

INTERNATIONAL CIVIL AVIATION ORGANIZATION



**REPORT OF THE TWENTY-EIGHTH MEETING OF THE REGIONAL
AIRSPACE SAFETY MONITORING ADVISORY GROUP
(RASMAG/28)**

BANGKOK, THAILAND, 21 – 24 AUGUST 2023

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

Approved by the Meeting
and published by the ICAO Asia and Pacific Office, Bangkok

RASMAG/28
Table of Contents

CONTENTS

| | |
|----------------------------------------------------------------------------------------------------|-----|
| INTRODUCTION | iii |
| Meetings..... | iii |
| Attendance | iii |
| Opening of the Meeting | iii |
| Documentation and Working Language | iii |
| Draft Conclusions, Draft Decisions and Decisions of RASMAG – Definition | iv |
| List of Draft Conclusions/Decisions and Draft Decision/Decisions | iv |
| REPORT ON AGENDA ITEMS – RASMAG/28 | 1 |
| Agenda Item 1: Election of Chair / Adoption of Agenda | 1 |
| Agenda Item 2: Review Outcomes of Related Meetings | 1 |
| Agenda Item 3: Reports from Asia/Pacific RMAs and EMAs | 7 |
| Agenda Item 4: Airspace Safety Monitoring Documentation and Regional Guidance Material..... | 31 |
| Agenda Item 5: Airspace Safety Monitoring Activities/Requirements in the Asia/Pacific Region | 33 |
| Agenda Item 6: Air Navigation Services Deficiencies | 41 |
| Agenda Item 7: Review and Update RASMAG Task List | 42 |
| Agenda Item 8: Any Other Business..... | 42 |
| Agenda Item 9: Date and Venue of the Next RASMAG Meeting..... | 42 |

RASMAG/28
Table of Contents

APPENDIXES TO THE REPORT

| | | |
|-------------|-----------------------------------------------------------------------------------|-----|
| Appendix A: | List of Participants | A-1 |
| Appendix B: | List of Papers | B-1 |
| Appendix C: | EMA handbook version 3.0 | C-1 |
| Appendix D: | Revised PBCS Action List for ANSPs | D-1 |
| Appendix E: | Asia Pacific Flight Information Region and Responsible Monitoring Agency | E-1 |
| Appendix F: | Asia/Pacific Consolidated Safety Report..... | F-1 |
| Appendix G: | Competent Airspace Safety Monitoring Organizations List..... | G-1 |
| Appendix H: | ATM and Airspace Safety Deficiencies List | H-1 |
| Appendix I: | RASMAG Task List | I-1 |

.....

INTRODUCTION

Meetings

1.1 The Twenty-Eighth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/28) was held from 21 to 24 August 2023, at the ICAO Asia and Pacific Regional Office in Bangkok, Thailand.

Attendance

2.1 The meeting was attended by 65 participants from 18 States, one Special Administrative Region of China, and three International Organizations including Australia, Brunei Darussalam, Cambodia, China, Hong Kong China, India, Indonesia, Japan, Lao PDR, Malaysia, Mongolia, New Zealand, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand, United States of America, Viet Nam, IATA, IFALPA and ICAO.

2.2 The List of Participants is at **Appendix A** to this Report.

Officers and Secretariat

3.1 Ms. Saifon Obromsook, Director of Safety Management Department, AEROTHAI, chaired the meeting.

3.2 Mr. Weng Kit Ying, ATM Officer and Mr. Shane Sumner, Regional Officer, Pacific Small Island Developing States (PSIDS) Liaison Officer, ICAO Asia and Pacific Office, were Secretaries of the RASMAG/28 meeting. They were assisted by Mr. Hiroyuki Takata, Regional Officer, ATM, and Dr. Prakayphet Chalayonnawin, Programme Analysis Associate, ATM.

Opening of the Meeting

4.1 Ms. Saifon Obromsook welcomed participants to the meeting.

4.2 On behalf of Mr. Tao Ma, Regional Director of ICAO Asia and Pacific Office, Mr. Weng Kit Ying welcomed all participants.

Documentation and Working Language

5.1 English was used as the working language for the meeting and for all documentation.

Note: airspace safety estimates in this report are measured in terms of fatal accidents per flight hour (fapfh).

5.2 A total of 38 Working Papers (WPs), ten Information Papers (IPs) and two Flimsies were presented to the meeting.

5.3 The List of Papers is at **Appendix B** to this Report.

5.4 **DISCLAIMER:** The presentation of material in this report does not imply the expression of any opinion whatsoever on the part of ICAO, APANPIRG or the RASMAG of APANPIRG concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

Conclusions, Draft Conclusions, Draft Decisions and Decisions of RASMAG – Definition

6.1 RASMAG recorded its actions in the form of Draft Conclusions, Draft Decisions and Decisions within the following definitions:

- a) **Draft Conclusions** of RASMAG related to matters that are not just of a purely technical or operational nature, which need to be considered by APANPIRG;
- b) **Conclusions** of RASMAG related to matters of a purely technical or operational nature, which APANPIRG had delegated authority to RASMAG to act upon;
- c) **Draft Decisions** related solely to matters dealing with the internal working arrangements of the RASMAG, which need to be considered by APANPIRG; and
- d) **Decisions** of RASMAG that related solely to matters dealing with the internal working arrangements of the RASMAG, which APANPIRG had delegated authority to RASMAG to act upon.

List of Draft Conclusions, Conclusions, Draft Decisions and Decisions

7.1 List of Draft Conclusions

| Draft Conclusion RASMAG/28-1: Formal Service Arrangements with CRA | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| What: That, States are urged to ensure that formal service arrangements are made with an APANPIRG-recognized, competent Central Reporting Agency for the submission and analysis of data link problem reports. | Expected impact: <input type="checkbox"/> Political / Global <input type="checkbox"/> Inter-regional <input checked="" type="checkbox"/> Economic <input type="checkbox"/> Environmental <input checked="" type="checkbox"/> Ops/Technical |
| Why: To ensure States meet their obligations for data link performance monitoring and analysis in accordance with Annex 6 Part I 7.1.5 and 7.3.4, and Annex 11 2.29 and 3.3.5.2 | Follow-up: <input checked="" type="checkbox"/> Required from States |
| When: 13-Dec-23 | Status: Draft to be adopted by PIRG |
| Who: <input checked="" type="checkbox"/> Sub groups <input checked="" type="checkbox"/> APAC States <input type="checkbox"/> ICAO APAC RO <input type="checkbox"/> ICAO HQ <input checked="" type="checkbox"/> Other: APANPIRG | |

RASMAG/28
History of the Meeting

7.2 List of Conclusions

| | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Conclusion RASMAG/28-2: Revised Survey of the Status of Current and Planned Implementation of Performance-Based Separation Minima | |
| <p>What: That, the revised <i>Survey of the Status of Current and Planned Implementation of Performance-Based Separation Minima</i> at RASMAG/28 WP/2 Attachment B be uploaded to the ICAO Asia/Pacific Regional Office website to replace the existing form.</p> | <p>Expected impact:</p> <input type="checkbox"/> Political / Global <input type="checkbox"/> Inter-regional <input type="checkbox"/> Economic <input type="checkbox"/> Environmental <input checked="" type="checkbox"/> Ops/Technical |
| <p>Why: To rationalize and simplify the survey questions</p> | <p>Follow-up: <input checked="" type="checkbox"/> Required from States</p> |
| <p>When: 24-Aug-23</p> | <p>Status: Adopted by Subgroup</p> |
| <p>Who: <input checked="" type="checkbox"/> Sub groups <input checked="" type="checkbox"/> APAC States <input type="checkbox"/> ICAO APAC RO <input type="checkbox"/> ICAO HQ <input type="checkbox"/> Other: Aircraft operators</p> | |

| | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Conclusion RASMAG/28-3: Guidance Material for the Continued Safety Monitoring of the Asia Pacific RVSM Airspace Version 2 | |
| <p>What: That,</p> <ol style="list-style-type: none"> 1. the Guidance Material for the Continued Safety Monitoring of the Asia Pacific RVSM Airspace Version 2 be adopted; and 2. the Guidance Material Version 2 be uploaded to the ICAO APAC website to replace the existing version. | <p>Expected impact:</p> <input type="checkbox"/> Political / Global <input type="checkbox"/> Inter-regional <input type="checkbox"/> Economic <input type="checkbox"/> Environmental <input checked="" type="checkbox"/> Ops/Technical |
| <p>Why: To update the Guidance Material to include current practices of the RASMAG, contents from the LHD Material Package, recent APANPIRG conclusions and decisions since its first publication in 2019.</p> | <p>Follow-up: <input type="checkbox"/> Required from States</p> |
| <p>When: 24-Aug-23</p> | <p>Status: Adopted by Subgroup</p> |
| <p>Who: <input checked="" type="checkbox"/> Sub groups <input checked="" type="checkbox"/> APAC States <input type="checkbox"/> ICAO APAC RO <input type="checkbox"/> ICAO HQ <input checked="" type="checkbox"/> Other: APAC RMAs</p> | |

| Conclusion RASMAG/28-4: Removal of EMA handbook Appendix A and Guidance for PBCS Non-Compliance Reporting | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>What: That,</p> <p>1. the removal of EMA Handbook Appendix A - Asia Pacific Flight Information Regions and Responsible Monitoring Agency (RASMAG/28 WP/22 refers); and</p> <p>2. the additional guidance for PBCS Non-compliance reporting;</p> <p>be included in amendments to the following:</p> <p style="padding-left: 40px;">a) The Revised EMA Handbook at Appendix C to the Report;</p> <p style="padding-left: 40px;">b) Revised PBCS Action List at Appendix D to the Report; and</p> <p style="padding-left: 40px;">c) The Asia Pacific Flight Information Regions and Responsible Monitoring Agency document at Appendix E to the Report;</p> <p>3. the above-mentioned documents be uploaded to replace the previous versions; and</p> <p>4. states/Administrations are urged to submit timely reports including Nil reports.</p> | <p>Expected impact:</p> <p><input type="checkbox"/> Political / Global</p> <p><input type="checkbox"/> Inter-regional</p> <p><input type="checkbox"/> Economic</p> <p><input checked="" type="checkbox"/> Environmental</p> <p><input checked="" type="checkbox"/> Ops/Technical</p> |
| <p>Why: Lack of a standardized implementation of non-compliance reporting practices would become universally adopted and consistent reporting among the States and RMAs.</p> | <p>Follow-up: <input checked="" type="checkbox"/> Required from States</p> |
| <p>When: 24-Aug-23</p> | <p>Status: Adopted by Subgroup</p> |
| <p>Who: <input checked="" type="checkbox"/> Sub groups <input checked="" type="checkbox"/> APAC States <input checked="" type="checkbox"/> ICAO APAC RO <input type="checkbox"/> ICAO HQ <input checked="" type="checkbox"/> Other: Regional Monitoring Agencies</p> | |

| Conclusion RASMAG/28-5: Survey for Asia Pacific States PBCS Approval Process | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>What: That, ICAO conducts a survey seeking information to better understanding by RASMAG and FIT-Asia of the PBCS approval process of APAC member states to ensure the PBCS approvals issued are in accordance with Annex 6 and PBCS manual Doc 9869 chapter 4.</p> | <p>Expected impact:</p> <p><input type="checkbox"/> Political / Global</p> <p><input type="checkbox"/> Inter-regional</p> <p><input type="checkbox"/> Economic</p> <p><input type="checkbox"/> Environmental</p> <p><input checked="" type="checkbox"/> Ops/Technical</p> |
| <p>Why: Only some APAC States have indicated using direct Operational Approval Process for PBCS and it is unclear what other process are employed.</p> | <p>Follow-up: <input checked="" type="checkbox"/> Required from States</p> |
| <p>When: 8-Sep-23</p> | <p>Status: Adopted by Subgroup</p> |
| <p>Who: <input type="checkbox"/> Sub groups <input checked="" type="checkbox"/> APAC States <input type="checkbox"/> ICAO APAC RO <input type="checkbox"/> ICAO HQ <input type="checkbox"/> Other:</p> | |

7.3 List of Draft Decisions

Nil.

7.4 List of Decisions

Nil

REPORT ON AGENDA ITEMS – RASMAG/28

Agenda Item 1: Election of Chair and Vice-Chair/Adoption of Agenda

Election of Chair

1.1 Ms. Saifon Obromsook, Director of Safety Management Department, AEROTHAI was re-elected as the Chair of the RASMAG meeting. Ms Christine Falk, Senior Operations Research Analyst, USA (FAA) was elected as Vice-Chair.

1.2 The provisional agenda (WP/1) was adopted by the meeting. The meeting noted IP/01 (List of Working and Information Papers).

Agenda Item 2: Review Outcomes of Related Meetings

FIT-Asia Meeting Outcomes (WP/2)

2.1 The Thirteenth Meeting of the FANS Interoperability Team-Asia (FIT-Asia/13) was held in Bangkok, Thailand from 06 to 09 June 2023.

2.2 FIT-Asia/13 had been provided with updated information on the status of Asia/Pacific engagement in data link problem reporting through the FANS-CRA website, and performance analysis reporting to a recognized FIT. All Asia/Pacific States that provide data link services had registered on the FANS-CRA website. **Table 1** recorded the submission of PRs through the website in 2023 (calendar year).

| State | # PR 2023 (to 28 May) | Performance Analysis Reports to FIT |
|------------------------------|--------------------------|-------------------------------------------|
| Australia | 1 | YES |
| China | 0 | YES ¹ |
| Fiji | 0 | YES |
| France (Polynésie Française) | 0 | YES |
| India | 0 | YES ² |
| Indonesia | 0 | YES ³ |
| Japan | 3 | YES |
| Malaysia | 1 | YES ⁴ |
| Myanmar | 0 | YES |
| Maldives | 0 | NO |
| Papua New Guinea | 4 | NO |
| Philippines | 0 | YES |

¹ Lanzhou and Urumqi FIRs

² Chennai and Kolkata FIRs.

³ Ujung Pandang FIR.

⁴ Kuala Lumpur FIR.

RASMAG/28
Report of the Meeting

| State | # PR 2023 (to 28 May) | Performance Analysis Reports to FIT |
|-------------|--------------------------|-------------------------------------------|
| New Zealand | 4 | YES |
| Singapore | 16 | YES |
| Sri Lanka | 0 | YES |
| USA | 7 | YES |
| Viet Nam | 3* | YES |

Table 1: Submission of PRs to FANS-CRA and Performance Analysis Reports to FIT

2.3 States/Administrations were invited to double-check the data before submission each year to avoid format errors and consistency issues.

2.4 FIT-Asia/13 was informed that the CRA could not thoroughly investigate some PRs because the dates of poor performance occurred too long before the PRs were submitted for relevant Communications Service Provider (CSP) and avionics logs to be available. Since CSP and avionics logs would be available for a limited period of time, Air Navigation Service Providers (ANSPs) were urged to take necessary actions promptly, including submitting PR.

2.5 The CRA also informed the FIT-Asia/13 meeting that multiple recent PRs in various areas were caused by problems with aftermarket retrofit avionics that aircraft operators installed without aircraft manufacturer involvement. In these cases, the responsibility to investigate and resolve the problems should be primarily on the aircraft operator and its avionics supplier, although the aircraft manufacturer would provide support as appropriate. In response to a query, FIT-Asia/13 was informed that IPACG and ISPACG had yet to discuss the matter at their meetings. FIT-Asia would discuss it further at future meetings.

Establishment of service agreement with the APANPIRG-recognized CRA

2.6 The FIT-Asia/13 meeting was informed that since the beginning of 2023, the CRA had no contract in place for its services in the Bay of Bengal and Arabian Sea areas. Accordingly, the CRA closed six new PRs in those areas without investigating them. Given that the PRs all involved Boeing aircraft, however, the CRA recommended to the PR originator to report the problems directly to Boeing for investigation. A side meeting was held to discuss the matter with the concerned State, the CRA, IATA and ICAO.

2.7 The RASMAG List of Competent Airspace Safety Monitoring Organizations (Last updated 25 July 2022) was reviewed and updated by FIT-Asia/13. The FIT-Asia/13 meeting was informed that ICAO had learned that not all FIT-Asia member administrations had formal service agreements with APANPIRG-recognized CRAs. **Table 2** shows the current formal CRA service agreements.

| | APANPIRG- recognized CRA | Scope of application | formal service agreement |
|----------------------------------|-----------------------------|------------------------------------------------|-----------------------------|
| IPACG, ISPACG (United States) | CRA Boeing | IPACG States, ISPACG States, and NAT States | Yes |
| Japan | CRA Japan | Japan | Yes |

* Unable to investigate due to lack of necessary information.

RASMAG/28
Report of the Meeting

| | APANPIRG-recognized CRA | Scope of application | formal service agreement |
|--------------------|--------------------------------|-------------------------------------|---------------------------------|
| SEASMA (Singapore) | CRA Boeing | Singapore, Philippines and Viet Nam | Yes |
| India | CRA Boeing | India | Yes (Not for 2023) |

Table 2: Current formal CRA service agreements

2.8 Subsequent to the FIT-Asia/13 meeting, ICAO reviewed the situation and considered that, given the importance of data link problem reporting in States' performance monitoring obligations under Annex 6 Operation of Aircraft Part 1⁵ and Annex 11 Air Traffic Services⁶, the following Draft Conclusion be considered:

Draft Conclusion RASMAG/28-1: Formal Service Arrangements with CRA

That, States are urged to ensure that formal arrangements are made with an APANPIRG-recognized, competent Central Reporting Agency for the submission and analysis of data link problem reports.

2.9 The meeting was informed that India was awaiting decision from the AAI headquarters to finalise the matter of engaging Boeing for CRA service.

PBCS Global Charter

2.10 FIT-Asia/13 was reminded that the Performance-Based Communications and Surveillance (PBCS) Implementation Strategy for the APAC Regions, and the PBCS Action List for ANSPs, urged all ANSPs using PBCS to support ATM operations to sign up to the PBCS Global Charter.

2.11 The FIT-Asia/13 meeting was also reminded that the PBCS Charter was not intended to be a long-term solution. It was provided as a PBCS performance specification option in place of or in addition to contractual agreements with CSPs. Therefore, ANSPs and Aircraft Operators were urged to sign up for the Charter as the most effective means and approach to monitor CSP compliance, which was an essential PBCS component.

Review of Annual PBCS Survey of the Implementation of Performance-based Horizontal Separation Minima

2.12 The Survey of the Status of Current and Planned Implementation of Performance-based Horizontal Separation Minima form had been amended to reflect the current separation minima in the *Procedures for Air Navigation Services – Air Traffic Management* (PANS ATM – Doc 4444) at FIT-Asia/12 in 2022.

2.13 FIT-Asia/13 was informed that some items in section 4 of the survey form might require clarification because the current and planned status were mixed in the survey. In addition, there were some editorial errors in the form.

⁵ Annex 6 Part I 7.1.5 and 7.3.4

⁶ Annex 11 2.29 and 3.3.5.2

RASMAG/28
Report of the Meeting

2.14 The meeting agreed the following Conclusion, drafted by FIT-Asia/13.

Conclusion RASMAG/28-2: Revised Survey of the Status of Current and Planned Implementation of Performance-Based Separation Minima

That, the revised *Survey of the Status of Current and Planned Implementation of Performance-Based Separation Minima* at **RASMAG/28 WP/02 Attachment B** be uploaded to the Asia/Pacific Regional Office to replace the existing form.

Asia/Pacific Region Combined PBCS Monitoring Report

2.15 The report highlighted consolidated performance data and issues associated with Actual Surveillance Performance (ASP) and Actual Communications Performance (ACP) for the region.

2.16 Overall ASP for the region had met the 95% criterion (**Table 3**). Brisbane FIR (YBBB) was the only FIR that cleared all RSP criteria in 2022.

| ACTUAL SURVEILLANCE PERFORMANCE - FIR AGGREGATE (ALL MEDIA TYPES) | | | | | | |
|-------------------------------------------------------------------|---------------------|------------|-------------|--------------------|------------|-------------|
| Region | Asia-Pacific Region | | | | | |
| Performance Criteria | RSP180 | | | | | |
| Time Period | 2022 January-June | | | 2022 July-December | | |
| Colour Key Meets Criteria 99.0%-99.84% Under Criteria | Message Counts | Criteria | | Message Counts | Criteria | |
| | | 95% | 99.90% | | 95% | 99.90% |
| FIR | | % <= 90sec | % <= 180sec | | % <= 90sec | % <= 180sec |
| PAZA | 1342364 | 98.94% | 99.70% | 1477614 | 98.94% | 99.68% |
| RJJJ | 1843788 | 98.49% | 99.66% | 2417297 | 98.69% | 99.69% |
| KZAK | 4301850 | 98.81% | 99.66% | 4831234 | 98.90% | 99.72% |
| NFFF | 186590 | 99.31% | 99.69% | 175745 | 99.13% | 99.63% |
| NTTT | 49699 | 99.76% | 99.90% | 72521 | 99.64% | 99.84% |
| NZZO | 196553 | 99.15% | 99.83% | 344849 | 98.91% | 99.69% |
| YBBB | 517841 | 99.93% | 99.97% | 952694 | 99.60% | 99.88% |
| YMMM | 306436 | 99.84% | 99.93% | 745742 | 99.47% | 99.76% |
| RPHI | 27832 | 99.25% | 99.76% | 344955 | 98.89% | 99.58% |
| VCCF | 385121 | 99.31% | 99.83% | 463887 | 99.55% | 99.91% |
| VOMF | 182599 | 98.44% | 99.32% | 241622 | 98.24% | 99.19% |
| VECF | 349179 | 98.95% | 99.61% | 364483 | 98.92% | 99.54% |
| VVTS | 154613 | 98.81% | 99.83% | 194999 | 99.06% | 99.83% |
| WAAF | 90840 | 99.42% | 99.80% | 121362 | 99.39% | 99.75% |
| WSJC | 408788 | 99.18% | 99.87% | 608655 | 99.12% | 99.84% |
| ZLLL | 188643 | 98.90% | 99.60% | 238034 | 98.90% | 99.70% |
| ZWWW | 103500 | 98.70% | 99.60% | 101848 | 98.80% | 99.70% |
| WMFC | 169757 | 98.89% | 99.72% | 390920 | 99.23% | 99.80% |

Table 3: Asia/Pacific Region ASP (RSP180)

2.17 Overall ACP for the region met the 95% criterion (**Table 4**). Chennai FIR (VOMF) was the only FIR that cleared all RCP criteria in 2022.

RASMAG/28
Report of the Meeting

| ACTUAL COMMUNICATION PERFORMANCE - FIR AGGREGATE (ALL MEDIA TYPES) | | | | | | | | | | |
|--------------------------------------------------------------------|----------------|---------------------|--------------|---------------|--------------|--------------------|--------------|--------------|---------------|--------------|
| Region | | Asia-Pacific Region | | | | | | | | |
| Performance Criteria | | RCP240 | | | | | | | | |
| Time Period | | 2022 January-June | | | | 2022 July-December | | | | |
| FIR | Message Counts | ACP Criteria | | ACTP Criteria | | Message Counts | ACP Criteria | | ACTP Criteria | |
| | | 95% | 99.90% | 95% | 99.90% | | 95% | 99.90% | 95% | 99.90% |
| | | % < = 180sec | % < = 210sec | % < = 120sec | % < = 150sec | | % < = 180sec | % < = 210sec | % < = 120sec | % < = 150sec |
| PAZA | 81331 | 98.89% | 98.89% | 98.77% | 99.18% | 95762 | 99.31% | 99.54% | 99.36% | 99.57% |
| RJJJ | 112574 | 99.63% | 99.75% | 99.79% | 99.85% | 151986 | 99.57% | 99.71% | 99.72% | 99.82% |
| KZAK | 246180 | 99.22% | 99.49% | 99.35% | 99.60% | 311405 | 99.38% | 99.60% | 99.59% | 99.73% |
| NFFF | 6607 | 99.51% | 99.72% | 99.65% | 99.72% | 6685 | 99.26% | 99.41% | 99.55% | 99.62% |
| NTTT | 4492 | 99.81% | 99.83% | 99.95% | 99.97% | 7138 | 99.57% | 99.64% | 99.94% | 99.94% |
| NZZO | 36564 | 99.21% | 99.47% | 99.58% | 99.74% | 65032 | 99.16% | 99.43% | 99.58% | 99.72% |
| YBBB | 11278 | 99.81% | 99.88% | 99.82% | 99.85% | 24371 | 99.57% | 99.73% | | |
| YMMM | 12812 | 99.34% | 99.51% | 99.52% | 99.69% | 32204 | 99.61% | 99.71% | | |
| RPHI | 9782 | 98.40% | 98.59% | 98.98% | 99.19% | 17065 | 98.12% | 98.36% | 98.63% | 98.89% |
| VCCF | 20125 | 98.22% | 99.71% | 99.91% | 100.00% | 25443 | 98.57% | 99.49% | 99.94% | 99.96% |
| VOMF | 66300 | 99.82% | 99.89% | 99.87% | 99.92% | 95889 | 99.82% | 99.88% | 99.88% | 99.92% |
| VECF | 20325 | 99.15% | 99.35% | 99.44% | 99.64% | 27629 | 99.08% | 99.36% | 99.40% | 99.58% |
| VVTS | 84045 | 95.94% | 96.46% | 99.62% | 99.79% | 60881 | 95.20% | 95.76% | 99.57% | 99.73% |
| WAAF | 17664 | 99.01% | 99.22% | 99.67% | 99.75% | 20604 | 99.27% | 99.48% | 99.77% | 99.86% |
| WSJC | 28819 | 99.00% | 99.24% | 99.10% | 99.34% | 49453 | 99.07% | 99.32% | 99.18% | 99.39% |
| ZLLL | 867 | 97.80% | 97.92% | 99.53% | 99.53% | 751 | 98.53% | 98.66% | 98.40% | 98.80% |
| ZWWW | 31 | 100.00% | 100.00% | 100.00% | 100.00% | 4 | 100.00% | 100.00% | 100.00% | 100.00% |
| WMFC | 52457 | 98.81% | 99.17% | 99.06% | 99.41% | 74495 | 99.17% | 99.43% | 99.38% | 99.59% |

Table 4: Asia/Pacific Region ACP (RCP240)

2.18 It was again noted that HF data link (HF DL) performance results did not meet PBCS performance requirements in all FIRs. (Table 5)

| Performance Criteria | | RSP180 | | | | | |
|----------------------|------------|-------------------|-------------|--------------|--------------------|-------------|--------------|
| Period | | 2022 January-June | | | 2022 July-December | | |
| FIR | Media Type | Message Counts | Criteria | | Message Counts | Criteria | |
| | | | 95% | 99.90% | | 95% | 99.90% |
| | | | % < = 90sec | % < = 180sec | | % < = 90sec | % < = 180sec |
| By Media Type | | | | | | | |
| PAZA | HF | 2405 | 57.17% | 73.35% | 3552 | 60.87% | 73.87% |
| KZAK | HF | 9289 | 58.35% | 73.54% | 5463 | 58.28% | 72.41% |
| NFFF | HF | 73 | 61.64% | 76.71% | 114 | 49.12% | 71.05% |
| NZZO | HF | | | | 147 | 65.30% | 77.55% |
| YBBB | HF | 353 | 66.01% | 84.70% | 419 | 74.22% | 85.92% |
| YMMM | HF | 233 | 57.08% | 73.81% | 255 | 48.63% | 69.02% |
| RPHI | HF | 164 | 71.95% | 84.87% | 115 | 67.97% | 81.09% |
| VOMF | HF | 86 | 30.23% | 59.42% | 388 | 25.26% | 40.98% |
| VECF | HF | 170 | 47.06% | 68.29% | 230 | 51.09% | 67.50% |
| WAAF | HF | 103 | 66.26% | 89.24% | 55 | 85.70% | 89.68% |
| WSJC | HF | 76 | 74.21% | 92.17% | 106 | 72.26% | 92.17% |
| ZLLL | HF | 16 | 31.25% | 62.50% | 24 | 33.33% | 66.66% |
| ZWWW | HF | 9 | 33.33% | 77.77% | 12 | 25.00% | 58.33% |
| WMFC | HF | 14 | 89.18% | 100.00% | 30 | 57.33% | 85.13% |

Table 5: HF Datalink performance in 2022

FIT-Asia Task List

2.19 The ninth meeting of FIT-Asia (FIT-Asia/9), held in Bangkok from 1-5 July 2019, had discussed a review of Regional Guidance Material for End-to-End Monitoring of Data Link Systems, and agreed to conduct a review of the Guidance Material, with a view to removing any material that may be redundant, or that duplicated material that was available in the GOLD Manual and PBCS Manual, and ensuring that all other contents correctly reflected current regional expectations for data link monitoring and reporting. The review would also take into consideration the formalization of regional procedures for the reporting of PBCS non-compliance to the relevant Regional Monitoring Agency (RMA) or En-route Monitoring Agency (EMA), and guidance for response to such reports by the State of Registry.

2.20 An action item was added into the FIT-Asia task list (Figure 1).

RASMAG/28
Report of the Meeting

| | | | | | |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------|
| 9/5 | Review and develop Draft of new version of <i>Guidance Material for End-to-End Safety and Performance Monitoring of ATS Data Link Systems in the APAC Region</i> in cooperation with CNS subject matter experts. Include region-specific matters from Appendix B to the GOLD Manual (to be removed from the manual in 2020) | FIT-Asia/42 FIT-Asia/13 | China, India, Indonesia, New Zealand, Singapore, USA, Boeing CRA, Secretariat FIT-Asia/SWG | Open Closed | FIT-Asia/9 Report paragraphs 3.5 and 5.1 Updated FIT-Asia/41 FIT-Asia/42 Transfer to RASMAG |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------|

Figure 1: FIT-Asia Task List – Action Item 9/5

2.21 However, as the task required non-FIT-Asia States/Administrations' contribution, the FIT-Asia had yet to complete the task. Therefore, FIT-Asia proposed transferring the task to RASMAG, where all member States/Administrations in the Region were participating. The meeting agreed to include this item in the RASMAG Task List.

Air Navigation Deficiencies Relating to Data Link Performance Monitoring and Analysis

2.22 FIT-Asia/13 had agreed to recommend the following update of data link-related ATM and Airspace Safety Deficiencies:

- retention of the following Deficiencies:

India: *Performance monitoring and analysis not reported for Mumbai FIRs.*

Maldives: *Problem reports not provided to CRA. Performance monitoring and analysis not reported to FIT.*

2.23 These recommendations were included in the Deficiencies List provided for RASMAG/28 discussion and agreement in WP/36.

2.24 The meeting was informed of India's progress towards submission of Data link performance monitoring and analysis reports for the Mumbai FIR, planned to commence at the FIT/Asia/14 meeting in 2024.

Outcomes of RASMAG/MAWG and RMACG Meetings (WP/3)

2.25 The Tenth Meeting of the Regional Airspace Safety Monitoring Advisory Group Monitoring Agencies Working Group (RASMAG/MAWG/10) Virtual Meeting was held from 30 January to 10 February 2023. The Eighteenth RMA Coordination Group Meeting (RMACG/18) was held from the 3rd to the 6th of April in a hybrid format.

2.26 Some salient points discussed during MAWG/10 and RMACG/18:

- Extension of the EUR RMA FPRAVP;
- Reduced Vertical Separation Minimum (RVSM) Minimum Monitoring Requirements (MMR);
- 1,000-flight hours monitoring requirement in Annex;
- Guidance for PBCS non-compliance reporting

Extension of the EUR RMA FPRAVP

2.27 EUR RMA presented details on further progress of the Flight Plan RVSM Approval Verification Process (FPRAVP), which was introduced by the EUR RMA in 2020. The FPRAVP was a proactive system for rejecting the flight plans of aircraft not approved for operations in RVSM airspace. While currently implemented in Germany only, it was intended to extend the scheme into the airspace of an additional seven States within the EUR RVSM area. More details were provided by the Monitoring Agency for the Asia Region (MAAR) in RASMAG/28, IP/4.

2.28 In noting the implementation of the FPRAVP in Europe and the possible impact on operators from other regions, it was also discussed how States in other regions demonstrate compliance with the ICAO Annex 6 requirements; specifically, to take appropriate action with non-approved aircraft operating in their airspace.

2.29 It was agreed that Annex 6 compliance assurance was not part of the remit of RMAs, however RMAs could serve as a conduit to raising the question as to such compliance so that State regulators could discharge their responsibilities. It was noted that, in order to provide a proactive service, such as the FPRAVP, an RMA required a mandate from the relevant PIRG.

RVSM Minimum Monitoring Requirements (MMR)

2.30 The RVSM Minimum Monitoring Requirements (MMR) Version 2023 was reviewed and adopted by the RMACG meeting (**RASMAG/28 WP/3 Attachment**). There were three changes: - Airbus A350-900 and A350-1000 Monitoring Groups were merged into the A350 Monitoring Group; - Airbus A321XLR was added to the MMR as a new Monitoring Group; and - Comac C919 was added to the MMR as a new Monitoring Group.

1,000-flight hours monitoring requirement in Annex 6

2.31 The RMACG meeting recalled the action for all RMAs to provide data on operators who were taking advantage of the 1,000-flight hours monitoring requirement in order to support the ongoing discussion on whether it would be possible to remove the requirement from Annex 6. It was the general consensus by the meeting that more time and investigation was necessary. It was agreed that this should involve feedback from operators, the potential need for an agreed transition period if the 1,000-hours requirement was to be phased out.

Guidance for PBCS non-compliance reporting

2.32 ICAO proposed the guidance for PBCS non-compliance report submission and handling processes, and the recommended EMA/RMA/ANSP actions. More details were provided in RASMAG/28 WP/21.

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

JASMA AKARA Safety Improvement Update (IP/09)

3.1 JASMA provided an update on the progress of the safety improvement plan for the AKARA – FUKUE Corridor. Phase 1 of the improvement plan had been implemented on 25 March 2021 (**Figure 2**), and remained the current status of the project.

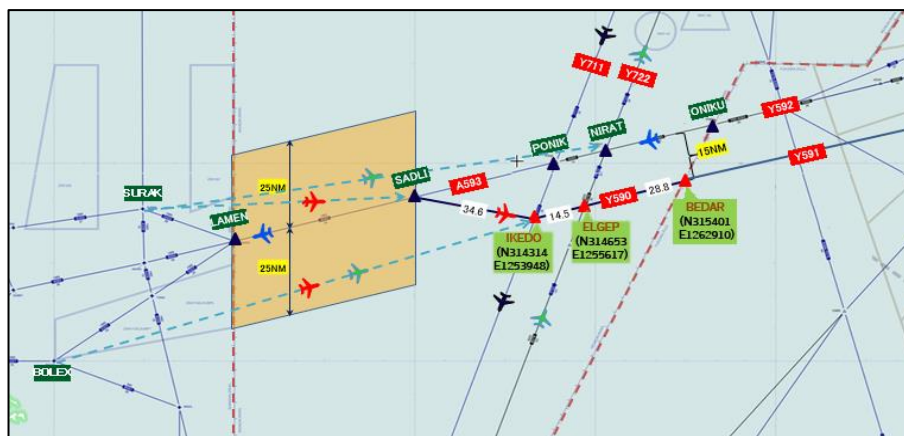


Figure 2: ATS route structure of AKARA-FUKUE Corridor in Phase 1

3.2 The Chair requested that updates arising from the planned bilateral discussion between Japan and Republic of Korea in Oct/Nov 2023 be shared at future meetings.

CHINA RMA'S Updates on LHD events reported in AKARA corridor (WP/4)

3.3 China Regional Monitoring Agency (RMA) presented the analysis of the Large Height Deviation (LHD) events between Shanghai Area Control Centre (ACC) and Incheon ACC collected by China RMA from 2021 to 2023, and China RMA's work to address related issues.

3.4 From 2022 to 2023, 29 events were confirmed as LHD events by both ACC. These events include no-transfer (LHD category 'E1-a'), late transfer ('E1-b'), transfer level changing ('E2'), receiving unit changes flight level in transferring unit's control area ('E3') and equipment or technical issues result in coordination errors (F). **Figure 3** shows the category⁷ of the confirmed LHD events from 2022 to 2023.

⁷ Categories of LHD events as recognized by RMAs were:

Category A: Flight crew fails to climb or descent the aircraft as cleared;

Category B: Flight crew climbing or descending without ATC clearance;

Category C: Incorrect operation or interpretation of airborne equipment;

Category D: ATC system loop error;

Category E: Coordination errors in ATC-to-ATC transfer of control responsibility as a result of human factors issues;

Category F: ATC transfer of control coordination errors due to technical issues;

Category G: Aircraft contingency leading to sudden inability to maintain level;

Category H: Airborne equipment failure and unintentional or undetected level change;

Category I: Turbulence or other weather-related cause leading to unintentional or undetected change of flight level;

Category J: TCAS RA – flight crew correctly climb or descend following the RA;

Category K: TCAS RA – flight crew incorrectly climb or descend following the RA;

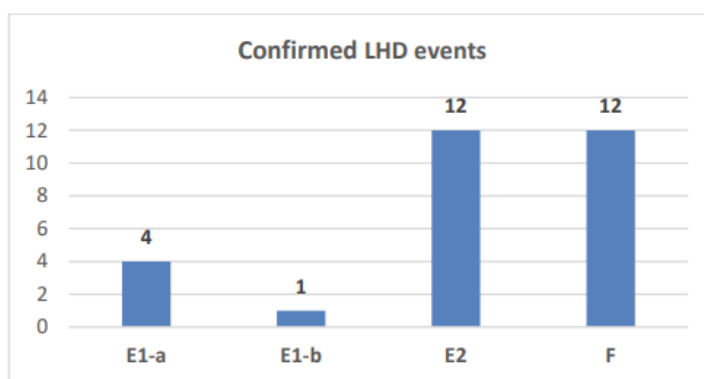


Figure 3: Confirmed events in 2022 and 2023

3.5 In the last two years, operational issues leading to Category F events (equipment error) were due to the ground system supporting Shanghai ACC estimating the aircraft passing time inaccurately, resulting in a difference between actual passing time and the estimated time. Through investigation, it was found that the equipment issues occurred during operations supported by the backup ground system. Shanghai ACC had identified the issue and coordinated with the manufacturer.

3.6 In response to China's RMA request, Republic of Korea agreed to share LHD data on a monthly basis. The mitigations to reduce LHDs were discussed and recorded under WP/19.

3.7 The meeting discussed the challenges in the determination of LHD validity, noting it would vary from case to case basis. Therefore, a prescriptive standardised definition would not be workable. It was proposed to discuss the definition of Sub categories of CAT E LHDs to facilitate effective analysis at the next MAWG meeting.

2022 Analyses for the Incheon FIR AKARA Corridor Interface with Shanghai/Fukuoka/Taipei FIRs (WP/5)

3.8 PARMO provided an update on its analysis of the AKARA - FUKUE corridor airspace using TSD and LHD reports from for calendar years 2015 – 2022. The key collision risk model (CRM) parameters, which were directly estimated from the TSD, took into account the route structure change in the airspace affecting specific CRM parameters.

Reported LHDs for AKARA Corridor Airspace

3.9 There were 108 reported LHDs in 2022 for the AKARA – FUKUE corridor airspace. This was an increase over the reported LHDs in calendar year 2021, however, all reported LHDs were mitigated with available surveillance, direct speech circuit or other means. There was no contribution towards the vertical operational risk estimate from the reported LHDs in 2022. China RMA, JASMA and PARMO shared the reported occurrence details for this report.

Vertical Risk Estimate

3.10 The vertical collision risk estimates for the AKARA – FUKUE Corridor airspace are shown in **Figure 4**. The 2022 vertical technical risk estimate of 0.24×10^{-9} fapfh meets the Target Level

Category L: An aircraft being provided with RVSM separation is not approved;

Category M: Others.

of Safety (TLS) for vertical technical risk, the technical risk TLS is 2.5×10^{-9} fapfh. The overall vertical risk estimate of 0.24×10^{-9} fapfh meets the overall vertical TLS of 5×10^{-9} fapfh.

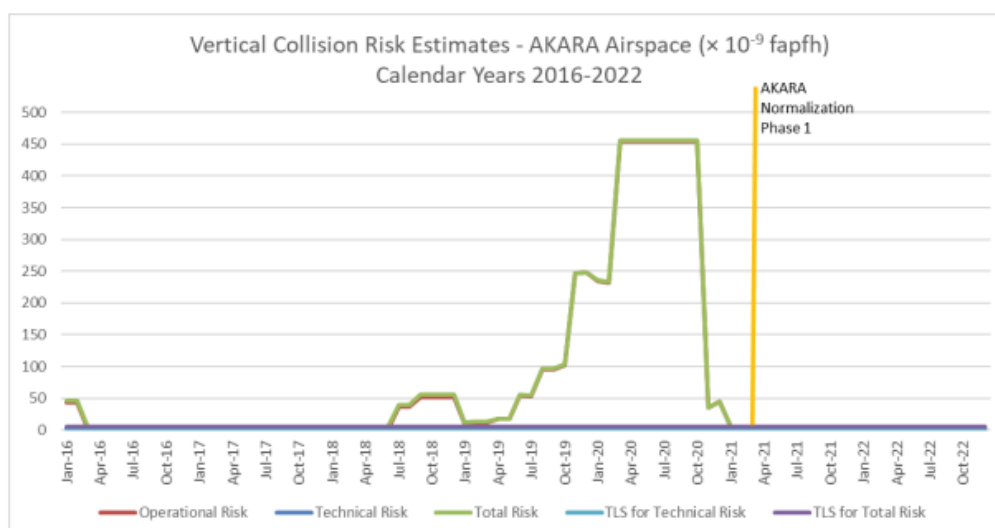


Figure 4: Twelve-month Rolling Vertical Collision Risk Estimates

3.11 The Meeting was informed by Republic of Korea that the various factors such as reduced occupancy and reorganised responsibilities of the airspace to one single ATC unit had led to the RVSM risk meeting the TLS, which is called as normalisation. Noting the normalisation and the increase of non-FLAS usage (up to 26% as of May, this year), Republic of Korea requested to review the removal of LHD Hot Spot B. This matter was further discussed under WP/19.

Note: LHD hot spots that meet the RASMAG criteria for deletion are identified as ‘potential non-hot spots’ and monitored for a further twelve months before removal, subject to continuing to meet the criteria.

RVSM Risk Assessment in the Brisbane, Honiara, Melbourne, Nauru and Port Moresby, FIRs – 1 January to 31 December 2022 (WP/6)

3.12 The Australian Airspace Monitoring Agency (AAMA) provided an airspace safety review of RVSM airspace risk within the Brisbane, Honiara, Melbourne, Nauru and Port Moresby FIRs. For the period 1 January 2022 to 31 December 2022.

3.13 **Table 6** detailed the results for the technical, operational and total risk, each of which met the TLS.

| Source of risk | Risk estimate | TLS | Comparison with TLS |
|-------------------|-----------------------------------------|----------------------------------------|------------------------|
| Technical risk | 0.077×10^{-9} | 2.5×10^{-9} | Below technical TLS |
| Operational risk | 1.42×10^{-9} | - | - |
| Total risk | 1.50×10^{-9} | 5.0×10^{-9} | Below total TLS |

Table 6: RVSM Risk Estimates for the period 1 January 2022 to 31 December 2022. The number of estimated annual flying hours is 443,496 based on the December 2021 TSD.

3.14 MAWG/7 had proposed that the reporting safety culture metric be measured by the reporting rate of occurrence per flight hour, with occurrences grouped by attribution is shown in **Table 7**. Reports were consistently made by both pilots and ATC.

RASMAG/28
Report of the Meeting

| Attribution | Number of reports | Flight hours | Number of reports per flight hour (x 10 ⁻⁵) |
|-------------------------|-------------------|----------------|---------------------------------------------------------|
| Pilot/Aircrew (A, B, C) | 30 | 443,496 | 6.76 |
| ATC (D, E, F) | 38 | 443,496 | 8.56 |
| Other | 6 | 443,496 | 1.35 |
| Total | 74 | 443,496 | 16.7 |

Table 7: Safety culture metric for Australia, Nauru, Papua New Guinea, and Solomon Islands by LHD attribution for the period 1 January 2022 to 31 December 2022

3.15 **Figure 5** identified the geographic location of LHD occurrences for the period 01 January to 31 December 2022. The occurrences at each location are represented by a coloured circle, with the radius proportional to the total risk at that location. The map is intended to provide a means to identify and visualise risk hot spots related to RVSM operations.

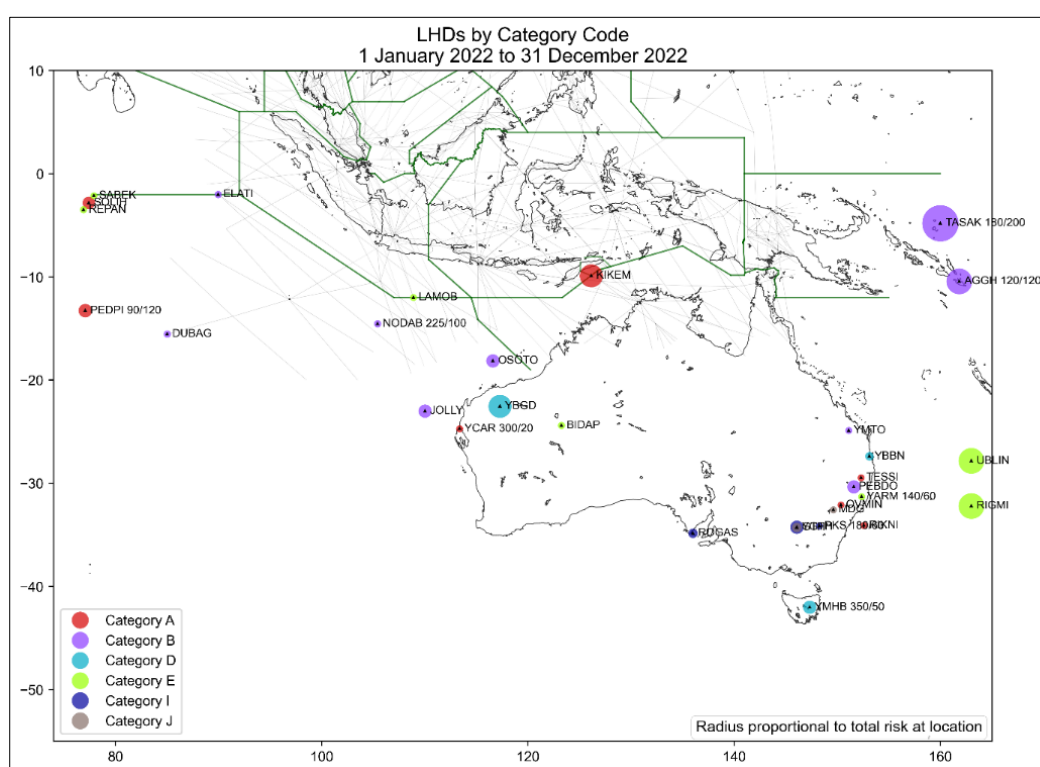


Figure 5: Geolocation of LHDs for Brisbane, Honiara, Melbourne, Nauru, and Port Moresby FIRs for the period 1 January 2021 to 31 December 2022.

3.16 The highest-risk occurrence in the rolling 12-month sample occurred at TASAK, in June 2022. It involved an international aircraft climbing without a clearance prior to crossing the Oakland Oceanic (KZAK FIR). The event was assessed as 2 minutes duration before a resolution was reached between Moresby, Honiara and Oakland ATC.

3.17 In the period 1 January 2022—31 December 2022, the number of LHDs with Aircrew/Pilot attribution, 30, was lower than the number of LHDs with ATC attribution, at 38. Category E occurrences (coordination errors as a result of human factors issues) were most prevalent at 32.

3.18 The risk had decreased since the value reported for the period 1 January 2020—31 December 2021 at the 27th Meeting of the RASMAG (RASMAG/27) in August 2022. This was partially because AAMA had revised their process of estimating collision risk modelling (CRM) parameters from the TSD, leading to more accurate results. Traffic levels generally increased in 2022

compared to 2020 and early 2021, particularly for domestic traffic in Australia.

3.19 The months of June to December 2022 exhibited a gradual increase in risk, but the total risk was still well below the TLS.

RVSM Risk Assessment in the Jakarta and Ujung Pandang Flight Information Regions (WP/7)

3.20 AAMA provided an airspace safety review of RVSM airspace risk in the Jakarta and Ujung Pandang Flight Information Regions (FIRs) for the period 1 January 2021 to 31 December 2022.

3.21 The results for the technical, operational, and total risk for the RVSM implementation in Jakarta and Ujung Pandang FIRs were detailed in **Table 8**.

| Source of risk | Risk estimate | TLS | Comparison with TLS |
|------------------|--------------------------|------------------------|---------------------|
| Technical risk | 0.133 x 10 ⁻⁹ | 2.5 x 10 ⁻⁹ | Below technical TLS |
| Operational risk | 3.10 x 10 ⁻⁹ | - | - |
| Total risk | 3.24 x 10 ⁻⁹ | 5.0 x 10 ⁻⁹ | Below total TLS |

Table 8: RVSM Risk Estimates for the period 1 January 2022 to 31 December 2022. The number of estimated annual flying hours was 435,220 based on the December 2021 TSD.

3.22 In the period 1 January 2022—31 December 2022, the number of LHDs with Aircrew/Pilot attribution, six occurrences, was lower than the number of LHDs with ATC attribution, at 55. Category E occurrences (coordination errors as a result of human factors issues) were most prevalent at 53.

Assessment of Safety Reporting Culture

3.23 An assessment of safety reporting culture for Indonesia is shown in **Table 9**.

| Attribution | Number of reports | Flight hours | Number of reports per flight hour (x 10 ⁻⁵) |
|-------------------------|-------------------|----------------|---------------------------------------------------------|
| Pilot/Aircrew (A, B, C) | 6 | 435,220 | 1.38 |
| ATC (D, E, F) | 55 | 435,220 | 12.6 |
| Other | 0 | 435,220 | 0 |
| Total | 61 | 435,220 | 14.0 |

Table 9: Safety culture metric for Indonesia by LHD attribution for the period 1 January 2022 to 31 December 2022.

3.24 The meeting was informed that DGCA Indonesia and Airnav Indonesia had noted the increased number of LHDs, and would prepare a package of mitigation measures. Indonesia would also coordinate with adjacent FIRs to discuss and develop mitigation measures to reduce LHDs that occurred at Indonesia's FIR boundaries.

China RMA Vertical Safety Report (WP/8)

3.25 The China Regional Monitoring Agency (China RMA) provided an RVSM safety report for nine Chinese FIRs (excluding Hong Kong and Taipei FIRs), and the Pyongyang FIR (Democratic People’s Republic of Korea).

3.26 The 2022 RVSM risk estimates for the Chinese FIRs (**Table10**) indicated that the TLS had been met, at **0.19 x 10⁻⁹** fapfh.

| The RVSM Airspace of Chinese FIRs – estimated annual flying hours = 1296204.4 hours | | | |
|--------------------------------------------------------------------------------------------|-----------------------------------------|----------------------|---------------------|
| <i>(note: estimated hours based on Dec 2022 traffic sample data)</i> | | | |
| Source of Risk | Risk Estimation | TLS | Remarks |
| <i>RASMAG 27 Total Risk</i> | 2.17×10^{-9} | 5.0×10^{-9} | <i>Below TLS</i> |
| Technical Risk | 0.10×10^{-9} | 2.5×10^{-9} | Below Technical TLS |
| Operational Risk | 0.09×10^{-9} | - | - |
| Total Risk | 0.19×10^{-9} | 5.0×10^{-9} | Below TLS |

Table 10: Risk Estimates for the RVSM airspace of Chinese FIRs

3.27 **Figure 6** provides the geographic location of risk bearing LHD reports within Airspace of Chinese FIRs during the assessment period.



Figure 6: Airspace of Chinese FIRs – Risk Bearing LHD

3.28 The 2022 RVSM risk estimate for the Pyongyang FIR was **zero**, as no LHD had been reported during 2021 or 2022.

3.29 Although occurrences of unserviceability of the TCAS function may not be considered as a LHD, China RMA deemed that it was important to record such occurrences in the analysis.

3.30 In response to a statement by Republic of Korea encouraging the implementation of AIDC between Incheon and Shanghai ACCs to mitigate LHDs, China informed the meeting that this should be coordinated between the relevant ATS authorities. ICAO reminded the meeting that AIDC implementation had been a regional performance expectation in the APANPIRG-adopted Asia/Pacific Seamless ANS Plan since 2013.

JASMA Vertical Safety Report (WP/9)

3.31 JASMA provided an executive summary of the airspace safety oversight assessment of the RVSM implementation in the Fukuoka Flight Information Region (FIR). A detailed report was also provided in **RASMAG/28 WP/9 Attachment**.

3.32 The total risk for the reporting period from 1 January to 31 December 2022 was **4.92 x 10⁻⁹** fapfh, which met the TLS and was improved from the risk reported to RASMAG/27 (9.52 x 10⁻⁹ fapfh). (**Table 11**).

| Japanese Airspace – estimated annual flying hours = 1,303,077 hours <i>(note: estimated hours based on Dec 2022 traffic sample data)</i> | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------------|---------------------|
| Source of Risk | Risk Estimation | TLS | Remarks |
| <i>RASMAG 27 Total Risk</i> | 9.52×10^{-9} | 5.0×10^{-9} | <i>Above TLS</i> |
| Technical Risk | 0.24×10^{-9} | 2.5×10^{-9} | Below Technical TLS |
| Operational Risk | 4.67×10^{-9} | - | - |
| Total Risk | 4.92×10^{-9} | 5.0×10^{-9} | Below TLS |

Table 11: Japanese Airspace RVSM Risk Estimates

3.33 **Figure 7** presented the collision risk estimate trends for the period.

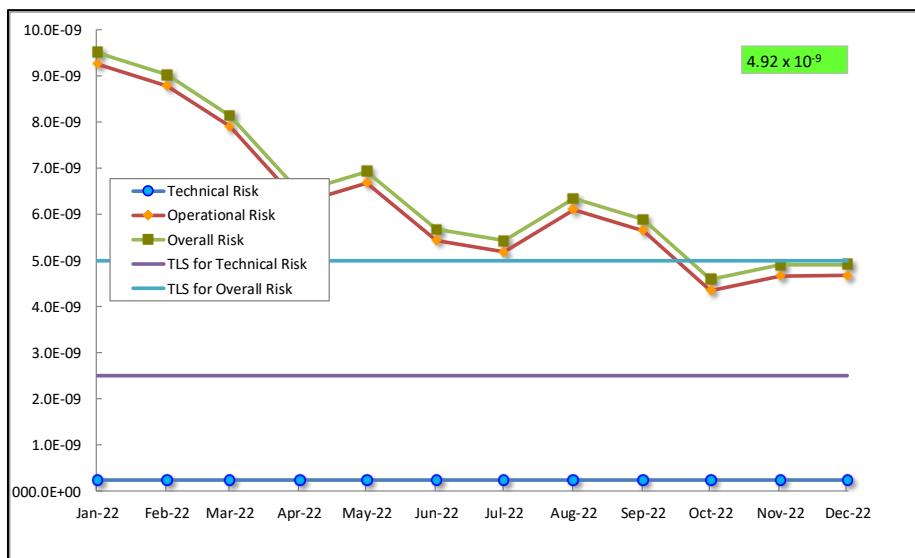


Figure 7: Japanese Airspace RVSM Risk Estimate Trends

3.34 **Figure 8** provided the geographic location of LHD reports occurred within Fukuoka FIR during the assessment period. The filled blue square symbols represent LHD location in the RVSM stratum of Fukuoka FIR. The circles represent LHD duration of 50 seconds or more.

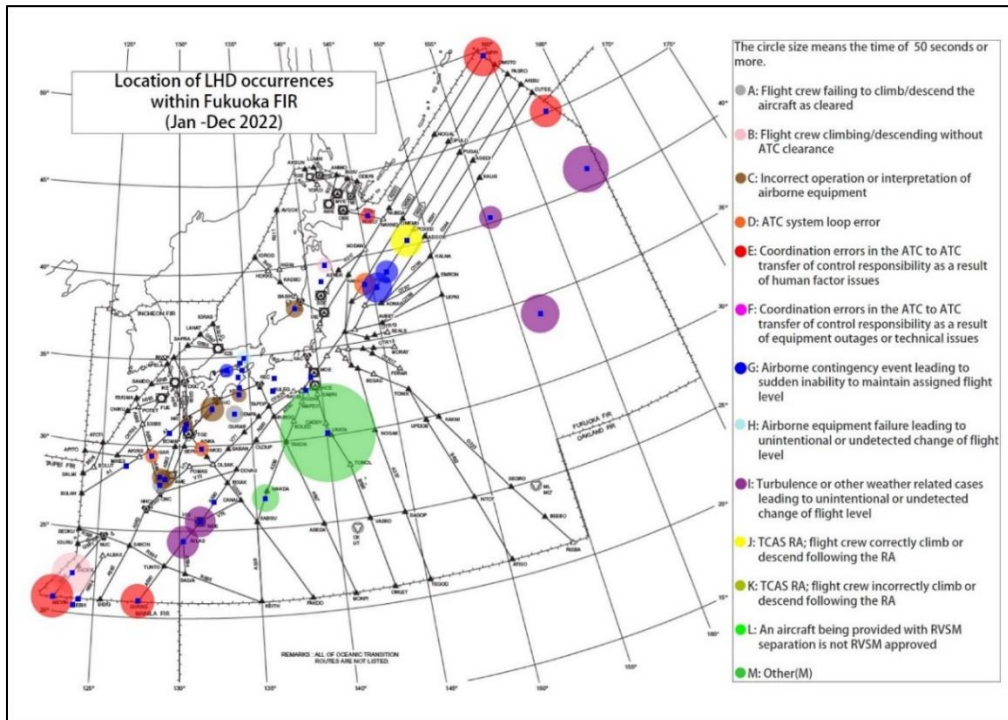


Figure 8: Geographical Location of LHDs within Fukuoka FIR

3.35 In 2022, there was no LHD reported at a part of Hot Spot B where the area is the east edge of the AKARA FUKUE corridor airspace and the FIR boundary between Fukuoka and Incheon FIRs.

3.36 A total of six category E LHDs occurred at Hot Spot D in 2022. Four of these LHDs occurred on transfer from the Manila ACC to Fukuoka ACC or the Fukuoka Air Traffic Management Center (ATMC), and the rest of the two LHDs occurred on transfer from Fukuoka ATMC or Fukuoka ACC to Manila ACC.

3.37 There was no LHD occurrence at the former Hot Spot L in 2022. The main reason was the reduced traffic volume along the FIR boundary between Fukuoka and Khabarovsk FIRs since traffic flow between Japan and Europe had changed significantly.

3.38 **Figure 9** shows the trend of traffic volume in Fukuoka FIR from 2008 to 2022

RASMAG/28
Report of the Meeting

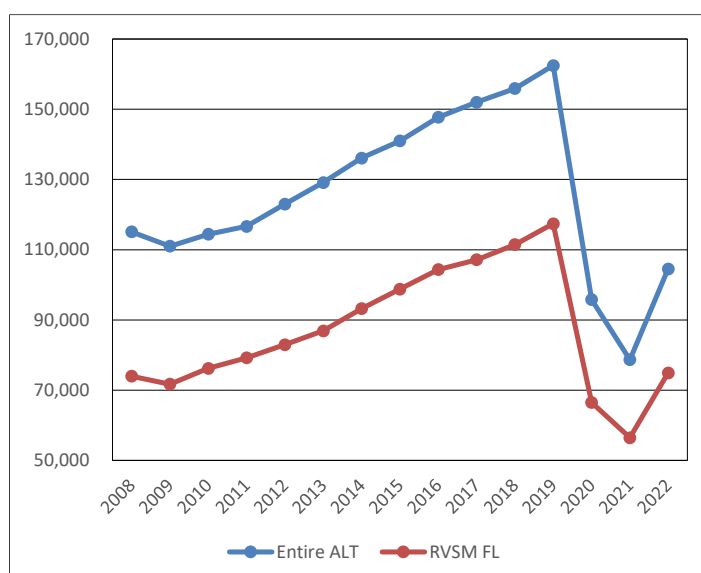


Figure 9: Traffic volume in Fukuoka FIR from 2008 to 2022

3.39 The traffic volume of Fukuoka FIR in 2022 was approximately 64% of that in 2019, which was a peak traffic volume before the COVID-19 pandemic. Additionally, the traffic volume in 2022 was nearly level with 2009 and 2010, which was the beginning of the recovery from the financial crisis of 2007 to 2008.

3.40 JASMA has participated in the trial of the management process of hot Spots, which the MAAR developed and presented at the Ninth meeting of the RASMAG Monitoring Agency Working Group (RASMAG-MAWG/9) in February 2022. The result and process of JASMA’s consideration and analysis for Hot Spot B and D and former Hot Spot L were summarised and presented in WP/10.

JASMA Hot Spot Identification (WP/10)

3.41 JASMA had monitored current and former hot spots around the Fukuoka FIR boundary: Hot Spot B (AKARA airspace), Hot Spot D (Fukuoka – Manila FIRs) and the former Hot Spot L (Fukuoka – Khabarovsk FIRs).

Hot Spot B Analysis

3.42 **Table 12** represents the results of the analysis and consideration for the east edge of Hot Spot B, the FIR boundary between Fukuoka and Incheon FIRs. ‘Negative’ means under the hot Spot criteria and “Positive” means over the criteria.

| East Edge of Hot Spot B (Fukuoka - Incheon FIRs) | 2018 | 2019 | 2020 | 2021 | 2022 |
|---------------------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------------|
| Number of LHDs | 19 | 29 | 5 | 0 | 0 |
| Criteria: Number | 10.67 | 8.00 | 8.40 | 8.00 | 6.43 |
| Hot Spot Risk (x10 ⁻⁹ FAPFH) | (Before Phase 1) | (Before Phase 1) | (Before Phase 1) | 0.00 | 0.00 |
| Criteria: Risk Estimate (x10 ⁻⁹ FAPFH) | (Before Phase 1) | (Before Phase 1) | (Before Phase 1) | 1.34 | 0.67 |
| Criteria: TLS (x10 ⁻⁹ FAPFH) | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Result and Action by RASMAG meeting | Continue Monitoring (RASMAG/24 in 2019) | Continue Monitoring (RASMAG/25 in 2020) | Continue Monitoring (RASMAG/26 in 2021) | Continue Monitoring (RASMAG/27 in 2022) | Potential to non-Hot Spot (RASMAG/28 in 2023) |
| | <i>Legend:</i> | | | <i>Positive</i> | <i>Negative</i> |

Table 12: Results of analysis and consideration on Hot Spot B

RASMAG/28
Report of the Meeting

3.43 The number of LHDs and hot spot risk for the east edge of Hot Spot B in 2021 and 2022 meet the criteria. Although the traffic volume of the eastbound/westbound flights flying the east edge of Hot Spot B in December 2022 was approximately 33% of the volume in January 2020, which was a peak volume before the COVID-19 pandemic, the average number of daily flights in December 2022 was over 150.

3.44 As a result of the hot Spot analysis and traffic volume, to the proposed reclassification of Hot Spot B area as “Potential non-hot Spot” was discussed under WP/19 *Asia/Pacific Consolidated Safety Report*.

Hot Spot D Analysis

3.45 **Table 13** represents the results of the analysis and consideration for Hot Spot D, the FIR boundary between Fukuoka and Manila FIRs. The number of LHDs in 2022 meets the criteria. However, the hot Spot Risk in 2022 is over the criteria of 0.67×10^{-9} . Based on the result, JASMA proposed retaining the Fukuoka - Manila FIR boundary as a hot spot.

| Hot spot D (Fukuoka - Manila FIRs) | 2018 | 2019 | 2020 | 2021 | 2022 |
|------------------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
| Number of LHDs | 10 | 5 | 7 | 9 | 4 |
| Criteria: Number | 10.67 | 8.00 | 8.40 | 8.00 | 6.43 |
| Hot spot Risk ($\times 10^{-9}$ FAPFH) | 7.71 | 4.70 | 3.85 | 5.95 | 1.70 |
| Criteria: Risk Estimate ($\times 10^{-9}$ FAPFH) | 1.69 | 1.38 | 2.28 | 1.34 | 0.67 |
| Criteria: TLS ($\times 10^{-9}$ FAPFH) | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Result and Action by RASMAG meeting | Continue Monitoring (RASMAG/24 in 2019) | Continue Monitoring (RASMAG/25 in 2020) | Continue Monitoring (RASMAG/26 in 2021) | Continue Monitoring (RASMAG/27 in 2022) | Continue Monitoring (RASMAG/28 in 2023) |
| <i>Legend:</i> | | | | <i>Positive</i> | <i>Negative</i> |

Table 13: Results of analysis and consideration on Hot Spot D

Former Hot Spot L Analysis

3.46 The number of LHDs and the hot Spot risk from 2020 to 2022 at Hot Spot L, the boundary between Fukuoka and Khavarovsk FIRs, met both criteria. There was no potential for hot Spots in the area.

3.47 As JASMA’s trial indicated, the procedure for hot Spot analysis was beneficial for RMAs/EMAs to manage hot Spots even though some detailed consideration and discussion, such as definition and standard of identifying a cluster or fluctuation of traffic volume, would be needed. Additionally, JASMA was ready to move forward to the next step; conducting the procedure as an ordinary and standard procedure.

Side meeting LHD Hot Spot B & D

3.48 A side meeting agreed that the naming of the current Hot Spots B & D should remain, and should not be segregated based on the analysis arising from low traffic levels during and since the COVID pandemic. RASMAG should not lose the big picture and forget the reasons behind the formalisation of these hot spots in the first place. Therefore, the chair proposed that additional explanation be included in remarks for these hot Spots to provide clarity of remaining issues. These remarks were further discussed under WP/19.

JASMA Horizontal Safety Report (WP/11)

3.49 JASMA provided the horizontal risk assessment results of the Fukuoka Flight Information Region (FIR) conducted by the Japan Airspace Safety Monitoring Agency (JASMA).

3.50 **Table 14** provides the North Pacific Ocean airspace horizontal risk estimates during the period January 2022 to December 2022.

| North Pacific Ocean Airspace – estimated annual flying hours = 103,253 hours <i>(note: estimated hours based on Dec 2022 traffic sample data)</i> | | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------|------------------|
| Risk | Risk Estimation | TLS | Remarks |
| <i>RASMAG 27 50 NM Lateral Risk</i> | <i>0.712 x 10⁻⁹</i> | <i>5.0 x 10⁻⁹</i> | <i>Below TLS</i> |
| <i>RASMAG 27 10 MIN Based-Longitudinal Risk</i> | <i>0.034 x 10⁻⁹</i> | <i>5.0 x 10⁻⁹</i> | <i>Below TLS</i> |
| <i>RASMAG 27 30 NM Distance-based Longitudinal Risk</i> | <i>0.014 x 10⁻⁹</i> | <i>5.0 x 10⁻⁹</i> | <i>Below TLS</i> |
| 50 NM Lateral Risk | 0.46 x 10⁻⁹ | 5.0 x 10⁻⁹ | Below TLS |
| 10 MIN Time-based Longitudinal Risk | 1.75 x 10⁻⁹ | 5.0 x 10⁻⁹ | Below TLS |
| 30 NM Distance-based Longitudinal Risk | 0.008 x 10⁻⁹ | 5.0 x 10⁻⁹ | Below TLS |

Table 14: North Pacific Ocean Airspace Horizontal Risk Estimates

3.51 There was a total of 21 Large Lateral Deviations (LLDs) and Large Longitudinal Errors (LLEs) reported to JASMA in 2022. The top contributor belonged to Category F (Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues – six occurrences) and Category H (Turbulence or weather related causes leading to a deviation in the horizontal dimension – six occurrences).

3.52 Current RNAV10 (RNP10) routes and the Pacific Organized Track System (PACOTS) in the airspace are still established by using 50 NM lateral distance. However, new RNP4 routes, which required PBCS and RNP4, were planned to be established in the North Pacific Ocean airspace in 2024. The RNP4 routes would be separated at least 23 NM from other ATS routes.

3.53 JASMA had started developing and updating procedures and software to calculate “23 NM Lateral Risk.”

3.54 In response to a query, JASMA clarified that Cat. F errors were not due to AIDC issues but rather the ATC system issues that calculated the estimated time incorrectly.

MAAR Safety Report (WP/12)

3.55 MAAR presented the results of airspace safety oversight for RVSM operations in South Asia/Indian Ocean Airspace (SA/IO), Southeast Asia (SEA) Airspace, and Mongolian Airspace during 2022.

South Asia Indian Ocean Airspace

3.56 The 2022 RVSM risk estimate for SA/IO airspace indicated that the TLS had met at **1.75 x 10⁻⁹ fapfh (Figure 10)**.

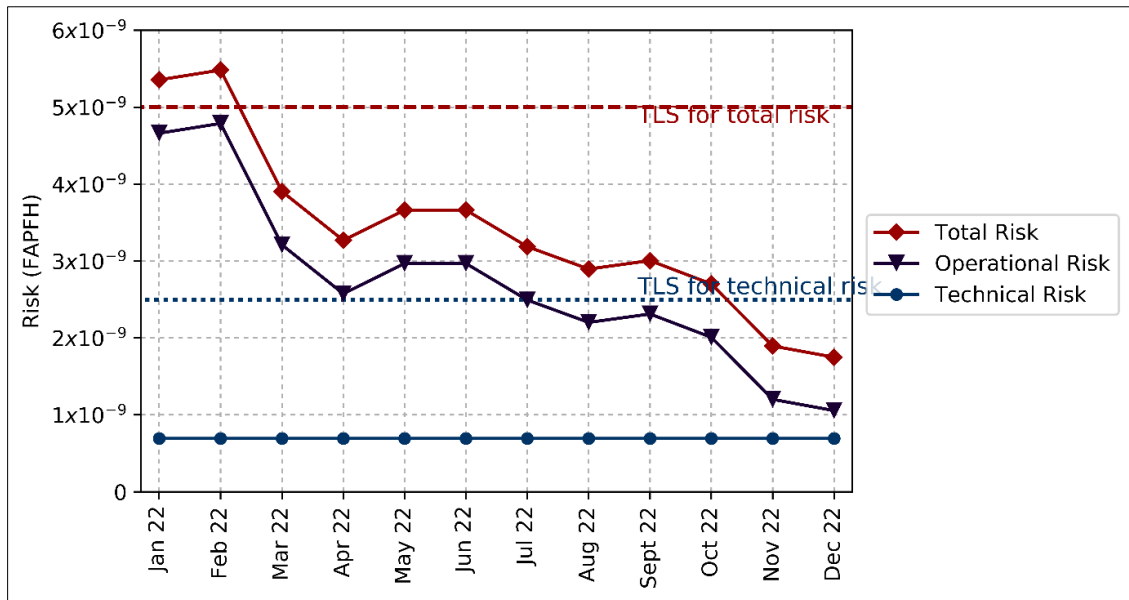


Figure 10: Trends of Risk Estimates for SA/IO RVSM Airspace

3.57 Table 15 shows the number of LHD and operational risk of each cluster as well as the results of checking against the criteria in SA/IO Airspace.

| 2022 Clusters (SA/IO) | Mumbai-Muscat (Hot Spot G) | Mumbai-Mogadishu (Hot Spot F) | Chennai/Kolkata-Yangon (Hot Spot A1) | Chennai-Kuala Lumpur (Hot Spot A2) | Chennai-Kolkata |
|---------------------------------------------------------------------|----------------------------|-------------------------------|--------------------------------------|------------------------------------|-----------------|
| Number of LHDs | 43 | 9 | 40 | 22 | 9 |
| Check Criteria: Number \geq 24.67 | Positive | Negative | Positive | Negative | Negative |
| Operational Risk ($\times 10^{-9}$ fapfh) | 0.79 | 0.02 | 0.02 | 0.00 | 0.00 |
| Check Criteria: Operational Risk \geq 0.18×10^{-9} fapfh | Positive | Negative | Negative | Negative | Negative |
| Check Criteria: Operation Risk \geq 5.00×10^{-9} fapfh | Negative | Negative | Negative | Negative | Negative |

Table 15: The results of identifying hot spots in SA/IO Airspace.

3.58 In the process of identifying hot spots, Mumbai-Muscat boundary (Hot Spot G) continued to meet the hot Spot identification criteria in terms of both the number of LHDs and the operational risk. Mumbai-Mogadishu boundary (Hot Spot F) did not meet any hot spot identification criteria. However, the number of LHDs at that boundary slightly increased in 2022. Therefore, **the western boundaries of Mumbai FIR (Hot Spot G and F)** should remain as Hot spots and continue to be monitored until further safety improvement initiatives or prevention measures such as AIDC are completed and demonstrate their effectiveness.

3.59 At the Kolkata-Yangon and Chennai-Yangon boundaries, the number of LHDs significantly increased in 2022. All LHDs at these two boundaries were in Category E. The increase in the number of LHDs could be attributed to the post-pandemic recovery of traffic. Controllers could face a rapid increase in workload, which could lead to human errors. At these two boundaries, there were no non-zero-duration LHDs in 2020 and 2021. However, there was one non-zero-duration LHD in 2022. As a result, the operational risk was 0.02×10^{-9} fapfh, which was the total operational risk at Hot Spot A1 and A2.

3.60 Furthermore, AIDC operation had been successfully implemented between Chennai OCC and Kuala Lumpur ACC since January 2021. However, the AIDC between Kolkata and Yangon and between Chennai and Yangon was not yet operational.

3.61 Regarding the process of identifying hot spots, the Hot Spot A1 (the boundaries between Kolkata /Dhaka/Chennai FIR and Yangon FIR) satisfied the criteria in terms of the number of LHD in 2022. Thus, Hot Spot A1 should remain on the hot spot list and should be monitored until further safety improvement initiatives were implemented and the number of LHDs and associated risks were reduced.

3.62 Hot Spot A2 (the boundary between Chennai FIR and Kuala Lumpur FIR) did not satisfy any hot spot identification criteria. Hence, Hot Spot A2 was proposed for reclassification as a potential non-hot spot.

Southeast Asia Airspace

3.63 The 2022 RVSM risk estimate for Southeast Asia (SEA) airspace indicated that the TLS for total risk had been met at 1.83×10^{-9} fapfh, as shown in **Figure 11**.

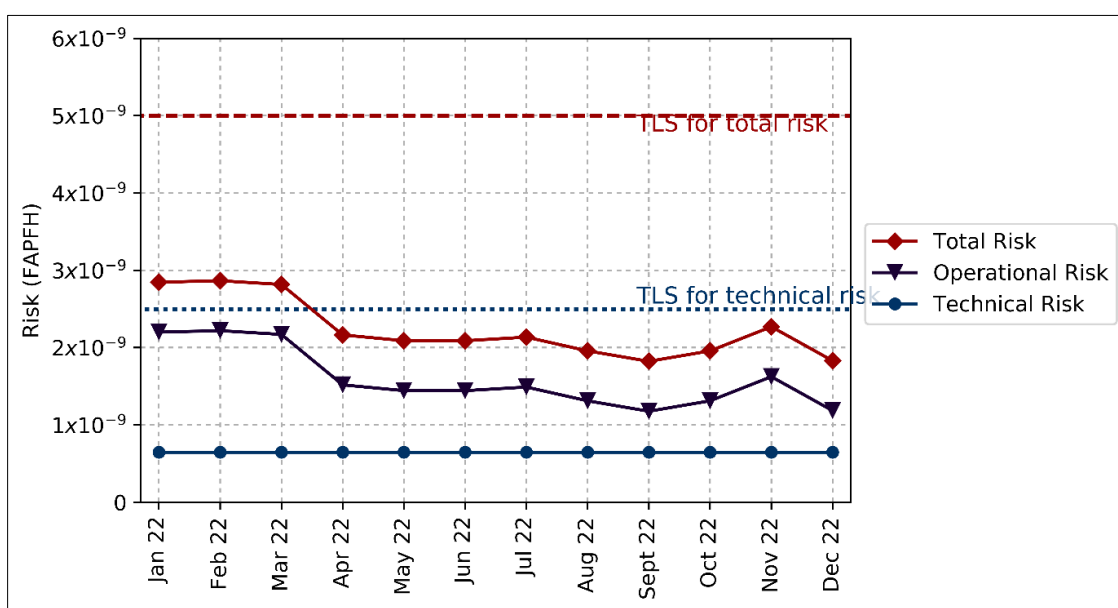


Figure 11: SEA Airspace RVSM Risk Estimates

3.64 57 of the 63 reported LHDs in SEA airspace (90%) were classified as Category E.

3.65 **Table 16** shows the number of LHDs and operational risk of each cluster as well as the results of checking against the criteria in SEA Airspace.

| 2022 Clusters (SEA) | Manila-Fukuoka (Hot Spot D) | Jakarta – Singapore/Kota Kinabalu (Hot Spot J) | Bangkok/Ho Chi Minh/ Kuala Lumpur - Singapore | Singapore-Kota Kinabalu |
|--------------------------------------|-----------------------------|------------------------------------------------|-----------------------------------------------|-------------------------|
| Number of LHDs | 4 | 14 | 11 | 8 |
| Check Criteria: Number \geq 12.60 | Negative | Positive | Negative | Negative |
| Operational Risk (x 10^{-9} fapfh) | 0.03 | 0.18 | 0.60 | 0.11 |

RASMAG/28
Report of the Meeting

| 2022 Clusters (SEA) | Manila-Fukuoka (Hot Spot D) | Jakarta – Singapore/Kota Kinabalu (Hot Spot J) | Bangkok/Ho Chi Minh/ Kuala Lumpur - Singapore | Singapore-Kota Kinabalu |
|---------------------------------------------------------------------------|-----------------------------|------------------------------------------------|-----------------------------------------------|-------------------------|
| Check Criteria: Operational Risk \geq 0.24×10^{-9} fapfh | Negative | Negative | Positive | Negative |
| Check Criteria: Operational Risk \geq 5.00×10^{-9} fapfh | Negative | Negative | Negative | Negative |

Table 16: The results of identifying hot spots in SEA Airspace

3.66 According to the result in **Table 16**, the following clusters satisfied the hot spot criteria:

- Jakarta – Singapore/Kota Kinabalu boundary (Hot Spot J); and
- Bangkok/Ho Chi Minh/Kuala Lumpur – Singapore boundary.

3.67 In 2022, the highest number of LHDs occurred at Manila - Fukuoka FIR boundaries of Manila FIR (Hot Spot D), no LHD cluster satisfies the Hot spot criteria in 2022.

3.68 If none of Manila FIR boundaries satisfy the hot spot criteria in 2022 and 2023 for both SEA and Japan Airspaces, Hot Spot D may be proposed for reclassification as potential non-hot spot. But it was noted that the AIDC implementation between Manila ACC and Fukuoka ACC was yet to begin.

3.69 Regarding the AIDC implementation with adjacent administrations of Manila ACC, the meeting was informed that the status with Oakland ARTCC has been changed to continuous operational trial.

3.70 The meeting noted the importance of AIDC and surveillance capabilities having the largest impact to the reduction CAT. E LHDs and risk in the APAC region. There are still areas and LHD Hot spots where AIDC have not been implemented. Therefore Chair encourage all administrations to utilise the analysis and outcomes of RASMAG as evidence to pursue system improvements.

Mongolian Airspace

3.71 In 2022, no LHD was reported within or at the boundary of the Mongolian Airspace. Hence, the analysis of operational errors cannot be conducted. As a result, the total risk was estimated as 0.33×10^{-9} fapfh.

APANPIRG Deficiencies

3.72 To facilitate the process of RVSM safety oversight, States were required to annually submit a December TSD (APANPIRG Conclusion 16/4) and ANSPs were responsible for submitting LHD data to their Regional Monitoring Agencies (RMAs) on a monthly basis.

3.73 MAAR had not received any data from Afghanistan since the political issue in August 2021. Except Afghanistan, MAAR received the TSD and LHD data from all other States in 2022. The States that submitted the data also provided good cooperation and promptly revised any error when requested.

3.74 As a result, MAAR proposed to maintain Afghanistan on the APANPIRG List of ATM and Airspace Safety Deficiencies under *Non-Provision of Safety-related Data*.

SEASMA Safety Report (WP/13)

3.75 The South East Asia Safety Monitoring Agency (SEASMA) provided a horizontal safety assessment report for operations on ATS routes N892, L625, N884 and M767 over the South China Sea. The assessment met the Target Level of Safety (TLS) values for lateral and longitudinal separation standards applicable for RNP 10 and RNP 4 operations. The assessment period covered was from 1 January to 31 December 2022.

3.76 The operational trial for RNP 4 operation on ATS routes N884 and M767 started in January 2022, and was officially implemented in April 2022. ATS routes M767 and N884 supported a hybrid mode of RNP 4 and RNP 10 operations. The lateral and longitudinal collision risk estimate trends for RNP 4 operation presented by SEASMA was the risk assessment of these two ATS routes. **Table 17** provides the horizontal risk estimates for the airspace over the South China Sea

| Airspace over the South China Sea – estimated annual flying hours = 46,703 hours (note: estimated hours based on December 2022 traffic sample data) | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------|------------------|
| Risk | Risk Estimation | TLS | Remarks |
| <i>RASMAG 27 Lateral Risk (RNP10)</i> | <i>0.017 x 10⁻⁹</i> | <i>5.0 x 10⁻⁹</i> | <i>Below TLS</i> |
| <i>RASMAG 27 Longitudinal Risk (RNP10)</i> | <i>0.375 x 10⁻⁹</i> | <i>5.0 x 10⁻⁹</i> | <i>Below TLS</i> |
| Lateral Risk (RNP 10) | 0.096 x 10⁻⁹ | 5.0 x 10⁻⁹ | Below TLS |
| Longitudinal Risk (RNP 10) | 0.375 x 10⁻⁹ | 5.0 x 10⁻⁹ | Below TLS |
| Lateral Risk (RNP 4) | 0.738 x 10⁻⁹ | 5.0 x 10⁻⁹ | Below TLS |
| Longitudinal Risk (RNP 4) | 0.786 x 10⁻⁹ | 5.0 x 10⁻⁹ | Below TLS |

Table 17: Horizontal Risk Estimates

3.77 The number of LLDs had increased from zero in 2021 to one in 2022 while the number of LLEs remained at zero. The LLD reported in 2022 was a CAT ‘A’ LLD, in which the flight crew deviated in the horizontal dimension without receiving ATC clearance.

Summary Report of Identified Airspace Risk and Mitigations (IP/02)

3.78 Singapore presented the analysis and mitigations to reduce Large Height Deviation (LHD) and Gross Navigation Error (GNE) occurrences in Singapore Flight Information Region (FIR) and the mitigation measures that were implemented.

BOBASMA Horizontal Safety Monitoring Report (WP/14)

3.79 The Bay of Bengal Airspace Safety Monitoring Agency (BOBASMA) presented the horizontal safety assessment for the Bay of Bengal/Arabian Sea Indian Ocean airspace during the period January to December 2022. The 50NM lateral and longitudinal risks remained below the Target Level of Safety (TLS) shown in **Table 18**.

| Bay of Bengal Arabian Sea Indian Ocean Airspace Estimated annual flying hours = 456825 Hours (Note: Estimated Hours based on Dec 2022 Traffic Sample Data) | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------------------------|------------------|
| Source of Risk | Risk Estimation | TLS | Remarks |
| <i>RASMAG 27 Lateral Risk</i> | <i>1.09397 x 10⁻⁹</i> | <i>5.0 x 10⁻⁹</i> | <i>Below TLS</i> |
| <i>RASMAG27 50NM Longitudinal Risk</i> | <i>1.07689 x 10⁻⁹</i> | <i>5.0 x 10⁻⁹</i> | <i>Below TLS</i> |
| Lateral Risk | 1.38017 x 10⁻⁹ | 5.0 x 10⁻⁹ | Below TLS |
| 50NM Longitudinal Risk | 0.484744 x 10⁻⁹ | 5.0 x 10⁻⁹ | Below TLS |

Table 18: Bay of Bengal Arabian Sea Indian Ocean Airspace Horizontal Risk Estimates

3.80 It was noted that due to the COVID-19 pandemic and associated restrictions, the number of flights drastically reduced all over the world in 2020, and this trend largely continued in 2021. Although the number of flights in the three Indian FIRs in 2019 through 2022 has recovered to a large extent, it had not reached pre-pandemic levels. As in the previous year, a reduced collision risk was observed compared to 2019.

PARMO Vertical Safety Monitoring Report (WP/16)

3.81 PARMO provided a vertical safety assessment for 2022 for the Pacific RVSM airspace and a portion of Northeast Asia RVSM airspace.

Pacific Airspace

3.82 The 2022 RVSM risk estimate for Pacific airspace indicated that the TLS had not been met at 32.6×10^{-9} (Table 19 and Figure 12).

| Pacific Airspace – estimated annual flying hours = 1,482,049 hours <i>(note: estimated hours based on Dec 2022 traffic sample data)</i> | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------------|---------------------|
| Source of Risk | Risk Estimation | TLS | Remarks |
| <i>RASMAG 27 Total Risk</i> | 28.2×10^{-9} | 5.0×10^{-9} | <i>Above TLS</i> |
| Technical Risk | 0.14×10^{-9} | 2.5×10^{-9} | Below Technical TLS |
| Operational Risk | 31.5×10^{-9} | - | - |
| Total Risk | 32.6×10^{-9} | 5.0×10^{-9} | Above TLS |

Table 19: Pacific Airspace RVSM Risk Estimates

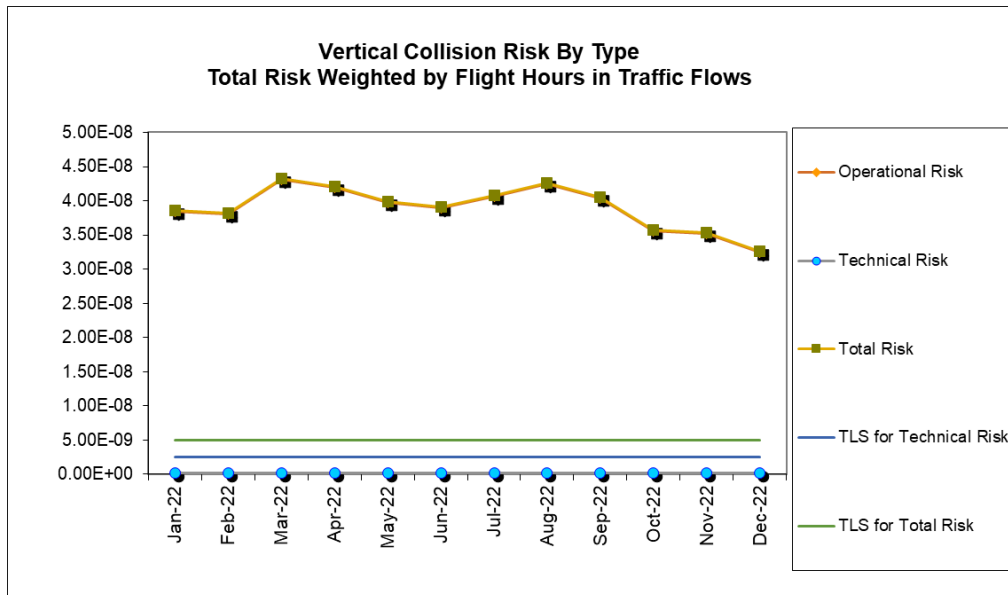


Figure 12: Pacific Airspace RVSM Risk Estimate Trends

3.83 The largest contributors to the vertical collision risk estimate were the reported LHD category E occurrences involving the Honolulu Control Facility and Oakland ARTCC. This specific set of reported LHDs accounted for 64 percent of the total vertical risk estimate. The current plan was to implement the FAA’s En-Route Automation Modernization (ERAM) system at the Honolulu Control Facility (HCF) by the end of 2025. Prior to that time, both facilities had implemented mitigation strategies.

3.84 In response to a query regarding improvement of surveillance capabilities, PARMO confirmed that Space –based ADS-B was not available for use in the Pacific airspace.

Northeast Asia Airspace

3.85 **Table 20** summarizes North East Asia airspace RVSM technical, operational, and total risks.

| North East Asia Airspace – estimated annual flying hours = 114,005.7 hours <i>(note: estimated hours based on Dec 2022 traffic sample data)</i> | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------------|---------------------|
| Source of Risk | Risk Estimation | TLS | Remarks |
| <i>RASMAG 27 Total Risk</i> | 0.04×10^{-9} | 5.0×10^{-9} | <i>Below TLS</i> |
| Technical Risk | 0.09×10^{-9} | 2.5×10^{-9} | Below Technical TLS |
| Operational Risk | 0.00×10^{-9} | - | - |
| Total Risk | 0.09×10^{-9} | 5.0×10^{-9} | Below TLS |

Table 20: North East Asia Airspace RVSM Risk Estimates

3.86 There were 108 reported LHDs in calendar year 2022. All reported occurrences had zero duration and zero flight levels crossed without ATC clearance. All of the reported occurrences were within the AKARA corridor airspace and were examined in a separate paper. There were no reported LHD occurrences from other areas within the Incheon FIR during calendar year 2022.

Central East Pacific Traffic Flow Assessment for Calendar Year 2021 (WP/18)

3.87 PARMO presented the 2022 vertical risk assessment for the Central East Pacific (CEP) traffic flow in Pacific airspace. This area was designated as Hot Spot N at RASMAG/24. The CEP traffic flow contained air traffic between mainland North America and Hawaii.

3.88 **Table 21** shows the number of reported LHDs and total duration by category in the CEP for calendar year 2022 and 2021. There was a decrease in the duration associated with category E occurrences for the CEP traffic flow in 2022 compared to 2021. **Figure 13** illustrates the location of LHDs in the CEP traffic flow.

| Category | 2021 | | 2022 | |
|--------------|-----------|---------------|----------|-----------|
| | No. LHD | Duration(min) | Category | No. LHD |
| A | 1 | 0 | A | 1 |
| B | 6 | 21 | B | 6 |
| E | 34 | 128.6 | E | 34 |
| I | 1 | 0 | I | 1 |
| Total | 42 | 149.6 | Total | 42 |

Table 21: Reported LHD Occurrences for CEP 2022 vs 2021

RASMAG/28
Report of the Meeting

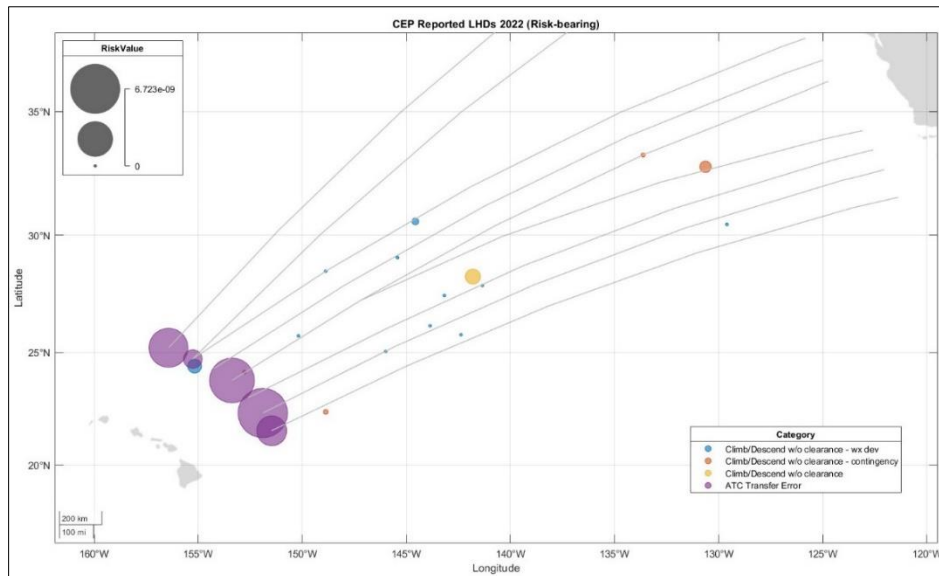


Figure 13: Reported LHDs within the CEP Traffic Flow – 2022

3.89 The overall vertical risk for the CEP in 2022 was 21.2×10^{-9} fapfh, which exceeded the target level of safety (TLS). This value represented a slight decrease from that reported in 2021. **Figure 14** shows the five-year (rolling 12-month) trend for the CEP vertical collision risk estimates.

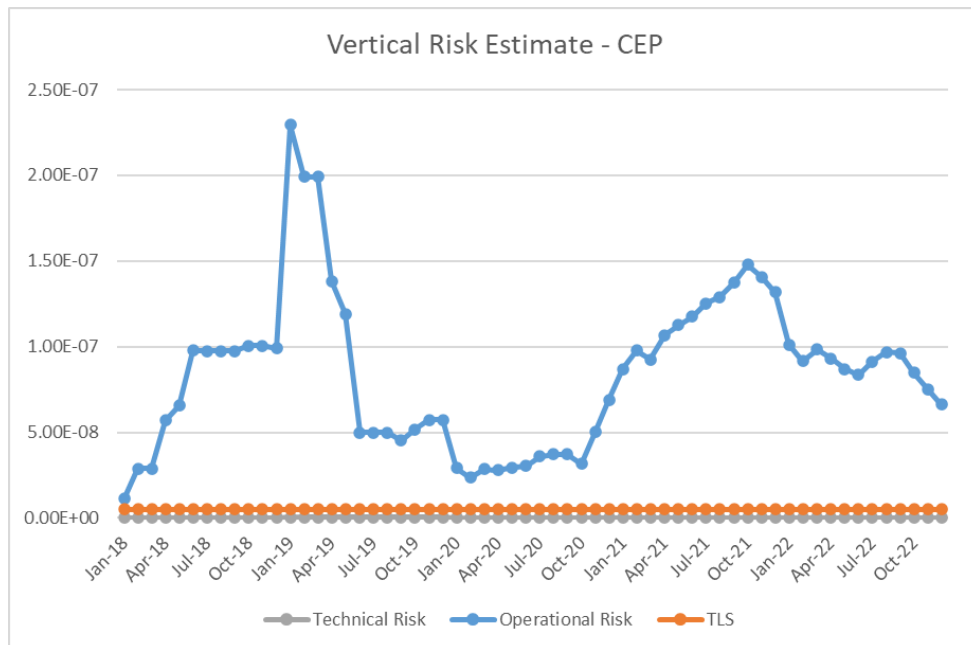


Figure 14: CEP vertical collision risk estimates by calendar year (rolling 12-month)

Hot Spot Identification process to Hot Spot N (FL/02)

3.90 **Table 22** provided the results of the hot Spot identification process applied to the CEP Traffic Flow, Hot Spot N.

| | 2018 | 2019 | 2020 | 2021 | 2022 |
|-------------------------------------|------|------|------|------|------|
| Number of LHDs in Hot Spot N | 11 | 36 | 29 | 42 | 44 |

RASMAG/28
Report of the Meeting

| | 2018 | 2019 | 2020 | 2021 | 2022 |
|---------------------------------------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|
| Number of Clusters (n) in Region | 4 | 3 | 3 | 3 | 3 |
| Hot Spot N Operational Risk | 23.7 | 16.4 | 17.3 | 23.7 | 21.2 |
| Criteria: Number of Occurrences in Region/(n+1) | 6.4 | 20.75 | 12.85 | 16.25 | 17.5 |
| Criteria: Region Risk Estimate ($\times 10^{-9}$) | 5.28 | 7.85 | 5.5 | 7.05 | 8.15 |
| Criteria: TLS $\geq 5 \times 10^{-9}$ fapfh | 5 | 5 | 5 | 5 | 5 |
| Result and Action by RASMAG Meeting | Continue Monitoring (RASMAG/24) | Continue Monitoring (RASMAG/25) | Continue Monitoring (RASMAG/26) | Continue Monitoring (RASMAG/27) | Continue Monitoring (RASMAG/28) |

Table 22: Hot Spot N Results

3.91 The results shown in **Table 22** confirmed the decision to continue monitoring the data collected for Hot Spot N. PARMO would provide an update for Hot Spot N to RASMAG/29 in 2024.

PARMO Horizontal Safety Monitoring Report (WP/17)

3.92 PARMO submitted its 2022 horizontal safety monitoring report for the Anchorage, Auckland, Nadi, Oakland, and Tahiti Flight Information Regions (FIRs). The lateral, longitudinal risks were all estimated to meet the TLS (**Table 23**). Of the 109 reported LLDs and LLEs, 86 (90%) were Category E, while 16 (5%) were Category A & B, four were Category D and two were Category J.

| Pacific Airspace – estimated annual flying hours = 1,482,049 hours <i>(note: estimated hours based on Dec 2022 traffic sample data)</i> | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------------|------------------|
| Risk | Risk Estimation | TLS | Remarks |
| <i>RASMAG 27 Lateral Risk</i> | 1.74×10^{-9} | 5.0×10^{-9} | <i>Below TLS</i> |
| <i>RASMAG 27 Longitudinal Risk</i> | 4.08×10^{-9} | 5.0×10^{-9} | <i>Below TLS</i> |
| Lateral Risk | 2.09×10^{-9} | 5.0×10^{-9} | Below TLS |
| Longitudinal Risk | 0.003×10^{-9} | 5.0×10^{-9} | Below TLS |

Table 23: Pacific Airspace Horizontal Risk Estimates

3.93 The report also identified some factors and provided mitigations:

- a) The reported occurrences involving aircraft transfers from the Honolulu Control Facility (HCF) and Oakland Oceanic OCA affect the User Preferred Routes (UPRs) crossing fixed airways within the Oakland Oceanic OCA. These specific events occurred frequently and required significant resources at the ATC facility to investigate underlying causes. A task force was established and determined remedial actions. The current plan was to implement the En-Route Automation Modernization (ERAM) system at the HCF, for implementation by 2025.
- b) As a consequent of a noticeable increase in deviations around adverse meteorological conditions, Oakland ARTCC provided operators with information on weather deviation procedures at a recent Oceanic Work Group (OWG) meeting. There were suggestions for aircraft operators to use in flight crew training. The most important part of the procedure was for the air crew to contact ATC via CPDLC or voice, stating “WEATHER DEVIATION REQUIRED”.

- c) The use of published airspace fixes that were not in the ATC automation system, prompting the automation system to disregard those fixes. These airspace fixes have since been removed from publications and there have been no repeat incidents.

Asia/Pacific Consolidated Safety Report (WP/19)

3.94 MAAR presented the Asia/Pacific Consolidated Safety Report, on behalf of the Asia/Pacific RMAs and EMAs (**Appendix F to this report**).

3.95 The report was divided into the Pacific (PAC) area, and Asia area (**Figure 15**).

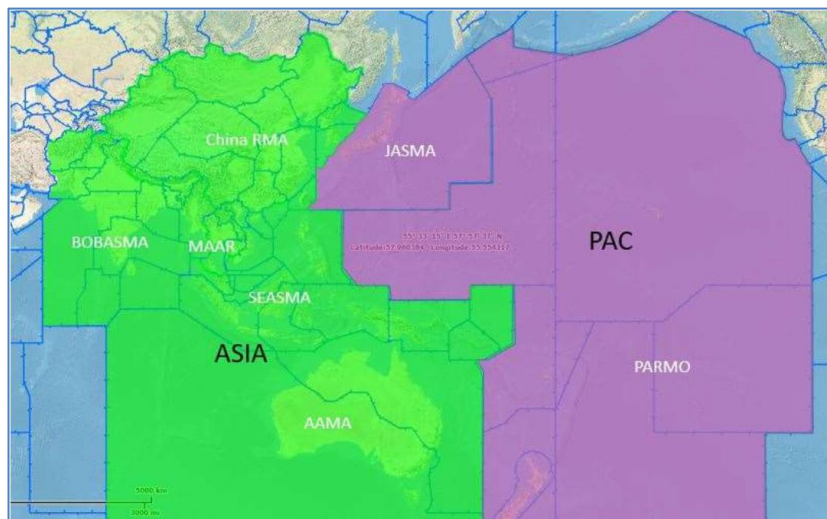


Figure 15: Asia and Pacific Safety Reporting Areas

Pacific Area Vertical Collision Risk

3.96 The estimated vertical collision risk for 2022 for the PAC area did not meet TLS. (**Table 24**). The overall risk vertical risk had been increasing from 2016 to 2021 due to improvements in reporting culture.

| Pacific Area – annual flying hours = 2,758,126 | | | |
|-------------------------------------------------------|------------------------------------------|----------------------|---------------------|
| Source of Risk | Risk Estimation | TLS | Remarks |
| Vertical Technical Risk | 0.19×10^{-9} | 2.5×10^{-9} | Below Technical TLS |
| Vertical Operational Risk | 19.43×10^{-9} | - | - |
| 2022 Vertical Overall Risk | 19.62×10^{-9} | 5.0×10^{-9} | Above TLS |

Table 24: Pacific Area Vertical Collision Risk 2022

3.97 The PAC vertical collision risk estimates had been above TLS and trending upwards each year from 2016 to 2019. In 2022, there was a slight decrease when compared to the previous year. (**Table 25**)

| Year | Vertical Overall Risk Estimate (x 10⁻⁹ fapfh) | Remark |
|-------------|-----------------------------------------------------------------|---------------|
| 2022 | 19.62 | Above TLS |
| 2021 | 19.74 | Above TLS |
| 2020 | 16.71 | Above TLS |
| 2019 | 30.21 | Above TLS |
| 2018 | 19.40 | Above TLS |
| 2017 | 7.30 | Above TLS |
| 2016 | 5.01 | Above TLS |

Table 25: Pacific Area Vertical Collision Risk Estimates 2016 – 2022

RASMAG/28
Report of the Meeting

3.98 There was a total of 118 LHDs in the Pacific area in 2022 (decreased from 123 in 2021), with total duration 449 minutes and 74 levels crossed. 34 of the occurrences were Category A, B or C (29%), 59 were Category D, E or F (50%), six were Category G or H (5%), 11 in Category I (9%), five were Category J or K (4%), and three were Category L or M (3%).

Pacific Area Horizontal Collision Risk

3.99 The estimated horizontal collision risk for 2022 for the PAC area met TLS in all longitudinal and lateral risk categories. (Table 26)

| Pacific Area – annual flying hours = 103,253 hours | | | |
|-----------------------------------------------------------|-------------------------|-----------------|----------------|
| 2022 PAC Area | Risk Estimation | Airspace | Remarks |
| Lateral Risk | 2.09×10^{-9} | Pacific | Below TLS |
| 50NM Lateral Risk | 0.456×10^{-9} | Japan | Below TLS |
| 30NM Longitudinal Risk | 0.0008×10^{-9} | Japan | Below TLS |
| 10MIN Longitudinal Risk | 1.754×10^{-9} | Japan | Below TLS |
| 2021 PAC Area | Risk Estimation | Airspace | Remarks |
| 30NM Lateral Risk | 1.74×10^{-9} | Pacific | Below TLS |
| 50NM Lateral Risk | 0.71×10^{-9} | Japan | Below TLS |
| 30NM Longitudinal Risk | - | Pacific | Below TLS |
| 30NM Longitudinal Risk | 0.01×10^{-9} | Japan | Below TLS |
| 50NM Longitudinal Risk | 2.22×10^{-9} | Pacific | Below TLS |
| 10MIN Longitudinal Risk | 0.03×10^{-9} | Japan | Above TLS |

Table 26: Pacific Area Horizontal Collision Risk 2021— 2022

3.100 There was a total of 146 LLDs and LLEs in the Pacific area in 2022 (increased from 137 in 2021), with a total duration of 478 minutes and total horizontal deviation of 715NM. 28 occurrences were Category A, B or C (19%), 102 of the occurrences were Category D, E or F (70%), 2 was Category G (1%), 12 were Category H (8%) and 2 in Category I or J (1%).

Asia Vertical Collision Risk

3.101 The estimated vertical collision risk for 2022 for the Asia area met TLS. (Table 27). The overall risk continued to decline since 2017 due to various safety improvement initiatives, but remained above TLS.

| Asia Area – annual flying hours = 7,305,055 hours (46% increase from 2021) | | | |
|-----------------------------------------------------------------------------------|-----------------------------------------|----------------------|---------------------|
| Source of Risk | Risk Estimation | TLS | Remarks |
| Vertical Technical Risk | 0.49×10^{-9} | 2.5×10^{-9} | Below Technical TLS |
| Vertical Operational Risk | 1.04×10^{-9} | - | - |
| 2022 Vertical Overall Risk | 1.53×10^{-9} | 5.0×10^{-9} | Below TLS |

Table 27: Asia Area Vertical Collision Risk 2022

3.102 The Asia vertical collision risk estimates had been above TLS each year from 2016 to 2020, but trending downwards since 2017 (Table 28). The 2022 vertical collision risk estimate was below TLS.

| Year | Vertical Overall Risk Estimate (x 10⁻⁹ fapfh) | Remark |
|-------------|-----------------------------------------------------------------|---------------|
| 2022 | 1.53 | Below TLS |
| 2021 | 4.03 | Below TLS |
| 2020 | 7.42 | Above TLS |
| 2019 | 12.88 | Above TLS |
| 2018 | 15.50 | Above TLS |

RASMAG/28
Report of the Meeting

| Year | Vertical Overall Risk Estimate (x 10 ⁻⁹ fapfh) | Remark |
|------|-----------------------------------------------------------|-----------|
| 2017 | 27.30 | Above TLS |
| 2016 | 12.53 | Above TLS |

Table 28: Asia Area Vertical Collision Risk Estimates 2016 –2022

3.103 There was a total of 518 LHDs reported in the Asia area in 2022, with total duration 192 minutes and zero levels crossed.

Asia Area Horizontal Collision Risk

3.104 The estimated horizontal collision risk for 2022 for the Asia area met TLS in all longitudinal and lateral risk categories. (**Table 29**)

| Asia Area – annual flying hours = 503,528 hours (51% increase from 2021) | | | |
|--------------------------------------------------------------------------|---------------------------|---------------|-----------|
| 2022 Asia Area | Risk Estimation | Airspace | Remarks |
| 30NM Lateral Risk | 0.068 × 10 ⁻⁹ | SEA | Below TLS |
| 50NM Longitudinal Risk | 0.096 × 10 ⁻⁹ | SEA | Below TLS |
| 30NM Lateral Risk | 0.786 × 10 ⁻⁹ | SEA | Below TLS |
| 50NM Longitudinal Risk | 0.475 × 10 ⁻⁹ | SEA and SA/IO | Below TLS |
| 2021 Asia Area | Risk Estimation | | Remarks |
| 30NM Lateral Risk | 0.0015 × 10 ⁻⁹ | SEA and SA/IO | Below TLS |
| 50NM Longitudinal Risk | 1.02 × 10 ⁻⁹ | SEA and SA/IO | Below TLS |
| 2020 Asia Area | Risk Estimation | | Remarks |
| 30NM Lateral Risk | 0.0004 × 10 ⁻⁹ | SEA and SA/IO | Below TLS |
| 50NM Longitudinal Risk | 0.85 × 10 ⁻⁹ | SEA and SA/IO | Below TLS |
| 2019 Asia Area | Risk Estimation | | Remarks |
| 30NM Lateral Risk | 0.0001 × 10 ⁻⁹ | SEA and SA/IO | Below TLS |
| 50NM Longitudinal Risk | 0.25 × 10 ⁻⁹ | SEA and SA/IO | Below TLS |

Table 29: Asia Area Horizontal Collision Risk 2019 - 2022

3.105 There were two LLDs and LLEs reported in the Asia area in 2022, with a duration of 104 minutes.

Reporting Rate of LHDs, LLDs and LLEs

3.106 **Table 30** shows the number of LHD, LLD and LLE reports for 2017 to 2022, and the number of reports per flying hours. Total estimated flying hours had been increasing since 2020, 7,234,881 hours in 2020, 7,604,927 in 2021 to 10,240,138 hours in 2022. The overall reporting rate of LHDs/LLDs/LLEs decreased in 2022.

3.107 The reporting rate in Republic of Korea and the Southwest Pacific significantly improved the in 2022. The reporting rate in SEA and SA/IO dramatically decreased in 2022 due to similar numbers of reports in 2021 and 2022, while there had been a significant increase in flying hours.

3.108 Mongolia and DPR Korea reported Nil LHDs in 2022.

| Airspace | # Reports | | | | | | 1 Report : Flying Hrs | | | | | |
|-----------------|-----------|------|------|------|------|------|-----------------------|------------|-----------|-----------|---------------|-----------|
| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| DPRK | 0 | 0 | 0 | 0 | 0 | 0 | - | - | - | - | - | - |
| Mongolia | 4 | 1 | 2 | 0 | 1 | 0 | 1: 37,771 | 1: 158,891 | 1: 82,138 | - | 1: 121,621 | - |
| SEA | 474 | 205 | 152 | 42 | 70 | 62 | 1: 6,548 | 1: 17,757 | 1: 22,275 | 1: 25,106 | 1: 15,456 | 1: 32,620 |

RASMAG/28
Report of the Meeting

| Airspace | # Reports | | | | | | 1 Report : Flying Hrs | | | | | |
|----------------------|--------------|--------------|--------------|------------|------------|------------|-----------------------|------------------|------------------|------------------|------------------|-----------------|
| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| SA/IO | 935 | 681 | 439 | 152 | 135 | 143 | 1: 3,166 | 1: 3,783 | 1: 7,955 | 1: 7,907 | 1: 11,167 | 1: 21,018 |
| Japan | 71 | 76 | 77 | 66 | 80 | 75 | 1: 21,510 | 1: 20,632 | 1: 20,762 | 1: 14,737 | 1: 13,528 | 1: 18,751 |
| China | 134 | 110 | 79 | 85 | 105 | 72 | 1: 18,248 | 1: 22,229 | 1: 31,119 | 1: 26,867 | 1: 15,477 | 1: 18,003 |
| Pacific | 42 | 43 | 173 | 134 | 176 | 179 | 1: 54,191 | 1: 45,064 | 1: 10,139 | 1: 6,404 | 1: 6,638 | 1: 8,280 |
| Indonesia | 34 | 23 | 37 | 18 | 41 | 54 | 1: 10,842 | 1: 53,603 | 1: 33,321 | 1: 17,346 | 1: 7,402 | 1: 8,060 |
| SW Pacific | 51 | 53 | 101 | 46 | 47 | 81 | 1: 17,572 | 1: 17,817 | 1: 9,335 | 1: 6,954 | 1: 11,975 | 1: 5,352 |
| ROK and AKARA | 5 | 12 | 34 | 5 | 24 | 108 | 1: 117,090 | 1: 28,365 | 1: 18,959 | 1: 25,965 | 1: 6,285 | 1: 1,056 |
| Total | 1,750 | 1,204 | 1,094 | 548 | 679 | 774 | 1: 8,180 | 1: 12,332 | 1: 14,330 | 1: 11,712 | 1: 11,200 | 1:13,230 |

Table 30: Total LHD, LLD and LLE Reports, and Reports per Flying Hours, 2017 - 2022

Hot Spots

3.109 **Table 31** summarizes current LHD Hot Spots, the FIRs involved, the year of identification, and status remarks.

| Hot Spot | Involved FIRs | Identified | Remarks |
|----------|----------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------|
| A1 | Kolkata/Dhaka-Yangon | 2015 | Cat. E LHDs. Risk reduced. |
| A2 | Chennai – Yangon/Kuala Lumpur | 2015 | Cat. E LHDs reduced. Risk reduced. Potential non-hot spot 2023 (RASMAG/28) |
| B | Incheon (AKARA Airspace) | 2015 | - Risk at Incheon-Fukuoka ACC interface mitigated. - Cat. E LHDs and risk at Incheon-Shanghai ACC interface reduced |
| D | Manila – all adjacent FIRs | 2015 | - Cat. E LHDs and risk at Manila/Fukuoka FIR boundary reduced. - Risk at all other Manila FIR boundaries mitigated. |
| F | Mogadishu – Mumbai | 2015 | Cat. E LHDs reducing. Risk reducing. |
| G | Sanaa/Muscat – Mumbai | 2015 | Cat. E LHDs. Risk reducing. |
| J | Jakarta – Singapore/Kota Kinabalu | 2018 | Cat. E LHDs. |
| M | Colombo – Melbourne | 2019 | LHDs and risk reducing. Awaiting response to establish a POC before removing from the hot spot list. |
| N | Oakland USA – Hawaii CEP | 2019 | Cat. E LHDs increasing. Risk increasing |
| O | Bangkok /Ho Chi Minh/Kuala Lumpur -Singapore | 2023 | Cat. E LHDs. |

Table 31: LHD Hot Spots in the Asia/Pacific Region

3.110 The meeting agreed that all hot spots except A2 be retained this year, and monitored for another year before considering their reclassification as potential non-hot spots can be removed. The meeting discussed the following changes to the Asia Pacific Consolidated report:

- a) include additional explanation of the Hot Spots B & D to provide clarity of remaining

issues

- b) delete the text "Existing LOA for provision of ATS" to prevent misunderstanding shown in Hot spot B
- c) add a description for good communication between China RMA and DPRK

3.111 Republic of Korea stated that it was necessary to implement AIDC and reduce longitudinal separation minima between Incheon and Shanghai ACC to decrease LHD category E, and to support removal of the AKARA Corridor FLAS. Therefore, Republic of Korea wished to pursue further coordination with China for the implementation of AIDC and reducing separation minima, regardless of the status of Phase 2 of the AKARA Corridor airspace project.

3.112 China RMA stated that discussion of operational matters such as AIDC implementation and reduction of separation should be referred to relevant ATS authorities.

3.113 The meeting was also reminded that reducing longitudinal separation would increase passing frequency and consequently could affect the technical risk. On the other hand, it could reduce operational risk due to the increased capacity for the same flight levels. It was highlighted that the necessary safety assessments should be conducted before the implementation of any separation minimum.

Agenda Item 4: Airspace Safety Monitoring Documentation and Regional Guidance Material

Review of the Guidance Material for Continued Safety Monitoring of APAC RVSM Airspace (WP/20)

4.1 MAAR proposed changes to the Guidance Material for the Continued Safety Monitoring of the Asia-Pacific RVSM Airspace. This review of the Guidance Material included contents from the LHD Material Package and updated information arising from APANPIRG conclusions and decisions since its first publication in 2019.

4.2 The meeting agreed to the proposed changes, and to the following Conclusion:

Conclusion RASMAG/28-3: Guidance Material for the Continued Safety Monitoring of the Asia Pacific RVSM Airspace Version 2

That,

1. the Guidance Material for the Continued Safety Monitoring of the Asia Pacific RVSM Airspace Version 2 be adopted; and
2. the Guidance Material Version 2 be uploaded to the ICAO APAC website to replace the existing version.

Guidance for PBCS Non-Compliance Reporting (WP/21)

4.3 ICAO presented guidance for PBCS non-compliance reporting, amendments to the PBCS non-compliance form, Monitoring Agencies Terms of reference and PBCS action list for ANSPs.

4.4 Each ANSP was expected to submit non-compliance reports to the respective RMA every month. A NIL report was required, similarly to LHD/LLD/LLE reporting. RMAs were required to forward reports to the designated EMAs (where applicable) for follow-up action and to inform the State of operator/registry of non-compliant aircraft. Furthermore, EMAs had to compile the submission by States by month as a part of the annual report. In addition, some improvements to the guidance were suggested, including the streamlining of PBCS non-compliance submission flow chart.

4.5 The meeting agreed to remove the reference to ‘the three previous months’ in the new proposed text for “PBCS action list for ANSP” Paragraph 1.15 taking alignment from the existing paragraph 1.4.

4.6 The meeting considered that any change to the PBCS non-compliance reporting form should be discussed by FIT-Asia, taking into account the need for harmonization between regions, particularly between the APAC and North Atlantic (NAT) regions.

Suggestions on PBCS Non-Compliance Report Exchange (FL/01)

4.7 China RMA shared the challenges in PBCS non-compliance reporting, and suggested the following:

- a) The ANSP sending non-compliance report provides materials, including data and descriptions as appropriate to support their claim;
- b) States receiving the non-compliance should note the contents of the data and transfer the non-compliance to the operators, and make sure remedial actions are taken as soon as possible.

4.8 The meeting agreed that China RMA’s suggestion to share data be further discussed at the next FIT-Asia meeting.

Asia Pacific Flight Information Region and Responsible Monitoring Agency (WP/22)

4.9 ICAO proposed the adoption of a stand-alone document detailing the Asia Pacific Flight Information Regions and Responsible Monitoring Agencies, to be maintained on the ICAO APAC website, and the consequential removal of this information from the EMA handbook.

4.10 The meeting noted that the existing information in **RASMAG/28 WP/22 Appendix A** should be updated as follows, prior to uploading to the Regional Office website:

| ICAO Contracting State | Designated EMA for PBN and Data Link Approvals |
|--------------------------------------------------|-------------------------------------------------------|
| China (except Sanya for Lanzhou and Urumqi FIRs) | China RMA |
| Japan | JASMA |

4.11 The meeting agreed the following Conclusion:

Conclusion RASMAG/28-4: Removal of EMA handbook Appendix A and Guidance for PBCS Non-Compliance Reporting

That,

1. the removal of EMA Handbook Appendix A - *Asia Pacific Flight Information Regions and Responsible Monitoring Agency* (RASMAG/28 WP/22 refers); and
2. the additional guidance for PBCS Non-compliance reporting;
be included in amendments to the following:
 - a) The Revised EMA Handbook at **Appendix C to the Report**;
 - b) Revised PBCS Action List at **Appendix D to the Report**; and
 - c) The Asia Pacific Flight Information Regions and Responsible Monitoring Agency document at **Appendix E to the Report**;
3. the above-mentioned documents be uploaded to the Asia/Pacific Regional Office website to replace the previous versions; and
4. states/Administrations are urged to submit timely reports including Nil reports.

Agenda Item 5: Airspace Safety Monitoring Activities/Requirements in the Asia/Pacific Region

Bilateral Meeting between Fukuoka and Manila ACC (IP/03)

5.1 Japan highlighted the collaborative work between Fukuoka & Manila ACC to prevent transfer errors at the Flight Information Region (FIR) interface between Fukuoka FIR and Manila FIR.

JASMA Assessment of Non-RVSM-Approved Aircraft (WP/23)

5.2 JASMA presented a list of operator-aircraft type operating within the RVSM airspace of Fukuoka FIR with no registration of RVSM in the approval databases as of July 2023. 98 aircraft with no registration in the RMA's approval database had been detected from Australia, Austria, Bermuda (United Kingdom), Cambodia, Canada, Cayman Islands (UK), China, China (Hong Kong), China (Taiwan), India, Indonesia, Japan, Malaysia, Philippines, Qatar, Republic of Korea, Singapore, Turkey United States, Vietnam. The detailed list was attached to **RASMAG/28 WP/23**.

5.3 The meeting was informed that the four Chinese aircraft identified in the list were RVSM approved.

China RMA Assessment of Non-RVSM-Approved Aircraft (WP/24)

5.4 China RMA presented a monthly check of flight plan data against the combined RVSM approval database up to July 2023. 15 suspected non-approved aircraft had been detected from Cayman Islands (UK), China, Indonesia, Japan, Qatar and Republic of Korea.

MAAR Assessment of Non-RVSM Approved Aircraft (WP/25)

5.5 MAAR presented the result of an annual audit that detected 24 aircraft from Argentina, India, Indonesia, Malaysia, Mexico, Turkey and USA that operated in RVSM airspace without valid RVSM approvals in the RMA's database.

5.6 The analysis indicated a slight increase compared to the previous year's count of 21 aircraft. The majority of the detected aircraft were Indonesian. MAAR had already engaged with the AAMA and had been informed that they were in the process of following up on the RVSM approval status with the DGCA of Indonesia.

5.7 No long-term repeated rogue aircraft had appeared on the list this year.

APANPIRG List of Deficiencies

5.8 Brunei Darussalam had provided MAAR with the 2020, 2021, and 2022 annual RVSM approval snapshots. MAAR recommended that RASMAG propose to APANPIRG that Brunei Darussalam be removed from the APANPIRG List of ATM and Airspace Safety Deficiencies. The removal of ATM and Airspace Safety Deficiencies was covered in WP/36.

5.9 In response to the increased number of Indonesia-registered aircraft in the list, Indonesia informed the meeting that they had all been approved, but updating the approval documentation was still subject to coordination.

PARMO RVSM Traffic Compliance Monitoring (WP/26)

5.10 An assessment of non-State-approved operators using the RVSM airspace in the Pacific and a portion of North East Asia overseen by PARMO for the period from December 2022, based on PARMO approvals records as of March 2023, was presented to the meeting. The analysis yielded 30 aircraft from 12 states that were confirmed to be operating in the RVSM level band without an RVSM approval as of March 2023 combined approval records.

5.11 After the re-evaluation of the December 2022 PARMO FIRs Traffic samples using the June 2023 combined approvals records, out of the 30 identified conducting non-approved operations: 24 registrations were found to be Approved, Ferried, Cancelled or Exported while three were found to be misfiles or typographical errors, one needed follow up to help determine its outcome and finally two aircraft remaining non-approved.

5.12 In review of the September 2022 through June 2023 monthly assessment of operations without an RVSM approval record on file, PARMO established that more frequent examination of traffic data reduced reporting errors. The burden on the analysts was subsequently reduced. An analyst did not have to pursue aircraft that had taken self-corrective action, been the result of a mistake made during flight plan filing, or delayed registration number change reporting, or lagged in the issuance of specific RVSM Authorizations.

5.13 Monthly traffic audit data showed overall workload could be reduced. When several months of information was used to determine if aircraft were potentially unapproved, there were fewer resulting cases to consider and the likelihood that they were actually unapproved was higher. Using an audit repeat period based on the average lag would be optimal to the reporting and pursuit of unapproved aircraft operations in RVSM.

5.14 The meeting was updated with information regarding the RVSM approval of the one aircraft registered to Republic of Korea.

Update Information on the EUR RMA FPRAVP (IP/04)

5.15 MAAR provided an update on the extension of the Flight Plan RVSM Approval Verification Process (FPRAVP), a proactive system created to reject flight plans of aircraft not approved for RVSM operations within the European airspace. The upcoming phase of the FPRAVP extension aims to incorporate seven additional States within the EUR RMA RVSM area, with the possibility of these States joining the scheme in 2024.

5.16 Based on the most recent bulletin version (version 21.8), there were still five MAAR State aircraft that continued to be listed on the EUR RMA bulletin, despite their previous inclusion in Bulletin version 17.7 in July 2022. **Table 33** presents a list of aircraft under MAAR’s responsibility that were listed on the EUR RMA Bulletin

| State of Operator | Operator Name | Aircraft Registration | Aircraft Type |
|-------------------|--------------------|-----------------------|---------------|
| India | Air Force of India | K3601 | E35L |
| | Air Force of India | K3604 | E35L |
| | Air Force of India | G2961 | GLF2 |
| | Air Force of India | GB8001 | GL5T |
| Pakistan | Army of Pakistan | 805 | B350 |

Table 33: List of MAAR rogue aircraft on the EUR RMA Bulletin

5.17 MAAR would continue to follow up with the State Authorities of India and Pakistan to establish communication with their respective State aircraft operators.

PARMO RVSM Long Term Height Monitoring Burden (WP/27)

5.18 An assessment of the monitoring burden associated with the Long-Term Height Monitoring (LTHM) requirements for airframes for which PARMO was the responsible RMA was provided to the meeting. PARMO approvals and global monitoring records as of 30 June 2023 were used to assess the monitoring burden.

5.19 The total number of unique airframes identified as having a full RVSM approval from a state of registry under PARMO responsibility as of 30 June 2023 was 558, with a resultant monitoring burden of 127 and a total of 17 aircraft not successfully monitored within the past two years (or 1,000 flight hours, whichever interval was longer).

5.20 A detailed list of the monitoring burden per State under PARMO responsibility was provided in **RASMAG/28 WP/27 Appendix A**.

5.21 The meeting was informed that discussion between New Zealand and PARMO had taken place and a possible solution had been identified to reduce the remaining burden.

NAARMO Long Term Height Monitoring Burden (IP/5)

5.22 The meeting was provided with an assessment of the monitoring burden associated with the long-term height monitoring requirements for airframes for which the North American Approvals Registry and Monitoring Organization (NAARMO, covering the airspace of USA, Canada and Mexico) was the responsible RMA, based on NAARMO approvals and global monitoring records as of 30 June 2023.

Statistical Analysis of ASE Variation based on Large-Data Analysis of Australian AHMS Results – Correcting for Bias (IP/6)

5.23 AAMA shared the results of an analysis of the Altimetry System Error (ASE) data using 7-years of Australian, from 2525 aircraft with stable ASE each using the WGS-84 ellipsoid height reference. Over 93,000,000 separate data points (each a summary of 1-minute) were used.

5.24 The results demonstrated a predictable bias in ASE with position (latitude, longitude), date and time of day up to ± 30 ft. There was no significant bias with flight level. For most aircraft with ASE calculated over a range of locations, times and dates, this bias would average zero. For some aircraft with smaller data sets, correcting for the bias had helped determine geoid height reference and improve ASE estimation.

China RMA Feasibility Verification of using Beidou Navigation Satellite System (BDS) Data for Aircraft Monitoring (IP/7)

5.25 The concept of an experiment validating the Beidou Satellite Navigation System (BDS) as a source of data to support height keeping capability monitoring was presented to the meeting. The paper described a trial based on antennas capable of receiving both GPS and BDS, and the associated by data analysis.

China RMA LTHM Burden Estimate Update (WP/28)

5.26 China detailed its expected monitoring burden for aircraft registered and operated by China and DPR Korea, to meet the LTHM requirement based on the RVSM approvals database at the end of June 2023. Detailed information was provided in **RASMAG/28 WP/28 Appendix A**.

5.27 The total number of aircraft approved for RVSM by China was 4,363, and the resultant monitoring burden was 783 airframes. The current outstanding monitoring burden was 145 airframes from Chinese operators.

5.28 The number of total approved airframes and resultant monitoring burden was increasing yearly, while the remaining burden was reduced from 2019 to 2021 and then increased from 2021 to 2023. This was mainly caused by traffic decrease, AHMS upgrade, and operational limits of B38M (Boeing 737 MAX 8) in the past three years. There were 52 B38M aircraft from 12 operators remaining to be monitored accounting for 35% of the total (149) in 2023.

5.29 For DPR Korea, there was one operator with four aircraft that required monitoring. In the last three years, China RMA was unable to travel to DPRK for on-board Height-Keeping Performance Monitoring (HKPM) for the four aircraft. China RMA was coordinating with DPRK for technical training and aircraft monitoring to be conducted in the following year.

5.30 The meeting noted that the four aircraft concerned may not have flown the necessary 1,000 hours that would then require they be included in the LTHM burden.

JASMA LTHM Burden Estimate Update (WP/29)

5.31 JASMA presented the current monitoring burden for aircraft registered and operated by Japan to meet Annex 6 LTHM requirements, as of June 2023.

5.32 The total number of RVSM-approved airframes was 821, and the total monitoring burden was 190. Taking into account aircraft which were approved for RVSM for the first time or were conducting height monitoring with the past two years, the outstanding burden was three airframes (1.6%).

5.33 The airframes remaining to be monitored were operated by small operators and may have had flight hours that had not reached 1,000 hours in the recent two years.

APAC Consolidated LTHM Compliance Status (WP/30)

5.34 MAAR presented the overview of LTHM compliance status in the APAC Region, including assessments of five APAC RMAs – AAMA, China RMA, JASMA, MAAR and PARMO. The assessment, based on RVSM approval data as at 30 June 2023, yielded a remaining monitoring burden in the APAC Region of 503 aircraft, which was a 5% decrease since 2021.

APANPIRG List of Deficiencies Consideration

5.35 **Table 34** lists the States having a remaining monitoring burden of 30% or more, which could be subject to an APANPIRG ATM and Airspace Safety Deficiency.

| State | 2021 | 2022 |
|-------------------------|------|------|
| DPRK (China RMA) | 100% | 100% |
| Papua New Guinea (AAMA) | 46% | 69% |
| Indonesia (AAMA) | 52% | 63% |
| Pakistan (MAAR) | 73% | 62% |
| Solomon Islands (AAMA) | 50% | 50% |
| Nepal (MAAR) | 45% | 46% |
| Mongolia (MAAR) | 29% | 39% |
| New Zealand (PARMO) | 8% | 36% |
| Bangladesh (MAAR) | 25% | 33% |

Table 34: List of States having monitoring burden over 30% as of 30 June 2023

5.36 RASMAG/27 had noted that, with most travel restrictions having been lifted in 2022, the consideration for States to be proposed to be included in the APANPIRG Deficiencies List would continue in RASMAG/28. Therefore, DPRK (China RMA), Papua New Guinea (AAMA), Indonesia (AAMA), Pakistan (MAAR), Solomon Islands (AAMA), Nepal (MAAR), Mongolia (MAAR), New Zealand (PARMO) and Bangladesh (MAAR) could be considered for inclusion in the Deficiency List if their remaining monitoring burden percentages were 30% or more until the next APANPIRG.

5.37 The paper outlined some recommendations for states and operators such as:

- a) State CAAs tracking and applying the 1,000 flight-hour criteria on their registered aircraft were encouraged to provide their RMA with a list of such aircraft so that the remaining monitoring burden can be reduced.
- b) APAC States were encouraged to inform their RMAs about any changes (such as transferred or de-registered aircraft) in a timely manner,
- c) APAC States should encourage aircraft operators to retrofit ADS-B-Out capability where feasible.
- d) The operators that have ADS-B-Out equipped aircraft but still have not fulfilled their monitoring requirements should consult the respective RMAs for other feasible arrangements.
- e) APAC States were encouraged to actively engage in sharing their ADS-B data with their designated RMA.

5.38 The meeting was informed that the 1,000 flight-hour criteria would be applied to the four aircraft from DPRK therefore DPRK can be omitted from the consideration of the APANPIRG ATM and Airspace Safety Deficiency listed in **Table 34**.

Regulatory Process of PBCS Operational Approvals (WP/31)

5.39 With reference to action item 26/1 of the RASMAG Task List, a preliminary study of administrations had been conducted. Some of the data was deduced from submitted approvals data of individual airframes, and some administrations had confirmed the use of direct operational approvals. The study only represented a small number of APAC administrations and it was still unclear where other process of approvals are employed.

5.40 Therefore, a survey was proposed to seek information from States to improve understanding by RASMAG and FIT-Asia of the PBCS approval process of APAC member states, and whether PBCS approvals issued were in accordance with Annex 6 and PBCS manual Doc 9869 chapter 4.

5.41 The meeting agreed to the following Conclusion:

Conclusion RASMAG/28-5: Survey for Asia Pacific States PBCS Approval Process

That, ICAO conducts a survey seeking information to improve understanding by RASMAG and FIT-Asia of the PBCS approval process of APAC member states, and whether PBCS approvals issued are in accordance with Annex 6 and PBCS manual Doc 9869

RVSM Approvals and Filing of RVSM Indicator by State Aircraft (WP/32)

5.42 ICAO presented a brief summary of actions taken in response to detection and handling of State aircraft operators that incorrectly file RVSM indicator ‘W’ in their flight plan.

5.43 The resultant survey supported by **Conclusion APANPIRG/32-6** indicated that the majority of the 15 responding States/administrations:

- a. had coordination processes in place to support discussions of RVSM and other airspace-safety-related issues with State aircraft operators;
- b. had rules or procedures in place to ensure that State aircraft operators did not file the RVSM-approved ‘W’ indicator in filed flight plans for non-RVSM-approved aircraft; and
- c. would like Asia Pacific RMAs to continue to cross-check ‘W’ in State Aircraft’s flight plans against RMAs’ RVSM database and try to resolve the discrepancies.

5.44 Therefore, the work of checking State aircraft RVSM approvals would remain with the RMAs.

5.45 The rejection of flight plans for aircraft that had not been reported as approved for RVSM had been implemented in RVSM designated airspace over Germany and would be extend to seven more European Union (EU) States (Austria, Denmark, France, Greece, Morocco, Moldova, and Spain) in 2024. As the rejection of such flight plans of non-RVSM aircraft started to gain more traction in European region, this could prompt States of non-EU origin to take more actions. It was noted that RVSM approval data for several of the banned aircraft from APAC Region had subsequently been provided to MAAR. However, these appeared to be government transport aircraft, and not military aircraft.

RASMAG/28
Report of the Meeting

5.46 However APAC state aircraft operating solely within APAC region may still pose an issue. Therefore, the RASMAG task list item 25/2 should remain open and monitored.

5.47 The meeting noted that the RVSM approval audit process conducted by RMAs was effective for identifying State aircraft operating in RVSM airspace without the appropriate RVSM approvals. RMAs were encouraged to continue this important audit process.

5.48 Regarding RASMAG action item task 26/4 concerning a mitigation for Hot Spot M, the meeting noted that AAMA, ICAO, MAAR and Sri Lanka had sent various formal letters to DGCA India for the nomination of a POC from the Indian Navy. India informed the meeting that the nomination of POC was in the final process of approval.

JASMA Assessment of Non-PBCS Approved Aircraft (WP/33)

5.49 JASMA presented the trend of the numbers and percentages for the Performance-Based Communications and Surveillance (PBCS)-filed flights and PBCS-approved flights flying in the Pacific Ocean airspace of Fukuoka Flight Information Region (FIR) as of June 2023. The list of operator-aircraft combinations identified as non-PBCS-approved flight in June 2023 is also provided in WP/38. **Figure 16** represents the number of all aircraft operating in the in the Pacific Ocean airspace of Fukuoka FIR, the percentage that included PBCS-filed flights, and the percentage that were PBCS-approved flights, for the period from January 2022 to June 2023.

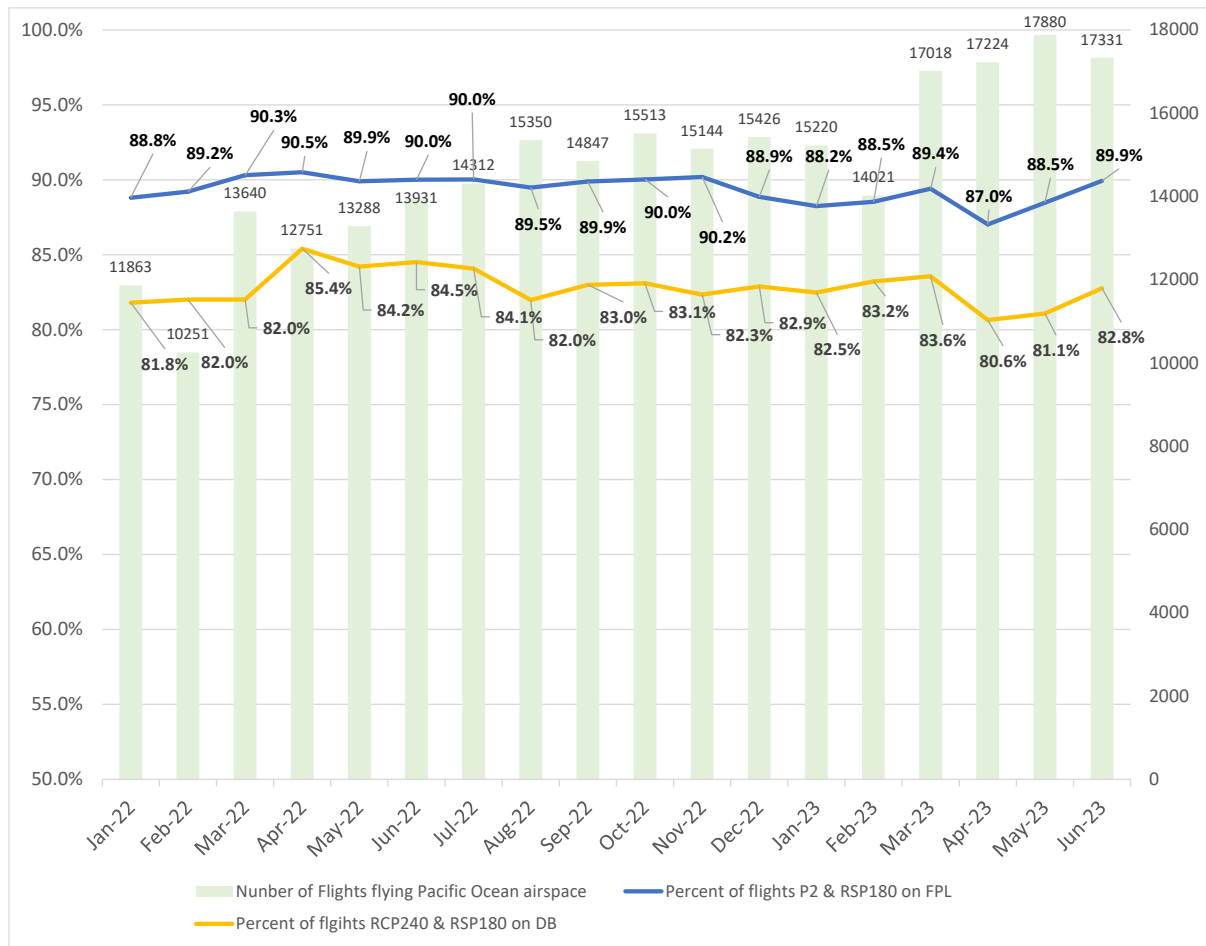


Figure 16: Percentage of PBCS-filed flights and PBCS-approved flights

5.50 The percentage of PBCS-filed flights was steady and approximately 90% in 2022, but it was slightly variable between 87% and 90% for the period of the first half of 2023. On the other hand, the percentage of PBCS-approved flights had maintained by approximately six to seven percent lower than the percentage of PBCS-filed flights.

5.51 It means that there were approximately 40 flights per day and 1,200 flights per month flying in the Pacific Ocean airspace of Fukuoka FIR in June 2023 that filled "P2" and "RSP180" in their flight plans but were not confirmed their PBCS approval/authorization in the approval database.

5.52 New RNP4 routes are planned to be established in the North Pacific Ocean airspace in 2024. The RNP4 routes would be separated at least 23 NM from other ATS routes, which aircraft are required PBCS and RNP4 approved.

5.53 To ensure airspace safety, JASMA had planned to conduct PBCS approval status verification checks with designated RMAs where aircrafts were found to have no PBCS approvals, as a trial in 2023.

5.54 The meeting noted that the manual process described above to identify and verify such aircraft was workable solution for aircraft that were registered in States that did not issue direct operational approvals.

JASMA PBCS Case Study (IP/08)

5.55 JASMA shared a case study of several B787-9 aircraft operated by some Japanese airline operator that did not meet the PBCS performance requirements in the North Atlantic Ocean airspace.

5.56 The paper also highlighted the actions taken by JASMA and CRA Japan, and offered some considerations to resolve the issue identified.

JASMA LLD Standard for 23 NM Lateral Separation (IP/10)

5.57 JASMA had presented the proposal for the new 5NM LLD standard at the RMACG/18 meeting. The meeting took into consideration the differing approaches to defining and monitoring LLDs in other regions, a uniform, global LLD definition of 5 NM was not required at this time. Therefore, it was conclude that the use of a 10 NM threshold in the NAT region would continue, even if lateral separation in the NAT oceanic airspace was 23 NM based on RCP 240, RSP 180 and RNP 4, and 19 NM for the Advanced Surveillance Enhanced Procedural Separation (ASEPS).

5.58 Further consideration and discussion would be needed before implementing new LLD criteria in the APAC region since they should cover other lateral separations in the Oceanic airspace, such as ASEPS. Therefore, States/Administrations were encouraged to inform monitoring agencies of their implementation plans for lateral separation minima such as 23 NM lateral separation minima and ASEPS.

Competent Airspace Safety Monitoring Organizations List (WP/35)

5.59 The meeting updated the *RASMAG List of Competent Airspace Safety Monitoring Organizations* (**Appendix G to the Report**).

Agenda Item 6: Air Navigation Services Deficiencies

ANS Deficiencies List (WP/36)

6.1 The meeting reviewed the APANPIRG ATM and Airspace Safety Deficiency List and agreed to make the following recommendation to APANPIRG/34, as recorded in **Appendix H to this Report**. The meeting was informed that the deadline for submission of information on reduction of the remaining monitoring burden must reach MAAR by 15 Nov 2023 in order to be processed in time for APANPIRG/34.

a) To be retained in the Deficiencies list:

- Afghanistan (Failure to submit Kabul FIR Large Height Deviation (LHD) data).
- Afghanistan (Remaining monitoring burden of 62%, RASMAG/26).
- Pakistan (Remaining monitoring burden of 62%, RASMAG/28).
- India (Post implementation monitoring not implemented, - Performance monitoring and analysis not reported for the Mumbai FIR).
- Maldives (Post implementation monitoring not implemented - Problem reports not provided to CRA. Performance monitoring and analysis not reported to FIT).

b) Removal of Deficiency:

Non-provision of Safety-Related Data – Requirement of Paragraph 3.3.5.1 of Annex 11 (provision of data for monitoring the height keeping performance of aircraft)

- Brunei Darussalam.

c) Add new Deficiency:

Long Term Height Monitoring requirement – remaining burden more than 30%

- Bangladesh (Remaining monitoring burden of 33%, RASMAG/28).
- Indonesia (Remaining monitoring burden of 63%, RASMAG/28).
- Mongolia (Remaining monitoring burden of 39%, RASMAG/28).
- Nepal (Remaining monitoring burden of 46%, RASMAG/28).
- New Zealand (Remaining monitoring burden of 36%, RASMAG/28).
- Papua New Guinea (Remaining monitoring burden of 69%, RASMAG/28).
- Solomon Islands (Remaining monitoring burden of 50%, RASMAG/28).

Agenda Item 7: Any Other Business

ATM Points of Contact (WP/37)

7.1 Meeting participants were requested to review and updated the ATM Points of Contact (**RASMAG/28 WP/37 Attachment A**) as appropriate.

Agenda Item 8: Review and Update RASMAG Task List

RASMAG Terms of Reference and Task List (WP/38)

8.1 The meeting reviewed the RASMAG Terms of Reference, and reviewed and updated the RASMAG Task List (**Appendix I to this Report**).

Agenda Item 9: Date and Venue of the Next RASMAG Meeting

9.1 The RASMAG/29 meeting would be tentatively planned for the July – August 2024 period in Bangkok, Thailand. Any Administration wishing to host the RASMAG/29 meeting should contact the ICAO APAC Regional Office.

Closing of the Meeting

10.1 In closing, the Chair thanked participants for their contributions to the meeting.

LIST OF PARTICIPANTS

| | STATE/NAME | | TITLE/ORGANIZATION |
|-----------|------------------------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | AUSTRALIA (1) | | |
| | 1. | Dr. Steve Barry | Risk Intelligence Specialist Airservices Australia <u>AUSTRALIA</u> |
| 2. | BRUNEI DARUSSALAM (2) | | |
| | 2. | Mr. Mohamad Fauzi Mohamad Sidek | Deputy Director of Civil Aviation Department of Civil Aviation Brunei Darussalam <u>BRUNEI DARUSSALAM</u> |
| | 3. | Mr. Hafizul Hamid | Search and Rescue Officer/Head of Air Navigation Services Department of Civil Aviation Brunei Darussalam <u>BRUNEI DARUSSALAM</u> |
| 3. | CAMBODIA (2) | | |
| | 4. | Mr. Oun Makara | Chief of ATS/AND Department State Secretariat of Civil Aviation <u>CAMBODIA</u> |
| | 5. | Mr. Lorn Thyrith | Director of Quality and Safety Department Cambodia Air Traffic Services <u>CAMBODIA</u> |

RASMAG/28
Appendix A to the Report

| | STATE/NAME | | TITLE/ORGANIZATION |
|-----------|-----------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 4. | CHINA (2) | | |
| | 6. | Mr. Yongyue Chen | Engineer China RMA <u>CHINA</u> |
| | 7. | Mr. Yang Hong | Engineer China RMA <u>CHINA</u> |
| 5. | HONG KONG, CHINA (3) | | |
| | 8. | Mr. Isaac Wong | Senior Air Traffic Management Standards Officer Civil Aviation Department, Hong Kong China <u>HONG KONG, CHINA</u> |
| | 9. | Mr. Anthony TSUI | Senior Operations Officer Civil Aviation Department, Hong Kong China <u>HONG KONG, CHINA</u> |
| | 10. | Mr. Curtis MA | Atg. Air Traffic Control Officer I Civil Aviation Department, Hong Kong China <u>HONG KONG, CHINA</u> |
| 6. | INDIA (2) | | |
| | 11. | Shri P Gowrishankar | JT.GM(ATM), Chennai Airports Authority of India <u>INDIA</u> |

RASMAG/28
Appendix A to the Report

| | STATE/NAME | | TITLE/ORGANIZATION |
|-----------|----------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| | 12. | Shri J Masivayana | DGM(ATM), Chennai Airports Authority of India <u>INDIA</u> |
| 7. | INDONESIA (3) | | |
| | 13. | Mr. Iyan Andri Permadi | Chief, Air Navigation Safety Data Air Navigation Inspector Directorate General of Civil Aviation Indonesia <u>INDONESIA</u> |
| | 14. | Mr. Henry Wiranto | Air Navigation Inspector (CNS) Directorate General of Civil Aviation Indonesia <u>INDONESIA</u> |
| | 15. | Mr. Ferry Sumadi | Flight Operation Inspector Directorate General of Civil Aviation Indonesia <u>INDONESIA</u> |
| 8. | JAPAN (4) | | |
| | 16. | Mr. Yasuhiro Marutsuka | Special Assistant to the Director Air Navigation Services Department Japan Civil Aviation Bureau <u>JAPAN</u> |
| | 17. | Mr. Yasutaka Hashimoto | Air Traffic Controller Fukuoka Area Control Center Japan Civil Aviation Bureau <u>JAPAN</u> |

RASMAG/28
Appendix A to the Report

| | STATE/NAME | | TITLE/ORGANIZATION |
|------------|---------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| | 18. | Mr. Kenichi Furukawa | Director Department of Research and Study Service Air Traffic Control Association Japan <u>JAPAN</u> |
| | 19. | Mr. Koji Kato | Director Research & Planning Service Air Traffic Control Association Japan <u>JAPAN</u> |
| 9. | LAO PDR (1) | | |
| | 20. | Mr. Sohnsacksit Khamkeo | Director of Air Navigation Standards Division Department of Civil Aviation of Lao People's Democratic Republic <u>LAO PDR</u> |
| 10. | MALAYSIA (2) | | |
| | 21. | Mr. Hafizuddin bin Mohamed | Assistant Director Civil Aviation Authority of Malaysia <u>MALAYSIA</u> |
| | 22. | Mr. Perumal Subramaniam | Senior Assistant Director Civil Aviation Authority of Malaysia <u>MALAYSIA</u> |
| 11. | MONGOLIA (2) | | |
| | 23. | Mr. Ganbaatar Puntsag | Senior inspector of AANOD Air Navigation Services Civil Aviation Authority of Mongolia (CAAM) <u>MONGOLIA</u> |

RASMAG/28
Appendix A to the Report

| | STATE/NAME | | TITLE/ORGANIZATION |
|------------|------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| | 24. | Mr. Davaadorj Odgerel | Director, Project and program coordination department Civil Aviation Authority of Mongolia (CAAM) <u>MONGOLIA</u> |
| 12. | NEW ZEALAND (1) | | |
| | 25. | Mr. Edmund Heng | Technical Specialist Aeronautical Services Civil Aviation Authority of New Zealand <u>NEW ZEALAND</u> |
| 13. | PHILIPPINES (1) | | |
| | 26. | Ms. Marianne O. Mamuad | Air Traffic Management Officer IV, Air Traffic Service Civil Aviation Authority of the Philippines <u>PHILIPPINES</u> |
| 14. | REPUBLIC OF KOREA (3) | | |
| | 27. | Mr. Jun-ho Lee | Assistant Director Ministry of Land, transport and Maritime Affairs, Republic of Korea <u>REPUBLIC OF KOREA</u> |
| | 28. | Ms. Hyein Jung | Deputy Director Ministry of Land Infrastructure and Transport <u>REPUBLIC OF KOREA</u> |

RASMAG/28
Appendix A to the Report

| | STATE/NAME | | TITLE/ORGANIZATION |
|------------|----------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| | 29. | Mr. Im Jaekyoung | Air Traffic Controller Air Traffic Management Ministry of Land, Infrastructure and Transport <u>REPUBLIC OF KOREA</u> |
| 15. | SINGAPORE (3) | | |
| | 30. | Mr. Wen Pei Goh | ATC Manager Civil Aviation Authority of Singapore (CAAS) <u>SINGAPORE</u> |
| | 31. | Mr. Lam Seng Lim | Safety Manager Civil Aviation Authority of Singapore (CAAS) <u>SINGAPORE</u> |
| | 32. | Ms. Valerie Sim | ATC Specialist (Safety) Civil Aviation Authority of Singapore (CAAS) <u>SINGAPORE</u> |
| 16. | SRI LANKA (2) | | |
| | 33. | Mr. Jude Peiris | Senior Manager - Air Traffic Control / Safety Airport and Aviation Services (Sri Lanka) Ltd. <u>SRI LANKA</u> |
| | 34. | Ms. Priyasha Ransrini Hettiarachchi | Manager - Air Traffic Control / Unit Safety Officer - Area Control Centre Airport and Aviation Services (Sri Lanka) Ltd. <u>SRI LANKA</u> |

RASMAG/28
Appendix A to the Report

| | STATE/NAME | | TITLE/ORGANIZATION |
|------------|----------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 17. | THAILAND (17) | | |
| | 35. | Mr. Buntoeng Megchai | Manager of Air Navigation Operations Management Department The Civil Aviation Authority of Thailand <u>THAILAND</u> |
| | 36. | Ms. Pranchalee Makarasut | Airworthiness and Aircraft Engineering Department Officer The Civil Aviation Authority of Thailand <u>THAILAND</u> |
| | 37. | Ms. Bussaya Wutthiyachoto | Air Navigation Standards Services Department Officer The Civil Aviation Authority of Thailand <u>THAILAND</u> |
| | 38. | Mr. Rattaphon Potipipith | Air Navigation Operations Planning Division Officer The Civil Aviation Authority of Thailand <u>THAILAND</u> |
| | 39. | Mr. Apiwat Torpradit | Flight Operations Standards Department Senior Officer The Civil Aviation Authority of Thailand <u>THAILAND</u> |

RASMAG/28
Appendix A to the Report

| | STATE/NAME | | TITLE/ORGANIZATION |
|--|-------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| | 40. | Mr. Todsapon Wachirakowit | Flight Operations Standards Department Senior Officer The Civil Aviation Authority of Thailand <u>THAILAND</u> |
| | 41. | Ms. Saifon Obromsook | Director, Safety Management Department Aeronautical Radio of Thailand Limited <u>THAILAND</u> |
| | 42. | Ms. Rinthida Jorntes | Safety Management System Assistant Manager Aeronautical Radio of Thailand Ltd. <u>THAILAND</u> |
| | 43. | Ms. Chantima Sritiapetch | Senior System Engineer (Safety Management System) Aeronautical Radio of Thailand Ltd. <u>THAILAND</u> |
| | 44. | Mr. Dolsarit Somseang | Executive Systems Engineer (Safety Management System) Aeronautical Radio of Thailand Ltd. <u>THAILAND</u> |
| | 45. | Mr. Raksit Soontornmalai | Senior Safety Management System Officer Aeronautical Radio of Thailand Ltd. <u>THAILAND</u> |

RASMAG/28
Appendix A to the Report

| | STATE/NAME | | TITLE/ORGANIZATION |
|--|-------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | 46. | Mr. Ponkrit Sawedsud | Systems Engineer (Safety Management System) Aeronautical Radio of Thailand Ltd. <u>THAILAND</u> |
| | 47. | Capt. Chanan Chueyen | Team Lead, Flight Operation Safety, Security and Risk Management Operations Department Thai Airways International Public Company Limited <u>THAILAND</u> |
| | 48. | Mrs. Kaew Dhapagupta | Aircraft Engineer, Quality Assurance Department, Technical Department Thai Airways International Public Company Limited <u>THAILAND</u> |
| | 49. | Ms. Benyalakshmi Siribhavanabhirajata | Safety Officer, Quality Assurance Department, Technical Department Thai Airways International Public Company Limited <u>THAILAND</u> |
| | 50. | Mr. Aniwat Polprapruit | Aircraft Engineer Trainee, Quality Assurance Department, Technical Department Thai Airways International Public Company Limited <u>THAILAND</u> |

RASMAG/28
Appendix A to the Report

| | STATE/NAME | | TITLE/ORGANIZATION |
|------------|-----------------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | 51. | Capt. Thammarat Thammalikhit | Administrative Assistant, Safety Management System Department, Corporate Safety and Quality Assurance Department Thai Airways International Public Company Limited <u>THAILAND</u> |
| 18. | UNITED STATES OF AMERICA (4) | | |
| | 52. | Mr. Shayne Campbell | Senior Air Traffic Representative, Asia Pacific Federal Aviation Administration Air Traffic Organization, System Operations <u>SINGAPORE</u> |
| | 53. | Ms. Christine Falk | Operations Research Analyst Federal Aviation Administration Separations Standards Analysis <u>UNITED STATES OF AMERICA</u> |
| | 54. | Mr. Micah Lyman | Foreign Affairs Specialist Federal Aviation Administration Air Traffic Safety Oversight <u>UNITED STATES OF AMERICA</u> |
| | 55. | Mr. John Warburton | Manager, Separation Standards Analysis Enterprise Services Test & Evaluation Division Federal Aviation Administration <u>UNITED STATES OF AMERICA</u> |

RASMAG/28
Appendix A to the Report

| | STATE/NAME | | TITLE/ORGANIZATION |
|------------|---------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 19. | VIET NAM (4) | | |
| | 56. | Mr. Nguyen Manh Tuan | Official Civil Aviation Authority of Viet Nam <u>VIET NAM</u> |
| | 57. | Mr. Dang Ha Khuong | Director of Safety, Quality and Security - Southern Region Air Traffic Services Viet Nam Air Traffic Management (VATM) <u>VIET NAM</u> |
| | 58. | Mr. Nguyen Manh Thang | Deputy Director of Safety and Quality Department Viet Nam Air Traffic Management (VATM) <u>VIET NAM</u> |
| | 59. | Mr. Dinh Quang Dang | Official of Safety and Quality Department Viet Nam Air Traffic Management (VATM) <u>VIET NAM</u> |
| 20. | IATA (1) | | |
| | 60. | Mr. Diego Albert | Regional Assistant Director Operations, Safety and Security International Air Transport Association (IATA) <u>SINGAPORE</u> |
| 21. | IFALPA (1) | | |
| | 61. | Capt. Jaffar Hassan | EVP Asia Pacific IFALPA <u>CANADA</u> |

RASMAG/28
Appendix A to the Report

| | STATE/NAME | | TITLE/ORGANIZATION |
|------------|-----------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 22. | ICAO (4) | | |
| | 62. | Mr. Shane Sumner | Regional Officer, Air Traffic Management ICAO Asia and Pacific Regional Office <u>THAILAND</u> |
| | 63. | Mr. Hiroyuki Takata | Regional Officer, Air Traffic Management ICAO Asia and Pacific Regional Office <u>THAILAND</u> |
| | 64. | Mr. Weng Kit Ying | Air Traffic Management Officer ICAO Asia and Pacific Regional Office <u>THAILAND</u> |
| | 65. | Dr. Prakayphet Chalayonnawin | Programme Analysis Associate, Air Traffic Management ICAO Asia and Pacific Regional Office <u>THAILAND</u> |

LIST OF PAPERS

LIST OF WORKING PAPERS

| NUMBER | AGENDA | TITLE | PRESENTED BY |
|--------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| WP/1 | 1 | Provisional Agenda | Secretariat |
| WP/2 | 2 | FIT-Asia Meeting Outcomes | Secretariat |
| WP/3 | 2 | Outcomes of RASMAG-MAWG and RMACG Meetings | MAAR |
| WP/4 | 3 | China RMA'S Updates on LHD events reported in AKARA corridor | China RMA |
| WP/5 | 3 | 2022 Analyses for the Incheon FIR AKARA Corridor Interface with Shanghai, Fukuoka and Taipei FIRs | PARMO |
| WP/6 | 3 | RVSM Risk Assessment in the Brisbane, Honiara, Melbourne, Nauru and Port Moresby Flight Information Regions 1 January 2022 to 31 December 2022 | AAMA |
| WP/7 | 3 | RVSM Risk Assessment in the Indonesian Flight Information Region 1 January 2022 to 31 December 2022 | AAMA |
| WP/8 | 3 | China Vertical Safety Report | China RMA |
| WP/9 | 3 | JASMA Vertical Safety Report | JASMA |
| WP/10 | 3 | JASMA Hot Spot Identification | AAMA |
| WP/11 | 3 | JASMA Horizontal Safety Report | JASMA |
| WP/12 | 3 | MAAR Safety Report | MAAR |
| WP/13 | 3 | SEASMA Horizontal Safety Report | Singapore |
| WP/14 | 3 | BOBASMA Horizontal Safety Monitoring Report | BOBASMA |
| WP/15 | 3 | <i>Not Used</i> | |
| WP/16 | 3 | PARMO Vertical Safety Monitoring Report 2022 | PARMO |
| WP/17 | 3 | PARMO Horizontal Safety Monitoring Report 2022 | PARMO |
| WP/18 | 3 | 2022 Central East Pacific Traffic Flow Assessment | PARMO |
| WP/19 | 3 | Asia/Pacific Consolidated Safety Report | MAAR |
| WP/20 | 4 | Review of the Guidance Material for the Continued Safety Monitoring of the Asia-Pacific RVSM Airspace | MAAR |
| WP/21 | 4 | Guidance of PBCS Non-Compliance Reporting | Secretariat |
| WP/22 | 4 | Asia Pacific Flight Information Region and Responsible Monitoring Agency | Secretariat |
| WP/23 | 5 | JASMA Assessment of Non-RVSM Approved Aircraft | JASMA |
| WP/24 | 5 | China RMA Assessment of PBCS and Non-RVSM Approved Aircraft | China RMA |
| WP/25 | 5 | MAAR Assessment of Non-RVSM Approved Aircraft | MAAR |

RASMAG/28
Appendix B to the Report

| NUMBER | AGENDA | TITLE | PRESENTED BY |
|--------|--------|---------------------------------------------------------------|--------------|
| WP/26 | 5 | PARMO RVSM Traffic Compliance Monitoring | PARMO |
| WP/27 | 5 | PARMO RVSM Long Term Height Monitoring Burden | PARMO |
| WP/28 | 5 | China RMA LTHM Burden Estimate Update | China RMA |
| WP/29 | 5 | JASMA LTHM Burden Estimate Update | JASMA |
| WP/30 | 5 | APAC Consolidated LTHM Compliance Status | MAAR |
| WP/31 | 5 | Regulatory process of PBCS operational approvals | Secretariat |
| WP/32 | 5 | RVSM Approvals and filing of RVSM indicator by State aircraft | Secretariat |
| WP/33 | 5 | JASMA Assessment of Non-PBCS Approved Aircraft | JASMA |
| WP/34 | 5 | <i>Not Used</i> | |
| WP/35 | 5 | Competent Airspace Safety Monitoring Organizations List | Secretariat |
| WP/36 | 6 | ATM and Airspace Deficiencies List | Secretariat |
| WP/37 | 7 | Air Traffic Management Points of Contact | Secretariat |
| WP/38 | 8 | RASMAG Terms of Reference and Task List | Secretariat |

LIST OF INFORMATION PAPERS

| NUMBER | AGENDA | TITLE | PRESENTED BY |
|--------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| IP/1 | - | List of Working Papers (WPs) and Information Papers (IPs) | Secretariat |
| IP/2 | 3 | Summary Report of Identified Airspace Risk and Mitigations | Singapore |
| IP/3 | 5 | Bilateral Meeting between Fukuoka and Manila ACC | Japan and Philippines |
| IP/4 | 5 | Update Information on the EUR RMA FPRAVP | MAAR |
| IP/5 | 5 | NAARMO RVSM Long Term Height Monitoring Burden | NAARMO |
| IP/6 | 5 | Statistical Analysis of Altimetry System Error (ASE) Variation based on Large-Data Analysis of Australian AHMS Results – Correcting for Bias 1 January 2022 to 31 December 2022 | AAMA |
| IP/7 | 5 | Feasibility Verification of using BDS Data for Aircraft Monitoring | China RMA |
| IP/8 | 5 | JASMA PBCS Case Study | JASMA |
| IP/9 | 3 | JASMA AKARA Safety Improvement Update | JASMA |
| IP/10 | 5 | JASMA LLD Standard for 23 NM Lateral Separation | JASMA |

LIST OF FLIMSIES

| NUMBER | AGENDA | TITLE | PRESENTED BY |
|---------------|---------------|-------------------------------------------------------|---------------------|
| Flimsy 1 | 4 | Suggestions on PBCS Non-Compliance Report Exchange | China RMA |
| Flimsy 2 | 3 | Hot Spot Identification Process applied to Hot Spot N | PARMO |

.....

RASMAG/28
Appendix C to the Report

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



ASIA/PACIFIC REGION

EN-ROUTE MONITORING AGENCY (EMA)

HANDBOOK

Version 3.0 - August 2023

Published by ICAO Asia and Pacific Office, Bangkok

TABLE OF CONTENTS

| | |
|------------------------------------------|-----|
| Table of Contents | i |
| Foreword | iii |
| List of Abbreviations and Acronyms | v |
| Explanation of Terms | vi |

PART 1

| | |
|-----------------------------------------------------------------------------------|---|
| 1. Description, Functions and Establishment of an En-route Monitoring Agency..... | 1 |
| 1.1 Description..... | 1 |
| 1.2 EMA Duties and Responsibilities..... | 1 |
| 1.3 Process for Establishing an EMA..... | 2 |

PART 2

| | |
|-----------------------------------------------------------------------------------|---|
| 2. Responsibilities and Standardized Practices of En-route Monitoring Agencies | 3 |
| 2.1 Purpose of this Part..... | 3 |
| 2.2 Establishment and Maintenance of database of PBN and other Approvals | 3 |
| 2.3 Monitoring of Horizontal Plane Navigation Performance..... | 4 |
| 2.4 Conducting Safety Assessments and Reporting Results..... | 5 |
| 2.5 Monitoring Operator Compliance with State Approval Requirements | 8 |
| 2.6 Remedial Actions..... | 9 |
| 2.7 Review of Operational Concept..... | 9 |

LIST OF APPENDICES

| | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Appendix A – Flight Information Regions and Responsible En-Route Monitoring Agency | 10 |
| Appendix B A – States and Designated EMA for the Reporting of En-route PBN and Data Link Approvals | 11 |
| Appendix C B – EMA Forms for Use in obtaining Record of En-route PBN and Data Link Approvals from a State Authority..... | 12 |
| Appendix D C – Minimal Informational Content for each State En-route PBN and Data Link Approval to be maintained in Electronic Form by an EMA..... | 18 |
| Appendix E D – Suggested Form for ATC Unit Monthly Report of Large Lateral Deviations or Large Longitudinal Errors | 27 |
| Appendix F E – Example “Know Your Airspace” analysis: Examination of Operations conducted on South China Sea – RNAV Routes L642 and M771 | 33 |
| Appendix G F – Example Safety Assessment: South China Sea Collision Risk Model and Safety Assessment | 39 |

RASMAG/28
Appendix C to the Report

| | | |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------|----|
| Appendix H G | – Sample content and Format for Collection of Sample of Traffic Movements..... | 53 |
| Appendix I H | – Monitoring Operator Compliance with State Approval Requirements Flow Chart | 54 |
| Appendix J I | – Letter to State Authority requesting Clarification of the Approval State En-route PBN or Data Link Approval Status of an Operator | 55 |
| Appendix K J | – Scrutiny Group Guidance | 56 |
| Appendix L K | – Pre/Post-Implementation Reduced Horizontal Separation Minima Flow Chart | 58 |

FOREWORD

The Regional Airspace Safety Monitoring Advisory Group (RASMAG) was established during 2004 by the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) to achieve a regional approach for coordination and harmonization of airspace safety monitoring activities, and to provide assistance to States in this respect.

The RASMAG noted that requirements for monitoring aircraft height-keeping performance and the safety of reduced vertical separation minimum (RVSM) operations had been more comprehensively developed than had requirements for monitoring other air traffic management (ATM) services, such as reduced horizontal separation based on performance based navigation (PBN), or for monitoring of air traffic services (ATS) data link systems. Although a handbook with detailed global guidance on the requirements for establishing and operating RVSM Regional Monitoring Agencies (RMA) had been developed by the ICAO Separation and Airspace Safety Panel (SASP), there was no comparable monitoring guidance document under development by ICAO for the safe use of a horizontal-plane separation minimum where PBN is applied and no suitable regional equivalent was available.

ICAO provisions require that the implementation of specified reduced separation minima, e.g. 50 NM lateral separation based on PBN RNAV 10, 50 NM longitudinal separation based on PBN RNAV 10 and Direct Pilot Controller Communication (DCPC), and PBN RNP 4 based 30 NM lateral and longitudinal separation based on Automatic Dependent Surveillance – Contract (ADS-C), Controller Pilot Data Link Communication (CPDLC), must first meet Annex 11 safety management system requirements and undergo a safety assessment based on collision risk modelling to confirm that the regionally established target level of safety (TLS) for the airspace has been met. Additionally, periodic safety reviews must be performed in order to permit continued operations. To date, the performance of safety assessments and continued monitoring for reduced horizontal separation minima had been carried out by a few specialized teams of technical experts and contractors supporting States within the region.

The recent inclusion of the previously independent RNP and RNAV concepts under ICAO's global PBN concept has led to some uncertainty amongst States regarding the monitoring requirements for reduced horizontal separation minima implementations where these minima are based on PBN approvals. The RASMAG agreed that there was a need to develop a handbook aimed at standardizing the principles and practices of the work of En-route Monitoring Agencies (EMAs) established to assess the safety performance of implementations utilizing reduced horizontal plane separations, in order to ensure the continued safe application of reduced horizontal separation standards in international airspace.

In anticipation of more widespread use of the PBN RNAV 10 and RNP 4 navigation specifications within the international airspace of the Asia/Pacific Region, this handbook is being provided to identify the safety assessment and monitoring requirements and related EMA duties and responsibilities associated with those navigation specifications, as well as the reduced separation minima which may be implemented based upon compliance with them. It should be noted that, with the exception of 50 NM lateral separation, introduction of the reduced horizontal minima additionally necessitates satisfaction of explicit communications and surveillance requirements as well as the navigation performance requirements.

RASMAG/28
Appendix C to the Report

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

APANPIRG has adopted this EMA Handbook under the terms of **Conclusion 20/25** as an Asia/Pacific regional guidance material. It is intended that the handbook will introduce a common set of principles and practices for safety assessment and ongoing safety monitoring in connection with operational usage of reduced horizontal-plane separation minima based on the application of PBN. The handbook will also help to promote an interchange of information among Asia/Pacific States in support of achieving common operational monitoring procedures, as well as supporting the acquisition and sharing of data resulting from the application of those procedures.

LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|----------|------------------------------------------------------------------------|
| ADS-C | Automatic Dependent Surveillance - Contract |
| ANSP | Air Navigation Service Provider |
| APANPIRG | Asia Pacific Air Navigation Planning and Implementation Regional Group |
| ATC | Air Traffic Control |
| ATM | Air Traffic Management |
| ATS | Air Traffic Services |
| CPDLC | Controller Pilot Data Link Communication |
| CRM | Collision Risk Model |
| EMA | En-route Monitoring Agency |
| FIR | Flight Information Region |
| FTP | File Transfer Protocol |
| ICAO | International Civil Aviation Organization |
| LLD | Large Lateral Deviation |
| LLE | Large Longitudinal Error |
| MASPS | Minimum Aviation System Performance Standard |
| NM | Nautical Miles |
| PBN | Performance-Based Navigation |
| RASMAG | Regional Airspace Safety Monitoring Advisory Group of APANPIRG |
| RMA | Regional Monitoring Agency |
| RNAV | Area navigation |
| RNP | Required Navigation Performance |
| RVSM | Reduced Vertical Separation Minimum |
| SASP | Separation and Airspace Safety Panel |
| SSR | Secondary Surveillance Radar |
| STC | Supplemental Type Certificate |
| TLS | Target Level of Safety |

EXPLANATION OF TERMS

Collision risk.

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

Core (lateral) navigational performance.

That portion of overall navigational performance which accounts for the bulk of observed lateral errors and which can be characterized by a single statistical distribution, usually symmetric about the mean lateral error with the frequency of increasing-magnitude errors decaying at least exponentially.

Exclusionary PBN airspace.

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

Horizontal separation.

The spacing provided between aircraft in the horizontal (lateral or longitudinal) plane to avoid collision.

Large lateral deviation (LLD).

Any deviation of 15 NM or more to the left or right of the current flight-plan track.

Large longitudinal error (LLE).

Any unexpected change in longitudinal separation between an aircraft pair, or for an individual aircraft the difference between an estimate for a given fix and the actual time of arrival over that fix, as applicable, in accordance with the criteria set out below:

| Type of Error | Category of Error | Criterion for Reporting |
|------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Longitudinal deviation | Aircraft-pair (Time-based separation applied) | Infringement of longitudinal separation standard based on routine position reports |
| Longitudinal deviation | Aircraft-pair (Time-based separation applied) | Expected time between two aircraft varies by 3 minutes or more based on routine position reports |
| Longitudinal deviation | Individual-aircraft (Time-based separation applied) | Pilot estimate varies by 3 minutes or more from that advised in a routine position report |
| Longitudinal deviation | Aircraft-pair (Distance-based separation applied) | Infringement of longitudinal separation standard, based on ADS-C, radar measurement or special request for RNAV position report |

RASMAG/28
Appendix C to the Report

| Type of Error | Category of Error | Criterion for Reporting |
|------------------------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Longitudinal deviation | Aircraft-pair (Distance-based separation applied) | Expected distance between an aircraft pair varies by 10NM or more, even if separation standard is not infringed, based on ADS-C, radar measurement or special request for RNAV position report |

Occupancy.

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

Operational Approval.

An approval granted to an operator by the State authority after being satisfied that the operator meets specific aircraft and operational requirements.

Operational risk.

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

Overall risk.

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

Passing frequency.

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

Target level of safety (TLS).

A generic term representing the level of risk which is considered acceptable in particular circumstances.

Technical Risk

The risk of collision associated with aircraft navigation performance.

PART 1

Description, Functions and Establishment of an En-route Monitoring Agency

1.1 Description

1.1.1 An En-route Monitoring Agency (EMA) is an organization providing airspace safety assessment and monitoring services to support the introduction and continued safe use of en-route horizontal-plane separation minima. An EMA comprises a group of specialists who carry out specific functions to provide these services. These functions are summarized in the following outline of EMA duties and responsibilities.

1.2 EMA Duties and Responsibilities

1.2.1 The duties and responsibilities of an EMA are:

- a) to establish and maintain a database of operational approvals specific to the horizontal-plane separation applied in the EMA's area of responsibility;
- b) to coordinate monitoring of horizontal-plane navigational performance and the identification of large horizontal-plane deviations;
- c) to receive reports of large horizontal-plane deviations identified during monitoring; to take the necessary action with the relevant State authority and operator to determine the likely cause of the horizontal-plane deviation and to verify the approval status of the relevant operator;
- d) to analyze data to detect horizontal-plane deviation trends and, hence, to take action as in the previous item;
- e) to undertake data collections as required by RASMAG to:
 - 1) investigate the navigational performance of the aircraft in the core of the distribution of lateral deviations;
 - 2) establish or add to a database on the lateral navigational performance of:
 - o the aircraft population
 - o aircraft types or categories
 - o individual airframes;
 - 3) examine the forecast accuracy of aircraft-provided times at future (i.e next position) required reporting points
- f) to archive results of navigational performance monitoring and to conduct periodic risk assessments in light of agreed regional safety goals;
- g) to contribute to a regional database of monitoring results;
- h) to initiate necessary remedial actions and coordinate with specialist groups as necessary in the light of monitoring results;

- i) to monitor the level of risk as a consequence of operational errors and in-flight contingencies as follows:
 - 1) determine, wherever possible, the root cause of each horizontal plane deviation together with its size and duration;
 - 2) calculate the frequency of occurrence;
 - 3) assess the overall risk in the system against the overall safety objectives; and
 - 4) initiate remedial action as required;
- j) to initiate checks of the approval status of aircraft operating in the relevant airspace where horizontal-plane separation is applied, identify non-approved operators and aircraft using the airspace and notify the appropriate State of Registry/State of the Operator accordingly;
- k) to coordinate/establish appropriate contacts for PBCS via RMA POCS for PBCS non-compliance, compile the submission of PBCS non-compliance reports by ANSP each month and, where necessary, propose APANPIRG ATM Deficiencies, for lack of reporting; and
- kl) to submit reports as required to APANPIRG through RASMAG.

1.3 Process for Establishing an EMA

1.3.1 An organization proposing to offer EMA services must be approved by the Regional Airspace Monitoring Safety Advisory Group of APANPIRG (RASMAG).

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

- a) previous monitoring experience; or
- b) participation in ICAO technical panels or other bodies which develop horizontal separation requirements or criteria for establishing separation minima based on PBN; or
- c) establishment of a formal relationship with an organization qualified under (a) or (b).

1.3.3 Once competence has been demonstrated, including presentation of sufficient material to RASMAG on which to make a reasoned assessment, the EMA should receive a formal approval by RASMAG as recorded in the relevant RASMAG meeting report and in the *RASMAG List of Competent Airspace Safety Monitoring Organizations*.

1.3.4 ~~Appendix A lists~~ The RASMAG regionally approved EMAs and the Asia/Pacific FIRs for which they hold EMA responsibility can be found on the ICAO website – APAC eDocuments, ATM, Safety monitoring. [APAC Electronic Documents \(icao.int\)](https://www.icao.int/APAC-Electronic-Documents/).

PART 2

Responsibilities and Standardized Practices of En-route Monitoring Agencies

2.1 Purpose of this part

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

2.2 Establishment and Maintenance of database of PBN and other Approvals

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

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

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

2.2.4 It is important to note that, in general, the aircraft operating in airspace where implementation of PBN-based separation is planned can be grouped into two categories. Some aircraft operate solely within the airspace targeted for introduction of reduced separation standards (and therefore may not have PBN and other required approval status) and others operate both within that airspace and other portions of airspace requiring PBN and other approvals.

2.2.5 It is the responsibility of the EMA supporting implementation of reduced separation to gather State approvals data for the former category of aircraft from authorities responsible for issuing those approvals. To do so requires the EMA to establish a communication link with each such State authority and to provide a precise description of the approvals information required. **Appendix C B** provides typical forms, with a brief description of their use, that an EMA might transmit to a State authority to obtain information on aircraft PBN or data link approval status.

2.2.6 To avoid duplication of work effort, wherever possible the EMA should collect State approvals information for the latter category of aircraft – those already operating in other airspace where reduced horizontal-plane separation minima are applied – from other EMAs. This collection will be facilitated if each EMA maintains, in a similar electronic form, a database of State PBN and data link approvals.

2.2.7 **Appendix D C** describes the minimum database content required and the format in which it should be maintained by an EMA. **Appendix D C** also contains a description of the data to be shared by EMAs and proposes procedures for data sharing.

2.3 Monitoring of Horizontal Plane Navigation Performance

2.3.1 An EMA must be prepared to collect the information necessary to monitor horizontal-plane navigational performance as part of the risk assessment. It must institute procedures to monitor core navigational performance and to continuously collect information descriptive of large deviations and operational errors in the horizontal plane.

Monitoring Core Navigational Performance

2.3.2 The EMA will investigate the navigational performance of the aircraft in the core of the distribution of lateral deviations by comparing aircraft reported position information with non-aircraft generated position information such as radar data. The EMA analysis of core navigation performance contributes to the determination of lateral overlap probability used in conducting a safety assessment. An EMA must enlist the cooperation of States and air navigation service providers (ANSPs) in monitoring horizontal-plane core navigational performance through the use of secondary surveillance radar or other appropriate surveillance systems. States and ANSPs have the responsibility to cooperate with the EMA and supply any requested data that will contribute to the evaluation of core navigational performance.

Monitoring of Large Lateral Deviations and Large Longitudinal Errors

2.3.3 Experience has shown that LLDs and LLEs have had significant influence on the outcome of safety assessments before and after implementation of PBN-based separation in a portion of airspace. Accordingly, a principal duty of an EMA is to ensure the existence of a programme to collect this information, assess the occurrences and initiate remedial action to correct systemic problems. Section 2.6 provides guidance to an EMA for initiating such remedial actions as may be necessary to resolve systemic problems uncovered by this programme. One way to ensure the existence of such a programme is to develop letters of agreement between States.

2.3.4 A programme to assess the occurrence of LLDs and LLEs will usually include a regional Scrutiny Group to support the EMA monitoring function. A Scrutiny Group is comprised of operational and technical subject matter experts that support the evaluation and classification of LLDs and LLEs.

2.3.5 Within the airspace for which it is responsible, each ANSP will need to establish the means to detect and report the occurrence of large horizontal-plane deviations. Experience has shown that the primary sources for reports of large horizontal-plane deviations are the ATC units providing air traffic control services in the airspace where reduced separation is or will be applied. The surveillance information available to these units – in the form of voice or ADS-C reports and, where available, surveillance radar or ADS-B returns – provides the basis for identifying large horizontal-plane deviations.

2.3.6 A programme for identifying large horizontal-plane deviations should be established and ATC units should report such events monthly. An example format for these monthly reports is shown in **Appendix E D**. These reports should contain, as a minimum, the following information:

- a) Reporting unit;
- b) Location of deviation, either as latitude/longitude, ATS route waypoint or other ATC fix;
- c) Date and time of large horizontal-plane deviation;
- d) Sub-portion of airspace, such as established route system, if applicable;
- e) Flight identification and aircraft type;
- f) Actual flight level or altitude;
- g) Horizontal separation being applied;
- h) Size of deviation;
- i) Duration of large deviation;
- j) Cause of deviation;
- k) Any other traffic in potential conflict during deviation;
- l) Crew comments when notified of deviation; and
- m) Remarks from ATC unit making report.

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

2.3.8 While an EMA will be the recipient and archivist for reports of large horizontal-plane deviations, it is important to note that an EMA alone cannot be expected to conduct all activities associated with a comprehensive programme to detect and report large horizontal-plane deviations. Rather, an EMA should enlist the support of RASMAG, the ICAO Regional Office, appropriate implementation task forces, scrutiny groups or any other entity that can assist in the establishment of such a programme.

2.4 Conducting Safety Assessments and Reporting Results

Safety Assessment

2.4.1 In order to conduct a safety assessment, an EMA will need to acquire an in-depth knowledge of the use of the airspace, typical aircraft types etc within which the reduced horizontal-plane separation will be implemented. Experience has shown that such knowledge can be gained through acquisition of charts and other material describing the airspace, and through periodic collection and analysis of samples of traffic movements within the airspace. The collation and consideration of this information results in a “Know Your Airspace” (KYA) analysis that documents matters of relevance to the reduced horizontal separation implementation being proposed. An example of a typical KYA analysis is included as **Appendix F E**.

2.4.2 A safety assessment conducted by an EMA consists of estimating the risk of collision associated with the horizontal-plane separation standard and comparing this risk to the established TLS. Examples of internationally recognised Collision Risk Models (CRMs) used in the development and implementation of reduced separation minima and their application in an example safety assessment (for the South China Sea area) are included in **Appendix G** of this document and in the ICAO Doc 9689 *Manual of Airspace Planning Methodology for the Determination of Separation Minima*.

2.4.3 RASMAG will determine the safety reporting requirements (e.g. format and periodicity) for the EMA.

Establishing the Competence Necessary to Conduct a Safety Assessment

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

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

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

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

Assembling a sample of traffic movements from the airspace

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

2.4.9 In planning the timing and duration of a traffic movement data sample, an EMA should take into account the importance of capturing any periods of heavy traffic flow which might result from seasonal or other factors. The duration of any traffic sample should be at least 30 days, with a longer sample period left to the judgment of an EMA. By regional agreement, as recorded in APANPIRG Conclusion 16/4, traffic sample data within the Asia/Pacific Region is collected by all States for the month of December each year for purposes of RVSM monitoring. During 2009, APANPIRG 20 expanded the usage of this data under certain conditions to support regional implementations, including reduced horizontal plane separation minima.

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

- a) date of flight;
- b) flight identification or aircraft call sign, in standard ICAO format;
- c) aircraft registration mark, if available;
- d) PBN approval type;
- e) aircraft type conducting the flight, as listed in the applicable edition of ICAO Doc 8643, Aircraft Type Designators;
- f) origin aerodrome, as listed in the applicable edition of ICAO Doc 7910, Location Indicators;
- g) destination aerodrome, as listed in the applicable edition of ICAO Doc 7910, Location Indicators;
- h) entry point (fix or latitude/longitude) into the airspace;
- i) time (UTC) at entry point;
- j) flight level (and assigned Mach number if available) at entry point;

- k) route after entry point;
- l) exit point from the airspace;
- m) time (UTC) at exit point;
- n) flight level (and assigned Mach number if available) at exit point;
- o) route before exit fix; and
- p) additional fix/time/flight-level/route combinations that the EMA judges are necessary to capture the traffic movement characteristics of the airspace.

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

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

Data Link Performance Monitoring

2.4.13 Applications specific to communication systems required for PBN-based operations such as data link introduce operational and technical risk into the system. Therefore end-to-end safety performance monitoring of air-ground and ground-air data link communication services should be ongoing, in accordance with the information contained in the *Guidance Material for End-to-End Safety and Performance Monitoring of Air Traffic Service (ATS) Data Link Systems in the Asia/Pacific Region*, issued by the ICAO Asia and Pacific Office, Bangkok. In the assessment of risk levels, an EMA may find it necessary to use data link performance data from data link Central Reporting Agencies (CRAs).

2.4.14 In conducting data link monitoring, CRA's could evaluate the following communication and surveillance performance elements:

- a) Position reporting methods and usage;
- b) Flight plans and data link capabilities;
- c) ADS-C downlink message traffic;
- d) ADS-C downlink transit times;
- e) ADS-C uplink message traffic;
- f) ADS-C uplink transit and response times;
- g) Anomalies identified in ADS-C data;
- h) Uplink messages with no response;
- i) CPDLC uplink and downlink message traffic, including response times; and
- j) Communication service provider outages and the effect on data link performance

Determining whether the Safety Assessment satisfies the TLS

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

- a) errors in aircraft navigation systems; and
- b) aircraft equipment failures resulting in unmitigated deviation from the cleared flight path, including those where not following the required procedures further increases the risk.

2.4.16 "Operational risk" is the term used to describe the risk of collision due to operational errors and in-flight contingencies. The term "operational error" is used to describe any horizontal

deviation of an aircraft from the correct flight path as a result of incorrect action by ATC or the flight crew. Examples of such actions include:

- a) a flight crew misunderstanding an ATC clearance, resulting in the aircraft operating on a flight path other than that issued in the clearance;
- b) ATC issuing a clearance which places an aircraft on a flight path where the required separation from other aircraft cannot be maintained;
- c) a coordination failure between ATC units in the transfer of control responsibility for an aircraft, resulting in either no notification of the transfer or in transfer at an unexpected transfer point;
- d) weather deviation (Note: these deviations may be instances where the aircraft captain initiates the manoeuvre using operational authority but without advising ATC, and are not necessarily deemed as being incorrect action. However, they still contribute to operational risk and should be reported).

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

2.5 Monitoring Operator Compliance with State Approval Requirements

2.5.1 The overall intent of post-implementation EMA activities is to support continued safe use of the reduced horizontal-plane separation. One important post-implementation activity is monitoring operator compliance with State approval requirements by carrying out periodic checks of the approval status of operators and aircraft using airspace where PBN-based separation is applied. This is vital if reduced separation is applied on an exclusionary basis, that is, if State PBN and data link approval is a prerequisite for use of the airspace.

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

2.5.3 Ideally, this compliance monitoring should be done for the entire airspace on a daily basis. Clearly, difficulties in accessing traffic movement information may make such daily monitoring impossible. However, as a minimum an EMA should conduct compliance monitoring of the complete airspace for at least a 30-day period annually. A flow chart depicting the process required for monitoring operator compliance with State approvals has been included as **Appendix I H**.

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

2.5.5 An EMA should keep in mind that the responsibility to take any action should an operator be found to have filed an incorrect declaration of State PBN or data link approval lies clearly with the State authority, not the EMA. The EMA responsibility is only to make the appropriate State authority aware of the issue, and provide advice or information as requested by the State authority.

2.6 Remedial Actions

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

- a) failure of an aircraft to comply with PBN or data link requirements,
- b) aircraft operating practices resulting in large horizontal-plane deviations, and
- c) operational errors.

2.6.2 Monitoring results should be periodically reviewed by the EMA and the associated regional Scrutiny Group in order to determine if there is evidence of any recurring problems or adverse trends. Guidance on the functions of a Scrutiny Group is contained in **Appendix K J**.

2.6.3 As a minimum, an EMA and the associated Scrutiny Group should conduct an annual review of reports of large horizontal-plane deviations with a view toward uncovering systemic problems and initiating remedial action. Should such problems be identified, an EMA should report its findings to the body overseeing horizontal-plane separation implementation, or to the RASMAG. An EMA should include in its report the details of large horizontal-plane deviations suggesting the root cause of the problem.

2.7 Review of Operational Concept

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

2.7.2 An EMA should review carefully the operational concept agreed by the body overseeing horizontal-plane separation implementation, generally the ANSP, with a view to identifying any features of airspace use which may influence risk. The flow chart at **Appendix L K** provides an overview of the implementation process for reduced horizontal plane separation minima and draws attention to the interrelationships between the implementation activities of the ANSP and the safety assessment and monitoring responsibilities of the EMA. An EMA should inform the oversight body of any aspects of the operational concept which it considers important in this respect.

APPENDIX A

Flight Information Regions and Responsible En-route Monitoring Agency

| FIR | Responsible EMA |
|-------------------|------------------------|
| Anchorage-Oceanic | PARMO |
| Auckland-Oceanic | |
| Bangkok | |
| Beijing | |
| Brisbane | AAMA |
| Calcutta | |
| Chennai | |
| Colombo | |
| Delhi | |
| Dhaka | |
| Fukuoka | |
| Guangzhou | |
| Hanoi | |
| Ho Chi Minh | SEASMA |
| Hong Kong | SEASMA |
| Honiara | |
| Inchon | |
| Jakarta | |
| Kabul | |
| Karachi | |
| Kathmandu | |
| Kota Kinabalu | SEASMA |
| Kuala Lumpur | SEASMA |
| Kunming | |
| Lahore | |
| Lanzhou | |
| Male | |
| Manila | SEASMA |
| Melbourne | AAMA |
| Mumbai | |
| Nadi | |
| Nauru | |
| Oakland-Oceanic | PARMO |
| Phnom Penh | |
| Pyongyang | |
| Port Moresby | |
| Sanya | SEASMA |
| Shanghai | |
| Shenyang | |
| Singapore | SEASMA |
| Tahiti | |
| Taipei | |
| Ujung Pandang | |
| Ulaan Baatar | |
| Urumqi | |
| Vientiane | |
| Wuhan | |
| Yangon | |

APPENDIX B A

States and Designated EMA for the reporting of En-route PBN and Data Link Approvals

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

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

RASMAG/28
Appendix C to the Report

APPENDIX C B

EMA Forms For Use in Obtaining Records of En-route PBN and Data Link Approvals from a State Authority

There are 3 EMA forms for the collection of essential information relating to en-route PBN and data link approvals:

- EMA A1 – Point of Contact Details for Matters Relating to PBN or Data Link Approvals
- EMA A2 – Record of en-route PBN or Data Link Approval
- EMA A3 – Withdrawal of en-route PBN or Data Link Approval

1. Please read these notes before attempting to complete forms EMA A1, A2 and A3.
2. It is important for the EMAs to have an accurate record of a point of contact for any queries that might arise from the monitoring of horizontal-plane separation. Recipients are therefore requested to include a completed EMA A1 with their first reply to the EMA. Thereafter, there is no further requirement unless there has been a change to the information requested on the form.
3. Form EMA A2 must be completed for each operator/aircraft granted a PBN or data link approval.
4. Form EMA A3 must be completed and submitted immediately whenever a State of Registry has cause to withdraw an operator/aircraft en-route PBN or data link approval.
5. Note: the fields in the forms EMA A2 and EMA A3 should be completed as indicated below.

| Fields | Instruction |
|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| State of Registry State of Operator State of PBN Approval | Enter the 2-letter ICAO identifier as contained in ICAO Doc 7910. In the case of there being more than one identifier designated for the State, use the letter identifier that appears first. |
| Operator Identifier | Enter the operator's 3 letter ICAO identifier as contained in ICAO Doc 8585. For International General Aviation, enter "IGA". If none, place an X in this field and enter the name of the operator/owner in the Remarks row. |
| Operator Type | Enter or Select Operator Type. E.g. Civil or Military |
| Registration Date Date of Approval Date of Expiry | Enter date in dd/mm/yyyy format, e.g. for 26 October 2007 enter 26/10/2007. |
| Aircraft Type | Enter the ICAO designator as contained in ICAO Doc 8643, e.g., for Airbus A320-211, enter A320; for Boeing B747-438 enter B744. |
| Aircraft Series | Enter series of aircraft type or manufacturer's customer designation, e.g., for Airbus A320-211, enter 211; for Boeing B747-438, enter 400 or 438. |
| Mode S Address Code (Hex) | Enter ICAO allocated Aircraft Mode S address code in hexadecimal format. |
| PBN Approval Type | Enter or select the type of PBN Approval, e.g. RNP 2, RNP 4, RNAV 10 or Others. Enter new line for each approval type. |
| Remarks | Any Remarks |

EMA A1

POINT OF CONTACT DETAILS
FOR MATTERS RELATING TO EN-ROUTE PBN OR DATA LINK APPROVALS

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

| | | | |
|----------------------------------------------|--|--|--|
| NAME OF STATE AUTHORITY OR ORGANISATION | | | |
| STATE OF REGISTRY | | | |
| STATE OF REGISTRY (ICAO 2 letter identifier) | | | |

If there is more than one identifier for the State, please use the first that appears in the list.

| | |
|------------------------|--|
| ADDRESS DETAILS | |
| STREET | |
| CITY | |
| STATE/PROVINCE | |
| ZIP/POSTAL CODE | |
| COUNTRY/REGION | |

| | |
|-----------------------|--|
| CONTACT PERSON | |
| TITLE | |
| FIRST NAME | |
| MIDDLE NAME | |
| LAST NAME | |
| JOB TITLE | |
| EMAIL | |

| | | | |
|----------------------|--|------------|--|
| PHONE DETAILS | | | |
| COUNTRY CODE | | AREA CODE | |
| DIRECT LINE | | FAX NUMBER | |

Please Tick One: Initial Reply Change of details

When complete, please return to:

EMA Address

Telephone:

Fax:

E-Mail

EMA A2

RECORD OF EN-ROUTE PBN APPROVAL

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

Please refer to the accompanying notes on the following page before providing the information requested below. PLEASE USE BLOCK CAPITALS.

RASMAG/28
Appendix C to the Report

| Aircraft & Operator Details | | | | | | | | | | | | | |
|----------------------------------------|---------------------------------------|---------------------------------------------------|-------------------------|------------------------------------|--------------------------------|---------------------------|-------------|-------------------------------------|-------------|--------------------|----------------------------------|------------------------------------------------|--------------------------|
| Registration No | | | | | | | | | | | | | |
| State of Registry | | | | | | | | | | | | | |
| Registration Date | | | | | | | | | | | | | |
| Name of Operator | | | | | | | | | | | | | |
| State of Operator | | | | | | | | | | | | | |
| Operator Identifier | | | | | | | | | | | | | |
| Operator Type | <i>[CIV/MIL]</i> | | | | | | | | | | | | |
| Aircraft Type | | | | | | | | | | | | | |
| Aircraft Series | | | | | | | | | | | | | |
| Manufacturers Serial No | | | | | | | | | | | | | |
| Mode S Address Code | | | | | | | | | | | | | |
| <i>Approval</i> | <i>Airworthiness Approval (State)</i> | <i>Primary Sensor Type (DME-DME/INS/IRS/GNSS)</i> | <i>Time Limit (hrs)</i> | <i>Vertical Guidance (APV/LPV)</i> | <i>RF Leg Capable (Yes/No)</i> | <i>Limitations (text)</i> | <i>Date</i> | <i>Operational Approval (State)</i> | <i>Date</i> | <i>Expiry date</i> | <i>Approval withdrawn (date)</i> | <i>Information provided by State authority</i> | <i>Regional approval</i> |
| RNAV10 | | | | | | | | | | | | | |
| RNAV5 | | | | | | | | | | | | | |
| RNAV2 | | | | | | | | | | | | | |
| RNAV1 | | | | | | | | | | | | | |
| RNP4 | | | | | | | | | | | | | |
| RNP2 | | | | | | | | | | | | | |
| Basic RNP1 | | | | | | | | | | | | | |
| Advanced RNP1 | | | | | | | | | | | | | |
| RNP APCH | | | | | | | | | | | | | |
| RNP AR APCH | | | | | | | | | | | | | |
| RVSM | | | | | | | | | | | | | |
| VDL | | | | | | | | | | | | | |
| Mode S | | | | | | | | | | | | | |
| SATCOM | | | | | | | | | | | | | |
| HF | | | | | | | | | | | | | |
| Remarks | | | | | | | | | | | | | |

RASMAG/28
Appendix C to the Report

When complete, please return to the following address.

EMA Address

Telephone:

Fax:

Email:

RASMAG/28
Appendix C to the Report

| Fields | Instruction |
|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| State of Registry State of Operator State of PBN Approval | Enter the 2-letter ICAO identifier as contained in ICAO Doc 7910. In the case of there being more than one identifier designated for the State, use the letter identifier that appears first. |
| Operator Identifier | Enter the operator's 3 letter ICAO identifier as contained in ICAO Doc 8585. For International General Aviation, enter "IGA". If none, place an X in this field and enter the name of the operator/owner in the Remarks row. |
| Operator Type | Enter or Select Operator Type. E.g. Civil or Military |
| Registration Date Date of Approval Date of Expiry | Enter date in dd/mm/yyyy format, e.g. for 26 October 2007 enter 26/10/2007. |
| Aircraft Type | Enter the ICAO designator as contained in ICAO Doc 8643, e.g., for Airbus A320-211, enter A320; for Boeing B747-438 enter B744. |
| Aircraft Series | Enter series of aircraft type or manufacturer's customer designation, e.g., for Airbus A320-211, enter 211; for Boeing B747-438, enter 400 or 438. |
| Mode S Address Code (Hex) | Enter ICAO allocated Aircraft Mode S address code in hexadecimal format. |
| PBN Approval Type | Enter or select the type of PBN Approval, e.g. RNP 2, RNP 4, RNAV 10 or Others. Enter new line for each approval type. |
| Remarks | Any Remarks |

RASMAG/28
Appendix C to the Report

| Fields | Instruction |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| State of Registry State of Operator | Enter the 2-letter ICAO identifier as contained in ICAO Doc 7910. In the case of there being more than one identifier designated for the State, use the letter identifier that appears first. |
| Operator Identifier | Enter the operator's 3 letter ICAO identifier as contained in ICAO Doc 8585. For International General Aviation, enter "IGA". If none, place an X in this field and enter the name of the operator/owner in the Remarks row. |
| Date of Withdrawal | Enter date in dd/mm/yyyy format, e.g. for 26 October 2007 enter 26/10/2007. |
| Aircraft Type | Enter the ICAO designator as contained in ICAO Doc 8643, e.g., for Airbus A320-211, enter A320; for Boeing B747-438 enter B744. |
| Aircraft Series | Enter series of aircraft type or manufacturer's customer designation, e.g., for Airbus A320-211, enter 211; for Boeing B747-438, enter 400 or 438. |
| Mode S Address Code (Hex) | Enter ICAO allocated Aircraft Mode S address code in hexadecimal format. |
| Approval Withdrawn | Enter or select the type of PBN Approval, e.g. RNP 2, RNP 4, RNAV 10 or Others. Enter new line for each approval type. |

APPENDIX C

Minimal Informational Content for Each State En-route PBN or Data Link Approval to Be Maintained In Electronic Form by an EMA

Aircraft PBN and Data Link Approvals Data

To properly maintain and track PBN and data link approval information some basic aircraft identification information is required (e.g., manufacturer, type, serial number, etc.) as well as details specific to an aircraft's PBN and data link approval status. Table 1 below lists the minimum data fields to be collected by an EMA for an individual aircraft. Table 2 on the following page describes the approvals database record format.

Table 1: Aircraft PBN and Data Link Approvals Data

| Field | Description |
|------------------------------------|-------------------------------------------------------------------------------------------------|
| Registration Mark | Aircraft's current registration mark |
| Mode S Address Code (Hex) | Aircraft's current Mode S code 6 hexadecimal digits |
| Manufacturer Serial Number | Aircraft Serial Number as given by manufacturer |
| Aircraft Type | Aircraft Type as defined by ICAO document 8643 |
| Aircraft Series | Aircraft generic series as described by the aircraft manufacturer (e.g., 747-100, series = 100) |
| State of Registry | State to which the aircraft is currently registered as defined in ICAO document 7910 |
| Registration Date | Date registration was active for current operator |
| Operator Identifier | ICAO code for the current Operator as defined in ICAO document 8585 |
| Operator Name | Name of the current Operator |
| State of Operator | State of the current Operator as defined in ICAO document 7910 |
| Operator Type | Aircraft is civil or military |
| PBN approval type | PBN approval – e.g. RNP 4, RNAV 2, RNP 1 |
| | |
| State of PBN approval | State granting PBN approval as defined in ICAO document 9613 |
| Date PBN approved | Date of PBN Approval |
| Date of PBN expiry | Date of Expiry for PBN Approval |
| Date of Data Link approval | Date of Data Link Approval |
| Remarks | Open comments |
| Date of withdrawal of PBN approval | Date of withdrawal of the aircraft's PBN approval (if applicable) |
| | |

Table 2: Approvals Database Record Format

| Field | Description | Type | Width | Valid Range |
|----------------------|------------------------------------------------------|--------------|--------------|--------------------|
| State of Registry | State of Registry | Alphabetic | 2 | AA-ZZ |
| Operator | Operator | Alphabetic | 3 | AAA-ZZZ |
| State of Operator | State of Operator | Alphabetic | 2 | AA-ZZ |
| AC Type | Aircraft Type | Alphanumeric | 4 | e.g. MD11 |
| AC Mark/Series | Aircraft Mark / Series | Alphanumeric | 6 | |
| Serial Number | Manufacturer's Serial/Construction Number | Alphanumeric | 12 | |
| AC Registration Mark | Aircraft registration mark | Alphanumeric | 10 | |
| Mode S | Aircraft Mode "S" address (Hexadecimal) | Alphanumeric | 6 | 000001-FFFFFF |
| PBN approval type | PBN approval type | Alphanumeric | 6 | e.g. RNP4 |
| Approval Date | Date PBN approval issued (dd/mm/yyyy) | Date | 10 | e.g. 31/12/1999 |
| Date of expiry | Date of expiry of PBN approval (if any) (dd/mm/yyyy) | Date | 10 | e.g. 31/12/1999 |
| DL Approval Date | Date Data Link approval issued (dd/mm/yyyy) | Date | 10 | e.g. 31/12/1999 |
| Remarks | National remarks | Alphanumeric | 60 | ASCII text |

Aircraft Re-Registration/Operating Status Change Data

Aircraft frequently change registration information. Re-registration and change of operating status information is required to properly maintain an accurate list of the current population. Table 3 below lists the minimum data fields to be maintained by an EMA to manage aircraft re-registration/operating status change data.

Table 3: Aircraft Re-Registration/Operating Status Change Data

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

Point of Contact Data

An accurate and up to date list of contact officers essential for an EMA to conduct its business. Table 4 lists the minimum content for organizational contacts and Table 5 lists the minimum content for individual points-of-contact.

Table 4: Organizational Contact Data

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

Table 5: Individual Point of Contact Data

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

Data Exchange between EMAs

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

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

Data Exchange Procedures

The standard mode of exchange shall be e-mail or FTP, with frequency of submission in accordance with Table 6 below. Data shall be presented in Microsoft Excel or Microsoft Access.

EMAs must be aware that the data are current only to the date of the created file.

Table 6: EMA Data Exchange Procedures

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

In addition to regular data exchanges, one-off queries shall be made between EMAs as necessary. This includes requests for data in addition to the minimum exchanged data set such as service bulletin information.

Exchange of Aircraft Approvals Data

An EMA shall exchange PBN and Data Link Approvals data with other EMAs. Table 7 below defines the fields required for sending a record to another EMA.

Table 7: Exchange of Aircraft Approvals Data

| Field | Need to Share |
|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Registration Mark | Mandatory |
| Mode S | Desirable |
| Serial Number | Desirable |
| Aircraft Type | Mandatory |
| Aircraft Series | Mandatory |
| State of Registry | Mandatory |
| Registration date | Desirable |
| Operator Identifier | Mandatory |
| Operator Name | Desirable |
| State of Operator | Mandatory |
| Civil or military indication (not a field on its own. It is indicated in the ICAO operator code as MIL except when the military has a code) | Desirable |
| PBN approval type | Mandatory |
| State of PBN approval | Mandatory |
| Date PBN approved | Mandatory |
| Date of PBN approval expiry | Mandatory |
| Date Data Link approved | Mandatory |
| Remarks | No |
| Date of withdrawal of PBN approval | Mandatory |
| Information by Authority | Mandatory |

Aircraft Re-Registration/Operating Status Change Data

An EMA shall share all re-registration information.

Table 8: *Exchange of Aircraft Re-Registration/Operating Status Change Data*

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

Exchange of Contact Data

An EMA shall share all organization and individual point of contact data in accordance with Tables 9 and 10 below.

Table 9: *Exchange of Organizational Contact Data Fields*

| Field | Need to Share |
|-------------------|----------------------|
| Type | Mandatory |
| State | Mandatory |
| State ICAO | Desirable |
| Company/Authority | Mandatory |
| Fax No | Desirable |
| Telephone number | Mandatory |
| Address (1-4) | Mandatory |
| Place | Mandatory |
| Postal code | Mandatory |
| Country | Mandatory |
| e-mail | Desirable |
| civil/military | Desirable |

Table 10: *Exchange of Individual Point of Contact Data Fields*

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

Confirmed Non-Compliant Information

As part of its monitoring assessments an EMA may identify a non-compliant aircraft. This information should be made available to other EMAs. When identifying a non-compliant aircraft an EMA should include:

- Notifying EMA
- Date sent
- Registration Mark
- Mode S
- Serial Number
- ICAO Type Designator
- State of Registry
- Registration Date
- Operator ICAO Code
- Operator Name
- State of Operator
- Date(s) of non-compliance(s)
- Action started (y/n)
- Date non-compliance resolved

Fixed parameters -Reference Data Sources

The sources of some standard data formats used by an EMA are listed below.

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

APPENDIX E D

Suggested Form for ATC Unit Monthly Report of LLD or LLE

[EN-ROUTE MONITORING AGENCY NAME]

Report of Large Lateral Deviation or Large Longitudinal Error

Report to the (*En-route Monitoring Agency Name*) of a large lateral deviation (LLD) or a large longitudinal error (LLE), as defined below:

*Note: Do not include ATC-approved deviation due to weather or other contingency events, unless the deviation magnitude is greater than the approved deviation

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

Name of ATC unit: _____

Please complete Section I or II as appropriate

SECTION I:

RASMAG/28
Appendix C to the Report

There were no reports of LLDs or LLEs for the month of _____

SECTION II:

There was/were _____ report(s) of LLD

There was/were _____ report(s) of LLE

Details of the LLDs and LLEs are attached.

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

When complete please forward the report(s) to:

En-route Monitoring Agency Name

Postal address

Telephone:

Fax:

E-Mail:

NAVIGATION ERROR INVESTIGATION FORM

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

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

NAVIGATION ERROR INVESTIGATION FORM

| PART 2 - Details of Aircraft, and Navigation and Communications Equipment Fit (To be completed by aircraft owner/operator) | | | |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----------------------------------------------------------|--------------|
| LRNS | Number of Systems (0, 1, 2 etc.) | Make | Model |
| INS | | | |
| IRS | | | |
| GNSS | | | |
| FMS | | | |
| Others (please Specify) | | | |
| COMS | | | |
| HF | | | |
| VHF | | | |
| SATCOM | | | |
| CPDLC | | | |
| Which navigation system was coupled to the autopilot at the time of observation of the error? | | | |
| Which Navigation Mode was selected at the time of observation of the error? | | | |
| Which Communication System was in use at the time of observation of the error? | | | |
| Aircraft registration and model/series | | | |
| Was the aircraft operating according to PBN requirements? | | <input type="checkbox"/> Yes <input type="checkbox"/> No | |

NAVIGATION ERROR INVESTIGATION FORM

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

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

APPENDIX F E

Example “Know Your Airspace” Analysis

**Examination of Operations conducted on
South China Sea - RNAV routes L642 and M771**

1. INTRODUCTION

1.1 This appendix shows how the characteristics of ATS routes L642 and M771 airspace analysis, derived from the traffic movement data collected during December 2007 and other sources, could support the safety assessment on the implementation of the reduced horizontal separation minima. This is an example of a “Know Your Airspace” analysis.

2. BACKGROUND

2.1 As the result of APANPIRG agreement, traffic movement information is collected each December from all Asia/Pacific Region flight information regions (FIRs) within which the Reduced Vertical Separation Minimum (RVSM) is applied. The traffic movement sample is termed the Traffic Sample Data (TSD). The TSD contains the following information for each flight operating in RVSM airspace during the month:

- a) call sign;
- b) aircraft type;
- c) origin aerodrome;
- d) destination aerodrome;
- e) on entry into the RVSM airspace of the FIR, the entry fix, entry time, entry flight level and route followed after the entry fix;
- f) on exit from RVSM airspace, the exit fix, corresponding time and flight level, and route followed after the exit fix; and
- g) optionally, for fixes internal to RVSM airspace, the fix name, corresponding time and flight level and routing after the fix

2.2 These data contribute to the conduct of an annual assessment of the safety of continued RVSM use. With proper treatment, these data are also useful to support assessment of the safety of reduced lateral and longitudinal separation minima.

2.3 Four FIRs – Ho Chi Minh, Hong Kong, Sanya and Singapore – have air traffic control responsibility for L642 and M771. Records of all flights operating on L642 and M771 from each of the four TSDs were merged through a software process to avoid duplicate counting of flights. The resulting combined TSD was compared to the TSD from each FIR in order to check for flights missing from individual TSDs but reported in others, and for agreement of times at fixes common to two TSDs. These and other consistency checks led to the conclusion that the quality of data-entry in each of the TSD samples was very high, and that, as a consequence, the combined December 2007 TSD provided a highly reliable basis for gaining insight into the airspace characteristics of flight operations on L642 and M771.

2.4 After processing and merging, a total of 5743 flight operations were observed on L642 and M771 during December 2007.

3. CHARACTERISTICS OF L642 AND M771

3.1 Flights operating on L642 and M771 in the combined December 2007 TSD were examined to identify and quantify several important characteristics of airspace use. Principal among these are the profile of operators using the routes, the aircraft types observed on the routes, the origin-destination aerodrome pairs for operations, flight level use on the routes and the operator/aircraft-type pairs seen to have used L642 or M771.

Operator Profile

3.2 Each traffic movement was examined to determine the operator conducting the flight. A total of 61 unique three-letter ICAO operator designators were observed in the merged TSD. Table 1 presents the top 25 of these operator-designator counts, which account for nearly 97 percent of the operations. As will be noted, the top four operators account for nearly half of the operations, while the top 10 account for about three operations in four.

| Number | Operator | Count | Proportion | Cumulative Count | Cumulative Proportion |
|--------|----------|-------|------------|------------------|-----------------------|
| 1 | SIA | 1045 | 0.1820 | 1045 | 0.1820 |
| 2 | CPA | 839 | 0.1461 | 1884 | 0.3281 |
| 3 | AXM | 439 | 0.0764 | 2323 | 0.4045 |
| 4 | MAS | 393 | 0.0684 | 2716 | 0.4729 |
| 5 | CES | 334 | 0.0582 | 3050 | 0.5311 |
| 6 | CSN | 328 | 0.0571 | 3378 | 0.5882 |
| 7 | TGW | 327 | 0.0569 | 3705 | 0.6451 |
| 8 | CCA | 248 | 0.0432 | 3953 | 0.6883 |
| 9 | CXA | 191 | 0.0333 | 4144 | 0.7216 |
| 10 | GIA | 159 | 0.0277 | 4303 | 0.7493 |
| 11 | SLK | 157 | 0.0273 | 4460 | 0.7766 |
| 12 | CAL | 142 | 0.0247 | 4602 | 0.8013 |
| 13 | SQC | 139 | 0.0242 | 4741 | 0.8255 |
| 14 | HVN | 139 | 0.0242 | 4880 | 0.8497 |
| 15 | JSA | 125 | 0.0218 | 5005 | 0.8715 |
| 16 | UAL | 99 | 0.0172 | 5104 | 0.8887 |
| 17 | CSZ | 97 | 0.0169 | 5201 | 0.9056 |
| 18 | HKE | 62 | 0.0108 | 5263 | 0.9164 |
| 19 | SHQ | 58 | 0.0101 | 5321 | 0.9265 |
| 20 | AHK | 46 | 0.0080 | 5367 | 0.9345 |
| 21 | TSE | 42 | 0.0073 | 5409 | 0.9418 |
| 22 | CRK | 41 | 0.0071 | 5450 | 0.9490 |
| 23 | VVM | 39 | 0.0068 | 5489 | 0.9558 |
| 24 | KAL | 31 | 0.0054 | 5520 | 0.9612 |
| 25 | CSH | 31 | 0.0054 | 5551 | 0.9666 |

Table 1. Top 25 Operator Designators Observed in Combined December 2007 TSD

3.3 A total of 37 unique ICAO four-letter aircraft-designators were found in the combined December 2007 TSD. Inspection of the data showed that less than one-half of one percent of December 2007 operations on L642 and M771 were conducted by either international general aviation (IGA) or State aircraft. The top 15 aircraft types, accounting for 97 percent of the December 2007 operations, are shown in table 2.

| Number | Type | Count | Proportion | Cumulative Count | Cumulative Proportion |
|--------|------|-------|------------|------------------|-----------------------|
| 1 | A320 | 1083 | 0.1886 | 1083 | 0.1886 |
| 2 | B772 | 900 | 0.1567 | 1983 | 0.3453 |
| 3 | A333 | 791 | 0.1377 | 2774 | 0.4830 |
| 4 | B773 | 557 | 0.0970 | 3331 | 0.5800 |
| 5 | B738 | 554 | 0.0965 | 3885 | 0.6765 |
| 6 | B744 | 465 | 0.0810 | 4350 | 0.7574 |
| 7 | A319 | 314 | 0.0547 | 4664 | 0.8121 |
| 8 | A306 | 148 | 0.0258 | 4812 | 0.8379 |
| 9 | B737 | 147 | 0.0256 | 4959 | 0.8635 |
| 10 | A321 | 145 | 0.0252 | 5104 | 0.8887 |
| 11 | B752 | 125 | 0.0218 | 5229 | 0.9105 |
| 12 | B742 | 108 | 0.0188 | 5337 | 0.9293 |
| 13 | MD11 | 90 | 0.0157 | 5427 | 0.9450 |
| 14 | B763 | 82 | 0.0143 | 5509 | 0.9593 |
| 15 | A343 | 62 | 0.0108 | 5571 | 0.9701 |

Table 2. Top 15 Aircraft-Type Designators Observed in Combined December 2007 TSD

3.4 Application of 50 NM longitudinal separation requires availability of Direct Controller-Pilot Communication (DCPC). In previous applications of 50 NM longitudinal separation within the Asia/Pacific Region, this requirement has been satisfied through direct high frequency radio communication between pilots and controllers, as well as through availability of controller-pilot data link communications (CPDLC) and the contract mode of automatic dependent surveillance (ADS-C).

3.5 As can be seen from the table above, the most frequently occurring aircraft type, the A320, accounts for nearly 19 percent of the operations. The DCPC requirement for operations of this aircraft type will likely need to be satisfied by other than CPDLC or ADS-C. The A320 are not known to be among those aircraft types equipped with either CPDLC or ADS-C. Likewise, types 5, 7, 8, 9, 10, 11, 12 and 14 (B738, A319, A306, B737, A321, B757, B742 and B763, respectively) – which account for an additional 19 percent of the operations in the December 2007 sample – are not known to be equipped, typically, with these technologies.

Origin-Destination Aerodromes

3.5 A total of 46 aerodromes appeared as either origins or destinations of flights in the combined December 2007 TSD. These aerodromes gave rise to a total of 106 origin-destination pairings.

3.6 The top 20 origin-destination pairs, in terms of operations, are shown in table 3. As can be seen from the table, nearly one in five operations flew between Singapore Changi Airport and Hong Kong International Airport.

| Number | Origin/ Destination | Count | Proportion | Cumulative Count | Cumulative Proportion |
|--------|------------------------|-------|------------|---------------------|--------------------------|
| 1 | WSSS VHHH | 549 | 0.0956 | 549 | 0.0956 |
| 2 | VHHH WSSS | 509 | 0.0886 | 1058 | 0.1842 |
| 3 | ZSPD WSSS | 297 | 0.0517 | 1355 | 0.2359 |
| 4 | WSSS ZSPD | 271 | 0.0472 | 1626 | 0.2831 |
| 5 | VHHH WMKK | 221 | 0.0385 | 1847 | 0.3216 |
| 6 | WMKK VHHH | 207 | 0.0360 | 2054 | 0.3577 |
| 7 | VVTS WSSS | 177 | 0.0308 | 2231 | 0.3885 |
| 8 | ZBAA WSSS | 174 | 0.0303 | 2405 | 0.4188 |
| 9 | WSSS ZBAA | 174 | 0.0303 | 2579 | 0.4491 |
| 10 | ZSPD WMKK | 159 | 0.0277 | 2738 | 0.4768 |
| 11 | WSSS ZSAM | 156 | 0.0272 | 2894 | 0.5039 |
| 12 | VHHH VVTS | 143 | 0.0249 | 3037 | 0.5288 |
| 13 | WMKK ZSPD | 142 | 0.0247 | 3179 | 0.5535 |
| 14 | WSSS ZGGG | 133 | 0.0232 | 3312 | 0.5767 |
| 15 | VMMC WMKK | 130 | 0.0226 | 3442 | 0.5993 |
| 16 | ZGGG WSSS | 128 | 0.0223 | 3570 | 0.6216 |
| 17 | WMKK VMMC | 127 | 0.0221 | 3697 | 0.6437 |
| 18 | VHHH WIII | 124 | 0.0216 | 3821 | 0.6653 |
| 19 | WIII VHHH | 119 | 0.0207 | 3940 | 0.6861 |
| 20 | ZSAM WSSS | 115 | 0.0200 | 4055 | 0.7061 |

Table 3. Top 20 Origin-Destination Pairs Observed in Combined December 2007 TSD

Use of the RNAV Routes

3.7 Table 4 shows use of the two routes in the combined December 2007 TSD. As can be seen, the proportion of operations on the two routes is not balanced.

| Number | Route | Count | Proportion | Cumulative Count | Cumulative Proportion |
|--------|-------|-------|------------|------------------|-----------------------|
| 1 | L642 | 3067 | 0.5340 | 3067 | 0.5340 |
| 2 | M771 | 2676 | 0.4660 | 5743 | 1.0000 |

Table 4. Count of Operations on L642 and M771

Flight-Level Usage on L642 and M771

3.8 Table 5 below presents the flight levels (FLs) and associated frequencies observed in the traffic sample. As can be seen, in order of use, FLs 360, 380 and 340 are the preferred altitudes on the routes, and account for 77 percent of the operations. The one observation at FL220 is very likely due to a minor error in data transcription or interpretation.

| Number | FL | Count | Proportion | Cumulative Count | Cumulative Proportion |
|--------|-----|-------|------------|------------------|-----------------------|
| 1 | 360 | 1738 | 0.3026 | 1738 | 0.3026 |
| 2 | 380 | 1442 | 0.2511 | 3180 | 0.5537 |
| 3 | 340 | 1244 | 0.2166 | 4424 | 0.7703 |
| 4 | 400 | 565 | 0.0984 | 4989 | 0.8687 |
| 5 | 320 | 459 | 0.0799 | 5448 | 0.9486 |
| 6 | 390 | 93 | 0.0162 | 5541 | 0.9648 |
| 7 | 300 | 90 | 0.0157 | 5631 | 0.9805 |
| 8 | 310 | 36 | 0.0063 | 5667 | 0.9868 |
| 9 | 410 | 29 | 0.0050 | 5696 | 0.9918 |
| 10 | 330 | 24 | 0.0042 | 5720 | 0.9960 |
| 11 | 370 | 9 | 0.0016 | 5729 | 0.9976 |
| 12 | 350 | 7 | 0.0012 | 5736 | 0.9988 |
| 13 | 290 | 6 | 0.0010 | 5742 | 0.9998 |
| 14 | 220 | 1 | 0.0002 | 5743 | 1.0000 |

Table 5. Flight-Level Use on L642 and M771

Operator/Aircraft-Type Combinations

3.9 In all, 107 combinations of operator and aircraft type were observed in the combined December 2007 TSD. The top 21 such combinations, accounting for 70 percent of the operations, are shown in Table 6, with both the operator and aircraft type designations shown in standard ICAO notation. The knowledgeable reader can determine readily those combinations likely to be equipped with CPDLC and ADS-C.

| Pair Number | Operator-Aircraft Type | Count | Proportion | Cumulative Count | Cumulative Proportion |
|-------------|------------------------|-------|------------|------------------|-----------------------|
| 1 | SIA-B772 | 611 | 0.1064 | 611 | 0.1064 |
| 2 | AXM-A320 | 439 | 0.0764 | 1050 | 0.1828 |
| 3 | CPA-A333 | 336 | 0.0585 | 1386 | 0.2413 |
| 4 | TGW-A320 | 327 | 0.0569 | 1713 | 0.2983 |
| 5 | SIA-B773 | 312 | 0.0543 | 2025 | 0.3526 |
| 6 | CPA-B773 | 245 | 0.0427 | 2270 | 0.3953 |
| 7 | MAS-A333 | 193 | 0.0336 | 2463 | 0.4289 |
| 8 | CXA-B737 | 144 | 0.0251 | 2607 | 0.4539 |
| 9 | SQC-B744 | 139 | 0.0242 | 2746 | 0.4781 |
| 10 | JSA-A320 | 125 | 0.0218 | 2871 | 0.4999 |
| 11 | CES-A333 | 124 | 0.0216 | 2995 | 0.5215 |
| 12 | CES-A319 | 122 | 0.0212 | 3117 | 0.5427 |
| 13 | SIA-B744 | 122 | 0.0212 | 3239 | 0.5640 |
| 14 | CSN-A320 | 103 | 0.0179 | 3342 | 0.5819 |
| 15 | MAS-B772 | 103 | 0.0179 | 3445 | 0.5999 |
| 16 | UAL-B744 | 99 | 0.0172 | 3544 | 0.6171 |
| 17 | CSN-A319 | 99 | 0.0172 | 3643 | 0.6343 |
| 18 | CSZ-B738 | 97 | 0.0169 | 3740 | 0.6512 |
| 19 | CPA-B772 | 95 | 0.0165 | 3835 | 0.6678 |
| 20 | SLK-A319 | 93 | 0.0162 | 3928 | 0.6840 |
| 21 | GIA-B738 | 92 | 0.0160 | 4020 | 0.7000 |

Table 6. Top 21 Operator/Aircraft-Type Combinations Observed in Combined December 2007 TSD

4. SUMMARY

4.1 The above reviews the Top 25 operators, Top 15 aircraft types, Top 20 origin-destination pairs, flight level use and Top 21 operator/aircraft-type combinations observed in the TSDs in light of the planned introduction of 50 NM lateral and longitudinal separation standards on L642 and M771. Using published information about data link use in other portions of Asia/Pacific Region airspace, this analysis notes the possible aircraft types and operators which might qualify for application of the reduced horizontal separation minima.

.....

APPENDIX G F

Example Safety Assessment

South China Sea Collision Risk Model and Safety Assessment

1. Introduction

1.1 The South East Asia Safety Monitoring Agency (SEASMA), an En-route Monitoring Agency (EMA), is responsible for supporting continued safe use of the six major air traffic service routes in South China Sea international airspace. This support consists of discharging the EMA duties listed in the Asia/Pacific En-route Monitoring Agency Handbook.

1.2 The purpose of this appendix is to present an example of a safety assessment, as conducted by SEASMA on the six major South China Sea routes, together with the collision risk model used, to assess compliance with APANPIRG-agreed Target Level of Safety (TLS) values for the maintenance of lateral and longitudinal separation standards. The examination period covered is 1 May 2008 through 30 April 2009.

2. Background

2.1 The six South China Sea routes – L642, M771, N892, L625, N884 and M767 – were introduced in November 2001 in order to relieve congestion in the airspace. At the same time, State approval for Required Navigation Performance 10 (RNP 10) (now RNAV 10 under Performance Based Navigation (PBN) terminology) became mandatory for operation at or above flight 290 (FL 290).

2.2 This performance requirement was the basis for employing a minimum lateral separation standard of 60NM between-route centerlines. As shown in Table 1, the six routes are organized into three route-pairs to serve principal origin destination points, no pre-departure clearance (No-PDC) flight levels by route and some information about routes crossing the RNAV routes.

| Route | Principal Service | Direction of Flow | No-PDC Flight Levels |
|-----------------|-----------------------------------|---------------------|---------------------------------|
| RNAV L642 | Hong Kong/Singapore-Kuala Lumpur | Northeast-southwest | 310, 320, 350, 360, 390 and 400 |
| RNAV M771 | Singapore-Kuala Lumpur /Hong Kong | Southwest-northeast | Same as L642 |
| RNAV N892 | Northeast Asia-Taiwan/Singapore | Northeast-southwest | Same as L642 |
| RNAV L625 | Singapore /Northeast Asia-Taiwan | Southwest-northeast | Same as L642 |
| RNAV N884 | Singapore /Manila | Southwest-northeast | Same as L642 |
| RNAV M767 | Manila/Singapore | Northeast-southwest | Same as L642 |
| Crossing Routes | Various | Bidirectional | Dependent upon route |

Table 1: Characteristics of Air Traffic Service Routes in South China Sea

2.3 The longitudinal separation minimum published for the six routes in November 2001 was 10 minutes with Mach Number Technique (MNT), or 80NM RNAV.

2.4 Radar monitoring of horizontal plane navigational performance was initiated with introduction of the RNAV routes. The enabling Letter of Agreement (LOA) – signed by China, Hong Kong China, Indonesia, Malaysia, Singapore, Thailand, Vietnam, and Philippines – specified details concerning the categories of errors to be monitored and reported to Singapore on a monthly basis. The LOA also called for reporting associated counts of flights monitored.

2.5 In anticipation of horizontal-plane separation changes being pursued by the ICAO South-East Asia RNP Task Force (RNP-SEA/TF), the LOA was revised in 2008 to formalize certain monitoring activities which had been carried out previously on an informal basis. Table 2 indicates the fixes where monitoring is taking place under the revised LOA.

| Route | Fixes | Monitoring Authority |
|-------|-----------------|----------------------|
| L642 | ESPOB to ENREP | Singapore |
| M771 | DULOP and DUMOL | Hong Kong, China |
| N892 | MELAS and MABLI | Singapore |
| L625 | AKOTA and AVMUP | Philippines |
| N884 | LULBU and LEGED | Philippines |
| M767 | TEGID to BOBOB | Singapore |

Table 2: Monitored Fixes in South China Sea Airspace

2.6 Since adoption of the original LOA, all instances of certain types of lateral and longitudinal errors have been reported to Singapore. The specifics of error-reporting are shown in Table 3. As will be noted, monitoring systems include automatic dependent surveillance – contract (ADS-C) and position reports, in addition to radar.

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

Table 3. Reporting Criteria for South China Sea Monitoring Programme

2.7 The monitoring criteria in Table 3 were chosen to support eventual work by the RNP-SEA/TF to introduce PBN separation standards, specifically RNAV 10-based 50NM lateral and longitudinal separation and RNP 4-based 30NM lateral and longitudinal separation. On 2 July 2008, the first of these separation reductions was introduced: the lateral separation standard between L642 and M771 was changed to 50NM and the preferred basis for longitudinal separation on these routes was changed to distance from time, with the minimum longitudinal separation standard between co-altitudes pairs reduced to 50NM.

3. Results of Data Collection

3.1 Table 4 shows the record of ANSP reporting of observed large errors and corresponding traffic counts covered by the South China Sea monitoring programme LOA (2008 revision) for the period May 2008 through April 2009.

| Month | Report received from: | | |
|----------------|-----------------------|-------------|-----------|
| | Hong Kong, China | Philippines | Singapore |
| May 2008 | Yes | No | Yes |
| June 2008 | Yes | No | Yes |
| July 2008 | Yes | No | Yes |
| August 2008 | Yes | Yes | Yes |
| September 2008 | Yes | Yes | Yes |
| October 2008 | Yes | Yes | Yes |
| November 2008 | Yes | Yes | Yes |
| December 2008 | Yes | Yes | Yes |
| January 2009 | Yes | Yes | Yes |
| February 2009 | Yes | Yes | Yes |
| March 2009 | Yes | Yes | Yes |
| April 2009 | Yes | Yes | Yes |

Table 4. Record of ANSP Reporting by Month for Period May 2008 through April 2009

3.2 *Reported Traffic Counts for May 2008 through April 2009 Monitoring Period*

3.2.1 Table 5 presents the total traffic counts reported by month transiting all South China Sea monitoring fixes.

| Monitoring Month | Total Monthly Traffic Count Reported Over Monitored Fixes | Cumulative 12-Month Count of Traffic Reported Over Monitored Fixes Through Monitoring Month |
|------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------------|
| May 2008 | 8123 | 81591 |
| June 2008 | 7743 | 83239 |
| July 2008 | 8423 | 85383 |
| August 2008 | 7568 | 86638 |
| September 2008 | 7293 | 87800 |
| October 2008 | 7673 | 89029 |
| November 2008 | 6576 | 89457 |
| December 2008 | 6665 | 89597 |
| January 2009 | 7244 | 90880 |
| February 2009 | 6380 | 89434 |
| March 2009 | 7016 | 88438 |
| April 2009 | 6603 | 87307 |

Table 5. Monthly Count of Monitored Flights Operating on South China Sea RNAV Routes

3.3 *Reports of LLD for May 2008 to April 2009 Monitoring Period*

3.3.1 There were no reported LLDs during the period May 2008 through April 2009.

3.3.2 Table 6 below presents the cumulative totals of LLDs in a manner similar to the traffic counts of table 5.

| Monitoring Month | Cumulative 12-Month Count of LLDs Reported Over Monitored Fixes Through Monitoring Month |
|------------------|------------------------------------------------------------------------------------------|
| May 2008 | 2 |
| June 2008 | 2 |
| July 2008 | 2 |
| August 2008 | 2 |
| September 2008 | 2 |
| October 2008 | 2 |
| November 2008 | 1 |
| December 2008 | 0 |
| January 2009 | 0 |
| February 2009 | 0 |
| March 2009 | 0 |
| April 2009 | 0 |

Table 6. Monthly Count of LLDs on South China Sea RNAV Routes

3.4 Reports of LLEs for May 2008 through April 2009 Monitoring Period

3.4.1 No ANSP reported an LLE in any of the categories shown in table 3 during the monitoring period.

4 The Collision risk model

4.1 Lateral Collision risk model: Compliance with Lateral TLS Value

4.1.1 Currently, the lateral separation standard between RNAV routes L642 and M771 is 50NM and 60NM otherwise for the other RNAV routes. The form of the lateral collision risk model used in assessing the safety of operations on the South China Sea RNAV routes is:

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

(1)

4.1.3 Table 7 presents the following descriptive information concerning equation (1) and its use in the ongoing assessment of RNAV-route lateral collision risk compliance with the APANPIRG-agreed TLS value of 5×10^{-9} fatal accidents per flight hour: (a) parameter definition, (b) parameter estimate value used in compliance assessment and (c) source for value of parameter estimate.

4.1.4 It should be noted that the value for the opposite-direction lateral occupancy parameter, a measure of the proximity of co-altitude aircraft on laterally adjacent routes, shown in table 7 has been updated based on the December 2008 TSD. The value is based solely on the passings observed between aircraft operating on L642 and M771 and is considered conservative, that is, leading to a higher lateral collision risk estimate than might be the case if operations on all RNAV routes were used in developing an occupancy estimate. Because of the opposite-direction flow on a pair of RNAV routes, no value of $|\bar{\dot{x}}|$, the same-direction relative along-track speed of a co-altitude aircraft pair on laterally adjacent routes, is presented.

| Model Parameter | Definition | Value Used in TLS Compliance Assessment | Source for Value |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| N_{ay} | Risk of collision between two aircraft with planned 50NM lateral separation | 5.0×10^{-9} fatal accidents per flight hour | TLS adopted by APANPIRG for changes in separation minima |
| S_y | Lateral separation minimum | 50NM | Current lateral separation minimum between L642 and M771; used as common South China Sea lateral separation standard in compliance assessment |
| $P_y(50)$ | Probability that two aircraft assigned to parallel routes with 50NM lateral separation will lose all planned lateral separation | 2.69×10^{-9} | Value required to meet exactly the APANPIRG-agreed TLS value using equation (1), given other parameter values shown in this table. |
| λ_x | Aircraft length | 0.0399NM | Based on December 2008 TSD operations on L642/M771 |
| λ_y | Aircraft wingspan | 0.0329NM | |
| λ_z | Aircraft height | 0.0099NM | |
| $P_z(0)$ | Probability that two aircraft assigned to same flight level are at same geometric height | 0.538 | Commonly used in safety assessments |
| S_x | Length of half the interval, in NM, used to count proximate aircraft at adjacent fix for occupancy estimates | 120NM, equivalent to the +/- 15-minute pairing criterion | Arbitrary criterion which does not affect the estimated value of lateral collision risk |
| $E_y(\text{same})$ | Same-direction lateral occupancy | 0.0 | Result of direction of traffic flows on each pair of RNAV routes |
| $E_y(\text{opp})$ | Opposite-direction lateral occupancy | 0.78 | Based on December 2008 TSD; only operations on L642/M771 used to derive estimate |
| \bar{V} | Individual-aircraft along-track speed | 483.9 knots | Combined December 2008 TSD |
| $ \bar{y}(S_y) $ | Average relative lateral speed of aircraft pair at loss of planned lateral separation of S_y | 75 knots | Conservative value based on assumption of waypoint insertion error |
| $ \bar{z} $ | Average relative vertical speed of a co altitude aircraft pair assigned to the same route | 1.5 knots | Conservative value commonly used in safety assessments |

Table 7 - Summary of Risk Model Parameters Used in Lateral Safety Assessment

4.2 Longitudinal Collision Risk model: Compliance with Longitudinal TLS Value

4.2.1 Currently, the longitudinal separation standard for co-altitude aircraft on RNAV routes, L642 and M771, is 50NM; the longitudinal separation standard for the other RNAV routes is either 10 minutes with Mach Number Technique (MNT) or 80NM.

4.2.2 The form of the longitudinal collision risk model used in assessing the safety of operations on the South China Sea RNAV routes is:

$$N_{ax} = P_y(0)P_z(0) \frac{2\lambda_x}{|\dot{x}|} \left[\frac{|\dot{x}|}{2\lambda_x} + \frac{|\dot{y}(0)|}{2\lambda_y} + \frac{|\dot{z}|}{2\lambda_z} \right] \times \sum_{k=m}^N \sum_{K=k}^M Q(k) \times P(K > k) \quad (2)$$

4.2.3 Table 8 below presents information about the parameters of the longitudinal collision risk model not already discussed in Table 7.

| Model Parameter | Definition | Value Used in TLS Compliance Assessment | Source for Value |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| N_{ax} | Risk of collision between two co-altitude aircraft with planned longitudinal separation equal to at least the applicable minimum longitudinal separation standard | 5.0×10^{-9} fatal accidents per flight hour | TLS adopted by APANPIRG for changes in separation minima |
| $P_y(0)$ | Probability that two aircraft assigned to same route will be at same cross-track position | 0.2 | May 2008 safety assessment of 50NM longitudinal separation minimum presented at RASMAG/9 |
| $ \dot{x}(m) $ | Minimum relative along-track speed necessary for following aircraft in a pair separated by m at a reporting point to overtake lead aircraft at next reporting point | 100 knots | RASMAG/9 safety assessment |
| $ \dot{y}(0) $ | Relative across-track speed of same-route aircraft pair | 1 knot | RASMAG/9 safety assessment |
| m | Longitudinal separation minimum | 50NM | Current preferred longitudinal separation minimum on RNAV routes L642 and M771; used for all RNAV routes in TLS compliance assessment |

| Model Parameter | Definition | Value Used in TLS Compliance Assessment | Source for Value |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| N | Maximum initial longitudinal separation between aircraft pair which will be monitored by air traffic control in order to prevent loss of longitudinal separation standard | 150NM | Arbitrary value of actual initial separation beyond which there is negligible chance that actual longitudinal separation will erode completely before next air traffic control check of longitudinal separation based on position reports |
| M | Maximum longitudinal separation loss over all pairs of co-altitude aircraft | Dependent on initial longitudinal separation distance | RASMAG/9 safety assessment showed that amount of initial longitudinal separation lost depends upon initial separation value |
| $Q(k)$ | Proportion of aircraft pairs with initial longitudinal separation k | Initial distribution of longitudinal separation for RNAV routes L642 and M771 used in RASMAG/9 safety assessment | Combined December 2007 TSD |
| $P(K > k)$ | Probability that a pair of same-route, co-altitude aircraft with initial longitudinal separation k will lose at least as much as k longitudinal separation before correction by air traffic control | Values derived to satisfy TLS of 50NM longitudinal separation minimum presented at RASMAG/9 | Result of direction of traffic flows on each pair of RNAV routes |

Table 8. Summary of Additional Risk Model Parameters Used in Longitudinal Safety Assessment

5. Safety Assessment

5.1 Results from the monitoring programme found in paragraph 3 have shown consistently that adherence to track and maintenance of inter-aircraft longitudinal separation are good in the airspace. Since initiation of monitoring in November 2001, there have been only two instances of a lateral deviation of 15NM or more from centerline and no reported large longitudinal error reported to Singapore.

5.2 Since January 2005, States have monitored roughly 300,000 flights while recording the two instances of large lateral deviations and no instances of reportable longitudinal errors. A reasonable conclusion from these results is that, whatever the values that pertain in the lateral and longitudinal dimensions, the rates of occurrence of large horizontal-plane navigational errors are so low that they do not evidence themselves frequently in the number of flights monitored.

5.3 The few instances of reported large errors are consistent with several facts about the South China Sea operational environment, as follows:

- the six RNAV routes have been fixed at the same coordinates since November 2001,
- more than 97 percent of operations are conducted by commercial operators regularly flying the routes,
- more than 98 percent of the operations are conducted using aircraft types of the most recent generations, and
- more than 60 percent of South China operations are conducted on the L642 and M771 routes where radar surveillance and very high frequency radio coverage are extant throughout almost all of the route lengths, providing the opportunity for controller intervention in the event that an aircraft or aircraft pair begins to stray.

5.4 Given the small number of reported large errors, the estimation of lateral and longitudinal collision risk is more challenging. This is because it is more difficult to estimate the two key probabilities on which the risk values depend: the probability that a pair of aircraft will lose, respectively, all planned 50 NM lateral separation and 50 NM minimum longitudinal separation – repressed symbolically as $P_y(50)$ and $P_x(S_x | S_x \geq 50)$.

5.5 The approach taken to estimating the two probability values is the same. It will be described for the case of lateral separation; differences in the outcome for longitudinal separation will be discussed after the lateral-separation case is explained.

5.6 Direct estimation of Lateral Collision Risk

5.6.1 This approach considers that the process of monitoring a flight has the following properties:

- a flight's performance observed at a monitored fix is the same as its performance during that portion of its operation where performance is not monitored formally,
- from the standpoint of the monitoring programme, there are only two possible outcomes for a flight: either observing a 15-NM or greater magnitude lateral deviation – the monitoring criterion for reporting a large lateral deviation in South China Sea airspace – or not observing a large lateral deviation
- p is the probability that a large lateral deviation occurs during a flight,
- p is constant from flight to flight
- Monitoring programme observation of a large lateral deviation for a flight does not influence the chance that a large lateral deviation will be observed for any other flight.

5.6.2 As a result, monitoring a flight can be considered to be a Bernoulli trial with probability, p , of “success” (observing a large lateral deviation) and probability $q = (1 - p)$, of “failure” (observing a lateral error less than 15NM in magnitude). Thus, the statistical distribution describing the probability of obtaining k “successes” (or large lateral deviations) in M successive trials (or monitoring observations) is the binomial:

$$b(M; k, p) = \binom{M}{k} p^k (1-p)^{(M-k)} = (M!) / (((M-k)! \cdot (k!))$$

where, for example, $k! = k \cdot (k-1) \cdot (k-2) \dots 2 \cdot 1$

The expected number of successes in n trials is given by:

$$M \cdot p$$

For Bernoulli trials, it is well known that, if the number of trials, M, increases while the probability, p, of success from trial to trial decreases such that the product expected number of successes, $M \cdot p$, remains sensibly constant, the probability of k successes in M trials, $b(M; k, p)$, can be approximated by the Poisson distribution, $p(k; \lambda)$, where:

$$p(k; \lambda) = e^{-\lambda} \lambda^k / (k!)$$

The parameter, λ , termed as the “intensity parameter”, is the expected value of the distribution, or expected number of successes, given by:

$$\lambda = M \cdot p$$

As can be seen by comparing the two, the expected value of the binomial distribution, $M \cdot p$, and the Poisson distribution, $\lambda = M \cdot p$, are the same.

It is common to refer to p as the “success rate.”

5.6.3 The Poisson distribution has application in estimating the number of arrivals of requests for service at a telephone switchboard, for example, higher values of λ will correspond to a more intense traffic at the switchboard. In the case of the South China Sea monitoring programme, the Poisson distribution is used to describe the number of large lateral deviations observed for M flights in the regions of the monitored fixes.

5.6.4 It is important to recognize that many values of λ could have produced the observed monitored results. The first recorded instance of a large lateral deviation was November 2007. From January 2005 to that time, roughly 167,000 flights were monitored without observation of a large lateral deviation. The occurrence of no errors during this period would have been consistent with a value of $\lambda = 0.0$, which would have corresponded to a success rate, p, of 0.0. In addition, it is intuitive that small “success” rates greater than 0.0 could have produced no observed large lateral deviations in 167,000 trials. For example, it is highly likely that a success rate, p, or rate of large lateral deviations, of 1×10^{-16} per flight could have produced no large lateral deviations in 167,000 monitored flights, since the expected number of large lateral errors, or successes, with this error rate is given by:

$$\lambda = M \cdot p = \text{expected number of successes}$$

or:

$$\begin{aligned} \lambda &= p \cdot n = (1 \times 10^{-16} \text{ large lateral deviations/flight}) \cdot (167,000 \text{ flights}) \\ &= 1.67 \times 10^{-11} \end{aligned}$$

which is nearly 0 successes, or observed large lateral deviations.

5.6.5 The process of increasing the possible error rate and determining if the expected number of large lateral errors in 167,000 trials would be consistent with the number observed could be

continued until some reasonable upper bound is determined. That upper rate value could then be used as a conservative estimate of the true, but unknown, error rate which is consistent with the monitored results.

5.6.6 The procedure used to produce an upper bound on the rate of large lateral deviations is to determine the value of the Poisson-distribution parameter, λ , which corresponds to a probability of 0.05 that the true, but unknown, rate of large lateral deviations would lead to more errors than the k errors, observed during a monitoring period. That is, to determine a value of λ such that:

$$0.05 = \text{Probability of more than } k \text{ errors}$$

$$= \sum_{N>k}^{\infty} p(N; \lambda)$$

Since $p(k; \lambda)$ is a probability distribution,

$$\sum_{N>k}^{\infty} p(N; \lambda) = 1 - \sum_{N=0}^k p(N; \lambda)$$

Thus, the expression can be re-written into the computationally more convenient form:

$$\sum_{N=0}^k p(N; \lambda) = 1 - 0.05 = 0.95$$

For the period from November 2001 until November 2007, the number of observed large lateral deviations was 0 each month. That is, k took on the value 0 for each month. In these cases, the expression above becomes:

$$0.95 = \sum_{N=0}^k p(N; \lambda)$$

$$= \sum_{N=0}^0 p(N; \lambda)$$

$$= p(k=0; \lambda)$$

$$= e^{-\lambda} \lambda^k / (k!)$$

$$= e^{-\lambda} \lambda^0 / (0!)$$

Since both λ^0 and $(0!)$ evaluate to 1, the expression above reduces to

$$0.95 = e^{-\lambda}$$

or,

$$\lambda = -\ln(0.95)$$

where $\ln(0.95)$ is the Natural logarithm of 0.95

Since the value of $-\ln(0.95)$ is roughly 0.05,

$$\lambda \approx 0.05$$

or, taking the approximate value as exact for ease of use and substituting the expression for λ in terms of p and M ,

$$\begin{aligned}\lambda &= 0.05 \\ p \cdot M &= 0.05 \\ p &= 0.05/M\end{aligned}$$

where
 p is the error rate per flight, and
 M is the number of monitored flights

5.6.7 In the method to estimate South China Sea lateral risk, the cumulative numbers of flights and reported large lateral deviations reported for the 12 months up to and including month N are used to estimate the lateral risk for month N . Thus, M is taken to be the total number of flights monitored within the last 12 months up to and including month N .

5.6.8 The two large lateral deviations were reported as single occurrences in November and December 2007. In the cases of the months November 2007 through November 2008, determination of the value of λ involves evaluation of the expression

$$0.95 = \sum_{N=0}^k p(N; \lambda)$$

for $k=1$ and $k=2$, depending upon the month from November 2007 through November 2008.

When $k=1$ or 2 , the expression is a transcendental equation in λ , most easily solved numerically. The values of λ for $k=0, 1$ and 2 are 0.051293, 0.35540 and 0.81770, respectively.

This approach yields a proportion, p , of lateral deviations at least as large in magnitude as 15NM for each month of the monitoring programme.

5.6.9 It is now necessary to impose a further assumption in order to obtain a value for $P_y(50)$, the probability that two aircraft with planned lateral separation of 50NM lose all planned lateral separation, for risk computation. Many years of experience by a number of States in analyzing lateral navigational performance has resulted in agreement on a general form for the distribution of lateral errors. The distribution, usually termed a “double double exponential” is a combination of two double exponential, or First Laplace, distributions which can be represented symbolically as:

$$f(y; \beta_1, \beta_2) = ((1 - \alpha) / 2\beta_1) e^{-|y|/\beta_1} + (\alpha / 2\beta_2) e^{-|y|/\beta_2}$$

for $-\infty < y < \infty$

$$\beta_2 > \beta_1 > 0$$

$$\alpha > 0$$

5.6.10 The first exponential is usually referred to as the “core” distribution since it is intended to describe typical lateral navigational performance; the second is generally called the “tail” distribution since it is intended to model the atypical, large lateral errors. For each distribution, the standard deviation, σ , is related to the parameter, β , by:

$$\beta = \sigma / 2$$

The parameter, α , is the weight of the larger-error component of the overall distribution.

The proportion of the overall distribution in excess of some absolute value of lateral deviation, Y , is given by:

$$\text{Probability } \{y \geq |Y|\} = (1 - \alpha)e^{-|Y|/\beta_1} + \alpha e^{-|Y|/\beta_2}$$

The self-convolution of this distribution, $C(z)$, evaluated at the separation standard, S_y , is related to the probability of lateral overlap by

$$p_y(S_y) = 2\lambda_y \bullet C(S_y)$$

It is well known that if β_2 is much greater than β_1 , then

$$\text{Probability } \{y \geq |Y|\} = e^{-|Y|/\beta_2}$$

and

$$p_y(S_y) = (2\alpha\lambda_y / \beta_2)e^{-S_y/\beta_2}$$

Further, for a fixed value of α , the maximum value of $C(S_y)$ is reached when $\beta_2 = S_y$, expressed as $\alpha(e \bullet S_y)$.

5.6.11 In the approach to estimating collision risk for South China Sea airspace, it has been assumed, conservatively, that the convolution will take on its maximum. Thus, for the value of $P_y(S_y)$ necessary to meet exactly the Target Level of Safety (TLS), the required value of α is thus:

$$(P_y(S_y) e \bullet S_y) / 2 \lambda_y$$

The approach, thus, reduces to determining whether the constraint that, for k large lateral deviations observed in M flights,

$$\lambda(k) / M = (1 - \alpha)e^{-|k|/S_y} + \alpha e^{-|k|/S_y}$$

can be satisfied for α which results in meeting exactly the TLS. Radar data collected in the Singapore FIR, although of a limited amount, indicates that the standard deviation of lateral deviations arising from typical navigational performance is 0.5NM to 1.0NM. Values in this range result in the value of $(1 - \alpha)e^{-|k|/S_y}$ to be negligible in comparison to $\alpha e^{-|k|/S_y}$. As a result,

$$\lambda(k) / M = \alpha e^{-|k|/S_y}$$

This constraint results in a computed value of α . The proportion by which the lateral collision risk differs from the TLS, multiplied by the TLS value, becomes the estimated lateral collision risk.

5.7 Estimation of Longitudinal Collision Risk

5.7.1 For the case of longitudinal collision risk estimation, the results from South China Sea monitoring indicate that there have been no reported instances of 3-minute or greater unexpected separation loss between a pair of co-altitude aircraft. These monitored data represent a sample of the convolution density function directly, rather than a sample of individual-aircraft deviation which then

must go through the process of distribution identification and fitting in order to produce a sample convolution density function.

5.7.2 It is assumed that the unexpected loss of longitudinal decays exponentially as the value of unexpected separation loss increases. If x represents unexpected separation loss, this assumption results in using an exponential distribution to characterize the probability of unexpected longitudinal separation loss between a pair of co-altitude aircraft. Using $g(x)$ to represent distribution of unexpected longitudinal separation loss, the form of this distribution is:

$$g(x) = \varphi e^{-\varphi x}$$

5.7.3 In a manner similar to the approach for estimating lateral collision risk, the parameter φ is estimated from the proportion of 3-minute or greater unexpected longitudinal separation loss which is derived from the Poisson–variate assumption. Once determined, this exponential distribution is used in conjunction with the distribution of initial inter-aircraft separation determined from data collection to support longitudinal risk estimation.

5.8 Compliance with Lateral and Longitudinal TLS Values

5.8.1 Figure 1 below presents the results of taking the direct estimation shown above for the monitoring period May 2008 to April 2009

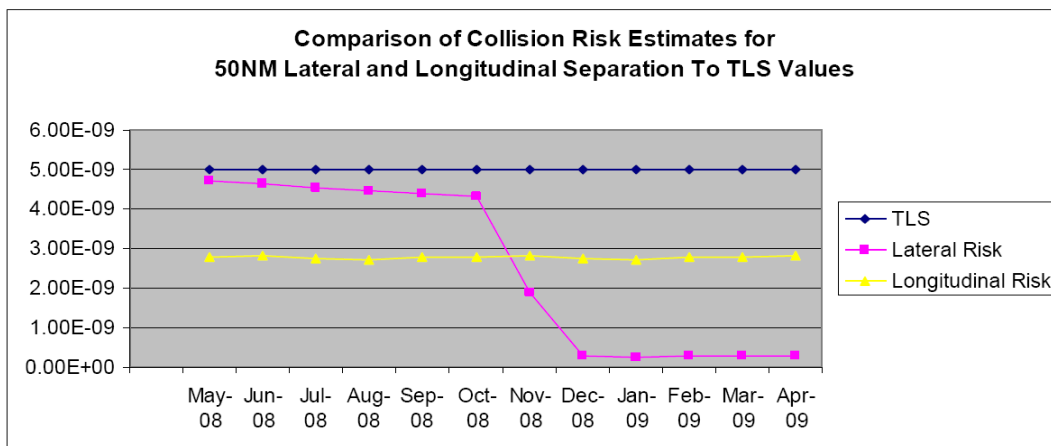


Figure 1. Assessment of Compliance with Lateral and Longitudinal TLS Values Based on Navigational Performance Observed During South China Monitoring Programme

5.8.2 As can be seen, both the estimates of lateral and longitudinal risk during the monitoring showed compliance with the TLS during all months of the monitoring period.

APPENDIX H

Sample Content and Format for Collection of Sample of Traffic Movements

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

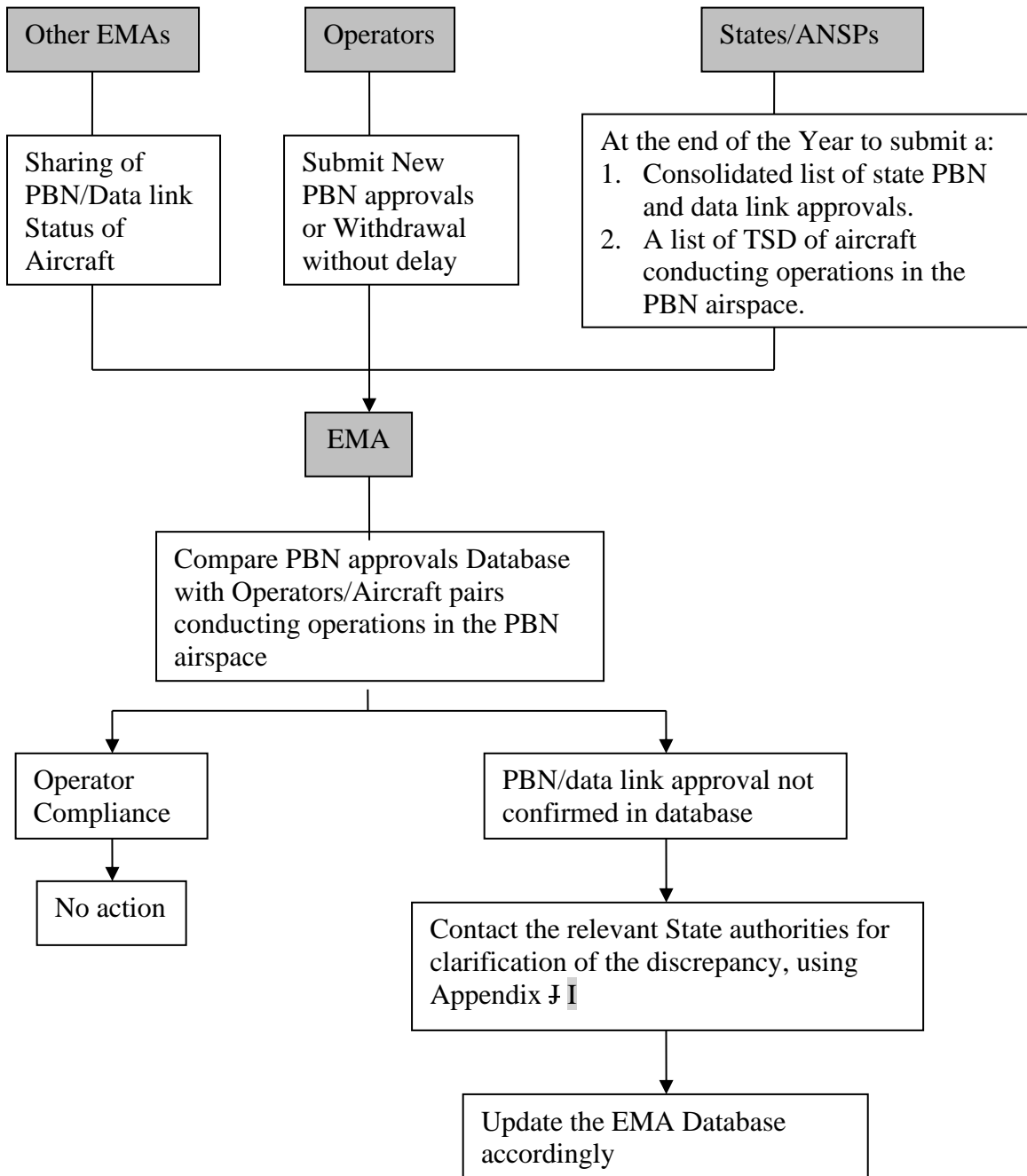
INFORMATION FOR EACH FLIGHT IN THE SAMPLE

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

| FIELD | EXAMPLE | MANDATORY OR OPTIONAL |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------|
| Date (dd/mm/yyyy) | 08/05/2007 for 8 May 2007 | MANDATORY |
| Aircraft Call Sign | XXX704 | MANDATORY |
| Aircraft Registration Mark | VH-ABC | MANDATORY |
| PBN Approval type | RNP 4 | MANDATORY |
| Aircraft Type | B734 | MANDATORY |
| Origin Aerodrome | WMKK | MANDATORY |
| Destination Aerodrome | RPLL | MANDATORY |
| Entry Fix into Airspace | MESOK | MANDATORY |
| Time at Entry Fix (UTC) | 0225 or 02:25 | MANDATORY |
| Flight Level at Entry Fix | 330 | MANDATORY |
| Assigned Mach number at Entry Fix | M0.77 | OPTIONAL |
| Route after Entry Fix | | MANDATORY |
| Exit Fix from Airspace | NISOR | MANDATORY |
| Time at Exit Fix (UTC) | 0401 or 04:01 | MANDATORY |
| Flight Level at Exit Fix | 330 | MANDATORY |
| Assigned Mach number at Exit Fix | M0.77 | OPTIONAL |
| Route before Exit Fix | | MANDATORY |
| First Fix Within the Airspace OR First Airway Within the Airspace | MESOK OR G582 | OPTIONAL |
| Time at First Fix (UTC) | 0225 or 02:25 | OPTIONAL |
| Flight Level at First Fix | 330 | OPTIONAL |
| Route after first fix | | OPTIONAL |
| Second Fix Within the Airspace OR Second Airway Within the Airspace | MEVAS OR G577 | OPTIONAL |
| Time at Second Fix (UTC) | 0250 or 02:50 | OPTIONAL |
| Flight Level at Second Fix | 330 | OPTIONAL |
| Route after second fix | | OPTIONAL |
| (Continue with as many Fix/Time/Flight-Level/Route entries as are required to describe the flight's movement within the airspace) | | OPTIONAL |

APPENDIX I G

Monitoring Operator Compliance with State Approval Requirements Flow Chart



APPENDIX J I

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

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

<STATE AUTHORITY ADDRESS>

1. The *(EMA name)* has been established by the ICAO Asia/Pacific Regional Airspace Safety Monitoring Advisory Group (RASMAG) to support safe implementation and use of the horizontal-plane separation in *(airspace where the EMA has responsibility)*, in accordance with guidance published by the International Civil Aviation Organization.
2. Among the other activities, the *(EMA name)* conducts a comparison of the State en-route PBN and data link approval status, provided by an operator to an air traffic control unit, to the record of State en-route PBN and data link approval available to us. This comparison is considered vital to ensuring the continued safe use of horizontal-plane separation.
3. This letter is to advise you that an operator which we believe is on your State registry provided notice of State en-route PBN or data link approval which is not confirmed by our records. The details of the occurrence are as follows:

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

- 4 We request that you advise this office of the en-route PBN and data link approval status of this operator. In the event that you have not granted an en-route PBN or data link approval to this operator, we request that you advise this office of any action which you propose to take.

Sincerely,

(EMA official)

APPENDIX ~~K~~ J

Scrutiny Group Guidance

1. Composition

The Scrutiny Group requires a diverse set of subject-matter expertise. The Scrutiny Group could consist of subject matter experts in air traffic control, aircraft operation, operational pilot groups, regulation and certification, data analysis, and risk modeling from the involved regions.

If necessary, a working group could be formed to discuss specific subject matters, and might consist of subject matter experts and specialists from member States, EMA, CRA, etc. The working group would be responsible for executing the preparatory work for a meeting of the Scrutiny Group, including the analysis and categorization of selected LLDs and LLEs.

2 Purpose

The goal of the Scrutiny Group is to examine reports of LLDs and LLEs from the EMA monitoring programme with the objective of determining which reports from the monitoring programme will influence the risk of collision associated with the reduced horizontal separation. For example, the Scrutiny Group could examine possible LLDs and LLEs affected by the reliability and accuracy of the avionics within the aircraft and/or by external meteorological events and/or by the human element in the development of the safety assessment.

Once the Scrutiny Group has made its initial determination, the data are reviewed to look for performance trends. If any adverse trends exist, the Scrutiny Group may make recommendations to either ANSPs or regulatory authorities for reducing or mitigating the effect of those trends as a part of ongoing reduced horizontal separation safety oversight.

3 Process

The primary method employed is to examine existing databases as well as other sources and analyze events resulting in:

- Lateral tracking errors based on a deviation of 15 NM either side of track, or a lesser deviation value determined by the EMA as necessary where lower value PBN specifications are used
- Variations of longitudinal separation of three minutes or more; or
- Variations of longitudinal separation of 10 NM or more.

These events are usually the result of operational errors, navigation errors or meteorologically influenced events etc. The largest source of reports useful for these purposes comes from existing reporting systems, such as the reporting system established by regional agreement.

The Scrutiny Group should meet to analyze reports of LLDs and LLEs so that adverse trends can be identified quickly and remedial actions can be taken to ensure that risk due to operational errors has not increased following the implementation of reduced horizontal separation.

4 Analysis and Methodology

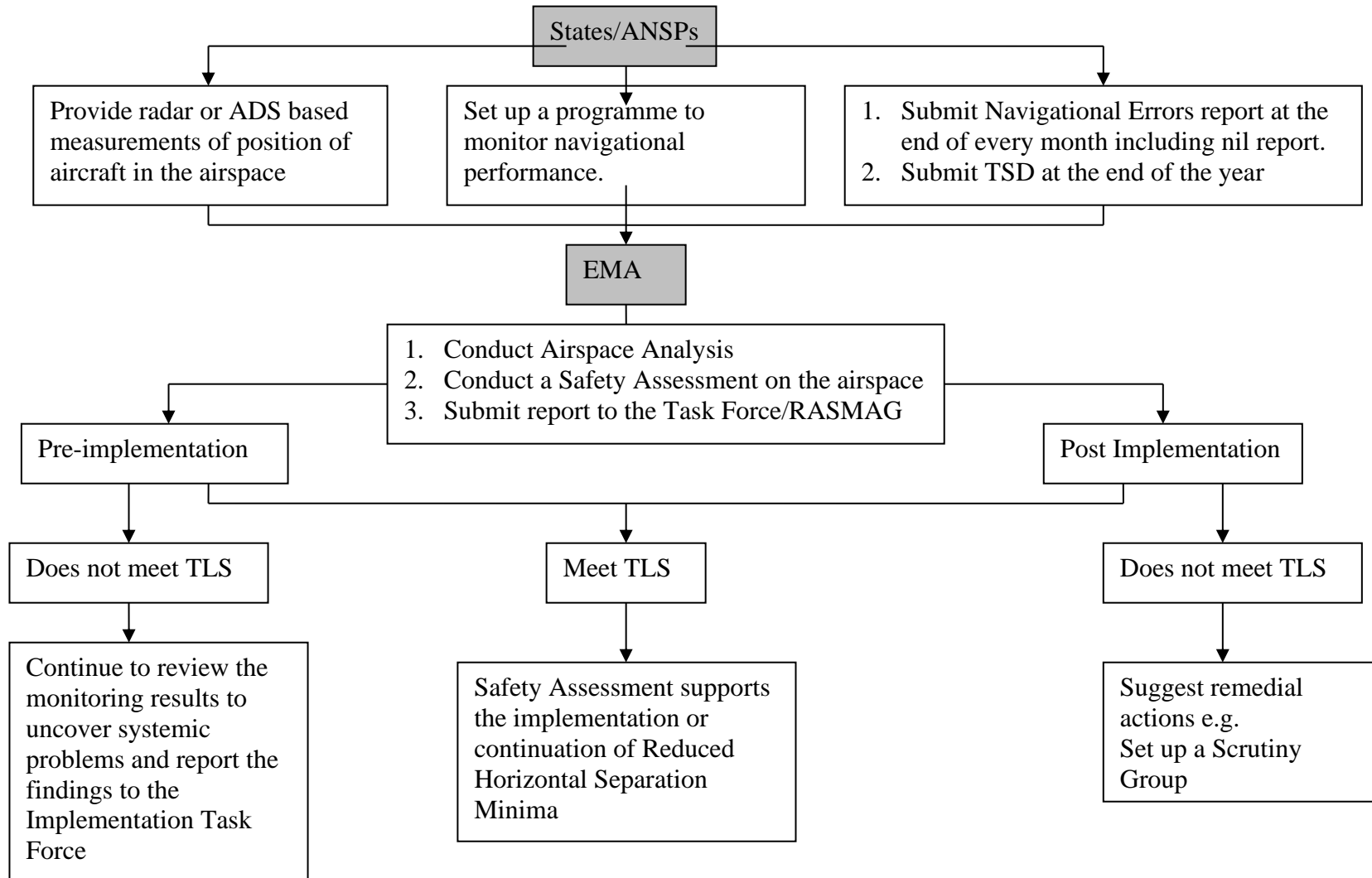
The working group is tasked to analyse the reports of interest and examine the category assigned to each event. The event categories can be found in the EMA handbook, Appendix E D.

The working group relies on its expert judgment and operational experience to analyse these reports. Upon completion of their preliminary analysis, the working group will present the results to the Scrutiny Group.

The Scrutiny Group shall examine its working group's analysis results and take follow-up action as required.

APPENDIX C

Pre/Post-Implementation Reduced Horizontal Separation Minima Flow Chart



1. ANSP action items

- 1.1 Register on CRA website at www.fans-cra.com.
- 1.2 Establish means to extract FANS1A analysis data for CPDLC and ADS-C using guidance provided in ICAO Doc 9869 PBCS Manual Appendix D.
- 1.3 Filter extracted data FANS1A analysis data for CPDLC and ADS-C using guidance in PBCS Manual Appendix D.
- 1.4 Establish means to perform analysis of CPDLC RCP and ADS-C RSP at a suitable interval (usually monthly, but specific interval will be determined by local factors such as volume of data).
- 1.5 Investigate any performance degradation identified during monthly analysis.
- 1.6 Report non-compliance with RCP/RSP specifications to CRA.
- 1.7 Support CRA non-compliance investigations.
- 1.8 Report any aircraft that are filing as PBCS qualified but showing non-compliance with RCP and RSP 95% normal operating criteria to your state CAA and RMA.
- 1.9 Withdraw the use of performance-based separation minima requiring PBCS where aircraft data link performance is not compliant with RCP and RSP 95% operating criteria.
- 1.10 Implement an analysis of service availability to determine the impact of reported unplanned outages in your airspace (usually annually).
- 1.11 Implement local procedures and training to ensure operational staff log FANS1/A problems identified during operations to enable subsequent investigation.
- 1.12 Implement local investigation process for reported FANS1/A problems.
- 1.13 Implement CRA website reporting of confirmed FANS1/A problems.
- 1.14 If implementing PBCS, sign up to Global PBCS Charter on CRA website.
- 1.15 Submit PBCS non-compliance report to designated EMA/RMA by 20th of every month (if falls on a weekend then the next available working day). (Refer to **Figure 1**- PBCS non-compliance submission flow chart)
- 1.16 Submission of Nil report is required. (Refer to **Figure 1**- PBCS non-compliance submission flow chart)

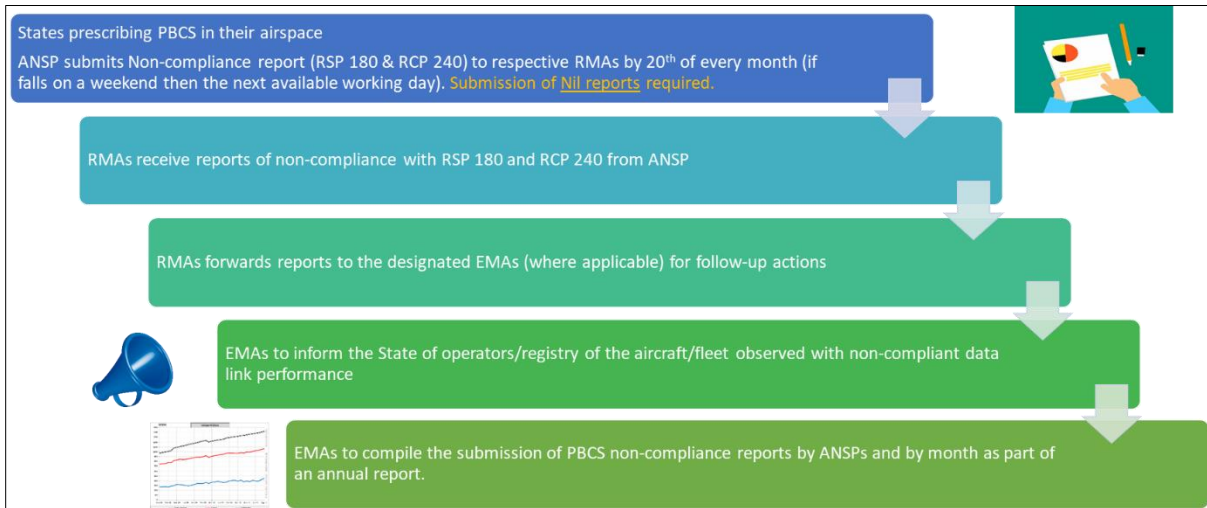


Figure 1 - PBCS non-compliance submission flow chart

2. ANSP Reports to FIT-Asia

2.1 Compile PBCS RCP and RSP performance report for the year from January to December, per regional reporting guidelines, using the template provided on the Asia/Pacific Regional Office website.

2.2 Ensure the PBCS performance data for the reporting year is provided to the ICAO Secretariat by not later than 28 February each year for inclusion in aggregated regional data reporting to FIT-Asia, RASMAG and APANPIRG.

2.3 Complete the Survey of the Implementation Status of Performance-Based Horizontal Separation Minima using the form available on the Asia/Pacific Regional Office website, and submit to the ICAO Secretariat by not later than 28 February each year.

2.4 FIT-Asia States: Compile report on PBCS system performance and availability observed in your FIR, including comment on operational impact of observed outages, results of analysis of problems and corrective action taken, and submit the report to FIT-Asia each year using the Working Paper template provided for the meeting.

2.5 Non-FIT-Asia/States: Compile report on PBCS system performance and availability observed in your FIR and, including comment on operational impact of observed outages, results of analysis of problems and corrective action taken, and submit the report to the relevant FIT in the format determined by the FIT.

3. FIT-Asia Reports to RASMAG

3.1 Nominated ANSP compile draft aggregated regional performance report from individual FIR reports for review at each year’s FIT-Asia meeting.

.....

Appendix A
Asia Pacific Flight Information Regions and Responsible Monitoring Agency

RASMAG-endorsed Asia Pacific EMAs and RMAs

| Monitoring Agency | Endorsed to provide EMA and/or RMA services |
|---------------------------------------------------------------------------|---------------------------------------------|
| Australian Airspace Monitoring Agency (AAMA) | EMA, RMA |
| Bay of Bengal Arabian Sea Indian Ocean Safety Monitoring Agency (BOBASMA) | EMA |
| China Regional Monitoring Agency (China RMA) | EMA, RMA |
| Japan Airspace Safety Monitoring Agency (JASMA) | EMA, RMA |
| Monitoring Agency for the Asia Region (MAAR) | RMA |
| Pacific Approvals Registry and Monitoring Organization (PARMO) | EMA, RMA |
| South East Asia Safety Monitoring Agency (SEASMA) | EMA |

Asia Pacific Flight Information Regions and Responsible Monitoring Agency

| FIR/UIR Location Indicator | RVSM Oversight Responsibility (RMA) | Horizontal Plane Oversight Responsibility (EMA) |
|-------------------------------|----------------------------------------|-------------------------------------------------------|
| Anchorage Oceanic (PZAN) | PARMO | PARMO |
| Auckland Oceanic (NZZO) | PARMO | PARMO |
| Bangkok (VTBB) | MAAR | N/A |
| Beijing (ZBPE) | China RMA | N/A |
| Brisbane FIR (YBBB) | AAMA | AAMA |
| Chennai (VOMF) | MAAR | BOBASMA |
| Colombo (VCCF) | MAAR | BOBASMA |
| Delhi (VIDF) | MAAR | BOBASMA |
| Dhaka (VGFR) | MAAR | BOBASMA |
| Fukuoka (RJJJ) | JASMA | JASMA |
| Guangzhou (ZGZU) | China RMA | N/A |
| Hanoi (VVVV) | MAAR | N/A |
| Ho Chi Minh (VVTS) | MAAR | SEASMA |
| Hong Kong (VHHK) | MAAR | SEASMA |
| Honiara (AGGG) | AAMA | N/A |
| Incheon (RKRR) | PARMO | N/A |
| Jakarta (WIIF) | AAMA | SEASMA |
| Kabul (OAKX) | MAAR | BOBASMA |
| Karachi (OPKR) | MAAR | BOBASMA |
| Kathmandu (VNSM) | MAAR | BOBASMA |
| Kolkata (VECF) | MAAR | BOBASMA |
| Kota Kinabalu (WBFC) | MAAR | SEASMA |

RASMAG/28
Appendix E to the Report

| FIR/UIR Location Indicator | RVSM Oversight Responsibility (RMA) | Horizontal Plane Oversight Responsibility (EMA) |
|------------------------------------------|----------------------------------------|-------------------------------------------------------|
| Kuala Lumpur (WMFC) | MAAR | SEASMA |
| Kunming (ZPKM) | China RMA | N/A |
| Lahore (OPLR) | MAAR | BOBASMA |
| Lanzhou (ZLHW) | China RMA | China RMA |
| Male (VRMF) | MAAR | BOBASMA |
| Manila (RPHI) | MAAR | SEASMA |
| Melbourne (YMMM) | AAMA | AAMA |
| Mumbai (VABF) | MAAR | BOBASMA |
| Nadi (NFFF) | PARMO | PARMO |
| Nauru (ANAU) | AAMA | N/A |
| New Zealand (NZZC) (Christchurch FIR) | PARMO | PARMO |
| Oakland Oceanic (KZAK) | PARMO | PARMO |
| Phnom Penh (VDPP) | MAAR | N/A |
| Port Moresby (AYPM) | AAMA | N/A |
| Pyongyang (ZKKP) | China RMA | N/A |
| Sanya (ZJSA) | China RMA | SEASMA |
| Shanghai (ZSHA) | China RMA | N/A |
| Shenyang (ZYSH) | China RMA | N/A |
| Singapore (WSJC) | MAAR | SEASMA |
| Tahiti | PARMO | PARMO |
| Taipei | MAAR | N/A |
| Ujung Pandang (WAAF) | AAMA | SEASMA |
| Ulaanbaatar (ZMUB) | MAAR | N/A |
| Urumqi (ZWUQ) | China RMA | China RMA |
| Vientiane (VLAO) | MAAR | N/A |
| Wuhan (ZHWH) | China RMA | N/A |
| Yangon (VYYY) | MAAR | BOBASMA |

2022 Asia Pacific **Consolidated Safety Report**

RASMAG/28
21 - 24 Aug 2023

Outline

- Background
- PAC Area
 - Vertical Collision Risk Estimates and Summary of LHDs
 - Horizontal Collision Risk Estimates and Summary of LLDs and LLEs
 - Geolocations of LHDs/LLDs/LLEs
 - Hot Spots
- Asia Area
 - Vertical Collision Risk Estimates and Summary of LHDs
 - Horizontal Collision Risk Estimates and Summary of LLDs and LLEs
 - Geolocations of LHDs/LLDs/LLEs
 - Hot Spots
- Reporting Rate of LHDs/LLDs/LLEs
- Conclusion

Background

Background

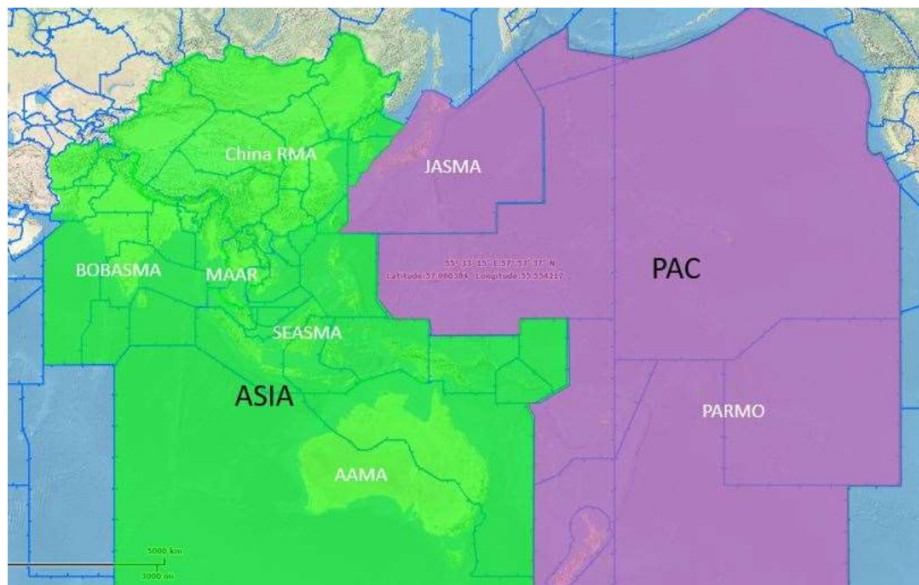
In MAWG/5, APAC monitoring agencies agreed to consolidate key elements from their safety risk analysis into one report to give an overall picture of airspace safety risk in Asia Pacific.

The report is divided into:

- **Pacific (PAC) Area**
- **Asia Area**

For each area, there will be a summary of:

- vertical collision risk estimates, LHD summary, and their hot spots (if any);
- horizontal collision risk estimates, LLD & LLE summary, and their hot spots (if any); and
- reporting rates in 3 groups: Category A + B + C (related to the pilot/aircrew), D + E + F (related to ATC), and G + H + I + J + K + L + M (Other).



Pacific Area (PAC)

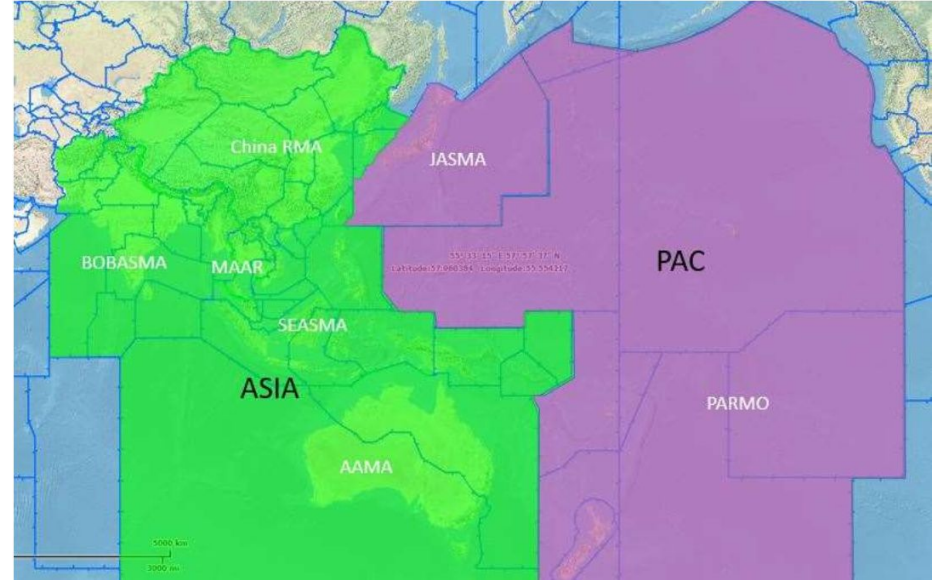
Traffic between North America and Asia, or
North America and South Pacific States

FIRs : Anchorage, Auckland, Fukuoka, Nadi,
Oakland, and Tahiti

Monitoring Agencies :

RMAs (Vertical): JASMA, PARMO

EMAs (Horizontal): JASMA, PARMO



Asia Area (Asia)

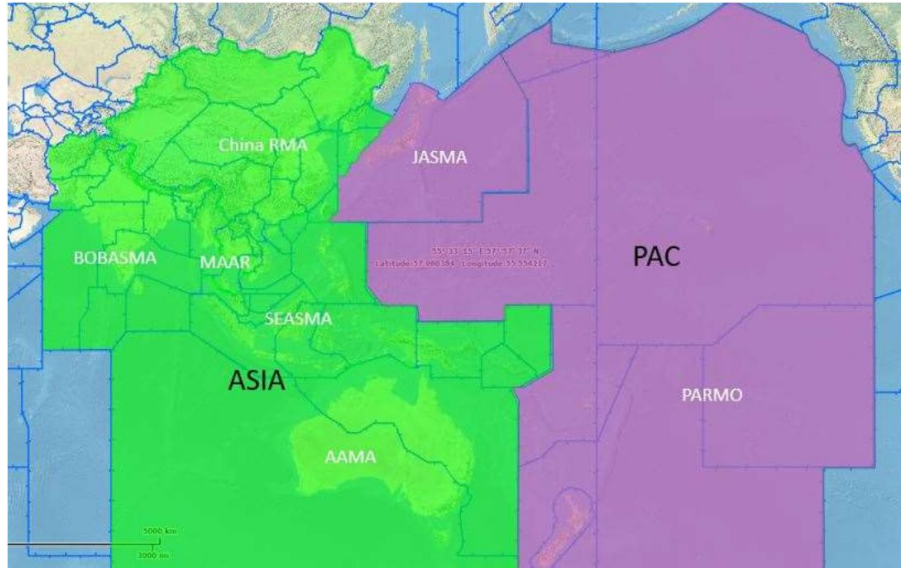
Traffic flows between between Asia and Middle East, Europe and South Pacific States.

FIRs : Bangkok, Beijing, Brisbane, Chennai,Colombo, Dhaka, Delhi, Guangzhou, Hanoi, Ho Chi Minh, Hong Kong, Honiara, Incheon, Jakarta, Karachi, Kathmandu, Kolkata, Kota Kinabalu, Kuala Lumpur, Kunming, Lahore, Lanzhou, Male, Manila, Melbourne, Mumbai, Nauru, Phnom Penh, Port Moresby, Pyongyang, Sanya, Shanghai, Shenyang, Singapore, Taipei, Ujung Pandang, Ulaanbaatar, Urumqi, Vientiane, Wuhan, and Yangon

Monitoring Agencies :

RMAs (Vertical): AAMA, China RMA, MAAR, PARMO

EMAs (Horizontal): AAMA, BOBASMA, PARMO, SEASMA



PAC Area

PAC : Vertical Collision Risk

PAC : Vertical Collision Risk Estimates

Number of annual flying hours: 2,758,126 hours/year

| 2022 PAC Area | Vertical Risk Estimate | Remark |
|------------------------------|--------------------------------------|---------------------|
| Vertical Technical Risk | 00.19 x 10 ⁻⁹ FAPFH | Below Technical TLS |
| Vertical Operational Risk | 19.43 x 10 ⁻⁹ FAPFH | |
| Vertical Overall Risk | 19.62 x 10⁻⁹ FAPFH | Above TLS |

PAC : Vertical Collision Risk Estimates

2016 - 2022

| Year | Vertical Overall Risk Estimate | Remark |
|------|--------------------------------|-----------|
| 2022 | 19.62 x 10 ⁻⁹ FAPFH | Above TLS |
| 2021 | 19.74 x 10 ⁻⁹ FAPFH | Above TLS |
| 2020 | 16.71 x 10 ⁻⁹ FAPFH | Above TLS |
| 2019 | 30.21 x 10 ⁻⁹ FAPFH | Above TLS |
| 2018 | 19.40 x 10 ⁻⁹ FAPFH | Above TLS |
| 2017 | 7.30 x 10 ⁻⁹ FAPFH | Above TLS |
| 2016 | 5.01 x 10 ⁻⁹ FAPFH | Above TLS |

PAC : Summary of LHDs

| Attributions | Category Code | Description | Number of Occurrences | Duration (minutes) | Number of Levels Crossed |
|-----------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------|--------------------------|
| Aircrew/ Pilot | A | Flight crew failing to climb/descend the aircraft as cleared | 6 | 5 | 5 |
| | B | Flight crew climbing/descending without ATC Clearance | 22 | 13 | 45 |
| | C | Incorrect operation or interpretation of airborne equipment | 6 | 8 | 5 |
| ATC | D | ATC system loop error | 8 | 63 | 12 |
| | E | Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues | 48 | 197 | 0 |
| | F | Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues | 3 | 8 | 1 |
| Aircraft/ Avionics/ Contingencies | G | Aircraft contingency event leading to sudden inability to maintain assigned flight level | 3 | 7 | 5 |
| | H | Airborne equipment failure leading to unintentional or undetected change of flight level | 3 | 2 | 0 |

PAC : Summary of LHDs

| Attributions | Category Code | Description | Number of Occurrences | Duration (minutes) | Number of Levels Crossed |
|------------------------|---------------|----------------------------------------------------------------------------------------------------------|-----------------------|--------------------|--------------------------|
| Weather/ Turbulence | I | Turbulence or other weather related causes leading to unintentional or undetected change of flight level | 11 | 35 | 1 |
| TCAS | J | TCAS resolution advisory, flight crew correctly climb or descend following the resolution advisory | 5 | 7 | 0 |
| | K | TCAS resolution advisory, flight crew incorrectly climb or descend following the resolution advisory | 0 | 0 | 0 |
| Other | L | An aircraft being provided with RVSM separation is not RVSM approved | 0 | 0 | 0 |
| | M | Other | 3 | 104 | 0 |
| F – 12 Total | | | 118 | 449 | 74 |

PAC : Horizontal Collision Risk

PAC : Horizontal Collision Risk Estimates

Number of annual flying hours: 103,253 hours/year

| 2022 PAC Area | Horizontal Risk Estimate | Airspace | Remark |
|-------------------------|------------------------------|----------|-----------|
| Lateral Risk | 2.09×10^{-9} FAPFH | Pacific | Below TLS |
| 50NM Lateral Risk | 0.456×10^{-9} FAPFH | Japan | Below TLS |
| 30NM Longitudinal Risk | 0.008×10^{-9} FAPFH | Japan | Below TLS |
| 10MIN Longitudinal Risk | 1.754×10^{-9} FAPFH | Japan | Below TLS |
| 2021 PAC Area | Horizontal Risk Estimate | Airspace | Remark |
| 30NM Lateral Risk | 1.74×10^{-9} FAPFH | Pacific | Below TLS |
| 50NM Lateral Risk | 0.71×10^{-9} FAPFH | Japan | Below TLS |
| 30NM Longitudinal Risk | - | Pacific | Below TLS |
| 30NM Longitudinal Risk | 0.01×10^{-9} FAPFH | Japan | Below TLS |
| 50NM Longitudinal Risk | 2.22×10^{-9} FAPFH | Pacific | Below TLS |
| 10MIN Longitudinal Risk | 0.03×10^{-9} FAPFH | Japan | Below TLS |

PAC : Summary of LLDs and LLEs

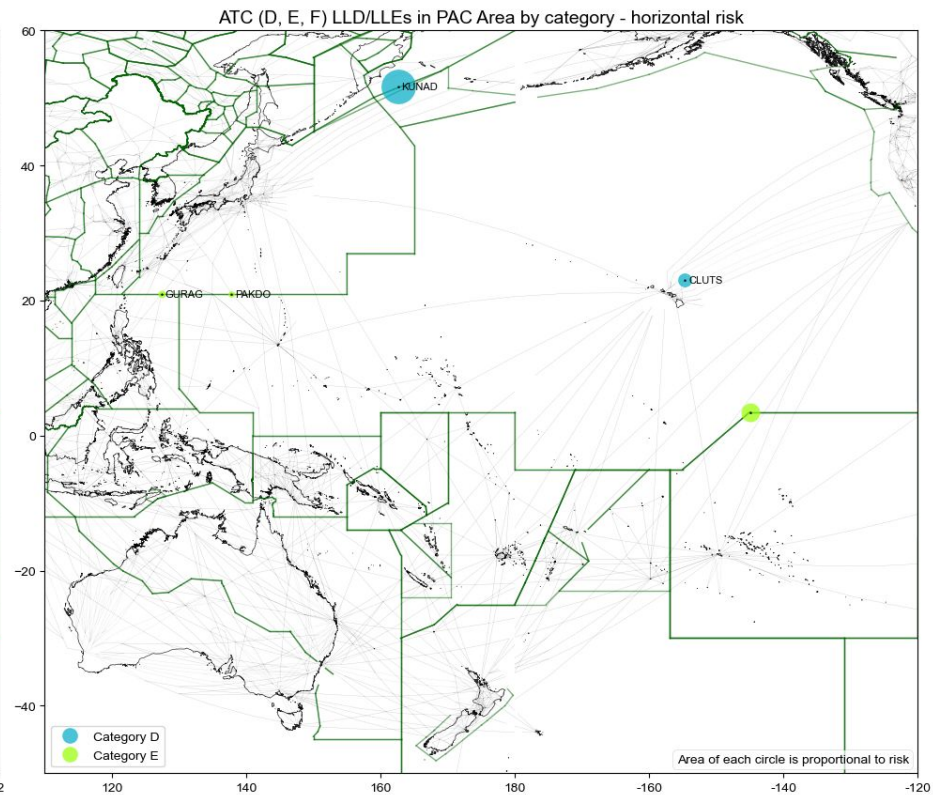
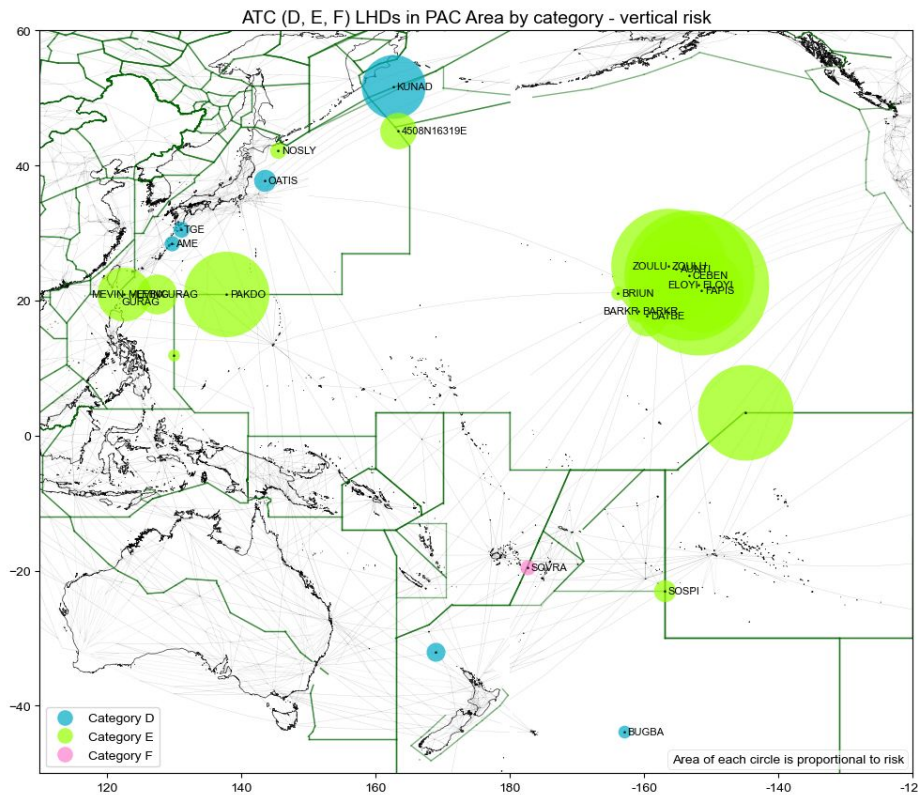
| Attributions | Category Code | Description | Number of Occurrences | Duration (minutes) | Number of Tracks/Routes Crossed | Horizontal Deviation (NM) |
|-------------------|---------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------|---------------------------------|---------------------------|
| Aircrew/ Pilot | A | Flight crew deviate without ATC Clearance | 16 | 1.5 | 1 | 317 |
| | B | Incorrect estimate or route provided due to incorrect operation or interpretation of airborne equipment | 8 | 45 | 0 | 12 |
| | C | Flight crew waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position | 4 | 66 | 0 | 80 |
| ATC | D | ATC system loop error | 4 | 57 | 0 | 10 |
| | E | Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues | 92 | 178.5 | 0 | 60 |
| | F | Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues | 6 | 44 | 0 | 0 |

PAC : Summary of LLDs and LLEs

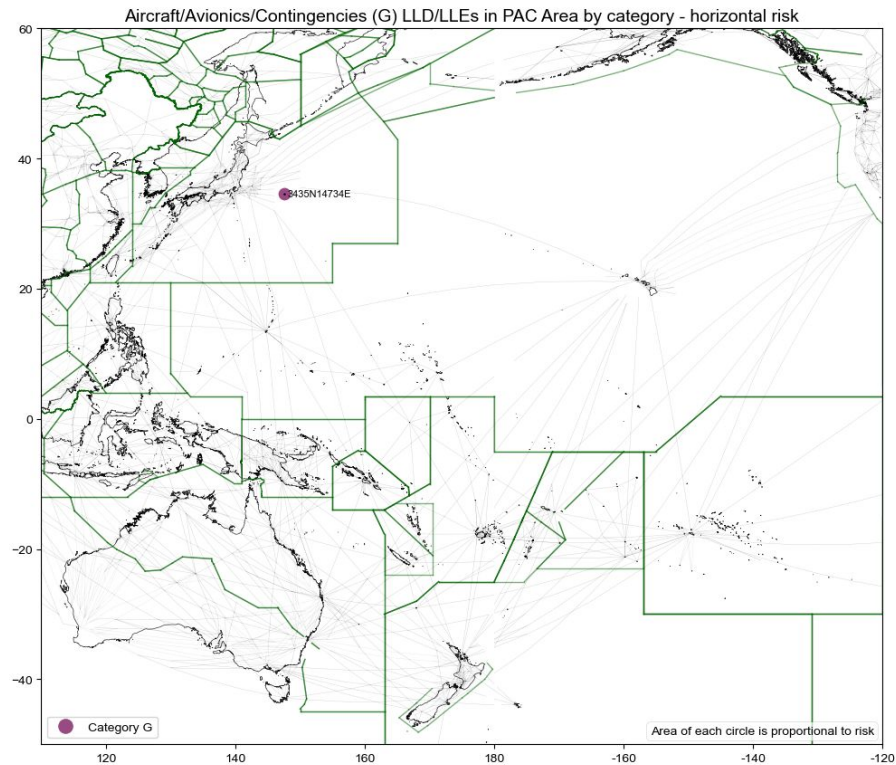
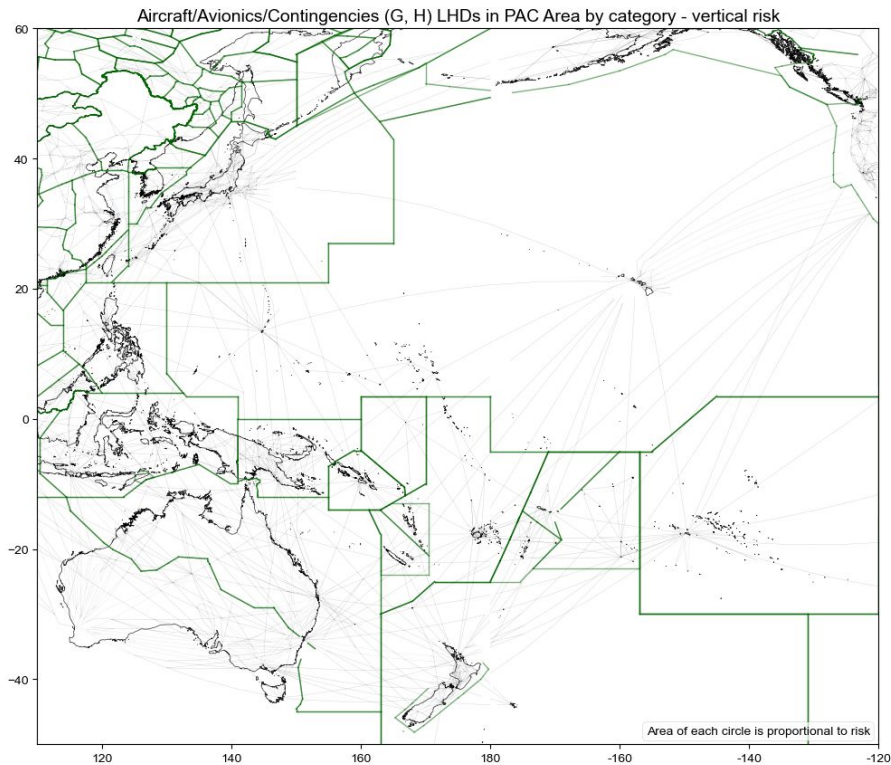
| Attributions | Category Code | Description | Number of Occurrences | Duration (minutes) | Number of Tracks/Routes Crossed | Horizontal Deviation (NM) |
|-----------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------|---------------------------------|---------------------------|
| Aircraft/ Avionics/ Contingencies | G | Navigation errors due to airborne equipment failure | 2 | 18 | 0 | 46 |
| Weather/ Turbulence | H | Turbulence or other weather related causes leading to a deviation in the horizontal dimension | 12 | 42 | 0 | 190 |
| Other | I | An aircraft was provided with reduced horizontal separation minima but did not meet the RNP/RSP/RCP specification; | 0 | 0 | 0 | 0 |
| | J | Other | 2 | 26 | 0 | 0 |
| Total | | | 146 | 478 | 1 | 715 |

PAC : Geolocation of LHDs/LLDs/LLEs

PAC : ATC (D, E, F)

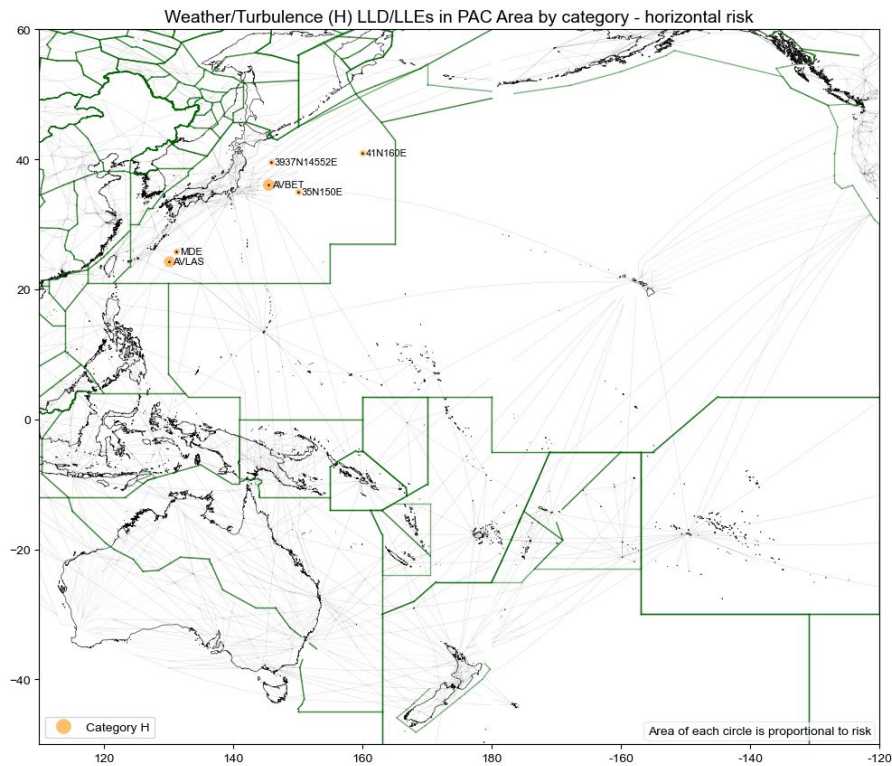
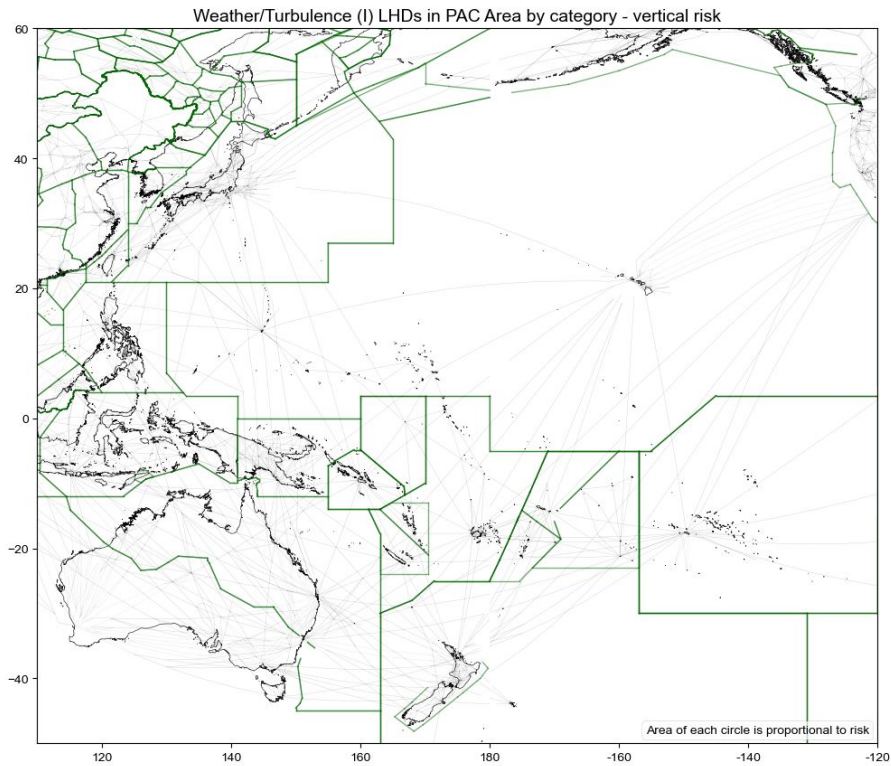


PAC : Aircraft Avionics/Contingencies (G, LHD:H)



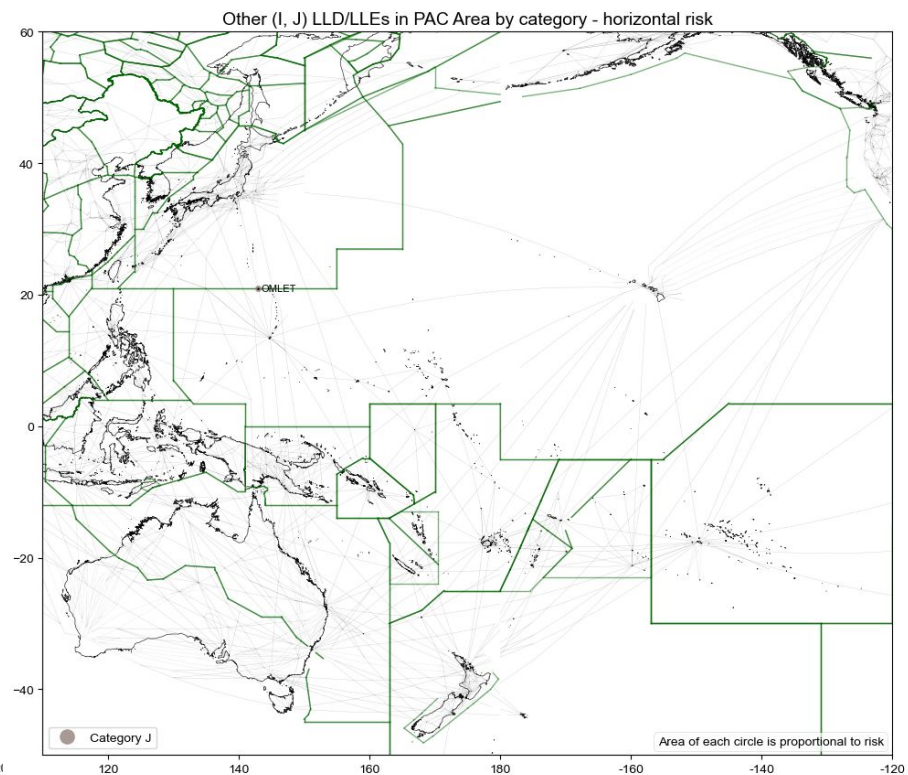
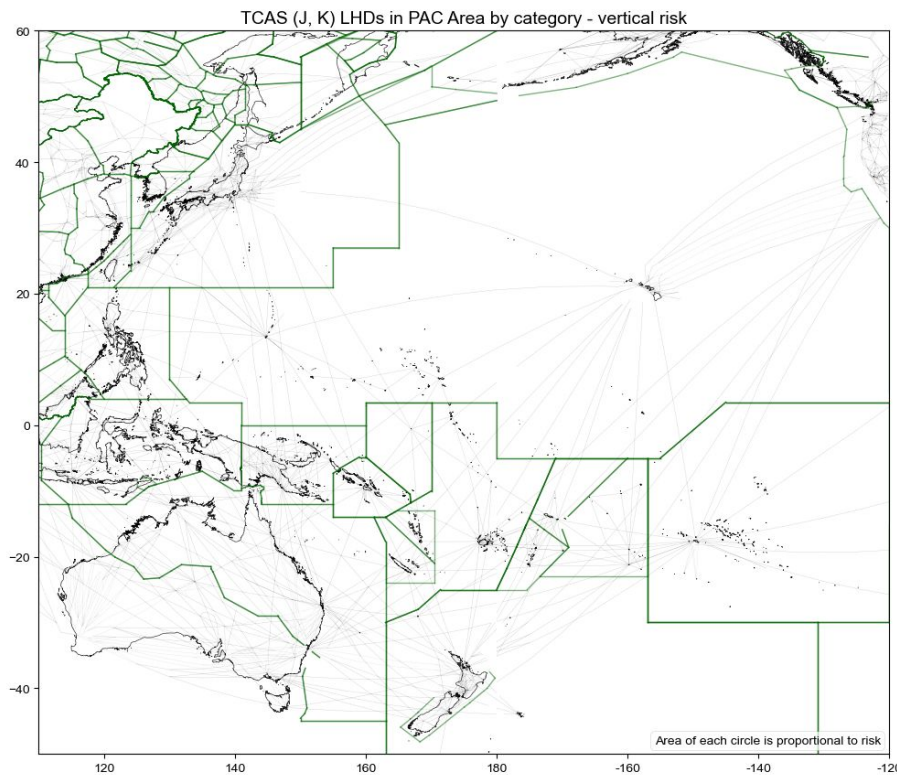
Note: No Category non-zero G and H LHD in 2022

PAC : Weather/Turbulence (LHD:I, LLD/LLE:H)



Note: No non-zero Category I LHD in 2022

PAC : TCAS (LHD:J, K)



Note: No non-zero Category J and K LHD in 2022

PAC : Hot Spots

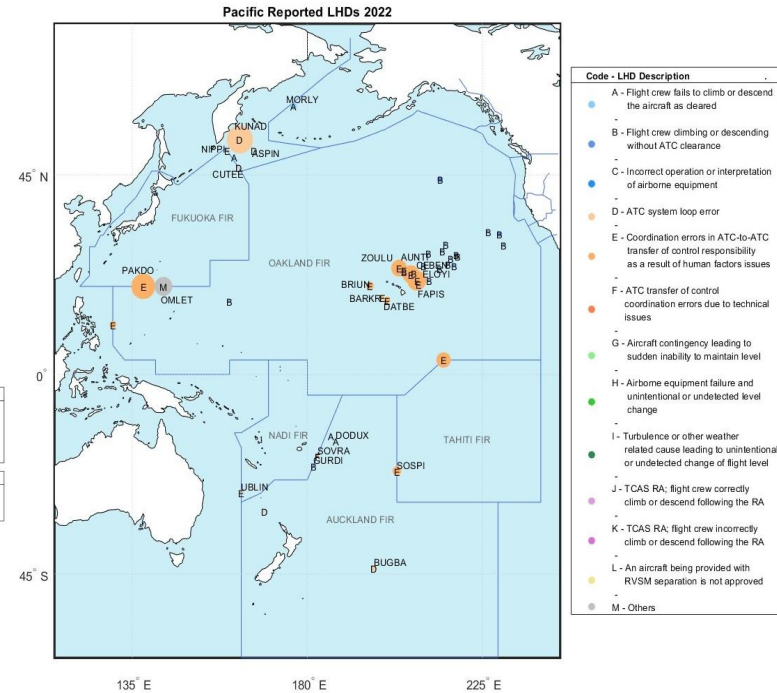
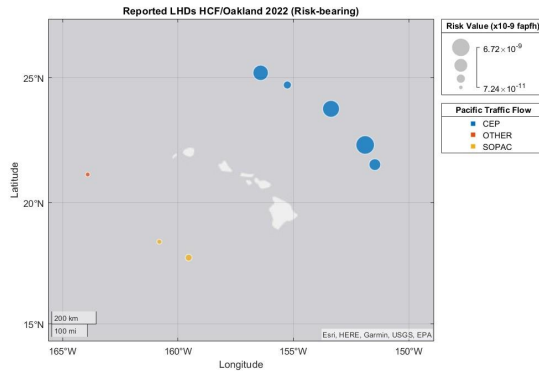
PAC : LHD Hot Spot N (North America - Hawaii CEP)

Nature of Occurrences : In 2021, several long duration LHDs were reported. Category E LHDs are the largest contribution to the vertical risk estimate in 2022 (this was also true for 2019, 2020, and 2021).

Contributing Factors : Central East Pacific (CEP) traffic flow has high traffic volume. The reported occurrences affect the user preferred routes that cross the CEP airways.

Trend : Increasing trend continued in reported category E LHDs between Honolulu Control Facility (HCF) and Oakland Center.

Mitigations : Implementation of new ATC system is planned for 2025. Both facilities developed mitigation procedures.



Asia Region

Asia : Vertical Collision Risk

ASIA : Vertical Collision Risk Estimates

Number of annual flying hours: 7,305,055 hours/year

| 2022 ASIA Area | Vertical Risk Estimate | Remark |
|---------------------------|-------------------------------|---------------------|
| Vertical Technical Risk | 0.49×10^{-9} FAPFH | Below Technical TLS |
| Vertical Operational Risk | 1.04×10^{-9} FAPFH | |
| Vertical Overall Risk | 1.53×10^{-9} FAPFH | Below TLS |

ASIA : Vertical Collision Risk Estimates

2016 - 2022

The vertical overall risk was improved to be below the TLS in 2021 and 2022.

| Year | Vertical Overall Risk Estimate | Remark |
|------|--------------------------------|-----------|
| 2022 | 1.53 x 10 ⁻⁹ FAPFH | Below TLS |
| 2021 | 4.03 x 10 ⁻⁹ FAPFH | Below TLS |
| 2020 | 7.42 x 10 ⁻⁹ FAPFH | Above TLS |
| 2019 | 12.88 x 10 ⁻⁹ FAPFH | Above TLS |
| 2018 | 15.50 x 10 ⁻⁹ FAPFH | Above TLS |
| 2017 | 27.30 x 10 ⁻⁹ FAPFH | Above TLS |
| 2016 | 12.53 x 10 ⁻⁹ FAPFH | Above TLS |

Asia : Summary of LHDs

| Attributions | Category Code | Description | Number of Occurrences | Duration (minutes) | Number of Levels Crossed |
|-----------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------|--------------------------|
| Aircrew/ Pilot | A | Flight crew failing to climb/descend the aircraft as cleared | 15 | 18.5 | 0 |
| | B | Flight crew climbing/descending without ATC Clearance | 17 | 14 | 0 |
| | C | Incorrect operation or interpretation of airborne equipment | 12 | 0 | 0 |
| ATC | D | ATC system loop error | 7 | 11 | 0 |
| | E | Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues | 390 | 144 | 0 |
| | F | Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues | 10 | 1 | 0 |
| Aircraft/ Avionics/ Contingencies | G | Aircraft contingency event leading to sudden inability to maintain assigned flight level | 0 | 0 | 0 |
| | H | Airborne equipment failure leading to unintentional or undetected change of flight level | 2 | 0 | 0 |

Asia : Summary of LHDs

| Attributions | Category Code | Description | Number of Occurrences | Duration (minutes) | Number of Levels Crossed |
|------------------------|---------------|----------------------------------------------------------------------------------------------------------|-----------------------|--------------------|--------------------------|
| Weather/ Turbulence | I | Turbulence or other weather related causes leading to unintentional or undetected change of flight level | 46 | 2.5 | 0 |
| TCAS | J | TCAS resolution advisory, flight crew correctly climb or descend following the resolution advisory | 2 | 1 | 0 |
| | K | TCAS resolution advisory, flight crew incorrectly climb or descend following the resolution advisory | 0 | 0 | 0 |
| Other | L | An aircraft being provided with RVSM separation is not RVSM approved | 0 | 0 | 0 |
| | M | Other | 17 | 0 | 0 |
| Total | | | 518 | 192 | 0 |

Asia : Horizontal Collision Risk

Asia : Horizontal Collision Risk Estimates

Number of annual flying hours: 503,528 hours/year

| 2022 Asia Area | Horizontal Risk Estimate | Airspace | Remark |
|------------------------|---------------------------------|---------------|-----------|
| 30NM Lateral Risk | 0.068 x 10 ⁻⁹ FAPFH | SEA | Below TLS |
| 50NM Lateral Risk | 0.096 x 10 ⁻⁹ FAPFH | SEA | |
| 30NM Longitudinal Risk | 0.786 x 10 ⁻⁹ FAPFH | SEA | Below TLS |
| 50NM Longitudinal Risk | 0.475 x 10 ⁻⁹ FAPFH | SEA and SA/IO | Below TLS |
| 2021 Asia Area | Horizontal Risk Estimate | | Remark |
| 30NM Lateral Risk | 0.0015 x 10 ⁻⁹ FAPFH | SEA and SA/IO | Below TLS |
| 50NM Longitudinal Risk | 1.02 x 10 ⁻⁹ FAPFH | SEA and SA/IO | Below TLS |

Asia : Summary of LLDs and LLEs

| Attributions | Category Code | Description | Number of Occurrences | Duration (minutes) | Number of Tracks/Routes Crossed | Horizontal Deviation (NM) |
|-------------------|---------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------|---------------------------------|---------------------------|
| Aircrew/ Pilot | A | Flight crew deviate without ATC Clearance | 1 | 0 | 0 | 15 |
| | B | Incorrect estimate or route provided due to incorrect operation or interpretation of airborne equipment | 0 | 0 | 0 | 0 |
| | C | Flight crew waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position | 0 | 0 | 0 | 0 |
| ATC | D | ATC system loop error | 0 | 0 | 0 | 0 |
| | E | Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues | 1 | 0 | 0 | 89 |
| | F | Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues | 0 | 0 | 0 | 0 |

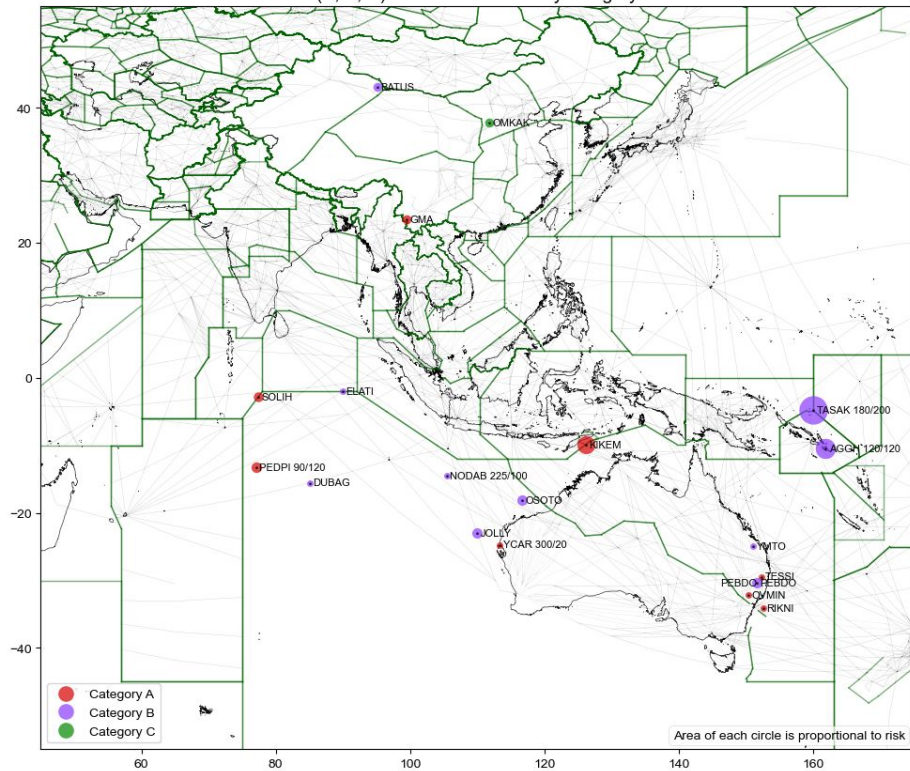
Asia : Summary of LLDs and LLEs

| Attributions | Category Code | Description | Number of Occurrences | Duration (minutes) | Number of Tracks/Routes Crossed | Horizontal Deviation (NM) |
|-----------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------|---------------------------------|---------------------------|
| Aircraft/ Avionics/ Contingencies | G | Navigation errors due to airborne equipment failure | 0 | 0 | 0 | 0 |
| Weather/ Turbulence | H | Turbulence or other weather related causes leading to a deviation in the horizontal dimension | 0 | 0 | 0 | 0 |
| Other | I | An aircraft was provided with reduced horizontal separation minima but did not meet the RNP/RSP/RCP specification; | 0 | 0 | 0 | 0 |
| | J | Other | 0 | 0 | 0 | 0 |
| Total | | | 2 | 0 | 0 | 104 |

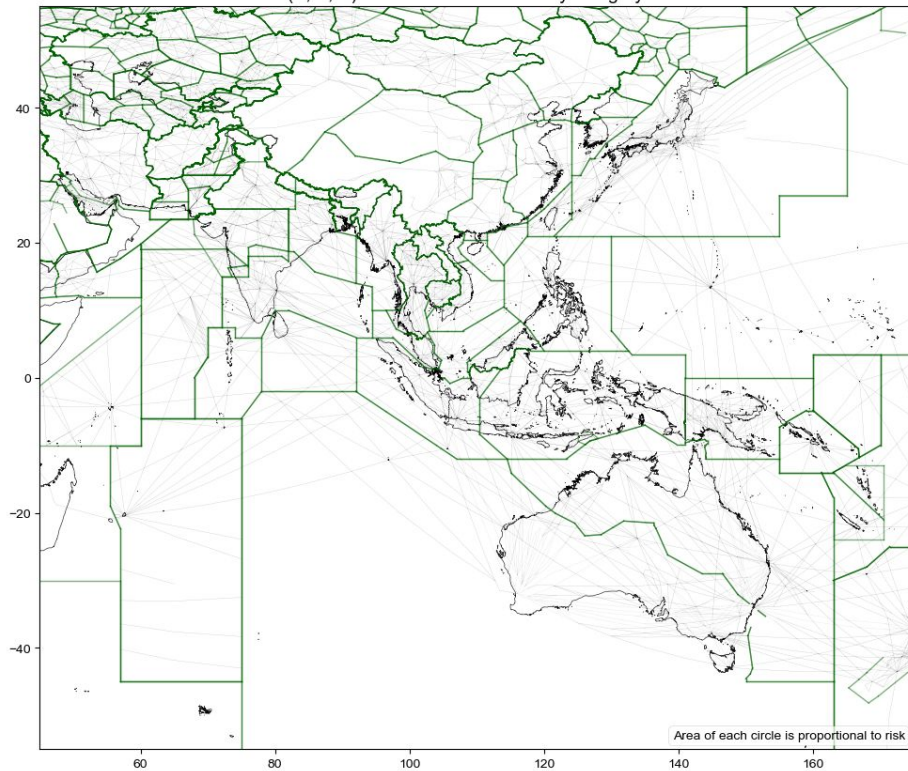
Asia : Geolocation of LHDs/LLDs/LLEs

Asia : Aircrew/Pilot (A, B, C)

Aircrew/Pilot (A, B, C) LHDs in Asia Area by category - vertical risk

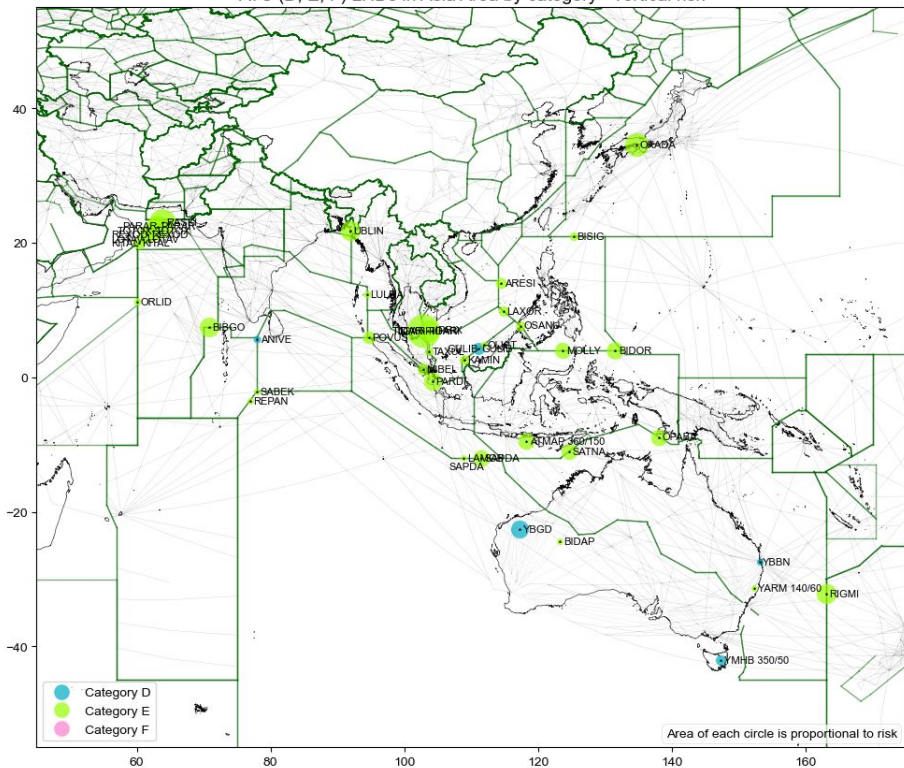


Aircrew/Pilot (A, B, C) LLD/LLEs in Asia Area by category - horizontal risk

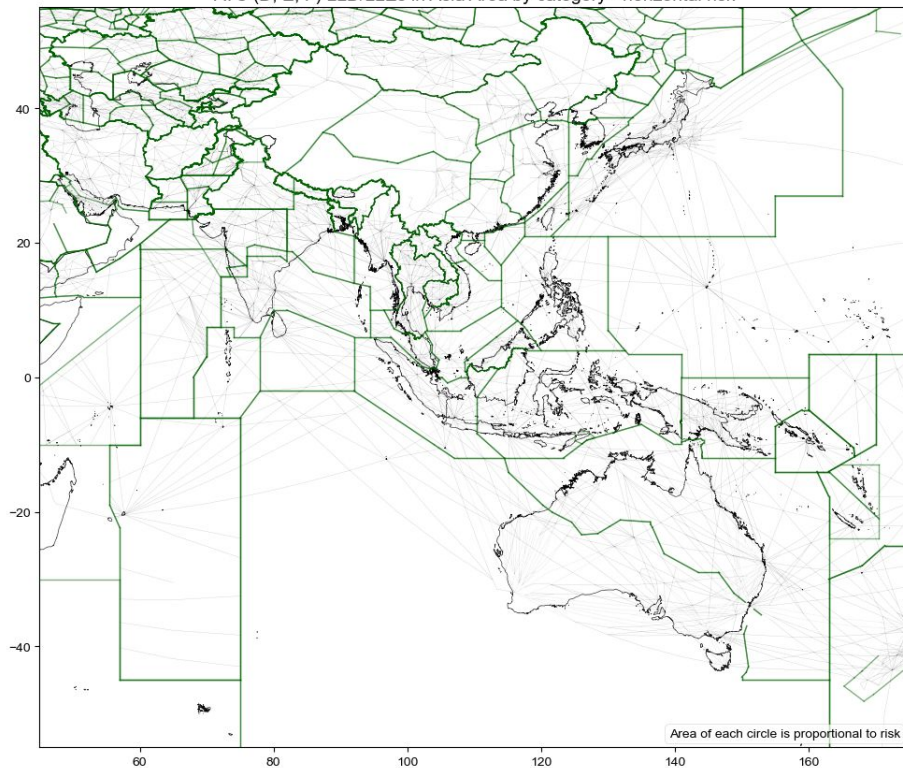


Asia : ATC (D, E, F)

ATC (D, E, F) LHDs in Asia Area by category - vertical risk

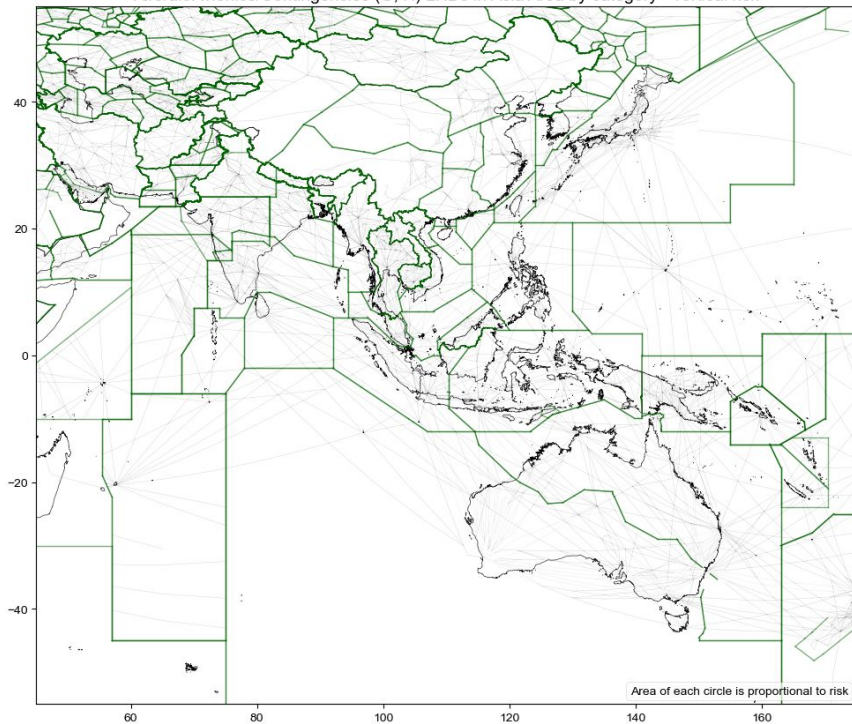


ATC (D, E, F) LLD/LLEs in Asia Area by category - horizontal risk

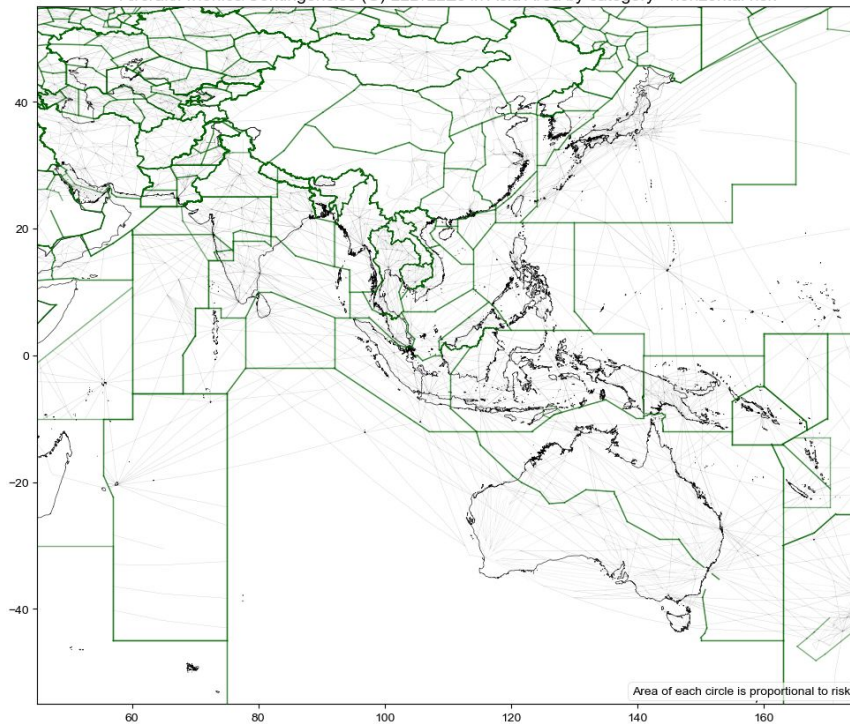


Asia : Aircraft Avionics/Contingencies (G, LHD:H)

Aircraft/Avionics/Contingencies (G, H) LHDs in Asia Area by category - vertical risk



Aircraft/Avionics/Contingencies (G) LLD/LLEs in Asia Area by category - horizontal risk

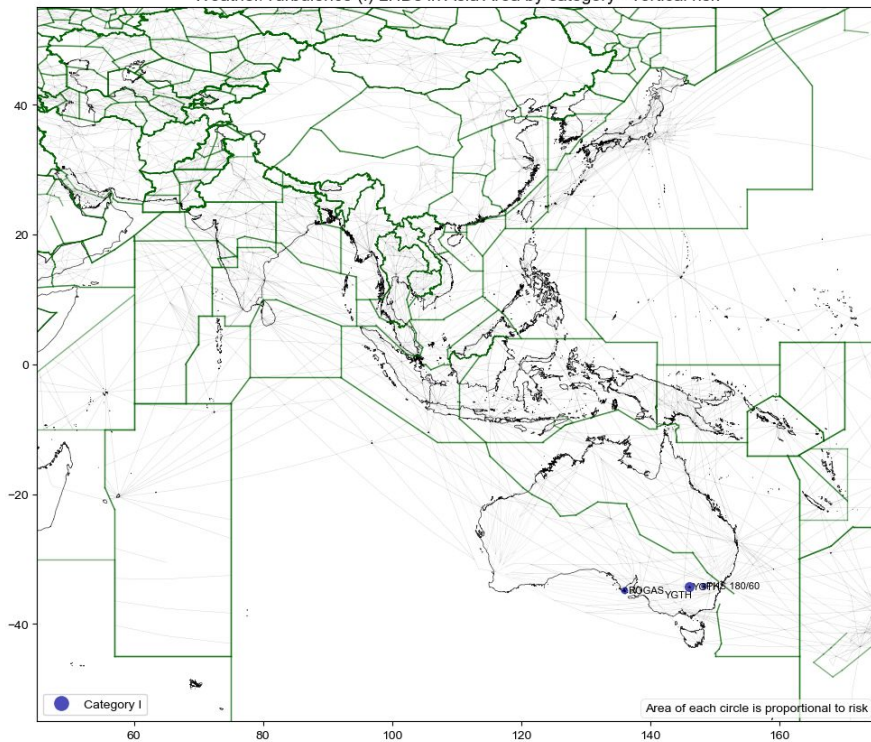


Note: No non-zero Category G and H LHD in 2022

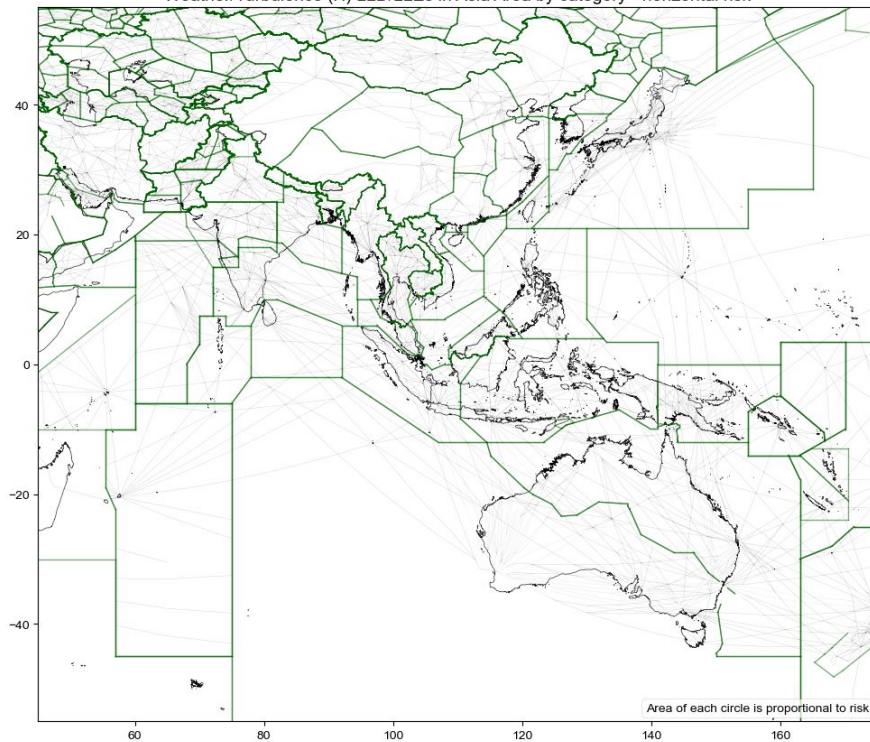
F - 38 Note: No non-zero Category G LLD/LLE in 2022

Asia : Weather/Turbulence (LHD:I, LLD/LLE:H)

Weather/Turbulence (I) LHDs in Asia Area by category - vertical risk

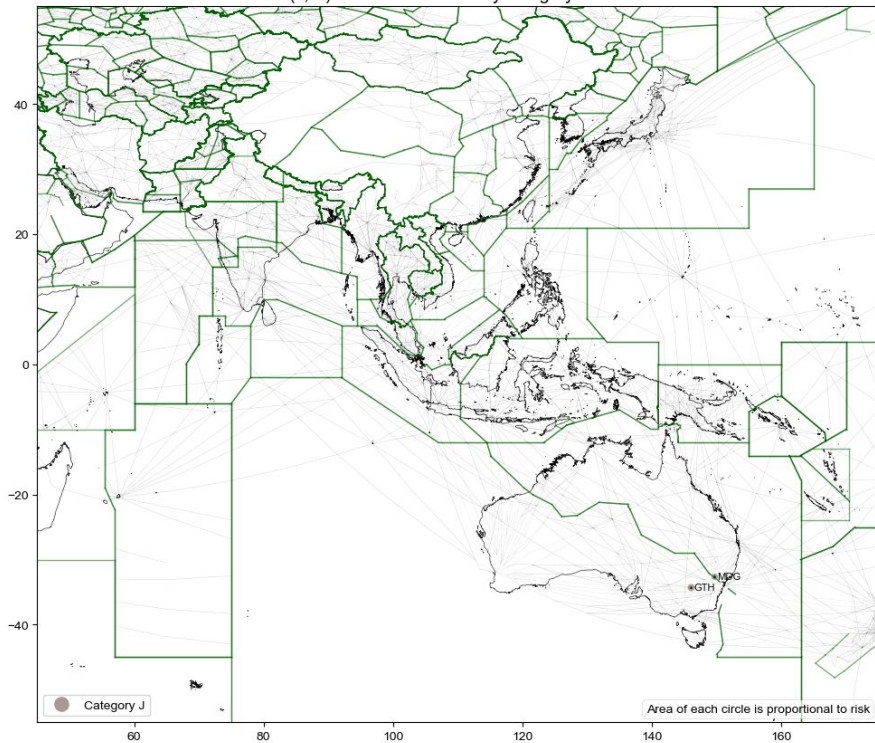


Weather/Turbulence (H) LLD/LLEs in Asia Area by category - horizontal risk

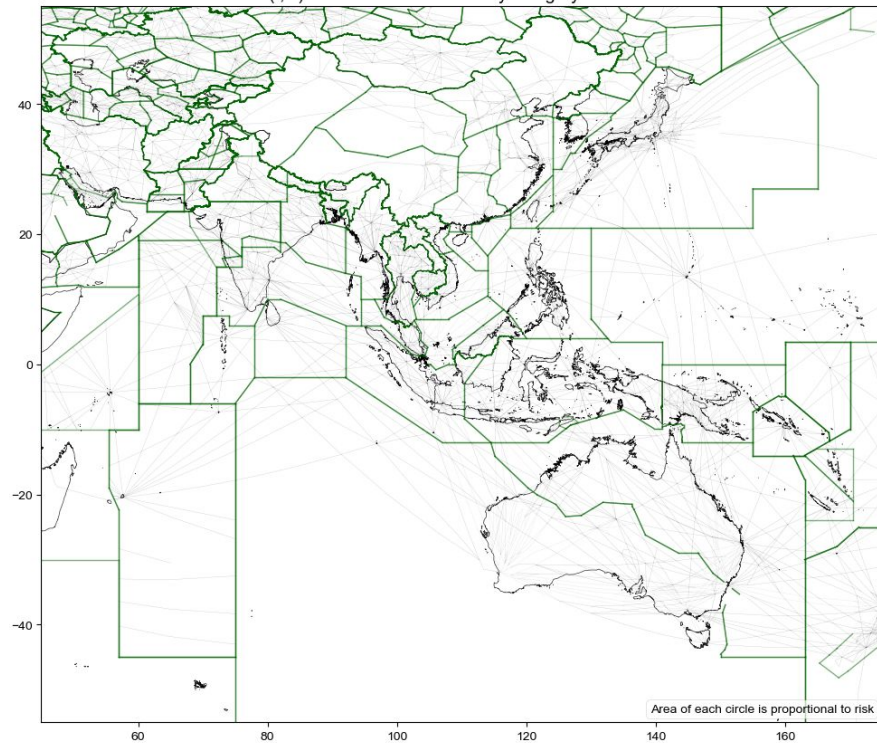


Asia : TCAS (LHD:J, K)

TCAS (J, K) LHDs in Asia Area by category - vertical risk



Other (I, J) LLD/LLEs in Asia Area by category - horizontal risk



Asia : Hot Spots

Asia : LHD Hot Spot A1 (Kolkata/Dhaka/Chennai - Yangon)

Nature of Occurrences : Coordination errors as a result of human factors issues (Category E)

Contributing Factors :

- Some gaps in communication and surveillance coverage
- The recovery of traffic

Trend : The number of LHDs significantly increased in 2022. However, there was one non-zero-duration LHD, contributing to the operational risk of 0.02×10^{-9} FAPFH.

Mitigations :

- The surveillance was enhanced by Space-Based ADS-B of Indian FIRs and ADS-B data sharing among Kolkata ACC, Chennai ACC and Yangon ACC.
- The AIDC has been initiated between Kolkata ACC/Chennai ACC and Yangon ACC, but has not been successfully operated yet.

Result from the identifying hot spots process :

- Hot Spot A1 satisfies the hot spot criteria in terms of the number of LHD.
- **Hot Spot A1 remains on the hot spot list** and should be monitored until further safety improvement initiatives are implemented and successfully reduce the number of LHDs and the associated risks.

| Boundary | The Number of LHDs | | |
|----------------|--------------------------|------|-----------------------|
| | 2020 | 2021 | 2022 |
| Kolkata-Yangon | 8 | 1 | 17 |
| Chennai-Yangon | 3 | 8 | 23 |
| Boundary | Operational Risk (FAPFH) | | |
| | 2020 | 2021 | 2022 |
| Kolkata-Yangon | 0 | 0 | 0 |
| Chennai-Yangon | 0 | 0 | 0.02×10^{-9} |

Asia : LHD Hot Spot A2 (Chennai - Yangon/Kuala Lumpur)

Nature of Occurrences : Coordination errors as a result of human factors issues (Category E)

Contributing Factors : Some gaps in communication and surveillance coverage.

Trend : The number of LHDs slightly increased. Nonetheless, there was no non-zero-duration LHD or operational risk in 2022.

Mitigations :

- The surveillance was enhanced by Space-Based ADS-B of Indian FIRs.
- The AIDC operation was successfully implemented between Chennai ACC and Kuala Lumpur ACC since January 2021

Result from the identifying hot spots process :

- Hot Spot A2 does not satisfy any hot spot criteria.
- Hot Spot A2 is labelled as the potential non-hot spot. If this boundary does not satisfy the hot spot criteria again in 2023, Hot Spot A2 can be proposed for removal from the list of hot spots.

| Boundary | The Number of LHDs | | |
|------------|--------------------------|-------------------------|------|
| | 2020 | 2021 | 2022 |
| Chennai-KL | 13 | 21 | 22 |
| Boundary | Operational Risk (FAPFH) | | |
| | 2020 | 2021 | 2022 |
| Chennai-KL | 0 | 0.05 x 10 ⁻⁹ | 0 |

Asia : LHD Hot Spot B (AKARA Airspace)

Nature of Occurrences : Reported occurrences classified as category E are most common.

Contributing Factors : The Flight Level Allocation Scheme (FLAS) limits available flight levels for the high traffic volume in the area.

Trend : Identified as a hot spot in 2015. All reported category E occurrences were mitigated in 2022 (also true for 2021), and there has been no reported LHD at the interface between Fukuoka and Incheon FIRs for over two years. As a result the vertical operational risk estimate was zero in 2021 and 2022.

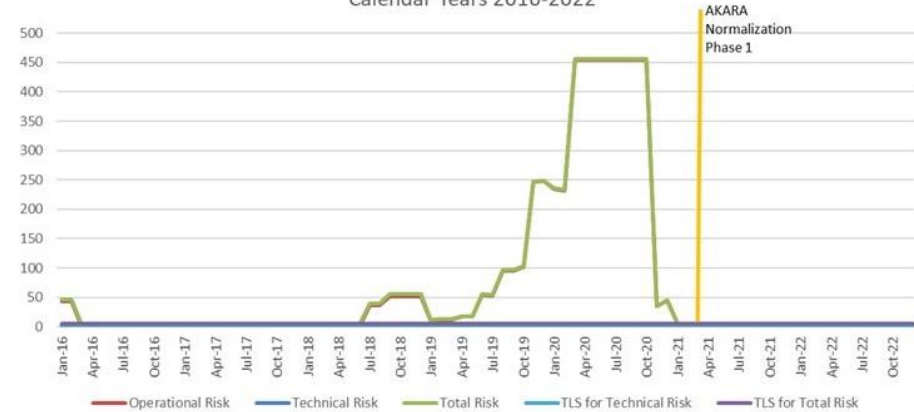
Mitigations :

- Significant route structure change was implemented in March 2021. The Phase I implementation included a parallel airway (Y590/Y591) to A593.
- Mitigations provided by the available surveillance and direct speech circuit.
- AIDC implementation to be discussed between Incheon ACC and Shanghai ACC.
- Incheon ACC to initiate discussions with Shanghai ACC regarding reducing longitudinal separation minima.

Result from the identifying hot spots :

- JASMA: Incheon-Fukuoka FIR boundary does not satisfy any hot spot criteria.
- China RMA: Incheon ACC-Shanghai ACC interface satisfies the hot spot criteria in terms of the number of LHD, with no calculated operational risk.
- **The risk at the Incheon-Fukuoka interface has been mitigated;** however, **hot spot B remains on the hot spot list due to the frequency of LHDs at the Incheon-Shanghai interface.**

Vertical Collision Risk Estimates - AKARA Airspace ($\times 10^{-9}$ fapfh)
Calendar Years 2016-2022



Asia : LHD Hot Spot D (Manila - adjacent FIRs)

Nature of Occurrences :

- Coordination errors as a result of human factors issues (Category E)
- Several coordination errors as a result of equipment outage or technical issues (Category F) emerging from AIDC failures.

Contributing Factors :

- Communication and surveillance coverage gaps along the boundaries of Manila FIR
- Verbal exchange of transfer information
- Sectors configuration of Manila ACC
- New ATM system and new infrastructure implementation such as AIDC

Trend : In 2021 and 2022, the total number of LHDs and the operational risk at this hot spot decreased from 2020. In 2022, the LHDs and the associated risk frequently occurred at

Manila-Fukuoka boundary.

| Boundary | Number of LHDs | | | Operational Risk (x 10 ⁻⁹ FAPFH) | | |
|----------------------|----------------|------|------|------------------------------------------------|------|------|
| | 2020 | 2021 | 2022 | 2020 | 2021 | 2022 |
| Manila-Fukuoka* | 8 | 11 | 8 | 4.34 | 6.40 | 1.73 |
| Manila-Ho Chi Minh | 4 | 7 | 3 | 0 | 0.77 | 0.05 |
| Manila-Hong Kong | 5 | 2 | 1 | 0.19 | 0 | 0 |
| Manila-Kota Kinabalu | 2 | 2 | 3 | 0.37 | 0 | 0.04 |
| Manila-Sanya | 2 | 0 | 0 | 0 | 0 | 0 |
| Manila-Singapore | 3 | 2 | 2 | 0 | 0 | 0.04 |
| Manila-Taipei | 3 | 4 | 3 | 0 | 0.07 | 0 |
| Manila-Ujung Pandang | 0 | 7 | 2 | 0 | 0.36 | 0.11 |
| Manila-Oakland | 0 | 2 | 0 | 0 | 0 | 0 |

Note: *The number of LHDs and operational risk at Manila-Kobe/Fukuoka Boundary are combined from MAAR's and JASMA's analysis. Hence, the same occurrence is counted only once.

Asia : LHD Hot Spot D (Manila - Fukuoka FIR)

Mitigations :

- Several safety improvement activities such as the new ATM system, ACC sector re-sectorization, enhanced surveillance, ADS-C/CPDLC have been implemented.
- Manila ACC and Fukuoka ACC have bilateral meetings regularly and agreed to implement a mitigation measure that would contribute to a reduction of transfer error due to human factor.

Result from the identifying hot spots process in SEA (MAAR):

The Manila-Fukuoka FIR boundary did not satisfied the hot spot criteria in 2022.

Result from the identifying hot spots process in Japan Airspace (JASMA):

- The Manila-Fukuoka FIR boundary satisfied the hot spot criteria in terms of the operational risk. Thus, JASMA proposes that the FIR boundary between Fukuoka and Manila FIRs remains as a hot spot.
- **Hot Spot D remains on the hot spot list** due to the risk at Manila-Fukuoka FIR boundary. However, **the risk at all other Manila FIR boundaries has been mitigated.** Hot Spot D should be monitored until further safety improvement initiatives are implemented and successfully reduce the number of LHDs and the associated risk.

Asia : LHD Hot Spot F (Mogadishu – Mumbai)

Nature of Occurrences : Coordination errors as a result of human factors issues (Category E)

Contributing Factors : The Mogadishu-Mumbai interface (Waypoint: ORLID, Route: G450) is in the oceanic airspace with poor communication and surveillance coverage.

Trend : Even though the number of LHDs increased in 2022, the operational risk conversely decreased.

Mitigations :

- The Space-Based ADS-B enhances surveillance capability of Indian FIRs.
- AIDC implementation between Mumbai ACC and Mogadishu ACC remains in the testing phase.

Result from the identifying hot spots process :

- Even though it does not satisfy any hot spot criteria, **Hot Spot F remains on the hot spot list** until further safety improvement initiatives or prevention measures such as AIDC are completed and demonstrate their effectiveness.

| Boundary | The Number of LHDs | | |
|------------------|------------------------------|-----------------------|-----------------------|
| | 2020 | 2021 | 2022 |
| Mogadishu-Mumbai | 8 | 5 | 9 |
| Boundary | The Operational Risk (FAPFH) | | |
| | 2020 | 2021 | 2022 |
| Mogadishu-Mumbai | 4.8×10^{-9} | 0.12×10^{-9} | 0.02×10^{-9} |

Asia : LHD Hot Spot G (Sanaa/Muscat – Mumbai)

Nature of Occurrences : Coordination errors as a result of human factors issues (Category E)

Contributing Factors : Sanaa-Mumbai and Muscat-Mumbai boundaries are oceanic airspace with poor communication and surveillance coverage.

Trend : The number of LHDs and the operational risk at both boundaries decreased in 2022.

Mitigations :

- The Space-Based ADS-B enhances surveillance capability of Indian FIRs.
- AIDC implementation between Mumbai ACC and Muscat ACC remains in the testing phase.

Result from the identifying hot spots process :

- Hot Spot G meet the criteria in terms of both the number of LHDs and the operational risk. **Hot Spot G remains on the hot spot list** until further safety improvement initiatives or prevention measures such as AIDC are completed and demonstrate their effectiveness.

| Boundary | The Number of LHDs | | |
|----------------------|------------------------------|-------------------------|-------------------------|
| | 2020 | 2021 | 2022 |
| Muscat-Mumbai | 48 | 44 | 43 |
| Sanaa-Mumbai | 1 | 4 | 2 |
| Boundary | The Operational Risk (FAPFH) | | |
| | 2020 | 2021 | 2022 |
| Muscat-Mumbai | 6.37 x 10 ⁻⁹ | 1.35 x 10 ⁻⁹ | 0.79 x 10 ⁻⁹ |
| Sanaa-Mumbai | 0 | 0.07 | 0 |

Asia : LHD Hot Spot J (Jakarta – Singapore/Kota Kinabalu)

Nature of Occurrences : Coordination errors as a result of human factors issues (Category E)

Contributing Factors : To be analysed

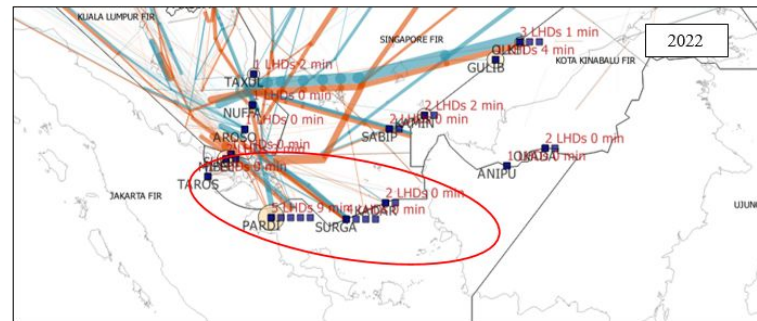
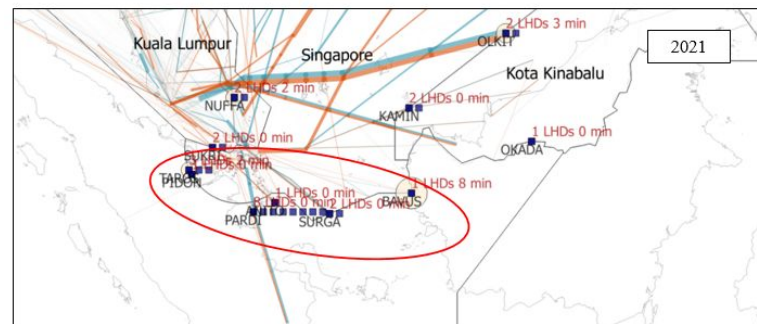
Trend : In SEA airspace, the number of LHDs and operational risk at Singapore-Jakarta boundary slightly decreased in 2022.

Mitigations : AAMA is working with SEASMA to share and confirm the information about LHDs on the Jakarta–Singapore FIR interface. AirNav Indonesia is working towards implementation of AIDC, which could mitigate coordination errors due to human factors issues.

Result from the identifying hot spots process :

This boundary satisfied the hot spot criteria in terms of the number of LHDs for 2 consecutive years (2021 and 2022).

Therefore, **Hot Spot J remains on the hot spot list.**



Asia : LHD Hot Spot M (Colombo – Melbourne)

Nature of Occurrences : Category A, B, and E LHDs.

Contributing Factors : A large number were pilot errors involving the Indian Navy.

Trend : Since 2019, the number of LHDs at Hot Spot M has been decreasing, so RASMAG/26 proposed to re-classify as a non-Hot Spot. However, AAMA and MAAR still do not have a suitable contact for the Indian Navy.

Mitigations :

- In 2020, the sectorisation was implemented at Colombo oceanic airspace. Furthermore, awareness and training were promoted to Colombo's ATS.
- AAMA, ICAO, MAAR and Sri Lanka had sent various formal letters to DGCA India for the nomination of a POC from the Indian Navy as a mitigation to the LHD Hotspot (M). However, ICAO, AAMA and MAAR have not received any response from DGCA India. For this reason, **Hot Spot M remains on the hot spot list.**

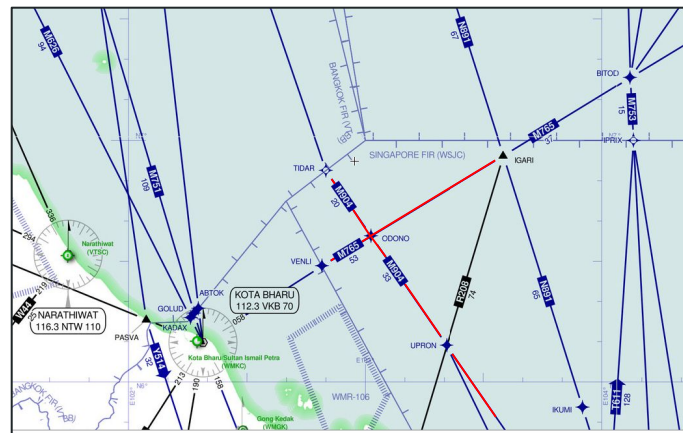
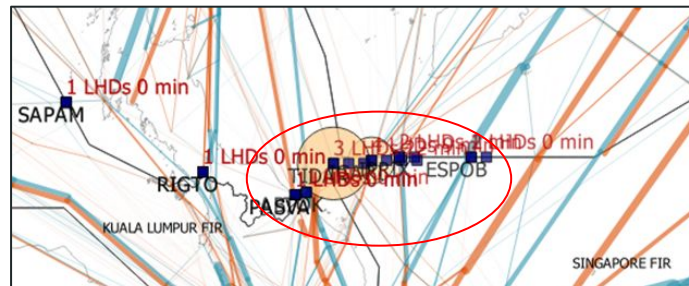
Asia : New LHD Hot Spot O (Bangkok/Ho Chi Minh/Kuala Lumpur - Singapore)

Nature of Occurrences : Coordination errors as a result of human factors issues (Category E).

Contributing Factors : The route structure and ATC procedures of handling crossing traffic over this area can be complex.

Trend : The operational risk increased to reach 51% of the total operational risk in SEA airspace.

Result from the identifying hot spots process : The boundaries of Bangkok, Ho Chi Minh, Kuala Lumpur, and Singapore FIRs satisfied the hot spot criteria in terms of the operational risk in 2022. Thus, this is included on the hot spot list as a **[new Hot Spot](#)**.



Reporting Rate of LHDs/LLDs/LLEs

Reporting Rate of LHDs/LLDs/LLEs

| Airspace | # Reports | | | | | | | 1 Report : Flying Hrs | | | | | | |
|---------------|--------------|--------------|--------------|--------------|------------|------------|------------|-----------------------|-----------------|------------------|------------------|------------------|------------------|-----------------|
| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| DPRK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | - | - | - | - | - | - |
| Mongolia | 0 | 4 | 1 | 2 | 0 | 1 | 0 | - | 1: 37,771 | 1: 158,891 | 1: 82,138 | - | 1: 121,621 | - |
| SEA | 426 | 474 | 205 | 152 | 42 | 70 | 62 | 1: 5,884 | 1: 6,548 | 1: 17,757 | 1: 22,275 | 1: 25,106 | 1: 15,456 | 1:32,620 |
| SA/IO | 778 | 935 | 681 | 439 | 152 | 135 | 143 | 1: 3,689 | 1: 3,166 | 1: 3,783 | 1: 7,955 | 1: 7,907 | 1: 11,167 | 1:21,018 |
| Japan | 43 | 71 | 76 | 77 | 66 | 80 | 75 | 1: 33,834 | 1: 21,510 | 1: 20,632 | 1: 20,762 | 1: 14,737 | 1: 13,528 | 1:18,751 |
| China | 117 | 134 | 110 | 79 | 85 | 105 | 72 | 1: 20,413 | 1: 18,248 | 1: 22,229 | 1: 31,119 | 1: 26,867 | 1: 15,477 | 1:18,003 |
| Pacific | 33 | 42 | 43 | 173 | 134 | 176 | 179 | 1: 63,500 | 1: 54,191 | 1: 45,064 | 1: 10,139 | 1: 6,404 | 1: 6,638 | 1:8,280 |
| Indonesia | 32 | 34 | 23 | 37 | 18 | 41 | 54 | 1: 11,520 | 1: 10,842 | 1: 53,603 | 1: 33,321 | 1: 17,346 | 1: 7,402 | 1:8,060 |
| SW Pacific | 52 | 51 | 53 | 101 | 46 | 47 | 81 | 1: 16,639 | 1: 17,572 | 1: 17,817 | 1: 9,335 | 1: 6,954 | 1: 11,975 | 1:5,352 |
| ROK and AKARA | 6 | 5 | 12 | 34 | 5 | 24 | 108 | 1: 93,291 | 1: 117,090 | 1: 28,365 | 1: 18,959 | 1: 25,965 | 1: 6,285 | 1:1,056 |
| Total | 1,487 | 1,750 | 1,204 | 1,094 | 548 | 679 | 774 | 1: 8,905 | 1: 8,180 | 1: 12,332 | 1: 14,330 | 1: 13,202 | 1: 11,200 | 1:13,230 |

Notes:

- The flying hours for Indonesian airspace in 2021 was calculated based on the 2020 TSD.
- The flying hours for SW Pacific and Indonesian airspace in 2022 were calculated based on the 2021 TSD.

2022 Reporting Rate of LHDs/LLDs/LLEs

| Airspace | Flying Hours | Aircrew/Pilot | | ATC | | Other | | Total | |
|---------------|-------------------|---------------|-----------------------|------------|-----------------------|------------|-----------------------|------------|-----------------------|
| | | # Reports | 1 Report : Flying Hrs | # Reports | 1 Report : Flying Hrs | # Reports | 1 Report : Flying Hrs | # Reports | 1 Report : Flying Hrs |
| DPRK | 10 | 0 | - | 0 | - | 0 | - | 0 | - |
| Mongolia | 44,732 | 0 | - | 0 | - | 0 | - | 0 | - |
| SEA | 2,022,449 | 3 | 1:674,150 | 57 | 1:35,482 | 2 | 1:1,011,225 | 62 | 1:32,620 |
| SA/IO | 3,005,641 | 2 | 1:1,502,821 | 139 | 1:21,623 | 2 | 1:1,502,821 | 143 | 1:21,018 |
| Japan | 1,406,330 | 18 | 1:78,129 | 26 | 1:54,090 | 31 | 1:45,365 | 75 | 1:18,751 |
| China | 1,296,204 | 4 | 1:32,4051 | 11 | 1:117,837 | 57 | 1:22,740 | 72 | 1:18,003 |
| Pacific | 1,482,049 | 40 | 1:37,051 | 136 | 1:10,897 | 3 | 1:494,016 | 179 | 1:8,280 |
| Indonesia | 435,220 | 6 | 1:72,537 | 48 | 1:9,067 | 0 | - | 54 | 1:8,060 |
| SW Pacific | 433,496 | 30 | 1:14,450 | 45 | 1:9,633 | 6 | 1:72,249 | 81 | 1:5,352 |
| ROK and AKARA | 114,006 | 0 | - | 108 | 1:1,056 | 0 | - | 108 | 1:1,056 |
| Total | 10,240,138 | 103 | 1:99,419 | 570 | 1:17,965 | 101 | 1:101,388 | 774 | 1:13,230 |

Notes:

- The flying hours for SW Pacific and Indonesian airspace in 2022 were calculated based on the 2021 TSD.

Conclusion

RVSM TLS Compliance - Vertical

- **The 2022 PAC vertical overall risk** was 19.62×10^{-9} FAPFH. The vertical overall risk slightly decreased from 2021 and was **higher than the target level of safety (TLS)**.
- **The 2022 ASIA vertical overall risk** was 1.53×10^{-9} FAPFH. The vertical overall risk decreased from 2021 and remained **below the TLS**. In addition, there is no individual airspace, where has the risk greater than the TLS.

RVSM TLS Compliance - Horizontal

- All horizontal risk estimates in 2022 were **below the TLS**.

RASMAG's Hot Spot List

| Hot Spot | Involved FIRs | Identified | Remarks |
|----------|----------------------------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A1 | Kolkata/Chennai/Dhaka - Yangon | 2015 | Cat. E LHDs. Risk reduced. |
| A2 | Chennai - Kuala Lumpur | 2015 | Cat. E LHDs reduced. Risk reduced. <u>Potential non-hot spot</u> 2023 (RASMAG/28). |
| B | Incheon (AKARA Airspace) | 2015 | - Risk at Incheon-Fukuoka interface mitigated. - Cat. E LHDs and risk at Incheon-Shanghai interface reduced. |
| D | Manila - all adjacent FIRs | 2015 | - Cat. E LHDs and risk at Manila-Fukuoka reduced. - Risk at all other Manila FIR boundaries mitigated. |
| F | Mogadishu - Mumbai | 2015 | Cat. E LHDs reducing. Risk reducing. |
| G | Sanaa/Muscat - Mumbai | 2015 | Cat. E LHDs. Risk reducing. |
| J | Jakarta - Singapore/Kota Kinabalu | 2018 | Cat. E LHD. |
| M | Colombo - Melbourne | 2019 | LHDs and risk reducing. Awaiting response to establish a POC before removing from the hot spot list. (Letters have been sent to DGCA India for request of the POC.) |
| N | Oakland USA - Hawaii CEP | 2019 | Cat. E LHDs increasing. Risk increasing. |
| O | Bangkok/Ho Chi Minh/Kuala Lumpur - Singapore | 2023 | Cat. E LHDs. |

Reporting Rate of LHDs/LLDs/LLEs

- The flying hours **increased** from 7,234,881 hours in 2020, 7,604,927 in 2021 to **10,240,138 hours in 2022**.
- The overall reporting rate of LHDs/LLDs/LLEs decreased in 2022:
 - 1 report : 13,202 hours in 2020
 - 1 report : 11,200 hours in 2021
 - 1 report : 13,230 hours in 2022
- The reporting rate in ROK and SW Pacific significantly improved in 2022.
- The reporting rate in SEA and SA/IO dramatically decreased in 2022, because the number of reports in 2022 were similar to the number in 2021, while the flying hours significantly increased.
- Mongolia submitted NIL reports in 2022
- DPRK submits NIL reports since 2016, but maintains a good communication with China RMA.

Thank You

APANPIRG Asia/Pacific Airspace Safety Monitoring

RASMAG LIST OF COMPETENT AIRSPACE SAFETY MONITORING ORGANISATIONS

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

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

(Last updated 23 August 2023)

| Organisation (including contact officer) | State | Competency | Status | Airspace assessed (FIRs) |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------|---------------|-----------------------------------------------------------------------------------------------------------|
| <p>Australian Airspace Monitoring Agency (AAMA) - Airservices</p> <p>https://www.airservicesaustralia.com/about-us/our-services/aama/</p> <p>Dr Amelia Gontar, Risk Intelligence Specialist Safety and Risk Airservices Australia Email: amelia.gontar@airservicesaustralia.com; or aama@airservicesaustralia.com;</p> <p>Dr Steve Barry Risk Intelligence Lead, Network Performance and Optimisation Airservices Australia</p> | Australia | RMA | Current | Brisbane, Honiara, Jakarta, Melbourne, Nauru, Port Moresby and Ujung Pandang (including Timor-Leste) FIRs |
| | | EMA | Current | Brisbane, Melbourne, Honiara, Nauru, and Port Moresby FIRs |

RASMAG/28
Appendix G to the Report

| Organisation (including contact officer) | State | Competency | Status | Airspace assessed (FIRs) |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Phone No: +61 432570211 Email: steve.barry@AirservicesAustralia.com</p> <p>Dr Mary D'Souza Safety & Security Assurance, Airservices Australia Email: Mary.D'Souza@AirservicesAustralia.com</p> <p>Email: aama@AirservicesAustralia.com</p> | | | | |
| <p>China RMA - Air Traffic Management Bureau, (ATMB) of Civil Aviation Administration of China (CAAC)</p> <p>http://www.chinarma.cn</p> <p>Mr. Yongyue Chen (Monsoon), Coordinator of China RMA, ADCC, ATMB of CAAC Email: rmachina@rmachina.cn</p> | China | RMA & EMA | Current | <p>RMA for: Beijing, Guangzhou, Kunming, Lanzhou, Pyongyang, Sanya, Shanghai, Shenyang, Urumqi, and Wuhan FIRs. EMA for: Lanzhou and Urumqi FIRs</p> |
| <p>India Bay of Bengal Arabian Sea Indian Ocean Safety Monitoring Agency (BOBASMA)</p> <p>http://www.aai.aero/public_notices/aaisite_test/bobasma_index.jsp</p> <p>Mr. A. P. Udayanarayanan Joint General Manager (ATM) Phone No: + 91 44 22561253 Fax No: +91 44 22561740 Email: bobasmachennai@gmail.com : bobasma@aai.aero</p> <p>Bay of Bengal Arabian Sea Indian Ocean Safety Monitoring Agency (BOBASMA)</p> | India | EMA | Current | <p>Chennai, Colombo, Delhi, Dhaka, Kabul, Karachi, Kolkata, Lahore, Male, Mumbai, Yangon,</p> |

RASMAG/28
Appendix G to the Report

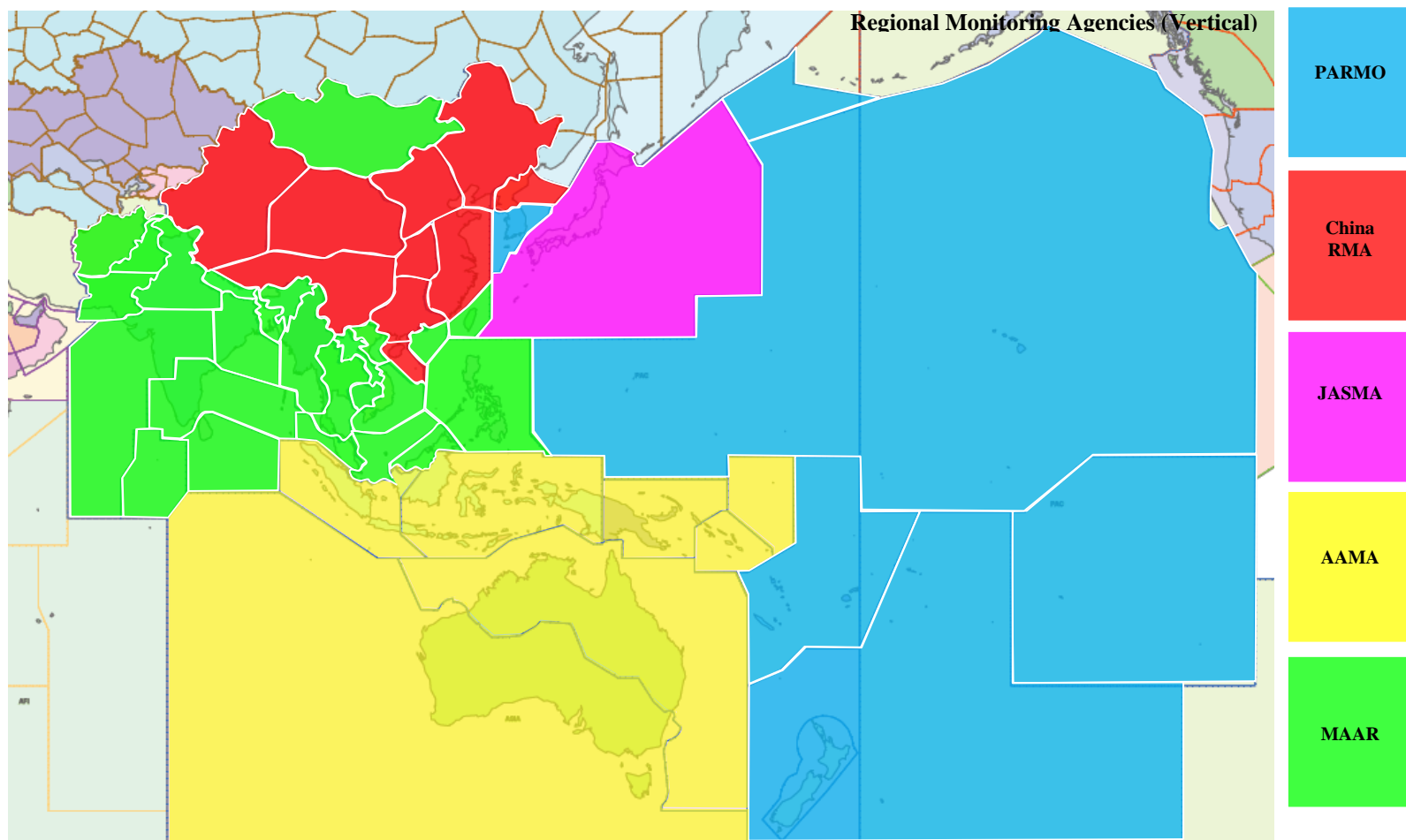
| Organisation (including contact officer) | State | Competency | Status | Airspace assessed (FIRs) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AEROTHAI Email: maar@aerothai.co.th | | | | Ulaan Bataar, Vientiane, Yangon FIRs |
| Pacific Approvals Registry and Monitoring Organization (PARMO) – Federal Aviation Administration (US FAA) http://www.faa.gov/air_traffic/separation_standards/parmo/ Christine Falk Federal Aviation Administration Separation Standards Analysis Branch Safety Analysis Subject Matter Expert Email: parmo@faa.gov | USA | RMA and EMA | Current | <u>RMA</u> for Anchorage Oceanic, Auckland Oceanic, Incheon, Nadi, Oakland Oceanic, Tahiti FIRs <u>EMA</u> for Anchorage Oceanic, Auckland Oceanic, Nadi, Oakland Oceanic, Tahiti FIRs |
| South East Asia Safety Monitoring Agency (SEASMA) - Civil Aviation Authority of Singapore (CAAS) Mr. Goh Wen Pei, Air Traffic Control Manager (ANS Safety & Security), Air Navigation Services Group, Email: goh_wen_pei@caas.gov.sg ; https://www.caas.gov.sg/operations-safety/airspace/south-east-asia-safety-monitoring-agency | Singapore | EMA and CRA | Current | <u>EMA</u> for Hong Kong, Ho Chi Minh, Kota Kinabalu, Kuala Lumpur, Manila, Jakarta, Sanya, Singapore and Ujung Pandang FIRs <u>CRA</u> for Singapore, Viet Nam and Philippines |
| FIT-ASIA ICAO Asia and Pacific Regional Office Email: apac@icao.int ; htakata@icao.int Mr. Kwek Chin Lin Chair, FIT-Asia | FIT-Asia States | FIT | Current | FIRs in the Asian Region not covered by IPACG/FIT and ISPACG/FIT |

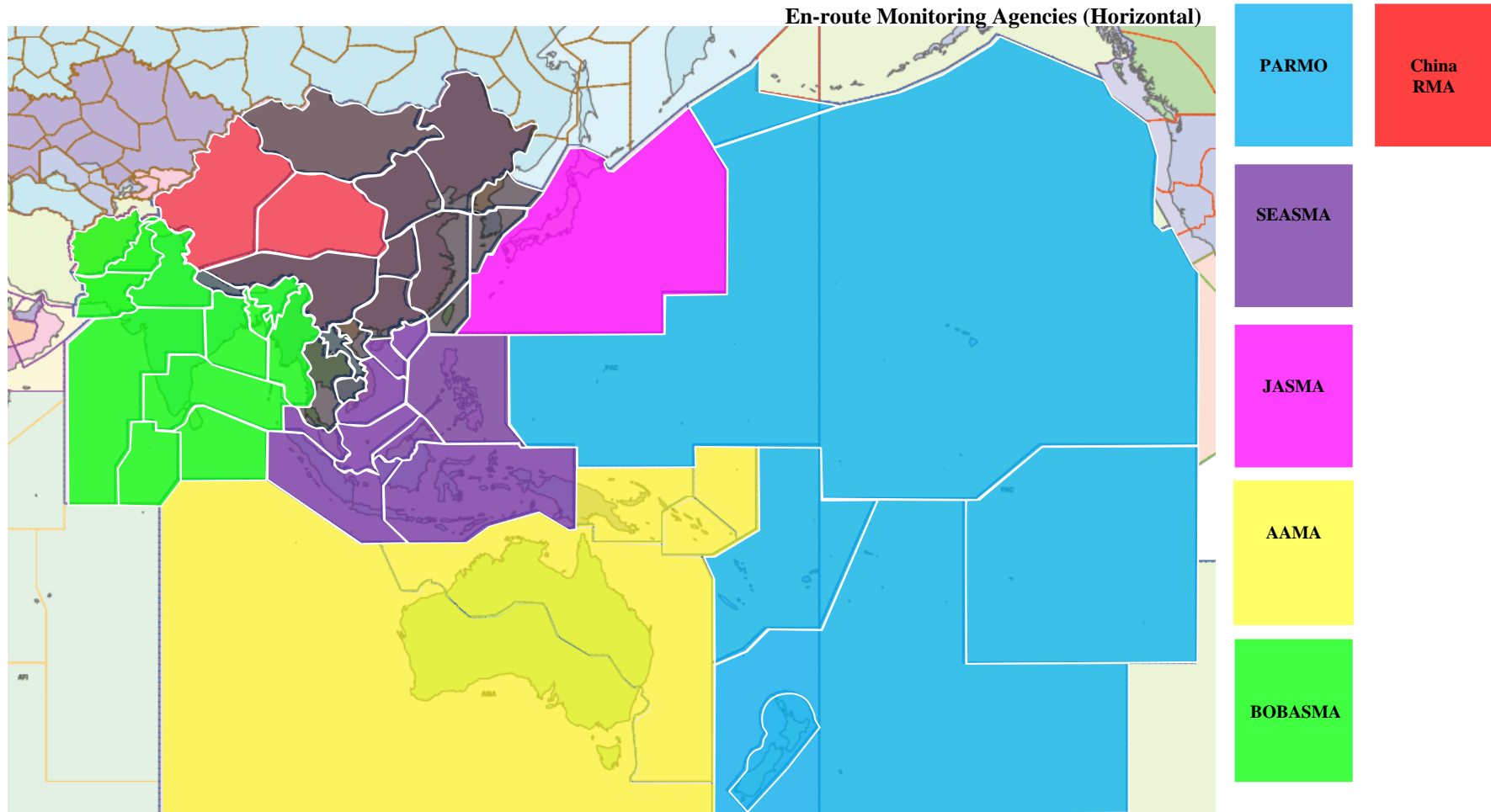
RASMAG/28
Appendix G to the Report

| Organisation (including contact officer) | State | Competency | Status | Airspace assessed (FIRs) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------|---------------|----------------------------------------------------------------------------------------------|
| <p>Email: kwek_chin_lin@caas.gov.sg</p> <p>Mr. Michael Matyas, Boeing Engineering Email: michael.matyas@boeing.com</p> | Boeing USA | CRA | Current | FIRs in the Asian Region not covered by IPACG/FIT, ISPACG/FIT, JASMA or SEASMA |
| <p>IPACG/FIT</p> <p>Mr. Yukio IMADA IPACG/FIT Co-Chair (JCAB) Email : imada-y037c@mlit.go.jp</p> <p>Mr. John Roman FAA IPACG/FIT Co-Chair (FAA) Email: john.roman@faa.gov</p> | Japan and USA | FIT & CRA | Current | North & Central Pacific (Oceanic airspace within Fukuoka FIR, and Anchorage & Oakland FIRs) |
| <p>ISPACG/FIT</p> <p>Mr. Todd Kendall Airways New Zealand ISPACG Co-Chair Email: Todd.Kendall@airways.co.nz</p> <p>Mr. Ahmad Usmani FAA ISPACG Co-Chair Email: ahmad.usmani@faa.gov</p> | ISPACG States | FIT&CRA | Current | South Pacific FIRs and members of the Informal South Pacific ATS Coordination Group (ISPACG) |

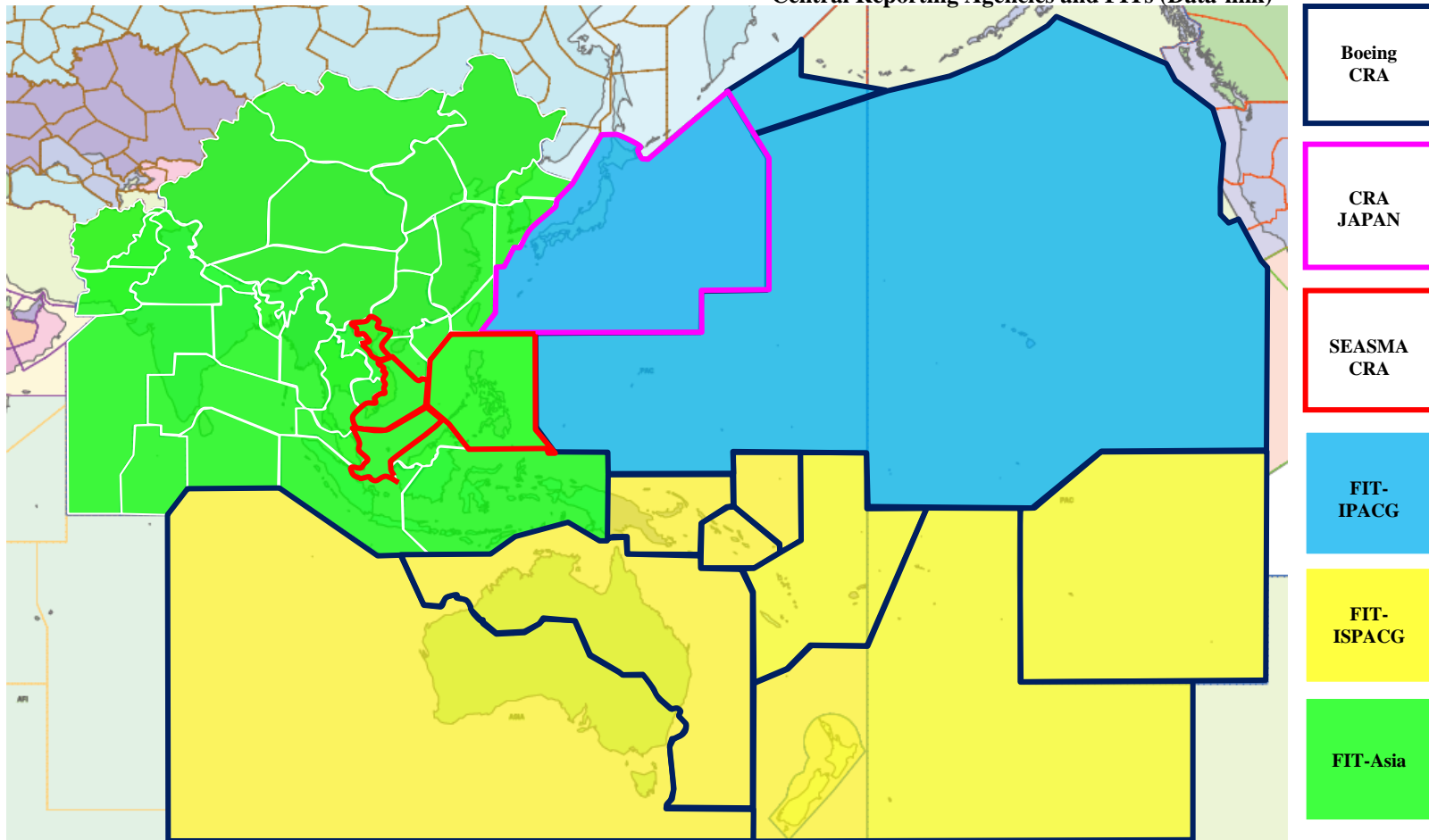
RASMAG/28
Appendix G to the Report

| Organisation (including contact officer) | State | Competency | Status | Airspace assessed (FIRs) |
|---------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------|---------------|---------------------------------|
| Ms. Lisa Bee, Inmarsat Aviation ISPACG/FIT Chair Email: Lisa.Bee@inmarsat.com | Inmarsat | FIT | | |
| Mr. Michael Matyas, Boeing Engineering ISPACG lead Email: michael.matyas@boeing.com | Boeing USA | CRA | | |





Central Reporting Agencies and FITs (Data-link)



RASMAG/28
Appendix H to the Report

Airspace Safety Deficiencies List (Updated 15 August 2023)

| States/facilities | Deficiencies | | | Corrective Action | | |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------|-------------|
| | Description | Date first reported | Remarks | Executing body | Target date | Priority ** |
| | Non Provision of Safety-related Data Requirement of Paragraph 3.3.5.1 of Annex 11 (provision of data for monitoring the height-keeping performance of aircraft) and APANPIRG Conclusion 16/6 – Non Provision of safety related data by States | | | | | |
| Afghanistan | Non-provision of safety related data | 12/07/2019 | Failure to submit Kabul LHD data for January-December 2018 and 2020. Afghanistan had submitted data for the period January to July 2021, but no further LHD reports were received after August 2021. | Afghanistan | RASMAG/27 | U |
| Brunei Darussalam | Non-provision of safety related data | 25/08/2022 | Failure to submit RVSM approval status validation data for two consecutive years (2020, 2021) RASMAG28, WP/25 - Brunei Darussalam is now providing the MAAR with the 2020, 2021, and 2022 annual RVSM approval snapshots. | Brunei Darussalam | RASMAG/28 | U |
| | State Responsibility to comply with the Annex 6 Height-Keeping Monitoring Requirement Annex 6 Part I Section 7.2.9 (10th Ed.) and Part II Section 2.5.2.10 (9th Ed.) | | | | | |
| Afghanistan | Non-compliance with LTHM requirement (remaining monitoring burden more than 30%) | RASMAG/23 | Remaining monitoring burden of 85% (RASMAG/26) MAAR informed ICAO that all known | Afghanistan | RASMAG24 | A |

RASMAG/28
Appendix H to the Report

| States/facilities | Deficiencies | | | Corrective Action | | |
|-------------------|----------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------|-------------|
| | Description | Date first reported | Remarks | Executing body | Target date | Priority ** |
| | | | airframes in Afghanistan have complied with the monitoring requirement (November 2022). Deficiency retained due to the unknown status of the Afghanistan aeronautical authority responsible for ensuring monitoring is conducted. | | | |
| Pakistan | Non-compliance with LTHM requirement (remaining monitoring burden more than 30%) | RASMAG/22 | Remaining monitoring burden of 61% (RASMAG/26) | Pakistan | RASMAG24 | A |
| Bangladesh | Non-compliance with LTHM requirement (remaining monitoring burden more than 30%) | RASMAG/28 | Remaining monitoring burden of 33% (RASMAG/28) | Bangladesh | RASMAG29 | A |
| Indonesia | Non-compliance with LTHM requirement (remaining monitoring burden more than 30%) | RASMAG/28 | Remaining monitoring burden of 63% (RASMAG/28) | Indonesia | RASMAG29 | A |
| Mongolia | Non-compliance with LTHM requirement (remaining monitoring burden more than 30%) | RASMAG/28 | Remaining monitoring burden of 39% (RASMAG/28) | Mongolia | RASMAG29 | A |
| Nepal | Non-compliance with LTHM requirement (remaining monitoring burden more than 30%) | RASMAG/28 | Remaining monitoring burden of 46% (RASMAG/28) | Nepal | RASMAG29 | A |
| New Zealand | Non-compliance with LTHM requirement (remaining monitoring burden more than 30%) | RASMAG/28 | Remaining monitoring burden of 36% (RASMAG/28) | New Zealand | RASMAG29 | A |
| Papua New Guinea | Non-compliance with LTHM requirement (remaining monitoring burden more than 30%) | RASMAG/28 | Remaining monitoring burden of 69% (RASMAG/28) | Papua New Guinea | RASMAG29 | A |
| Solomon Islands | Non-compliance with LTHM requirement (remaining monitoring burden more than 30%) | RASMAG/28 | Remaining monitoring burden of 50% (RASMAG/28) | Solomon Islands | RASMAG29 | A |
| | Data Link Performance Monitoring | | | | | |

RASMAG/28
Appendix H to the Report

| States/facilities | Deficiencies | | | Corrective Action | | |
|-------------------|---------------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------|-------------|-------------|
| | Description | Date first reported | Remarks | Executing body | Target date | Priority ** |
| | and Analysis Requirements of Paragraph 2.28 and/or 3.3.5.2 of Annex 11 not met | | | | | |
| India | Post-implementation monitoring not implemented | 13/07/2017 | Performance monitoring and analysis was reported for the Chennai and Kolkata FIRs, but was not reported for the Mumbai FIR. | India | TBD | A |
| Maldives | Post-implementation monitoring not implemented | 29/5/2015 | Problem Reports not provided to CRA. Performance monitoring and analysis not reported to FIT. | Maldives | TBD | A |

** Note: In accordance with the *APANPIRG Handbook - Asia/Pacific Supplement to the Uniform Methodology for the Identification, Assessment and Reporting of Air Navigation Deficiencies*, priority for Air Navigation Deficiencies is guided by the principle that a deficiency with respect to an ICAO Standard is accorded a “U” status, while a non-compliance with a Recommended Practice or a PANS is considered as “A” or “B” subject to additional expert evaluation. The final prioritization of deficiencies is the prerogative of APANPIRG.

RASMAG/28
Appendix I

RASMAG — TASK LIST

(last updated 24 August 2023)

| ACTION ITEM | DESCRIPTION | TIME FRAME | RESPONSIBLE PARTY | STATUS | REMARKS |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 22/8 | MAWG to discuss the measure used to determine overall Asia/Pacific TLS compliance and make recommendations to RASMAG/23 (<i>APANPIRG Conclusion 20/4 – Asia/Pacific Performance Metrics</i> refers) related to Hot Spots | APANPIRG/32 | MAWG | Open Completed | RASMAG/26 update Ref Secretariat review of Regional Safety Assessment RASMAG/27 update: Action Item 26/5 refers. |
| 25/1 | RMAs to check that all States to adopt the new F2 Form and States to explicitly check YES or NO in field 15 (RSP180 Approval) and 18 (RCP240 Approval). | RASMAG/27 | All RMAs to check Myanmar Viet Nam | Open Completed | RASMAG/26 update para 5.7 <i>Myanmar and Viet Nam had not adopted the new F2 form, which included PBCS approvals information.</i> RASMAG/27 update para 5.18 |
| 25/2 | The meeting suggested that the question be raised to the ATM/SG/8 on how to detect/handle State aircraft operators that incorrectly file ‘W’ in their flight plans (RASMAG/25/WP04). | ATM/SG/9 RASMAG/28 ATM/SG/11 RASMAG/29 | ICAO | Open | RASMAG/26 update ATM/SG/8 was informed of RASMAG/25 advice. Draft Conclusion RASMAG/26-3 to also be discussed and endorsed at ATM/SG/9 RASMAG/27 Update para 5.27 ref paper to Assembly. RASMAG/28 WP/32 Continue to monitor |

RASMAG/28
Appendix I

| ACTION ITEM | DESCRIPTION | TIME FRAME | RESPONSIBLE PARTY | STATUS | REMARKS |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 25/3 | The meeting discussed the identification of Category J events as LHDs, given that these were not taken into account in risk modelling or ATC separations as an independent safety net action using the command authority of a pilot to conduct a safe trajectory, bearing in mind the Aircraft Collision Avoidance System (ACAS) Resolution Advisory (RA) and ATC essential traffic information. The issue of ‘nuisance’ RAs was also discussed, as these were the majority of Category J LHDs. The meeting agreed that the RASMAG Chair would further discuss this at the MAWG. RASMAG/25/WP08 | MAWG/9 | RASMAG Chair | Open Completed | RASMAG/27 update: Report para 2.22. MAWG/9 provided common guidance for APAC RMAs on how to treat TCAS RA-related reports. |
| 26/1 | Noting that there were cases where some States were using a process other than direct operational approvals to enable aircraft operators to file PBCS indicators in flight plans, ICAO undertook to study how information on such State regulatory processes could be obtained | RASMAG/27 RASMAG/28 RASMAG/29 | ICAO, States? | Open | RASMAG/26 Report para. 2.8 RASMAG/28 report para X.X – RASMAG/28 agreed to conduct a survey Report para 5.41 and Conclusion RASMAG/28-5 |
| 26/2 | JASMA noted that five LHDs at SADLI did not appear to have been included in the PARMO report. China RMA informed the meeting that the data would be shared with JASMA and PARMO. Republic of Korea also requested the data be shared with them (China RMA also agreed that information on this area should be shared), and advised that they would share relevant data with China RMA, JASMA and PARMO. | RASMAG/27 | China RMA JASMA Republic of Korea PARMO | Open Completed | RASMAG/26 Report para. 3.40 RASMAG/27 WP/20 LHD information is being shared between China RMA, JASMA and PARMO. |
| 26/3 | In response to JASMA’s invitation to the meeting, particularly IATA and IFALPA, to provide feedback on the increasing number of Category A LHDs, IFALPA agreed that decreasing opportunities for pilots to operate aircraft may have | MAWG/9 | JASMA | Open Completed | RASMAG/26 Report para. 3.46 JASMA will provide information on Cat. A LHDs to IATA and IFALPA, and will also provide information to MAWG/9. |

RASMAG/28
Appendix I

| ACTION ITEM | DESCRIPTION | TIME FRAME | RESPONSIBLE PARTY | STATUS | REMARKS |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | <p>contributed. JASMA was also asked whether these events could be categorized by time of day, as fatigue may be a contributing factor due to some operators requiring pilots to fly longer than usual flight hours. JASMA agreed to provide IFALPA with further information, but noted it would take some time to prepare</p> | | | | <p>RASMAG/27 WP/26</p> |
| <p>26/4</p> | <p>It was also noted that a significant number of the occurrences at this hot spot (<i>Hot Spot M</i>) were the result of Indian Navy flights not complying with ATC instructions, and that an identified mitigation strategy was to establish contact with the Indian Navy to resolve the matter. This mitigation had not yet been achieved. India informed the meeting that contact details for the Indian Navy could be provided if AAMA could provide the details of the occurrences. A formal letter on the subject should also be addressed to the Director General of Civil Aviation of India, with copy to BOBASMA.</p> | <p>MAWG/9 ?</p> | <p>BOBASMA AAMA</p> | <p>Open Completed</p> | <p>RASMAG/26 Report para 3.114 AAMA to write to DGCA India to obtain contact details for Indian Navy AAMA to provide details of occurrences RASMAG/27 update WP/9 Refer Action Item 27/5</p> |
| <p>26/5</p> | <p>The Chair informed the meeting that the process of identification and monitoring of LHD hot spots had been developed informally over several years to facilitate the focus of RASMAG on areas requiring specific attention. The MAWG was invited to consider drafting a formalized process for this purpose, for consideration by RASMAG</p> | <p>RASMAG/27 RASMAG/28 RASMAG/29</p> | <p>MAAR</p> | <p>Open</p> | <p>RASMAG/26 Report para 3.116 RASMAG/27 WP/7 RASMAG/27 Update: Hot Spot methodology trial to be validated at RASMAG/28. RASMAG/28 WP/19 the hot spot identification method is still in trial basis.</p> |

RASMAG/28
Appendix I

| ACTION ITEM | DESCRIPTION | TIME FRAME | RESPONSIBLE PARTY | STATUS | REMARKS |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 26/6 | APAC RMAs to administer a short questionnaire to States' POCs on the matter of RMA responsibility in this regard (sharing of RVSM approval data for State aircraft) | 31 March 2022 | All APAC RMAs | Open Completed | RASMAG/26 Report para 5.21 Subject to APANPIRG/32 adoption of Draft Conclusion RASMAG/26-3 MAAR to prepare draft questionnaire for review at MAWG/9 RASMAG/27 WP/31 |
| 27/1 | Draw the attention of ATM/SG and APANPIRG to issues related to PBCS non-compliance reporting (lack of reports, gaps in data, delayed reporting, lack of POCs, poor participation in RMA measures on PBCS, reporting processes and tracking of non-compliant aircraft) | ATM/SG/10 APANPIRG/33 | Secretariat | Open | RASMAG/27 report para 2.26 APANPIRG/33 WP/11 & RASMAG/28 WP/21 Meeting agreed to Conclusion RASMAG/28-4 |
| 27/2 | Explore the development of Regional Guidance for PBCS non-compliance reporting (including Nil Occurrence reports) and handling processes | FIT-Asia/13 | Secretariat Others? | Open Completed | RASMAG/27 report para 2.28 RASMAG/28 WP/21 Meeting agreed to Conclusion RASMAG/28-4 |
| 27/3 | Provide update on AKARA airspace improvement project planning, if any. | ATM/SG/10 | China Japan Republic of Korea | Open Completed | RASMAG/27 report para 3.6 ATM/SG/10 WP/39 |
| 27/4 | ICAO APAC Office to coordinate with ICAO HQ on AKARA airspace improvement project Phase 2 | 30 September 2022 | Secretariat | Open Completed | RASMAG/27 report para 3.9 ICAO Headquarters response: The TWG is inactive. No State has made any approach to the TWG Secretariat to resume activity. |
| 27/5 | ICAO APAC Regional Office to write to DGCA India seeking contact details for Indian Navy (Hot Spot M mitigations) | 30 September 2022 | Secretariat | Open Completed | RASMAG/27 report para 3.33 Action items and 25/2 and 26/4 refer. ICAO formal letter sent on 8 Feb 2023 and 16 Aug 2023. |
| 27/6 | 2022 APAC Consolidated Safety Report to be provided to APANPIRG/33 and ANC | APANPIRG/33 APANPIRG/34 | Secretariat | Open Ongoing | RASMAG/27 report para 3.128 APANPIRG/33 WP/11 Appendix A |

RASMAG/28
Appendix I

| ACTION ITEM | DESCRIPTION | TIME FRAME | RESPONSIBLE PARTY | STATUS | REMARKS |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------|------------------------------|-------------------------------------------------------------------------|
| 27/7 | Provide feedback to MAAR on the LHD Material Package, including LHD points of contact, for all APAC Administrations. | 30 September 2022 | All Administrations and Monitoring Agencies | Open Completed | RASMAG/27 WP/24 and report para 4.3 Feedback received |
| 27/8 | Inform Brunei Darussalam of RASMAG/27 recommended ATM and Airspace Deficiency | 30 September 2022 | Secretariat | Open Completed | RASMAG/27 WP/29 and report para 5.19 ICAO letter sent on 29 Aug 2022 |
| 27/9 | Inform Lao PDR and Mongolia of ATM and Airspace Deficiency to be proposed at RASMAG/28 | 30 September 2022 | Secretariat | Open Completed | RASMAG/27 WP/29 and report para 5.19 ICAO letter sent on 29 Aug 2022 |
| 27/10 | Present survey findings on removal of 1,000 flight hour portion of Annex 6 RVSM monitoring requirement to RMACG | RMACG/17 (Part II) | MAAR | Open Completed | RASMAG/27 WP/33 and report para 5.38 WP presented at RMACG/16 |
| 27/11 | Present survey findings on continuance of 'W' check of State aircraft | RMACG/17 (Part II) | MAAR | Open Completed | RASMAG/27 WP/31 and report para 5.26 WP presented at RMACG/17 |
| 28/1 | Review and develop Draft of new version of <i>Guidance Material for End-to-End Safety and Performance Monitoring of ATS Data Link Systems in the APAC Region</i> in cooperation with CNS subject matter experts. Include region-specific matters from Appendix B to the GOLD Manual (to be removed from the manual in 2020) | RASMAG/29 | Secretariat USA, New Zealand, China | Open | RASMAG/28 WP/2 task transferred from FIT/Asia |
| 28/2 | Discuss the definition of Sub categories of LHD/LLD/LLEs to facilitate effective analysis at the next MAWG meeting | MAWG/11 | Monitoring Agencies | Open | RASMAG/28 report para 3.14 |
| 28/3 | Review the data sharing procedure of additional data to support non-compliance reports | FIT/Asia/14 | China RMA | Open | RASMAG/28 report para 4.7 |
| 28/4 | States/Administrations to inform monitoring agencies of their implementation plans for lateral separation minima such as 23 NM lateral separation minima and ASEPS | Nil | All | Ongoing | RASMAG/28 report para 5.58 |

RASMAG/28
Appendix I

| ACTION ITEM | DESCRIPTION | TIME FRAME | RESPONSIBLE PARTY | STATUS | REMARKS |
|-------------|----------------------------------------------------------------------------------------------|------------|---------------------|--------|----------------------------|
| 28/5 | Review the reporting criteria of LLDs to be used in the APAC region at the next MAWG meeting | MAWG/11 | Monitoring Agencies | Open | RASMAG/28 report para 5.57 |
| 28/6 | Review and discuss how multi-boundary hot spots may be separated/managed | MAWG/11 | Monitoring Agencies | Open | RASMAG/28 report para 3.48 |

.....