INTERNATIONAL CIVIL AVIATION ORGANIZATION

REPORT OF THE FIRST MEETING OF THE REGIONAL AIRSPACE SAFETY MONITORING ADVISORY GROUP (RASMAG/1)

BANGKOK, THAILAND, 26 – 30 APRIL 2004

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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PART I – HISTORY OF THE MEETING

1. Introduction

1.1 The First Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/1) was held in Bangkok from 26 to 30 April 2004 at the Kotaite Wing of the ICAO Asia/Pacific Office.

1.2 The establishment of RASMAG was the result of a decision (Decision 14/48) of the fourteenth meeting of the Asia/Pacific Planning and Implementation Regional Group (APANPIRG/14) held from 4 to 8 August 2003 at Bangkok.

2. Attendance

2.1. The meeting was attended by 23 experts from 8 States and 3 International Organizations. A list of participants is at **Appendix A** to this report.

3. Officers & Secretariat

3.1. Mr. Robert Butcher, Safety Manager, Airservices Australia acted as Chairperson and presided over the meeting throughout its duration.

3.2. Mr. David J. Moores, Regional Officer ATM, was the Secretary for the meeting and was assisted by Mr. Andrew Tiede, Regional Officer ATM.

4. Opening of the Meeting

4.1. The meeting was opened by Mr. David J. Moores on behalf of Mr. Lalit Shah, Regional Director of the Asia/Pacific Regional Office, who welcomed the participants to Bangkok and this inauguration meeting of the RASMAG. This meeting marks a milestone in the development of safety management programmes for the international airspace in the Asia and Pacific Region. The envisaged role of RASMAG should facilitate States providing and operating the safety management services required for the provision of Air Traffic Services in accordance with ICAO SARPs. He drew attention to other regional safety initiatives underway in a number of forums especially in regard to flight operations, but this was the first safety group being formed by ICAO to centralize the assistance to States and advice on regional airspace safety and monitoring activities involving flight operations and the air traffic services. Whilst a primary task of the group is to review the monitoring and safety assessment activities carried out by the regional monitoring agencies established by APANPIRG for implementation and operation of reduced separation minima, other airspace safety matters would also be taken into consideration. This meeting was charged with establishing the RASMAG as a functioning body within its terms of reference. There will be many challenges to be faced but the outcome of this Group's activities could have a profound effect on enhancing the safety of airspace operations in the Asia and Pacific Region. Mr. Moores thanked the participants and their Administrations for supporting this new and challenging regional initiative of APANPIRG.

4.2 Mr. Moores advised the meeting that Airservices Australia had offered to the ICAO Asia and Pacific Office to provide the Chairperson for RASMAG and nominated Mr. Robert Butcher. The Regional Office supported the nomination and Mr. Moores requested the meeting to endorse Mr. Butcher as Chairperson. This was supported unanimously by the meeting.

4.3 Mr. Butcher thanked the meeting for their confidence in him and suggested that RASMAG/1 would be primarily involved with establishing the ground rules and processes under which the Group will operate. It was also important for the members of RASMAG to be certain of the bounds within which they will operate and to be clear on the terms of reference that APANPIRG had set. Mr. Butcher noted the considerable expertise available within the Group and hoped that the outcomes of this and future meetings would result in an enhancement of safety within the Asia/Pacific Region. The meeting was advised by Mr. Butcher that in his view, it was important to keep in mind that there are two sides to the safety equation which RASMAG must address. Firstly, that of safety modeling of airspace and the monitoring of aircraft operational aspects, and secondly, the air traffic services operational safety activities required as part of the implementation process along with the need to undertake follow-up assessment to ensure that safety is being maintained

5. Language and Documentation

5.1. All discussions were conducted in English. Documentation was issued in English. A total of 13 Working Papers and 5 Information Papers were considered by the meeting. A list of the Working and Information Papers is at **Appendix B**.

PART II - REPORT ON AGENDA ITEMS

Agenda Item 1: Adoption of Agenda

1.1 The meeting considered the provisional agenda and adopted it as the agenda for the meeting:

Agenda Item 1:	Adoption of Provisional Agenda
Agenda Item 2:	Review the Terms of Reference of RASMAG and develop a Task List
Agenda Item3:	Review the airspace safety monitoring structure and programmes in the Asia/Pacific Region
Agenda Item 4:	Review and develop requirements for airspace safety monitoring
Agenda Item 5:	Review airspace safety performance in the international airspace of the Asia/Pacific Region
Agenda Item 6:	Review regional and global airspace planning and implementation developments related to requirements for airspace safety monitoring services
Agenda Item 7:	Consider inter-regional coordination arrangements and practices
Agenda Item 8:	Other airspace safety related issues
Agenda Item 9:	Airspace safety monitoring documentation and distribution requirements
Agenda Item 10:	Other business

Agenda Item 2: Review of Terms of Reference of RASMAG and develop a Task List

2.1 The meeting recalled that in establishing the RASMAG APANPIRG/14 formulated the following Decision:

Decision 14/48 – Establishment of the Regional Airspace Monitoring Advisory Group (RASMAG)

That, the Regional Airspace Safety Monitoring Advisory Group (RASMAG) be established with Terms of Reference as shown in Appendix D to the Report on Agenda Item 3. The RASMAG shall report annually to APANPIRG and the ATM/AIS/SAR/SG on the results of its airspace safety monitoring activities. The members of the Group should comprise experts from the regional monitoring agencies and other specialists as required.

2.2 The meeting reviewed the Terms of Reference and was of the view that further clarification was required as to the extent to which the Group could make decisions without first obtaining approval or endorsement from APANPIRG as reflected by its status as an Advisory Group.

2.3 To emphasize the above point, the meeting considered that its relationship with the RVSM Regional Monitoring Agencies (RMAs) could influence the way they operate. In this regard, the meeting noted that RVSM had been in operation since 1997 when it was implemented in the North Atlantic Region (NAT) and since then wide spread implementation of RVSM had taken place with considerable data and knowledge gained on aircraft height-keeping performance through the monitoring programmes in the NAT and Europe in particular. In this regard, other RMAs, e.g. for the NAT and Europe, were constituted in such a way that they could make changes to their monitoring practices and requirements without having first to gain approval from their respective Regional Planning and Implementation Groups (PIRGs). This allowed those RMAs to make decisions to change their monitoring requirements and practices. In the case of RASMAG, it was not clear whether similar action could be taken or if approval by APANPIRG was required. The meeting recognized that, if this were the case, a delay of up to one year could arise to obtain approval by the next APANPIRG meeting, which could result in the Asia/Pacific monitoring programme being out of step with other regions.

2.4 The Secretariat advised the meeting that where ICAO provisions, guidance material and policy already exist, RASMAG could endorse or approve adoption by the RMAs. In cases where regional agreements were required such as establishing an RMA, publishing regional guidance material, or changing the terms of reference then APANPIRG approval would be required. RASMAG has a task to coordinate and harmonize airspace safety monitoring activities and this would include bringing regional RMA practices in line with other regions in accordance with ICAO requirements.

2.5 The Chairman commented that sub paragraph c) contained in the TOR inferred that the RASMAG's work was limited to reviewing only ADS and CPDLC applications of data link. He noted that one of the objectives for RASMAG as detailed in the TOR is to review regional and global airspace planning and developments in order to anticipate requirements for airspace safety monitoring and assessment activities. Given that APANPIRG has recently endorsed the creation of an ADS-B Task Force to assist States to implement ADS-B systems, the Chairman suggested that there would possibly need to be some review of these activities by RASMAG. The meeting agreed that the task list should be amended to encompass other applications of data link as required.

2.6 The meeting agreed to recommend to APANPIRG/15 a revision to item i) and under the Task List, item c) to the Terms of Reference, as shown in **Appendix C.**

2.7 In view of the foregoing the meeting drafted the following Draft Decision:

Draft Decision 1/1 – Revision to the Terms of Reference of RASMAG

That the Terms of Reference of RASMAG be revised as shown in Appendix C.

Agenda Item 3: Review the airspace safety monitoring structure and programmes in the Asia/Pacific Region

Airspace safety management in the Asia Region

3.1 The meeting noted that APANPIRG/12 (Decision 12/44, 2001) established the Asia/Pacific Airspace Safety Monitoring Task Force (APASM/TF) to develop an airspace safety monitoring agency (RASMA) for the Asia/Pacific Region, and prepared a plan for the formation of the group to be considered by APANPIRG. The initial objective was to set up a functional management team to ensure that the services of the RASMA were provided to all regional airspace and safety authorities, and air traffic service providers and in an efficient and cost effective manner. During the course of its work, the Task Force considered that the institutional difficulties to form RASMA as a business entity were too complex, and a number of States for legal reasons, would have difficulty in making use of

RASMA services. In this regard, the Plan was changed to take into account that existing safety monitoring arrangements by States in support of implementation of airspace changes were operating satisfactorily. In this regard APANPIRG/14 (August 2003) approved the establishment of a Regional Airspace Safety Monitoring Advisory Group (RASMAG) under APANPIRG. The meeting agreed that the Plan provided useful background information but did not need to be developed further as the group was now functioning under the TORs established by APANPIRG.

3.2 The meeting recognized that Annex 11 required States to implement systematic and appropriate ATS safety management programmes to ensure that safety is maintained in the provision of ATS within airspace and at aerodromes. In this regard, under APANPIRG's regional implementation planning requirements, arrangements were put in place by States to undertake airspace safety assessments and to provide airspace safety monitoring for the introduction of airspace changes and reduction in aircraft separation minima, and for ongoing operations. Various States had accepted the responsibility to provide regional and sub-regional safety assessment and monitoring services as described below. In regard to the need for an acceptable level of safety for the international en-route airspace, APANPIRG established a target level of safety (TLS) of 5 x 10^{-9} fatal accidents per flight hour per dimension (vertical and horizontal).

3.3 The meeting reviewed the present structure and service providers for airspace safety monitoring and safety assessments for the international airspace in the region. To assist the meeting, a map of the Asia/Pacific FIRs was used to identify areas where safety monitoring services and assessments were required.

3.4 APANPIRG had approved the establishment of the following airspace safety management arrangements and regional monitoring agencies (RMAs) and other monitoring groups to provide the safety assessment and monitoring services for changes in international airspace in line with Annex 11 requirements as follows:

Reduced vertical separation minimum (RVSM)

a) Pacific Approvals and Monitoring Organization (PARMO) operated by the US Federal Aviation Administration (FAA) for the Pacific Region (previously included the Asia Region); and

b) Monitoring Agency for the Asia Region (MAAR) operated by AEROTHAI of Thailand for the Asia Region (took over responsibility from APARMO for the Asia Region on 2 September 2003); and

c) The FIRs for which the RMAs are responsible for are shown at **Appendix D**.

RNP 10 operations and reduced lateral separation

South China Sea route system (RNP 10/60 NM lateral spacing)

a) No monitoring group is established, however, for the initial implementation, the Civil Aviation Authority of Singapore (CAAS) collected and collated the safety data and Airservices Australia performed the safety assessment. CAAS continues to provide data collection services and presents the information to the ICAO Regional Office for further action;

b) Oversight of the safety arrangements for the South China Sea area is provided by the Southeast Asia ATS Coordination Group (SEACG); and

c) Formal arrangements to establish a safety monitoring group to carry out monitoring services and safety assessments for implementation and operation of reduced horizontal separation were required.

EMARSSH route structure including Bay of Bengal area (RNP 10/50 NM lateral spacing)

a) No safety monitoring group is established. Airservices Australia carried out the safety assessment services for the implementation using safety data provided by States and coordinated by the Regional Office;

b) Oversight responsibility was transferred from the EMARSSH project team to the Bay of Bengal ATS Coordination Group (BBACG), and

c) Formal arrangements to establish a safety monitoring group to carry out monitoring services and safety assessments for implementation and operation of reduced horizontal separation were required.

ADS/CPDLC services for the Bay of Bengal area

a) Central Reporting Agency (CRA) for the assessment of data link system performance to be operated by Boeing on behalf of the Bay of Bengal States;

b) Oversight is provided by the FANS Implementation Team (FIT) and BBACG; and

d) Formal arrangements to establish a safety monitoring group to carry out monitoring services and safety assessments for implementation and operation of reduced horizontal separation were required.

Airspace safety management in the Pacific Region

3.5 Within the Pacific Region, safety assessment and monitoring services are provided by States through arrangements put in place by the relevant informal ATS coordination groups, the Informal Pacific ATS Coordination Group (IPACG for the North/Central Pacific) and the Informal South Pacific ATS Coordinating Group (ISPACG). The meeting was advised by the United States that IPACG had been established through a bi-lateral agreement between Japan and the United States in 1989 to enable these States to address operational air traffic matters concerning the traffic flows across the North Pacific. This was the first group of its kind in the region to provide such a forum for States, international organizations and the industry groups concerned to coordinate and progress operational air traffic control and related matters within international oceanic airspace. The APANPIRG was not established until 1991 and IPACG filled an important gap in regional coordination and operational development work. The FAA performed the initial safety assessment for reduced horizontal separation of 50 NM and maintains a data base of approved RNP 10 operators.

3.6 In order to ensure the appropriate level of ATS data link system performance, to plan and test operations that would enable benefits, and to resolve system problems, it is necessary to perform monitoring, coordination, testing, and problem research tasks. To address these concerns, dedicated sub-teams, called CRAs, have been established. The United States presented the meeting with details on the CRAs operating in the Pacific Region. The meeting was informed of task and resources requirements, involved stakeholders and details on the interaction between the CRAs, FITs and other interested parties. The meeting noted that some of this information was included in the draft CRA guidance material described below, and this information would be taken into account in the development of the guidance

material.

3.7 The meeting noted that the data link performance monitoring services, e.g. ADS and CPDLC were being provided by CRA Japan for the Tokyo FIR. For the remainder of the Pacific Region, Boeing operates the CRA. Airservices Australia provides RVSM monitoring and other airspace safety services for the Melbourne and Brisbane FIRs, and specifically RVSM monitoring and assessment for the international airspace over the Indian Ocean contained within those FIRs. ATS coordination activities in the Pacific Region are reported to APANPIRG.

3.8 In regard to the above, Australia informed the meeting that the RMA Handbook did not show the correct Australian airspace for which PARMO was responsible. The Melbourne FIR was listed but the airspace over the territory of Australia and westwards over the Indian Ocean was not part of the PARMO area. The meeting agreed that the Handbook should be amended and this would be brought to the attention of the party responsible. In addition, the Chairman proposed to amend the Asia/Pacific Airspace Safety Monitoring Structure at **Appendix E** of this report, to reflect a direct reporting line to RASMAG by Australia, given the latter's role in providing monitoring services for RVSM in the western oceanic airspace of the Brisbane and Melbourne FIRs.

3.9 Following the success of the IPACG, States responsible for providing the air traffic services in the oceanic airspace of the South Pacific, i.e. Australia, Fiji, France, New Zealand and United States, established the ISPACG by multi-lateral agreements in 1991 to undertake similar activities.

3.10 The ICAO Regional Office was invited to attend meetings of IPACG and ISPAG as an observer and over the years had made a significant contribution to the work of these groups. The reports of the meetings were presented to the ATM/AIS/SAR/SG and APANPIRG. Unfortunately, ICAO had not attended the IPACG/ISPACG meetings during the past two years due to resource constraints and their absence was highly regretted. The meeting recognized the importance of these forums and the pioneering work they had undertaken to reduce oceanic airspace separation by introducing RNP 10 and 50 NM horizontal separation and ADS/CPDLC applications. The work undertaken by these groups in regard to data link services has provided the benchmarks for evaluating data link performance, ADS and CPDLC operating procedures and setting up the required safety management programmes, which included establishing a Central Reporting Agency.

3.11 In light of the foregoing, the meeting agreed that the work of IPACG and ISPACG in regard to the safety management programmes operated by these groups for the Pacific Region should be reviewed by RASMAG. Accordingly, the United States agreed to coordinate with IPACG and ISPACG to ensure that reports of their meetings, and reports from the CRAs and FITs operating under these groups, were provided to RASMAG.

Need for additional monitoring and safety assessment services

3.12 The meeting considered the nomenclature used within ICAO and regional documentation to describe entities that carry out airspace safety services, e.g., monitoring for RVSM, RNP, data link services, and to perform safety assessments for the reduction in separation minima for international airspace. In regard to RVSM, ICAO has adopted the term RMA described in the RVSM Manual (Doc 9574), and the establishment of an RMA was by regional agreement. In the Asia/Pacific Regions there are two RMAs, viz, PARMO for the Pacific Region and MAAR for the Asia Region. In the North Atlantic the term CMA was adopted for the body to carry out the safety work for the route structure, initially in the horizontal dimension and later also for RVSM, whereby it performs the function of an RMA. The Middle East Central Monitoring Agency is the RMA for that region. In regard to data link monitoring there are three CRAs operating in the Asia/Pacific Region. The CAAS who carries out the monitoring services for the SCS RNP 10 routes is referred to as a Monitoring Authority.

3.13 The meeting noted the variety of terms and functions related to the provision of safety services for various international airspace safety monitoring activities. In consideration of the need to assign service providers to perform safety services within sub-regions of the Asia/Pacific Region, the meeting agreed that it was desirable to use a different term than that used for established groups described above. The traditional names would continue to be used for groups providing identical services. However, it was recognized that there was a need to appoint service providers on a sub-regional basis to provide safety services e.g. for RNP, reduction in separation and ATC application of data link services (technical performance is carried out by a CRA) that did not fall within the accepted understanding of the roles of these other groups Accordingly, the meeting agreed to recommend to APANPIRG that the term Safety Monitoring Agency (SMA) be adopted for this purpose. For example, the function of the CAAS Monitoring Authority would better be described under the title of a SMA. Likewise, other State monitoring bodies that provide services for the international airspace endorsed by APANPIRG would become SMAs. In this case, MAAR which acts as the RMA for RVSM, could also perform the function of a SMA for safety work associated with other airspace activities**.** The meeting recognized that it would be necessary to define the services to be provided by a SMA, and the duties, responsibilities and terms of reference should be developed. In this regard, the meeting agreed to consider this further at the RASMAG/2 meeting.

3.14 In view of the foregoing the meeting drafted the following Draft Decision:

Draft Decision 1/2 – Adoption of the term Safety Monitoring Agency (SMA)

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

3.15 In regard to RVSM safety management programmes, the meeting recognized that ICAO provisions provide clear guidance on the requirements and arrangements to be put in place for RVSM implementation and ongoing operations. The meeting was of the view that these arrangements had been appropriately established for the FIRs where RVSM was operating. In the case of the safety arrangements for horizontal safety management, ICAO provisions were not so clear and there were no specific requirements to establish a regional monitoring agency for RNP and data link applications. However, when the overall ICAO provisions for safety monitoring programmes and related guidance material were taken into account, formalized safety monitoring programmes and safety assessment were required on a regular basis.

3.16 The meeting was reminded of the establishment of the CMA by the North Atlantic System Planning Group for the introduction of the organized track system in the North Atlantic airspace with 60 NM lateral route spacing based on the Minimum Navigation Performance Specification (MNPS) in 1977. Guidance on the CMA activities are contained in Appendix 4 to the *Manual on Airspace Planning Methodology for the Determination of Separation Minima* (Doc 9689). When RVSM was implemented in the NAT Region in 1997, the NAT CMA also undertook the RVSM monitoring programme on behalf of the NAT States.

3.17 The meeting agreed that it was necessary to establish safety monitoring groups to undertake the safety management programmes for the application of RNP, data link services and related separation minima.

3.18 The following areas were identified as requiring a safety monitoring group to be established for airspace safety monitoring services and safety assessments in the Asia/Pacific Region:

a) South China Sea area –for the safety assessment of the RNP 10 route structure and reduced horizontal separation, and application of data link services;

b) RNP 10 routes across the Bay of Bengal area – for the safety assessment and monitoring of the routes, reduced horizontal separation, and application of data link services;

c) RNP 10 routes from Southeast Asia to the Middle East – for the safety assessment and monitoring of the routes, reduced horizontal separation, and application of data link services;

d) Melbourne/Brisbane FIRs covering the southern Indian Ocean – establishment of an RMA for RVSM and safety monitoring group for reduced horizontal separation and data link services (Airservices Australia providing the services but not designated as an RMA); and

e) Some FIRs in the Pacific Region required further investigation to determine the safety services to be established.

3.19 The meeting was informed that at the combined FIT-BOB/3 and BBACG/14 (February 2004), in follow-up to BBACG/13, Thailand informed the meeting that AEROTHAI with experience in operating the RVSM RMA since 2 September 2003, was in a position to carry out the safety assessment work to support ADS/CPDLC operations involving a reduction in aircraft separation in the Asia Region. To expand its work to include this task, MAAR would require funding. Further, FIT-BOB/3 recognized that RASMAG would be assessing airspace safety requirements including establishment of safety monitoring groups in the Asia/Pacific Region, and agreed to refer the matter to RASMAG. The meeting agreed that under its TORs, RASMAG could recommend to APANPIRG an appropriate service provider to provide safety monitoring services.

3.20 The meeting noted the safety assessment services provided by Airservices Australia for the implementation of the South China Sea routes and the EMARSSH routes in the Asia Region. The EMARSSH safety assessment is provided at **Appendix F**. The meeting considered the establishment of safety monitoring group for the areas identified above and agreed that further information was required on the funding arrangements to operate the safety monitoring groups and details of the services to be provided. In this regard, the meeting agreed that the ATS providers concerned should prepare a detailed proposal for the operation of a safety monitoring group outlined above to be presented at the next meeting of the RASMAG on 4 – 8 October 2004.

3.21 In regard to the safety services provided by Airservices Australia as described in 3.18 d) above, the meeting agreed that they were already performing the function of an RMA and safety monitoring group, and should be formally appointed by APANPIRG to integrate their activities into the regional safety management programmes for international airspace.

3.22 In view of the foregoing the meeting drafted the following Draft Conclusion:

Draft Conclusion 1/3 – Appointment of Airservices Australia to provide RMA and SMA services for the international airspace within the western part of the Melbourne and Brisbane FIRs

That, recognizing the safety management services provided by Airservices Australia for RVSM within the international airspace of the western part of the Melbourne and Brisbane FIRs, they be appointed as the Regional Monitoring Agency for RVSM and as the Safety Monitoring Agency for RNP, data link services and related separation minima.

ADS/CPDLC operational trial in the Bay of Bengal area

3.23 The meeting reviewed the establishment of the CRA for the Bay of Bengal operational trial which commenced on 19 February 2004. The aim of the trial was to prepare for the implementation of ADS and CPDLC services by some of the ATS providers in the Bay of Bengal area. IATA advised the meeting that operators had experienced problems with the ADS reporting rate that had been set by an ATC Unit participating in the trial. This had resulted in aircraft ADS systems providing ADS periodic reports occasionally at intervals of 2 minutes or less. IATA advised that these small reporting intervals were not acceptable to operators and they would not participate in trials if such unreasonable rates were being demanded. On previous occasions in other FIRs in the Asia Region where ADS was operating on a trial basis, high update rates were also experienced. On a trial and operational basis, such reporting rates were not warranted for routine ADS reporting. The meeting supported the concerns of IATA and agreed that the States involved in the trial be requested to review their procedures for operating their ADS systems, and where applicable adjust the reporting rate in line with the procedures in the FANS Operations Manual (FOM). For technical testing of data link performance, the meeting recognized that higher reporting rates may be used for limited periods to test system capability. In this regard, ATS providers should inform operators when the system would be on test.

3.24 The meeting was informed by Japan that in addition to the cost of making ADS reports using satellite communications, there was a more serious problem of risking overloading the data link capacity, thereby risking interruption to ADS operations.

3.25 In regard to the application of separation, the ADS reporting rate would be determined by the maximum reporting interval requirements applicable to the separation minima. For example, in the case of 50 NM longitudinal separation based on RNP 10, PANS-ATM, Doc 4444 requires the maximum reporting interval to be 27 minutes. The meeting agreed that ADS reporting intervals should be set as necessary for the air traffic service being provided.

3.26 The meeting was informed that for the Bay of Bengal operational trial, the FIT-BOB had adopted the FOM for the ADS and CPDLC operating procedures to be used by States. The ADS reporting procedures in the FOM states in paragraph 5.2 that "*ATSUs should ensure that the periodic reporting rate in use is in accordance with the position reporting requirements of the separation standard being used*." Also, in 5.2 it states *"Arbitrarily selecting higher periodic reporting rates adds undue economic cost and unnecessarily loads the data link system*."

3.27 The meeting noted that in paragraph 5.4 of the FOM it states that "*Depending on individual circumstances the controlling authority should limit the periodic reporting rate to no more frequently than (5) minutes*." The meeting was of the opinion that this was an excessively high rate not required for routine ADS operations as described above. The meeting agreed that this matter should be brought to the attention of IPACG and ISPACG who were jointly responsible for publishing the FOM. The United States members present agreed to raise the matter with the organizations concerned.

Agenda Item 4: Review and develop requirements for airspace safety monitoring

4.1 The United States presented information summarizing the report of the second special meeting of the North Atlantic Operations and Airworthiness Sub-Group on 23-24 March 2004. This meeting, like the first, was convened to examine evidence of lack of altimetry system error(ASE) stability observed in aircraft height-keeping performance monitoring results from the North Atlantic and Europe. Discussions focused on an apparent cause for this lack of stability: gradual degradation in the performance of certain avionics components of air data computers. The Sub-Group considered the effect which enhanced RVSM maintenance requirements might have on the observed errors, and the associated changes such enhancements might have on current maintenance practices. While the Sub-Group agreed

that the magnitude of height-keeping errors observed through monitoring was not an immediate cause for concern, the lack of altimetry system error stability, evidenced as a gradual increase in error magnitude over time for a particular airframe, would eventually lead to height-keeping performance failing to comply with requirements. The Sub-Group agreed that monitoring should continue at present levels until remedies for the lack of altimetry error stability were identified and shown to be effective.

4.2 The meeting was advised by MAAR that the RVSM/TF/21 meeting (27-31 October 2003) carried out a 90-day review of RVSM implementation in the Bay of Bengal and Beyond area, and had discussed the requirements for ongoing long term monitoring post RVSM implementation in the Asia Region. It was noted that ICAO had not established a global policy for long-term monitoring. The meeting was informed that the ICAO long term monitoring policy was a subject being examined by the Separation and Airspace Safety Panel (SASP) under its Project Team 2.

4.3 In regard to the minimum monitoring requirements (MMRs) for implementing RVSM, the ICAO Draft RMA Handbook provided guidance. The Handbook had been completed by SASP and was in the process of being adopted by ICAO, and it was expected to be published in 2005. It was pointed out that the RVSM Manual (Doc 9574) allowed for the monitoring requirements to be established regionally, which could result in different requirements between the regions where issues specific to a region were taken into account. In light of the handbook guidance, all regions should not establish requirements less than those recommended by ICAO. The PARMO had adopted the MMR recommended in the Handbook, and the meeting agreed that this should be the minimum requirement for the Region. The MMR contained in the RMA Handbook is provided at **Appendix G**.

Agenda Item 5: Review airspace safety performance in the international airspace of the Asia/Pacific Region

5.1 The meeting reviewed the results of the safety assessment carried out by MAAR and PARMO for RVSM operations in the Asia and Pacific Regions.

RVSM safety review in the Asia Region

5.2 MAAR had carried out the safety assessment updates for the one year review of RVSM implementation in the West Pacific (WPAC) and South China Sea (SCS) area, which took into account the usage of the modified single alternate flight level orientation scheme (FLOS) on ATS routes A1/P901, and for the 90-Day review of implementation in the Bay of Bengal area, which used the conventional single alternate FLOS.

WPAC/SCS Airspace

5.3 For the post RVSM implementation in WPAC/SCS, the technical risk was 6.17×10^{-11} fatal accidents per flight hour. The total risk attributed to all causes was 1.92×10^{-9}. Both estimates satisfy the agreed TLS value of no more than 2.5×10^{-9} for the technical risk 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 for risk due to all causes.

5.4 Although the risk estimates using the modified CRM indicated that it had been safe for the RVSM to be implemented in the WPAC/SCS airspace, there were a number of large height deviations (LHDs) that occurred after the implementation in October 2002. This greatly influenced the operational risk. Hence, careful monitoring of the LHD occurrences in WPAC/SCS was very important and inevitably required for the annual review of safety oversight for the RVSM implementation.

5.5 The meeting noted the concern of MAAR and PARMO regarding States failing to report LHDs, and encouraged States to provide such reports to MAAR, PARMO and other RMAs in a timely manner.

Bay of Bengal Airspace

5.6 The estimates of technical, operational, and total risks for the 4-month post implementation of RVSM in the BOB airspace are summarized below and show that the TLS had been met.

Source of Risk	Risk Estimation	TLS	Remarks
Technical Risk	1.83×10^{-9}	2.5×10^{-9}	Below Technical TLS
Operational Risk	1.58×10^{-9}	-	-
Total Risk	3.41×10^{-9}	5.0×10^{-9}	Below Technical TLS

Risk Estimated for 4 Months Post RVSM Implementation in BOB

5.7 The RVSM/TF agreed that it would be necessary to collect new traffic sample data to accurately represent the traffic volume for the 1-year review after RVSM was implemented in Bay of Bengal. Therefore, MAAR requested the States concerned to provide a one month traffic sample data for the month of July 2004 to be submitted to MAAR via email no later than 31 August 2004. The one-year review of safety oversight for the RVSM implementation in BOB would be presented to the RVSM/TF/23 meeting planned for November 2004.

RVSM safety review in the Pacific Region

5.8 The United States provided information on a periodic reporting process aimed at comparing actual performance to safety goals related to the RVSM implementation in Pacific airspace. As the RMA for Pacific airspace, the PARMO was responsible for circulating regular reports of all reported height-keeping deviations, together with the necessary information to relate the estimated system risk to the TLS. In fulfillment of this responsibility, the PARMO had created the report presented to this meeting, which was the first of what were planned to be quarterly reports from the PARMO. This report contained a summary of large height deviation reports received by the PARMO for the year 2003. In addition, an update of the vertical collision risk for Pacific airspace was presented. The vertical collision risk estimate for this period was roughly a factor of 30 below the TLS of 5.0×10^{-9} fatal accidents per flight hour. However, this estimate was based on a composite of old parameters combined with recent traffic counts and was not representative of a complete calendar year of large height deviation reporting. Future reports would contain estimates of risk with increasing confidence as the PARMO expands the automated analysis tools used to estimate the collision risk model parameters.

Harmonization of the modified single alternate FLOS with the single alternate FLOS

5.9 The meeting was informed that at the RVSM/TF/16 meeting (September 2002), discussions were held regarding harmonization of the modified single alternate FLOS used for the SCS route structure with the single alternate FLOS used in adjacent RVSM airspace outside of the SCS area. It was considered by the Task Force that "ultimately a single alternate flight level orientation scheme should be adopted", and studies would be made in preparation for any transition plan to a single alternate FLOS.

5.10 At the RVSM/TF/18 meeting (one year review, July 2003) noting the studies undertaken by States, it was recognized that there were many issues to be resolved and at this stage, in view of the short time frame to implement RVSM in the Bay of Bengal and Beyond on 27 November 2003, it was decided to continue with the modified single alternate FLOS for the WPAC/SCS areas, with a view to reviewing the FLOS when the study by States concerned was completed. Hence, MAAR planned to

request States concerned to collect traffic sample data at the RVSM/TF/22 meeting. The period of the proposed TSD would be based on the requirement of that meeting.

5.11 Further, the RVSM/TF/18 agreed that it would be beneficial to prepare a safety assessment based on the traffic sample data collected after RVSM was implemented in October 2002 to assist in the decision making process for the use of single alternate FLOS in the Western Pacific/South China Sea area.

5.12 The meeting was also advised that Japan and Korea were planning to implement RVSM in the Incheon, Naha and Tokyo FIRs on 9 June 2005 and this would have an impact on the traffic flows in the WPAC/SCS area. The matter would be raised at the SEACG/11 meeting on 24-28 May 2004. Also, the RVSM/TF was planning to hold a meeting to resolve this matter in September 2004.

5.13 The meeting recognized that the operational situation on the SCS route system was complex and required the safety studies to be completed before the matter could be resolved. In view of the plans in place to address this matter, the meeting was not in a position to address it further, and agreed it was best left to the RVSM Task Force to resolve the matter with the States and other parties concerned. The meeting further recognized that there were a number of safety related matters concerning RVSM operations that were being addressed by the SEACG and RVSM/TF. This meeting would review the issues concerned in due course following submission of the reports of these groups.

Agenda Item 6: Review regional and global airspace planning and implementation developments related to requirements for airspace safety monitoring services

Regional planning

6.1 The meeting noted that implementation of air navigation services by States was a primary element of the Regional Air Navigation Plan that was kept under review by APANPIRG. Requirements to implement new air navigation services would be brought to the attention of APANPIRG and any safety related matters would need to be identified. Similarly, the Asia/Pacific Regional Plan for the New CNS/ATM Systems was kept under review by APANPIRG. The Secretariat advised the meeting that RASMAG would be kept informed of developments in the regional planning process. Also, the Group would be kept informed of developments arising from the ICAO Global Aviation Safety Plan and other regional safety initiatives of interest to the Group.

6.2 In the near term, the meeting noted that planning for implementation of 30 NM horizontal separation using ADS in the Pacific Region was underway and safety related issues would be brought to RASMAG for review through the reports of the ATS coordination groups responsible for implementation. Also, ADS-B was becoming a major implementation consideration, and SASP was presently developing separation minima to be applied using this system. RASMAG would be kept informed of developments.

AIDC services

6.3 The meeting was informed by Japan that AIDC service provision between Tokyo ACC and Oakland ARTCC were initiated in 1998 and has been providing the controllers with a message exchange service scheme regarding oceanic flights transiting both FIRs.

6.4 With increasing demand for implementation of AIDC services in many States in the world, Japan considered it was important to know how to evaluate the performance of AIDC operations between ATS facilities in an appropriate manner, in order to ensure safe application of the AIDC service. The meeting was informed of the experience of Japan with the AIDC service, an approach to AIDC

performance monitoring, and on one of the possible evaluation methods of AIDC performance data.

6.5 The meeting expressed its appreciation to Japan for providing useful information on its AIDC performance monitoring programme, which would be taken into account in developing the regional data link monitoring guidance material.

Agenda Item 7: Consider inter-regional coordination arrangements and practices

7.1 The meeting noted that ad hoc inter-regional coordination arrangements were in place in the region, and meetings with adjacent regions were arranged as circumstances required. It was noted that with the inter-regional implementation projects such as EMARSSH and RVSM, inter-regional coordination was effectively carried out. In particular, coordination with military authorities had resulted in good cooperation. The inter-regional coordination activities were reported to APANPIRG. RASMAG would in the course of its work need to coordinate with similar groups in other regions, and review the coordination activities between the RMAs and safety monitoring groups. It was recognized that harmonization of safety activities between the regions was an important consideration and it would be given appropriate priority.

Agenda Item 8: Other airspace safety related issues

Development of safety management systems in the region

8.1 In considering the elements to be taken into account in monitoring programmes and safety assessments, the meeting recognized that considerable attention was given to the technical aspect of system performance, e.g. for RVSM operations, aircraft height-keeping performance was a key element and for RNP, aircraft navigation accuracy. Monitoring programmes were well developed and reliable for gathering data on system technical performance. The use of collision risk modeling provided a means to quantify technical risk in regard to a TLS, and this was relatively straightforward to calculate. However, in the case of air traffic service performance and in particular human factors, the meeting was of the view that this was much less developed and more difficult to quantify. To gain an overall assessment of the total risk present in the ATM system, it would be necessary to undertake a thorough risk analysis of all factors contributing to risk. The meeting noted work being carried out by ICAO to address total ATM system performance, and recognized that this was a very complex subject that required considerable further work to make use of this concept.

8.2 The meeting expressed concern that, because the Annex 11 provision on safety management programme only came into effect on 27 November 2003, there was little lead time for States to establish safety management systems and to develop safety assessment expertise to address complex airspace environments where reduced separation minima was being implemented and operating. It was recognized that States who had implemented safety management systems and used a systematic approach to evaluating operational risk and managing ongoing operations, were much better equipped to deal with airspace safety matters. States that had little experience with safety management systems and had not put in place arrangements specifically to deal with ATS safety matters, would find it difficult to manage complex airspace and reduced separation that required safety assessments to be performed.

8.3 In this regard, the meeting was of the opinion that regional and State implementation programmes for the introduction of reduced separation, must pay special attention to this matter. Furthermore, the meeting recognized that obtaining accurate information on operational errors, in particular involving ATC errors, would be difficult where the safety culture was not conducive to open and transparent reporting of errors. The human factors consideration was likely to be one of the weakest

links in the safety equation.

8.4 The meeting recognized that these issues had a significant impact on the ability of the RMAs, CRAs and safety monitoring groups to undertake their work effectively. The meeting agreed that at the next meeting, attention should be given to reviewing progress made by States to meet their obligations in regard to the established regional safety management arrangements**.**

8.5 In the light of the foregoing, the meeting agreed that more attention needed to be given to education, and a start could be made by holding an ATS safety management workshop on the matters described above with an emphasis on practical hands-on experience. The meeting was advised that for the workshop to be effective, it was essential that the desired target group was identified, and States sent participants that could make a real contribution to their organizations' safety activities. Also, it was highly desirable that some kind of follow-up activity was carried out to provide support to the participants.

8.6 The Secretariat informed the meeting that an ATM Safety Management Seminar was in the Regional Office programme for this year and was tentatively scheduled for November. In light of the discussion at this meeting, a workshop could be arranged to meet the objectives outlined above. The meeting agreed that RASMAG should undertake the planning for the workshop and to hold its next meeting to follow-on from the workshop. This would enable RASMAG experts to participate in the workshop and minimize cost to States to support both events. The next RASMAG meeting was scheduled on 4-8 October 2004, and it was agreed to split the period into two parts of two and half days to include the workshop.

8.5 The meeting was of the opinion that ICAO should emphasize to States in the Asia/Pacific Region the importance of being cognizant of the provisions in Annex 11 regarding implementation of systematic and appropriate ATS safety management programmes. This was particularly important when implementing airspace changes involving requirements to conduct safety assessments and monitoring programmes, including follow-up activities. This information could be included in the letter to States suggested in paragraph 9.12 below.

Agenda Item 9: Airspace safety monitoring documentation and distribution requirements

Draft Guidance Material for End-To-End Safety and Performance Monitoring of Air Traffic Service (ATS) Data Link Systems in the Asia/Pacific Region

9.1 The United States presented draft text for consideration as *Guidance Material for End-to-End Safety and Performance Monitoring of Air Traffic Service (ATS) Data Link Systems in the Asia/Pacific Region*. The draft text was developed in May 2003 by the Asia Pacific Airspace Safety Monitoring Task Force. The guidance material was intended to provide a set of working principles for ATS data link system performance monitoring that would be applied by all States implementing these systems, as well as providing detailed guidance on the requirements for establishing and operating a FANS-1/A Interoperability Team (FIT) and Central Reporting Agency (CRA). It was intended that this guidance material would help promote a standardized approach for monitoring the performance of ATS data link systems within the Region.

9.2 The meeting reviewed the draft guidance material and considered there was a need to clarify the responsibility of the ATS provider to undertake analysis of data link performance and problem reports. In this regard, there would be an ongoing need for a CRA, due to changes that occurred in aircraft avionics and ATM automated systems that could impact on data link performance.

9.3 The meeting agreed that the guidance material should include information on the importance of the CRA's coordination role with other organizations participating in data link evaluation

programmes, in particular in regard to problem resolution and follow-up. Also, requirements should be included for the CRA to report to the FIT and for the FIT to report to RASMAG.

9.4 In regard to coordination, the guidance material should include a need for coordination between CRAs to ensure that problem reports received by one CRA and remedial actions taken were passed on to other CRAs in a timely manner.

9.5 In view of the information provided by Japan, guidance needed to be included for ATS providers to monitor AIDC end-to-end performance.

9.6 The meeting agreed that the guidance material would assist with the setting up and operation of a CRA and would be adopted by RASMAG and developed further. Further material would be developed and presented to the next RASMAG meeting. The meeting agreed that the guidance material would be brought to APANPIRG to be approved as regional guidance material when appropriate. The draft document is provided in **Appendix H.**

Reporting requirements

9.7 The United States presented to the meeting a prototype version of what was intended to be quarterly safety monitoring reports from the PARMO relating to the ongoing oversight of RVSM in the Pacific. It was noted that one of the duties of the PARMO as a RMA was the regular circulation of reports reviewing RVSM-related performance in all Pacific FIRs relative to safety goals. The report format presented described both the fidelity and the content of monthly reports of large height deviations received from ATC units and other sources. Separate appendices provided details of the reports received during 2003 as they influence estimation of technical and operational risk, as well as those occurring outside of RVSM airspace. Based on these reports, the document then provided estimates of technical and overall risk. These estimates were then compared with the RVSM safety goal, TLS.

9.8 The meeting considered information provided by the United States on the South Pacific FANS-1/A Implementation Team (SOPAC-FIT) reporting. Since the establishment of the SOPAC-FIT under ISPACG, annual reports had been provided to APANPIRG on findings related to the use of ATS data link. In addition, from 2003 a report was also provided to the CNS/ATM/IC/SG.

9.9 The meeting reviewed the content of the MAAR, PARMO and SOPAC-FIT reports, which were comprehensive and provided essential information in a well laid out and readable format. The meeting agreed that such a report format would be a suitable model for other safety monitoring groups to use in reporting the results of their work. Accordingly, the meeting recommended that all safety monitoring groups in the Asia/Pacific Region should adopt a standard report style. The meeting agreed to prepare a model format for the Asia/Pacific Region.

9.10 The meeting reviewed the reporting procedures adopted by the various groups in the region, and agreed that all reports by the authorized groups related to safety management activities carried out for the international airspace of the Asia/Pacific Region should be made available to the RASMAG. RASMAG would review the reports and present a consolidated annual report to APANPIRG on the state of the safety of the international airspace in the region. The meeting agreed that RMAs should provide quarterly reports covering traffic sampling and operational errors with an annual assessment report of the achieved level of safety and results of monitoring activity. Reporting for organizations involved in RNP monitoring should be on a six monthly basis. Reporting from organizations such as CRAs and FITs should be in accordance with their current reporting schedules to their coordinating groups. A template of the items to be contained in reports to RASMAG is at **Appendix I**.

9.11 In regard to the above, the meeting agreed that the ICAO Regional Office should inform RMAs, safety monitoring groups, CRAs and FITs in the Asia/Pacific Region to submit reports on their activities to RASMAG through the Regional Office, and to include information on the establishment of

RASMAG and its role.

Agenda Item 10: Other business

10.1 The meeting developed an Action Plan on the basis of items discussed during the course of the meeting as shown in **Appendix J**.

11. **Date and venue of next meeting**

11.1 The meeting agreed that for the time being, in view of the implementation programmes under way in the region, and the amount of guidance material that RASMAG is developing, and to complete setting up its review process, meetings should be held twice a year with the first meeting of each year to be convened before APANPIRG in the May to June period.

11.2 The meeting agreed that the next meeting would be held at the Regional Office, Bangkok on 4-8 October 2004 in conjunction with the workshop on ATS safety management.

12. **Closing of the meeting**

12.1 The meeting expressed its appreciation to the Regional Office for the excellent support and facilities. In particular it appreciated the high standard of catering.

12.2 The Chairman thanked the members for their active participation and the good results achieved, which would highly facilitate establishing RASMAG as an effective body.

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LIST OF WORKING AND INFORMATION PAPERS

WORKING PAPERS

WP No.	Date	Agenda Item	Presented by	Subject
1	26/4/04	1	Secretariat	Provisional Agenda
2	26/4/04	2	Secretariat	Terms of Reference and Task List
3	26/4/04	3	Secretariat	RASMAG Plan
4	26/4/04	3	Secretariat	APARMO & MAAR Duties and Responsibilities
5	26/4/04	5	Secretariat	Review of RVSM Implementation and Follow-up in the Western Pacific and South China Sea and the Bay of Bengal and Beyond Areas
6	26/4/04	4	Secretariat	Establishment of RVSM Minimum Monitoring Requirements for the Asia/Pacific Region
7	26/4/04	3, 6	Secretariat	Establishment of the Central Reporting Agency (CRA) for the Implementation of ADS and CPDLC ATC Services in the Bay of Bengal area and Future Developments
8	26/4/04	3	Secretariat	Asia/Pacific Region Airspace Safety Monitoring Structure
9	26/4/04	5	Secretariat	Safety Assessment for the Revised ATS Route Structure – Asia to/from Europe/Middle East, South of the Himalayas
10	27/4/04	3	United States	Draft Guidance Material for End-to-End Safety and Performance Monitoring of Air Traffic Service (ATS) Data Link Systems in the Asia/Pacific Region
11	27/4/04	6	Japan	AIDC Performance Monitoring
12	28/4/04	3	United States & Japan	Pacific Central Reporting Agency (CRA) Services
13	28/4/04	3	United States	South Pacific FANS-1/A Implementation Team (FIT) Reporting

INFORMATION PAPERS

IP No.	Date	Agenda Item	Presented by	Subject
1	26/4/04	1	Secretariat	List of Information and Working Papers
2	26/4/04	3	PARMO	Quarterly Safety Monitoring Reports from the Pacific Approvals Registry and Monitoring Organization
3	26/4/04	4	United States	Draft Summary of Discussions of the NAT Operations/ Airworthiness (OPS/AIR) Sub-Group ASE Stability Focus Group Meeting
4	27/4/04	3	MAAR	Summary of the Safety Assessment/Oversight for the RVSM Implementation in Asia Region
5	27/4/04	5	CRA of Japan	Summary Report of Central Reporting Agency of Japan

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TERMS OF REFERENCE
REGIONAL AIRSPACE SAFETY MONITORING ADVISORY GROUP (RASMAG)

Terms of Reference of the RASMAG

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;

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

d) review and recommend on the competency and compatibility of monitoring organizations;

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; and

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

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ICAO DRAFT RMA HANDBOOK

FLIGHT INFORMATION REGIONS AND RESPONSIBLE REGIONAL MONITORING AGENCY

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

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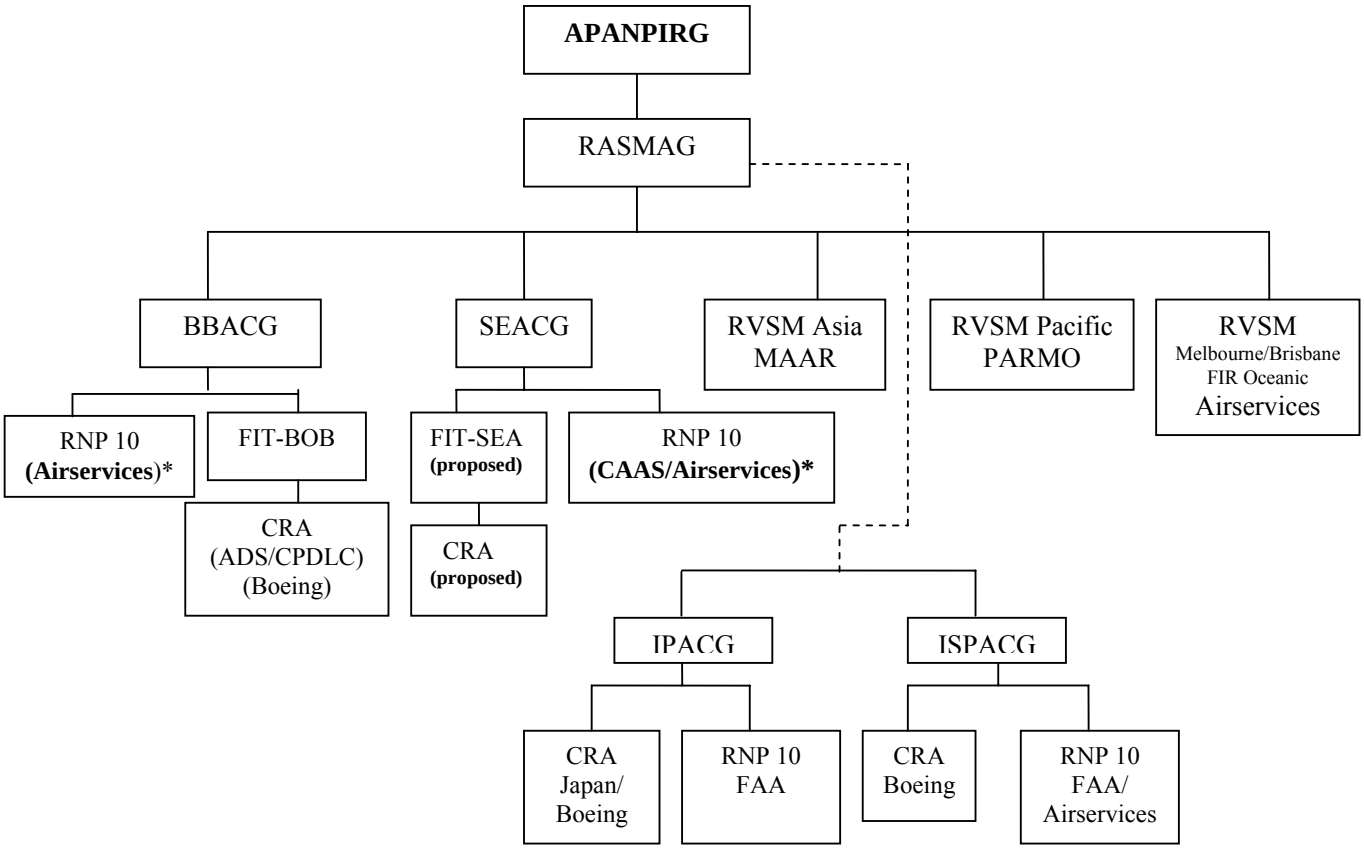
ASIA/PACIFIC AIRSPACE SAFETY MONITORING STRUCTURE



* *Service or service provider to be confirmed or established*

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Safety Assessment for the Proposed EMARSSH Route Structure Where a 50 NM Lateral Separation Minimum is Planned To Be Applied – Lateral Separation on Parallel Tracks

Prepared by
Dr David Anderson
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Summary

This paper provides a safety assessment for the EMARSSH revised ATS Route structure that employs a 50 NM lateral separation minimum between RNP 10 approved aircraft. The safety assessment is carried out for lateral separation on parallel tracks and was completed using traffic movement data from February and March 2002. The paper estimates the effect the re-structure of the ATS routes would have on the lateral occupancy on the parallel tracks and concludes that the Target Level of Safety is likely to be satisfied provided certain limits on gross navigational errors are met.

Introduction

This paper provides a safety assessment for the parallel tracks of the EMARSSH revised ATS route structure where a 50 NM lateral separation minimum between RNP 10 approved aircraft is planned.

The data source for this safety assessment is a sample of aircraft movements collected in February and March 2002. The results of analysing the traffic movement data are presented below.

The traffic movement sample collected in February and March 2002 does not reflect the proposed EMARSSH route re-structure. A new traffic movement sample should be collected to complete the safety assessment once the revised route structure has been implemented.

Background

The standard collision risk model that is used is

$$N_{ay} = P_y(S_y)P_z(0)\frac{\lambda_x}{S_x}\left\{E_y(same)\left[\frac{\overline{|\Delta V|}}{2\lambda_x}+\frac{\overline{|\dot{y}(S_y)|}}{2\lambda_y}+\frac{\overline{|\dot{z}(0)|}}{2\lambda_z}\right]+E_y(opp)\left[\frac{\overline{|V|}}{\lambda_x}+\frac{\overline{|\dot{y}(S_y)|}}{2\lambda_y}+\frac{\overline{|\dot{z}(0)|}}{2\lambda_z}\right]\right\}$$

Table 1 presents the individual parameters used in the risk model, together with their definitions and assumed values. The values have been taken to be the same as in references 2 and 3, where appropriate, since the traffic is likely to be similar, and also allow for the future introduction of RVSM.

Model Parameter	Description	Value
N_{ay}	Number of fatal accidents per flight hour due to loss of lateral separation.	Calculated
S_y	Lateral separation minimum.	50 NM
$P_y(S_y)$	Probability that two aircraft assigned to routes separated by the lateral separation minimum S_y are in lateral overlap.	Calculated (see below)
$P_z(0)$	Probability that two aircraft operating at the same flight level are in vertical overlap.	0.538
λ_x	Average aircraft length.	0.0311 NM
λ_y	Average aircraft wingspan.	0.0282 NM
λ_z	Average aircraft height with undercarriage retracted.	0.0081 NM
S_x	Length of longitudinal window used to calculate occupancy.	120 NM
$E_y(same)$	Same direction lateral occupancy.	Calculated (see below)
$E_y(opp)$	Opposite direction lateral occupancy.	Calculated (see below)
$\overline{\lvert\Delta V\rvert}$	Average relative along-track speed between aircraft on same direction routes separated by the lateral separation minimum.	13 Kts
$\overline{\lvert V\rvert}$	Average absolute aircraft ground speed.	480 Kts
$\overline{\lvert\dot{y}(S_y)\rvert}$	Average absolute relative cross track speed for an aircraft pair that lose all of their assigned lateral separation.	75 Kts
$\overline{\lvert\dot{z}(0)\rvert}$	Average absolute relative vertical speed of an aircraft pair that is assigned to the same flight level on adjacent routes.	1.5 Kts

Table 1. Parameters associated with the Collision Risk Model for the Lateral Dimension.

Lateral occupancy is a measure of the density of traffic on a parallel route system. Lateral occupancy may be defined in terms of proximate pairs.

A pair of aircraft on adjacent parallel routes is said to be proximate if the aircraft cross adjacent fixes at the same level on their respective routes within the longitudinal window, S_x of each other, travelling in either the same direction for same direction occupancy, or in opposite directions for opposite direction occupancy.

Same (Opposite) direction lateral occupancy is defined as twice the number of same (opposite) direction proximate pairs divided by the total number of flights considered in the occupancy estimation.

Unfortunately, when a route structure is revised and new parallel routes introduced, there is no direct way of counting proximate pairs. Therefore, the route structure has been analysed in three main sets of routes. The first set comprises the routes AS3, AS4, AS5, BB3, BB4, and BB5; the second comprises AS1, AS2, BB1, and BB2; and the third comprises BB7, BB8, BB9 and BB10. For each set of routes the same and opposite direction vertical occupancy was calculated and the flow in aircraft per hour was calculated assuming an appropriate number of used levels (see reference 1). For the first set of routes the flow for the revised route structure was divided by three because three routes are essentially replacing one. For the second set of routes the flow was divided by two for a similar reason. Finally, the flow for the third set of routes was taken to be the average of the flows calculated at the waypoints MEPOK, RIBRO, SAGOD, TUNKO and UBCOX.

The same and opposite direction lateral occupancies were then estimated from the various flow figures as in reference 1, assuming a 120 NM longitudinal window. Table 2 presents the results of the calculations.

Route Set	Same Direction Flow	Opposite Direction Flow	Estimated Same Direction Lateral Occupancy	Estimated Opposite Direction Lateral Occupancy
1	0.210	0.120	0.140	0.080
2	0.123	0.075	0.062	0.038
3	0.180	0.320	0.240	0.135

Table 2. Occupancy Estimates for the EMARSSH Route Structure.

The value of $P_y(S_y)$, the probability that two aircraft assigned to routes separated by the lateral separation minimum S_y are in lateral overlap, depends on the core lateral navigational accuracy of the aircraft as well as on the prevalence of gross lateral deviations. It is assumed that the core lateral navigational accuracy is RNP 10, namely that 95 percent of the time the lateral deviations will be within 10NM of the route centreline.

Modelling the overall lateral errors of aircraft by double-double exponential densities, $DDE(y;\alpha,\lambda_1,\lambda_2)$, where λ_1 is related to the RNP value, and assuming that $\lambda_2 = S_y$, as is usually done in lateral collision risk estimation, the maximum permitted value of $P_y(S_y)$

may be calculated so that the Target Level of Safety (TLS) of 5×10^{-9} fatal accidents per flying hour will be met. Reference 5 gives an expression for $P_y(S_y)$, and also gives a relationship between $P_y(S_y)$ and ζ, the probability of a lateral error within 10NM of an adjacent route, and also between $P_y(S_y)$ and η, the probability of a lateral error at least as large as half of the route spacing.

The parameters and other values assumed above give the values in Table xx for the maximum permitted values of $P_y(S_y)$, ζ and η such that N_{ay} will be less than the TLS.

Route Set	Maximum Permitted $P_y(S_y)$	Maximum Permitted ζ	Maximum Permitted η
1	2.27×10^{-8}	6.8×10^{-6}	5.61×10^{-4}
2	2.50×10^{-8}	7.7×10^{-6}	5.65×10^{-4}
3	1.35×10^{-8}	3.5×10^{-6}	4.48×10^{-4}

Table 3. Maximum permitted values of $P_y(S_y)$, ζ and η.

The North Atlantic (NAT) airspace has ζ error probabilities ranging from 6×10^{-5} to 8×10^{-5}. The NAT is, however, not a typical example. Its organised track structure (OTS) is constructed every 12 hours, and pilots are generally forced to enter route coordinates manually. This procedure is particularly error prone, especially since each OTS track is described in terms of waypoints at specified 10 degrees of longitude increments (20°W, 30°W, 40°W, etc).

It is anticipated that the EMARSSH routes will not experience as high gross errors as in the NAT and will be able to meet the TLS.

Conclusion

Provided the gross lateral errors for the EMARSSH routes will be less than those in Table 3 the lateral collision risk will be less than the Target Level of Safety of 5×10^{-9} fatal accidents per flying hour. Because of the fixed nature of the EMARSSH route structure it is expected that these conditions will be met.

References

1. Air Traffic Services Planning Manual, ICAO DOD 9426-AN/924, 1984.

2. "A Preliminary Estimate of Values for the Collision Risk Model Parameters Relating to the Physical Characteristics of Aircraft", IP/11, Twelfth Meeting of the ICAO Reduced Vertical Separation Minimum (RVSM) Implementation Task Force RVSM/TF/12, Denpasar, Indonesia, 10 – 14 September 2001.

3. "A Preview Of The Safety Assessment In The Western Pacific/South China Sea Airspace Where The Reduced Vertical Separation Minimum (RVSM) Is Planned To Be Applied", WP/8, Twelfth Meeting of the ICAO Reduced Vertical Separation Minimum (RVSM) Implementation Task Force RVSM/TF/12, Denpasar, Indonesia, 10 – 14 September 2001.

4. "Initial Estimate of Vertical Occupancy Values For Western Pacific - South China Sea Airspace Where The Reduced Vertical Separation Minimum (RVSM) Is Planned To Be Applied", WP/9, Eleventh Meeting of the ICAO Reduced Vertical Separation Minimum (RVSM) Implementation Task Force RVSM/TF/11, Kuala Lumpur, 30 April – 4 May 2001.

5. "Navigation Requirements for the Implementation of 50-nm Route Spacing in Oceanic Airspace", WP/4, Working Group A Meeting of the ICAO Review of the General Concept of Separation Panel, Annapolis, USA, 6 – 17 November 2000.

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DRAFT RVSM HANDBOOK MINIMUM MONITORING REQUIREMENTS

1. **Monitoring prior to the issue of RVSM approval is not a requirement**. However, operators should be prepared to submit monitoring plans to their State aviation organizations that demonstrate how they intend to meet the requirements specified in the table below. Monitoring will be carried out in accordance with this table, for pre-RVSM implementation after an aircraft has received airworthiness approval, and for post RVSM-implementation, after an aircraft operator has been approved for RVSM operations.

2. Any aircraft type not specified in the table below will most likely be subject to the monitoring requirements as indicated in Category 2. However, this and any other query in respect of monitoring requirements can be clarified by contacting the appropriate Regional Monitoring Agency (RMA).

MONITORING IS REQUIRED IN ACCORDANCE WITH THIS CHART

MONITORING PRIOR TO THE ISSUE OF RVSM APPROVAL IS **NOT** A REQUIREMENT

CATEGORY		**AIRCRAFT TYPE**	**MINIMUM OPERATOR MONITORING FOR EACH AIRCRAFT GROUP**
1	GROUP APPROVED: DATA INDICATES COMPLIANCE WITH THE RVSM MASPS	[A30B, A306], [A312 (GE) A313(GE)], [A312 (PW) A313(PW)], A318, [A319, A320, A321], [A332, A333], [A342, A343], A345, A346 B712, [B721, B722], B732, [B733, B734, B735], B737(Cargo), [B736, B737/BBJ, B738/BBJ, B739], [B741, B742, B743], B74S, B744 (5" Probe), B744 (10" Probe), B752, B753, [B762, B763], B764, B772, B773 CL60(600/601), CL60(604), C560, [CRJ1, CRJ2], CRJ7, DC10, F100, GLF4, GLF5, LJ60, MD10, MD11, MD80 (All series), MD90, T154	10% or Two airframes from each fleet* of an operator to be monitored as soon as possible but not later than 6 months after the issue of RVSM approval and thereafter as directed by the RMA * *Note. For the purposes of monitoring, aircraft within parenthesis [ ] may be considered as belonging to the same fleet. For example, an operator with six A332 and four A333 aircraft may monitor one A332 and one A333* ***or*** *two A332 aircraft* ***or*** *two A333 aircraft.*
2	GROUP APPROVED: INSUFFICIENT DATA ON APPROVED AIRCRAFT	Other group aircraft other than those listed above including: A124, ASTR, B703, B731, BE20,BE40, C500, C25A, C25B, C525, C550**, C56X, C650, C750, CRJ9, [DC86, DC87], DC93, DC95, [E135, E145], F2TH, [FA50 FA50EX], F70, [F900, F900EX], FA20, FA10, GLF2(II), GLF(IIB), GLF3, GALX,, GLEX, H25B(700), H25B(800), H25C, IL62, IL76, IL86, IL96, J328, L101, L29(2), L29(731), LJ31, [LJ35,LJ36], LJ45, LJ55, SBR1, T134, T204, P180, PRM1,YK42	60% of airframes from each fleet of an operator **or** individual monitoring, as soon as possible but not later than 6 months after the issue of RVSM approval and thereafter as directed by the RMA . ** Refer to aircraft group table for detail on C550 monitoring
3	Non-Group	Non-group approved aircraft	100% of aircraft shall be monitored as soon as possible but not later than 6 months after the issue of RVSM approval.

Note:–The above table represents the minimum monitoring requirements; but RMAs may increase these requirements at their discretion.

Applied Monitoring Groups for Aircraft Certified under Group Approval Requirements

Monitoring Group	A/C ICAO	A/C Type	A/C Series
A124	A124	AN-124 RUSLAN	ALL SERIES
A300	A306 A30B	A300 A300	600, 600F, 600R, 620, 620R, 620RF B2-100, B2-200, B4-100, B4-100F, B4-120, B4-200, B4-200F, B4-220, C4-200
A310-GE	A310	A310	200, 200F,300, 300F
A310-PW	A310	A310	220, 220F,320
A318	A318	A318	ALL SERIES
A320	A319 A320 A321	A319 A320 A321	CJ , 110, 130 110, 210, 230 110, 130, 210, 230
A330	A332, A333	A330	200, 220, 240, 300, 320, 340
A340	A342, A343,	A340	210, 310
A345	A345	A340	540
A346	A346	A340	640
A3ST	A3ST	A300	600R ST BELUGA
AN72	AN72	AN-74, AN-72	ALL SERIES
ASTR	ASTR	1125 ASTRA	ALL SERIES
ASTR-SPX	ASTR	ASTR SPX	ALL SERIES
AVRO	RJ1H, RJ70, RJ85	AVRO	RJ70, RJ85, RJ100
B712	B712	B717	200
B727	B721 B722	B727	100, 100C, 100F,100QF, 200, 200F
B732	B732	B737	200, 200C
B737CL	B733 B734 B735	B737	300, 400, 500
B737NX	B736 B737 B738 B739	B737 B737 B737 B737	600 700, 700BBJ 800, BBJ2 900
B737C	B737	B737	700C
B747CL	B741 B742 B743	B747	100, 100B, 100F, 200B, 200C, 200F, 200SF, 300
B74S	B74S	B747	SR, SP
B744-5	B744	B747	400, 400D, 400F (With 5 inch

Monitoring Group	A/C ICAO	A/C Type	A/C Series
			Probes)
B744-10	B744	B747	400, 400D, 400F (With 10 inch Probes)
B752	B752	B757	200, 200PF
B753	B753	B757	300
B767	B762 B763	B767	200, 200EM, 200ER, 200ERM, 300, 300ER, 300ERF
B764	B764	B767	400ER
B772	B772	B777	200, 200ER, 300, 300ER
B773	B773	B777	300, 300ER
BE40	BE40	BEECHJET 400A	ALL SERIES
BE20	BE20	BEECH 200 -KINGAIR	ALL SERIES
C500	C500	500 CITATION, 500 CITATION I, 501 CITATION I SINGLE PILOT	ALL SERIES
C525	C525	525 CITATIONJET, 525 CITATIONJET I	ALL SERIES
C525-II	C25A	525A CITATIONJET II	ALL SERIES
C525 CJ3	C25B	CITATIONJET III	ALL SERIES
C550-552	C550	552 CITATION II	ALL SERIES
C550-B	C550	550 CITATION BRAVO	ALL SERIES
C550-II	C550	550 CITATION II, 551 CITATION II SINGLE PILOT	ALL SERIES
C550-SII	C550	S550 CITATION SUPER II	ALL SERIES
C560	C560	560 CITATION V, 560 CITATION V ULTRA, 560 CITATION V ULTRA ENCORE	ALL SERIES
C56X	C56X	560 CITATION EXCEL	ALL SERIES
C650	C650	650 CITATION III , 650 CITATION VI , 650 CITATION VII	ALL SERIES
C750	C750	750 CITATION X	ALL SERIES
CARJ	CRJ1, CRJ2	REGIONALJET	100, 200, 200ER, 200LR
CRJ-700	CRJ7	REGIONALJET	700
CRJ-900	CRJ9	REGIONALJET	900
CL600	CL60	CL-600 CL-601	CL-600-1A11 CL-600-2A12, CL-600-2B16
CL604	CL60	CL-604	CL-600-2B16
BD100	CL30	CHALLENGER 300	ALL SERIES
BD700	GL5T	GLOBAL 5000	ALL SERIES
CONC	CONC	CONCORDE	ALL SERIES

Monitoring Group	A/C ICAO	A/C Type	A/C Series
DC10	DC10	DC-10	10, 10F, 15, 30, 30F, 40, 40F
DC86-7	DC86, DC87	DC-8	62, 62F, 72, 72F
DC93	DC93	DC-9	30, 30F
DC95	DC95	DC-9	SERIES 51
E135-145	E135, E145	EMB-135, EMB-145	ALL SERIES
F100	F100	FOKKER 100	ALL SERIES
F2TH	F2TH	FALCON 2000	ALL SERIES
F70	F70	FOKKER 70	ALL SERIES
F900	F900	FALCON 900, FALCON 900EX	ALL SERIES
FA10	FA10	FALCON 10	ALL SERIES
FA20	FA20	FALCON 20 FALCON 200	ALL SERIES
FA50	FA50	FALCON 50, FALCON 50EX	ALL SERIES
GALX	GALX	1126 GALAXY	ALL SERIES
GLEX	GLEX	BD-700 GLOBAL EXPRESS	ALL SERIES
GLF2	GLF2	GULFSTREAM II (G-1159),	ALL SERIES
GLF2B	GLF2	GULFSTREAM IIB (G-1159B)	ALL SERIES
GLF3	GLF3	GULFSTREAM III (G-1159A)	ALL SERIES
GLF4	GLF4	GULFSTREAM IV (G-1159C)	ALL SERIES
GLF5	GLF5	GULFSTREAM V (G-1159D)	ALL SERIES
H25B-700	H25B	BAE 125 / HS125	700B
H25B-800	H25B	BAE 125 / HAWKER 800XP, BAE 125 / HAWKER 800, BAE 125 / HS125	ALL SERIES/A, B/800
H25C	H25C	BAE 125 / HAWKER 1000	A , B
IL86	IL86	IL-86	NO SERIES
IL96	IL96	IL-96	M , T, 300
J328	J328	328JET	ALL SERIES
L101	L101	L-1011 TRISTAR	1 (385-1), 40 (385-1), 50 (385-1), 100, 150 (385-1-14), 200, 250 (385-1-15), 500 (385-3)
L29B-2	L29B	L-1329 JETSTAR 2	ALL SERIES
L29B-731	L29B	L-1329 JETSTAR 731	ALL SERIES
LJ31	LJ31	LEARJET 31	NO SERIES, A
LJ35/6	LJ35	LEARJET 35 LEARJET	NO SERIES, A

Monitoring Group	A/C ICAO	A/C Type	A/C Series
	LJ36	36	
LJ40	LJ40	LEARJET 40	ALL SERIES
LJ45	LJ45	LEARJET 45	ALL SERIES
LJ55	LJ55	LEARJET 55	NO SERIES B, C
LJ60	LJ60	LEARJET 60	ALL SERIES
MD10	MD10	MD-10	ALL SERIES
MD11	MD11	MD-11	COMBI, ER, FREIGHTER, PASSENGER
MD80	MD81, MD82, MD83, MD87, MD88	MD-80	81, 82, 83, 87, 88
MD90	MD90	MD-90	30, 30ER
P180	P180	P-180 AVANTI	ALL SERIES
PRM1	PRM1	PREMIER 1	ALL SERIES
T134	T134	TU-134	A, B
T154	T154	TU-154	A , B, M, S
T204	T204, T224, T234	TU-204, TU-224, TU-234	100, 100C, 120RR, 200, C
YK42	YK42	YAK-42	ALL SERIES

Note this list is not considered exhaustive.

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DRAFT GUIDANCE MATERIAL FOR END-TO-END SAFETY AND PERFORMANCE MONITORING OF AIR TRAFIC SERVICE (ATS) DATA LINK SYSTEMS IN THE ASIA/PACIFIC REGION

1. Background

1.1 The Asia Pacific Airspace Safety Monitoring (APASM) Task Force established by the Asia Pacific Air Navigation Planning Implementation Regional Group (APANPIRG) 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), 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 International Civil Aviation Organization (ICAO) ICAO Separation and Airspace Safety Panel (SASP) and was expected to be completed early in 2004. There was no comparable document under development by ICAO for Air Traffic Control data link communication applications. The APASM Task Force agreed that there was a requirement to develop guidance material for the Asia/Pacific Region covering safety and performance monitoring for ATS data link applications, which could also serve as a basis for global guidance.

1.2 The experience gained by the Informal Pacific ATC Coordinating Group (IPACG) and the Informal South Pacific ATS Coordinating Group (ISPACG) FANS Interoperability Teams (FITs) and the supporting Central Reporting Agency (CRA) to monitor automatic dependent surveillance (ADS) and controller pilot data link communications (CPDLC) performance for both aircraft and ground systems, was used as a resource on which to develop monitoring guidance material.

2. Purpose of Guidance Material

2.1 The purpose of this guidance material is to provide a set of working principles common to all States implementing ATS data link systems. The guidance material is also intended to provide assist with detailed guidance on the requirements for establishing and operating a FIT. It is intended that this guidance material will help promote a standardized approach for implementation within the Region. This information will also help to promote interchange of information among different Regions to support common operational monitoring procedures.

3. Description of an ATS Data Link Regional Monitoring Agency

3.1 Unlike many other systems, the technologies adopted to provide ATS data link functionality exist in several different domains (e.g. aircraft, space, ground network, air traffic service units, human factors) and the elements in all domains must be successfully integrated. Avionic and ground equipment from many different vendors, as well as the sub-systems of several different communication networks, must inter-operate to provide the required end-to-end system performance. In addition, procedures must be coordinated among many different airlines and countries to provide the desired operational performance. Technical and operational elements must then coalesce to allow the environment to demonstrate mature and stable performance. Only then can essential benefits be realized.

3.2 Realization that an interoperability team approach was essential to the success of any ATS data link implementation was an important lesson learned by the ISPACG, who first implemented CNS/ATM applications using FANS 1/A systems. Stakeholders had worked together well during the

initial development and subsequent certification of FANS-1/A. ISPACG members expected benefits from FANS-1/A soon after in-service operations began even though a problem-reporting system was in place when FANS-1/A operations commenced, many problems went unresolved and it was not immediately possible to adopt the new operational procedures that would result in higher traffic capacity and more economic routes. Therefore, a FANS Interoperability Team was formed to address both technical and procedural issues and help to ensure that benefits would result. However, the ISPACG also realized that a traditional industry team approach would not be effective. Daily attention and/or significant research were required if the many issues were to be adequately resolved. To address these concerns, the FIT created a dedicated sub-team, the CRA, to perform the daily monitoring, coordination, testing, and problem research tasks outlined by the FIT. This approach is similar to that taken for RVSM implementations where supporting groups provide aircraft height keeping monitoring services.

3.3 Although the monitoring process described above was first developed for FANS-1/A based CPDLC and ADS applications the monitoring process is identical for Aeronautical Telecommunications Network (ATN) based ATS applications as well. This was validated during the Preliminary Eurocontrol Test of Air/ground data Link (PETAL) implementation of ATN based ATS data link services in Maastricht Area Control Center.

3.4 The principal members of an interoperability team are the major stakeholders of the systems that must interoperate to achieve the desired system performance and end-to-end operation. In the case of ATS data link systems, such as FANS-1/A or ATN, the major stakeholders are aircraft operators, ATS providers, communications network service providers, and airframe manufacturers. Other stakeholders such as regulators, pilot and controller associations, as well as international organizations, also play an important role.

3.5 Interoperability teams should be established to oversee the problem reporting and end-to-end system performance monitoring processes. They monitor system performance for a given region and act on reported problems. Any safety-related issues discovered by the team should be referred to the appropriate State or regulatory authorities for action. These processes were designed to ensure that the ATS data link systems meet established performance and interoperability requirements and to confirm that operations and procedures are working as planned. As a result of these aims and of subsequent evolution, the terms of reference for an interoperability team monitoring ATS data link systems are the following:

Problem Identification and Resolution

- establishing a problem reporting system;
- reviewing de-identified problem reports, and determining appropriate resolution;
- identifying trends;
- developing interim operational procedures to mitigate the effects of problems until such time as they are resolved;
- monitoring the progress of problem resolution; and
- preparing summaries of problems encountered and their operational implications for regional dissemination.

System Performance

- determining and validating system performance requirements;
- establishing a system performance monitoring system;
- assessing system performance based on information in CRA monthly reports;
- authorizing and coordinating system testing;
- identifying accountability for each system element. Developing, documenting and implementing a quality assurance plan that will provide a path to a more stable system, and
- identifying configurations of the end-to-end system that provide acceptable data link performance, and ensuring that such configurations are maintained by all stakeholders.

Achieving Benefits

- formulating plans for long-term procedural enhancements that take advantage of ATS data link benefits;
- coordinating testing in support of implementation of enhanced operational procedures such as:
  - reduced separation;
  - Dynamic Airborne Route Planning (DARP) procedures, such as those which have been implemented on South Pacific routes providing some of the first tangible benefits from FANS-1/A; and
  - user-preferred routing, in which operators define their own flexible tracks, promises to provide greater incremental economic benefits than DARP.

Note. — Benefits available from ATS data link systems will differ from region to region. The benefits listed above are an example of benefits being sought by the South Pacific FIT.

Reporting

- providing annual summary reports to appropriate steering groups; and
- Forward reports from the FIT to other interested industry teams.

4. CRA Description

4.1 In order for an interoperability team to achieve its important goals of problem resolution, system performance assurance, and planning and testing of operations that will enable benefits, work must be done on a daily basis. To address these concerns a dedicated sub-team, such as the CRA, is required to do the daily monitoring, coordination, testing, and problem research tasks outlined by the terms of reference for the interoperability team.

4.2 CRA Resource Requirements

4.2.1 To be effective, the CRA must have two main components: dedicated staff and adequate tools. Staffing requirements will vary depending on the complexity of the region being monitored. There are several factors that affect regional complexity from an ATS monitoring standpoint such as dimensions of the airspace, variety in operating procedures, number of airlines, number of different airborne equipment variants, number of air traffic service providers, number of different ground equipment variants and number of communications network service providers.

4.2.2 The CRA must have the tools to be able to simulate an ATS ground station to the extent of exercising all combinations and ranges of CPDLC uplinks and ADS reports. The CRA must also have

access to airborne equipment. For the airborne side, a test bench is adequate; however, engineering simulators that can be connected to either the ARINC or SITA communication network can offer additional capability. In support of the data link audit analysis task, the CRA must have software that can decode data link service provider audit data and produce usable reports. Without these tools it is virtually impossible for a CRA to resolve problems or monitor system performance.

4.2.3 Coordination is also a large part of the CRA's job. In the pursuit of problem resolution, action item resolution, monitoring, and testing, many issues arise that require coordination among many stakeholders. The CRA has the primary responsibility to provide this coordination function as delegated by the interoperability team.

4.3 CRA Task and Resource Requirements Table

4.3.1 Following is a list of CRA tasks and associated resource requirements.

CRA Task	**Resource Requirement**
• Manage data confidentiality agreement with all FIT members who provide problem reports	Legal services, technical expertise

• Develop and administer problem report process
  • de-identify all reports
  • enter de-identified reports into a data base
  • keep the identified reports for processing
  • request audit data from data link service providers
  • assign responsibility for problem resolution where possible
  • analyze the data
• Identify trends
	Problem reporting data base, ATS audit decode capability, airborne test bench as a minimum, simulator highly recommended, ATS simulation capability (CPDLC and ADS)

• Schedule, coordinate procedures testing	Airborne test bench as a minimum, simulator capability highly recommended, ATS simulation capability (CPDLC and ADS), ATS audit decode and report capability, technical expertise, operational expertise
• Administer and monitor an informal end-to-end configuration process.	Technical expertise
• Develop (as recommendations) new end-to-end system performance requirements.	Technical expertise, operational expertise
• Receive, decode, and process monthly end-to-end system performance reports from the air traffic service providers	Database tools, technical expertise
• Coordinate and test the implementation of proposed benefit enhancing procedures resulting from ATS data link systems for a given region (i.e. Dynamic Airborne Route Planning and or User Preferred Routes)	Technical expertise, operational expertise

5. Standards for Establishment and Operation of an ATS Data Link FIT and CRA

5.1 Recognizing the safety oversight responsibilities necessary to support the implementation and continued safe use of ATS data link systems, the following standards apply to any organization intending to fill the role of an FIT:

a) the organization must receive authority to act as an FIT as the result of a decision by a State, a group of States or a regional planning group, or by regional agreement;

b) the organization acting as an FIT should appoint a CRA the has the required tools and personnel with the technical skills and experience to carry out the following CRA functions:

1. develop and administer problem report process;
2. de-identify all reports;
3. enter de-identified reports into a database;
4. keep the identified reports for processing;
5. request audit data from data link service providers;
6. assign responsibility for problem resolution where possible;
7. analyze the data;
8. receive, decode, and process monthly end-to-end system performance reports from the air traffic service providers;
9. coordinate and test the implementation of proposed benefit enhancing procedures resulting from ATS data link systems for a given region;
10. administer and monitor an informal end-to-end configuration process;
11. manage data confidentiality agreements with all RMA members who provide problem reports, and
12. identify trends.

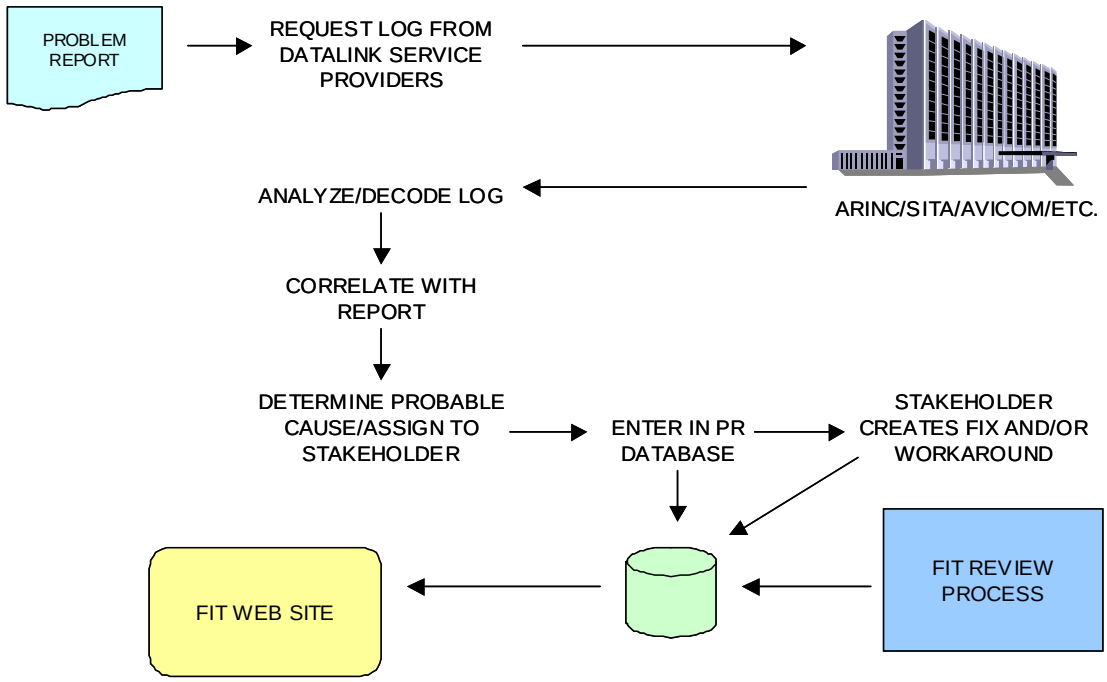
c) the FIT should ensure that the CRA is adequately funded to carry out their required functions.

6. Working Principles Common to all Interoperability Team Agencies

6.1 As stated, the intent of this guidance material is to introduce a common set of working principles for FITs. These principles have been agreed as the result of the combined experience of the North Atlantic FANS Implementation Group, South Pacific FANS Interoperability Team, Pacific FANS Interoperability Team, the FANS Action Team for the Bay of Bengal, and the ATN implementation in Maastricht ACC.

6.2 Problem Identification and Resolution

6.2.1 The problem identification and resolution process, as it applies to an individual problem, consists of a data collection phase, followed by problem analysis and coordination with affected parties to secure a resolution, and interim procedures to mitigate the problem in some instances. This is shown in the diagram below.



6.2.2 The problem identification task begins with receipt of a report from a stakeholder, usually an operator, ATS provider or communication service provider. If the person reporting the problem has used the problem reporting form provided in the appropriate regional manual, then data collection can begin. If not, additional data may have to be requested from the person reporting the problem.

6.2.3 The data collection phase consists of obtaining message logs from the appropriate parties (which will depend on which service providers were being used and operator service contracts). Today, this usually means obtaining logs for the appropriate period of time from ARINC and SITA (occasionally other service providers, such as AVICOM and AEROTHAI will be involved), but in future, with ATN development, additional providers (which should comply with EUROCAE ED-111), will become involved and airborne recordings should become available (as per EUROCAE ED-112). Usually, a log for a few hours before and after the event that was reported will suffice, but once the analysis has begun, it is sometimes necessary to request additional data, (sometimes for several days prior to the event if the problem appears to be an on-going one).

6.2.4 Additionally, some airplane specific recordings may be available that may assist in the data analysis task. These are not always requested initially as (doing so would be an unacceptable imposition on the operators), but may occur when the nature of the problem has been clarified enough to indicate the line of investigation that needs to be pursued. These additional records include:

- aircraft maintenance system logs;
- Built In Test Equipment data dumps for some airplane systems; and
- SATCOM activity logs.

6.2.5 Logs and printouts from the flight crew and recordings/logs from the ATS provider (s) involved in the problem may also be necessary. It is important that the organization collecting data for the analysis task requests all this data in a timely matter, as much of it is subject to limited retention.

6.2.6 Once the data has been collected, the analysis can begin. For this, it is necessary to be able to decode all the message types involved. Obviously, a tool that can decode all the ATS data link messages of the type used in that region is necessary. These tools would include:

- AFN (ARINC 622), ADS and CPDLC (RTCA DO-258/EUROCAE ED-100) in a region operating FANS-1/A;
- Context Management, ADS and CPDLC applications ICAO Doc 9705 and RTCA DO-280/ED-110) in a region using ATN; and
- FIS or ARINC 623 messages used in the region.

6.2.7 Once the messages have been decoded, the analysis requires a thorough understanding of the complete message traffic, including:

- media management messages;
- relationship of ground-ground and air-ground traffic; and
- message envelope schemes used by the particular data link technology (ACARS, ATN, etc).

6.2.8 It is also important for the analyst to have a good understanding in how the aircraft systems operate and interact to provide the ATS data ink functions, as many of the reported problems are airplane system problems.

6.2.9 All this information will enable the analyst to determine a probable cause by working back from the area where the problem was noticed to where it began. In some cases, this may entail manual decoding of parts of messages based on the appropriate standard to identify particular encoding errors. It may also require lab testing using the airborne equipment (and sometimes the ground networks) to reliably assign the problem to a particular cause.

6.2.10 Once the problem has been identified, then the task of coordination with affected parties begins. The stakeholder who is assigned responsibility for fixing the problem must be contacted, and a corrective action plan agreed.

6.2.11 This information (the problem description, the results of the analysis, and the plan for corrective action) is then entered in a database covering data link problems, both in a complete form to allow continued analysis and monitoring of the corrective action, as well as in a de-identified form for the information of other stakeholders. These de-identified summaries are reported at the appropriate regional management forum.

6.2.12 The CRA's responsibility does not end with determining the cause of the problem and identifying a fix. As part of that activity, procedural methods to mitigate the problem may have to be developed while the solution is being coordinated (software updates to a fleet may take a considerable period before all aircraft have the fix).

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DRAFT

REPORT TO THE REGIONAL AIRSPACE SAFETY MONITORING ADVISORY GROUP

Reporting Agency	
Monitoring Function (vertical/horizontal separation, ATS data link, etc.)	
Geographic Area(s) of Responsibility	
Period of Report	
Data Sources	
Data Collection Summary (Large height deviations, gross/lateral navigational deviations, problem reports, etc.)	
Target Level of Safety/Performance Requirements	
Summary of Analysis	
Operational Issues/Mitigating Factors	
Collision Risk Estimate/Observed Performance	
Conclusions/Recommendations	
Supporting Documentation (Appendices)	

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ACTION ITEMS

Item No	Item Description	Start Date	Reference	Action By	Target Date	Status
1	Amend the Terms of Reference for RASMAG	30/4/04	RASMAG/1 Report, para 2.7	Secretariat	1/10/04	OPEN
2	Coordinate with IPACG/ISPACG to formalise reporting from CRAs/FITs direct to RASMAG	30/4/04	RASMAG/1 Report, para 3.11	Secretariat L. McCormick	1/6/04	OPEN
3	Review draft guidance material for End-to-End datalink systems performance monitoring	30/4/04	RASMAG/1 WP/10	All members, Secretariat	1/10/04	OPEN
4	Facilitate the required RVSM reporting to RASMAG from Australian RMA	30/4/04	RASMAG/1 Report, para 3.8	R. Butcher	1/6/04	OPEN
5	Coordinate by letter to ALL RMAs, CRAs and FITs requesting safety assessment and monitoring reports as per the reference. Draft to be circulated to members of RASMAG prior to despatch.	30/4/04	RASMAG/1 Report, para 9.11	Secretariat	1/6/04	OPEN
6	Coordinate by letter to ALL States in Asia/Pac reminding them of their responsibilities with regards to safety assessments, monitoring and follow-up as per the reference. Draft to be circulated to members of RASMAG prior to despatch.	30/4/04	RASMAG/1 Report, para 8.7	Secretariat	1/6/04	OPEN
7	Monitor outcome of FLOS discussions at next RVSM TF meeting and report back to RASMAG	30/4/04	RASMAG/1 Report, para 5.13	Secretariat	1/10/04	OPEN
8	Develop generic reporting template for use by RMAs and other bodies to report RVSM, RNP and Data link monitoring activity to RASMAG and instructions.	30/4/04	RASMAG/1 Report, para 9.10	All members	1/6/04	OPEN
9	Facilitate safety workshop for States as add-on activity to the next RASMAG meeting.	30/4/04	RASMAG/1 Report, para 8.5	Secretariat, All members	1/8/04	OPEN
10	Review regional and global airspace and ATM implementation plans to identify requirements for airspace safety monitoring and assessment activities.	30/4/04	TOR	All members, Secretariat	1/10/04	OPEN
11	Provide update on reporting by States of safety data for airspace safety monitoring programmes.	30/4/04	RASMAG/1 Report, para 8.4	Secretariat	1/10/04	OPEN

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