets the periodic reporting rate for the aircraft filing RNP 4 to be 832 seconds (13.86 minutes). The periodic report rate for the aircraft filing RNP 10 is set to 1600 seconds (26.67 minutes).

7.11 In relation to the Anchorage Oceanic FIR, there are approximately 4,600 flights per month, or 150 flights per day transiting the FIR. Of these flights, approximately 70 percent are utilizing ADS-C to report position and 30 percent are utilizing HF radio to report position. From the roughly 110 flights per day that utilize ADS-C, approximately 30 and 70 percent had filed RNP 4 and RNP 10, respectively, in their flight plans.

ANC Laurel Award

7.12 The ICAO Air Navigation Commission Laurel Award, in the form of a gold statuette, is bestowed on an individual or group who has made an outstanding contribution to the work of the Commission, including through its panels, study groups, worldwide meetings, or any appropriate manner, in furthering the safety, regularity and efficiency of international civil aviation. The first ANC Laurel Award was conferred in 1999, the Air Navigation Commission's fiftieth anniversary year.

7.13 During September 2008, the Fifth ANC Laurel Award was conferred by the ANC on Mr. Brian Colamosca who, until his recent retirement from the FAA, was a long term expert participant at RASMAG meetings. The Laurel Award recognizes Mr. Colamosca's outstanding contribution to the work of the Commission in the field of Reduced Vertical Separation Minimum (RVSM) as well as his overall contribution to the safety, regularity and efficiency of international civil aviation through his efforts in the global arena, particularly through RVSM implementation in the North Atlantic and Pacific Regions.

7.14 The meeting recorded their warmest congratulations and best wishes to Mr. Colamosca on the achievement of this award, a well deserved recognition of his continuous efforts in support of the Asia/Pacific region through his dedication and commitment to the work of RVSM in general and RASMAG in particular.

Agenda Item 8: Date and venue of the next RASMAG meeting

8.1 The meeting acknowledged the value of the RMA technical meeting being the first day of each RASMAG meeting, specifically as this meeting during RASMAG/10 had enabled Asia/Pacific RMAs to deal with a range of issues on a face-to-face basis. The meeting agreed that RASMAG/11 would retain this format. Noting it was likely that a Global RMA meeting would be scheduled in the period 20-22 May 2009 as part of the SASP meeting 25 May – 5 June 2009 in Montreal, Canada the meeting agreed that RASMAG/11 would be held from 8-12 June 2009, at the Regional Office premises.

8.2 The Secretariat would make appropriate arrangements and issue meeting invitations in due course that noted that the first day was set aside for the combined RMAs technical meeting.

9. Closing of the meeting

9.1 The Chairman, Mr. Butcher, thanked the meeting participants for their valued input to a busy work program that resulted in agreement on a number of important issues and the progression of a number of RASMAG documents including the EMA Handbook and Long Term Monitoring Impact Statement. He noted the excellent work undertaken by the RMAs and the fact that in many of the region's FIRs the TLS was being met, and that in those where this was not the case the RMAs had implemented detailed analysis of errors to understand and resolve factors driving the increased risk estimates.

9.2 The Chairman also noted the work completed during the meeting to review and provide material for the PBN Task Force Implementation Plan and welcomed the presence of the co-chair of that group during RASMAG/10. He commented that this provided an excellent opportunity for the direct exchange of information between the two groups that will hopefully enhance the coordination between them as PBN implementation takes place throughout the region.

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LIST OF WORKING AND INFORMATION PAPERS

WORKING PAPERS

NUMBER	AGENDA	TITLE	PRESENTED BY
WP/1	1	Provisional Agenda	Secretariat
WP/2	2	Outcomes of the 45th DGCA Conference	Secretariat
WP/3	3	Progress of China RMA Construction	China RMA
WP/4	3	Safety Monitoring Report from China Regional Monitoring Agency, November 2007 – October 2008 *(restricted)*	China RMA
WP/5	5	The Safety Oversight of the 100 feet Deviation between Chinese FLOS and ICAO Traditional FLOS	China RMA
WP/6	5	Long-term Height Monitoring of China RVSM Airspace	China RMA
WP/7	2	Outcomes of APANPIRG/19	Secretariat
WP/8	6	Review of RASMAG Task List	Secretariat
WP/9	5	Expand December TSD for Airspace Planning and Implementation	Secretariat
WP/10	4	Review of RASMAG List of Competent Airspace Safety Monitoring Organizations	Secretariat
WP/11	4	Review of Regional PBN Implementation Plan	Secretariat
WP/12	2	Outcomes of WPAC/SCS RSG/5 Meeting	Secretariat
WP/13	3	Safety Monitoring Report from the Pacific Approvals Registry and Monitoring Organization, October 2007 – September 2008 *(restricted)*	USA
WP/14	4	Proposed SMA Handbook Amendment	Japan
WP/15	3	Safety Assessment of RVSM within the Fukuoka Flight Information Region *(restricted)*	Japan
WP/16	5	Guidance Material for End-to-End Safety and Performance Monitoring of Air Traffic Service (ATS) Data Link Systems in the Asia/Pacific Region – Operational Aspects of Data Link Monitoring	Singapore
WP/17	3	Safety Assessment of RVSM within the Australian Flight Information Regions *(restricted)*	Australia
WP/18	3	Summary of the Airspace Safety Review for the RVSM Implementation in Asia Region *(restricted)*	Thailand
WP/19	3	Safety Assessment of RVSM within the Indonesian Flight Information Regions *(restricted)*	Australia
WP/20	5	Impact of the implementation of global long term monitoring requirement in the Japanese RVSM airspace	Japan

NUMBER	AGENDA	TITLE	PRESENTED BY
WP/21	5	Summary of the Investigation into the Use of Automatic Dependent Surveillance-Broadcast Data for Monitoring Aircraft Altimetry System Error	USA
WP/22	5	Report from the South East Asia Safety Monitoring Agency November 2007 – October 2008	Singapore
WP/23	4	Draft SMA Handbook	Singapore

INFORMATION PAPERS

NUMBER	AGENDA	TITLE	PRESENTED BY
IP/1	-	List of Working Papers (WPs) and Information Papers (IPs)	Secretariat
IP/2	2	Review of ASIA/PAC AIDC Implementation Status	Secretariat
IP/3	7	ICAO ANC Laurel Award to Mr. Brian Colamosca	Secretariat
IP/4	5	Traffic Sample Data (TSD) State Letter	Secretariat
IP/5	5	Text from Annex 6 Amendment	Secretariat
IP/6	2	Review of the 34th Meeting of the RVSM Implementation Task Force	Secretariat
IP/7	5	Summary of Recent Data Analyses presented to Oceanic Separation Reduction Working Group (OSWRG) Scrutiny Group	USA
IP/8	5	The Pacific Approvals Registry and Monitoring Organization (PARMO) Plan for Assessing the Monitoring Responsibility Associated with the Long-Term Height Monitoring Requirements	USA
IP/9	7	Status of the development and implementation of ADS-B In-Trail Procedures	USA

FLIMSY

NUMBER	AGENDA	TITLE	PRESENTED BY
1	4	Draft EMA Handbook	Australia & New Zealand

…….

ASIA RVSM MINIMUM MONITORING REQUIREMENTS:

(LAST REVIEWED: RASMAG/10, December 2008)

1. UPDATE OF MONITORING REQUIREMENTS CHART AND WEBSITE. As significant data is obtained, monitoring requirements for specific aircraft types may change. When the chart is updated, a letter will be distributed to States and operators. The updated chart will be posted on the MAAR website being maintained by Aeronautical Radio of Thailand, Ltd. (AEROTHAI) on behalf of the International Civil Aviation Organization (ICAO) Asia-Pacific regional planning group. The website address is:

http://www.aerothai.co.th/maar

2. INITIAL MONITORING. All Asia operators that operate or intend to operate in airspace where RVSM is applied are required to participate in the RVSM monitoring program. The attached chart of monitoring requirements establishes requirements for initial monitoring associated with the RVSM approval process. In their application to the appropriate State authority for RVSM approval, operators must show a plan for meeting the applicable initial monitoring requirements.

3. AIRCRAFT STATUS FOR MONITORING. Aircraft engineering work that is required for the aircraft to receive RVSM airworthiness approval must be completed prior to the aircraft being monitored. Any exception to this rule will be coordinated with the State authority.

4. APPLICABILITY OF MONITORING FROM OTHER REGIONS. Monitoring data obtained in conjunction with RVSM monitoring programs from other regions can be used to meet Asia monitoring requirements. The Monitoring Agency for Asia Region (MAAR), which is responsible for administering the Asia monitoring program, has access to monitoring data from other regions and will coordinate with States and operators to inform them on the status of individual operator monitoring requirements.

5. MONITORING PRIOR TO THE ISSUE OF RVSM OPERATIONAL APPROVAL IS NOT A REQUIREMENT. Operators should submit monitoring plans to the responsible civil aviation authority that show how they intend to meet the requirements specified in the table below. Monitoring will be carried out in accordance with this table.

6. AIRCRAFT GROUPS NOT LISTED ON THE CHART. Contact the MAAR for clarification if an aircraft group is not listed on the Minimum Monitoring Requirements chart or for clarification of other monitoring related issues. An aircraft group not listed in the table below will probably be subject to Category 2 monitoring requirements.

7. TABLE OF MONITORING GROUPS. A table of monitoring groups is provided in the pages following the Minimum Monitoring Requirements Chart. The table shows the aircraft types and series that are grouped together for operator monitoring purposes.

8. TRAILING CONE DATA. Altimetry System Error estimations developed using Trailing Cone data collected during RVSM certification flights can be used to fulfill monitoring requirements. It must be documented, however, that aircraft RVSM systems were in the approved RVSM configuration for the flight.

9. MONITORING OF AIRFRAMES THAT ARE RVSM COMPLIANT ON DELIVERY. If an operator adds new RVSM compliant airframes of a type for which it already has RVSM operational approval and has completed monitoring requirements for the type in accordance with the attached chart, the new airframes are not required to be monitored. If an operator adds new RVSM compliant airframes of an aircraft type for which it has NOT previously received RVSM operational approval, then the operator should complete monitoring in accordance with the attached chart.

10. FOLLOW-ON MONITORING. Monitoring is an on-going program that will continue after the RVSM approval process. A follow-on sampling program for additional operator aircraft will be coordinated by the Asia-Pacific RVSM Implementation Task Force.

MONITORING AGENCY FOR ASIA REGION (MAAR)

EFFECTIVE AS OF: 1 July 2005

MONITORING IS REQUIRED IN ACCORDANCE WITH THIS CHART, HOWEVER, IT IS NOT REQUIRED TO BE COMPLETED PRIOR TO OPERATIONAL APPROVAL			
MONITORING CATEGORY		**AIRCRAFT TYPE**	**MINIMUM OPERATOR MONITORING FOR EACH AIRCRAFT GROUP**
1	Group approved and monitoring data indicates performance in accordance with RVSM standards. **Group Definition:** aircraft have been manufactured to a nominally identical design and build and for RVSM airworthiness approval fall into a group established in an RVSM certification document (e.g., Service Bulletin, Supplemental Type Certificate, Type Certificate Data Sheet).	[A30B, A306], [A312 (GE), A313 (GE)], [A312 (PW), A313 (PW)], A318, [A319, A320, A321], [A332, A333], [A342, A343], A344, A345, A346 B712, [B721, B722], [B733, B734, B735], B737(Cargo), [B736, B737/BBJ, B738/BBJ, B739], [B741, B742, B743], B74S, B744 (5" Probe), B744 (10" Probe), B752, B753, [B762, B763], B764, B772, B773 CL60(600/601), CL60(604), C560, [CRJ1, CRJ2], CRJ7, DC10, [E135, E145], F100, GLF4, GLF5, LJ60 L101, MD10, MD11, MD80 (All series), MD90	Two airframes from each fleet* of an operator to be monitored as soon as possible but **not later than 6 months after the issue of RVSM operational approval** ** Note. For the purposes of monitoring, aircraft within brackets [ ] may be considered as belonging to the same monitoring group. For example, an operator with six A332 and four A333 aircraft may monitor one A332 and one A333 **or** two A332 aircraft **o**r two A333 aircraft.*
2	Group approved but insufficient monitoring data collected to move aircraft to Monitoring Category 1. Group definition applies.	Other group aircraft other than those listed in Category 1 including: A124, ASTR, B703, B731, B732, BE20, BE40, C500, C25A, C25B, C525, C550**, C56X, C650, C750, CRJ9, [DC86, DC87], DC93, DC95, F2TH, [FA50 FA50EX], F70, [F900, F900EX], FA20, FA10, GLF2(II), GLF(IIB), GLF3, GALX, GLEX, H25B(700), H25B(800), H25C, IL62, IL76, IL86, IL96, J328, L29(2), L29(731), LJ31, [LJ35, LJ36], LJ45, LJ55, SBR1, T134, T154, T204, P180, PRM1,YK42	60% of airframes from each fleet of an operator (round up if fractional), as soon as possible but **not later than 6 months after the issue of RVSM operational approval.** (*Note: If 60 percent of the fleet yields a fractional number, round up to the next whole aircraft (e.g., for a fleet of 2 aircraft, 0.6 x 2 = 1.2; therefore, 2 aircraft must be monitored). ** Refer to aircraft group table for detail on C550 monitoring
3	Non-Group **Non-group Definition:** aircraft that do not fall under the group definition and for RVSM airworthiness approval are presented as an individual airframe.	Non-group approved aircraft	100% of aircraft shall be monitored as soon as possible but **not later than** **6 months after the issue of RVSM operational approval.**

MONITORING GROUPS FOR AIRCRAFT CERTIFIED UNDER GROUP APPROVAL REQUIREMENTS

Monitoring Group	ICAO Desig-nator	A/C Type	A/C Series
A124	A124	AN-124 RUSLAN	ALL SERIES
A300	A306 A30B	A300 A300	600, 600F, 600R, 620, 620R, 620RF B2-100, B2-200, B4-100, B4-100F, B4-120, B4-200, B4-200F, B4-220, C4-200
A310-GE	A310	A310	200, 200F,300, 300F
A310-PW	A310	A310	220, 220F,320
A318	A318	A318	ALL SERIES
A320	A319 A320 A321	A319 A320 A321	CJ , 110, 130 110, 210, 230 110, 130, 210, 230
A330	A332, A333	A330	200, 220, 240, 300, 320, 340
A340	A342, A343,	A340	210, 310
A345	A345	A340	540
A346	A346	A340	640
A3ST	A3ST	A300	600R ST BELUGA
AN72	AN72	AN-74, AN-72	ALL SERIES
ASTR	ASTR	1125 ASTRA	ALL SERIES
ASTR-SPX	ASTR	ASTR SPX	ALL SERIES
AVRO	RJ1H, RJ70, RJ85	AVRO	RJ70, RJ85, RJ100
B712	B712	B717	200
B727	B721 B722	B727	100, 100C, 100F,100QF, 200, 200F
B732	B732	B737	200, 200C
B737 (Classic)	B733 B734 B735	B737	300, 400, 500
B737 New Generation (NG)	B736 B737 B738 B739	B737 B737 B737 B737	600 700, 700BBJ 800 900
B737 (Cargo)	B737	B737	700C
B747Classic (CL)	B741 B742 B743	B747	100, 100B, 100F, 200B, 200C, 200F, 200SF, 300
B74S	B74S	B747	SR, SP
B744-5	B744	B747	400, 400D, 400F (With 5 inch Probes)
B744-10	B744	B747	400, 400D, 400F (With 10 inch Probes)
B752	B752	B757	200, 200PF

Monitoring Group	ICAO Desig-nator	A/C Type	A/C Series
B753	B753	B757	300
B767	B762 B763	B767	200, 200EM, 200ER, 200ERM, 300, 300ER, 300ERF
B764	B764	B767	400ER
B772	B772	B777	200, 200ER, 300, 300ER
B773	B773	B777	300, 300ER
BE40	BE40	BEECHJET 400A	ALL SERIES
BE20	BE20	BEECH 200 -KINGAIR	ALL SERIES
C500	C500	500 CITATION, 500 CITATION I, 501 CITATION I SINGLE PILOT	ALL SERIES
C525	C525	525 CITATIONJET, 525 CITATIONJET I	ALL SERIES
C525-II	C25A	525A CITATIONJET II	ALL SERIES
C525 CJ3	C25B	CITATIONJET III	ALL SERIES
C550-552	C550	552 CITATION II	ALL SERIES
C550-B	C550	550 CITATION BRAVO	ALL SERIES
C550-II	C550	550 CITATION II, 551 CITATION II SINGLE PILOT	ALL SERIES
C550-SII	C550	S550 CITATION SUPER II	ALL SERIES
C560	C560	560 CITATION V, 560 CITATION V ULTRA, 560 CITATION V ULTRA ENCORE	ALL SERIES
C56X	C56X	560 CITATION EXCEL	ALL SERIES
C650	C650	650 CITATION III , 650 CITATION VI , 650 CITATION VII	ALL SERIES
C750	C750	750 CITATION X	ALL SERIES
CARJ	CRJ1, CRJ2	REGIONALJET	100, 200, 200ER, 200LR
CRJ-700	CRJ7	REGIONALJET	700
CRJ-900	CRJ9	REGIONALJET	900
CL600	CL60	CL-600 CL-601	CL-600-1A11 CL-600-2A12, CL-600-2B16
CL604	CL60	CL-604	CL-600-2B16
BD100	CL30	CHALLENGER 300	ALL SERIES
BD700	GL5T	GLOBAL 5000	ALL SERIES
CONC	CONC	CONCORDE	ALL SERIES
DC10	DC10	DC-10	10, 10F, 15, 30, 30F, 40, 40F
DC86-7	DC86, DC87	DC-8	62, 62F, 72, 72F
DC93	DC93	DC-9	30, 30F
DC95	DC95	DC-9	SERIES 51
E135-145	E135,	EMB-135, EMB-145	ALL SERIES

Monitoring Group	ICAO Desig-nator	A/C Type	A/C Series
	E145		
F100	F100	FOKKER 100	ALL SERIES
F2TH	F2TH	FALCON 2000	ALL SERIES
F70	F70	FOKKER 70	ALL SERIES
F900	F900	FALCON 900, FALCON 900EX	ALL SERIES
FA10	FA10	FALCON 10	ALL SERIES
FA20	FA20	FALCON 20 FALCON 200	ALL SERIES
FA50	FA50	FALCON 50, FALCON 50EX	ALL SERIES
GALX	GALX	1126 GALAXY	ALL SERIES
GLEX	GLEX	BD-700 GLOBAL EXPRESS	ALL SERIES
GLF2	GLF2	GULFSTREAM II (G-1159),	ALL SERIES
GLF2B	GLF2	GULFSTREAM IIB (G-1159B)	ALL SERIES
GLF3	GLF3	GULFSTREAM III (G-1159A)	ALL SERIES
GLF4	GLF4	GULFSTREAM IV (G-1159C)	ALL SERIES
GLF5	GLF5	GULFSTREAM V (G-1159D)	ALL SERIES
H25B-700	H25B	BAE 125 / HS125	700B
H25B-800	H25B	BAE 125 / HAWKER 800XP, BAE 125 / HAWKER 800, BAE 125 / HS125	ALL SERIES/A, B/800
H25C	H25C	BAE 125 / HAWKER 1000	A , B
IL86	IL86	IL-86	NO SERIES
IL96	IL96	IL-96	M , T, 300
J328	J328	328JET	ALL SERIES
L101	L101	L-1011 TRISTAR	1 (385-1), 40 (385-1), 50 (385-1), 100, 150 (385-1-14), 200, 250 (385-1-15), 500 (385-3)
L29B-2	L29B	L-1329 JETSTAR 2	ALL SERIES
L29B-731	L29B	L-1329 JETSTAR 731	ALL SERIES
LJ31	LJ31	LEARJET 31	NO SERIES, A
LJ35/6	LJ35 LJ36	LEARJET 35 LEARJET 36	NO SERIES, A
LJ40	LJ40	LEARJET 40	ALL SERIES
LJ45	LJ45	LEARJET 45	ALL SERIES
LJ55	LJ55	LEARJET 55	NO SERIES B, C
LJ60	LJ60	LEARJET 60	ALL SERIES
MD10	MD10	MD-10	ALL SERIES
MD11	MD11	MD-11	COMBI, ER, FREIGHTER, PASSENGER
MD80	MD81,	MD-80	81, 82, 83, 87, 88

Monitoring Group	ICAO Desig-nator	A/C Type	A/C Series
	MD82, MD83, MD87, MD88		
MD90	MD90	MD-90	30, 30ER
P180	P180	P-180 AVANTI	ALL SERIES
PRM1	PRM1	PREMIER 1	ALL SERIES
T134	T134	TU-134	A, B
T154	T154	TU-154	A , B, M, S
T204	T204, T224, T234	TU-204, TU-224, TU-234	100, 100C, 120RR, 200, C
YK42	YK42	YAK-42	ALL SERIES

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REGIONAL AIRSPACE SAFETY MONITORING ADVISORY GROUP

ASIA/PACIFIC

ENROUTE~~SAFETY~~ MONITORING AGENCY

HANDBOOK

VERSION 1.10~~8.3~~

FOREWORD

The Regional Airspace Safety Monitoring Advisory Group (RASMAG) was established during 2004 by the Asia Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) to achieve a regional approach for coordination and harmonization of airspace safety monitoring activities, and to provide assistance to States in this respect. The RASMAG noted that requirements for monitoring aircraft height-keeping performance and the safety of reduced vertical separation minimum (RVSM) operations had been more comprehensively developed than had requirements for monitoring other air traffic management (ATM) services, such as reduced horizontal separation based on performance based navigation (PBN), or for monitoring of air traffic services (ATS) data link systems. For RVSM, a handbook with detailed guidance on the requirements for establishing and operating Regional Monitoring Agencies (RMA) had been developed by the ICAO Separation and Airspace Safety Panel (SASP), with the intent that the handbook be applied globally. There was no comparable global document under development by ICAO for the continued safe use of a horizontal-plane separation minimum where PBN is applied.

ICAO provisions require that the implementation of specified reduced separation minima, e.g. 50-NM lateral separation based on PBN RNAV 10, 50-NM longitudinal separation based on PBN RNAV 10 and Direct Pilot Controller Communication (DCPC), and 30 NM lateral and longitudinal separation based on Automatic Dependent Surveillance (ADS), Controller Pilot Data Link Communication (CPDLC) and PBN RNP 4, must first meet safety management system requirements and undergo a safety assessment based on collision risk modelling to confirm that the regionally established target level of safety (TLS) has been met for the airspace. Additionally, periodic safety reviews must be performed in order to permit continued operations. To date, the performance of safety assessments and continued monitoring for reduced horizontal separation minima had been carried out by a few specialized teams made up of technical experts and contractors supporting States within the region.

Under Decision 16/1, APANPIRG had adopted the term Safety Monitoring Agency (SMA) to mean an organization approved by regional agreement to provide airspace safety monitoring and implementation services for international airspace in the Asia/Pacific region for implementation and operation of reduced horizontal separation. Reference to the term SMA was subsequently amended by RASMAG and adopted by APANPIRG (Decision 20/XX) to En-route Monitoring Agency (EMA).The RASMAG agreed that there was a need to develop a handbook aimed at standardizing the principles and practices of such ESMAs, in order to ensure the continued safe application of reduced horizontal separation standards in international airspace. –Inclusion of the previously independent RNP and RNAV concepts under ICAO's global PBN concept has led to uncertainty amongst States regarding the monitoring requirements for new separation minima implementations where these minima are based on PBN approvals. In anticipation of more widespread use of the PBN RNAV 10 and RNP 4 navigation specifications within the international airspace of the Asia/Pacific Region, this handbook is being provided to identify the monitoring requirements and related SMAEMA duties and responsibilities associated with those navigation specifications and the reduced separation minima which may be implemented based upon compliance with them. It should be noted that, with the exception of 50-NM lateral separation, introduction of the reduced horizontal minima necessitates satisfaction of explicit communications and surveillance requirements as well as the navigation performance requirements.

It is intended that this handbook will introduce a common set of principles and practices for monitoring in connection with reduced horizontal-plane separation minima based on the application of PBN. The handbook will also help to promote an interchange of information among Asia/Pacific States in support of achieving common operational monitoring procedures and of pooling data resulting from application of those procedures. Accordingly, APANPIRG has adopted the EMA Handbook under the terms of Conclusion 20/XX as Asia Pacific regional guidance material.

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The Handbook is presented in two parts. Part 1 defines an ~~SMA~~EMA, describes its functions by means of a list of duties and responsibilities, and identifies the process by which an organization receives credentials as an ~~SMA~~EMA. Part 2 provides specific guidance to assist an ~~SMA~~EMA in carrying out the duties and responsibilities presented in Part 1.

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TABLE OF CONTENTS

Includes appendices

1) SCS implementation safety assessment

2) SCS Know your airspace analysis

3) *Reformat all the forms in the appendices*

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LIST OF ABBREVIATIONS AND ACRONYMS

ADS	Automatic dependent surveillance
ANSP	Air navigation service provider
APANPIRG	Asia Pacific Air Navigation Planning and Implementation Regional Group
ATC	Air traffic control
ATM	Air traffic management
ATS	Air traffic services
CPDLC	Controller pilot data link communication
CRM	Collision risk model
EMA	En-route Monitoring Agency
FIR	Flight Information Region
FTP	File transfer protocol
ICAO	International Civil Aviation Organization
LLD	Large lateral deviation
LLE	Large longitudinal error
MASPS	Minimum aviation system performance standard
NM	Nautical miles
PBN	Performance-based navigation
RASMAG	Regional Airspace Safety Monitoring Advisory Group of APANPIRG
RMA	Regional Monitoring Agency
RNAV	Area navigation
RNP	Required navigation performance
RVSM	Reduced vertical separation minimum
SASP	Separation and Airspace Safety Panel
~~SMA~~	~~Safety Monitoring Agency.~~
SSR	Secondary surveillance radar

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STC	Supplemental Type Certificate
TLS	Target level of safety

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EXPLANATION OF TERMS

Collision risk.
The expected number of mid-air collisions in a prescribed volume of airspace for a specific number of flight hours due to loss of planned separation. (*Note: One collision is considered to produce two accidents.)*

Exclusionary PBN airspace.
Airspace in which flight cannot be planned by civil aircraft which do not hold a valid PBN approval from the appropriate State authority.

Horizontal separation.
The spacing provided between aircraft in the horizontal plane to avoid collision.

Large lateral deviation (LLD).
Any deviation of 15 NM or more to the left or right of the current flight-plan track.

Large longitudinal error (LLE).
~~Any along-track error of 10 NM or more, or 3 minutes or more, as derived from surveillance data or calculated from the difference between an estimate for a given fix and the actual time of arrival over that fix, as applicable.~~ Any unexpected change in longitudinal separation between an aircraft pair, or for an individual aircraft the difference between an estimate for a given fix and the actual time of arrival over that fix, as applicable, in accordance with the criteria set out below:

Type of Error	Category of Error	Criterion for Reporting
~~Lateral deviation~~	~~Individual-aircraft error~~	~~15NM or greater magnitude~~
Longitudinal deviation	Aircraft-pair (Time-based separation applied)	Infringement of longitudinal separation standard based on routine position reports
Longitudinal deviation	Aircraft-pair (Time-based separation applied)	Expected time between two aircraft varies by 3 minutes or more based on routine position reports
Longitudinal deviation	Individual-aircraft (Time-based separation applied)	Pilot estimate varies by 3 minutes or more from that advised in a routine position report
Longitudinal deviation	Aircraft-pair (Distance-based separation applied)	Infringement of longitudinal separation standard, based on ADS, radar measurement or special request for RNAV position report
Longitudinal deviation	Aircraft-pair (Distance-based separation applied)	Expected distance between an aircraft pair varies by 10NM or more, even if separation standard is not infringed, based on ADS, radar measurement or special request for RNAV position report

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Occupancy.
A parameter of the collision risk model which is twice the count of aircraft proximate pairs in a single dimension divided by the total number of aircraft flying the candidate paths in the same time interval.

Operational Approval.
The process of assuring the State authority that an operator meets all the requirements for operating aircraft in airspace where reduced horizontal separation based on PBN been implemented.

Operational risk.
The risk of collision due to operational errors and in-flight emergencies.

Overall risk.
The risk of collision due to all causes, which includes the technical risk and the operational risk.

Passing frequency.
The frequency of events in which the centers of mass of two aircraft are at least as close together as the metallic length of a typical aircraft when traveling in the opposite or same direction on adjacent routes separated by the planned lateral separation at the same flight level.

Target level of safety (TLS).
A generic term representing the level of risk which is considered acceptable in particular circumstances.

Technical Risk
The risk of collision associated with aircraft navigation performance.

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Part 1

1 Description of a En-routeSafety Monitoring Agency, Its Functions and Establishment

1.1 Description

1.1.1 An Een-routesafety Mmonitoring Aagency (SMAEMA) comprises a group of specialists who carry out specific functions to support the introduction and continued safe use of en-route horizontal-plane separation minima. which are based on the application of PBN navigation specifications and additional requirements adopted by ICAO. These functions are shown in the following set of SMAEMA duties and responsibilities.

1.2 SMAEMA Duties and Responsibilities

1.2.1 The duties and responsibilities of an organization providing international airspace safety assessment, monitoring and implementation services in connection with en-route PBN based and data link based horizontal-plane separation minima are:

1.2.1.1 to establish and maintain a database of aircraft approved by the respective State authorities for PBN operations and other required aircraft capabilities such as data link;

1.2.1.2 to coordinate monitoring of horizontal-plane navigational performance and the identification of large horizontal-plane deviations;

1.2.1.3 to receive reports of large horizontal-plane deviations identified during monitoring; to take the necessary action with the relevant State authority and operator to determine the likely cause of the horizontal-plane deviation and to verify the approval status of the relevant operator;

1.2.1.4 to analyze data to detect horizontal-plane deviation trends and, hence, to take action as in the previous item;

1.2.1.5 to undertake data collections as required by RASMAG to:

a) investigate the navigational performance of the aircraft in the core of the distribution of lateral deviations;

b) establish or add to a database on the lateral navigational performance of:

- the aircraft population
- aircraft types or categories
- individual airframes;

c) examine the forecast accuracy of aircraft-provided times at future required reporting points

1.2.1.6 to archive results of navigational performance monitoring and to conduct scheduled risk assessments in light of agreed regional safety goals;

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1.2.1.7 to contribute to a regional database of monitoring results;

1.2.1.8 to initiate necessary remedial actions and coordinate with specialist groups as necessary in the light of monitoring results;

1.2.1.9 to monitor the level of risk as a consequence of operational errors and in-flight contingencies as follows:

a) determine, wherever possible, the root cause of each deviation together with its size and duration;

b) calculate the frequency of occurrence;

c) assess the overall risk in the system against the overall safety objectives; and

d) initiate remedial action as required;

1.2.1.10 to initiate checks of the approval status of aircraft operating in the relevant airspace where PBN is applied, identify non-approved operators and aircraft using the airspace and notify the appropriate State of Registry/State of the Operator accordingly; and

1.2.1.11 to submit reports as required to APANPIRG through RASMAG.

1.3 Process for Establishing an ~~SMA~~EMA

1.3.1 An organization proposing to offer ~~SMA~~EMA services must be approved by the RASMAG~~APANPIRG~~. ~~The process for such credentialing consists of technical preparations, endorsement by the RASMAG and, finally, APANPIRG review and approval.~~

1.3.2 In order to effectively carry out the duties and responsibilities of an ~~SMA~~EMA, an organisation must be able to demonstrate an acceptable level of competence. Competence may be demonstrated by:

a) previous monitoring experience; or

b) participation in ICAO technical panels or other bodies which develop horizontal separation requirements or criteria for establishing separation minima based on PBN; or

c) establishment of a formal relationship with an organization qualified under (a) or (b).

1.3.3 Once competence has been demonstrated, the ~~SMA~~EMA should receive a formal approval~~endorsement~~ by RASMAG ~~and receive approval from APANPIRG~~.

1.3.4 Appendix A lists the RASMAG ~~SMAs~~EMAs and the FIRs for which they are responsible.

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PART 2

2. Guidance on the Responsibilities and Standardised Practices of En-routeSafety Monitoring Agencies

2.1 Purpose of this part

2.1.1 The purpose of this part of the Handbook is to document experience gained by organizations supporting the introduction of PBN-basedreduced horizontal-plane separation minima within the Asia and Pacific Region, and elsewhere, in order to assist an SMAEMA in fulfilling its responsibilities. Where necessary to ensure standardized practices among ESMAs, detailed guidance is elaborated further in appendices.

2.2 Establishment and Maintenance of a Database of PBN and Other Necessary Approvals

2.2.1 The experience gained through the introduction of RVSM within Asia/Pacific has shown that the concept of utilising monitoring agencies is essential to ensure safety in the region. They have a significant role to play in all aspects of the safety monitoring process. One of the functions of an SMAEMA is to establish a database of operators and aircraft approved by their respective State authorities for PBN operations and, if necessary, for use of data link in the region for which the SMAEMA has responsibility. This information is of vital importance in effectively assessing the risk in the airspace.

2.2.2 Aviation is a global industry; many operators may be approved for PBN and data link operations and their approvals registered with an SMAEMA operating in a region where reduced horizontal separation has been implemented. Thus, there is considerable opportunity for information sharing among ESMAs. While a region or sub-region introducing reduced horizontal-plane separation may need its own SMAEMA to act as a focal point for the collection and collation of approvals for aircraft operating solely in that region, it may not need to maintain a complete database of all approved aircraft in the world. It will, however, be required to establish links with other SMAsEMAs in order to determine the PBN and/or data link status of aircraft, so that an assessment of the technical risk can be made.

2.2.3 To avoid duplication by States in registering approvals with SMAsEMAs, the concept of a designated SMAEMA for the processing of approval data has been established. Under the designated SMAEMA concept, all States are associated with a specified SMAEMA for the reporting of PBN and data link approvals. Appendix B provides a listing of States and the respective cognizantdesignated SMAEMA for PBN and data link approvals. SMAsEMAs may contact any State to address safety matters without regard to the designated SMAEMA for approvals.

2.2.4 It is important to note that, in general, the aircraft operating in airspace where implementation of PBN-based and data link based separation is planned can be categorized into two classes. Some aircraft operate solely within the airspace targeted for introduction of reduced separation standards (and therefore may not have PBN and other required approval status), and others operate both within that airspace and other portions of airspace requiring PBN and other approvals. It is the responsibility of the SMAEMA supporting introduction of reduced separation to gather State approvals for the former category of aircraft from authorities responsible for issuing those approvals. To do so requires that the SMAEMA establish a communication link with each such State authority and provide a precise description of the approvals information required. Appendix C provides the pertinent forms, with a brief description of their use, that an SMAEMA should supply to a State authority to obtain information on aircraft PBN or data link approval status.

2.2.5 Where possible, the SMAEMA should collect State approvals information for the latter category of aircraft – those already operating in other airspace where reduced horizontal-plane separation minima are

applied – from other SMAsEMAs. This collection will be facilitated if each SMAEMA maintains, in a similar electronic form, a database of State PBN and data link approvals.

2.2.6 Appendix D contains the minimum database content required and the format in which it should be maintained by an SMAEMA. Appendix D also contains a description of the data to be shared by SMAsEMAs and the procedures for sharing.

2.3 Monitoring of Horizontal-Plane Navigation Performance

2.3.1 An SMAEMA must be prepared to collect the information necessary to monitor horizontal-plane navigational performance as part of the risk assessment. It must institute procedures for the collection of information descriptive of large deviations in the horizontal plane and operational errors caused by non-compliance with air traffic control (ATC) instructions or loop errors within the ATC system.

2.3.2 An SMAEMA must enlist the cooperation of States and air navigation service providers (ANSPs) in monitoring horizontal-plane navigational performance through the use of secondary surveillance radar or other appropriate surveillance systems. States and ANSPs have the responsibility to cooperate with the SMAEMA and supply any requested data that will contribute to the evaluation of navigational performance.

Monitoring the Occurrence of Large Lateral Deviations and Large Longitudinal Errors

2.3.3 Experience has shown that large lateral deviations (LLDs) (deviations of 15NM or more in magnitude by an aircraft) and large longitudinal errors (LLEs) (unexpected errors changes in longitudinal separation of more than 10 NM or 3 minutes between members of an aircraft pair) have had significant influence on the outcome of safety assessments before and after implementation of PBN-based separation in a portion of airspace. Accordingly, a principal duty of an SMAEMA is to ensure the existence of a program to collect this information and assess the importance of such occurrences.

2.3.4 Section 2.6 provides direction to an SMAEMA for taking such remedial actions as may be necessary to resolve systemic problems uncovered by this program.

2.3.5 Within the airspace for which it is responsible, each ANSP will need to establish the means to detect and report the occurrence of large horizontal-plane deviations. Experience has shown that the primary sources for reports of large horizontal-plane deviations are the ATC units providing air traffic control services in the airspace where reduced separation is or will be applied. The surveillance information available to these units – in the form of voice or ADS reports and, where available, surveillance radar or ADS-B returns – provides the basis for identifying large horizontal-plane deviations. A program for identifying large horizontal-plane deviations should be established and ATC units should report such events monthly. A suggested form for these monthly reports is shown in Appendix E. These reports should contain, as a minimum, the following information:

a) Reporting unit

b) Location of deviation, either as latitude/longitude or ATC fix

c) Date and time of large horizontal-plane deviation

d) Sub-portion of airspace, such as established route system, if applicable

e) Flight identification and aircraft type

f) Actual flight level or altitude

g) Horizontal separation being applied

h) Size of deviation

i) Duration of large deviation

j) Cause of deviation

k) Any other traffic in potential conflict during deviation

l) Crew comments when notified of deviation

m) Remarks from ATC unit making report

2.3.6 Other sources for reports of large horizontal-plane deviations should also be explored. An SMAEMA is encouraged to determine if operators within the airspace for which it is responsible are willing to share pertinent summary information from internal safety oversight databases. In addition, an SMAEMA should enquire about access to State databases of safety incident reports which may be pertinent to the airspace. An SMAEMA should also examine voluntary reporting safety databases, where these are available, as possible sources of large horizontal-plane deviations incidents in the airspace for which it is responsible.

2.3.7 While an SMAEMA will be the recipient and archivist for reports of large navigation errors, it is important to note that an SMAEMA alone cannot be expected to conduct all activities associated with a comprehensive program to detect and report large horizontal-plane deviations. Rather, an SMAEMA should enlist the support of RASMAG, the ICAO regional office, appropriate implementation task forces, or any other entity that can assist in the establishment of such a program.

2.4 Conducting Safety Assessments and Reporting Results

Safety Assessment

2.4.1 A safety assessment conducted by an SMAEMA consists of estimating the risk of collision associated with the horizontal-plane separation standard and comparing this risk to the established TLS. Examples of CRMs used in the development of separation minima are included in Appendix H of this document and in the ICAO Doc 9689 *Manual of airspace Planning Methodology for the Determination of Separation Minima*. An SMAEMA will need to acquire an in-depth knowledge of the use of the airspace within which the horizontal-plane separation has been implemented. Experience has shown that such knowledge can be gained through acquisition of charts and other material describing the airspace, and through periodic collection of samples of traffic movements within the airspace.

2.4.2 RASMAG will determine the safety reporting requirements for the SMAEMA.

Establishing the Competence Necessary to Conduct a Safety Assessment

2.4.3 Conducting a safety assessment is a complex task requiring specialized skills which are not practiced widely. As a result, prior to receiving regional approval to operate as an SMAEMA, the organization will need to demonstrate the necessary competence to complete the required tasks.

2.4.4 Ideally, an SMAEMA will have the internal competence to conduct a safety assessment. However, recognizing that personnel with the required skills may not be available internally, an SMAEMA may find it necessary to augment its staff, either through arrangements with another SMAEMA or with an external (i.e. non SMAEMA) organization possessing the necessary competence.

2.4.5 If it is necessary to use an external organization to conduct a safety assessment, an SMAEMA must have the competence to judge that such an assessment is done properly. This competence could be acquired through an arrangement with an SMAEMA which has conducted safety assessments.

2.4.6 An SMAEMA will need to take into account that a safety assessment must reflect the factors which influence collision risk within the airspace where the reduced horizontal-plane separation will be applied. Thus, an SMAEMA will need to establish a method to collect and organize pertinent data and other information descriptive of these airspace factors. As will be noted below, some data sources from other airspace where reduced horizontal-plane separation has been implemented may assist an SMAEMA in conducting a safety assessment. However, an SMAEMA may not use the safety assessment results from another portion of airspace as the sole justification for concluding that the TLS will be met in the airspace where the SMAEMA has safety assessment responsibility.

Assembling a sample of traffic movements from the airspace

2.4.7 Samples of traffic movement data should be collected for the entire airspace where reduced horizontal-plane separation will be implemented. As a result, ANSPs providing services within the airspace are required to cooperate in providing this data.

2.4.8 In planning the timing and duration of a traffic movement data sample, an SMAEMA should take into account the importance of capturing any periods of heavy traffic flow which might result from seasonal or other factors. The duration of any traffic sample should be at least 30 days, with a longer sample period left to the judgment of an SMAEMA. (Note: by agreement, traffic sample data within the Asia-Pacific Region is collected by all States for the month of December each year for purposes of RVSM monitoring. SMAsEMAs may wish to arrange for the augmentation of this sample to enable them to acquit their monitoring activity.)

2.4.9 The following information should be collected for each flight in the sample:

a) date of flight

b) flight identification or aircraft call sign, in standard ICAO format

c) aircraft type conducting the flight, as listed in the applicable edition of ICAO Doc 8643, Aircraft Type Designators

d) aircraft registration mark, if available

e) origin aerodrome, as listed in the applicable edition of ICAO Doc 7910, Location Indicators

f) destination aerodrome, as listed in the applicable edition of ICAO Doc 7910, Location Indicators

g) entry point (fix or latitude/longitude) into the airspace

h) time at entry point

i) flight level (and assigned Mach number if available) at entry point

j) exit point from the airspace

k) time at exit point

l) flight level (and assigned Mach number if available) at exit point

m) additional fix/time/flight-level combinations that the SMAEMA judges are necessary to capture the traffic movement characteristics of the airspace

2.4.10 Where possible, in coordinating collection of the sample, an SMAEMA should specify that information be provided in electronic form (for example, in a spreadsheet). Appendix F contains a sample specification for collection of traffic movement data in electronic form, where the entries in the first column may be used as column headings on a spreadsheet template.

2.4.11 Acceptable sources for the information required in a traffic movement sample could include one or more of the following: ATC observations, ATC automation system data, automated air traffic management system data and secondary surveillance radar (SSR) reports.

2.4.11

Data Link Performance Monitoring

Performance Monitoring

2.4.12 Applications specific to communication systems required for PBN-based operations such as data link introduce operational and technical risk into the system. Therefore end-to-end safety performance monitoring of air-ground and ground-air data link communication services should be ongoing, in accordance with the information contained in the *Guidance Material for End-to-End Safety and Performance Monitoring of Air Traffic Service (ATS) Data Link Systems in the Asia/Pacific Region*, issued by the ICAO Asia and Pacific Office, Bangkok . The operational aspect of data link performance monitoring is carried out by the relevant SMAEMA.

2.4.13 The following communication and surveillance performance elements **could be considered for evaluation**~~should be evaluated~~**:**

a. Position reporting methods and usage

b. Flight plans and data link capabilities

c. ADS downlink message traffic

d. ADS downlink transit times

e. ADS uplink message traffic

f. ADS uplink transit and response times

g. Anomalies identified in ADS data

Duplicate messages

Negative downlink transit times

h. Uplink messages with no response

~~Negative and negligible uplink transit times~~

i. CPDLC uplink and downlink message traffic, including response times

j. Communication service provider outages and the effect on data link performance

Agreed Process for Determining Whether the TLS is satisfied as the Result of a Safety Assessment

2.4.14 "Technical risk" is the term used to describe the risk of collision associated with aircraft navigation performance. Some of the factors which contribute to technical risk are:

a) errors in aircraft navigation systems; and

b) aircraft equipment failures resulting in unmitigated deviation from the cleared flight path, including those where not following the required procedures further increased the risk.

2.4.15 The term "operational error" is used to describe any horizontal deviation of an aircraft from the correct flight path as a result of incorrect action by ATC or the flight crew. Examples of such actions are:

a) a flight crew misunderstanding an ATC clearance, resulting in the aircraft operating on a flight path other than that issued in the clearance;

b) ATC issuing a clearance which places an aircraft on a flight path where the required separation from other aircraft cannot be maintained;

c) a coordination failure between ATC units in the transfer of control responsibility for an aircraft, resulting in either no notification of the transfer or in transfer at an unexpected transfer point;

d) weather deviation (Note: these deviations may be instances where the aircraft captain initiates the manouvre using operational authority but without advising ATC, and are not necessarily deemed as being incorrect action).

2.4.16 The TLS which must be satisfied is established by regional agreement and documented in the Regional Supplementary Procedures (Doc 7030). The generic Asia/Pacific TLS is presently established, for each dimension (lateral, longitudinal and vertical), as 5×10^{-9} fatal accidents per flight hour due to loss of planned separation; however, specific TLS values may be determined by ICAO for application of a particular separation minimum.

2.5 Monitoring Operator Compliance with State Approval Requirements

2.5.1 The overall intent of post-implementation ~~SMA~~EMA activities is to support continued safe use of the reduced horizontal-plane separation. One important post-implementation activity is carrying out periodic checks of the approval status of operators and aircraft using airspace where PBN-based ~~and data link-based~~ separation is applied. This is vital if reduced separation is applied on an exclusionary basis, that is, if State PBN and data link approval is a prerequisite for use of the airspace. This activity is termed monitoring operator compliance with State approval requirements. RASMAG should consider whether the ~~SMA~~EMA needs to conduct an annual safety assessment as a means to determine whether the TLS continues to be met.

2.5.2 An ~~SMA~~EMA will require two sources of information to monitor operator compliance with State approval requirements: a listing of the operators, and the type and registration marks of aircraft conducting operations in the airspace; and the database of State PBN and data link approvals.

2.5.3 Ideally, this compliance monitoring should be done for the entire airspace on a daily basis. Difficulties in accessing traffic movement information may make such daily monitoring impossible. As a minimum, an SMAEMA should conduct compliance monitoring of the complete airspace for at least a 30-day period annually.

2.5.4 When conducting compliance monitoring, the filed PBN or data link approval status shown on the flight plan of each aircraft movement should be compared to the database of State PBN and data link approvals. When a flight plan shows a PBN or data link approval not confirmed in the database, the appropriate State authority should be contacted for clarification of the discrepancy. An SMAEMA should use a letter similar in form to that shown in Appendix G for the official notification.

2.5.5 An SMAEMA should keep in mind that the State authority has the responsibility to take any action should an operator be found to have filed an incorrect declaration of State PBN or data link approval.

2.6 Remedial Actions

2.6.1 Remedial actions are those measures taken to remove causes of systemic problems associated with factors affecting safe use of the PBN-based and data link based separation. Remedial actions may be necessary to remove the causes of problems such as the following:

a) failure of an aircraft to comply with PBN or data link requirements

b) aircraft operating practices resulting in large horizontal-plane deviations

c) operational errors.

2.6.2 An SMAEMA should review monitoring results periodically in order to determine if there is evidence of any recurring problems.

2.6.3 As a minimum, an SMAEMA should conduct an annual review of reports of large horizontal-plane deviations with a view toward uncovering systemic problems. Should such a problem be discovered, an SMAEMA should report its findings to the bodyorganization overseeing PBN basedreduced horizontal-plane separation implementation, or to the RASMAG. An SMAEMA should include in its report the details of large horizontal-plane deviations suggesting the existence of a systemic problem.

2.7 Review of Operational Concept

2.7.1 Experience has shown that the operational concept adopted by bodies overseeing horizontal-plane separation implementations can affect substantially the collision risk in airspace.

2.7.2 An SMAEMA should review carefully the operational concept agreed by the body overseeing horizontal-plane separation implementation of reduced horizontal-plane separation based on PBN with a view to identifying any features of airspace use which may influence risk. An SMAEMA should inform the oversight body of any aspects of the operational concept which it considers important in this respect.

LIST OF APPENDICES

APPENDIX A	Flight Information Regions and Responsible En-RouteSafety Monitoring Agency
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APPENDIX C	SMAEMA Forms for Use in Obtaining Record of PBN and Data Link Approvals From A State Authority
APPENDIX D	Minimal Informational Content for Each State PBN and Data Link Approval to be Maintained in Electronic Form by an SMAEMA
APPENDIX E	Suggested Form for ATC Unit Monthly Report of Large Lateral Deviations or Large Longitudinal Errors
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APPENDIX A -

Flight Information Regions and Responsible En-routeSafety Monitoring Agency ***(Note: Put FIR names in Alphabetical order, include Kabul, Lahore Karachi)***

Responsible SMAEMA	FIR
PARMO	Anchorage Oceanic
	Auckland Oceanic
AAMA	Brisbane
	Honiara
	Inchon
AAMA	Melbourne
	Nadi
	Naha
	Nauru
PARMO	Oakland Oceanic
	Port Moresby
	Tahiti
	TokyoFukuoka
	Bangkok
	Calcutta
	Chennai
	Colombo
	Delhi
	Dhaka
	Hanoi
SEASMA	Ho Chi Minh
SEASMA	Hong Kong
	Jakarta
	Karachi
	Kathmandu
SEASMA	Kota Kinabalu
SEASMA	Kuala Lumpur
	Lahore
	Male
SEASMA	Manila
	Mumbai
	Phnom Penh
SEASMA	Sanya AOR
SEASMA	Singapore
	Taibei
	Ujung Pandang
	Ulaan Baatar
	Vientiane
	Yangon

APPENDIX B -

States and Designated SMAEMA for the reporting of PBN and Data Link aApprovals

The following table provides a listing of States and the respective designated SMAEMA for the reporting of PBN and data link approvals. Each designated SMAEMA should advise the relevant States of its requirements with respect to reporting of PBN and data link approvals.

ICAO Contracting State	Designated SMAEMA for PBN and Data Link Approvals
Afghanistan	
Australia	AAMA
Bangladesh	
Bhutan	
Brunei Darussalam	
Cambodia	
China	SEASMA
Cook Islands	
Democratic People's Republic of Korea	
Fiji	
India	
Indonesia	
Japan	
Kiribati	
Lao People's Democratic Republic	
Malaysia	SEASMA
Maldives	
Marshall Islands	
Micronesia (Federated States of)	
Mongolia	
Myanmar	
Nauru	
Nepal	
New Zealand	
Pakistan	
Palau	
Papua New Guinea	
Philippines	SEASMA
Republic of Korea	
Samoa	
Singapore	SEASMA
Solomon Islands	
Sri Lanka	
Thailand	
Tonga	
United States	PARMO
Vanuatu	
Viet Nam	SEASMA

APPENDIX C -

SMAEMA Fforms Ffor Uuse in Oobtaining Rrecord of PBN and Data Link Aapprovals Ffrom a State Aauthority

NOTES TO AID COMPLETION OF SMAEMA FORMS A1, A2, AND A3

1. Please read these notes before attempting to complete forms SMAEMA A1, A2, and A3.

2. It is important for the SMAsEMAs to have an accurate record of a point of contact for any queries that might arise from the monitoring of reduced horizontal-plane separation navigation performance. Recipients are therefore requested to include a completed SMAEMA A1 with their first reply to the SMAEMA. Thereafter, there is no further requirement unless there has been a change to the information requested on the form.

3. If recipients are unable to pass the information requested in the SMAEMA A2 to the SMAEMA by electronic means, a hard copy SMAEMA A2 must be completed for each aircraft granted a PBN or data link approval. The numbers below refer to the superscript numbers on the blank SMAEMA A2.

   (1) Enter the single letter ICAO identifier as contained in ICAO Doc 7910. In the case of their being more than one identifier designated for the State, use the letter identifier that appears first.
   (2) Enter the operator's 3 letter ICAO identifier as contained in ICAO Doc 8585. For International General Aviation, enter "IGA". For military aircraft, enter "MIL". If none, place an X in this field and write the name of the operator/owner in the Remarks row.
   (3) Enter the ICAO designator as contained in ICAO Doc 8643, e.g., for Airbus A320-211, enter A320; for Boeing B747-438 enter B744.
   (4) Enter series of aircraft type or manufacturer's customer designation, e.g., for Airbus A320-211, enter 211; for Boeing B747-438, enter 400 or 438.
   (5) Enter ICAO allocated Aircraft Mode S address code.
   (6) Enter yes or no.
   (7) Example: For 26 October, 2007 write 26/10/07.
   (8) Use a separate sheet of paper if insufficient space available.
   ~~(9) Enter PBN or DL.~~

4. The above numbers refer to those superscript numbers used in SMAEMA A3 - "Withdrawal of PBN Approval." ***SMAEMA A3 must be completed and forwarded to the SMAEMA immediately when the State of registry has cause to withdraw the approval of an operator/aircraft for PBN operations.***

~~SMA~~EMA A1
POINT OF CONTACT DETAILS/CHANGE OF POINT OF CONTACT DETAILS FOR MATTERS RELATING TO PBN OR DATA LINK APPROVALS

This form should be completed and returned to the address below on the first reply to the ~~SMA~~EMA or when there is a change to any of the details requested on the form (PLEASE USE BLOCK CAPITALS).

STATE OF REGISTRY:

ORGANIZATION OR OPERATOR:

STATE OF REGISTRY (ICAO 2 LETTER IDENTIFIER):

Enter the 2-letter ICAO identifier as contained in ICAO Doc 7910. In the event that there is more than one identifier for the same State, the one that appears first in the list should be used.

ADDRESS:

CONTACT PERSON:

Full Name:

Title: Surname: Initials:

Post/Position:

Telephone #: Fax #:

E-mail:

Initial Reply*/Change of Details* (**Delete as appropriate)*

When complete, please return to the following address:

~~SMA~~EMA Address

Telephone:
Fax:
E-Mail:

~~SMA~~EMA A2
RECORD OF PBN APPROVAL

1. When a State of Registry approves or amends the approval of an operator/aircraft for PBN, details of that approval must be recorded and sent to the appropriate ~~SMA~~EMA without delay.

2. *Before providing the information as requested below, reference should be made to the accompanying notes* **(PLEASE USE BLOCK CAPITALS)**.

State of Registry[1]:

Name of Operator[2]:

State of Operator[1]:

Aircraft Type[3]:

Aircraft Series[4]:

Manufacturers Serial No:

Registration No:

Mode S Address Code[5]:

PBN Approval Type~~Airworthiness Approval~~[6]:

Date Issued[7]:

PBN Approval Type:

Date Issued[7]:

~~PB~~Data Link Approval[6]~~N Approval Type~~[6]:

Date Issued[7]:

~~Date of Expiry~~[7] ~~(If Applicable):~~

~~Method of Compliance (E.g Service Bulletin):~~

Remarks[8]:

When complete, please return to the following address.
~~SMA~~EMA Address

Telephone:
Fax:

E-Mail: _____

SMAEMA A3
WITHDRAWAL OF PBN OR DATA LINK APPROVAL

1. When a State of Registry has cause to withdraw the PBN or data link approval of an operator/aircraft, details as requested below, must be submitted to the SMAEMA by the most appropriate method.

2. *Before providing the information as requested below, reference below, reference should be made to the accompanying notes* **(PLEASE USE BLOCK CAPITALS)**.

State of Registry[1]:

Name of Operator[2]:

State of Operator[1]:

Aircraft Type[3]:

Aircraft Series[4]:

Manufacturers Serial No:

Registration:

Aircraft Mode S Address Code[5]:

Date of Withdrawal of PBN or Data Link Approval Withdrawn (PBN or DL)[97]:

Date of Withdrawal of of PBN Approval[7]:

Reason for Withdrawal of PBN or Data Link Approval[8]:

Remarks:

When complete, please return to the following address.

SMAEMA Address

Telephone:
Fax:
E-Mail:

APPENDIX D -

Minimal Informational Content For Each State PBN Or Data Link Approval To Be Maintained In Electronic Form By An SMAEMA

Aircraft PBN and Data Link Approvals Data

To properly maintain and track PBN and data link approval information some basic aircraft identification information is required (e.g., manufacturer, type, serial number, etc.) as well as details specific to an aircraft's PBN and data link approval status. Table 1 lists the minimum data fields to be collected by an SMAEMA for an individual aircraft. Table 1a describes the approvals database record format.

Note: This appendix primarily details the different data elements to be stored by and/or exchanged between SMAs. The details of data types, unit and format will be defined in document TBA

Table 1. Aircraft PBN and Data Link Approvals Data

Field	Description
Registration Number	Aircraft's current registration number.
Mode S	Aircraft's current Mode S code 6 hexadecimal digits.
Serial Number	Aircraft Serial Number as given by manufacturer
ICAO type Designator	Aircraft Type as defined by ICAO document 8643
Series	Aircraft generic series as described by the aircraft manufacturer (e.g., 747-100, series = 100).
State of Registry	State to which the aircraft is currently registered as defined in ICAO document 7910
Reg. Date	Date registration was active for current operator.
Operator ICAO Code	ICAO code for the current Operator as defined in ICAO document 8585.
Operator Name	Name of the current Operator.
State of Operator	State of the current Operator as defined in ICAO document .7910
Civil or military indication *	Aircraft is civil or military
Airworthiness (MASPS) Approved	Yes or no indication of airworthiness approval
Date Airworthiness Approved	Date of Airworthiness Approval
PBN Approval type	PBN approval – eg RNP 4, RNAV 2, RNP 1
Region for PBN Approval	Name of region where the PBN approval is applicable Note: Only required if PBN Approval is issued for a specific region.
State Of PBN Approval	State granting PBN approval as defined in ICAO document 9613
Date PBN Approved	Date of PBN Approval
Date of PBN Expiry	Date of Expiry for PBN Approval
Method of Compliance (service bulletin or STC)	Reference number/name of compliance method used to make a/c MASPS compliant.
Date of Data Link Approval	Date of Data Link Approval
Remarks	Open comments
Date of Withdrawal of Airworthiness (MASPS) Approval	Date of withdrawal of the aircraft's Airworthiness approval (if applicable)
Date of Withdrawal of PBN approval	Date of withdrawal of the aircraft's

Field	Description
	PBN approval (if applicable)
Info by Authority	Yes or no indication “Was the information provided to the SMAEMA by a State Authority?”

* not necessarily a separate field. Can be a field on its own, or. It is indicated in the operator ICAO code as MIL when the military has an ICAO code designator.

Table 1a. Approvals Database Record Format

Field	Description	Type	Width	Valid Range
1State of Registry	State of Registry	Alphabetic	2	AA-ZZ
Operator2	Operator	Alphabetic	3	AAA-ZZZ
3State of OeratorOperator	State of Operator	Alphabetic	2	AA-ZZ
4AC Type	Aircraft Type	Alphanumeric	4	e.g. MD11
5AC Mark/Series	Aircraft Mark / Series	Alphanumeric	6	
6Serial Number	Manufacturer's Serial/Construction Number	Alphanumeric	12	
AC 7Registration Number	Aircraft Registration Number	Alphanumeric	10	
8Mode S	Aircraft Mode "S" Address (Hexadecimal)	Alphanumeric	6	000001-FFFFFF
9	Airworthiness Approved	Alphabetic	1	"Y", "N"
10	Date Airworthiness Approval Issued (dd/mm/yyyy)	Date	8	e.g. 31/12/1999
9PBN Approval Type11	PBN Approval Type	Alphanumeric	6	e.g RNP4
10Approval Date2	Date PBN Approval Issued (dd/mm/yyyy)	Date	8	e.g. 31/12/1999
11Date of Expiry3	Date of Expiry of PBN Approval (if any) (dd/mm/yyyy)	Date	8	e.g. 31/12/1999
12DL Approval Date	Date Data Link Approval Issued (dd/mm/yyyy)	Date	8	e.g. 31/12/1999
13Remarks4	National Remarks	Alphanumeric	60	ASCII text
15	Method of compliance	Alphanumeric	60	ASCII text

Aircraft Re-Registration/Operating Status Change Data

Aircraft frequently change registration information. Re-registration and change of operating status information is required to properly maintain an accurate list of the current population as well as to correctly identify height measurements. Table 2 lists the minimum data fields to be maintained by an SMAEMA to manage aircraft re-registration/operating status change data.

Table 2. Aircraft Re-Registration/Operating Status Change Data

Field	Description
Reason for change	Reason for change. Aircraft was re-registered, destroyed, parked, etc.
Previous Registration Number	Aircraft's previous registration number.
Previous Mode S	Aircraft's previous Mode S code.
Previous Operator Name	Previous name of operator of the aircraft.
Previous, Operator ICAO Code	ICAO code for previous aircraft operator.
Previous State of the Operator	ICAO code for the previous State of the operator
State of New Operator	ICAO code for the State of the current aircraft operator.
New Registration Number	Aircraft's current registration number.
New State of Registration	Aircraft's current State of Registry.
New Operator Name	Current name of operator of the aircraft.
New Operator ICAO Code	ICAO code for the current aircraft operator.
Aircraft ICAO Type designator	Aircraft Type as defined by ICAO document 8643
Aircraft Series	Aircraft generic series as described by the aircraft manufacturer (e.g., 747-100, series = 100).
Serial Number	Aircraft Serial Number as given by manufacturer
New Mode S	Aircraft's current Mode S code 6 hexadecimal digits.
Date change is effective	Date new registration/ change of status became effective.

Contact Data

An accurate and up to date list of contacts is essential for an SMAEMA to do business. Table 3 lists the minimum content for organizational contacts and Table 4 lists the minimum content for individual points-of-contact.

Table 3. Organizational Contact Data

Field	Description
Type	Type of contact (e.g., Operator, Airworthiness Authority, Manufacturer)
State	State in which the company is located.
State ICAO	ICAO code for the State in which the company is located.
Company/Authority	Name of the company/authority as used by ICAO (e.g., Bombardier)
Fax No	Fax number for the company.
Telephone Number	Telephone number for the company.
Address (1-4)	Address lines 1-4 filled as appropriate for the company.
Place	Place (city, etc.) in which the company is located.
Postal code	Postal code for the company.
Country	Country in which the company is located.
Remarks	Open comments
Modification Date	Last Modification Date.
Web Site	Company Web HTTP Location.
e-mail	Company e-mail address.
civ/mil	Civil or Military.

Table 4. Individual Point of Contact Data

Field	Description
Title Contact	Mr., Mrs., Ms., etc.
Surname Contact	Surname of point of contact.
Name Contact	Name of point of contact.
Position Contact	Work title of the point of contact.
Company/Authority	Name of the company/authority as used by ICAO (e.g., Bombardier)
Department	Department for the point of contact.
Address (1-4)	Address lines 1-4 filled as appropriate for the point of contact.
Place	Place (city, etc.) in which the point of contact is located.
Postal code	Postal code for the location of the point of contact.
Country	Country in which the point of contact is located.
State	State in which the point of contact is located.
E-mail	E-mail of the point of contact.
Telex	Telex number of the point of contact.
Fax No	Fax number of the point of contact.
Telephone no 1	First telephone number for the point of contact.
Telephone no 2	Second telephone number for the point of contact.

Data Exchange Between ES~~S~~MAs

The following sections describe how data is to be shared between ~~SMAs~~EMAs as well as the minimum data set that should be passed from one ~~SMA~~EMA to another. This minimum sharing data set is a sub-set of the data defined in previous sections of Appendix D.

All ~~SMAs~~EMAs receiving data have responsibility to help ensure data integrity. A receiving ~~SMA~~EMA must report back to the sending ~~SMA~~EMA any discrepancies or incorrect information found in the sent data.

Data Exchange Procedures

The standard mode of exchange shall be e-mail or FTP. Data shall be presented in Microsoft Excel or Access. ~~SMAs~~EMAs must reali~~sz~~e that the data are~~is~~ current only to the date of the created file.

Table 5. ~~SMA~~EMA Data Exchange Procedures

Data Type	Data Subset	Frequency	When
PBN and Data Link Approvals	All	Monthly	First week in month
Aircraft Re-registration/status	New since last broadcast	Monthly	First week in month
Contact	All	Monthly	First week in month
Non-Compliant Aircraft~~/Group~~	All	As Required.	As Occurs

In addition to regular data exchanges, one-off queries shall be given to an ~~SMA~~EMA on request. This includes requests for data in addition to the minimum exchanged data set such as service bulletin information.

Exchange of Aircraft Approvals Data

An SMAEMA shall only exchange PBN and Data Link Approvals data with another SMAEMA when an aircraft is at minimum Airworthiness Approveds.. The following table defines the fields required for sending a record to another SMAEMA.

Table 6. Exchange of Aircraft Approvals Data

Field	Needed to Share
Registration Number	Mandatory
Mode S	Desirable
Serial Number	Mandatory
ICAO type Designator	Mandatory
Series	Mandatory
State of Registry	Mandatory
Registration Date	Desirable
Operator ICAO Code	Mandatory
Operator Name	Desirable
State of Operator	Mandatory
Civil or military indication (not a field on its own. It is indicated in the ICAO operator code as MIL except when the military has a code)	Desirable
Airworthiness (MASPS) Approved	Mandatory
Date Airworthiness Approved	Mandatory
PBN Approval Type	Mandatory
State Of PBN Approval	Mandatory
Date PBN Approved	Mandatory
Date of PBN Approval Expiry	Mandatory
Method of Compliance (service bulletin or STC)	Desirable
Date Data Link Approved	Mandatory
Remarks	No
Date of Withdraw of Airworthiness (MASPS) Approval	Mandatory
Date of Withdraw of PBN approval	Mandatory
Info by Authority	Mandatory

Aircraft Re-Registration/Operating Status Change Data

An SMAEMA shall share all re-registration information.

Table 7. Exchange of Aircraft Re-Registration/Operating Status Change Data

Field	Need to Share
Reason for change (ie. re-registered, destroyed, parked)	Mandatory
Previous Registration Number	Mandatory
Previous Mode S	Desirable
Previous Operator Name	Desirable
Previous, Operator ICAO Code	Mandatory
Previous State of Operator	Mandatory
State of Operator	Mandatory
New registration number	Mandatory
New State of Registration	Mandatory
New Operator Name	Desirable
New Operator Code	Desirable
Aircraft ICAO Type designator	Mandatory
Aircraft Series	Mandatory
Serial Number	Mandatory
New Mode S	Mandatory
Date change is effective	Desirable

Exchange of Contact Data

~~Only State Data, Manufacturer and Design Organizations~~

Table 8. Exchange of Organizational Contact Data Fields

Field	Need to Share
Type	Mandatory
State	Mandatory
State ICAO	Desirable
Company/Authority	Mandatory
Fax No	Desirable
Telephone Number	Mandatory ~~Desirable~~
Address (1-4)	Mandatory ~~Desirable~~
Place	Mandatory ~~Desirable~~
Postal code	Mandatory ~~Desirable~~
Country	Mandatory ~~Desirable~~
e-mail	Desirable
civ/mil	Desirable

Table 9. Exchange of Individual Point of Contact Data Fields

Field	Need to Share
Title Contact	Desirable
Surname Contact	Mandatory
Name Contact	Desirable
Position Contact	Desirable
Company/Authority	Mandatory
Department	Desirable
Address (1-4)	MandatoryDesirable
Place	MandatoryDesirable
Postal code	MandatoryDesirable
Country	MandatoryDesirable
State	MandatoryDesirable
E-mail	Desirable
Fax No	Desirable
Telephone no 1	MandatoryDesirable
Telephone no 2	Desirable

Confirmed Non-Compliant Information
As part of its monitoring assessments an SMAEMA may identify a non-compliant aircraft ~~or discover an aircraft group that is not meeting the ICAO performance requirements or the MASPS~~. This should be made available to other SMAsEMAs.

When identifying a non-compliant aircraft an SMAEMA should include

- Notifying SMAEMA
- Date Sent
- Field
- Registration Number
- Mode S
- Serial Number
- ICAO Type Designator
- State of Registry
- Registration Date
- Operator ICAO Code
- Operator Name
- State of Operator
- Date(s) of non-compliance(s)
- Action Started (y/n)
- Date Non-compliance Resolved

~~*Data specific to Risk Assessment*~~

Except as authorized by the ICAO Asia/Pacific Regional Office, data specific to particular risk assessments tThis data will not be shared between SMAsEMAs as it is specific to the airspace being assessed and in some cases confidential information. This includes Flight Plan Data, Operational Error Data, Occupancy Data, Aircraft type proportions, and Flight time information.

Fixed parameters -Reference Data Sources

Some of the data that are used internally to an SMAEMA and form some of the standard for data formats are listed below.

- ICAO Doc. 7910 " Location Indicators"
- ICAO Document 8585 " Designators for Aircraft Operating Agencies, Aeronautical Authorities, and Services"
- ICAO Document 8643 " Aircraft Type Designators"
- IATA "Airline Coding Directory"

APPENDIX E-

Suggested Form for ATC Unit Monthly Report of Large Lateral Deviations or Large Longitudinal Errors

[EN-ROUTESAFETY MONITORING AGENCY NAME]

Report of Large Lateral Deviation or Large Longitudinal Error

Report to the (*En-routeSafety Monitoring Agency Name*) of a large lateral deviation (LLD) or a large longitudinal error (LLE), of 15NM by an aircraft or an unexpected change in longitudinal error separation of at least [X 10 NM or 3 minutes] between two co-altitude, same-route aircraft, including those due to weather deviations and other contingency events, as defined below:

Type of Error	Category of Error	Criterion for Reporting
Lateral deviation	Individual-aircraft error	15NM or greater magnitude
Longitudinal deviation	Aircraft-pair (Time-based separation applied)	Infringement of longitudinal separation standard based on routine position reports
Longitudinal deviation	Aircraft-pair (Time-based separation applied)	Expected time between two aircraft varies by 3 minutes or more based on routine position reports
Longitudinal deviation	Individual-aircraft (Time-based separation applied)	Pilot estimate varies by 3 minutes or more from that advised in a routine position report
Longitudinal deviation	Aircraft-pair (Distance-based separation applied)	Infringement of longitudinal separation standard, based on ADS, radar measurement or special request for RNAV position report
Longitudinal deviation	Aircraft-pair (Distance-based separation applied)	Expected distance between an aircraft pair varies by 10NM or more, even if separation standard is not infringed, based on ADS, radar measurement or special request for RNAV position report

Name of ATC unit:_____

Please complete Section I or II as appropriate

SECTION I:

There were no reports of LLDslarge lateral deviations or large longitudinal errorsLLEs for the month of _____

SECTION II:

There was/were _____ report(s) of a LLDlateral deviation of 15NM or more

There was/were _____ report(s) of LLE unexpected change a in longitudinal error separation of at least [X 10 NM or 3 minutes] between co-altitude, same-route aircraft.

Details of the LLDs and LLEs lateral deviation(s) and unexpected change(s) in longitudinal errorseparation (s) are attached.

(Please use a separate form for each report of lateral deviation or longitudinal error[b1]).

(use forms from the LOA GNE Monitoring SCS as template)

SECTION III:

When complete please forward the report(s) to:

En-routeSafety Monitoring Agency Name
Postal address
Telephone:
Fax:
E-Mail:

APPENDIX F –

Note: Align this template with the standardized Asia/Pacific RMA data collection template, include PBN Approval type in RMA template, include ATS route in EMA template

Sample Content and Format for Collection of Sample of Traffic Movements

The following table lists the information required for each flight in a sample of traffic movements.

INFORMATION FOR EACH FLIGHT IN THE SAMPLE

The information requested for a flight in the sample is listed in the following table with an indication as to whether the information is necessary or is optional:

ITEMFIELDield	EXAMPLE	MANDATORY OR OPTIONAL
Date (either month/day/year or day/month/year format) (dd/mm/yyyy)	5/01/00 or 081/05/20070 for 81 May 20070	MANDATORY
Aircraft call sign	XXX704	MANDATORY
Aircraft Type	B734	MANDATORY
Aircraft registration mark	VH-ABC	OPTIONAL
Origin Aerodrome	WMKK	MANDATORY
Destination Aerodrome	RPLL	MANDATORY
PBN Approval type	RNP 4	MANDATORY
Entry Fix into Airspace	MESOK	MANDATORY
Time at Entry Fix (UTC)	2:25 (or 0225)0225 or 02:25	MANDATORY
Flight Level at Entry Fix	330	MANDATORY
Assigned Mach number at Entry Fix	M0.77	OPTIONAL
Exit Fix from Airspace	NISOR	MANDATORY
Time at Exit Fix (UTC)	4:01 (or 0401 or 04:01)	MANDATORY
Flight Level at Exit Fix	330	MANDATORY
Assigned Mach number at Exit Fix	M0.77	OPTIONAL
First Fix Within the Airspace OR First Airway Within the Airspace	MESOK OR G582	OPTIONAL
Time at First Fix (UTC)	02:25 OR 0225 or 02:25	OPTIONAL
Flight Level at First Fix	330	OPTIONAL
Second Fix Within the Airspace OR Second Airway Within the Airspace	MEVAS OR G577	
Time at Second Fix (UTC)	02:50 OR 0250 or 02:50	OPTIONAL
Flight Level at Second Fix	330	OPTIONAL
(Continue with as many Fix/Time/Flight-Level entries as are required to describe the flight's movement within the airspace)		OPTIONAL

Information Required for a Flight in Traffic Sample

APPENDIX G -

Letter To State Authority Requesting Clarification Of The State PBN or Data Link Approval Status Of An Operator

When the PBN or data link approval status shown in filed flight plan is not confirmed in an SMAEMA's database of State approvals, a letter similar to the following should be sent to the relevant State authority.:

<STATE AUTHORITY ADDRESS>

1. The (*SMAEMA name*) has been established by the ICAO Asia/Pacific Regional Airspace Safety Monitoring Advisory Group (RASMAG)APANPIRG to support safe implementation and use of the horizontal-planePBN based separation in (*airspace where the SMAEMA has responsibility*), in accordance with guidance published by the International Civil Aviation Organization.

2. Among the other activities, the (*SMAEMA name*) conducts a comparison of the State PBN and data link approval status, providednotified by an operator to an air traffic control unit, to the records of State PBN and data link approvals available to us. This comparison is considered vital to ensuring the continued integrity safe use of horizontal-plane PBN based separation.

3. This letter is to advise you that an operator which we believe is on your State registry provided notice of State PBN or data link approval which is not confirmed by our records. The details of the occurrence are as follows:

Date:
Operator name:
Aircraft flight identification:
Aircraft type:
Registration mark:
FiledNotified PBN Approval type:
Filed Data Link Approval Status:
ATC unit receiving notification:

4 We request that you advise this office of the PBN and data link approval status of this operator. In the event that you have not granted a PBN or data link approval to this operator similar to that notified by the operator as above, we request that you advise this office of any action which you propose to take.

Sincerely,

(*SMAEMA official*)

APPENDIX H -

Description of Models Used to Estimate Risk

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PACIFIC REGIONAL PERFORMANCE-BASED NAVIGATION IMPLEMENTATION PLAN

Interim Edition

~~**September 2008**~~
RASMAG/10 December 2008
(Note: Changes proposed by RASMAG are identified by grey highlight and ~~text strikethrough~~)

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ASIA/PACIFIC REGIONAL PERFORMANCE-BASED NAVIGATION IMPLEMENTATION PLAN

1. Executive Summary

1.1 This Asia/Pacific Regional PBN Implementation Plan has been produced in line with Resolution A 36/23 adopted by ICAO Assembly in its 36th Session held in September 2007 and Conclusion 18/~~53~~ 52 adopted by APANPIRG/18. The Regional PBN Plan addresses the strategic objectives ~~of~~ for PBN implementation based on clearly established operational requirements, avoiding equipage of multiple on-board or ground based equipment, avoidance of multiple airworthiness and operational approvals and explains in detail contents relating to potential navigation applications. The Plan envisages the conduct of pre- and post-implementation safety assessments and continued availability of conventional air navigation procedures during transition. The Plan also discusses issues related to implementation which include traffic forecasts, aircraft fleet readiness, adequacy of ground-based CNS infrastructure etc. Implementation targets for various categories of airspace for the short term (2008 – 2012) and for the medium term (2013 – 2016) have been projected in tabular forms to facilitate easy reference. For the long term (2016 and beyond) it has been envisaged that GNSS will be the primary navigation infrastructure. It is also ~~envisaged~~ expected that precision approach capability using GNSS and its augmentation system will become available in the long term.

2. Explanation of Terms

2.1 The drafting and explanation of this document is based on the understanding of some particular terms and expressions that are described below:

2.1.1 **Asia/Pacific Regional PBN Implementation Plan.** A document adopted by APANPIRG, often referred to as the "Regional PBN Plan", offering appropriate guidance for air navigation service providers, airspace operators and users, regulating agencies, and international organizations~~,~~ on the evolution of navigation capabilities ~~,~~ as one of the key systems supporting air traffic management, and which describes the RNAV and RNP navigation applications that should be implemented in the short, medium and long term in the ~~ASIA/PAC~~ APAC Region.

2.1.2 **Performance Based Navigation** Performance based navigation specifies RNAV and RNP system performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in an airspace.

2.1.3 **Performance requirements.** Performance requirements are defined in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept. Performance requirements are identified in navigation specifications which also identify which navigation sensors and equipment may be used to meet the performance requirement.

3. Acronyms

3.1 The acronyms used in this document along with their expansions are given in the following list

ABAS	Aircraft-Based Augmentation System
AIS	Aeronautical Information ~~System~~ Services
APAC	Asia and Pacific
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APCH	Approach
APV	Approach Procedures with Vertical Guidance
ATC	Air Traffic Control
Baro VNAV	Barometric Vertical Navigation
CNS/ATM	Communication Navigation Surveillance/Air Traffic Management

CPDLC	Controller Pilot Data Link Communications
DME	Distance Measuring Equipment
EMA	En-route Monitoring Agency
FASID	Facilities and Services Implementation Document
FIR	Flight Information Region
FMS	Flight Management System
GBAS	Ground-Based Augmentation System
GNSS	Global Navigation Satellite System
GRAS	Ground-based Regional Augmentation System
IATA	International Air Transport Association
IFALPA	International Federation of Air Line Pilots' Associations
INS	Inertial Navigation System
IRU	Inertial Reference Unit
PANS	Procedures for Air Navigation Services
PBN	Performance Based Navigation
PIRG	Planning and Implementation Regional Group
RASMAG	Regional Airspace Safety Monitoring Advisory Group
RCP	Required Communication Performance
RNAV	Area Navigation
RNP	Required Navigation Performance
SARP	Standards and Recommended Practices
SBAS	Satellite-Based Augmentation System
SID	Standard Instrument Departure
STAR	Standard Instrument Arrival
TMA	Terminal Control Area
VOR	VHF Omni-directional Radio-range
WGS	World Geodetic System

4. Introduction

Need for the regional PBN Implementation Plan

4.1 The Thirty-sixth Session of the ICAO Assembly held in Montreal in September 2007 adopted a Resolution to resolve that States and ~~planning and implementation regional groups (~~PIRGs~~)~~ complete a regional PBN implementation plan by 2009.

4.2 Recognizing that the PBN concept is now established, States should ensure that all RNAV and RNP operations and procedures are in accordance with the PBN concept as detailed in State letter AN 11/45-07/22 and the ICAO Doc 9613: PBN Manual for ensuring a globally harmonized and coordinated transition of PBN.

4.3 In view of the need for detailed navigation planning, it is advisable to develop a Regional PBN Plan to provide proper guidance to air navigation service providers, airspace operators and users, regulating agencies, and international organizations~~,~~ on the evolution of navigation capabilities ~~,~~ as one of the key systems supporting air traffic management, and which describes the RNAV and RNP navigation applications that should be implemented in the short and medium term in the ~~ASIA/PAC~~ APAC Region.

4.4 Furthermore, the Asia/Pacific Regional PBN Implementation Plan will ~~be~~ contain the basic material serving as guidance for regional projects for the implementation of air navigation infrastructure, such as ABAS, SBAS, GBAS, GRAS, etc., as well as for the development of national implementation plans.

Roles of Navigation in supporting ATM operations

4.5 An "~~A~~airspace ~~C~~concept" may be viewed as a general vision or master plan for a particular airspace. Based on particular principles, an ~~A~~airspace ~~C~~concept is geared towards specific objectives. Strategic objectives drive the general vision of the ~~A~~airspace ~~C~~concept. These objectives are usually identified by airspace users, air traffic management (ATM), airports as well as environmental and government policy. It is the function of the ~~A~~airspace ~~C~~concept and the concept of operations to respond to these requirements. The strategic objectives which most commonly drive ~~A~~airspace ~~C~~concept are ~~S~~safety, ~~C~~capacity, ~~E~~efficiency, ~~A~~access, and the ~~E~~environment.

4.6 Navigation is one of several enablers of an ~~A~~airspace ~~C~~concept. Communications, ATS Surveillance and ATM are also essential elements of an ~~A~~airspace ~~C~~concept.

4.7 The ~~Performance Based Navigation (~~PBN~~)~~ concept specifies RNAV and RNP system performance requirements in terms of accuracy, integrity, availability, continuity and functionality needed for the proposed operations in the context of a particular Airspace Concept, when supported by the appropriate navigation infrastructure. In that context, the PBN concept represents a shift from sensor-based to performance-based navigation. Performance requirements are identified in navigation specifications which also identify the choice of navigation sensors and equipment that may be used to meet the performance requirements. These navigation specifications are defined at a sufficient level of detail to facilitate global harmonization by providing specific implementation guidance for States and operators.

4.8 Under the PBN concept, the generic navigation requirements are defined based on operational requirements. Thus, users may evaluate the available options. To ensure synchronization of investment and interoperability of the airborne and ground systems, the selection of the solution should be in consultation with aviation stakeholders, including international and domestic airline operators, air navigation service providers, and regulators. The solution selected should also be the most cost-effective one.

4.9 The development of the ~~Performance Based Navigation~~ PBN concept recognized that advanced aircraft RNAV systems are achieving ~~a~~ an enhanced and predictable level of navigation performance accuracy which, together with an appropriate level of functionality, allows a more efficient use of available airspace to be realized. It also takes account of the fact that RNAV systems have developed over a 40-year period and as a result there were a large variety of differing implementations globally. Identifying navigation requirements rather than on the means of meeting the requirements will allow use of all RNAV systems meeting these requirements irrespective of the means by which these are met.

Benefits of Performance-Based Navigation

4.10 The main benefits derived from the implementation of PBN are:

a) Increased airspace safety through the implementation of continuous and stabilized descent procedures using vertical guidance;
b) Reduced aircraft flight time due to the implementation of optimal flight paths, with the resulting savings in fuel, noise reduction, and enhanced environmental protection;
c) Use of the RNAV and/or RNP capabilities that already exist in a significant percentage of the aircraft fleet flying in APAC airspace;
d) Improved airport and airspace arrival paths in all weather conditions, and the possibility of meeting critical obstacle clearance and environmental requirements through the application of optimized RNAV or RNP paths;
e) Implementation of more precise approach, departure, and arrival paths that will reduce dispersion and will foster smoother traffic flows;
f) Reduced delays in high-density airspaces and airports through the implementation of additional parallel routes and additional arrival and departure points in terminal areas;
g) Reduction of lateral and longitudinal separation between aircraft to accommodate more traffic;

h) Decrease ATC and pilot workload by utilizing RNAV/RNP procedures and airborne capability and reduce the needs for ATC-Pilot communications and radar vectoring;
i) Increase of predictability of the flight path.

Goals & Objectives of PBN Implementation

4.11 APANPIRG, in its Eighteenth meeting (September 2007), discussed various issues related to an early implementation of PBN in the region. To facilitate coordination between States, a PBN Task Force was formed under Conclusion 18/52 and tasked to develop a harmonized regional PBN implementation plan.

4.12 The Asia/Pacific Regional PBN Implementation Plan has the following strategic objectives:

a) To ensure that the implementation of the navigation item of the CNS/ATM system is based on clearly established operational requirements.
b) To avoid undue equipage of multiple on board equipment and/or ground-based systems.
c) To avoid the need for multiple airworthiness and operational approvals for intra- and inter-regional operations.
d) To explain in detail the contents of the Regional Air Navigation Plan, relating to potential navigation applications.

4.13 Furthermore, the Asia/Pacific Regional PBN Implementation Plan will provide a high-level strategy for the evolution of the navigation applications to be implemented in the ~~ASIA/PAC~~ APAC Region in the short term (2008-2012) and medium term (2013-2016). This strategy is based on the concepts of Area Navigation (RNAV) and Required Navigation Performance (RNP) in accordance with ICAO Doc. 9613: *Performance Based Navigation Manual*, and will be applied to aircraft operations involving instrument approaches, standard departure (SID) routes, standard arrival (STAR) routes, and ATS routes in oceanic and continental areas.

4.14 The ~~Asia/Pacific~~ Regional PBN ~~Implementation~~ Plan was developed by the APAC States together with the international organizations concerned (including IATA and IFALPA)~~,~~ and is intended to assist the main stakeholders of the aviation community plan a gradual transition to the RNAV and RNP concepts. The main stakeholders of the aviation community that benefit from this Regional Plan are:

- Airspace operators and users.
- Air navigation service providers.
- Regulating agencies.
- International organizations.

4.15 ~~This Regional Plan~~ The Regional PBN Plan is intended to assist the main stakeholders of the aviation community plan the future transition and their investment strategies. For example, airlines and operators can use this ~~Regional~~ Plan to ~~plan~~ derive future equipage and additional navigation capability investments; air navigation service providers can plan a gradual transition for the evolving ground infrastructure. Regulating agencies will be able to anticipate and plan for the criteria that will be needed in the future.

4.16 Recognizing the safety benefits of PBN, the thirty-sixth session of the ICAO Assembly held in Montreal, September 2007 adopted a Resolution to resolve that States and ~~planning and implementation regional groups~~ (PIRGs~~)~~ ~~complete~~ prepare ~~a~~ PBN implementation plans by 2009 to achieve:

a) Implementation of RNAV and RNP operations (where required) for en route and terminal areas according to established timelines and intermediate milestones; and
b) Implementation of ~~approach procedures with vertical guidance (~~APV~~)~~ (Baro-VNAV and/or augmented GNSS) for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30 per cent by 2010, 70 per cent by 2014.

Planning Principles

4.17 Planning for the implementation of PBN in the ~~ASIA/PAC~~ APAC Region shall be based on the following principles:

a) Pre- and post-implementation safety assessments will be conducted in accordance with ICAO provisions to ensure the application and maintenance of the established target levels of safety.
b) Continued application of conventional air navigation procedures during the transition period, to guarantee the operations by users that are not RNAV- and/or RNP-equipped.
c) The first regional PBN implementation plan should address the short term (2008-2012) and medium term (2013-2016) and take into account long term global planning issues.
d) Target date for ~~completion~~ preparation of the first regional PBN implementation plan is APANPIRG/19 (September 2007).

5. PBN Operational Requirements & Implementation Strategy

5.1 Introduction of PBN should be consistent with the Global Air Navigation Plan. Moreover, PBN implementation shall be in full compliance with ICAO SARPs and PANS and support relevant ICAO Global Plan Initiatives.

5.2 The ICAO Council accepted the second amendment to the Global Air Navigation Plan for the CNS/ATM System in November 2006. The approved plan has been renamed as Global Air Navigation Plan (Doc 9750). The relevant Global Plan Initiatives including implementation of performance based navigation (PBN) and navigation system have been included in the Global Plan. The introduction of PBN must be supported by an appropriate navigation infrastructure consisting of an appropriate combination of Global Navigation Satellite System (GNSS), self-contained navigation system (inertial navigation system) and conventional ground-based navigation aids.

5.3 The *Strategy for the Provision of Precision Approach, Landing & Departure Guidance Systems* and the *Strategy for Implementation of GNSS Navigation Capability* were reviewed and updated by the Eleventh meeting of CNS/MET Sub Group of APANPIRG in July 2007. The updated strategies were reviewed and adopted by APANPIRG as *Strategies for the Provision of Navigation Services* in its Eighteenth meeting held in September, 2007 under ~~its~~ Conclusion 18/30.

Route Operations

5.4 As the routes structure and en-route operation are extensive and complicated in APAC ~~Asia-Pacific~~ region, it is difficult to restructure and include the whole airspace in a single implementation plan for en-route operations.

5.5 Considering the traffic characteristics and CNS/ATM capability, en-route operations can be classified as Oceanic, Remote continental, and Continental en-route.

5.6 In principle, ~~for~~ each classification of en-route operation (paragraph 5.5 above) should adopt, but not be limited to, a single RNAV or RNP navigation specification. This implementation strategy ~~will~~ should be applied by implementing States in coordination with airspace users ~~the Sstate/territories/international organizations themselves~~, and the RNAV and RNP navigation applications should be coordinated between ~~these~~ Sstates to ensure harmonization.

5.7 In areas where operational benefits can be achieved and appropriate CNS/ATM capability exists or can be provided for a more accurate navigation specification than that specified in this plan, States are

encouraged to introduce the more accurate navigation specification on the basis of coordination with stakeholders and affected ~~neighboring~~ States~~/Territories~~.

Similarly, in circumstances where affected States are agreeable to completing an implementation in advance of the timelines specified in this plan, early implementation is encouraged on the basis of coordination between affected States and airspace users.

TMA Operations

5.8 TMA operations have their own characteristics, taking into account the applicable separation minima between aircraft and between aircraft and obstacles. TMA operations ~~It~~ also involve~~s~~ the diversity of aircraft, including low-performance aircraft flying in the lower airspace and conducting arrival and departure procedures on the same path or close to the paths of high-performance aircraft.

5.9 In this sense and as called for under APANPIRG Conclusion 18/53, ~~the~~ States~~/Territories~~ shall develop their own national plans for the implementation of PBN in sovereign TMAs. Such national plans should be based on the Asia/Pacific Regional PBN Implementation Plan, seek~~ing~~ the harmonization of the application of PBN and avoid~~ing~~ the need for multiple operational approvals for intra- and inter-regional operations. ~~and the~~ A~~a~~pplicable aircraft separation criteria should also be considered.

Instrument Approaches

5.10 States are encouraged to introduce PBN approaches that provide Vertical Guidance to enhance safety. Conventional approach procedures and conventional navigation aids should be maintained to support non-equipped aircraft during the transitional period.

5.11 During early implementation of PBN, IFR Approaches based on PBN should be designed to accommodate a mixed-equipage (PBN and non-PBN) environment. ATC workload should be taken into account while developing approach procedures. One possible way to accomplish this is to co-locate the Initial Approach Waypoint for both PBN and conventional approaches

6. Current Status & Forecast

APAC traffic forecast

6.1 The GEN part of FASID (Doc9673 Vol. II) provides the information and data of the following traffic forecasts:

- **Forecasts of air traffic demand for air navigation systems planning**
- **Passenger forecasts**
- **Aircraft movement forecast**
- **Major city-pairs forecasts**

6.2 The forecast data as well as the figures contained in the FASID document are the results of the regular meetings of Asia/Pacific Area Traffic Forecasting Group (APA TFG). These forecasts are updated periodically in conjunction with APA TFG meetings and are not subject to the amendment procedure related to the FASID. The APA TFG is tasked to update the long-range forecasts of passenger traffic produced for the Asia and Pacific (ASIA/PAC) regions, encompassing the intra-Asia/Pacific and trans-Pacific markets, along with preliminary city-pair forecasts to include the 40 busiest routes in terms of passengers carried within these regions. In addition, aircraft movements are forecast for a five-year horizon initially for the aggregate trans-Pacific market and city-pairs of three selected flight information regions (FIRs) of the intra-Asia/Pacific traffic. States are encouraged to consider the up to date forecast data contained in the FASID document while developing or updating the regional and national implementation plan.

6.3 The February 2008 forecast ~~conducted~~ prepared by IATA ~~on 27 February 2008~~ for ~~Asia and Pacific~~ APAC traffic in respect of passenger, cargo, aircraft movements and new aircraft deliveries in ~~all~~ the Regions is also provided in the Appendix B to this plan as reference.

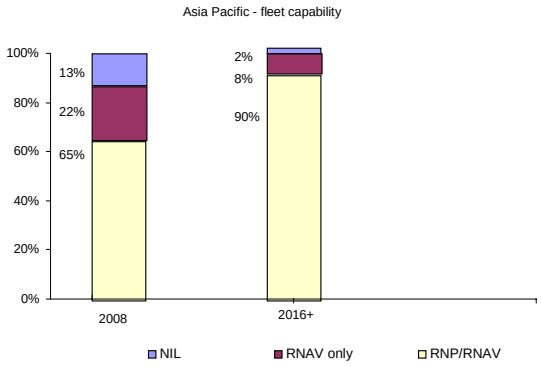
Aircraft fleet readiness status

6.4 2007 was a record year for Asia/Pacific airlines with 418 new aircraft deliveries and more than 1,000 new orders. The overall number of deliveries to Asia/Pacific based airlines in 2008 is expected to total 430 aircraft.

6.5 All major commercial aircraft manufacturers since the 1980's have included RNAV capabilities. The commercial aircraft currently produced incorporate an RNP capability.

6.6 One significant issue for PBN implementation today is directly related to the multitude of FMS installations and varying degrees of capabilities associated with the current fleet of RNAV aircraft. Specifically, there are numerous FMS systems installed in today's fleets, all with varying capabilities.

6.7 The diagram below displays a high level analysis based on fleet numbers from Ascend Online Fleets database March 2008 and RNAV/RNP classification by IATA.



CNS Infrastructure

Needs more text ??

Navigation infrastructure

Needs more text ??

Global Navigation Satellite System (GNSS)

6.8 Global Navigation Satellite System (GNSS) is a satellite-based navigation system utilizing satellite signals, such as Global Positioning System (GPS), for providing accurate and reliable position, navigation, and time services to airspace users. In 1996, the International Civil Aviation Organization (ICAO) endorsed the development and use of GNSS as a primary source of future navigation for civil aviation. ICAO noted the increased flight safety, route flexibility and operational efficiencies that could be realized from the move to space-based navigation.

6.9 GNSS supports both RNAV and RNP operations. Through the use of appropriate GNSS augmentations, GNSS navigation provides sufficient accuracy, integrity, availability and continuity to support en-route, terminal area, and approach operations. Approval of RNP operations with appropriate certified avionics provides on-board performance monitoring and alerting capability enhancing the integrity of aircraft navigation.

6.10 GNSS augmentations include Aircraft-Based Augmentation System (ABAS), Satellite-Based Augmentation System (SBAS), Ground-Based Augmentation System (GBAS), and Ground-based Regional Augmentation System (GRAS).

Other PBN navigation infrastructure

6.11 Other navigation infrastructure includes INS, VOR/DME, DME/DME, and DME/DME/IRU. These navigation infrastructures may satisfy the requirements ~~pf~~ of RNAV navigation specifications, but not those of RNP.

6.12 INS may be used to support PBN en-route operations with RNAV-10 and RNAV-5 navigation specifications.

6.13 VOR/DME may be used to support PBN en-route and STAR operations based on the RNAV-5 navigation specification.

6.14 Uses of DME/DME and DME/DME/IRU may support PBN en-route and terminal area operations based on RNAV-5, RNAV-2 or RNAV-1 navigation specifications. Validation of DME/DME coverage area and appropriate DME/DME geometry should be conducted to identify possible DME/DME gaps, including identification of critical DMEs, and to ensure proper DME/DME service coverage.

Surveillance infrastructure

6.15 For RNAV operations, States should ensure that sufficient surveillance coverage is provided to assure the safety of the operations. For RNP operations, surveillance coverage may not be required. Details on the surveillance requirements for PBN implementation can be found in the ICAO PBN Manual and ICAO PANS-ATM (Doc 4444), and information on the current existing surveillance infrastructure in APAC ~~the Asia-Pacific~~ can be found in ICAO FASID tables.

Communication infrastructure

6.16 Implementation of RNAV/RNP routes includes communication requirements. Details on the communication requirements for PBN implementation can be found in ICAO PANS-ATM (Doc 4444), ICAO RCP Manual (Doc 9869), and ICAO Annex 10. Information on the current existing communication infrastructure in APAC ~~the Asia-Pacific~~ can also be found in ICAO FASID tables.

7. Implementation ~~Road Map of~~ Plan for Performance Based Navigation

ATM Operational Requirements

7.1 The Global ATM Operational Concept (Doc 9854) makes it necessary to adopt an airspace concept able to provide an operational scenario that includes r~~R~~oute networks, m~~M~~inimum separation standards, assessment of obstacle clearance, and a CNS infrastructure that satisfies specific strategic objectives, including safety, access, capacity, efficiency, and environment.

7.2 In this regard, the following programmes will be developed:

a) traffic and cost benefit analyses
b) necessary updates on automation
c) operational simulations in different scenarios
d) ATC personnel training
e) Flight plan processing
f) Flight procedure design training to include PBN concepts and ARINC-424 coding standard
g) Enhanced electronic data and processes to ensure appropriate level of AIS data accuracy, integrity and timeliness
h) WGS-84 implementation in accordance with ICAO Annex 15
i) uniform classification of adjacent and regional airspaces, where practicable
j) RNAV/RNP applications for SIDs and STARs

k) Coordinated RNAV/RNP routes implementation
l) RNP approach with vertical guidance

Short Term Implementation Plan ~~Road Map~~

Route Operations

7.3 During the planning phase of any implementation of PBN routes, States should gather inputs from all aviation stakeholders to obtain operational needs and requirements. These needs and requirements should then be used to derive airspace concepts and to select appropriate PBN navigation specification.

7.4 In this phase, the application of RNAV-10 and RNP-4 navigation specifications is expected for Oceanic and Remote continental routes. Prior to implementation of RNP-4, States should consider air traffic demands, ATC workload, ground equipment capabilities and fleet readiness statistics, and consult all stakeholders.

7.5 For Continental routes, the application of RNAV-5 and RNAV-2 navigation specifications is expected. In the continental en-route areas of operation, States may choose to implement RNAV-2 routes to enhance efficiency of airspace usage and support closer route spacing, noting that appropriate communication and surveillance coverage must be provided. The RNAV-2 navigation specification can also be used in ~~certain~~ airspace~~,~~ where sufficient CNS capability is provided and there are operational benefits.

TMA Operations

7.6 In selected TMAs, the application of RNAV-1 in a radar environment can be supported though the use of GNSS or ground navigation infrastructure, such as DME/DME and DME/DME/IRU. In this phase, mixed operations (equipped and non-equipped) will be permitted.

7.7 In a non-radar environment and/or in an environment without adequate ground navigation infrastructure, the SID/STAR application of Basic-RNP1 is expected in selected TMAs with exclusive application of GNSS. In this phase, mixed operations (equipped and non-equipped) will be permitted.

Instrument Approaches

7.8 The application of RNP APCH with Baro-VNAV procedures is expected to be implemented in the maximum possible number of airports, commencing primarily with international airports. To facilitate transitional period, conventional approach procedures and conventional navigation aids should be maintained for non-equipped aircraft.

7.9 States should promote the use of APV operations (Baro-VNAV or augmented GNSS) to enhance safety and accessibility of RNP approaches.

7.10 The application of RNP AR APCH procedures should be considered in selected airports, where obvious operational benefits can be obtained due to the existence of significant obstacles.

Summary table & Implementation targets

Short Term (2008-2012)		
Airspace	**Preferred Nav. Specifications**	**Acceptable Nav. Specifications**
Route – Oceanic	RNP 4	RNAV 10
Route – Remote continental	RNP 4	RNAV 10
Route – Continental en-route	RNAV 2, RNAV 5	
TMA – Arrival	RNAV 1 in radar environment and with adequate navigation infrastructure. Basic-RNP 1 in non-radar environment	
TMA – Departure	RNAV 1 in radar environment and with adequate navigation infrastructure. Basic-RNP 1 in non-radar environment	
Approach	RNP APCH with Baro-VNAV in most possible airports RNP AR APCH in airport where there are obvious operational benefits.	
Implementation Targets • RNP APCH (with Baro-VNAV) in 30% of instrument runways by 2010 and 50% by 2012 and priority should be given to airports with operational benefits • RNAV 1 SID/STAR for 50% of international airports by 2010 and 75% by 2012 and priority should be given to airports with RNP Approach • Re-defining existing RNAV/RNP routes into PBN navigation specification by 2012 • Implementation of additional RNAV/RNP routes		

Medium Term Implementation Plan ~~Road Map~~

Route Operations

7.11 Noting the current development of route spacing standards for RNAV 1, RNAV 2, RNP 2, in this phase, it is expected that the implementations of all existing RNAV/RNP routes are consistent with PBN standards. States are encouraged~~, as much as possible,~~ to harmonize their RNAV/RNP routes based on consistent PBN navigation specifications and separation standards. Implementations of additional RNAV/RNP routes are also encouraged.

7.12 With the utilization of ADS and CPDLC, the application of RNP routes in the Oceanic and Remote continental airspace in the ~~ASIA/PAC~~ APAC Region is expected. This will permit the use of smaller lateral and longitudinal separation, such as 30 NM based on the RNP 4 navigation specification. States should also consider the fleet readiness status during their planning.

7.13 Noting the current development of RNP 2 navigation specification, in this phase, the application of RNP 2 is expected for the continental en-route airspace with high air traffic density. Depending on the sufficiency of DME/DME coverage or GNSS availability, States may consider the use of RNAV 2 navigation specification.

7.14 In this phase, the establishment of a backup system in case of GNSS failure or the development of contingency procedures will be necessary.

TMA Operations

7.15 Noting the current development of Advanced RNP 1 navigation specification, in this phase, it is expected that the application of RNAV 1 or RNP 1 will be expanded in selected TMAs. The application of RNAV 1/RNP 1 will also depend on DME/DME infrastructure, GNSS availability and aircraft navigation capability. In TMAs of high air traffic complexity and movement (excluding airspaces – ***Note,; what does this mean??),*** the use of RNAV 1 or RNP 1 equipments will be mandatory. In TMAs of less air traffic complexity, mixed operations will be permitted (equipped or non-equipped).

Instrument Approaches

7.16 In this phase, the extended application of RNP APCH with Baro-VNAV or APV in most airports is expected. These applications may also serve as a back-up to precision approaches and provide vertical guided approaches for the runways without precision approach capability.

7.17 The extended application of RNP AR Approaches is expected for airports where there are operational benefits.

7.18 The introduction of application of landing capability using GNSS and its augmentations is expected to guarantee a smooth transition toward high-performance approach and landing capability.

Summary table & Implementation targets

Medium Term (2013-2016)		
Airspace	**Preferred Nav. Specification**	**Acceptable Nav. Specification**
Route – Oceanic	RNP 2	RNP 4, RNAV 10
Route – Remote continental	RNP 2	RNAV 2, RNP 4, RNAV 10
Route – Continental en-route	RNAV 1, RNP 2	RNAV 2, RNAV 5
TMA – Arrival	Expand RNAV 1 or RNP 1 application Mandate RNAV 1 or RNP 1 approval for aircraft operating in higher air traffic density TMAs	
TMA – Departure	Expand RNAV 1 or RNP 1 application Mandate RNAV 1 or RNP 1 approval for aircraft operating in higher air traffic density TMAs	
Approach	Expansion of RNP APCH (with Baro-VNAV) and APV Expansion of RNP AR APCH where there are operational benefits Introduction of landing capability using GNSS and its augmentations	
Implementation Targets • RNP APCH with Baro-VNAV or APV in 100% of instrument runways by 2016 • RNAV 1 or RNP 1 SID/STAR for 100% of international airports by 2016 • RNAV 1 or RNP 1 SID/STAR for 70% of busy domestic airports where there are operational benefits • Implementation of additional RNAV/RNP routes		

Long Term Implementation Strategies (2016 and beyond)

7.19 In this phase, GNSS is expected to be a primary navigation infrastructure for PBN implementation. States should work co-operatively on a multinational basis to implement GNSS in order to facilitate seamless and inter-operable systems and undertake coordinated ~~R&D~~ research and development programmes on GNSS implementation and operation.

7.20 Moreover, during this phase, States are encouraged to consider segregating traffic according to navigation capability and granting preferred routes to aircraft with better navigation performance.

7.21 With the expectation that precision approach capability using GNSS and its augmentation systems will become available, States are encouraged to explore the use of such capability where there are operational and financial benefits.

8. Transitional Strategies

8.1 During transition to PBN, sufficient ground infrastructure for conventional navigation systems must remain available to serve non-equipped flights. Before existing ground infrastructure is considered for removal, users should be given reasonable transition time to allow them to equip appropriately to attain equivalent PBN-based navigation performance. States should approach removal of existing ground infrastructure with caution to ensure that safety is not compromised. ~~such as by~~ Pperformance of safety assessments and consultation with users through regional air navigation planning processes will be necessary.

8.2 States should coordinate to ensure that harmonized separation standards and procedures are developed and introduced concurrently in all flight information regions along major traffic flows to allow for a seamless transition towards PBN.

8.3 States should cooperate on a multinational basis to implement PBN in order to facilitate seamless and inter-operable systems and undertake coordinated ~~R&D~~ research and development programmes on PBN implementation and operation.

8.4 States are encouraged to consider segregating traffic according to navigation capability and granting preferred routes to aircraft with better navigation performance**,** taking due consideration of the needs of State~~/Military~~ aircraft.

8.5 States should encourage operators and other airspace users to equip with PBN-capable avionics. This can be achieved through early introductions of RNP approaches, preferably those with vertical guidance.

8.6 ICAO Asia-Pacific Regional Office should provide leadership supporting implementation and transition towards PBN.

9. Safety Assessment & Monitoring Requirements

Need for a safety assessment

9.1 To ensure that the introduction of PBN applications within the Asia/Pacific Region is undertaken in a safe manner, in accordance with relevant ICAO provisions implementation shall only take place following conduct of a safety assessment by the implementing State or group of States that demonstrates that an acceptable level of safety will be met. This assessment may also need to demonstrate that residual levels of risk associated with specific PBN implementations are acceptable. Additionally, after implementation ongoing periodic safety reviews shall be undertaken by the implementing State or group of States, where required, in order to establish that operations continue to meet acceptable levels of safety.

En-route safety assessment and monitoring

9.2 When considering en-route PBN implementations, the ICAO *Procedures for Air Navigation Services – Air Traffic Management* (PANS-ATM, Doc 4444, Chapter 5, Section 5.4) contains procedures and RNAV procedural separation minima for use in the separation of aircraft in the en-route phase. In some cases, these separation minima require specific RNP capabilities and are based on collision risk modelling which determines communications and surveillance requirements. However, this modelling does not include all operational and technical aspects and is dependent upon parameter values that may vary depending on the particular airspace where the separation minimum will be applied. Therefore, prior to implementation, a system verification of sufficient duration and integrity must be performed to assess such parameters and conditions including weather deviations or other contingency events for the airspace concerned and to demonstrate that operational and technical requirements will be met.

9.3 Recognizing that, in some instances, previous implementations of reduced separation applications had not been subject to the necessary post-implementation monitoring, APANPIRG/16 (August 2005)

provided clarification of the responsibilities and requirements of implementing States in terms of the following Conclusion:

Conclusion 16/5 – No implementation of reduced separation unless compliant with Annex 11

That, recognizing that some States had not adequately complied with safety management provisions, the Regional Office advise States of the Asia/Pacific Region that further regional implementation of reduced separation minima should only proceed in circumstances where implementing States can demonstrate an ability to comply with Annex 11, Chapter 2, safety management provisions for the continuous monitoring and regular assessment of the safety level achieved.

9.4 APANPIRG has established the Regional Airspace Safety Monitoring Advisory Group (RASMAG) to facilitate the airspace safety monitoring aspects for implementations of reduced separation minima and CNS/ATM applications within the Asia and Pacific Regions. RASMAG has adopted the term En-route Monitoring Agency (EMA) to describe an organization providing airspace safety assessment, monitoring and implementation services for international airspace in the Asia/Pacific region to assist the implementation and operation of reduced horizontal (lateral and longitudinal) separation minima. To ensure regional harmonization of en-route safety assessment requirements and methodologies, implementing States are encouraged to work cooperatively with RASMAG who will provide guidance and technical assistance to States to support their en-route PBN implementations.

Undertaking a safety assessment

9.5 The implementing State or group of States shall ensure that a safety assessment and, where required, ongoing monitoring of PBN implementations are conducted. The implementing State or group of States may have the capability to undertake such activities or, in the case of en-route implementations, may seek assistance from an En-route Monitoring Agency. The latter course of action is preferred as an EMA can establish the necessary monitoring and data collection activity in an effective manner for the international airspaces in which the EMA holds responsibility.

9.6 In undertaking a safety assessment to enable en-route implementation of PBN, a State authority or EMA shall:

1) Establish and maintain a database of PBN approvals;
2) Pre-implementation - conduct safety and readiness assessments and, for international implementations, report results to RASMAG;
3) Post-implementation - maintain awareness of data link performance and monitor aircraft horizontal-plane navigation performance and the occurrence of large navigation errors (lateral and longitudinal), implement remedial actions as necessary and, for international implementations, report results to RASMAG;
4) Monitor operator compliance with State approval requirements after PBN implementation;
5) Initiate necessary remedial actions in any instances where PBN requirements are not met.

9.7 Detailed information relating to the international airspace jurisdiction, roles and responsibilities of regional EMAs is contained in the *Asia/Pacific En-route Monitoring Agency Handbook*, which is available from the ICAO Asia/Pacific Regional Office.

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Appendix A – CHANGES TO THE ASIA/PACIFIC REGIONAL PBN IMPLEMENTATION ~~REGIONAL~~ PLAN

Whenever a need is identified for a change to this document, the Request for Change (RFC) Form (see Section 1.6 below) should be completed and submitted to the ICAO Asia and Pacific Regional Office. The Regional Office will collate RFCs for consideration by the Performance Based Navigation Task Force (CNS/MET Sub-group of APANPIRG).

When an amendment has been agreed by a meeting of the Performance Based Navigation Task Force then a new version of the PBN Regional Plan will be 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.:

Final approval for publication of an amendment to the PBN Regional Plan will be the responsibility of APANPIRG.

1.5 EDITING CONVENTIONS

(Intentionally blank)

TO BE DEVELOPED

1.6 PBN Regional Plan REQUEST FOR CHANGE FORM

RFC Nr:	

Please use this form when requesting a change to any part of this PBN Regional Plan. This form may be photocopied as required, emailed, faxed or e-mailed to ICAO Asia and Pacific Regional Office +66 (2) 537-8199 or icao_apac@bangkok.icao.int

1. SUBJECT:				
2. REASON FOR CHANGE:				
3. DESCRIPTION OF PROPOSAL: [expand / attach additional pages if necessary]				
4. REFERENCE(S):				
5. PERSON INITIATING:			**DATE:**	
ORGANISATION:				
TEL/FA/X/E-MAIL:				
6. CONSULTATION	**RESPONSE DUE BY DATE:**			
	Organization	**Name**	**Agree/Disagree**	**Date**
7. ACTION REQUIRE :				
8. PBN REGIONAL PLAN EDITOR			**DATE REC'D :**	
9. FEEDBACK PASSED			**DATE :**	

1.7 AMENDMENT RECORD

Amendment Number	Date	Amended by	Comments

Appendix B – IATA Traffic Forecast

"By 2010 Asia will be the largest single market for aviation" - IATA 27th Feb 2008. Globally predicted passenger traffic will rise by 4.9 per cent per year between 2007 and 2026, almost trebling in two decades as jet planes got bigger and more people flew on them. Meanwhile airfreight will rise by 5.8 per cent annually in the same period.The greatest demand will come from the Asia-Pacific region, where airlines will take delivery of 31 per cent of new planes in the next 20 years, compared with 24 per cent for Europe and 27 per cent for North America.

Passenger
Asia Pacific airlines saw a marginal drop in demand growth from 6.2 per cent in December 2007 to 5.7 per cent in January 2008. Currently, airlines in the region benefited from increased competitiveness due to the strong Euro and the booming economies of both India and China.

Cargo
Steady year-on-year airfreight growth of 4.5 per cent was recorded in January 2008. In the larger freight markets there is continued strength. Asia Pacific airlines saw demand increase 6.5 per cent, up from 6 per cent in December 2007, boosted by the booming economies in China and India.

For the period 2002-2020 aircraft movements are expected to increase at an annual growth rate of 5.4 per cent, to reach almost 294 thousand aircraft movements by the year 2020. Average annual growth rates of 6.5, 5.7 and 5.2 per cent are forecast for the periods 2005 - 2010, 2010-2015 and 2015 - 2020, respectively.

TRANSPACIFIC PASSENGER FORECAST			
Average Annual Percentage Growth Rates			
Low	Medium		High
2005-2010	5.3	6.5	7.8
2010-2015	4.5	5.7	7.0
2015-2020	4.0	5.2	6.5
2002-2020	4.1	5.4	6.7

The Intra-Asia/Pacific passenger aircraft movements are expected to increase at an average annual growth rate of 4.6 per cent to the year 2020. The growth rates for the intermediate periods of 2005-2010, 2010-2015 and 2015-2020 are 5.0, 4.3 and 4.2 per cent, respectively.

INTRA ASIA /PACIFIC AIRCRAFT MOVEMENT FORECAST			
Average Annual Percentage Growth Rates			
Low	Medium		High
2005-2010	3.6	5.0	5.5
2010-2015	3.1	4.3	5.2
2015-2020	3.1	4.2	5.2
2002-2020	3.3	4.6	5.6

New Aircraft Deliveries by Region
Record new aircraft orders were placed by the airline industry in 2005 – 2007. The large numbers of new orders represent strong confidence in the future prospects of the global airline industry. In its latest forecast of aviation growth, European aircraft maker Airbus said the world's fleet of large

passenger jets (of more than 100 seats) would double in the next 20 years to nearly 33,000. The greatest demand will come from the Asia-Pacific region, where airlines will take delivery of 31 per cent of new planes in the next 20 years, compared with 24 per cent for Europe and 27 per cent for North America.

New Aircraft Deliveries by Region	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012+**
	Existing						
Africa	**665**	**26**	**15**	**20**	**16**	**13**	**28**
Asia Pacific	**3,578**	**329**	**428**	**407**	**344**	**267**	**440**
Europe	**5,301**	**292**	**348**	**364**	**251**	**153**	**297**
Latin America/Caribbean	**1,031**	**93**	**91**	**45**	**66**	**43**	**65**
Middle East	**626**	**41**	**57**	**44**	**36**	**27**	**164**
North America	**6,987**	**240**	**293**	**309**	**222**	**163**	**412**
Total	**18,188**	**1,026**	**1,237**	**1,208**	**944**	**679**	**1,551**
Increase in Global aircraft fleet (%)	**4.2**	**4.9**	**4.6**	**4.9**	**3.4**	**2.4**	**2.4**

Appendix C - Reference documentation for developing operational and airworthiness approval

TO BE DEVELOPED.

Appendix D – Practical Example of tangible benefits

TO BE DEVELOPED.

APANPIRG Asia/Pacific Airspace Safety Monitoring

RASMAG LIST OF COMPETENT AIRSPACE SAFETY MONITORING ORGANIZATIONS

The Regional Airspace Safety Monitoring Advisory Group of APANPIRG (RASMAG) is required by its terms of reference to recommend and facilitate the implementation of airspace safety monitoring and performance assessment services and to review and recommend on the competency and compatibility of airspace monitoring organizations. In order to assist in addressing these requirements, RASMAG updates and distributes the following list of competent airspace safety monitoring organizations for use by States requiring airspace safety monitoring services. In the context of the list, abbreviations have meanings as follows:

- RMA – Regional Monitoring Agency – safety assessment and monitoring in the vertical plane (i.e. RVSM);
- EMA – En-route Monitoring Agency – safety assessment and monitoring in the horizontal plane (i.e. RHSM, RNAV10, RNP4);
- CRA – Central Reporting Agency – technical performance of data link systems (i.e. ADS/CPDLC); and
- FIT – FANS 1/A Interoperability/Implementation Team – parent body to a CRA.

(last updated 19 December 2008)

Organisation *(including contact officer)*	State	Competency	Status	Airspace assessed (FIRs)
Australian Airspace Monitoring Agency (AAMA) - Airservices Australia Mr Robert Butcher, Manager Human Factors and Analysis, Safety Management Group, email robert.butcher@airservicesaustralia.com	Australia	APANPIRG RMA	Current	Brisbane, Honiara, Jakarta, Melbourne, Nauru, Port Moresby and Ujung Pandang FIRs.
		EMA	Current	Brisbane, Melbourne FIRs.

Organisation *(including contact officer)*	State	Competency	Status	Airspace assessed (FIRs)
China RMA - Air Traffic Management Bureau, (ATMB) of Civil Aviation Administration of China (CAAC) Mr. Tang Jinxiang, Engineer of Safety and Monitoring Technical Group, ATMB e-mail: tangjx@adcc.com.cn	China	APANPIRG RMA	Current	Beijing, Guangzhou, Kunming, Lanzhou, Shanghai, Shenyang, Urumqi and Wuhan FIRs and Sector 01 (airspace over Hainan Island) of the Sanya FIR.
JCAB RMA - Japan Civil Aviation Bureau Mr. Kazunaga Suzuki, Special Assistant to the Director, Flight Procedures and Airspace Program Office, email suzuki-k22z@mlit.go.jp	Japan	APANPIRG RMA	Current	Fukuoka FIR
		EMA	Available second quarter – 2009	Fukuoka FIR
Monitoring Agency for the Asia Region (MAAR) – Aeronautical Radio of Thailand LTD Mr. Nuttakajorn Yanpirat, Executive Officer, Systems Engineering,Aeronautical Radio of Thailand Ltd. Email: nuttakajorn.ya@aerothai.co.th	Thailand	APANPIRG RMA	Current	Bangkok, Kolkatta, Chennai, Colombo, Delhi, Dhaka, Hanoi, Ho Chi Minh, Hong Kong, Karachi, Kathmandu, Kota Kinabalu, Kuala Lumpur, Lahore, Male, Manila, Mumbai, Phnom Penh, Pyongyang, Sanya FIR, Singapore, Taibei, Ulaan Bataar, Vientiane, Yangon FIRs

Organisation *(including contact officer)*	State	Competency	Status	Airspace assessed (FIRs)
Pacific Approvals Registry and Monitoring Organization (PARMO) – Federal Aviation Administration (US FAA) Mr. Dale Livingston, Manager, Separation Standards Analysis Team, FAA, email: dale.livingston@faa.gov	USA	APANPIRG RMA	Current	Anchorage Oceanic, Auckland Oceanic, Incheon, Nadi, Oakland Oceanic, Tahiti FIRs
		EMA	Current	Anchorage Oceanic, Oakland Oceanic
South East Asia Safety Monitoring Agency (SEASMA) - **Civil Aviation Authority of Singapore (CAAS)** Mr. Kuah Kong Beng, Chief Air Traffic Control Officer, email: KUAH_Kong_Beng@caas.gov.sg	Singapore	EMA for South China Sea	Current	Hong Kong, Ho Chi Minh, Kota Kinabalu, Kuala Lumpur, Manila, Sanya and Singapore FIRs
FIT - SEA (ICAO Regional Office email icao_apac@bangkok.icao.int & **CRA Japan** Mr. Masahisa Hayashi, Deputy Director, Air Traffic Control Association Japan, email:hayashi@atcaj.or.jp	ICAO Regional Office & CRA Japan	FIT & CRA	Current	South China Sea FIRs

Organisation *(including contact officer)*	State	Competency	Status	Airspace assessed (FIRs)
IPACG/FIT Mr. Takahiro Morishima, JCAB Co-Chair, email: morishima-t2zg@mlit.go.jp & Mr. Reed Sladen, FAA Co-Chair, email reed.b.sladen@faa.gov	Japan & USA	FIT & CRA	Current	North & Central Pacific (Oceanic airspace within Fukuoka FIR, and Anchorage & Oakland FIRs)
CRA Japan Mr. Masahisa Hayashi, Deputy Director, Air Traffic Control Association Japan, email:hayashi@atcaj.or.jp	Japan	CRA	Current	Fukuoka FIR for IPACG/FIT Ho Chi Minh, Manila, Singapore FIRs for FIT-SEA
FIT - BOB ICAO Regional Office email icao_apac@bangkok.icao.int & Mr. Bradley Cornell, Boeing Engineering, email Bradley.D.Cornell@Boeing.Com	ICAO Regional Office & Boeing USA	FIT & CRA	Current	Bay of Bengal FIRs, Ujung Pandang and Jakarta FIRs, provides assistance to the members of the Arabian Sea/Indian Ocean ATS Coordination Group (ASIOACG)
ISPACG/FIT Mr. Bradley Cornell, Boeing Engineering, email Bradley.D.Cornell@Boeing.Com	Boeing USA	FIT & CRA	Current	South Pacific FIRs and members of the Informal South Pacific ATS Coordination Group (ISPACG)

International Civil Aviation Organization | Organisation de l'aviation civile internationale | Organización de Aviación Civil Internacional | Международная организация гражданской авиации | منظمة الطيران المدني الدولي | 国际民用航空组织

Ref.: T3/10.0, T3/10.1.17 – AP169/08 (ATM) 26 November 2008

Subject: December collection of one month Traffic Sample Data (TSD)

Action required: December 2008 TSD be submitted to Regional Monitoring Agencies (RMAs) by January 2009

Sir/Madam,

I have the honour to direct your attention to the Conclusions of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) in relation to the provision of traffic data by States for safety assessment and monitoring purposes. APANPIRG noted the amended provisions of Annex 11, effective 24 November 2005, that specifically require the institution of ongoing monitoring on a regional basis of aircraft height keeping performance for all airspace where RVSM is applied. APANPIRG also recognized that periodic monitoring by States of the safety performance of operations using reduced horizontal separation was also necessary under the broader provisions of Annex 11, which require implementation of systematic and appropriate ATS safety programmes.

APANPIRG/16 (August 2005) endorsed the use of a standardized approach to the sampling of vertical and horizontal traffic data under the terms of Conclusion 16/4, adopting the month of December every year for the collection of a one month traffic sample data by all States. Accordingly, States are reminded that, in accordance with Conclusion 16/4, traffic sample data should be collected for the month of December 2008 and submitted to RVSM RMAs before the end of January 2009.

In its review of these matters, APANPIRG/19 (1-5 September, 2008) noted the very positive response from States in respect of the provision of Traffic Sample Data (TSD) for December 2007. In view of this positive response, APANPIRG/19 was able to remove a number of States from the List of Deficiencies in the ATM/AIS/SAR Fields. However, APANPIRG/19 also noted that not all States had submitted December traffic data as called for by Conclusion 16/4 and retained some States on the Deficiencies List.

The RVSM Regional Monitoring Agency (RMA) for the FIRs listed below is the Monitoring Agency for the Asia Region (MAAR). States with responsibilities for these FIRs should complete traffic sampling for a period of one month for December 2008 in accordance with the format and requirements of MAAR. Resulting data should be submitted electronically to MAAR by the end of January 2009 for airspace safety analysis. The appropriate Traffic Sample Data format and instructions are available from the MAAR website at: http://www.aerothai.co.th/maar/dl.php.

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Mumbai	Phnom Penh	Sanya	Singapore	Vientiane	Yangon		

RMA services for the FIRS listed below are provided by the Pacific Approvals Registry and Monitoring Organization (PARMO). States with responsibilities for these FIRs should complete traffic sampling for a period of one month for December 2008 in accordance with the format and requirements of PARMO. This data should be submitted electronically to PARMO by the end of January 2009 for airspace safety analysis. The appropriate Traffic Sample Data format and instructions are available from the PARMO website at http://www.tc.faa.gov/acb300/PARMO/

Anchorage Oceanic	Oakland Oceanic	Auckland Oceanic	Nadi	Tahiti	Incheon

The Australian Airspace Monitoring Agency (AAMA) provides RVSM RMA services for the FIRs in the table below. States with responsibilities for these FIRs should complete traffic sampling for a period of one month for December 2008 in accordance with the format and requirements of AAMA. Details of AAMA arrangements are available from Mr Robert Butcher, Manager Human Factors & Analysis, Airservices Australia via email: robert.butcher@airservicesaustralia.com

Australian airspaces *(Domestic, Pacific and Indian Ocean)*	Nauru	Honiara	Port Moresby	Jakarta	Ujung Pandang

The China RMA will coordinate data collection/collation activities for all sovereign RVSM airspaces in China. The Japan Civil Aviation Bureau (JCAB) RMA will undertake data management for the Fukuoka FIR.

In addition to the annual December traffic sample data, States must also routinely provide continuous monthly RVSM Large Height Deviation (LHD) reports, including "Nil" reports if applicable, to the relevant RMAs. LHD reporting templates are available from the respective RMAs.

Accept, Sir/Madam, the assurances of my highest consideration.

for Mokhtar A. Awan
Regional Director

RASMAG — TASK LIST

(last updated 19 December 2008)

ACTION ITEM	DESCRIPTION	TIME FRAME	RESPONSIBLE PARTY	STATUS	REMARKS
2/4	Develop SMA Handbook.RASMAG/10 changed name to En-route Monitoring Agency (EMA) Handbook	Report Progress to RASMAG/11	Chairman (R. Butcher), All members Secretariat	Open Closed	RASMAG/10 changed name to EMA Handbook and finalised technical content. Overall editorial update to be completed by drafting team, present final version to RASMAG/11. Draft APANPIRG Decision for name change prepared Superseded by Action Item 10/8
3/1	Provide guidance to States in respect of the issues surrounding quantum and application of Target Levels of Safety (TLS).	Report Progress to RASMAG/11	RASMAG members Secretariat	Open Closed	Referred to RMAs by RASMAG/5 for discussion/action. Additional guidance material included in Amendment 44 to Annex 11, effective November 2006.
7/6	Define and promulgate a standardised process under which a safety monitoring organisation could gain approval by APANPIRG for regional activity	Report progress to RASMAG/11	RASMAG, RMAs, SMAs, EMAs	Open Closed	RASMAG/10 agreed that regional agreement not required for EMAs, RASMAG would take responsibility for competency, draft Decision prepared for APANPIRG consideration
7/7	Asia/Pacific RMAs communicate collectively prior to the next RASMAG meeting with the objective of providing some guidance on regional issues/impacts resulting from the implementation of global long term height monitoring provisions for RVSM operations.	Report progress to RASMAG/11	Asia/Pacific RMAs	Open Closed	RASMAG/10 formed small drafting team to prepare impact statement, advanced draft to be presented to RASMAG/11 for review Action Item 9/1 supersedes
8/4	Include the following question re AIDC on LHD reporting template for Asia/Pacific RMAs in relation to Category 'E' LHDs: *Was an automated capability (e.g. AIDC) used for the coordination of the flight?*	RASMAG/11	Asia/Pacific RMAs including China RMA	Open Closed	RASMAG/11 to confirm status

ACTION ITEM	DESCRIPTION	TIME FRAME	RESPONSIBLE PARTY	STATUS	REMARKS
~~8/5~~	~~Include additional note to RASMAG LHD Categorization 'M' (Others), as follows~~ ~~*Note: this includes situations of flights operating (including climbing/descending) in airspace where flight crews are unable to establish normal air-ground communications with the responsible ATS Unit.*~~	~~RASMAG/11~~	~~Asia/Pacific RMAs including China RMA~~	~~Open~~ ~~Closed~~	~~RASMAG/11 to confirm status~~
8/6	Take action to implement LTHM Actions 1-6 as described in RASMAG/8 report In particular, ensure arrangements for regional cooperation between RMAs	RASMAG/11	Asia/Pacific RMAs ~~including China RMA~~	Open	RASMAG LTHM Actions promulgated by State Letter AP018/8 of 31 January 2008. RASMAG/9 informed no progress made due to priority workloads for all RMAs and Regional Office. RASMAG/10 informed of actions taken so far, update RASMAG/11 about progress
~~8/11~~	~~Prepare a paper for RASMAG/10 that summarises regional initiatives for AIDC including APANPIRG requirements and status of regional AIDC implementation~~	~~RASMAG/10~~	~~Secretariat~~	~~Open~~ ~~Closed~~	~~Secretariat presented IP/2 on AIDC regional implementation status to RASMAG/10~~
~~8/13~~	~~United States to investigate AIDC implementations and compile comparison between numbers of ATC coordination errors before and after AIDC implementation~~	~~RASMAG/10~~	~~United States~~	~~Open~~ ~~Closed~~	~~United States presented WP/25 to RASMAG/9 using interim data, further investigations will be submitted to RASMAG/10~~
~~9/1~~	~~Prepare advanced draft of Asia/Pacific Regional Impact Statement regarding the implementation of long term global height monitoring in accordance with APANPIRG Conclusion 18/4 for consideration by RASMAG/10 in December 2008. Task List item 7/7 refers.~~	~~RASMAG/11~~	~~Small drafting team comprising members from all Asia/Pacific RMAs including China, keep Bangkok Secretariat informed of progress.~~	~~Open~~ ~~Closed~~	~~RMA Technical meeting on first day of RASMAG/10 will finalise the draft document for presentation to the RASMAG/10 plenary meeting.~~ ~~RASMAG/10 formed small drafting team to advance this work, advanced version will be presented to RASMAG/11 Action Item 10/9 supersedes.~~

ACTION ITEM	DESCRIPTION	TIME FRAME	RESPONSIBLE PARTY	STATUS	REMARKS
~~9/2~~	~~Constitute small drafting team to prepare draft Section 9 (Safety monitoring matters etc) of the PBN Regional Implementation Plan being prepared by the PBN Task Force.~~	~~30 June 2008~~	~~Representatives from Australia, New Zealand, Singapore, United States and IFALPA, with the RASMAG Chairman as the primary coordinator.~~	~~Open~~ ~~Closed~~	~~Submit to Bangkok Secretariat by end of June to enable submission to PBN/TF/3 meeting 15-18 July 2008.~~ ~~Secretariat submitted WP to PBN/TF/3. The RASMAG material was incorporated by PBN/TF into regional PBN Plan~~ ~~RASMAG/10 reviewed interim edition of regional PBN plan, proposed amendment to PBN/TF 4 in March 2009 Superseeded by Action 10/10~~
9/3	Include estimate of annual hours flown and standardise reporting across RMAs – graphs, and bar graphs using WP/18 from AAMA to RASMAG/9 as the basis	RASMAG/10	All Asia/Pacific RMAs including China RMA.	Open	This information available from some RMAs during RASMAG/10, others will comply by RASMAG/11
9/4	Japan to attempt to capture and analyse data in relation to implementation of AIDC with Republic of Korea during 2009 Attempt to show Category E LHD performance before and after implementation of AIDC	RASMAG/12	JCAB RMA	Open	
10/1	Standardise annual December TSD data collection template across all RMAs for regional application. Noting intention to expand use of December TSD to EMA and general planning and implementation, ensure collection of "En-route PBN Approvals Status" (e.g. RNP 4) and ATS route parameters.	RASMAG/11	Asia/Pacific RMAs, EMAs	Open	Lead RMA is PARMO. RMAs to work by correspondence, present final template to RASMAG/11 for adoption
10/2	Undertake studies to quantify the magnitude of the problem of RVSM non-approved flights operating in RVSM airspace. Identify solutions.	RASMAG/11	Asia/Pacific RMAs,	Open	Lead RMA is PARMO. RMAs to work by correspondence, present adequate information to RASMAG/11 to compile briefing for APANPIRG

ACTION ITEM	DESCRIPTION	TIME FRAME	RESPONSIBLE PARTY	STATUS	REMARKS
10/3	Recognising delays in RMA manual, Annex 6 monitoring requirements not implemented until Nov 2010, encourage APANPIRG to adopt MAAR MMRs as recommended by RASMAG.	RASMAG/11	RASMAG, Regional Office	Open	RASMAG/10 prepared draft APANPIRG Conclusion for consideration by APANPIRG in September 2009
10/4	Noting intention of DPR Korea to implement RVSM by mid 2009, relay offer from China RMA to lead technical assistance to DPR Korea, notify willingness of RASMAG, MAAR and Regional Office to assist China RMA in supporting DPR Korea	RASMAG/11	Regional Office	Open	Regional Office to write to DPR Korea, notify outcomes to ATMB China
10/5	Prepare up to date Table for inclusion in Regional Monitoring Impact Statement that accurately reflects the Asia/Pacific FIRs and the RMA responsible for each FIR	RASMAG/11	Asia/Pacific RMAs	Open	Lead RMA is AAMA. RMAs to work by correspondence, present final version to RASMAG/11 for inclusion in impact statement
10/6	Review monitoring requirements for Embraer family of twin jets including EMB 170 and EMB 190 with objective of including these types appropriately in regional MMRs	RASMAG/11	Asia/Pacific RMAs	Open	Lead RMA is PARMO. RMAs to work by correspondence, present adequate information to RASMAG/11 to form basis of amendment to regional MMRs
10/7	Prepare Taxonomy of RMA related terms with objective of clarifying and standardising reporting of LHD by States and limiting under reporting. Consider inclusion of taxonomy as appendix to Regional Monitoring Impact Statement	RASMAG/11	Asia/Pacific RMAs	Open	Lead RMA is AAMA. RMAs to work by correspondence, present final version to RASMAG/11 for inclusion in impact statement
10/8	Prepare final version of EMA Handbook for recommendation by RASMAG/11 to APANPIRG for adoption as regional guidance material	RASMAG/11	Small drafting Group (~~S~~EMAHRT members)	Open	Present final version to RASMAG/11 for recommendation

ACTION ITEM	DESCRIPTION	TIME FRAME	RESPONSIBLE PARTY	STATUS	REMARKS
10/9	Write advanced draft of Regional Impact Statement for long term height monitoring as required by APANPIRG Conclusion 18/4	RASMAG/11	Small drafting Group (Mr Butcher, Mr Tang Jinxiang, Mr Yanpirat, Mr Oseto, Ms Falk, Mr Farmer and RASMAG Secretary)	Open	Present advanced version to RASMAG/11 as basis for APANPIRG briefing
10/10	Submit working papers to PBN/TF/4 which provide the RASMAG proposals for amendment to the interim Edition of the Regional PBN Plan and a copy of the most up-to-date EMA Handbook.	PBN/TF/$ March 2009	Regional Office	Open	
10/11	Standardise methodology of assessing duration of LHDs in application of the CRM	RASMAG/11	Asia/Pacific RMAs	Open	Lead RMA is AAMA. RMAs to work by correspondence, present updated information to RASMAG/11.

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