INTERNATIONAL CIVIL AVIATION ORGANIZATION

REPORT OF THE EIGHTH MEETING OF THE REGIONAL AIRSPACE SAFETY MONITORING ADVISORY GROUP (RASMAG/8)

BANGKOK, THAILAND, 10 – 14 DECEMBER 2007

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 Eighth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/8) was held in Bangkok, Thailand from 10 to 14 December 2007 at the Kotaite Wing of the ICAO Asia/Pacific Office.

2. Attendance

2.1 The meeting was attended by 25 participants from Australia, China, India, Indonesia, Japan, New Zealand, Singapore, Thailand, United States and IATA. 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, was the Secretary for the meeting and was assisted by Mr. Polawat Chootai, Regional Officer ATM.

4. Opening of the Meeting

4.1 The meeting was opened by Mr. Andrew Tiede on behalf of Mr.. Lalit Shah, Regional Director of the Asia/Pacific Regional Office. He welcomed China to the RASMAG meeting for the first time and commended China for the smooth implementation of RVSM a few weeks ago. In a follow on from the work of APANPIRG/18, Mr. Tiede was looking forward to the review of the submission from Japan towards becoming an APANPIRG RMA as well as a number of other matters that needed work by RASMAG. Very importantly, as a direct result of the work of the RVSM Scrutiny Group, the MAAR paper to this meeting was showing that the RVSM target level of safety was now being achieved in the Western Pacific/South China Sea area. There were also many other working papers for consideration by the meeting and Mr. Tiede wished all participants a hard working but fruitful meeting.

4.2 In his opening remarks the Chairman, Mr. Butcher, welcomed participants to the meeting noting specifically the attendance of representatives from China and Indonesia. Mr. Butcher informed the meeting that a record number of working papers covering a range of topics had been provided for review and action by the meeting and that was in itself a positive sign of the importance which States assigned to the work programme of RASMAG. The meeting would hear feedback regarding the implementation of RVSM in Chinese FIRs which was a significant step forward for both China and the Region, and additionally would finalize its review of Japan's credentials to be endorsed as an APANPIRG RMA. Additionally, the meeting was informed of the need to complete work in relation to the Safety Monitoring Agency Handbook and the need for a detailed review of the reports from the Regional RMAs in relation to RVSM safety assessments.

5. Documentation and Working Language

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

5.2 Twenty-two (22) Working Papers and eight (8) Information Papers were presented to the meeting. A list of papers is included at **Appendix B** to this Report.

REPORT ON AGENDA ITEMS

Agenda Item 1: Adoption of Agenda

1.1 The following agenda was adopted for the meeting:

Agenda Item 1: Adoption of Agenda

Agenda Item 2: Outcomes of APANPIRG/18 and 44th DGCA

Agenda Item 3: Airspace safety monitoring documentation and regional guidance material

Agenda Item 4: Reports from Asia/Pacific RMAs

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 RASMAG/9 Meeting

Agenda Item 2: Outcomes of APANPIRG/18 and 44th DGCA

44th DGCA Conference

2.1 The 44th Conference of Directors General of Civil Aviation, Asia/Pacific Region (44th DGCAs) was held in Xi'an, China from 22 – 26 October 2007. The Conference was attended by 231 delegates from 35 States/Administrations and 5 International Organizations and raised 17 items for action by regional DGCAs.

2.2 In reviewing the action items, the meeting took note of Action Items 44/1 regarding resolution of deficiencies, 44/2 urging States to implement safety management systems with high priority, 44/4 applying the Global Aviation Safety Plan principles and objectives and 44/15 calling for even greater regional cooperation and enhanced coordination between the various civil aviation groupings active in the region.

2.3 Of particular interest to the meeting were the matters raised as Action Item 44/6 urging States to support implementation of Performance Based Navigation (PBN) as per ICAO guidance material and to support the Asia/Pacific PBN taskforce that had been established by APANPIRG/18. At this stage of the Asia/Pacific implementation it was not clear what level of monitoring would be required for PBN based implementations and what level of involvement would be required by RASMAG.

2.4 The meeting was informed that ATM/AIS/SAR/SG/17 (July 2007) had raised concerns in this regard recognizing that in the implementation of RNP and RVSM, major difficulties were being experienced in this region setting up and operating the ATM safety management arrangements for contiguous airspaces involving several States, especially in terms of airspace safety monitoring and performing safety assessments. Considerable effort and progress has been made to establish the safety oversight mechanisms through the regional monitoring agencies (RMAs) and safety monitoring agencies

(SMAs) for application of vertical and horizontal separation however, to maximize benefits of using PBN for air traffic separation and capacity enhancement, States would need to be able to conduct complex airspace and ATC system analysis and conduct safety assessments and related activities.

2.5 The meeting recognized that the first meeting of the PBN task force would occur in January 2008 and requested that the Secretariat prepare and present a paper on behalf of RASMAG that explained the objectives of RASMAG for facilitating the safe implementation of reduced separation minima and CNS/ATM applications within the Asia/Pacific regions in the context of airspace safety monitoring. This would enable the PBN task force to be properly informed about RASMAG and ensure that RASMAG was able to provide assistance to the PBN/TF if necessary. The meeting also added an item to the task list to ensure that RASMAG/9 undertook a review of the RASMAG Terms of Reference to ensure that RASMAG was enabled to assist PBN implementation.

APANPIRG/18

2.6 The Eighteenth meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/18) was held from 3-7 September 2007. As well as reviewing progress on Conclusions and Decisions raised by previous APANPIRG meetings, APANPIRG/18 raised a total of 62 new Conclusions and Decisions for regional action. The meeting noted the Conclusions and Decisions related to ATM, AIS and SAR matters and was gratified to note that the *Guidance Material for the Asia/Pacific Region ADS/CPDLC/AIDC Ground Systems Procurement and Implementation* which was prepared by RASMAG was adopted by Conclusion18/5 and has been circulated as regional guidance material.

2.7 In respect to items of specific relevance to RASMAG, the meeting was informed that APANPIRG/18 had agreed that future meetings of APANPIRG would consider RASMAG matters under a specific Agenda heading, rather than as part of the ATM/AIS/SAR matters as had been the previous arrangement.

2.8 The meeting endorsed APANPIRG/18's comments thanking Thailand for their commitment in undertaking the horizontal safety assessment for the South China Sea parallel route structure and noted that Conclusion 18/2 placed a number of States on the Deficiencies List for non provision of safety related data. The meeting appreciated that Conclusion 18/3 drew attention to the high number of Large Height Deviations (LHDs) resulting regionally from ATC to ATC coordination errors and highlighted APANPIRG's recommendation for AIDC implementation to assist this situation.

2.9 The meeting recognized that APANPIRG's concerns in relation to imminent global height monitoring provisions had led to Conclusion 18/4 requiring Asia/Pacific RMAs to prepare a regional impact statement detailing consequences of global RVSM long term height monitoring requirements. Outcomes of the discussions in this regard are recorded elsewhere in this report. The meeting was also pleased to accept the work required of RASMAG under Conclusion 18/6 to review Japan's application for APANPIRG RMA approval. Outcomes of these discussions are shown in paragraphs 4.1 to 4.5.

2.10 In relation to the funding of safety monitoring, the meeting noted outcomes from APANPIRG/18 under which States currently providing safety services in the Asia/Pacific region have agreed to do so indefinitely. Accordingly, APANPIRG/18 considered that the regional problem had been overcome and, under Decision 18/57, dissolved the RASMC/TF and allocated residual responsibilities to RASMAG in terms of Conclusion 18/56. The amended Terms of Reference for RASMAG adopted by APANPIRG/18 are shown at **Appendix C**.

Agenda Item 3: Airspace safety monitoring documentation and regional guidance material

SMA Handbook

3.1 The meeting recalled that Action item 2/4 of the RASMAG action items list identified the need to develop a handbook and/or guidance material for planned Regional Safety Monitoring Agencies (SMAs). Work on this matter has been on-going within RASMAG for a considerable time and the meeting considered that the final version of the Handbook needed to be presented to RASMAG/9 during mid 2008 for adoption.

3.2 The meeting discussed the draft document in some detail, specifically a number of issues identified for RASMAG resolution. With regards to paragraph 1.3.1.1, questions were raised on the sort of database envisaged for SMAs and whether the data was for specific airframes. The United States advised that PARMO had been maintaining an RNP approvals database for the Pacific and that they regularly updated the database to the best of their ability. The database includes data on RNP10 approvals although this is being updated on approvals related to oceanic/international airspace. The meeting was also informed that the data held by PARMO was airframe specific. Additional discussion highlighted that "additional capabilities" that the SMA may need identify would specifically include datalink. The United States indicated that they would be pleased to make the RNP database available for other SMAs as necessary.

3.3 Subsequent to this initial plenary review of the draft document by the meeting, representatives from Australia and New Zealand undertook a more detailed editing and review exercise with a revised version presented to the meeting for further discussion and amendment. The meeting then considered the version included at **Appendix D** should be reviewed by members of RASMAG prior to the next meeting, with any comments provided directly to the Chairman. The meeting anticipated being in a position to finalize the SMA Handbook during RASMAG/9 in May 2008.

RMA Manual

3.4 The meeting was informed that ICAO Headquarters Secretariat would convene a meeting of all global RMAs from 13-15 May 2008 as part of the May SASP WG/WHL/13 with the objective of ensuring the RMA Manual was finalised by the end of 2008. The HQ Secretariat had identified a number of matters for consideration, including:

a) Long Term Monitoring Requirements.
b) Safety Assessment Reports to PIRGS.
c) Minimum Monitoring Requirement (MMR.) List
d) Lessons learned
e) Information to the PIRGs regarding what should be expected of an RMA
f) Approvals: Technical only or operational (which may be restricted by regional ATM procedures)
g) Validity of monitoring results on re-registration of airframe
h) Data sharing
i) Legal and access issues regarding KSN
j) Updates of living aspects of the Manual
k) Third party use of monitoring data

3.5 Invitations to the meeting would be issued shortly to all recognised global RMAs in order to ensure a comprehensive review process and full agreement on the final RMA Manual. Asia/Pacific RMAs including the China RMA were encouraged to attend this meeting.

Agenda Item 4: Reports from Asia/Pacific RMAs

Approval of JCAB RMA as APANPIRG RMA

4.1 Issues associated with the regional credentialing of safety monitoring organizations had been discussed during previous RASMAG meetings and had led to the adoption of the RASMAG List of Competent Safety Monitoring Organizations. However, noting the inability of RASMAG to further progress this matter as a result of higher priority items on the RASMAG work programme and to avoid delay in advancing the JCAB vertical monitoring agency to APANPIRG RMA status, RASMAG/7 (June 2007) identified relevant material in Annex 11, the RVSM Manual (Doc 9574) and the RMA Manual which would provide an adequate basis against which to assess the capabilities of the JCAB RMA.

4.2 APANPIRG/18 conducted a preliminary review of a submission prepared by Japan that addressed the respective provisions in the documentation identified by RASMAG/7, as described above. Whilst not wishing to delay a decision until RASMAG had been able to fully review the submission and make recommendations to APANPIRG/19 in September 2008, APANPIRG/18 recognized that the meeting did not possess the specialized technical skill set to make a properly informed decision on the matter. Accordingly, under the terms of Conclusion 18/6, APANPIRG's approval of JCAB as an APANPIRG RMA with responsibility for the Fukuoka FIR was only granted subject to a full review of Japan's submission by RASMAG/8.

4.3 In conducting a technical review of Japan's submission, the meeting noted the comprehensive manner in which the documentation had been prepared by Japan. It was evident that the performance of the JCAB RMA was adequately demonstrated and documented against the provisions of Annex 11, the RVSM Manual and the RMA Manual and a summary of these outcomes has been retained as **Appendix E.** Additionally, the JCAB RMA had submitted a periodic safety assessment of RVSM operations in the Fukuoka FIR to the meeting that was in the format and of the standard required by RASMAG for regional safety assessments.

4.4 Based on this review, the meeting had no hesitation in endorsing Conclusion 18/6 and offered full congratulations to JCAB RMA for achieving APANPIRG RMA status. The Regional Office would transmit a letter to APANPIRG members informing them of the outcomes in this regard. RASMAG looked forward to continuing to work with the JCAB RMA in undertaking regional safety monitoring activities that would help to ensure the continued safe operation of reduced separation applications in the Asia/Pacific region.

4.5 Japan informed the meeting of the extensive support that had been received from PARMO and MAAR in assisting their preparations as an RMA and expressed deep appreciation for this assistance. The close coordination between these agencies had been very beneficial to Japan and it was their wish and expectation that this would continue.

HMU implementation in Japan

4.6 In regard to the implications of the long-term RVSM height monitoring requirements for the Region, Japan recalled comments from APANPIRG/18 that there are, at present, no ground-based Height Monitoring Unit (HMU) facilities within the Region and therefore any monitoring of aircraft operating only within the Asia/Pacific Region requires application of the relatively GPS-based monitoring system.

4.7 JCAB considered the potential need for setting up HMU facilities and has started consultation process with relevant departments and agencies to develop a concrete implementation plan. After obtaining financial approval, JCAB will commence the technical specification design process and site surveying in early 2008 to eventually commission 3 HMU facilities in Japan. The planned schedule

gives a target date for commissioning of the first HMU in 2011, with the other two HMUs following in 2012 and 2013 respectively.

4.8 Since Japan is located at the west end of the Pacific and its strategic location connects Northeast Asia and the Pacific, Japan anticipated that the availability of HMU facilities in Japan is expected to enhance monitoring of aircraft height-keeping capability as well as data collection and analysis capability in Asia; thus contributing to safety improvement. **Figure 1** below indicates estimated position of HMUs installation and mainly traffic flow in Fukuoka FIR.

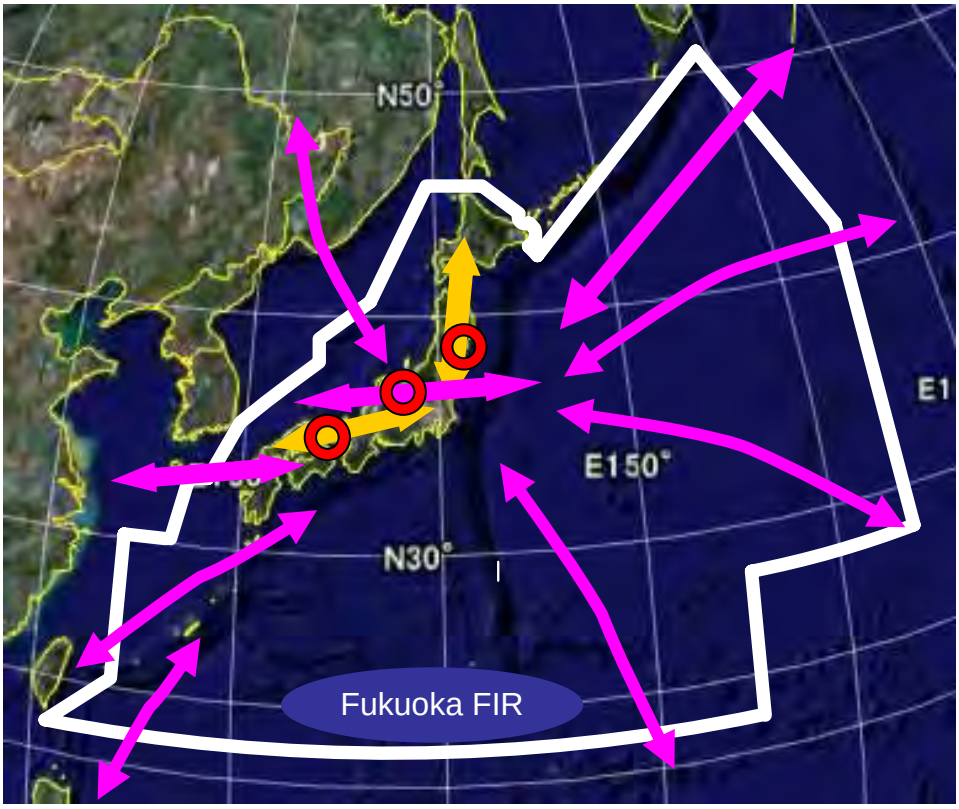

Figure 1: Proposed location of ground based MHU facilities in Japan

4.9 The meeting thanked Japan for the presentation and for their commitment to assisting with height monitoring infrastructure in the Asia/Pacific Region. Noting the encouraging progress with alternative technologies for height monitoring, the meeting also drew Japan's attention to the developments with ABS-B and Multilateration discussed later in this report

PARMO's RMA activities

4.10 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, 1 October 2006 through 30 September 2007, in the PARMO's ongoing process of providing quarterly updates of information relevant to the continued safe use of the RVSM in Pacific and North-East Asia airspace. The meeting noted that there were seventy-nine reported large height deviations occurring within Pacific and North East Asia RVSM airspace during the assessment period, of which six events were either outside the area of responsibility of PARMO or outside the RVSM level band and were therefore not considered.

4.11 Twenty-two large height deviations that contribute to technical risk were reported to the PARMO during the reporting period. The causes of fourteen deviations were reported as pilot response to Traffic Alert and Collision Avoidance System (TCAS) or Airborne Collision Avoidance System (ACAS) resolution advisories. The cause of four deviations was reported to be turbulence or other weather-related causes. The cause of the three additional deviations was due to equipment failure. The cause of the remaining event was an aircraft contingency event leading to the inability to maintain assigned flight level.

4.12 The total of fifty-one reports of non-technical-risk large height deviations were provided to the PARMO during the reporting period, forty-six of these events involved whole flight levels and contributed to the operational risk in the Pacific and North East Asia airspace. Thirty-two of the fifty-one events were related to errors in coordination of control between ATC facilities with, of these thirty-two events, twenty-three occurring in Pacific airspace and the remaining nine events occurring in North East Asia airspace. Accordingly, PARMO considered that the largest contributor to risk-bearing large height deviations in both Pacific and North East Asia airspace were coordination errors in the ATC-unit-to-ATC-unit transfer of control responsibility as a result of human factors issues. This type of event includes late or non-existent coordination, incorrect time estimate/actual, and flight level and/or ATS route not in accordance with agreed parameters.

Pacific Airspace

4.13 The technical risk was estimated to be 0.097×10^{-9} fatal accidents per flight hour. The operational risk estimate is 1.50×10^{-9} fatal accidents per flight hour. The estimate of the overall vertical collision risk was 1.60×10^{-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 was based on the most recent 12 months of large height deviation reporting and recently updated collision risk parameters based on the December 2006 traffic samples collected and is shown in **Table 1** below.

Source of Risk	Lower Bound Risk Estimation	TLS	Remarks
Technical Risk	0.097×10^{-9}	2.5×10^{-9}	Below Technical TLS
Operational Risk	1.504×10^{-9}	-	
Total Risk	**1.601×10^{-9}**	**5.0×10^{-9}**	**Below Overall TLS**

Table 1: Vertical Collision Risk Estimates for Pacific Airspace

4.14 **Figure 2** below provides a graphical representation of the updated risk estimates for Pacific RVSM airspace based on recent reports of large height deviations.

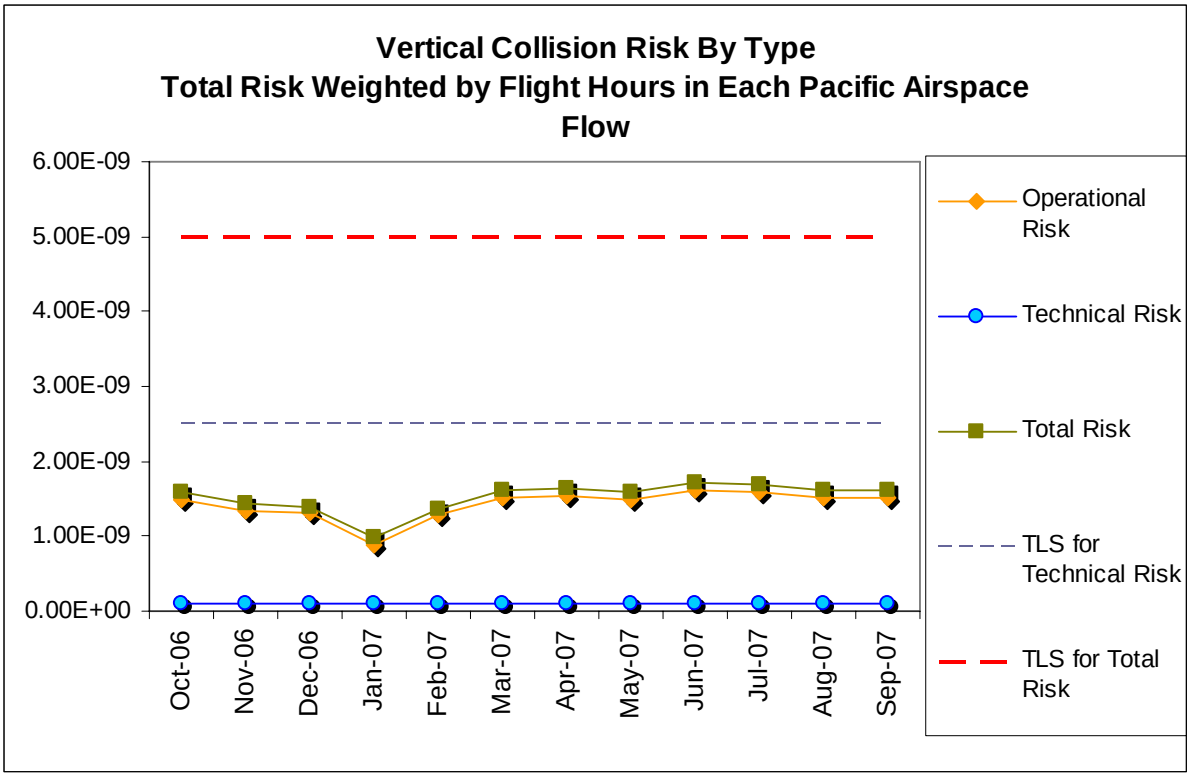

Figure 2: Vertical Collision Risk for Pacific RVSM Airspace

North East Asia Airspace

4.15 The technical risk for North East Asia airspace was estimated by PARMO to be 0.086.x 10^{-9} fatal accidents per flight hour and the operational risk estimate is 0.094 x 10^{-9} fatal accidents per flight hour. Consequently the estimate of the overall vertical collision risk was 1.025 x 10^{-9} fatal accidents per flight hour, which easily satisfies the regionally agreed TLS value of 5.0 x 10^{-9} fatal accidents per flight hour. This estimate was based on the most recent 12 months of large height deviation reporting and is shown in **Table 2** below.

Source of Risk	Lower Bound Risk Estimation	TLS	Remarks
Technical Risk	0.086 x 10^{-9}	2.5 x 10^{-9}	Below Technical TLS
Operational Risk	0.094 x 10^{-9}	-	
Total Risk	**1.025 x 10^{-9}**	**5.0 x 10^{-9}**	**Below Overall TLS**

Table 2: Vertical Collision Risk Estimates for North East Asia Airspace

4.16 **Figure 3** below provides a graphical representation of the updated risk estimates for North East Asia RVSM airspace based on recent reports of large height deviations.

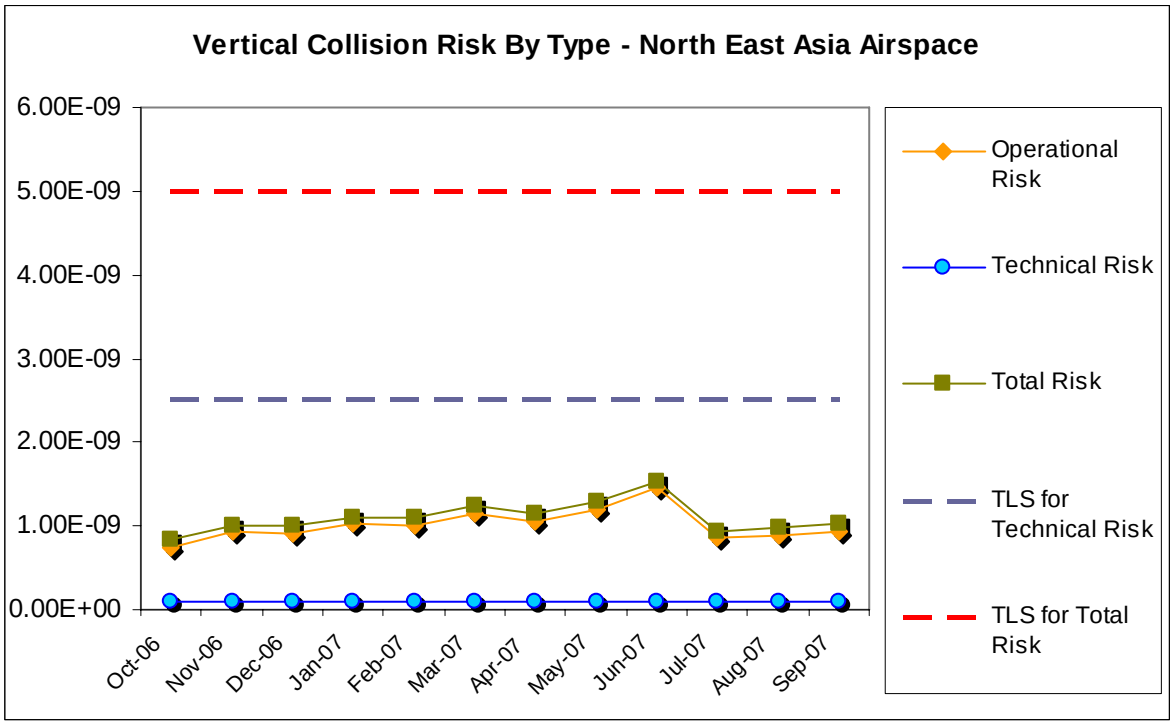

Figure 3: Vertical Collision Risk for North East Asia RVSM Airspace

Non RVSM approved operators using Pacific Airspace

4.17 The PARMO informed the meeting that amongst the duties and responsibilities of an RMA is the performance of periodic checks of the approval status of operators and aircraft using airspace where RVSM is applied. This activity, termed "monitoring operator compliance with State approval requirements", is especially important if RVSM is applied on an exclusionary basis, that is, if State RVSM approval is a prerequisite for use of the airspace.

4.18 In conducting this work, a comparison was made between the annual December traffic sample data (TSD) for 2005 and 2006 and the combined approvals database maintained by PARMO. A similar analysis is planned using the requested December 2007 traffic movement samples. Those flights in the TSD but failing to match with the approvals database appear to lack State RVSM approval and were then the subject of subsequent correspondence between the PARMO and the relevant State authorities and operators.

4.19 The checks revealed that, in general, operator compliance was considered to be very high. However, some instances of apparent non-compliance resulting from likely systematic causes were observed and a small number of possible instances of operator non-compliance are currently under investigation by PARMO.

MAAR's RMA activities

4.20 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. MAAR expressed particular appreciation to States with responsibility for the Hong Kong, Kota Kinabalu, Sanya, Singapore, and Ujung Pandang FIRs for the submission of well-formatted traffic sample data in a

timely manner which had significantly improved the data integrity and simplified the calculation of risk estimates.

Bay of Bengal Airspace

4.21 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 2006 and the most recent rolling 12 months of Large Height Deviation (LHD) reports between October 2006 and September 2007 submitted by relevant States in the BOB Region. The risk estimation was conducted based on the single alternate flight orientation scheme (FLOS) applied on the EMARSSH route structure over the BOB airspace.

4.22 LHD occurrences in the BOB RVSM airspace were summarized as follows:

- Total of 6 LHD occurred in the BOB RVSM airspace, accounted for 9 minutes of LHD duration between October 2006 and September 2007, and
- All of the 6 LHD occurrences are subject to ATC system loop error (Category D) and account for a total of 9 minutes.

4.23 **Table 3** below summarizes the results of the airspace safety oversight as of September 2007 in terms of the technical, operational, and total risks for the RVSM implementation in the BOB airspace.

Source of Risk	Lower Bound Risk Estimation	TLS	Remarks
Technical Risk	0.79×10^{-9}	2.5×10^{-9}	Below Technical TLS
Operational Risk	0.19×10^{-9}	-	-
Total Risk	**0.98×10^{-9}**	**5.0×10^{-9}**	**Below Overall TLS**

Table 3: Risk Estimates for the RVSM Implementation in BOB Airspace

4.24 In addition, **Figure 4** below presents the graphical trends of collision risk estimates for each month using the appropriate cumulative 12-months of LHD reports since October 2006.

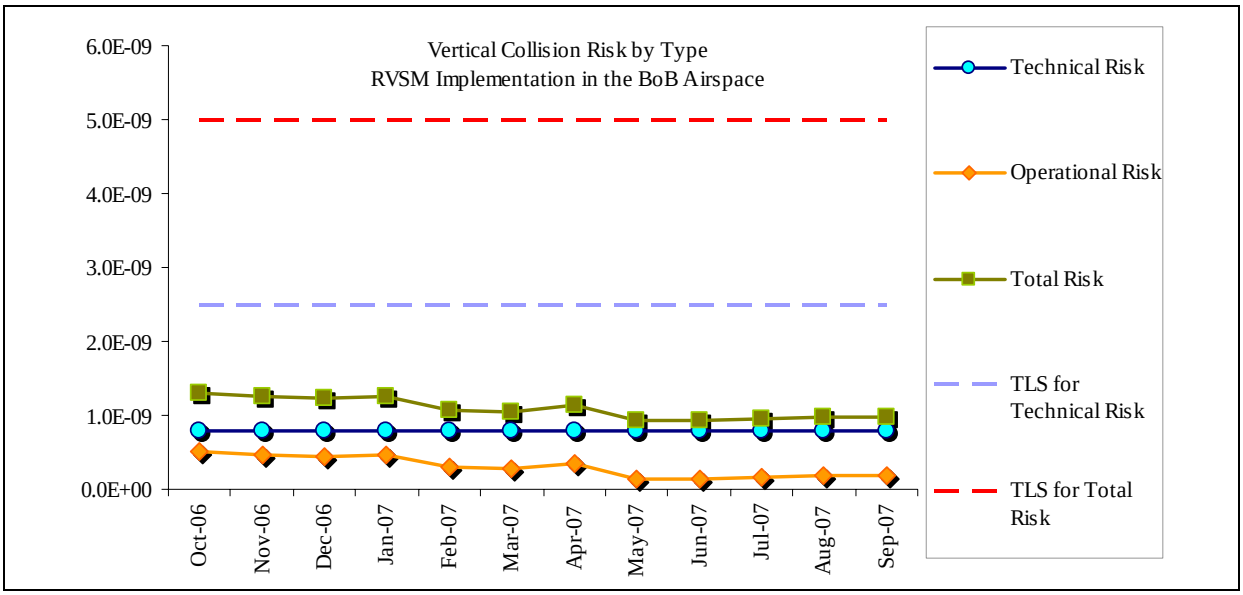

Figure 4: Trends of Risk Estimates for the RVSM Implementation in BOB Airspace

4.25 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.

4.26 The Chairman commented that it was significant that the MAAR assessment of the BOB airspace indicates that the operational risk for such a large airspace is significantly low and even well below that for the technical risk. He went on to state that he was unaware of any other examples in the Region where this was the case and queried the level of confidence that MAAR had in the reporting of LHDs for the BOB airspace. MAAR confirmed that they had accurately reported the assessed risk based on the information provided to them by the States concerned. Further discussion continued on this matter with the Chairman noting that one neighbouring RMA was aware of a number of LHD reports in the airspace that it was responsible for that should also have generated risk bearing reports for some of the FIRs within the BOB airspace. He was concerned that this appeared not to be reflected in the data reported by MAAR.

4.27 The meeting considered this issue in some depth, agreeing to a proposal by the Chairman that the RMAs should identify a process by which they would share any LHD reports provided to them that would also be of relevance to another RMA responsible for adjacent FIRs. By adopting this process the meeting hoped to improve reporting by States and to assist RMAs to validate LHDs of relevance to their area of jurisdiction. An item was added to the task list in this respect.

Western Pacific/South China Sea Airspace

4.28 MAAR also provided a summary of airspace safety oversight for RVSM implementation 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 2006 and the most recent rolling 12 months of Large Height Deviation (LHD) reports between October 2006 and September 2007 submitted by relevant States in the WPAC/SCS region. The risk estimation was conducted based on the modified single alternate flight orientation scheme (FLOS) applied on the on the WPAC/SCS route structures.

4.29 The meeting noted that 12 months of LHD data had not been submitted by Vietnam in respect of the Hanoi and Ho Chi Minh FIRs. The integral position of these FIRs in the South China Sea meant that the missing data could have a significant impact on the accuracy of the safety assessment. The absence of this data had bee brought to the attention of Vietnam during the WPAC/SCS RSG/3 meeting in October and the Secretariat undertook to contact Vietnam and request the urgent provision of the missing data.

4.30 LHD occurrences in the WPAC/SCS RVSM airspace were summarized as follows:

- Total of 51 LHD occurred in the WPAC/SCS RVSM airspace, which accounted for 231 minutes of LHD duration between October 2006 and September 2007,
- In December 2006, there is one 72-minute LHD of Category D. This error and its duration were also contributable to radio communication failure, and
- Significant portion of the LHD occurrences (40 of 51 occurrences) as well as duration (144 of 231 minutes) is attributable to coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues (Category E)

4.31 **Table 4** below summarizes the results of the airspace safety oversight, as of September 2007, in terms of the technical, operational, and total risks for the RVSM implementation in the WPAC/SCS airspace.

Source of Risk	Lower Bound Risk Estimation	TLS	Remarks
Technical Risk	0.42×10^{-9}	2.5×10^{-9}	Below Technical TLS
Operational Risk	3.13×10^{-9}	-	-
Total Risk	**3.55×10^{-9}**	**5.0×10^{-9}**	**Below Overall TLS**

Table 4: Risk Estimates for the RVSM Implementation in WPAC/SCS Airspace

4.32 In addition, **Figure 5** presents the trends of collision risk estimates for each month using the appropriate cumulative 12-month of LHD reports since October 2006.

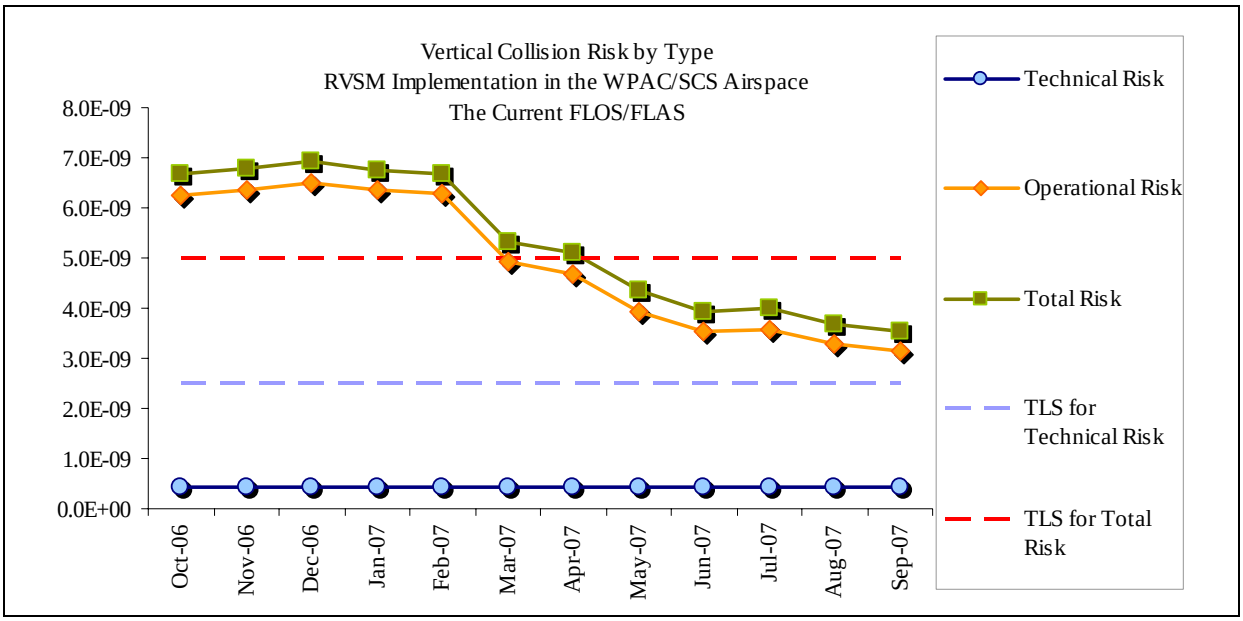

Figure 5: Trends of Risk Estimates for the RVSM Implementation in WPAC/SCS Airspace

4.33 Based on these collision risk estimates, 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 due to the loss of a correctly established vertical separation standard of 1,000 ft and to all causes, respectively.

4.34 The meeting reviewed the adverse trend and exceedance of the TLS that had characterized the WPAC/SCS safety assessment for some time, recalling that previous RASMAG reports had recorded total risk estimates as follows:

RASMAG/3 (Jun 2005) = 4.90×10^{-9} (provisional, due lack of data)
RASMAG/4 (Oct 2005) = 3.46×10^{-9} (provisional, due lack of data)
RASMAG/5 (Jun 2006) = 7.08×10^{-9}
RASMAG/6 (Nov 2006) = 11.3×10^{-9}
RASMAG/7 (Jun 2007) = 6.09×10^{-9}
RASMAG/8 (Sep 2007) = 3.55×10^{-9}

4.35 The meeting was pleased to note that the decline in LHD occurrences since January 2007 which contributed to the overall improvement in the safety assessment and had led to the TLS for this area being satisfied for the first time in some years. This was an important milestone regionally and the meeting congratulated the WPAC/SCS RSG which had been instrumental in assisting States to investigate and remediate LHDs resulting from ATC to ATC coordination errors. The meeting anticipated that the level of awareness generated by the WPAC/SCS RSG about RVSM issues amongst affected States would continue to enhance safety performance in this area.

JCAB's RMA activities

Fukuoka FIR airspace

4.36 The Japan Civil Aviation Bureau RMA (JCAB RMA) presented the meeting with the result of the RVSM airspace safety assessment for the Fukuoka FIR.

4.37 The meeting noted that during the period of 12 months from 1 Oct 2006 to 30 Sep 2007, JCAB received 56 LHD reports in connection with the Fukuoka FIR. Of the 56 reports, 25 LHD occurrences were attributable to technical errors, 24 were attributable to operational errors and 7 LHDs occurred outside the Fukuoka FIR – of which 6 were operational errors and one was a technical error.

4.38 Following detailed analysis of the 30 operational errors, JCAB RMA attributed 25 of them to Category E (i.e. errors in ATC-unit-to ATC-unit transfer). The percentage of "errors in ATC-unit-to-ATC-unit transfer" between Fukuoka FIR and each adjacent FIR was as follows:

a) 52% of errors were with Manila ACC (13 out of 25 errors)
b) 32% of errors were with Incheon ACC (8 out of 25 errors)
c) 8% of errors were with Vladivostok ACC (2 out of 25 errors)
d) 4% of errors were with Oakland ARTCC (1 out of 25 errors)
e) 4% of errors were with Anchorage ARTCC (1out of 25 errors)

4.39 **Table 5** below summarizes the results of the airspace safety oversight, as of September 2007, in terms of the technical, operational, and total risks for the RVSM implementation in the Fukuoka FIR.

Source of Risk	Lower Bound Risk Estimation	TLS	Remarks
Technical Risk	0.42×10^{-9}	2.5×10^{-9}	Below Technical TLS
Operational Risk	11.0×10^{-9}		
Overall Risk	**11.4×10^{-9}**	**5.0×10^{-9}**	**Exceeds the TLS**

Table 5: Risk Estimates for safety assessment of the Fukuoka FIR RVSM airspace

4.40 The meeting noted that the overall risk result of the RVSM safety assessment for the Fukuoka FIR exceeded the regionally agreed TLS mainly due to the LHDs caused by "errors in ATC-unit-to ATC-unit transfer'. The meeting was concerned about the exceedance of the TLS and recalled previous safety assessment results as follows:

RASMAG/7 (Jun 2007) = 8.61×10^{-9}
RASMAG/8 (Dec 2007) = 11.4×10^{-9}

4.41 In this context, the Fukuoka FIR was not satisfying the regional RVSM TLS and was exhibiting an adverse trend. The JCAB RMA had made JCAB aware of these circumstances and a number of initiatives had commenced in order to manage the situation, as described below.

4.42 With regard to the 25 LHDs caused by "Errors in ATC-unit-to ATC-unit transfer", JCAB had continued coordination with affected ATC units with the aim of preventing further recurrence of similar errors. JCAB had been advised that remedial actions were undertaken by those ATC units, such as conducting refresher training courses for controllers and establishment of procedures to strengthen monitoring capability by supervisors as to transfer of control activities.

4.43 Additionally, Japan was an active member of the WPAC/SCS RSG and, as part of the work programme of the RSG described in paragraphs 5.34 to 5.50 below, had recently implemented remedial actions involving changed ATC arrangements in both Naha ACC and Fukuoka ATMC, implementation of a LHD MOU with Manila ACC as well as reaching agreement for amended ATS new route arrangements between the Manila and Fukuoka FIRs. It was anticipated that these enhancements would assist in lowering the number of errors in ATC-unit-to ATC-unit transfer and JCAB will also continue monitoring the situation and cooperate with other ATC units for any improvements to reduce the level of overall risk.

4.44 To further assist in the prevention of such human error, JCAB continued to consider that the implementation of AIDC would be one of the most effective remedial actions. Following the successful implementation of AIDC with Oakland ARTCC and Anchorage ARTCC, JCAB planned to implement AIDC with Incheon ACC by the end of first quarter 2008. Japan considered that further expansion of AIDC implementation was urgently required in order to reduce "errors in ATC-unit-to-ATC-unit transfer" and was undertaking planning and implementation activities with neighboring States in this respect.

AAMA's RMA activities

4.45 Australia presented the results of the safety assessments of the Australian Domestic and Indian Oceanic Airspaces undertaken by the Australian Airspace Monitoring Agency (AAMA). The meeting noted that the assessment covered the 12 month period ending on 30 November 2007 using the traffic sample data for December 2006. Australia stated that the AAMA had found it significantly beneficial to undertake the safety assessments on a monthly basis given the timely availability of operational error reports and the ability to more closely identify negative trends in relation to the risk estimation. This enabled the AAMA to focus on resolving the factors which led to errors in a proactive manner.

4.46 The AAMA reported that the LHD occurrences in the Australian RVSM airspace were primarily captured as operational errors within the Airservices' Electronically Submitted Incident Report (ESIR) System. A total of 695 minutes duration was assigned to the 48 non-NIL LHDs identified through the assessment process, for the 12-month reporting period. The report highlighted that this was a significant increase in the total duration time identified in the previous report to RASMAG in June 2007, and summarized these LHDs as follows:

- As previously identified, L Category LHDs remain the most significant in terms of duration even though the actual number of risk-bearing reports in this category remains relatively low. While 4 new reports in this category were identified during November, a detailed review of the investigations into these incidents identified only one could be considered as risk bearing in terms of the RVSM assessment.

- The most significant type of LHD in terms of number of reports continues to be "Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues" (Category E). Four reports related to this category were identified during November, with two assessed as risk bearing totalling 7 minutes duration. Of note is that assessed 188 minutes duration originates from just 2 of the 19 non-nil reports of this category.

- The increase in non-nil duration for November 2007 is primarily the result of a single Category L incident of 80 minutes duration.

4.47 The meeting was informed that the assessment for the Australian airspace resulted in an estimation of the total risk as4.7×10^{-9} fatal accidents per flight hour, which represents an increasing trend observed over the last 6 months primarily as a result of the continued presence of a number of high-time error reports in the assessment sample and the addition of a number of reports in November 2007 with high time values. The trend is expected to remain unchanged until at least December 2007 before significant high time reports held in the rolling 12 month data sample are eliminated from the assessment sample.

4.48 The meeting noted that the collision risk estimates determined by the Australian RMA 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.

4.49 **Table 6** 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.

Source of Risk	Lower Bound Risk Estimation	TLS	Remarks
Technical Risk	0.018×10^{-9}	2.5×10^{-9}	Below Technical TLS
Operational Risk	4.66×10^{-9}	-	-
Total Risk	4.7×10^{-9}	5.0×10^{-9}	Below Overall TLS

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

4.50 In addition, **Figure 6** below presents the trends of collision risk estimates for each month using the appropriate cumulative 12-month interval of LHD reports since December 2006.

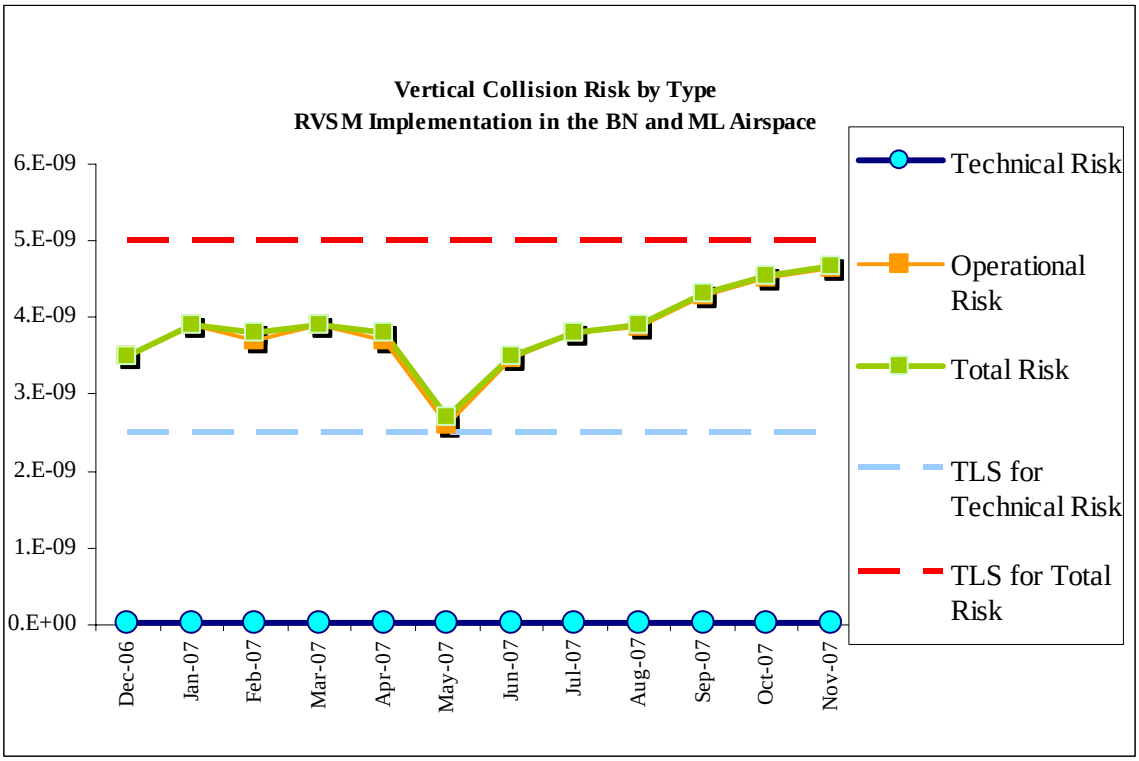

Figure 6: Trends of Risk Estimates for RVSM Implementation in Australian Airspace

4.51 The meeting commented on the good outcome for the Australian airspace in terms of estimated risk noting however the significant trend in risk increase since May 2007. The AAMA informed the meeting that Airservices Australia was monitoring this trend closely and had spent time investigating fully the sources of the errors that generated the high time LHDs. The meeting thanked the AAMA for the presentation and congratulated Australia on continuing to achieve risk estimates below the TLS.

AAMA provision of RMA services for Port Moresby, Honiara and Nauru FIRs

4.52 Australia presented details of an Australian initiated program aimed at fostering and promoting aviation safety and operational efficiency in the Indonesian and Papua New Guinea region, including Timor Leste. The meeting was informed that the objectives of the program are to support the achievement of consistent levels of air safety and service in the major air corridors between Australia and the rest of the world by assisting its immediate neighbouring States to develop, operate and sustain the required capabilities; and to achieve high levels of air safety in the domestic aviation operations of those States. Australia commented that this program has received support from the Australian Government, the Governments of Indonesia, Papua New Guinea and Timor Leste, relevant Government agencies and the aviation industry.

4.53 In concert with the introduction of the cooperative program, the Australian Airspace Monitoring Agency (AAMA) identified an opportunity to directly assist Papua New Guinea to enhance its safety management system, improve the reporting culture in that system and achieve quality data outputs that would enable the responsible RMA to undertake the necessary RVSM safety assessment reporting. This work was subsequently commenced by the AAMA, supported by the Papua New Guinea ANSP who agreed the direct interface with the AAMA would be enhanced if that organization took on the role of RMA for the Port Moresby FIR.

4.54 The meeting was informed that the AAMA had coordinated with PARMO in relation to these matters and PARMO fully supported the direct interface between Papua New Guinea and the AAMA, and the transfer of the RMA responsibilities for the Port Moresby FIR to the AAMA. Additionally, the meeting was informed that discussions had been held between the PARMO and AAMA regarding responsibility for RMA services covering both the Honiara and Nauru FIRs. To that extent it was recognized that as Australia already provides upper airspace air traffic services for both FIRs they have been collecting operational error and traffic data for these airspaces for sometime. The meeting was informed that both RMAs considered there was significant procedural benefit in transferring the responsibility for monitoring services for these FIRs from PARMO to the AAMA.

4.55 The Secretary thanked Australia for the paper and for highlighting the good work undertaken by Australia in promoting safety among States within the Region, commenting that the Secretariat would fully support the new RMA proposals for the Port Moresby, Honiara and Nauru FIRs. The meeting endorsed the proposals.

Quantify effectiveness of AIDC

4.56 The meeting engaged in extensive discussions that recognized the effective role of AIDC messaging in reducing ATC coordination errors. The meeting supported the general recommendation of APANPIRG that AIDC implementation should be encouraged regionally and considered that RASMAG should endeavour to quantify the safety benefits that resulted. In order that RASMAG could gain a better appreciation of the specific position of APANPIRG in relation to regional planning initiatives for AIDC and to better understand the status of AIDC implementation regionally, the meeting requested the ATM Secretariat to work with the CNS Secretariat at the Regional Office with the objective of producing a summary paper on AIDC for the next meeting.

4.57 The United States agreed to undertake investigations into their AIDC arrangements with surrounding States with a view to identifying and quantifying the differences between the numbers of ATC coordination errors before and after implementation of AIDC messaging. The United States was hopeful that this work could be completed in time for presentation to the next RASMAG meeting

4.58 In order to commence regional tracking of the effectiveness of AIDC in reducing the instances of ATC to ATC coordination errors, the United States suggested that additional information requests should be added to the LHD reporting form for category ‘E’ events. Accordingly, the meeting agreed that the following question be added to the LHD reporting templates for Asia/Pacific RMAs and requested RMAs to take action accordingly:

a) Was an automated capability (e.g. AIDC) used for the coordination of the flight?

China – preparation for APANPIRG RMA status

4.59 Recognizing that it would be impractical for an RMA outside China to assume responsibility for such a large airspace as the sovereign Chinese RVSM airspace, as part of their RVSM implementation programme China had made significant steps towards establishing the China RMA to take on the long-term airspace monitoring and safety assessment responsibilities.

4.60 Using the same procedure that had been adopted by RASMAG for the JCAB RMA, China would present a draft submission against the relevant provisions of Annex 11, the RMA Manual and the RVSM Manual to the RVSM Task Force/33 (90 day review China implementation) in April 2008. The final submission would be presented to RASMAG/9 in May 2008 to enable a thorough review by RASMAG with the objective of recommending to APANPIRG/19 that the China RMA be approved as an APANPIRG RMA.

4.61 China had commenced RMA activities during 2006. The application for the establishment of the China RMA has already been submitted to the General Administration of Civil Aviation of China (CAAC) and is expected to receive a formal authorization by the end of 2007. The Air Traffic Management Bureau (ATMB) of CAAC has already established a mechanism for Traffic Sample Data (TSD) and Large Height Deviation (LHD) data collection and has formed the relevant working groups in each FIR around China.

4.62 In the mean time, ATMB carried out international cooperation activities in a wide range of related areas. Cooperative relationships have been established with FAA Technical Center and the Monitoring Agency for Asia Region (MAAR) that provide China with valuable training and practical experience in RVSM risk assessment and RMA establishment matters. The key members of the China RMA all received the training provided by FAA Technical Center and MAAR and have the capability to accomplish the work of RMA. China had also received good support from IFALPA and IATA, and received positive coordination and assistance from neighboring countries and foreign operators.

4.63 ATMB has also provided all the computer equipment and office space for the conduct of RMA functions. The software platform relating to TSD processing and risk assessment is under development. The work of database establishment and maintenance is complete and includes provision for RVSM Point of Contact (POC) database, RVSM approvals database, TSD database and LHD information database. Additionally, ATMB has signed contracts with FAA for the purchase of two Enhanced GPS Monitoring Unit (EGMU) equipments for airframe height monitoring. The shipment is expected to be received in January 2008, as will training relating to the application of EGMU and post-processing software provided by representatives from FAA and CSSI.

4.64 The meeting encouraged China to continue with their efforts to establish RMA capability for the FIRs of China. The progress so far was extremely encouraging and RASMAG looked forward to reviewing the submission from China during the May 2008 RASMAG meeting.

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

Issues limiting effectiveness of Asia/Pacific RMAs

5.1 MAAR provided information to the meeting that in order to adequately address the duties and responsibilities of a Regional Monitoring Agency (RMA) as required by the RVSM Manual (Doc 9574) and the RMA Manual, MAAR is structurally organized into two groups, as follows:

a. RVSM safety administrative group, responsible for:

- Establishing and maintaining the RVSM point of contact (POC) database,
- Establishing and maintaining the RVSM approvals database,
- Administering aircraft Height Keeping Performance (HKP), and reporting results appropriately,
- Monitoring operator compliance with State approval requirements after RVSM implementation, and
- Backing up and maintaining the overall system.

b. RVSM safety analysis group, responsible for:

- Monitoring the occurrence of large height deviations (LHD), and reporting results appropriately,
- Conducting safety and readiness assessments and report results appropriately, and

- Initiating necessary remedial actions if RVSM requirements are not met.

5.2 However, in attempting to fully address the tasks required of MAAR a number of difficulties were experienced routinely which, in aggregate, acted to severely limit the ability of MAAR to provide meaningful services in supporting RVSM implementations in the Asia Region.

5.3 MAAR had provided specific details, as shown in **Table 7** below, of some of the difficulties being experienced and the actions being taken by MAAR to attempt to address the situation.

No.	Description of Experienced Difficulties	MAAR Remedial Action	Proposed Remedial Action
1.	RVSM Point of Contact (POC) information is out of date.	Attempt to confirm the POC with all incoming contacts via email or within the RVSM related meetings.	Develop a list of the current RVSM POC for each States and establish the requirement to update the POC to the responsible RMA on a yearly basis.
2.	RVSM approval data are not updated on a regular basis.	Attempt to coordinate/follow up with the States concerned to submit the updated the RVSM approval record.	Establish the requirement for all States concerned to update the entire RVSM approval records to the responsible RMA on a monthly basis in addition to the real time when there is a change of the RVSM approval status of particular aircraft.
3.	Lack of information on the HKP monitoring activities and results of RVSM approved aircraft.	Request information from the States concerned or aircraft operators case by case.	Establish the requirement for all States concerned to include the HKP monitoring information/results to the RVSM approval records. Revise Form F2 by including the information on the HKP monitoring (i.e. date of monitoring, compliant status, etc.)
4.	Number of aircraft operators misunderstand the role of RMA on the RVSM operational approval. Hence, they attempt to request RVSM airworthiness and full approval from MAAR.	Clarify the role of MAAR to the misunderstood aircraft operators via email and/or telephone. Provide the clear duties and responsibility of MAAR on the MAAR website.	Provide adequate information regarding the process of RVSM approval process and RMA role to all aircraft operators.

No.	Description of Experienced Difficulties	MAAR Remedial Action	Proposed Remedial Action
5.	Number of aircraft operators do not understand that F2 forms (RVSM approval record) are to be submitted to MAAR by State CAA only, resulting in increasing coordination workload and complaints from airline operators	Clarify the rationale to the misunderstood aircraft operators via email and/or telephone. Provide the clear process of RVSM of MAAR on the MAAR website.	Same as (4) above
6.	Some States under the responsibility of MAAR misunderstood that they are under the responsibility of another RMA.	Clarify the area of responsibility of MAAR to the misunderstood States via email and/or telephone. Provide the area of responsibility of MAAR on the MAAR website.	Provide confirmation letter to the States concerned regarding the area of responsibility of the MAAR in Asia Region.
7.	Aircraft potentially not holding RVSM operational approval operated in the RVSM airspace undetected.	Coordination and notification procedures are in place.	Recommend the States concerned to strengthen the procedure/requirement on the monitoring of RVSM compliance of aircraft operating in the RVSM airspace. Recommend the States concerned update the entire RVSM approval records to the responsible RMA on a regular basis.

Table 7: Coordination difficulties identified by MAAR

5.4 The meeting agreed that similar difficulties, to a greater or lesser degree, were routinely experienced by all of the Asia/Pacific RMAs and that a regional solution was necessary in order to enable RMAs to work effectively. The meeting recognized that as RMAs did not have authority as State regulators, immediate and significant assistance was required from States to address the issues raised above in order to enable RMAs to assist States in meeting their obligations under the provisions of Annex 11 which require that:

> *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 safety objectives.*

Development of Long Term Height Monitoring provisions

5.5 The meeting recalled that the Eleventh Meeting of the Working Group of the Whole of the ICAO Separation and Airspace Safety Panel (SASP-WG/WHL/11) adopted a proposed statement of long-term monitoring requirements to support continued safe use of RVSM. Subsequently, the Air Navigation Bureau reviewed the statement from SASP and made significant changes to the SASP proposal which were subsequently adopted by the Air Navigation Commission with a proposed effective

date of November 2010. Information in this regard was circulated by Headquarter State Letter in late 2007 (ICAO Ref: AN 13/11.1-07/72, 7 December 2007), including the following text 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.
>
> *Note:— Monitoring data from any regional monitoring programme established in accordance with Annex 11, 3.3.5.2, may be used to satisfy the requirement.*

5.6 However, the meeting was informed that the SASP remains of the view that the above text does not provide sufficient flexibility to enable specific regions to address local issues and during November 2007 presented the following proposed text for Annex 6, with new material shown in bold font, to the Air Navigation Bureau for consideration:

> 7.2.7 The State of the Operator that has issued an RVSM approval to an operator shall establish a requirement which ensures that **a minimum of** 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.
>
> - *Note.— Monitoring data from any regional monitoring programme established in accordance with Annex 11, 3.3.5.2, may be used to satisfy the requirement.*
>
> *(**SASP Note**: For completeness, existing Annex 6, paragraph 7.2.8 is included)*
>
> 7.2.8 All States that are responsible for airspace where RVSM has been implemented, or that have issued RVSM approvals to operators within their State, shall establish provisions and procedures which ensure that appropriate action will be taken in respect of aircraft and operators found to be operating in RVSM airspace without a valid RVSM approval.
>
> - *Note 1.— These provisions and procedures need to address both the situation where the aircraft in question is operating without approval in the airspace of the State, and the situation where an operator for which the State has regulatory oversight responsibility is found to be operating without the required approval in the airspace of another State.*
>
> - *Note 2.— Guidance material relating to the approval for operation in RVSM airspace is contained in the Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9574).*
>
> **7.2.9 Regional Planning Authorities shall be responsible for instituting such monitoring programmes as are necessary to provide assurance that the RVSM Safety Objectives are being met. Specific requirements are set out in ICAO Doc. 7030 Regional Supplementary Procedures**.

5.7 The meeting noted the differences in the two proposals and appreciated the attempts by the SASP, as the body responsible for identifying the need for long term height monitoring, to ensure flexibility in arrangements to suit local circumstances. The meeting requested that States take care to fully review the State Letter in relation to this matter (ICAO Ref: AN 13/11.1-07/72, 7 December 2007) and, taking into consideration the amended text prepared by the SASP (above), recognize that the proposed Annex 6 amendment may not provide APANPIRG with the ability to implement effective regional monitoring programmes to suit local circumstances. Accordingly, RASMAG encouraged States to respond to the State Letter and to seek direct input from any RMA associated with that State to ensure an informed response is provided from the recognized regional experts.

5.8 In any event, the meeting considered that there was sufficient information between the two texts to clearly indicate that, from November 2010, Annex 6 would carry Standards for airframe height monitoring that obliged States to ensure operators in RVSM airspace conducted height monitoring at regular periodicity – presently proposed as once during a two-year period or within a period of 1,000 flying hours, whichever is greater - for the foreseeable future.

Regional management of Long Term Height Monitoring requirements

Background

5.9 The meeting recalled discussions during RASMAG/7 in relation to the position of the ICAO SASP that globally applicable minimum long-term monitoring requirements were required for RVSM operations as Altimetry System Error (ASE) drift could not be detected without specialized monitoring systems and could therefore pose a serious risk if uncorrected. It was anticipated that the global provisions which were currently under development, as described in paragraphs 5.5 to 5.8 above, would become effective from November 2010.

5.10 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. APANPIRG/18 was of the opinion that work should be undertaken as soon as possible in order to assess the consequences for the Asia/Pacific Region of the implementation of long term monitoring requirements and, under the terms of Conclusion 18/4, requested 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.

Methodologies to manage regional Long Term Height Monitoring

5.11 Although the final composition of the long term height monitoring provisions was still subject to final resolution the meeting agreed that it was reasonable to expect, as a minimum, that an RMA would need to carry out the following tasks:

a) Educate States and airspace users as to the roles and functions of an RMA,

b) Establish the monitoring requirements to be satisfied by each operator,

c) Coordinate with other RMAs so that monitoring results are shared, and

d) Ensure that an adequate monitoring system infrastructure exists.

Educate States and airspace users about the roles and functions of an RMA

5.12 In light of the difficulties being experienced by MAAR and other Asia/Pacific RMAs, as described in paragraphs 5.1 to 5.4 above, it was evident to the meeting that there was considerable confusion amongst States and airspace users about the roles and responsibilities of regional RMAs. The finalization of the RMA Manual during 2008 as proposed by the ICAO Headquarters Secretariat would provide up to date documentation that would be useful to Asia/Pacific RMAs in educating affected parties. The meeting was of the view that the preparation and distribution of an information circular describing the roles and responsibilities of an RMA, the height monitoring process and equipment required and the reasons and quantum of the long term height monitoring requirements would be extremely beneficial in better informing affected parties. Accordingly, the meeting formulated Long term Height Monitoring (LTHM) Action 1, as follows:

LTHM Action 1: Based on the final draft of the RMA Manual which was expected to be available from June 2006, Asia/Pacific RMAs in conjunction with RASMAG prepare and widely promulgate an information circular detailing, as a minimum, the roles and responsibilities of an RMA, the height monitoring process and equipment required, and the reasons and quantum of the global long term height monitoring requirements.

Establishing Monitoring Requirements for Each Operator

5.13 The meeting agreed that in order to provide effective monitoring oversight of the operators and individual aircraft of each State for which an RMA is designated to provide service in accordance with the relevant material in the RMA Manual, it was essential for an RMA to continuously and clearly identify the current operators and associated individual aircraft for which it held monitoring oversight responsibility. The introduction of long term height monitoring requirements would introduce additional and ongoing responsibilities for RMAs in this regard.

5.14 The RMA Manual designates which States and FIRs are served by each RMA. Using this designation, each RMA establishes a database of State approvals for all RVSM-approved operators for which it holds responsibility. However, as described previously, the difficulty of maintaining the accuracy of existing databases was a problem experienced consistently by all RMAs and the problem could only be overcome by the focused assistance of States. In particular, States needed to accept responsibilities to provide updated information to RMAs on an ongoing, rather than on request, basis.

5.15 To ensure that relevant RMA databases were updated as soon as possible in order to sustain present service delivery as well as prepare the region for the introduction of global long term monitoring requirements, the meeting agreed to LTHM Action 2 below:

LTHM Action 2: To maintain effective delivery of existing RMA services and facilitate planning specifically designed to prepare for application of global long-term RVSM height monitoring requirements from 2010, each Asia/Pacific RMA should, as a matter of priority, bring to the attention of State regulators the difficulties being experienced by RMAs in receiving timely and accurate information (including routine large height deviation [LHD] reporting) from States. Asia/Pacific RMAs should seek assistance from States in implementing robust processes to:

a) continuously update RMA databases of operators and aircraft holding State RVSM approvals,
b) enable the expeditious forwarding of all LHD and related reports to RMAs, and
c) ensure availability of current details for State RVSM Point of Contact (POC) officials.

5.16 Using the database of approvals for those States for which it is responsible, as updated in accordance with LTHM Action 2, the meeting considered that each Asia/Pacific RMA should be able to develop a list of operators and corresponding minimum number of airframes to be monitored in accordance with the long term height monitoring provisions – presently proposed as once during a two-year period or within a period of 1,000 flying hours, whichever is greater.

5.17 Taking into account any special circumstances occasioned by infrequent airspace users such as international general aviation to ensure that the long-term RVSM monitoring requirements are applied equitably, the meeting agreed that the next step for Asia/Pacific RMAs should be to develop a process for determining the minimum monitoring goals which must be accomplished for the operators and aircraft to which respective RMAs provide services. This should be undertaken in accordance with LTHM Action 3, as follows:

> **LTHM Action 3:** Whilst recognizing that responsibility for compliance with Annex 6 height monitoring provisions remains the responsibility of States as soon as practicable each Asia/Pacific RMA, in conjunction with State regulatory authorities and airspace user organizations, should develop a methodology for reviewing the RMA database of RVSM approvals in order to develop and promulgate a list of the minimum height monitoring which must be accomplished by each operator to which the RMA provides services. In preparing this list, account should be taken of special circumstances pertaining to infrequent airspace users recognizing that some operators may be required to complete minimum monitoring requirements which are a function of the proposed 1,000-flying-hour limit rather than the two-year limit.

Coordinate between global RMAs to ensure that monitoring results are shared

5.18 After completing the actions called for by LTHM Action 3, each Asia/Pacific RMA will have determined its maximum potential monitoring burden. Recognising that some airframes will operate within the area of responsibility of two or more RMAs, coordination should be completed between all global RMAs in order to avoid duplication of monitoring effort. For example, there are already extensive monitoring results for Asia/Pacific domiciled aircraft which operate international flights in Europe or North America and over fly ground-based height monitoring facilities there. These monitoring results should be shared between global RMAs in order to ensure that only the minimum amount of global monitoring required is undertaken and duplications are avoided. Such a coordinated examination between global RMAs will clarify the true monitoring burden faced by each Asia/Pacific RMA and leads to LTHM Action 4, as follows:

> **LTHM Action 4:** After determining the potential monitoring burden posed by the operators to which it provides service, each Asia/Pacific RMA should examine monitoring results accumulated by all other authorized global RMAs, regardless of region, in order to utilize monitoring results from other regions to avoid duplication and reduce the actual monitoring burden the RMA faces.

Ensure an adequate regional height monitoring infrastructure

5.19 The special steps which an operator must take in order to satisfy its monitoring requirements will depend on the monitoring infrastructure available within the airspace where it conducts flights. Basically, there are two types of monitoring systems available at present, both of them specifically designed to determine aircraft total vertical error and altimetry system error.

5.20 The first is a set of ground-based systems, with the EUROCONTROL Height Monitoring Unit equipment being the best established with 4 installations operating – 3 in Europe and one in Britain.

A second ground-based system is the Aircraft Geometric Height Measurement Element (AGHME) used in North America with 3 systems operational in the United States and 2 in Canada. An additional 2 systems will become operational in the United States in the near term.

5.21 Each system offers an operator the same convenience - assuming that the ground-based device is functioning and that the aircraft flies within its coverage area, flight over one of these systems will result in a successful monitoring result. The economic advantage to an operator is the same with both systems - the monitoring is free, in the sense that the actual costs of establishing and maintaining the ground-based systems are transparent to the operator. However, the meeting was informed that the capital and operating costs for these ground-based monitoring systems are substantial. If these costs are recovered through route charges or other mechanisms which result in expenses being borne by operators, the apparent per-monitoring savings may not materialize.

5.22 The difficulty which an operator faces in using one of these ground-based systems is that its aircraft must fly over the system while it is functioning. If the operator's normal flight patters must be altered to do this, there is a cost in terms of additional operating costs. If the ground-based system is non-operational when the aircraft flies over it, there is no successful monitoring and the operator has borne a cost without a benefit.

5.23 The second type of monitoring system is a portable GPS-based Monitoring System (GMS), which requires placement of a specialized data collection device aboard each aircraft for one flight. Unlike ground-based monitoring systems, use of the GMS requires that an operator take special steps to arrange for monitoring by a service-supplier and there is an explicit cost for this service. However, since the specialized data collection device is placed aboard an aircraft to be monitored, no alteration to the operator's flight pattern is required.

5.24 Acknowledging that the interaction of operator flight patterns, availability of suitable sites for ground-based monitoring systems and associated capital costs, and availability of GMS assets and related matters are complex, the meeting recognized that the most efficient regional monitoring infrastructure would necessarily include both types of monitoring systems. Typically, only an RMA is likely to have all necessary information about these various factors and, in determining the monitoring system infrastructure, it would be necessary for consultation between all affected parties since any decisions to enhance such infrastructure might require capital investment by States, user cost-sharing etc.

5.25 The meeting recalled that there are, at present, no such ground based monitoring facilities within the Asia/Pacific Region and only limited availability of the portable GMS systems. In order to ensure availability of suitable regional monitoring infrastructure, the meeting agreed to LTHM Action 5, as follows:

> **LTHM Action 5:** Each Asia/Pacific Region RMA should, in light of its anticipated height monitoring burden, propose recommendations through RASMAG to APANPIRG useful in determining the regional ground-based and GPS-based Monitoring System (GMS) height monitoring infrastructure necessary to enable its affiliated operators to meet the global long-term RVSM monitoring requirements applicable from November 2010.

5.26 The meeting agreed that it would be very beneficial if monitoring could be undertaken using systems which have other functions in the aviation system. As recorded in paragraphs 5.28 to 5.33 below**,** two such types of systems have presented themselves as potential candidates, these being Automatic Dependent Surveillance – Broadcast (ADS-B) and Multilateration. Although the primary function of both these systems is air traffic control surveillance, both systems produce the fundamental measurement - aircraft geometric height - needed to support aircraft height-keeping performance monitoring. However, since the utility of ADS-B or Multilateration systems for height monitoring will

depend on the accuracy with which they produce estimates of geometric height, the meeting endorsed LTHM Action 6, as follows:

> **LTHM Action 6:** Asia/Pacific RMAs collaboratively investigate the technical feasibility of using the aircraft geometric height produced by ADS-B and Multilateration surveillance systems to support monitoring of aircraft height keeping performance.

5.27 In order to raise awareness of the issues resulting from the pending implementation of long term height monitoring requirements as highlighted by APANPIRG Conclusion 18/4, the meeting requested that the Regional Office circulate the LTHM Actions identified above to all States, airspace users and Asia/Pacific RMAs. This was expected to assist the region by providing the maximum lead time to all affected parties to make adequate preparations for implementation.

ABS-B and/or Multilateration to provide geometric height

5.28 Australia informed the meeting that as a result of the development of long term monitoring requirements for RVSM in the last year, the AAMA had turned its attention to resolving the issue of monitoring the large number of domestic aircraft that remain within the Australian FIRs and are therefore not height monitored on an on-going basis.

5.29 Previous work reviewed by the SASP included a methodology that utilized geometric height data from ADS-B reports to undertake height monitoring. As a result, given the planned implementation of ADS-B ground stations within Australia, work had begun on initial data gathering and assessment activities with a view to determining the validity of using ADS-B derived geometric and barometric height data for aircraft monitoring. Australia stated that the output from these initial activities had been reported to the SASP at its recent meeting in Santiago de Chile in November 2007 where it received endorsement of the work so far and encouragement that research should continue. Details of the work provided to SASP was described to the meeting and it was informed that Airservices Australia intends to progress further analyses which will be presented to the SASP WG/WHL/13 meeting in Montreal in May 2008. Australia will also provide RASMAG with information concerning the progression of this work at its next meeting immediately following the next SASP meeting.

5.30 Work was also proceeding in the United States in relation to use of ADS-B for height monitoring. While not an impediment to use of the horizontal-plane aircraft position for surveillance, the FAA Technical Center has determined that the uncorrected aircraft geometric height produced using GMU-collected pseudoranges is not of sufficient accuracy to support adequate estimation of TVE, AAD and ASE. The technical challenge is, thus, to develop a non-real-time method of improving the accuracy of the ADS-B-derived aircraft geometric height.

5.31 The United States was also investigating the use of Multilateration based surveillance systems to provide geometric height data of sufficient accuracy for RVSM long term height monitoring. The HMU and the AGHME systems described previously rely on Multilateration to produce estimates of aircraft geometric height. Conceptually, any Multilateration system could provide estimates of aircraft geometric height.

5.32 As with ADS-B, however, the typical aircraft geometric height produced by a Multilateration system is not of sufficient accuracy to support monitoring. Unlike the situation with ADS-B, the fundamental inaccuracy has to do with the placement of ground stations in a Multilateration network. Usually, these stations are arranged to provide horizontal-plane surveillance of a wide area, whereas accurate determination of aircraft geometric height by systems such as the HMU or the AGHME require a number of stations placed rather closer together in order to achieve height-measurement accuracy within a relatively small volume of airspace. Additionally, the precise-time source used in a monitoring system may be of greater fundamental accuracy than that required for Multilateration.

5.33 Following the presentations from Australia and United States the meeting discussed some of the likely benefits for the region if ADS-B and/or Multilateration was an accepted method for height monitoring. The United States suggested that they would be willing to assist directly with the analyses being undertaken by Australia. As a result the meeting strongly supported further research taking place and for the Asia/Pacific RMAs to cooperatively support this work.

WPAC/SCS RVSM Scrutiny Working Group

5.34 The First Meeting of the Western Pacific/South China Sea RVSM Scrutiny Working Group (WPAC/SCS RSG/1) was convened as a result of the APANPIRG/17 (August 2006) review of RVSM operations in the WPAC/SCS area, in which concerns had been raised in relation to the apparent poor safety performance of RVSM operations against the established target level of safety. Since RASMAG/7, two meetings of the WPAC/SCS RSG had been held - WPAC/SCS RSG/2 in June 2007 and WPAC/SCS RSG/3 in October-November 2007.

5.35 WPAC/SCS RSG/2 noted that the estimate of overall risk (i.e. technical & operational risk) in the latest MAAR safety assessment was 6.09×10^{-9}, which still exceeded the agreed TLS value of 5.0×10^{-9} fatal accidents per flight hour due to all causes. The cause of this infringement was the high number of operational errors, of which the errors in ATC Unit-to-ATC Unit coordination was significant. However, although the TLS was still not being satisfied, WPAC/SCS RSG/2 was pleased to note a dramatic reversal of the adverse trend that had previously been exhibited and considered it was a very pleasing result given the circumstances. WPAC/SCS RSG/2 was strongly of the opinion that remedial actions taken by States as a result of discussions during WPAC/SCS RSG/1 (January 2007) had contributed directly to the reversal of the negative trend.

5.36 In order to facilitate the investigation of the LHD occurrences reported since WPAC/SCS RSG/1, MAAR provided limited details of each of the specific LHD occurrences reported by States over the period January 2007 to April 2007. WPAC/SCS RSG/2 conducted an extensive review of the summary LHD information provided by MAAR in relation to the 16 available LHD reports received from States for this period. The data analysis was supported by verbal feedback from State delegates.

5.37 WPAC/SCS RSG/2 recognized that the high percentage of ATC coordination errors was consistent with the finding of WPAC/SCS RSG/1. In noting that there were many ways in which air navigation service providers (ANSPs) could address their obligations in relation to improving performance in this area, WPAC/SCS RSG/1 had considered that this was a primary function of ANSPs and the meeting urged affected ANSPs to continue to take urgent and effective action in this regard.

5.38 The level bust and TCAS reports were not considered by WPAC/SCS RSG/2 to be systemic in nature and therefore did not lend themselves to a systemic solution. In reviewing the LHD reports which were subsequently found not to meet LHD criteria, WPAC/SCS RSG/2 recalled discussions during WPAC/SCS RSG/1 as to what actually comprised a LHD. It was evident that different interpretations were held by different States and that this had resulted in LHD reports being submitted for some situations that, although they were occurrences resulting in flight level variance of 300 ft or more, were not actually LHD occurrences and therefore should not have been reported as such. The meeting was hopeful that the guidance material recently provided by RASMAG including the plain language definition of a LHD would assist States to avoid the erroneous reporting of LHD.

Japan – Measures to Mitigate LHD on ATS route A590

5.39 Japan provided the meeting with details of the mitigating measures taken by Japan Civil Aviation Bureau (JCAB) to rectify the four LHD cases, as reported at WPAC/SCS RSG/1, caused by "Error in ATC-unit-to-ATC-unit transferred/transition message" for flights from the Fukuoka FIR to the Manila FIR. As a result of the information made available at WPAC/SCS RSG/1, Fukuoka Air Traffic Flow Management Centre (ATMC) scrutinized the four LHD cases, identified several potential causal factors and implemented remediation.

5.40 WPAC/SCS RSG/2 considered that the process and outcomes outlined by Japan were a good example of the application of an ATS safety management system (SMS), showing how specific recommendations had been implemented as a result of an investigation of LHD related operational errors. An ATS SMS that enables detailed examination of operational errors to be undertaken in order to identify weaknesses was likely to be effective in reducing the likelihood of errors.

Fukuoka ATMC, Naha ACC, Manila ACC - Implementation of LHD MOU

5.41 Following WPAC/SCS RSG/1, Japan and the Philippines had engaged in close coordination in order to reduce the numbers of LHD incidents being reported. As part of this work, a Memorandum of Understanding (MOU) in respect to Mutual Reporting of LHD Occurrences had been signed between the Chiefs of Fukuoka ATMC, Manila Area Control Centre (ACC) and Naha ACC for implementation on 1 June 2007. The MOU detailed procedures ensuring that when an LHD is observed or reported, the ATMC/ACC supervisor first becoming aware of the LHD should coordinate with the supervisors of the other two Centres in order to ensure that they are aware of the LHD occurrence.

5.42 WPAC/SCS RSG/2 congratulated Japan and the Philippines on this initiative which recognized the intent of the discussions that had been held during WPAC/SCS RSG/1. The ability of all affected ATMC/ACCs to be aware of the LHD would facilitate early investigation of the situation, enabling accelerated remediation and assisting greatly in reducing the numbers of LHDs. WPAC/SCS RSG/2 encouraged other States to follow the model established by Japan and Philippines and join in similar formalized arrangements aimed at reducing the numbers of LHD occurrences.

Adoption of Scenario 3 FLOS/FLAS for the WPAC/SCS Area

5.43 The Scenario 3 proposal for the WPAC/SCS area FLOS/FLAS reached in-principle agreement of all parties at the WPAC/SCS RSG/2 meeting. Scenario 3 was adopted as the basis for the future work of the Scrutiny Group and comprised an ICAO compliant single alternate FLOS, with the exception of the six unidirectional parallel routes, i.e. L642, M771, N892, L625, N884 and M767, on which special high capacity arrangements had been agreed that involved managed use of all odd and even flight levels in each direction. States and MAAR would undertake a comprehensive safety review of Scenario 3 and provide feedback to the next meeting.

5.44 MAAR provided a safety assessment based on the Scenario 3 proposal for review by WPAC/SCS RSG/3, who noted that the level of technical risk for the Scenario 3 FLOS/FLAS was relatively higher compared to the existing flight level arrangement. This occurred because the current vertical separation between the adjacent flight levels on the main ATS routes including six parallel routes and A1/P901 was 2 000 ft, whereas the separation minima between routes for Scenario 3 would become 1 000 ft. Hence, the occupancy values for the same and opposite direction parameter would increase in the Scenario 3 context.

5.45 However, the increase in technical risk due to the increasing number of same track proximate pairs would be partially offset by the decrease in the occupancy value of the crossing tracks. On the other hand, the operational risk was significantly high, resulting from the large number of LHD occurrences in the past years. Consequently, the total risk estimate for the proposed Scenario 3 had exceeded the overall target level of safety. Importantly, MAAR highlighted that it was necessary to understand that this risk estimate captured only the increased impact of Scenario 3 on the technical risk because of the objective nature of technical risk, whereas the influence of Scenario 3 on operational risk was not captured in the estimation because the information was variable.

5.46 On behalf of the first meeting of the East Asia ATM Coordination Group (EATMCG/1), Japan reported that all the EATMCG participants agreed to adopt the new flight level allocations in the SCS area. The new level allocations accommodated the Scenario 3 proposals. WPAC/SCS RSG/3 was also informed that agreement on the transition tasks was reached. EATMCG/1 also discussed and agreed to a suitable flight level allocation for the management of Large Scale Weather Deviations (LSWD).

5.47 To prevent the potential hazard of the same flight levels between N884 and A582/A590, the meeting agreed that traffic on N884 should be rerouted via a new extension to N884 from LBG-CAB-LEBIX-ALBAX-YURIX. Japan and the Philippines agreed to establish this new extension to N884 and agreed that the northeast-bound RNP 10 route LBG-CAB-LEBIX-ALBAX-YURIX and the southwest-bound ATS route A582 utilize the single alternate FLOS.

5.48 WPAC/SCS RSG/3 agreed with a proposal to simplify the routing between Guam and Hong Kong by implementing a new route to the south of R596 through the Manila and Oakland FIRs, which would then join the existing routes W12 and A461 to Hong Kong. The existing R596 would be decommissioned as it would be replaced by the new route, with a target date of AIRAC 14 February 2008.

5.49 Recognizing that no safety issues had been identified by the safety analyses conducted by any of the affected States or MAAR, a number of systemic benefits would result, consensus between all affected States had been reached, and the Regional Office and IATA supported the implementation, the meeting made a 'Go' decision for the implementation of the new level allocation in the WPAC/SCS area. Taking into account the implementation complexities expressed by States, the meeting set a target date of AIRAC 5 June 2008 to implement the final version of the WPAC/SCS level allocation**.**

5.50 The meeting commended the WPAC/SCS RSG for the excellent progress that had been made in a relatively short period of time and looked forward to reviewing the outcomes of the implementation process during the June 2008 RASMAG meeting.

Review of RVSM/TF/31 and RVSM/TF/32

5.51 The meeting was informed that since RASMAG/7, two meetings of the RVSM Implementation Task Force had taken place to support the implementation of RVSM in China. RVSM/TF/31 was held in July-August 2007 and RVSM/TF/32 in September 2007.

RVSM/TF/31

5.52 China presented draft RVSM flight level transition procedures for review, noting that the proposals by China and some of these procedures were yet to be coordinated with States concerned. RVSM/TF/31 reviewed the proposals by China and made suggestions to be considered by both China and States concerned during the coordination process.

5.53 Following the establishment of safety-related working groups in every ACC in China, China started the trial TSD collection procedure in May 2007, in order to identify problems and errors associated with the collection process. The official TSD collection was undertaken nation-wide from 1 June to 1 July 2007 and had resulted in a one month TSD (June 2007) for the whole China sovereign airspace that was suitable for the preliminary risk assessment. During the early stage of the collection period, additional monitoring was conducted to ensure that all the data collected were without errors. At this stage, although final figures still had to be collated for international and domestic operations, it was evident from examination of global RMA databases and domestic data that the 90 percent figure for airframe approvals would be readily achieved and it was anticipated that the final outcome would be in the order of 95 percent.

5.54 The outcome of the preliminary readiness assessment for the Shanghai FIR undertaken by China demonstrated that, based on the collision risk estimates from the received TSD and LHD reports, the technical risk for the RVSM implementation in Shanghai FIR was 1.43×10^{-10} and the total risk attributed to all causes was 3.936×10^{-9} fatal accidents per flight hour. Therefore, the risk estimates satisfy the agreed regional 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 300 m and to all causes, respectively.

RVSM/TF/32

5.55 RVSM/TF/32 agreed that, based on the information and the safety assessments provided by China, and subject to finalization of the ongoing Letters of Agreements with neighbouring States, RVSM operations in all the airspaces of China could be implemented at 1600 UTC on 21 November 2007. The RVSM flight level allocation to be implemented by China would be in accordance with the China metric system where air traffic control instructs pilots with meters and the pilots consult a conversion table to fly at a flight level in feet corresponding to the metric value.

5.56 China described the comprehensive activities undertaken to establish the monitoring authority of the General Administration of Civil Aviation of China (CAAC) which is responsible for sovereign Chinese airspace. China also described the coordination undertaken with PARMO and MAAR for the comprehensive training required to conduct the readiness and safety assessments for the RVSM implementation.

5.57 The meeting reviewed the geographical areas of sovereign Chinese airspace included in the readiness and safety assessments. The areas cover nine Chinese FIRs, including the Beijing, Shanghai, Guangzhou, Wuhan, Shenyang, Lanzhou, Urumqi, Kunming, and Sanya FIR (over Hainan Island). In addition, based on the collected TSD, the meeting reviewed the flight operation statistics, traffic flow characteristics, operator and aircraft profiles, and flight level utilization used to describe the air traffic environment of the sovereign Chinese airspace. The meeting noted that the percentage of operations that would be conducted by approved operators and aircraft in the planned RVSM airspace would increase to 92.5 percent by November 2007.

5.58 The meeting reviewed the summary of LHD occurrences associated with the RVSM implementation in the sovereign Chinese airspace, given as follows:

- Total of 33 LHD occurred in the Chinese airspace, accounting for 52.32 minutes of duration, and nine climbing flight levels crossed and ten descending flight levels crossed since January 2006.

- Sixteen LHD occurred in the recent 12 months since August 2006, accounting for 5.72 minutes of duration and nine climbing flight levels crossed and ten descending flight levels crossed.

5.59 In addition, China advised the meeting that several preventive measures for LHD occurrences concerning the coordination error in the ATC-to-ATC transfer of control responsibility as a result of human factors issue (Category E) would be put in place.

5.60 The meeting noted that the FAA Technical Centre reviewed the ATMB readiness and safety assessment and had independently verified the risk values presented. Specifically, the FAA Technical Centre team:

- produced readiness estimate values which were virtually identical to the ATMB team's results which indicated that China's readiness goal for RVSM implementation would be met;
- found that the parameter estimation procedures used in the safety assessment were identical to those used in risk estimation processes carried out by PARMO and NAARMO in the Asia/Pacific, and North American Regions, respectively;
- agreed that, after thorough review of the LHD material provided by the ATMB, the proportion of time spent at incorrect flight levels used in estimating operational risk was appropriate;
- found that the ATMB used the probability of lateral overlap, $P_y(0)$, provided by the Technical Centre;
- found that the ATMB used the probability of loss of vertical separation, $P_z(0)$ and $P_z(1{,}000)$, provided by the Technical Centre; and
- found that the ATMB employed software used by the Technical Centre to compute technical and operational risk.

5.61 The meeting noted that the technical and overall risk estimates satisfied the agreed TLS value of no more than 2.5×10^{-9} and 5.0×10^{-9} fatal accidents per flight hour, respectively. Consequently, based on the readiness and safety assessment, the meeting took a 'Go' decision for RVSM implementation to proceed.

Status of RVSM implementation in Chinese airspace

5.62 China informed the meeting that China RVSM was implemented as scheduled at 1600 UTC on 21 November 2007 in the Beijing, Guangzhou, Kunming, Lanzhou, Shanghai, Shenyang, Urumqi and Wuhan FIRs and Sector 01 (airspace over the Hainan Island) of the Sanya FIR.

5.63 Before the implementation, China has undertaken significant preparation and composed a detailed transition plan. On the date of RVSM implementation, administrators from all the responsible department of CAAC and ATMB and senior technical experts of ATC equipment were on site during the whole process, witnessing and conducting the transition procedures to ensure the CVSM to RVSM transition process was smooth and safe.

5.64 To ensure the safety of operations and enable controllers to become with the changes, the traffic flow inside China will be maintained at not more than current volumes for the first few months after transition. The airspace capacity and operational efficiency will be gradually improved in the Chinese domestic airspace in the future. In December this year, the China RMA will conduct a follow up RVSM airspace risk assessment further examine the trend of risks after the transition.

5.65 The meeting warmly congratulated China for the successful implementation of RVSM throughout the Chinese airspace. This was a significant undertaking that had been achieved in a very short time period. The willingness of the China RMA to work with the FAA Technical Center had meant that safety assessments had been completed in accordance with the standard expected by RASMAG and had given clear indication to the 'Go/No Go' meeting that there was no safety impediment to the implementation. This implementation meant that the Ulaan Bataar FIR was the sole remaining airspace in the Asia/Pacific Region that was not yet RVSM.

5.66 China graciously expressed their thanks to everyone for the great effort, competence, dedication and enthusiasm while helping China to meet the formidable challenge presented by this very complex task, China expressed sincere appreciation to all the States, organizations and individuals that assisted China to achieve such a splendid accomplishment.

Expansion of horizontal monitoring for South China Sea area

5.67 The meeting was reminded that at the Seventeenth meeting of the ATM/AIS/SAR Sub-Group held from 2 to 6 July 2007, Singapore expressed willingness to monitor movement data and gross navigational error reports on two additional ATS routes, namely L642 and M767 in the South China Sea area to facilitate the implementation of RNP10 (50/50NM) operations. Subsequently, Singapore was tasked by the Sub-Group to revise the current LOA for the monitoring of aircraft gross navigation errors and to collect data for the conduct of safety assessment to implement 50/50NM and 30/30NM reduced horizontal separation in the South China Sea area. Accordingly, Singapore presented the meeting with the revised draft Letter of Agreement (**Appendix F**) for review.

5.68 The meeting recognized that Singapore, as the Monitoring Authority, was responsible for collating relevant data concerning flight operations including, any associated Gross Navigational Errors (GNE) on 4 routes in the South China Sea area as follows:

a) DULOP and DUMOL on M771
b) AKOTA and AVMUP on L625
c) LULBU and LEGED on N884
d) MELAS and MABLI on N892

5.69 As a result of the amendments to the LOA, Singapore would continue in the role of the Monitoring Authority in collating relevant data and in addition and will monitor traffic movement data and GNE on the following 2 additional routes:

(a) ESPOB to ENREP on L642
(b) TEGID to BOBOB on M767

5.70 The meeting thanked Singapore for promptly completing the work in updating the Letter of Agreement. The meeting considered that the amendments to the LOA were appropriate and Singapore was encouraged to finalize the changes and circulate the LOA for signature by affected States.

Singapore to assume SMA responsibilities for South China Sea area

5.71 Resulting from the need to increase the airspace capacity and efficiency on ATS Routes L642 and M771, Singapore informed the meeting that a Special Coordination Meeting (SCM) from 25 to 27 September 2007 was held at the Singapore Aviation Academy to progress the implementation of 50/50NM horizontal separation based on RNP10 operations on ATS Routes L642 and M771. The SCM meeting noted that a safety assessment would be required to be conducted before the reduced separation could be implemented and the target date of implementation is 3 July 2008.

5.72 The meeting supported Singapore's intention to provide SMA services for the South China Sea area by engaging an external consultant to conduct the horizontal safety assessment to progress the implementation of 50/50NM reduced separation L642 and M771 and subsequently to become the SMA for the South China Sea area once the requirements to perform as an SMA were fulfilled.

5.73 Singapore would provide a copy of the safety assessment to the next RASMAG meeting and RASMAG would continue to assist Singapore towards achieving SMA capability.

RASMAG List of Competent Airspace Safety Monitoring Organizations

5.74 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 G**) for use by States requiring airspace safety monitoring services.

5.75 In conducting this review, the meeting was pleased to include an entry for the China RMA and update the entry for the JCAB RMA to reflect the "approved APANPIRG RMA" status that had been awarded to Japan by APANPIRG/18 on review by RASMAG/8. The meeting again congratulated China and Japan on these achievements.

United States – Update on 30/30 NM operational trial in Oakland FIR

5.76 The United States provided a comprehensive update in relation to the operational trial of 30 nautical mile (NM) lateral and 30 NM longitudinal (30/30) separations which had commenced in December 2005in Oakland Oceanic Control Area (CTA) Sector 3. The trial was expanded in March 2007 to include all Oakland oceanic sectors. The update included aspects of the lateral navigational approval status of aircraft operating in Oakland Oceanic airspace along with estimates of their navigational performance, a summary of recent datalink service provider performance and information related to weather deviations, increased reporting rates and lateral deviation contracts.

5.77 FAA has formed a Scrutiny Group (SG) in order to review the results of system performance during the operational trial. The SG is composed of representatives from various FAA organizations, including specialists in oceanic air traffic control and engineering operations from Oakland Center (ZOA), as well as representatives from Headquarters air traffic services, the Flight Standards Service and the Aircraft Certification Service.

5.78 In order for aircraft to participate in the operational trial they are required to be approved for RNP-4 operations. Currently in Oakland Oceanic airspace approximately 15% of the traffic files a flight plan indicating RNP-4 approval. The seven operators with RNP4 approvals in Oakland Oceanic airspace are United Airlines, Qantas Airways, Air New Zealand, Cathay Pacific Airways, Singapore Airlines, Singapore Airlines Cargo, and United Parcel Service. New RNP-4 operator UPS began filing RNP-4 for some of their flights in Oakland's Oceanic airspace in July 2007 and the percentage of their flights filing RNP-4 has increased to about 50 percent since that time. United Airlines has also increased the number of flights filing RNP-4 since May of this year from about 30 percent to 67 percent in September.

5.79 A summary of an analysis which estimated the lateral navigational performance of aircraft eligible for ADS-based separation standards in Oakland Oceanic airspace was presented. These results, combined with reports of gross navigational errors are used to estimate the lateral overlap probability for use in the safety assessment for the 30/30 separation standard.

5.80 The reliability of datalink service provision is vital to the use of reduced separation standards in oceanic airspace. The FAA monitors transit times of messages sent between aircraft and the ARTCC to assess the performance of the service providers. The Ocean 21 system used in Oakland oceanic airspace collects data from which these transit times can be determined. The graphs in **Appendix H** summarize the performance of the service providers in relation to ADS-C and CPDLC message transit times, respectively, and their respective FANS-1/A Operations Manual (FOM) targets.

Datalink performance requirements for reduced horizontal separation minima

5.81 The United States presented comprehensive information summarizing recent developments in the Asia/Pacific and North Atlantic Regions pertaining to the establishment of specifications for the performance of datalink services in relation to reduction in horizontal separation minima.

5.82 In addition to work in the Pacific portion of the Asia/Pacific Region, the North Atlantic Region has shown interest in the application of datalink services and related reduction in horizontal–plane separation minima. This interest has manifested itself in the use of datalink as an alternative to high-frequency-based-radio reporting of position.

5.83 Experiences gained by the United States as a result of the 30/30 operational trial in the Pacific demonstrated that the performance of datalink service providers was integral to the use of datalink for reduced separation applications. During the trial irregular performance of the datalink service necessary for the provision of these reduced horizontal-plane separation minima was noted, leading to the suspension of the trial by the FAA whilst data link service providers completed equipment upgrades.

5.84 As a result, it had become clear to the Scrutiny Group formed by the FAA to oversee the trial that requirements for the provision of datalink services are not fully defined. An extensive cooperative effort between the RTCA in the US and the European Organization for Civil Aviation Equipment (EUROCAE) has as one of its aims the specification of performance requirements for communications in connection with the provision of air traffic services. Relatively recently, this work has produced a documented Safety Performance Requirement (SPR) for the availability of datalink service provision.

5.85 As a result of the their awareness of the Pacific experience with provision of datalink services and reduction of the redundant infrastructure for such services with in the North Atlantic, the North Atlantic Systems Planning Group (NAT/SPG) has taken steps to adopt the RTCA/EUROCAE SPR relating to the availability of the service. Additionally, the SPR was accepted by the IPACG/27 meeting in November 2007.

5.86 The meeting clearly recognized the importance of this work and the evidence that had come forward from the 30/30 trial in the Pacific. The matter had long been recognized as a problem in the Pacific region and the meeting was encouraged to see that it was now identified as a global issue, thanking the United States for accepting the burden of advancing this matter globally on behalf of all affected parties.

5.87 The meeting gave in principle support to the activities so far; however, as this was the first occasion that RASMAG had been presented with detailed information, the meeting would need more time to fully review the SPR before providing formal endorsement. Additionally, the regional processes for technical matters were that the ATM/AIS/SAR and CNS/MET Sub Groups would review the circumstances and make appropriate recommendations to APANPIRG. In terms of the technical nature of datalink it was particularly appropriate that the CNS/MET Sub Group also review the matter.

Large Height Deviation – Lost Communication between Aircraft and ATC

5.88 IATA, also speaking on behalf of IFALPA, informed the meeting of concerns regarding the revised LHD Categorizations that resulted from the deliberations of RASMAG/7. Specifically they identified that in a period when there is no contact between aircraft and ATSU units, real threats exist to preservation of RVSM constraints as aircraft may be required to respond to on-board emergencies requiring changes of altitude, or may change altitude to meet planned or unplanned performance outcomes. The meeting was informed that in IATA's and IFALPA's view these issues can only safely be addressed by ensuring full data capture of such failures.

5.89 IATA highlighted the fact that if no timely communication exists between the relevant ATSU and the aircraft for extended periods of time then no current data is available to positively confirm the current altitude. This is no less a matter of height keeping than a report at an incorrect altitude as the central theme is that the aircraft is not positively identified at the correct altitude at the correct time. Additionally the meeting was informed that both IFALPA and IATA had formed the view that simply removing this data from the LHD Categorization list as proposed at RASMAG/7 does nothing to resolve the safety issues.

5.90 The meeting considered in some detail a request from IATA and IFALPA to accept that extended inability to establish communications between aircraft and ATC is a LHD and should be recorded under the new LHD Categorization Item –M. Lengthy discussion took place regarding proposed scenarios in an attempt to identify the nature of reports related to such loss of communication events. The meeting recognized that each situation was different and would have to be considered on its merits, but that some cases would be LHDs. As such, reporting of all such incidents should be made available to the relevant RMA and analysis by the RMA would allow a determination to be made as to whether the situation comprised an LHD and, if so, which LHD categorization was appropriate.

5.91 In this context, to ensure that such events are adequately reported the meeting agreed to add the note below to the RASMAG LHD categorization 'M' (i.e. 'Others') as shown in **Appendix I** that highlighted the situation where air ground communications were unable to be established. To support the provision of adequate data in this respect, the meeting encouraged IATA and IFALPA to report all circumstances of concern to enable RMAs to assess the matters.

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.

Agenda Item 6: Review and update RASMAG Task List

6.1 In reviewing the RASMAG task list, the meeting was appraised of the status of items considered complete and suitable for closure as well as those remaining open, noting the progress that had been made. Additional items were added to ensure the presentation of an information paper about RASMAG to the first meeting of the PBN Task Force and the review of RASMAG Terms of Reference to ensure PBN matters were addressed. The preparation of a submission by China to advance to APANPIRG RMA status was also included, for review by RASMAG/9.

6.2 The meeting agreed that the updated task list included as **Appendix J** accurately reflected the work programme of RASMAG.

Agenda Item 7: Any other business

Traffic Sample Data State Letter

7.1 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 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.

7.2 In this regard the Regional Office had issued State Letter Ref: T3/10.0, T3/10.1.17 – AP124/07 (ATM) during November 2007 requesting submission of December 2007 TSD to relevant regional monitoring agencies.

Paperless RASMAG Meetings

7.3 In noting the large volume of working papers and associated attachments to be considered by the meeting and the very high percentage of notebook computers in use in the meeting room, the meeting requested that the Secretariat take strong steps towards a paperless meeting environment. It was the opinion of the meeting that the RASMAG should work as a completely paperless meeting and requested that the Secretariat refrain from routinely printing copies of any material that was readily available in electronic format from the website.

Agenda Item 8: Date and venue of RASMAG/9 meeting

8.1 The meeting recognised that significant extra work by RMAs would be necessary to support the changes precipitated by the long term height monitoring provisions. With the China RMA expected to achieve APANPIRG RMA status in the near term, the Asia/Pacific Region would be serviced by 5 RMAs. The meeting considered that there were many benefits to be gained in adopting standardised methodologies applicable to all Asia/Pacific RMAs and that standardised processes could only be achieved by regular combined meetings of Asia/Pacific RMAs.

8.2 Accordingly, the meeting agreed that the first day of each RASMAG meeting, commencing from RASMAG/9 would be reserved for a combined Asia/Pacific RMAs technical meeting. The RMAs would meet on the Monday to discuss and resolve technical issues prior to the commencement of the full RASMAG plenary meeting on the Tuesday. The Regional Office would issue invitations to a 5 day RASMAG meeting but noting that the first day was reserved for the combined RMAs meeting.

8.3 Recognizing that the ICAO HQ Global RMAs meeting would take place in conjunction with the May SASP meeting, the meeting agreed that the next RASMAG meeting should be held immediately after the SASP meeting. Accordingly, the week of 26-30 May was for a five day meeting comprising the one day combined RMAs meeting followed by a 4 day full plenary meeting.

9. Closing of the meeting

9.1 The Chairman, Mr. Butcher, thanked the meeting participants for their valued participation in RASMAG and noted the excellent work that had been achieved at this meeting. Mr. Butcher again congratulated China on its implementation of RVSM and hoped that it would continue its support of RASMAG by sending representatives on an on-going basis. Additionally, Mr. Butcher reminded the meeting of the significant achievement by Japan in being recognized formally as an RMA

and that he was sure that safety within the Region would be enhanced by the considerable expertise that Japan provides.

9.2 Mr. Butcher noted that while significant work had been achieved by States and the RMAs in producing safety assessments for the Region's RVSM airspace, along with supporting activities such as scrutiny groups aimed at reducing error and managing risk, there were still significant questions to be resolved regarding the effectiveness of State data reporting in some areas. Specifically he reminded the meeting of the importance of resolving these issues effectively to ensure the continued confidence in the assessment process and encouraged the RMAs to coordinate the sharing of data on LHDs to facilitate more accurate assessments being conducted.

Retirement of Mr. B. Colamosca, United States FAA

9.3 The meeting was aware that Mr. Brian Colamosca, of the FAA William J. Hughes Technical Center, was of an age whereupon he would be retiring from service with the FAA in the foreseeable future. As such, it was anticipated that this would be his last attendance at an Asia/Pacific RASMAG meeting.

9.4 Delegates at the meeting unanimously offered their congratulations to Mr. Colamosca for his pending retirement. He had been identified with RVSM monitoring matters since the very early days of RVSM implementation globally and his retirement would leave a noticeable gap in the Asia/Pacific programme. All delegates had been involved with Mr. Colamosca through the RASMAG and many had also received RMA related training from him and his colleagues at the FAA Technical Center. The meeting expressed great gratitude and appreciation to Mr. Colamosca for his long standing and tireless efforts on behalf of the Asia/Pacific Region and wished him and his family good health and many happy years in retirement.

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LIST OF WORKING PAPERS AND INFORMATION PAPERS

WORKING PAPERS

NUMBER	AGENDA	TITLE	PRESENTED BY
WP/1	1	Provisional Agenda	Secretariat
WP/2	2	Outcomes of the 44th DGCA Conference	Secretariat
WP/3	2	Outcomes from APANPIRG/18 Specific to RASMAG	Secretariat
WP/4	5	The Second and the Third Meeting of the Western Pacific/South China Sea RVSM Scrutiny Group	Secretariat
WP/5	5	Review of RASMAG List of Competent Airspace Safety Monitoring Organizations	Secretariat
WP/6	6	Review of RASMAG Task List	Secretariat
WP/7	7	Review of the 31st and the 32nd Meetings of the RVSM Implementation Task Force	Secretariat
WP/8	4	Safety Monitoring Report from the Pacific Approvals Registry and Monitoring Organization, October 2006 – September 2007	PARMO
WP/9	4	Possible Asia Pacific Regional Monitoring Agency Actions in light of Expected Global Application of Long-Term Reduced Vertical Separation Minimum (RVSM) Monitoring Requirements	United States
WP/10	4	Considerations regarding Possible Use of New Technologies for Monitoring Aircraft Height-Keeping Performance	United States
WP/11	4	Toward Establishing Data Link Performance Requirements necessary to support Application of Reduced Horizontal-Plane Separation Minima	United States
WP/12	4	Issues concerning MAAR Operations	MAAR
WP/13	5	Airspace Safety Review for the RVSM Implementation in Asia Region	MAAR
WP/14	4	Revised Letter of Agreement (LOA) for Monitoring of Aircraft Navigation Errors in the South China Sea Area	Singapore
WP/15	4	Establishment of Safety Monitoring Agency (SMA) by Singapore and the Conduct of Horizontal Safety Assessment to implement 50/50NM Separation in the South China Sea Area	Singapore
WP/16	5	Large Height Deviations (LHD) & Lost Communications between ATC and Aircraft	IFALPA IATA
WP/17	4	Approval for Establishment of JCAB APANPIRG RMA for the Fukuoka FIR	Japan

NUMBER	AGENDA	TITLE	PRESENTED BY
WP/18	4	Safety Assessment fro the Introduction of RVSM within the Remaining Portions of Australian Domestic and Indian Oceanic Airspaces	Australia
WP/19	4	Provision of Regional Monitoring Agency Services for Port Moresby Flight Information Region	Australia AAMA
WP/20	4	Use of ADS-B Height-Keeping Monitoring	Australia
WP/21	4	Summary of RVSM Airspace Safety Assessment for the Fukuoka FIR	Japan
WP/22	3	Safety Monitoring Agency Handbook	Australia

INFORMATION PAPERS

NUMBER	AGENDA	TITLE	PRESENTED BY
IP/1	-	List of Working Papers (WPs) and Information Papers (IPs)	Secretariat
IP/2	2	Outcomes of APANPIRG/18	Secretariat
IP/3	5	Traffic Sample Data (TSD) State Letter	Secretariat
IP/4	4	Update on Status of Proposed Long-Term Reduced Vertical Separation Minimum (RVSM) Monitoring Requirements	United States
IP/5	4	Update concerning Operational-Trial Use of 30-nm Lateral; and Longitudinal Separation Minima in the Oakland Flight Information Region	United States
IP/6	4	Assessment of Non-State-Approved Operators Using Pacific RVSM Airspace	PARMO
IP/7	4	The Preparation of Regional Monitoring Agency (RMA) Establishment in China	China
IP/8	4	Analysis of the Effect of AIDC on ATC Coordination and Transfer Errors	Australia New Zealand

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REGIONAL AIRSPACE SAFETY MONITORING ADVISORY GROUP (RASMAG)

TERMS OF REFERENCE OF THE RASMAG

(Last updated APANPIRG/18, September 2007)

The objectives of the Group are to:

a) facilitate the safe implementation of reduced separation minima and CNS/ATM applications within the Asia and Pacific Regions in regard to airspace safety monitoring; and

b) assist States to achieve the established levels of airspace safety for international airspace within the Asia and Pacific Regions.

To meet these objectives the Group shall:

a) review airspace safety performance in the Asia and Pacific Regions at the regional level and within international airspace;

b) review and develop as necessary, guidance material for airspace safety monitoring, assessment and reporting activities, including the duties, responsibilities and scope of regional monitoring entities;

c) recommend, and facilitate as necessary, the implementation of airspace safety monitoring and performance assessment services;

d) review and recommend on the competency and compatibility of monitoring organizations and recommend to APANPIRG specific airspace responsibility for individual regional monitoring entities;

e) review, coordinate and harmonize regional and inter-regional airspace safety monitoring activities;

f) review regional and global airspace planning and developments in order to anticipate requirements for airspace safety monitoring and assessment activities;

g) address other airspace safety related issues as necessary;

h) facilitate the distribution of safety related information to States, and

i) provide to APANPIRG comprehensive reports on regional airspace safety and coordinate with other contributory bodies of APANPIRG as appropriate.

TASK LIST

To review the safety monitoring programmes in the Asia and Pacific Regions for implementation and operation of:

a) reduced vertical separation minimum (RVSM);

b) reduced horizontal (lateral and longitudinal) separation minima using RNP;

c) aircraft separation applications using data link, e.g. ADS and CPDLC; and

d) ATS Unit to ATS Unit operational messaging using AIDC.

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REGIONAL AIRSPACE SAFETY MONITORING ADVISORY GROUP

ASIA/PACIFIC

SAFETY MONITORING AGENCY

HANDBOOK

VERSION 1.3

Part 1

1 Introduction

1.1 Background

1.1.1 The Regional Airspace Safety Monitoring Advisory Group (RASMAG) was established 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. 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 for other air traffic management (ATM) services, such as reduced horizontal separation based on required navigation performance (RNP) or other performance based navigation types, and 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) was at an advanced stage of development by the ICAO Separation and Airspace Safety Panel (SASP). There was no comparable document under development by ICAO for the continued safe use of a horizontal-plane separation minimum where RNP is applied.

1.1.2 The experience gained by the Informal Pacific Air Traffic Control Coordination Group (IPACG) and the Informal South Pacific ATS Coordinating Group (ISPACG) FANS Interoperability Teams (FITs) and the supporting Central Reporting Agencies (CRAs) to monitor end-to-end performance of automatic dependent surveillance (ADS) and controller-pilot data link communication (CPDLC) for both aircraft and ground systems was used as a resource from which regional guidance material has been developed.

1.1.3 ICAO provisions require that the implementation of specified reduced separation minima, e.g. 50 NM lateral and longitudinal separation based on RNAV 10, and 30 NM lateral and longitudinal separation based on ADS and RNP 4, must first meet safety management system requirements and undergo a safety assessment based on collision risk modeling to confirm that the target level of safety (TLS) has been met for the airspace. Additionally, periodic safety reviews must be performed in order to permit continued operations.

1.1.4 To date, the performance of safety assessments and continued monitoring for RVSM, reduced horizontal separation minima, and ATS data link services had been carried out by a few specialized teams made up of technical experts and contractors supporting States within the region.

1.1.5 The RASMAG agreed that there was a need to develop a reduced horizontal separation handbook aimed at standardizing the principles and practices of safety monitoring agencies (SMAs), which are responsible for the safe application of reduced horizontal separation standards in international airspace. With the implementation of performance based navigation (PBN) concepts, currently there is still uncertainty regarding the monitoring requirements for new separation minima implementations based on PBN. In view of the anticipated use of RNAV10 and RNP4 within the international airspace of the Asia/Pacific Region, this handbook is being developed to serve the monitoring needs associated with those navigation requirements and associated separation minima.

1.2 Purpose of Handbook

1.2.1 It is intended that this handbook will introduce a common set of principles and practices for monitoring in connection with horizontal-plane minima based in part on application of PBN. The handbook will also help to promote an interchange of information among different regions in support of achieving common operational monitoring procedures.

1.3 SMA Duties and Responsibilities

1.3.1 The duties and responsibilities of an organization providing airspace monitoring in connection with PBN-based horizontal-plane separation minimum are:

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

1.3.1.2 to coordinate monitoring of horizontal-plane navigational performance and the identification of large horizontal-plane errors;

1.3.1.3 to receive reports of those large horizontal-plane errors of non-compliant aircraft; to take the necessary action with the relevant State and operator to determine the likely cause of the horizontal-plane error and verify the approval status of the relevant operator;

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

1.3.1.5 to undertake data collections as required by the regional planning group to:

a) investigate horizontal separation performance of the aircraft in the core of the distribution;

b) establish or add to a database on the horizontal separation performance of:

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

1.3.1.6 archive results of navigational performance monitoring and contribute to conduct of annual risk assessment in light of agreed regional safety goals;

1.3.1.7 monitor compliance of operators with State PBN approval requirements after implementation of PBN-based horizontal-plane separation minimum;

1.3.1.8 contribute to regional database of monitoring results;

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

1.3.1.10 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.

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

1.3.1.12 to submit annual reports to the regional planning group.

1.4 In order to effectively carry out the duties and responsibilities of an SMA, certain prescribed standards shall be met. These standards include competence as demonstrated by:

a) previous monitoring experience;

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

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

1.5 Once competence has been demonstrated, the SMA should receive a formal recommendation by a State or group of States within Region; and receive approval from APANPIRG

1.6 List of Definitions

The following definitions are intended to clarify specialized terms used in this document.

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.)*

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

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 RNP has been implemented.

Overall risk.
The risk of collision due to all causes, which includes the technical risk and all risk due to operational errors and in-flight emergencies

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.

PART 2

2 Working Principles Common to all Safety Monitoring Agencies

2.1 Review of operational concept

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

2.1.2 An RMA should review carefully the operational concept agreed by the body overseeing implementation of the RVSM with a view to identifying any features of airspace use which may influence risk. An SMA should inform the oversight body of any aspects of the operational concept which it considers important in this respect.

2.2 Establishment and Maintenance of an RNP Approvals Database

2.2.1 The experience gained through the introduction of RVSM has shown that the concept of a monitoring agency is essential to ensure safety in the region. It has a significant role to play in all aspects of the safety monitoring process. One of the functions of an SMA is to establish a database of aircraft approved by their respective State authorities for PBN operations in the region for which the SMA has responsibility. This information is of vital importance in effectively assessing the risk in the airspace.

2.2.2 Aviation is a global industry and many aircraft may be approved for PBN operations and their approvals registered with an SMA operating in a region where reduced horizontal separation has been implemented. Thus, there is considerable opportunity for information sharing between SMAs. While a region or sub-region introducing PBN-based separation may need its own SMA to act as a focal point for the collection and collation of PBN-approvals for aircraft operating solely in that region, it may not need to maintain a complete database of all aircraft in the world that are PBN approved. It will, however, be required to establish links with other SMAs in order to determine the PBN 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 SMAs, the concept of a designated SMA for the processing of approval data has been established. Under the designated SMA concept, all States are associated with a specified SMA for the reporting of PBN approvals. Appendix A provides a listing of States and the respective cognizant SMA for PBN approvals. SMAs may contact any State to address safety matters without regard to the designated SMA for approvals.

2.2.4 It is important to note that, in general, the aircraft operating in airspace where PBN-based separation introduction is planned can be categorized into two classes. Some aircraft operate solely within the airspace targeted for introduction of PBN-based separation standards, and others operate both within that airspace and other portions of PBN airspace. It is the responsibility of the SMA supporting introduction of PBN-based separation to gather State approvals for the former category of aircraft from authorities issuing those approvals. To do so requires that the SMA establish a communication link with each such State authority and provide a precise description of the approvals information required. Appendix B provides the pertinent forms, with a brief description of their use, that an SMA should supply to a State authority to obtain information on aircraft PBN approval status.

2.2.5 Where possible, the SMA should collect State approvals information for the latter category of aircraft – those already operating in other PBN airspace – from other SMAs. This collection will be facilitated if each SMA maintains, in a similar electronic form, a database of State PBN approvals.

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

2.3 Monitoring of Horizontal-Plane Navigation Performance

2.3.1 An SMA 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 navigation errors and operational errors caused by non-compliance with air traffic control (ATC) instructions or loop errors within the ATC system.

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

Monitoring the Occurrence of Large Navigation Errors

2.3.3 Experience has shown that large navigation errors – errors of 25 NM or more in magnitude – 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 SMA is to ensure the existence of a program to collect this information and assess the importance of such occurrences.

2.3.4 **Section x** provides direction to an SMA for action in the event that this program uncovers the occurrence of a large navigation error.

2.3.5 Within the airspace for which it is responsible, each ATS provider will need to establish the means to detect and report the occurrence of large navigation errors. Experience has shown that the primary sources for reports of large navigation errors are the ATC units providing air traffic control services in the airspace where PBN-based 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 returns – provides the basis for identifying large navigation errors. A program for identifying large navigation errors should be established and ATC units should report such events monthly. A suggested form for these monthly reports is shown in Appendix D. These reports should contain, as a minimum, the following information:

a) Reporting unit

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

c) Date and time of large navigation error

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

e) Flight identification and aircraft type

f) Assigned flight level

g) Actual flight level or altitude

h) Size of navigation error

Duration of large navigation error

i) Cause of error

j) Any other traffic in potential conflict during error

k) Crew comments when notified of error

l) Remarks from ATC unit making report

2.3.6 Other sources for reports of large navigation errors should also be explored. An SMA 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 SMA should enquire about access to State databases of safety incident reports which may be pertinent to the airspace. An SMA should also examine voluntary reporting safety databases, such as the Aviation Safety Reporting System administered by the U.S. National Aeronautics and Space Administration, as possible sources of large navigation error incidents in the airspace for which it is responsible.

2.3.7 While an SMA will be the recipient and archivist for reports of large navigation errors, it is important to note that an SMA alone cannot be expected to conduct all activities associated with a comprehensive program to detect and report large navigation errors. Rather, an SMA should enlist the support of the ICAO regional planning group, the relevant 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

2.4.1 A safety assessment consists of estimating the risk of collision associated with the horizontal-plane separation standard and comparing this risk to the TLS. An SMA 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. Currently, there is no standard collision risk model (CRM) that is applicable to all airspace. In order to take account of regional variations, it is necessary to obtain regional agreement on existing CRMs to be used by all SMAs.

Safety Assessment

2.4.2 A principal duty of an SMA is to conduct a safety assessment associated with the implementation of a horizontal-plane separation standard.

2.4.3 The regional planning group will determine the safety reporting requirements for the SMA.

Establishing the Competence Necessary to Conduct a Safety Assessment

2.4.4 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 SMA, the organization will need to demonstrate the necessary competence to complete the required tasks.

2.4.5 Ideally, an SMA will have the internal competence to conduct a safety assessment. However, recognizing that personnel with the required skills may not be available internally, an SMA may find it necessary to augment its staff, either through arrangements with another SMA or with an organization possessing the necessary competence.

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

2.4.7 An SMA will need to take into account that a safety assessment must reflect the factors which influence collision risk within the airspace where the horizontal-plane separation will be applied. Thus, an SMA 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 horizontal-plane separation has been implemented may assist an SMA in conducting a safety assessment. However, an SMA 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 SMA has safety assessment responsibility.

Assembling a sample of traffic movements from the airspace

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

2.4.9 In planning the timing and duration of a traffic movement data sample, an SMA 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 SMA.

2.4.10 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 at entry point

j) exit point from the airspace

k) time at exit point

l) flight level at exit point

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

2.4.11 Where possible, in coordinating collection of the sample, an SMA should specify that information be provided in electronic form (for example, in a spreadsheet). **Appendix E** 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.

2.4.12 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.

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

2.4.13 "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.

2.4.14 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.

2.4.15 The TLS which must be satisfied is 5 x 10-9 fatal accidents per flight hour due to loss of planned (lateral and longitudinal) separation.

2.5 On-going Safety Reporting and Monitoring Operator Compliance with State Approval Requirements Implementation of Horizontal-Plane Separation

2.5.1 The overall intent of post-implementation SMA activities is to support continued safe use of the 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 separation is applied. This is vital if PBN-based separation is applied on an exclusionary basis, that is, if State PBN approval is a prerequisite for use of the airspace.

This activity is termed monitoring operator compliance with State approval requirements. The regional planning group should consider whether the SMA needs to conduct an annual safety assessment as a means to determine whether the TLS continues to be met.

2.5.2 An SMA 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 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 SMA 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 approval status shown on the flight plan of each aircraft movement should be compared to the database of State PBN approvals. When a flight plan shows an PBN approval not confirmed in the database, the appropriate State authority should be contacted for clarification of the discrepancy. An SMA should use a letter similar in form to that shown in **Appendix F** for the official notification.

2.5.5 An SMA 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 approval.

2.6 Remedial Actions

2.6.1 Remedial actions are those measures taken to remove causes of systematic problems associated with factors affecting safe use of the PBN-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 requirements

b) aircraft operating practices resulting in large navigational errors

c) operational errors

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

2.6.3 As a minimum, an SMA should conduct an annual review of reports of large navigational errors with a view toward uncovering systematic problems. Should such a problem be discovered, an SMA should report its findings to the organization overseeing PBN-based separation implementation, or to the organization that authorized the establishment of the SMA. An SMA should include in its report the details of large navigation errors suggesting the existence of a systematic problem.

LIST OF APPENDICES

APPENDIX A

Flight Information Regions and Responsible Safety Monitoring Agency

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

APPENDIX B

States and Cognizant SMA for the reporting of PBN approvals

The following table provides a listing of States and the respective cognizant SMA for the reporting of PBN approvals, for distribution by the cognizant SMA.

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

APPENDIX C

SMA forms for use in obtaining record of PBN approvals from a State authority

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

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

2. It is important for the SMAs to have an accurate record of a point of contact for any queries that might arise from monitoring of navigation performance. Recipients are therefore requested to include a completed SMA A1 with their first reply to the SMA. 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 SMA A2 to the SMA by electronic means, a hard copy SMA A2 must be completed for each aircraft granted a PBN approval. The numbers below refer to the superscript numbers on the blank SMA 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.

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

SMA A1
POINT OF CONTACT DETAILS/CHANGE OF POINT OF CONTACT DETAILS FOR MATTERS RELATING TO PBN APPROVALS

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

STATE OF REGISTRY: enter State here

STATE OF REGISTRY (ICAO 2 LETTER IDENTIFI here
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 #

E-mail

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

When complete, please return to the following address:

SMA Address

Telephone:; Fax:
E-Mail:

SMA 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 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]:

Airworthiness Approval[6]:

Date Issued[7]:

PBN Approval Type[6]:

Date Issued[7]:

Date of Expiry[7] (If Applicable):

Method of Compliance (Service Bulletin, STC etc):

Remarks[8]:

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

Telephone:; Fax:
E-Mail:

SMA A3
WITHDRAWAL OF PBN APPROVAL

1. When a State of Registry has cause to withdraw the PBN approval of an operator/aircraft, details as requested below, must be submitted to the SMA 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 Approval[7]:

Reason for Withdrawal of PBN Approval[8]:

Remarks:

When complete, please return to the following address.

SMA Address

Telephone:; Fax:
E-Mail:

APPENDIX D

Minimal informational content for each State PBN approval to be maintained in electronic form by an SMA

Aircraft PBN Approvals Data

To properly maintain and track PBN 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 approval status. Table 1 lists the minimum data fields to be collected by an SMA 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 exchange between SMAs. The details of data types, unit and format will be defined in document TBA

Table1. Aircraft PBN 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 XXXX
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.
Remarks	Open comments
Date of Withdraw of Airworthiness (MASPS) Approval	Date of withdraw of the aircraft's Airworthiness approval (if applicable)

Field	Description
Date of Withdraw of PBN approval	Date of withdraw of the aircraft's PBN approval (if applicable)
Info by Authority	Yes or no indication " Was the information provided to the SMA 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
1	State of Registry	Alphabetic	2	AA-ZZ
2	Operator	Alphabetic	3	AAA-ZZZ
3	State of Operator	Alphabetic	2	AA-ZZ
4	Aircraft Type	Alphanumeric	4	e.g. MD11
5	Aircraft Mark / Series	Alphanumeric	6	
6	Manufacturer's Serial/Construction Number	Alphanumeric	12	
7	Aircraft Registration Number	Alphanumeric	10	
8	Aircraft Mode "S" Address (Hexadecimal)	Alphanumeric	6	
9	Airworthiness Approved	Alphabetic	1	"Y", "N"
10	Date Airworthiness Approval Issued (dd/mm/yyyy)	Date	8	e.g. 31/12/1999
11	PBN Approval Type	Alphanumeric	6	e.g RNP10
12	Date PBN Approval Issued (dd/mm/yyyy)	Date	8	e.g. 31/12/1999
13	Date of Expiry of PBN Approval (if any) (dd/mm/yyyy)	Date	8	e.g. 31/12/1999
14	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 SMA to manage aircraft re-registration/operating status change data.

Table2. 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 SMA to do business. Table 3 lists the minimum content for organizational contacts and Table 4 lists the minimum content for individual points-of-contact.

Table3. 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 SMAs

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

All SMAs receiving data have responsibility to help ensure data integrity. A receiving SMA must report back to the sending SMA 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 must realize when making a request, that the data is current only to the date of the created file.

Table5. SMA Data Exchange Procedures

Data Type	Data Subset	Frequency	When
PBN 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 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 SMA shall only exchange PBN Approvals data with another SMA when an aircraft is at minimum Airworthiness Approved. The following table defines the fields required for sending a record to another SMA.

Table6. 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
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 SMA shall share all re-registration information.

Table7. 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

Table8. 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	Desirable
Address (1-4)	Desirable
Place	Desirable
Postal code	Desirable
Country	Desirable
e-mail	Desirable
civ/mil	Desirable

Table9. 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)	Desirable
Place	Desirable

Field	Need to Share
Postal code	Desirable
Country	Desirable
State	Desirable
E-mail	Desirable
Fax No	Desirable
Telephone no 1	Desirable
Telephone no 2	Desirable

Confirmed Non-Compliant Information
As part of its monitoring assessments an SMA 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 SMAs.

When identifying a non-compliant aircraft an SMA should include

- Notifying SMA
- 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
This data will not be shared between SMAs 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 SMA 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 Navigation Errors

SAFETY MONITORING AGENCY NAME

Report of Large Navigation Error

Report to the (Safety Monitoring Agency Name) of a navigation error of TBD, including those due to contingency events.

Name of ATC unit:_____

Please complete Section I or II as appropriate

SECTION I:

There were no reports of large navigation errors for the month of _____

SECTION II:

There was/were _____ report(s) of a navigation error of TBD. Details of the navigation error(s) are attached.

(Please use a separate form for each report of navigation error).

SECTION III:

When complete please forward the report(s) to:

Safety Monitoring Agency Name
Postal address
Telephone:
Fax:
E-Mail:

APPENDIX F

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:

ITEM	EXAMPLE	NECESSARY OR OPTIONAL
Date (either month/day/year or day/month/year format)	5/01/00 or 01/05/00 for 1 May 2000	NECESSARY
Aircraft call sign	MAS704	NECESSARY
Aircraft Type	B734	NECESSARY
Origin Aerodrome	WMKK	NECESSARY
Destination Aerodrome	RPLL	NECESSARY
Entry Fix into Airspace	MESOK	NECESSARY
Time at Entry Fix	2:25 (or 0225)	NECESSARY
Flight Level at Entry Fix	330	NECESSARY
Exit Fix from Airspace	NISOR	NECESSARY
Time at Exit Fix	4:01 (or 0401)	NECESSARY
Flight Level at Exit Fix	330	NECESSARY
First Fix Within the Airspace OR First Airway Within the Airspace	MESOK OR G582	OPTIONAL
Time at First Fix	02:25 OR 0225	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	02:50 OR 0250	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 approval State PBN Approval Status of an Operator

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

<STATE AUTHORITY ADDRESS>

1. The (SMA name) has been established by APANPIRG to support safe implementation and use of the PBN based separation in (airspace where the SMA has responsibility) in accordance with guidance published by the International Civil Aviation Organization.

2. Among the other activities, the (SMA name) conducts a comparison of the State PBN approval status notified by an operator to an air traffic control unit to the records of State PBN approvals available to us. This comparison is considered vital to ensuring the continued integrity of PBN based separation.

3. This letter is to advise that an operator which we believe is on your State registry provided notice of State PBN 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:
Notified PBN Approval type:
ATC unit receiving notification:

4 We request that you advise this office of the PBN approval status of this operator. In the event that you have not granted a PBN 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,

(SMA official)

APPENDIX H

Description of Models Used to Estimate Risk

JCAB RMA Accreditation

Annex11-Air Traffic Services				
Mandatory or Desirable	**Requirements for establishment and operation of an RMA**	**Detail**	**Status**	**Reference**
Mandatory	States shall establish a safety programme, in order to achieve an acceptable level of safety in the provision of ATS.		Civil Aviation Bureau, Japan (JCAB) as the civil aviation authority of Japan providing ATS for the Fukuoka FIR, has a safety programme in place, and has implemented plans to strengthen the safety assessment and monitoring capability as part of the safety programme.	Annex11- Air Traffic Services Chapter 2, paragraph 2.27.1
Mandatory	For all airspace where a reduced vertical separation minimum of 300 m (1000 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 safety objectives. The coverage of the height-monitoring facilities provided under this programme shall be adequate to permit monitoring of the relevant aircraft types of all operators that operate in RVSM airspace.	The number of separate monitoring programmes should be restricted to the minimum necessary to effectively provide the required services for the region.	JCAB will become an RMA in the Asia/Pacific region authorized by APANPIRG that provides airspace safety assessment and monitoring services for RVSM within the Fukuoka FIR. In addition, JCAB plans to implement ground-based Height Monitoring Unit (HMU) during 2011/2013 to enhance regional height monitoring capability.	Annex11- Air Traffic Services Chapter3, paragraph 3.3.5.1

Annex11-Air Traffic Services				
Mandatory or Desirable	**Requirements for establishment and operation of an RMA**	**Detail**	**Status**	**Reference**
Mandatory	Arrangements shall be put in place, through interregional agreement, for the sharing between regions of data from monitoring programmes.	Guidance material relating to vertical separation and monitoring of height-keeping performance is contained in the Manual on Implementation of a 300 m (1000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9574).	JCAB has already commenced and will continue sharing Traffic Sample Data (TSD), Large Height Deviation (LHD) reports, and other relevant information with PARMO, MAAR and other authorized RMAs. JCAB is an active member of the Asia/Pacific Regional Airspace Safety Monitoring Advisory Group (RASMAG) of APANPIRG.	Annex11- Air Traffic Services Chapter3, paragraph 3.3.5.2

RVSM Manual				
Mandatory or Desirable	**Requirements for establishment and operation of an RMA**	**Detail**	**Status**	**Reference**
Mandatory	Establish a database of aircraft approved by the respective State authorities for operations at RVSM levels in that region.		Database has been established by JCAB and will be continually maintained.	ICAO RVSM Manual (Doc 9574) paragraph 6.4.4
Mandatory	RMAs in regions that have previously established databases share approvals and height -monitoring data among each other.		Database information is in similar format to that used by other Asia/Pacific RMAs and information is already shared with MAAR and PARMO.	Doc 9574 paragraph 6.4.4
Mandatory	a) Receive reports of height deviations of non-compliant aircraft which are of a magnitude equal to or greater than the following criteria.	1) TVE – 90m (300ft); 2) ASE – 75m (245ft);and 3) ADD – 90m (300ft).	JCAB has received reports of those height deviations by using of GPS-based Monitoring Unit (GMU) for detection of technical errors. HMU will enhance this function when implemented. JCAB has established an adequate system to ensure	Doc 9574 paragraph 6.4.5

RVSM Manual				
Mandatory or Desirable	**Requirements for establishment and operation of an RMA**	**Detail**	**Status**	**Reference**
			the reporting of LHD by air traffic controllers and operators. LHD reporting requirements are published in the AIP.	
Mandatory	b) Take necessary action with the relevant State and operator to:	1) Determine the likely cause of the height deviation. 2) Verify the approval status of the relevant operator.	JCAB investigates all results of height-keeping performance data to determine the likely cause of the height deviation and verifies the approval status of the relevant operators by checking databases and/or contacting relevant State authority if necessary.	Doc 9574 paragraph 6.4.5
Mandatory	c) Recommend, wherever possible, remedial action.		JCAB develops recommendations for remedial action wherever necessary.	Doc 9574 paragraph 6.4.5

RVSM Manual				
Mandatory or Desirable	**Requirements for establishment and operation of an RMA**	**Detail**	**Status**	**Reference**
			These are routinely provided to affected operators and State authorities as part of the investigation process.	
Mandatory	d) Analyze data to detect height deviation trends and, hence, to take action as in c).		JCAB analyzes reported results of height-keeping performance data and detects height-keeping trends, and develops recommendations for remedial action wherever necessary.	Doc 9574 paragraph 6.4.5
Mandatory	e) Undertake such data collections as required by the RPG to;	1) Investigate height-keeping performance of the aircraft in the core of the distribution.	ENRI supports JCAB to investigate height-keeping performance of the aircraft in the core of the distribution. JCAB plans to further develop this function when HMUs would be implemented during 2011/2013.	Doc 9574 paragraph 6.4.5

RVSM Manual				
Mandatory or Desirable	**Requirements for establishment and operation of an RMA**	**Detail**	**Status**	**Reference**
		2) Establish or add to a database on the height-keeping performance of: -the aircraft population; -aircraft types or categories; and -individual airframes;	JCAB database contains above information based on Registration/Withdrawal Form.	Doc 9574 paragraph 6.4.5
Mandatory	f) Monitor the level of risk of collision as a consequence of operational errors and in-flight contingencies as follows;	1) Establish a mechanism for collation and analysis of all reports of height deviations of 90m (300ft) or more resulting from the above errors/actions. 2) Determine, wherever possible, the root cause of each deviation together with its size and duration. 3) Calculate the frequency of occurrence. 4) Assess the overall risk (technical combined with operational and in-flight contingencies)in the system against the overall safety objectives	JCAB has LHD reporting procedures in the AIP. JCAB conducts safety risk analysis using collected LHD reports and traffic sample data in accordance with international methodologies adopted by global RMAs and as required by RASMAG. If any anomaly is detected, JCAB investigates the situation and take appropriate actions.	Doc 9574 paragraph 6.4.5

RVSM Manual				
Mandatory or Desirable	**Requirements for establishment and operation of an RMA**	**Detail**	**Status**	**Reference**
		5) Initiate remedial action as required.		
Mandatory	g) Institute checks on the "approval status" of aircraft operating in the relevant RVSM airspace, identify non-approved operators and aircraft using RVSM airspace and notify the appropriate State of Registry/State of the Operator accordingly;		JCAB has a database of aircraft approved by JCAB for operations at RVSM levels, and maintains the data by regularly sharing with PARMO and MAAR. This database is also updated with data of Eurocontrol and other RMA on ad-hoc basis. JCAB requires operators to indicate RVSM approval status in their flight plan. If there were any inconsistency of RVSM approval status between flight plan and actual aircraft, the situation is investigated and remedial	Doc 9574 paragraph 6.4.5

RVSM Manual				
Mandatory or Desirable	**Requirements for establishment and operation of an RMA**	**Detail**	**Status**	**Reference**
			action, such as notification to the State of registry/State of the Operators, is undertaken.	
Mandatory	h) Circulate regular reports on all height-keeping deviations, together with such graphs and tables necessary to relate the estimated system risk to the TLS.		JCAB is a member of RASMAG and provides this information routinely to RASMAG meetings in respect of Fukuoka FIR. JCAB will follow the out-come of coordination among the Asia/ Pacific RMAs.	Doc 9574 paragraph 6.4.5
Mandatory	i) Submit annual reports to the RPG.		JCAB has presented assessment reports to ICAO through RASMAG, since the first assessment in 2004 under guidance from MAAR and PARMO, and will continue to report as part of the regional process established by RASMAG.	Doc 9574 paragraph 6.4.5

RMA Manual				
Mandatory or Desirable	**Requirements for establishment and operation of an RMA**	**Detail**	**Status**	**Reference**
Mandatory	An RMA must have both the authority and technical competence to carry out its functions.	a) the organization must receive authority to act as an RMA as the result of a decision by a State, a group of States or a planning and implementation regional group (PIRG)	APANPIRG and RASMAG have been fully briefed on the intentions and capabilities of JCAB. APANPIRG/18 raised Conclusion 18/6 approving JCAB as Asia/Pacific RMA subject to final review by RASMAG/8 (Dec 2007).	RMA Manual Chapter 1, Paragraph 1.3.1
		b) the organization acting as an RMA has adequate personnel with the technical skills and experience to carry out the functions	JCAB has demonstrated its safety assessment capability since 2005. JCAB has been working closely with ENRI which has world-known experts and can provide expertise for JCAB any time.	RMA Manual Chapter 1, Paragraph 1.3.1

RMA Manual				
Mandatory or Desirable	**Requirements for establishment and operation of an RMA**	**Detail**	**Status**	**Reference**
			JCAB officials have been given trainings as required, and have sufficient knowledge and experience to carry out duties.	
Mandatory	It is responsibility of the body authorizing establishment of an RMA to ensure that the requirements are met.		APANPIRG has approved JCAB subject to final review by RASMAG/8.	RMA Manual Chapter 1, Paragraph 1.3.2
Desirable	The organization intending to be an RMA participates in a training programme under the guidance of one of the established RMA's.	For an organization with no prior experience with RVSM monitoring, such a programme could take as long as one year and should include both formal and on-the-job training.	JCAB has had close relationships with MAAR and PARMO for some years, including training opportunities and RASMAG discussions. A number of safety assessments for Fukuoka FIR have been prepared in consultation with PARMO and MAAR.	RMA Manual Chapter 1, Paragraph 1.3.2

RMA Manual				
Mandatory or Desirable	**Requirements for establishment and operation of an RMA**	**Detail**	**Status**	**Reference**
			JCAB is in the process of developing a formalized internal training programme and is currently coordinating the establishment of a structured training mechanism, including recurrent programme, with ENRI.	

……

OPERATIONAL LETTER OF AGREEMENT BETWEEN

General Administration of Civil Aviation of China	China
Civil Aviation Department	Hong Kong, China
Directorate General of Civil Aviation	Indonesia
Department of Civil Aviation	Malaysia
Air Transportation Office	Philippines
Civil Aviation Authority	Singapore
Aeronautical Radio of Thailand Ltd	Thailand
Civil Aviation Administration	Viet Nam

FOR

MONITORING OF AIRCRAFT NAVIGATION ERRORS

IN THE

SOUTH CHINA SEA ***AREA***

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Operational Letter of Agreement

Document Management

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Letter of Agreement	1 – 10	DD MMM YYYY
Appendix A-Navigation Error Report	A1 – 6	DD MMM YYYY

Operational Letter of Agreement

Overview

Introduction

The following document is a Letter of Agreement (LOA) between those Air Traffic Service (ATS) authorities shown on page one of this document. The letter of agreement details monitoring procedures between the following ATS units:

Bangkok ACC	Hanoi ACC
Ho Chi Minh ACC	Hong Kong ACC
Jakarta ACC	Kota Kinabalu ACC
Kuala Lumpur ACC	Manila ACC
Sanya ACC	Singapore ACC

Objective

The objective of this LOA is to define agreed procedures for the monitoring, notification, investigation, analysis and reporting of aircraft navigation errors in respect of aircraft to which ~~60NM lateral separation standard and a 10 minute or 80NM RNAV longitudinal~~ *reduced horizontal separation minima* is applied when operating on the following designated RNAV routes:

L642	M771	N892
L625	M767	N884

Scope

The procedures contained in this LOA implement the performance monitoring requirements associated with the introduction of the ~~60NM lateral~~ *reduced horizontal* separation standard, and for the reporting and monitoring of gross lateral and longitudinal navigational errors.

For the purposes of this LOA, the term ‘Service Providers’ refers to organisations which are responsible for the provision of Air Traffic Control (ATC) services.

The term ‘Regulatory Authority’ refers to those organizations responsible for the investigation of navigational errors. In some cases, the Regulatory Authority may be the same as the Service Provider.

Effective Date

This letter of agreement becomes effective on *DD MMMM YYYY.*

Overview, continued

Background

The use of these ~~lateral and longitudinal~~ *horizontal* separation standards is restricted to aircraft which meet the requirements detailed in the respective States' AIP Supplements. This includes a requirement for Required ~~Navigation Performance (RNP) 10~~ *RNP 10 / RNP 4 Performance Based Navigation (PBN)* approval and it is the responsibility of the operator to ensure that such requirements are satisfied when so declared.

~~RNP 10~~ *PBN* approval includes operators meeting certain requirements with regard to crew training and in-flight operating procedures. The responsibility for approval for such operations rests with the State of Registry of the Operator.

Monitoring navigation errors is a joint responsibility between the aircraft operators, the States of Registry, and the ATC providers. There are established requirements for the operators to monitor navigation performance under the terms of their ~~RNP~~ *PBN* Approval. This document sets out the responsibilities and procedures to be followed by staff of the signatory organizations to this LOA.

Area of Applicability

The procedures outlined in this LOA shall be applied to all aircraft operating on the following designated RNAV routes:

L642	M771	N892
L625	M767	N884

Monitoring Procedures

Lateral Deviations

Monitoring shall be based on radar observations.

When the radar controller observes a lateral deviation of 15NM or more, the controller shall:

- Immediately advise the pilot in command; and
- Provide the 'Duty Supervisor' with the necessary information to enable Part 1 of the Navigation Error Investigation Form (as shown in **Appendix A**) to be completed.

Where an aircraft is off-track as the result of ATC approved diversion (e.g. due weather), no notification under the terms of this Letter of Agreement need be submitted.

Longitudinal Deviations

Monitoring of longitudinal errors shall be accomplished by reporting occurrences where the observed longitudinal separation, following a check, is either less or more than the expected longitudinal separation as detailed below.

Where a time standard is being used, this check will follow the receipt of a routine position report. Notification, in accordance with **Appendix A**, shall be submitted in all cases where:

- The separation standard is infringed; or
- The expected time between two aircraft varies by 3 minutes or more, even if the applicable separation standard is not infringed; or
- A pilot estimate varies by 3 minutes or more from that advised in a routine position report.

Where a distance standard is being used, the check may be based on ADS, radar observations, or it may be the result of a specific request for RNAV distance reports. Notification, in accordance with **Appendix A**, shall be submitted in all cases where:

- The separation standard is infringed; or
- The expected distance between two aircraft varies by 10NM or more, even if the applicable separation standard is not infringed.

Notification Procedures

Action by ATC Unit	The duty supervisor, when advised of the deviation, shall be responsible for completion and submission of a Navigation Error Investigation Form. A copy of the aircraft's flight plan shall be attached to the Navigation Error Investigation Form, and forwarded to the Chief of ATC. The Chief of ATC shall forward copies of the Navigation Error Investigation Form (Parts 1 to 4) to the aircraft operator and the State of Registry of the aircraft or the State of the Operator, as considered appropriate. In addition, the copy for the aircraft operator shall be sent with a covering letter (as provided in **Appendix A**) requiring the operator to complete the Navigation Error Investigation Form and to provide reasons for the error.

Investigation Procedures

Investigation Procedures

The investigation of errors notifiable under this Letter of Agreement is a joint responsibility of the operator, the ~~ATC~~ *Regulatory* Authority of the airspace in which the error occurred, and the State of Registry or State of the Operator of the aircraft involved.

The initial investigation shall be undertaken by the aircraft operator, who is responsible for supplying all data and comments needed to complete the form at **Appendix A**. The completed reports are to be returned by the operator to the originating ~~ATC~~ *Regulatory* Authority. For aircraft registered in States not included in this LOA, these reports are also to be forwarded to the State of Registry of the aircraft or the State of the operator.

Further action by States other than signatories to this LOA is outside the scope of this agreement, and shall be at the discretion of that State.

On receipt of the completed report from the aircraft operator, the relevant ~~ATC~~ *Regulatory* Authority will first check that all information required has been supplied and, if necessary, the ~~ATC~~ *Regulatory* Authority shall request and further information from either the operator, the State of the Operator, or the State of Registry of the aircraft.

If the completed form from the aircraft operator is not received within 14 days of the date of dispatch, the ~~ATC~~ *Regulatory* Authority will contact the operator and request the completed form.

Once the completed information has been received, the ~~ATC~~ *Regulatory* will complete Part 5 of the Navigation Error Investigation Form as detailed in **Appendix A**. The cause of the error is to be classified in accordance with the criteria specified in Part 5.

The decision as to whether any further investigation is warranted will be taken by the ~~ATC~~ *Regulatory* Authority based on their assessment of the seriousness of the error.

Analysis of Errors & Reporting

At the end of each month, Service Providers shall forward to the Operations Division, Civil Aviation Authority of Singapore (CAAS), a copy of all completed Navigation Error Investigation Forms (Parts 1 to 5) covering reported errors or nil reports for that month, together with data on the number of movements on the routes being monitored as recorded by the relevant Flight Data Processing System, or other auditable means.

CAAS shall be responsible for calculation of the frequency of the errors, in accordance with Doc 7030.

Each six months, the Monitoring Authority should prepare an assessment schedule setting out the results of the monitoring for the preceding six-month period and forward a copy of this schedule to:

a. All signatory States to the Monitoring Letter of Agreement; and

b. The Chairman of the APANPIRG ATS/AIS/SAR Sub-Group, through the ICAO Bangkok Office.

Permitted Error Rate Exceeded

Where the summary statistics show a long term trend which could result in the Permitted Error Rate being exceeded, ATC Authorities of the States concerned, in conjunction with the ICAO Regional Office, will jointly consider the causes, to determine if the problems can be eliminated, and to take appropriate remedial action.

Revision

This LOA shall remain in force until it is cancelled or superseded.

For any reason, which might make it advisable to change this agreement and its associated attachments, the interested State shall propose the pertinent revision.

Operational Letter of Agreement

Authority

China	Name Designation Department
Hong Kong, China	Name Designation Department
Indonesia	Name Designation Department
Malaysia	Name Designation Department

Continued on next page

Authority, Continued

Philippines	Name Designation Department
Singapore	Name Designation Department
Thailand	Name Designation Department
Viet Nam	Name Designation Department

Operational Letter of Agreement

Appendix A

NAVIGATION ERROR REPORT

Dear

Air Traffic Control service providers are monitoring traffic on routes in the South China Sea Area, as part of the implementation of reduced separation minima on those routes.

These procedures require the reporting and investigation of:

i) Lateral tracking errors of 15NM or more;

ii) Variations of longitudinal separation of three minutes or more; or

iii) Variations of longitudinal separation of 10NM or more.

A Navigation Error Investigation Form relating to one of your aircraft is enclosed.

An investigation of this occurrence is required. A detailed explanation should be provided within 10 days, using the attached Navigation Error Investigation Form. In your reply, you are also requested to indicate any corrective action taken to prevent future occurrences.

Yours faithfully,

NAVIGATION ERROR NVESTIGATION FORM

Instructions for Service Provider responsible officer:

Please ensure that Part 1 of this form has been completed to the maximum extent possible, and distribute according to the requirements of the Letter of Agreement on monitoring of aircraft navigation errors in the South China Sea *Area* ~~airspace~~.

Instructions for aircraft owner/operator:

Please supply any details required in Part 1 of this form which have not already been completed, together with the information requested in Parts 2, 3 and 4 (if applicable), and return to:

[*Appropriate Regulatory Authority*]

Instructions for Investigating Agency (Regulatory Authority):

Please complete Part 5 of this form and return to:

[*Appropriate Service Provider*]

NAVIGATION ERROR INVESTIGATION FORM

PART 1 - To be completed by responsible officer in the Service Provider (and aircraft owner/operator if need)		
ATC Unit Observing Error:		
Date/Time (UTC):		
Type of Error: (tick one) ☐ LATERAL ☐ LONGITUDINAL		
Details of Aircraft		
	First Aircraft	**Second Aircraft (when longitudinal deviation observed)**
Aircraft Identification:		
Name of owner/Operator:		
Aircraft Type:		
Departure Point:		
Destination:		
Route Segment:		
Cleared Track:		
Position where error was observed: (BRG/DIST from fixed point or LAT/LONG)		
Extent of deviation – magnitude and direction: (NM for lateral, min/NM for longitudinal)		
Flight Level:		
For All Errors		
Action taken by ATC:		
Other Comments:		

**** (Please Attach ATS Flight Plan)**

NAVIGATION ERROR INVESTIGATION FORM

PART 2 - Details of Aircraft, and Navigation and Communications Equipment Fit (To be completed by aircraft owner/operator)			
LRNS	**Number of Systems (0, 1, 2 etc.)**	**Make**	**Model**
INS			
IRS			
GNSS			
FMS			
Others (please Specify)			
COMS			
HF			
VHF			
SATCOM			
CPDLC			
Which navigation system was coupled to the autopilot at the time of observation of the error?			
Which NAV MODE was selected at the time of observation of the error?			
Which comms system was in use at the time of observation of the error?			
Aircraft registration and model/series			
Was the aircraft operating according to ~~RNP~~ *PBN* requirements?		☐Yes ☐ No	

NAVIGATION ERROR INVESTIGATION FORM

PART 3 – Detailed description of incident (To be completed by owner/operator – use separate sheet if required)
Please give your assessment of the actual track flown by the aircraft, and the cause of the deviation:
Corrective action proposed:

PART 4 – To be completed by owner/operator, only in the event of partial or total navigation equipment failure.			
Nav System Type	**INS**	**IRS/FMS**	**Others (Please specify)**
Indicate the number of units of each type which failed			
Indicate position at which failure(s) occurred			
Give an estimate of the duration of the equipment failure(s)			
At what time were ATC advised of the failure(s)?			

NAVIGATION ERROR INVESTIGATION FORM

PART 5 – To be completed by investigating agency		
Have all required data been supplied?	□ Yes	□ No
Is further investigation warranted?	□ Yes	□ No
Will this incident be the subject of a separate report?	□ Yes	□ No
General comments:		
Classification: (please circle) A B C D E F G H I		

CLASSIFICATION OF GROSS NAVIGATION ERRORS	
Class	**Cause**
A	Aircraft not approved to ~~RNP~~ *PBN requirements*
B	ATC system loop error
C	Waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position
D	Other navigation errors, including equipment failure notified to ATC in time for action
E	Other navigation errors, including equipment failure notified to ATC too late for action
F	Other navigation errors, including equipment failure of which notification was not received by ATC
G	Mode select error
H	Weather deviation (other than approved)
I	Other (please specify):

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Procedures for the Assessment of Aircraft Navigation Errors In Support of the Implementation of *Reduced Horizontal Separation Minima* ~~A Revised ATS Route Structure (60NM Route Spacing)~~ In the South China Sea Area

1. Introduction

1.1 This document provides guidance on the methodology to be adopted in the assessment of navigation errors associated with the implementation of *reduced horizontal separation minima* ~~a revised route structure, and a revised lateral separation minimum of 60NM~~, in the South China Sea *Area*.

1.2 This document should be read in conjunction with the Letter of Agreement between States of the South China Sea Area, entitled *"Letter of Agreement for the Monitoring of Aircraft Navigation Errors in the South China Sea Area"*.

2. Data Gathering Responsibility

2.1 The States responsible for the gathering and onwards forwarding of data relating to the monitoring letter of agreement, and the monitoring areas identified in paragraph 4, shall be Hong Kong China, the Philippines, and Singapore.

2.2 Data gathering requirements are detailed in paragraph 5.

3. Monitoring Authority

3.1 ~~Until such time as a permanent monitoring authority is established by APANPIRG, the organization responsible for the collection and reporting of navigation error data will be the~~ Civil Aviation Authority of Singapore (CAAS) *shall be responsible for the collection and reporting of navigation error*.

4. Designated Monitoring Areas

4.1 In order to validate the monitoring requirements supporting the reduction in *horizontal separation minima* ~~lateral separation to 60NM~~, it is necessary to assess the track keeping ability of aircraft operating on the route structure, whilst they have been using on-board RNAV navigation systems only, for a maximum period of time, relative to the route being flown.

4.2 It is also essential that observation of the navigation of the aircraft, using radar, occurs before the on-board navigation systems have been able to "up-date" using ground-based navigation aids, such as DME/DME, or VOR/VOR.

4.3 In assessing navigation errors on the 6 core routes – ie L642, M771, N892, L625, N884 and M767 – there are only four appropriate areas at which the required monitoring may be undertaken, given the extensive ground-based navigation aid coverage in the South China Sea *Area*.

4.4 These areas are the route segments between:

a) DULOP and DUMOL on M771
b) AKOTA and AVMUP on L625
c) LULBU and LEGED on N884
d) MELAS and MABLI on N892
e) ESPOB and ENREP on L642
f) TEGID and BOBOB on M767

4.5 Monitoring of aircraft on these route segments should be undertaken as soon as possible after the aircraft enters radar coverage.

4.6 It should be noted that navigation error reports relating to areas other than those stated above, should also be processed and reported on, in order to support data gathering for future reductions in lateral and longitudinal separation. Details on the processing of these reports are given at paragraph 7.

5. Collection and Forwarding of Data

5.1 Those States identified in Paragraph 2, are required, at the end of each month, to collect the following data:

a) Recorded navigation errors at the required monitoring areas, by way of the "Navigation Error Investigation Form", as detailed in the Letter of Agreement on the Monitoring of Navigation Errors; and

b) Total monthly movement statistics relating to air traffic passing the designated monitoring areas within the designated monitoring height band.

Note: The recording of monthly traffic movement statistics in the monitoring areas should be auditable – in other words, some formal method of recording the movements – eg copies of flight progress strips or data from Flight Data Processing Systems – should be available for audit if required.

5.2 After collection, the required data should be forwarded to the Monitoring Authority (CAAS), for assessment, to arrive not later than 15 days from the end of the month within which the data was collected. This will allow time for the Navigation Error Investigation Forms relating to occurrences near the end of a month, to be processed and returned as detailed in that form.

5.3 In respect of paragraph 5.1.a), if there have been no error reports submitted, a "Nil Return" should be submitted to the Monitoring Authority.

6. Assessing of Navigation Errors

6.1 The monitoring requirements associated with the introduction of the reduced *horizontal separation minima* ~~lateral separation minima of 60NM~~ will be in accordance with the requirements for *RNP10 / RNP4 PBN* ~~RNP 10 navigation performance~~, i.e. aircraft navigation performance shall be such that the standard deviation of lateral track errors *shall be in accordance with the PBN requirement.* ~~shall be less than 8.7km (4.7NM)~~.

6.2 The requirements will be met, if the number of navigation errors by approved flights, measured in the monitoring area, divided by the total number of approved flights over those monitoring points, is less than the required parameters, over a period of time for *the PBN requirement*. ~~RNP 10 navigation performance~~. (See Appendix B).

6.3 The assessments for each month should be recorded separately, and also cumulatively, on a month-to month basis. If the assessment in any particular month exceeds the required parameter, a check should be made to ensure that the cumulative assessment does not also exceed the required parameter.

6.4 If a trend is identified, which indicates that the required parameter is being exceeded regularly, or the cumulative assessment indicates a upwards trend, the Monitoring Authority should notify, though the ICAO Bangkok Office, the APANPIRG ATS/AIS/SAR Sub-Group, which should then investigate the need for a review of the applicable procedures.

6.5 An example of an assessment schedule is shown at Appendix B.

7. Processing of Navigation Error Reports Relating to Areas Other Than Required Monitoring Areas

7.1 The Letter of Agreement on the Monitoring of Navigation Errors required all participating States to notify all appropriate navigation errors to the Monitoring Authority. This data should be collated and assessed in the following manner.

7.2 If the navigation error report relates to aircraft tracking on RNAV routes L625, L642, M767, M771, N884, or N892, the error should be assessed and processed in accordance with paragraph 6 above.

7.3 If the report relates to aircraft tracking on other routes, the errors should be assessed, and recorded separately. This information should be assessed by the APANPIRG ATS/AIS/SAR Sub-Group meeting, for appropriate action.

8. Reporting Procedures

8.1 The Monitoring Authority should prepare an assessment schedule (refer to Appendix B), and forward a copy of this schedule, at least every 6 months, to:

a) All signatory States to the Monitoring Letter of Agreement; and

b) The Chairman of the APANPIRG ATS/AIS/SAR Sub-Group, through the ICAO Bangkok Office.

8.2 In addition, a report should be prepared on those errors reported in accordance with paragraph 7.3 above.

9. Attachments

Appendix A – Assessment Schedule Process
Appendix B – Sample Assessment Schedule

Appendix A

Assessment Schedule Process for Designated Monitoring Areas

STEP 1.

Hong Kong, Philippines and Singapore carry out a total monthly traffic count for approved traffic at FL290 and above, over the points:

a) DULOP and DUMOL on M771
b) AKOTA and AVMUP on L625
c) LUBLU and LEGED on N884
d) MELAS and MABLI on N892
e) ESPOB and ENREP on L642
f) TEGID and BOBOB on M767

STEP 2.

Hong Kong, Philippines and Singapore collate all Navigation Error Investigation Forms.

STEP 3.

Not later than the 15th day of each month, send the statistics gathered in Steps 1 and 2, to the Monitoring Authority (CAAS).

STEP 4.

The Monitoring Authority collates the information into an assessment schedule.

STEP 5.

Each 6 months, the assessment schedule is sent to:

a) All signatory States to the Monitoring Letter of Agreement; and

b) The Chairman of the APANPIRG ATS/AIS/SAR Sub-Group, through the ICAO Bangkok Office.

STEP 6 (if required).

If the trend in errors is increasing, notify, through the ICAO Bangkok Office, the APANPIRG ATS/AIS/SAR Sub-Group, for appropriate action.

Appendix B

Example of Navigation Error Assessment Schedule For Designated Monitoring Areas

a. Example of Monthly Total – Single Area

Month/ 1997	Total traffic at DULOP/DUMOL	Errors Category 1	Errors Category 2	Error Rate Category 1	Error Ratio Category 2
April	3105	1	0	3.22×10^{-4}	0
May	3042	2	0	6.57×10^{-4}	0
June	2810	0	0	0	0
July	2995	1	1	3.34×10^{-4}	3.34×10^{-4}

Category 1 => 30NM Category 2 = 50 – 70NM

b. Example of Cumulative Monthly Total – Single Area

Month/ 1997	Total traffic at DULOP/DUMOL	Errors Category 1	Errors Category 2	Error Rate Category 1	Error Ratio Category 2
April	3105	1	0	3.22×10^{-4}	0
May	6147	3	0	4.88×10^{-4}	0
June	8957	3	0	3.35×10^{-4}	0
July	11952	4	1	3.34×10^{-4}	8.36×10^{-3}

Category 1 => 30NM Category 2 = 50 – 70NM

c. Example of Monthly Total – All ~~Four~~ *Six* Areas

Month/ 1997	Total traffic at Areas	Errors Category 1	Errors Category 2	Error Rate Category 1	Error Ratio Category 2
April	7852	2	0	2.55×10^{-4}	0
May	8311	2	0	2.41×10^{-4}	0
June	8263	1	0	1.21×10^{-4}	0
July	7678	1	1	1.30×10^{-4}	1.30×10^{-4}

Category 1 => 30NM Category 2 = 50 – 70NM

d. Example of Cumulative Monthly Total – All ~~Four~~ *Six* Areas

Month/ 1997	Total traffic at Areas	Errors Category 1	Errors Category 2	Error Rate Category 1	Error Ratio Category 2
April	7852	2	0	2.55×10^{-4}	0
May	16163	4	0	2.47×10^{-4}	0
June	24426	5	0	2.05×10^{-4}	0
July	32104	6	1	1.87×10^{-4}	3.11×10^{-3}

Category 1 => 30NM Category 2 = 50 – 70NM

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 in the vertical plane (i.e. RVSM);
- SMA – Safety Monitoring Agency – safety assessment in the horizontal plane (i.e. RHSM, RNP10, RNP4); and
- CRA – Central Reporting Agency – technical performance of data link systems (i.e. ADS/CPDLC)
- FIT – FANS 1/A Interoperability/Implementation Team – parent body to a CRA.

(last updated 11 January 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, Melbourne, Port Moresby, Nauru and Honiara FIRs.
		SMA	Current	Brisbane, Melbourne FIRs.

Organisation *(including contact officer)*	State	Competency	Status	Airspace assessed (FIRs)
China RMA, Air Traffic Management Bureau, China Mr. Tang Jinxiang, Engineer of Safety and Monitoring Technical Group, ATMB e-mail: tangjx@adcc.com.cn	China	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. Masao Kondo, Special Assistant to the Director, Flight Procedures and Airspace Program Office, email kondou-m2pd@mlit.go.jp)	Japan	APANPIRG RMA	Current	Fukuoka FIR
		SMA	Available second quarter – 2009	Fukuoka FIR
Monitoring Agency for the Asia Region (MAAR) (Dr. Paisit Herabat Executive Officer, Systems Engineering,Aeronautical Radio of Thailand Ltd. Email: paisit@aerothai.co.th	Thailand	APANPIRG RMA	Current	Bangkok, Kolkatta, Chennai, Colombo, Delhi, Dhaka, Hanoi, Ho Chi Minh, Hong Kong, Jakarta, Karachi, Kathmandu, Kota Kinabalu, Kuala Lumpur, Lahore, Male, Manila, Mumbai, Phnom Penh, Sanya FIR, Singapore, Taibei, Ujung Pandang, Ulaan Bataar, Vientiane, Yangon FIRs

Organisation *(including contact officer)*	State	Competency	Status	Airspace assessed (FIRs)
Pacific Approvals Registry and Monitoring Organization (PARMO) - FAA Mr. Brian Colamosca Manager, Separation Standards Analysis Group, FAA, email: brian.colamosca@faa.gov	USA	APANPIRG RMA	Current	Anchorage Oceanic, Auckland Oceanic, Incheon, Nadi, Oakland Oceanic, Tahiti FIRs
Civil Aviation Authority of Singapore (CAAS) (Mr. Kuah Kong Beng, Chief Air Traffic Control Officer, email: KUAH_Kong_Beng@caas.gov.sg)	Civil Aviation Authority of Singapore (CAAS)	Monitoring Authority for Gross Navigation Error (GNE) in South China Sea	Current	Hong Kong, Ho Chi Minh, Manila, Sanya, Singapore FIRs,
		SMA	From 3rd quarter 2008	Hong Kong, Ho Chi Minh, Manila, Sanya, Singapore FIRs,
FIT/SEA (ICAO Regional Office email icao_apac@bangkok.icao.int & CRA Japan (Mr. Yoshiro Nakatsuji, Director, Air Traffic Control Association Japan, email: naka@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. Hiroshi Inoguchi, JCAB Co-Chair, email: Inoguchi-h2hh@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. Yoshiro Nakatsuji, Director, Air Traffic Control Association Japan, email: naka@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)

United States 30/30 Operational Trial - Pacific Airspace

Datalink performance against FOM Requirements for period November 2006 – October 2007

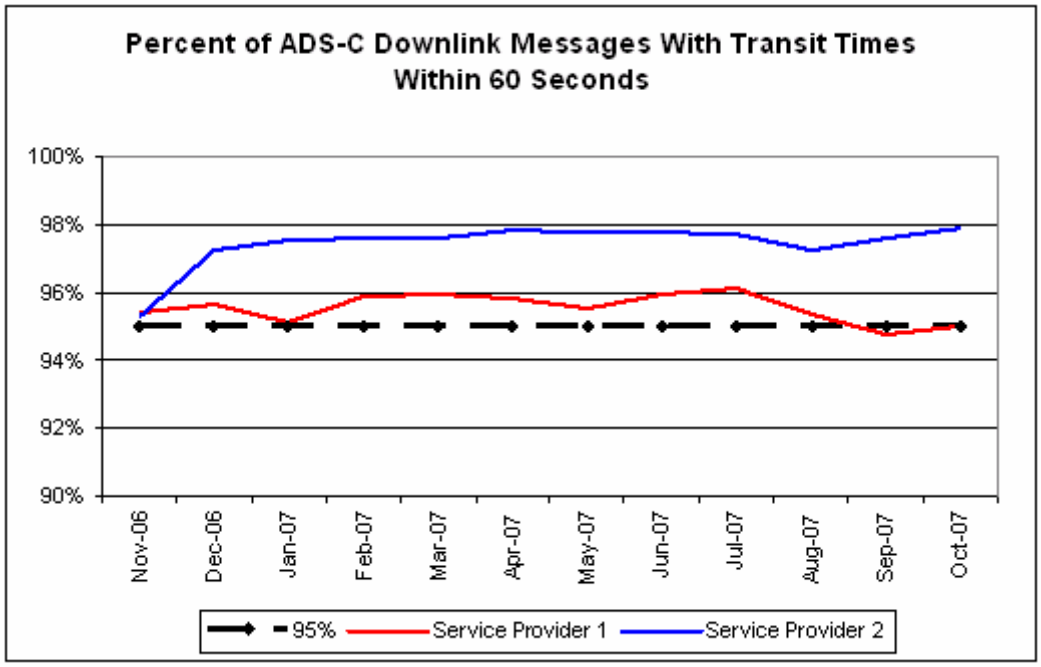

Figure 1. Percent of ADS-C Downlink Messages with Transit Times ≤ 60 Seconds

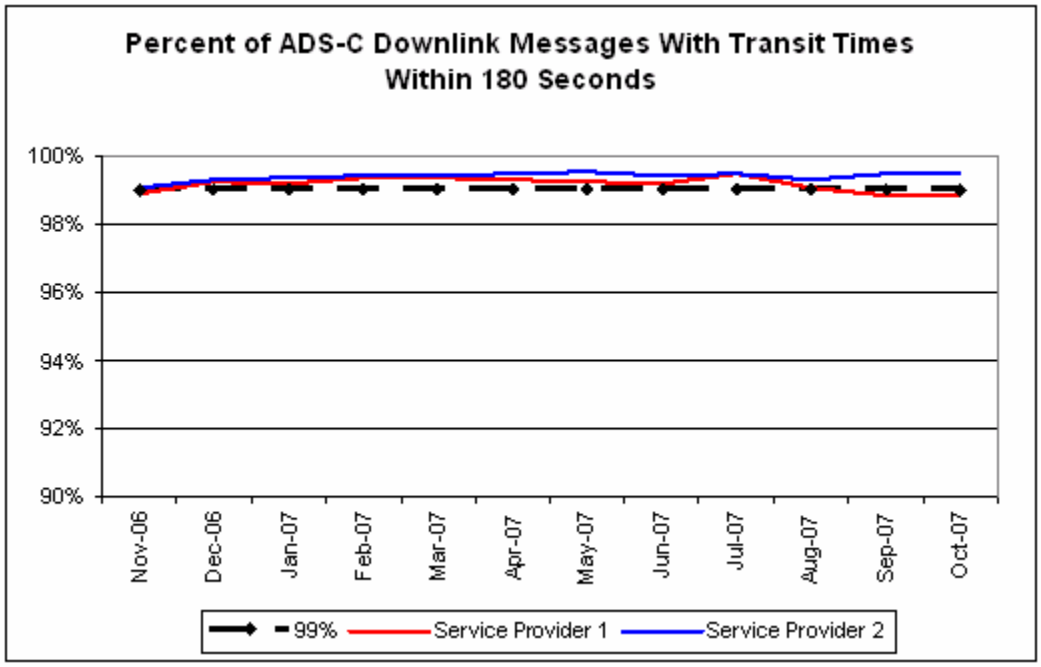

Figure 2. Percent of ADS-C Downlink Messages with Transit Times ≤ 180 Seconds

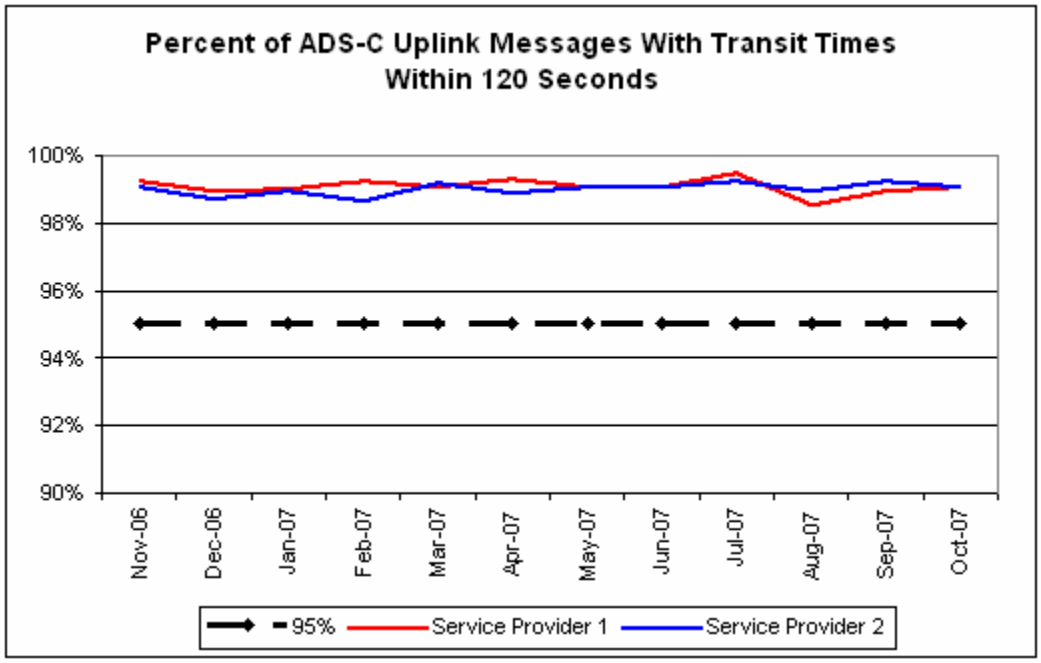

Figure 3. Percent of ADS-C Uplink Messages with Transit Times ≤ 120 Seconds

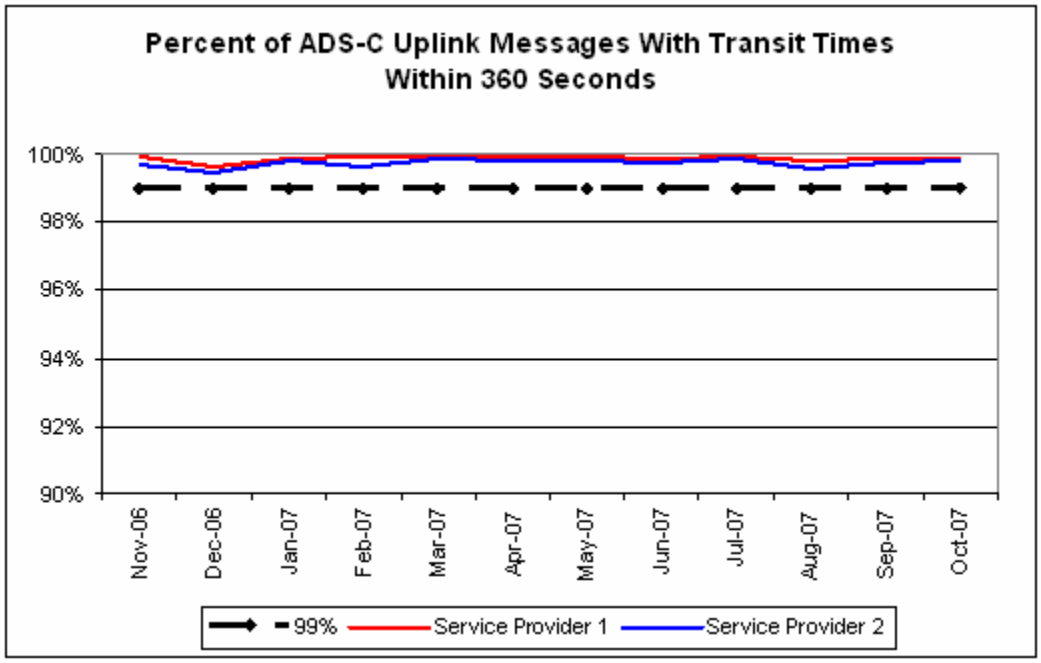

Figure 4. Percent of ADS-C Uplink Messages with Transit Times ≤ 360 Seconds

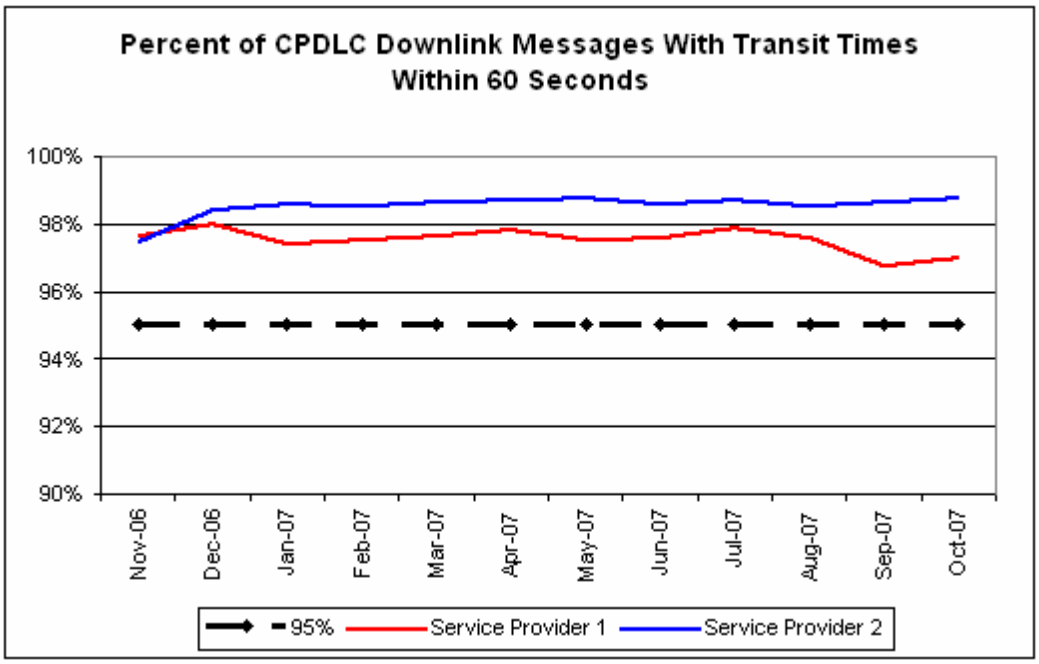

Figure 5. Percent of CPDLC Downlink Messages with Transit Times ≤ 60 Seconds

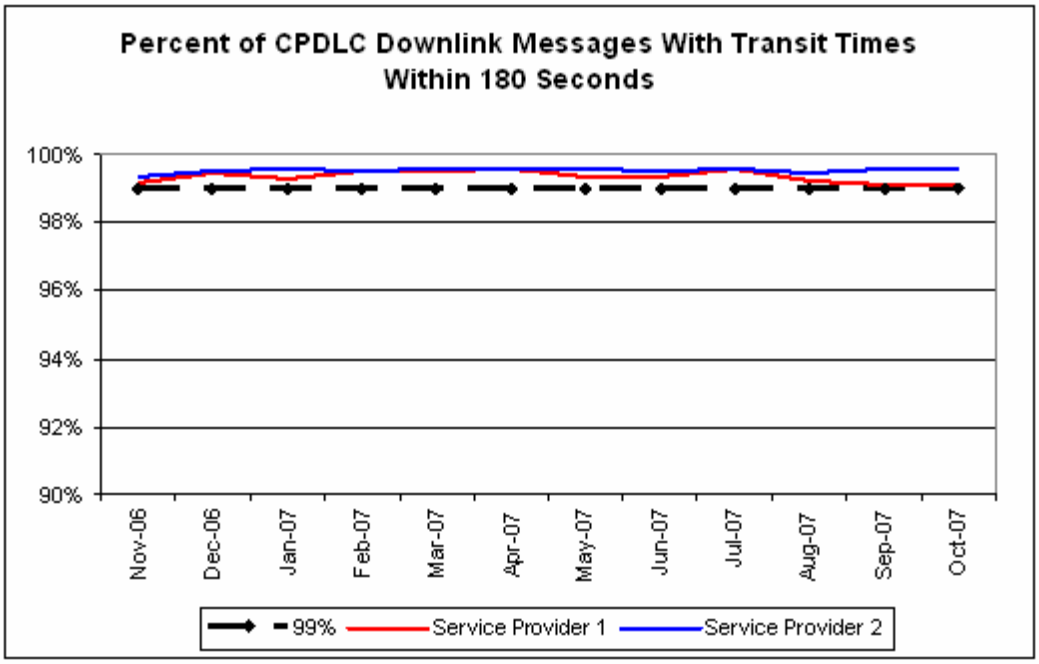

Figure 6. Percent of CPDLC Downlink Messages with Transit Times ≤ 180 Seconds

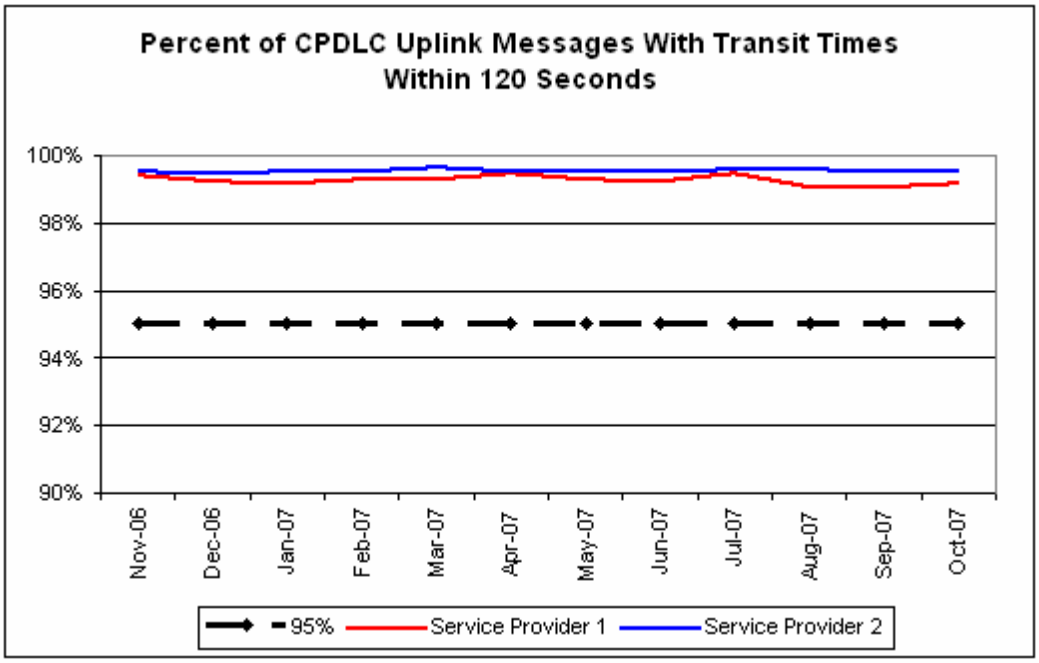

Figure 7. Percent of CPDLC Uplink Messages with Transit Times ≤ 120 Seconds

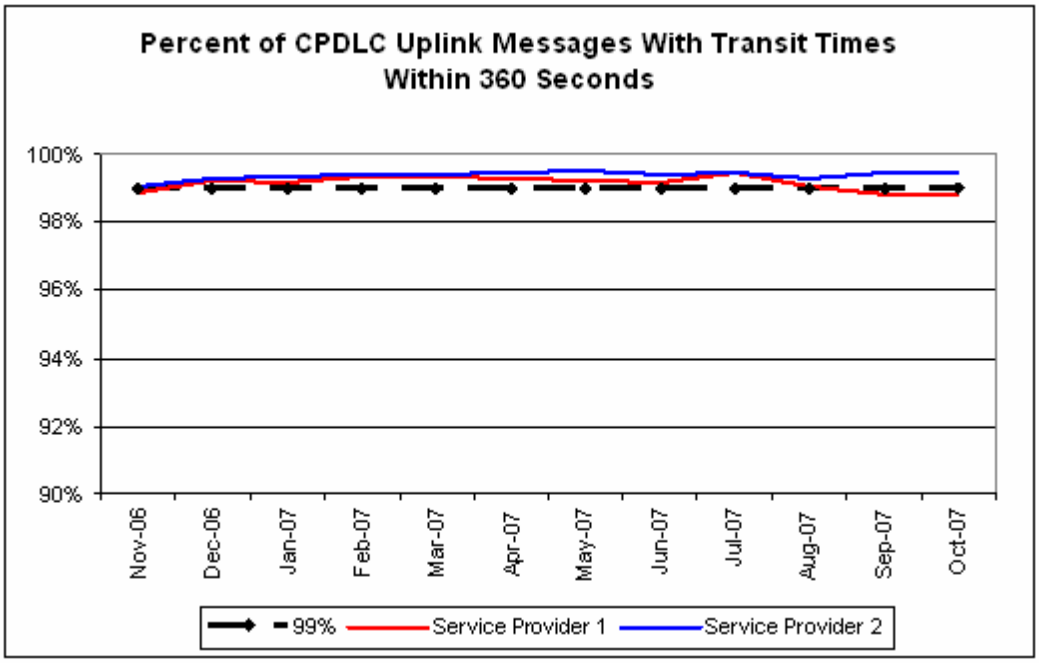

Figure 8. Percent of CPDLC Uplink Messages with Transit Times ≤ 360 Seconds

RASMAG Categorization of Large Height Deviations (LHD) in RVSM Safety Monitoring Reports for application by Asia/Pacific RVSM Regional Monitoring Agencies (RMAs)

The APANPIRG Regional Airspace Safety Monitoring Advisory Group (RASMAG) recognized that in order to be consistent with the plain language LHD definition and associated guidance listing possible causes of LHD occurrences adopted by RASMAG during 2007, standardization of the LHD categorizations applied by Asia/Pacific RMAs was necessary. Accordingly, RASMAG adopted and promulgated the LHD categorizations described in Table 1 below for application by all RMAs serving the Asia/Pacific region.

(***last updated RASMAG/8 December 2007)***

Code	RVSM Operations Large Height Deviation (LHD) Categorization
Operational Errors	
A	flight crew failing to climb/descend the aircraft as cleared;
B	flight crew climbing/descending without ATC clearance;
C	Incorrect operation or interpretation of airborne equipment (e.g. incorrect operation of fully functional FMS, incorrect transcription of ATC clearance or re-clearance, flight plan followed rather than ATC clearance, original clearance followed instead of re-clearances etc);
D	ATC system loop error; (e.g. ATC issues incorrect clearance or flight crew misunderstands clearance message);
E	coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues (e.g. late or non-existent coordination, incorrect time estimate/actual, flight level, ATS route etc not in accordance with agreed parameters);
F	coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues;

Aircraft Contingency Events	
G	aircraft contingency event leading to sudden inability to maintain assigned flight level (e.g. pressurization failure, engine failure);
H	airborne equipment failure leading to unintentional or undetected change of flight level (e.g. altimetry errors);
Deviation due to Meteorological Condition	
I	turbulence or other weather related causes;
Deviation due to TCAS RA	
J	TCAS resolution advisory; flight crew correctly following the resolution advisory; ***Note:*** *LHD resulting from actions complying with a TCAS RA would not reflect risk in the RVSM airspace since it is a proper remedial action of flight crew. Nonetheless, it is strongly recommended that all LHD occurrences related to TCAS resolution advisory be reported to the responsible RMA for detailed airspace safety analysis.*
K	TCAS resolution advisory; flight crew incorrectly following the resolution advisory
Others	
L	An aircraft being provided with RVSM separation is not RVSM approved (e.g. flight plan indicating RSVM approval but aircraft not approved, ATC misinterpretation of flight plan)
M	Other ***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.*

Table 1: LHD Categorizations utilized by Asia/Pacific RMAs

RASMAG — TASK LIST

(last updated 14 December, 2007)

ACTION ITEM	DESCRIPTION	TIME FRAME	RESPONSIBLE PARTY	STATUS	REMARKS
~~1/7~~	~~Monitor outcome of FLOS discussions at next RVSM TF meeting and report back to RASMAG.~~	~~RASMAG/7~~	~~Secretariat~~	~~Open~~ ~~Closed~~	~~Establishment of the WPAC/SCS RVSM Scrutiny Working Group was endorsed by APANPIRG/17. The first meeting will be held in Jan 2007.~~ ~~WPAC/SCS RSG/1 meeting held Jan/Feb 2007, second meeting to be held 12-15 June. Good progress made by RSG/1 in identifying reasons for LHD and identifying remedial measures.~~ ~~WPAC/SCS RSG/3 (Oct/Nov 2007) agreed to revised FLOS and FLOS for target implementation date 5 June 2008.~~ ~~WPAC/SCS RSG will continue carriage of this issue.~~
2/4	Develop SMA Handbook.	Report Progress to RASMAG/8	Chairman (R. Butcher), All members Secretariat	Open	Work progressed on the draft document by RASMAG/6, all members to review and provide input to Mr Butcher by end of Jan 2007. No input received by Mr. Butcher before RASMAG/7, to be provided as soon as possible and not later than September 2007 to enable work to progress. APANPIRG/18 (Sept 2007) was informed of difficulties in establishing SMA because no SMA Handbook available Significant work undertaken by RASMAG/8, final draft available for adoption by RASMAG/9. Feedback to Chairman (Mr. Butcher) before RASMAG/9

ACTION ITEM	DESCRIPTION	TIME FRAME	RESPONSIBLE PARTY	STATUS	REMARKS
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/8	RASMAG members Secretariat	Open	Referred to RMAs by RASMAG/5 for discussion/action. Additional guidance material included in Amendment 44 to Annex 11, effective November 2006.
~~3/2~~	~~Consider funding issues in respect of the provision of multi national infrastructures e.g. safety monitoring services.~~	~~Report Progress to RASMAG/8~~	~~RASMAG members Secretariat, including Air Transport Officer~~	~~Open~~ ~~Closed~~	~~First meeting of Regional Airspace Safety Monitoring Committees Task Force held February 2007, results reported to RASMAG/7~~ ~~RASMAG/7 amended TOR of RASMC/TF and RASMAG to progress this matter, subject APANPIRG/18 adoption in September 2007~~ ~~APANPIRG/18 (Sept 2007) disbanded RASMC/TF and gave residual responsibilities to RASMAG. States providing services agreed to provide services indefinitely, so no further action required by RASMAG~~
5/5	Regional Office to coordinate with the RNP-SEA/TF to ensure inclusion of safety assessment requirements in the Task Force TOR	Report progress to RASMAG/8	Regional Office	Open	Next RNP-SEA/TF meeting scheduled ~~March 2007 late 2007 or early 2008~~ from 4 to 7 March 2008

ACTION ITEM	DESCRIPTION	TIME FRAME	RESPONSIBLE PARTY	STATUS	REMARKS
6/1	Create common template for all Asia Pacific RMA reporting based on current MAAR template	Report progress to RASMAG/8	Asia Pacific RMAs	Open Closed	Progress discussed during RASMAG/7, final work still to be completed by RMAs. RASMAG/7 report includes common template reporting from all APANPIRG RMAs
6/2	Implement single annual consolidated Asia Pacific RMAs report based on 31 March data period of 12 months from 1May to 30 April annually and including appropriate December traffic sample data for consideration by May/June RASMAG prior to August/September APANPIRG	Report progress to RASMAG/8	Asia Pacific RMAs	Open Completed	Progress discussed during RASMAG/7, final work still to be completed by RMAs Consolidated report presented to APANPIRG/18
7/1	Submit working paper to ATM/AIS/SAR Sub Group in July 2007 analysing effect that the implementation of AIDC has had on numbers of ATC Unit to ATC Unit coordination errors to provided evidence/justification for early implementation of AIDC	Submit to ATM/AIS/SAR/ SG July 2007	New Zealand, Australia	Open Closed	Working paper prepared by New Zealand however results inconclusive so not presented to July 2007 ATM/AIS/SAR/SG
7/2	Prepare submission supporting advancement of Japan vertical monitoring agency to RMA for consideration by RASMAG/8. Submission to address provisions of Annex 11, RVSM Manual (Doc 9574) and RMA Manual in respect of requirements for establishment and operation of an RMA	Submit to RASMAG/8	Japan, assisted by MAAR & PARMO	Open Completed	APANPIRG/18 reviewed WP/40 from Japan and, under Conclusion 18/6, approved Japan RMA subject to review by RASMAG/8. Review by RASMAG/8 led to Japan being approved as APANPIRG RMA.
7/3	Include plain language definition of LHD on MAAR and PARMO LHD template	Report progress to RASMAG/8	MAAR, PARMO	Open Completed	Now included on MAAR and PARMO templates
7/4	Include yes/no tick box for question "*Were the Supervisors of the affected ACCs advised of this LHD occurrence*" on MAAR and PARMO LHD template	Report progress to RASMAG/8	MAAR, PARMO	Open Completed	Now included on MAAR and PARMO Templates

ACTION ITEM	DESCRIPTION	TIME FRAME	RESPONSIBLE PARTY	STATUS	REMARKS
~~7/5~~	~~Secretariat to provide extracts from report of RASMG/7 relating to RVSM implementation in China via Regional Office letter to China.~~	~~End June 2007~~	~~Regional Office~~	~~Open~~ ~~Completed~~	~~Regional Office completed multiple co ordinations with China~~
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/8	RASMAG, RMAs	Open	
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/9	Asia/Pacific RMAs	Open	RASMAG/8 reviewed work so far and adopted 6 Long Term Height Monitoring (LTHM) actions in Asia/Pacific area for dissemination Update RASMAG/9
8/1	Review RASMAG TOR to ensure capability to support regional PBN implementation	RASMAG/9	RASMAG/9	Open	
8/2	Present paper describing roles and responsibilities to PBN/TF/1 in January 2008	January 2008	Secretariat	Open	
8/3	RMAs to coordinate prior to the next meeting to implement a process which enables the efficient sharing of LHD data relevant to one or more RMAs, e.g. LHDs occurring at an FIR boundary shared between RMAs	RASMAG/9	Asia/Pacific RMAs including China RMA	Open	
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?*	February 2008	Asia/Pacific RMAs including China RMA	Open	

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.*	January 2008	Asia/Pacific RMAs including China RMA	Open	
8/6	Take action to implement LTHM Actions 1-6 as described in RASMAG/8 report	First quarter 2008	Asia/Pacific RMAs including China RMA	Open	Update RASMAG/9 about progress
8/7	Asia/Pacific RMAs, including China, to attend Global RMAs meeting to finalize RMA Manual at ICAO Montreal from 13-15 May 2008 as part of SASP meeting.	May 2008	Asia/Pacific RMAs including China RMA	Open	
8/8	Circulate letter to APANPIRG members and Asia/Pacific RMAs advising JCAB RMA has been approved as APANPIRG RMA.	December 2007	Secretariat	Open	
8/9	Prepare submission supporting advancement of China RMA to APANPIRG RMA status for consideration by RASMAG/9. Submission from China to address provisions of Annex 11, RVSM Manual (Doc 9574) and RMA Manual in respect of requirements for establishment and operation of an RMA – as described in IP08 to RASMAG/7	Submit to RASMAG/9	China, assisted by MAAR, PARMO & Regional Office	Open	
8/10	Contact Vietnam and request urgent submission of LHD data for 2007 for Hanoi and Ho Chi Minh FIRs	December 2007	Secretariat	Open	
8/11	Prepare a paper for RASMG/9 that summarises regional initiatives for AIDC including APANPIRG requirements and status of regional AIDC implementation	RASMAG/9	Secretariat	Open	

ACTION ITEM	DESCRIPTION	TIME FRAME	RESPONSIBLE PARTY	STATUS	REMARKS
8/12	Transmit State Letter on behalf of RASMAG to all States and Asia/Pacific RMAs describing outcomes of RASMAG/8 in terms of LTHM Actions 1 – 6 and request assistance from States in complying with LTHM Actions.	January 2008	Secretariat	Open	
8/13	United States to investigate AIDC implementations and compile comparison between numbers of ATC coordination errors before and after AIDC implementation	RASMAG/9	United States	Open	

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