International Civil Aviation Organization

The Third Meeting of the APANPIRG ATM Sub-Group (ATM /SG/3)

Bangkok, Thailand, 03-07 August 2015

Agenda Item 3: Performance Frameworks and Metrics

FIT-ASIA/4 AND RASMAG/20 OUTCOMES

(Presented by the Secretariat)

SUMMARY

This paper presents the outcomes of the FIT-Asia/4 and RASMAG/20 meetings.

1. INTRODUCTION

1.1 The Fourth Meeting of the Future Air Navigation Systems Interoperability Team-Asia (FIT-Asia/4) was held on 25 May 2015 at Bangkok, Thailand and the Twentieth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/20) was held from 26-28 May 2015 at the same venue.

1.2 A total of 61 participants attended either or both the FIT-Asia/4 and RASMAG/20 meetings from Australia, Bangladesh, China, India, Indonesia, Japan, Lao PDR, Mongolia, Philippines, Republic of Korea, Singapore, Thailand, the United States, Viet Nam, IATA, and ICAO.

2. DISCUSSION

CRA Services

2.1 FIT-Asia/3 had been informed that there was a considerable lack of data-link problem reporting among FIT-Asia States and airspace users, and few FIT-Asia States had arrangements in place for the analysis of problem reports by a competent Central Reporting Agency (CRA). While the number of States making arrangements for the analysis of problem reports had improved, the FIT-Asia/4 noted that overall there had been little reporting of both problems and performance data.

2.2 The meeting was reminded that the FIT-Asia Terms of Reference (TOR) required *inter-alia*, that it conducted activities to support FIT-Asia participant States' compliance with ICAO Annex 11 – *Air Traffic Services* and Global Operational Data-Link Document (GOLD) requirements for data-link performance. Moreover, FIT-Asia/4 recalled that monitoring, reporting and analysis of data-link performance and problems was essential for the achievement and maintenance of system performance required for the application of RNP based separation standards.

2.3 FIT-Asia/4 was reminded that Conclusion*24/24: ADS/C and CPDLC Problem Reporting and Analysis* requested FIT-Asia States to register on the FIT-Asia website (http://www.ispacg-cra.com), and report their registration to the ICAO Asia/Pacific Regional Office by 31 December 2013 and report problems relating to Automatic Dependent Surveillance-Contract (ADS-C) and Controller Pilot Data-Link Communications (CPDLC) services to the CRA for analysis.

2.4 **Table 1** lists the FIT-Asia administrations that had either implemented ADS-C/CPDLC, or were expected to do so under the Asia/Pacific Seamless ATM Plan, and their FIT-Asia CRA registration status.

Administration	Data-Link (ADS-C/CPDLC) Service Status	Seamless ATM Expectation (Nov 2015)	FIT-Asia CRA Registration
China	Implemented	YES	YES
India	Implemented	YES	YES
Indonesia	Implemented	YES	**YES**
Malaysia		YES	**YES**
Myanmar	Implemented	YES	**YES**
Maldives	Implemented	YES	**YES**
Philippines		YES	SEASMA*
Singapore	Implemented	YES	SEASMA*
Sri Lanka	Implemented	YES	
Thailand			
Viet Nam	Implemented	YES	SEASMA* **YES**

* *The South East Asia Safety Monitoring Agency (SEASMA) provides CRA service for Philippines, Singapore and Viet Nam. Current SEAMA CRA arrangements expire September 2016.*

Table 1: FIT-Asia ADS-C/CPDLC Implementation and CRA Registration Status.

2.5 Since FIT-Asia/3, only two administrations had submitted problem reports to FIT-Asia CRA. The FIT-Asia CRA website administrator had noted that several Problem Reports (PRs) could not be assessed, as the data link service provider only retained logs for 90 days. In addition, only three administrations had submitted performance data analysis to FIT-Asia/4.

2.6 IATA had contracted Boeing on behalf of Airports Authority of India to provide CRA services for Indian and South Asian Flight Information Regions (FIRs). IATA was in the process of renewing the CRA service contract with Boeing until 31 December 2016, and expected to continue this arrangement to at least 2018 or until AAI indicated a wish to take over the CRA service. The service covered the airspace of India, Maldives, Myanmar and Sri Lanka, and would also cover Bangladesh when data link services were implemented there.

CRA Problem Reports Analysis

2.7 The Boeing CRA presented an analysis of data link problem reports analysed since FIT-Asia/3. States were urged to access the CRA website and enter PRs immediately, to allow for timely data retrieval and analysis of data. The meeting noted that there were occasional difficulties in logging on to the CRA website. Boeing CRA was requested to provide further information on the CRA workflow, and more clarity on how to use the website.

2.8 It was also noted that most of the problems reported related to fundamental errors, indicating a lack of familiarity with GOLD procedures and guidance. While States should be familiar with GOLD, it was recognized that it would be beneficial to provide a short video presentation of known problem areas, particularly CPDLC hand-off processes.

2.9 Boeing CRA informed the meeting that any new ATS unit coming on line or making automation system changes could contact Boeing CRA to arrange data link functional and performance testing using their test-bed facilities.

Data Link Performance Reports

2.10 China provided data link performance data for the period October 2014 to March 2015, for the L888 route. The performance data was measured against. CPDLC Actual Communications Performance (ACP) for messages sent within three centres (Chengdu, Lanzhou and Urumqi per media type media type (Satellite, Very High Frequency - VHF and High Frequency - HF) was measured against the 95% 320 second and 99.9% 370 second Required Communication Performance (RCP) 400 specification. The ADS-C downlink latency of HF failed to meet the 95% target, due to the long latency of the messages from some HF stations. In discussing the HF latency, it was agreed that China would provide information on which aircraft types were reverting to HF, and Boeing CRA would then endeavour to determine why.

2.11 Singapore presented data link performance for the Singapore FIR for the period May 2014 to April 2015. The performance data was measured against GOLD RCP and RSP requirements. Data link performance in the Singapore FIR generally met the RCP 240 and RSP 180 performance requirements, either meeting or just falling below the 99.9% performance targets and meeting the 95% targets.

2.12 India provided the FIT-Asia/4 meeting with analysis of the observed performance of the ADS/CPDLC data link within the Chennai Flight Information Region during a twelve month period from January 2014 to December 2014 by the Bay of Bengal Arabian Sea Indian Ocean Safety Monitoring Agency (BOBASMA). The GOLD Performance Analysis Tool (GPAT) tool version 3 was used for monitoring Chennai FIR data link performance. All operators satisfied RCP-240 criteria of 95 percent of transactions within 180 seconds, but only a few operators met the criteria of 99.9 percentage transitions within 210 seconds. The ATM automation systems at Mumbai, Delhi and Kolkata were being upgraded so as to enable collection of ADS and CPDLC data for performance monitoring of the ground systems. India also advised the meeting that approximately 62% of the traffic within the Chennai FIR were data link equipped.

2.13 Indonesia presented information on planned integration of ADS-C/CPDLC with the Jakarta Air Traffic Services Centre (JATSC). An operational trial had been running in the Jakarta FIR, and operational implementation was expected in September 2015. Data link services had been provided in the Ujung Pandang FIR since 23 September 2010.

Revised Data Link Performance Reporting Template and Guidance

2.14 The Asia/Pacific Region Data Link Performance Reporting Template, developed by FIT-Asia/2, was found to be in need of further editorial and structural amendment. There was also a need for some brief guidance for the use of the template. The FIT-Asia/4 considered an updated template and guidance, which mainly consisted of error removal, and restructuring of content and format.

2.15 The FIT-Asia/4 meeting agreed that a common January - December data link performance reporting period each year should be used by FIT-Asia States. It was also suggested that reporting of outages should also be provided for in the template; thus the meeting agreed to a Draft Decision. The following Draft Conclusion was endorsed by RASMAG/20, for consideration by APANPIRG/26:

Draft Conclusion RASMAG/20-1: Data Link Performance Reporting Template and Guidance

That, the revised Data Link Performance Reporting Template and Guidance at **Appendix D to the Report** replaces the Data Link Performance Reporting Template on the ICAO Asia/Pacific Regional Office website.

Operational Significance of 99.9% Performance Criteria

2.16 FIT-Asia TF/4 discussed the operational significance of the 99.9% data link performance criteria, and what could be done in cases of ACP, Actual Communication Technical Performance (ACTP) and ADS-C downlink latency 'just' failing to meet the standard. GOLD Appendix D paragraph D 2.4.7.5 was reviewed. To support the performance objectives of the Seamless ATM Plan, and to ensure consistency of performance monitoring, analysis and reporting and CRA problem reporting among FIT-Asia States, a Draft Conclusion was developed. The following Draft Conclusion was endorsed by RASMAG/20, for consideration by the APANPIRG/26:

Draft Conclusion RASMAG/20-2: Data Link Performance Guidelines

That, FIT-Asia States are urged to:

a) Monitor data link performance against the RCP240 and RSP180 criteria specified in Appendix B of the Global Operational Data Link Document (GOLD); and

b) apply the guidelines specified in the GOLD Appendix D to determine whether fleet performance (the aggregate fleet of all data link aircraft operating in the airspace concerned, except only where it related to analysis of individual operator performance) either:

i. meets the 99.9% performance level; or

ii. requires submission of CRA problem reports and/or investigation that will attempt to determine the cause of the degradation.

Note: Gold Version 2.0 Appendix D Paragraph D.2.4.7.5.2 refers.

Air Navigation Service Deficiencies

2.17 Regarding the lack of response to Conclusion*24/24: ADS/C and CPDLC Problem Reporting and Analysis*, the FIT-Asia/4 meeting agreed to a Draft Conclusion. The following Draft Conclusion was endorsed by RASMAG/20, for consideration by APANPIRG/26:

Draft Conclusion RASMAG/20-3: ANS Deficiencies Relating to Data Link Performance Monitoring and Analysis

That, an Air Navigation Deficiency should be raised against non-implementation of the provisions of Annex 11 Paragraph 2.27.5 when any FIT-Asia administration has implemented operational ADS-C/CPDLC services and:

a) has not made arrangements for the reporting and analysis of data link problems to a competent CRA as identified by the Regional Airspace Safety Monitoring Advisory Group (RASMAG); or

b) does not report data link problems to the CRA; or

c) does not provide data link problem analysis reports to a recognized FANS Interoperability/Implementation Team (FIT); or

d) does not provide data-link performance analysis reports to a recognized FIT.

2.18 The FIT-Asia/4 and RASMAG/20 meetings agreed to the additions to the Deficiency List at **Appendix A**.

AAMA Safety Report (WP03)

2.19 Australia presented the results of Reduced Vertical Separation Minimum (RVSM) safety assessments undertaken by the Australian Airspace Monitoring Agency (AAMA) for the twelve month period ending 31 December 2014. The report showed that for the Australian (Brisbane, Melbourne), Nauru, Papua New Guinea (Port Moresby) and Solomon Islands (Honiara) Flight Information Regions (FIRs), the Target Level of Safety (TLS) was met with a risk assessment of **3.01 x 10^{-9}** (TLS, 5.0 x 10^{-9}).

2.20 In the Australian, Nauru, Papua New Guinea and Solomon Islands airspace, the AAMA reported that there been a total of 28 occurrences of pilots climbing or descending an aircraft not in accordance with the clearance (n=11) or without a clearance (n=17). The occurrences involved a range of operators and locations and there did not appear to be any underlying common factor.

2.21 Regarding Indonesian airspace, the TLS was met for the reporting period (**2.18 x 10^{-9}**). AAMA noted a significant grouping of Category E (ATC coordination error) LHDs on the Jakarta/Ujung Pandang FIR boundary, a majority of which were attributed to Jakarta Area Control Centre (ACC), with either no coordination being provided to the adjacent FIR or incorrect information provided.

China RMA Safety Report

2.22 China presented the airspace safety oversight results for RVSM in the airspace of Chinese FIRs and the Pyongyang FIR (Democratic Republic of Korea – DPRK) during 2014. The estimates of technical and total risks for the airspace of Chinese FIRs exceeded the TLS of 5.0 x 10^{-9} fatal accidents per flight hour, with an overall risk estimate of **5.50 x 10^{-9}**. **Figure 1** presents collision risk estimate trends for the Chinese FIRs.

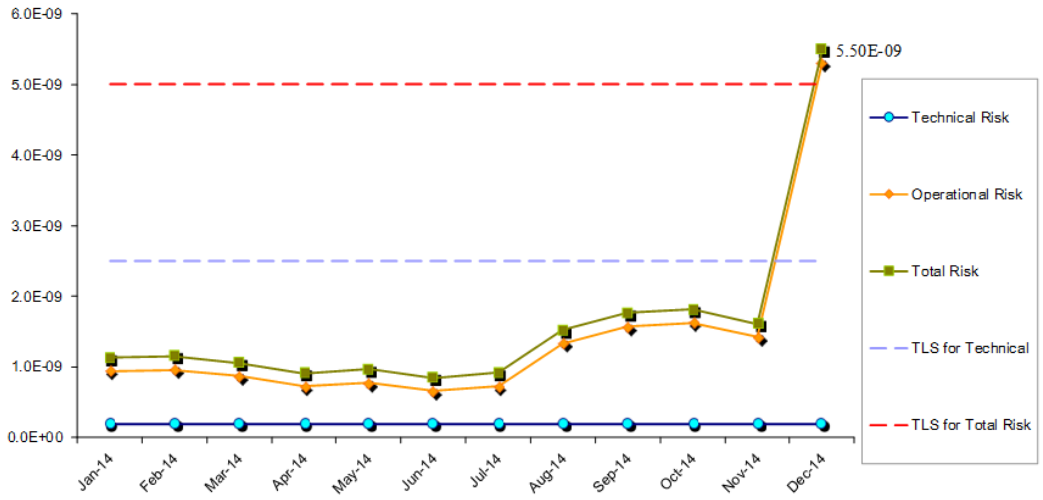

Figure 1: Chinese FIRs RVSM Risk Estimate Trends

2.23 China RMA noted that in 2014 a number of Category E LHDs were not reported by domestic ATC. China RMA conducted an intensive investigation into the causes leading to lack of reporting. In the second half of 2014, China RMA took action to improve LHD reporting in China with workshops in all regional centres, updating training material and simplifying the LHD reporting template. China RMA reported that the situation was improving and would provide further updates to RASMAG/21 meetings.

2.24 China recalled the LHD 'hot spot near the China – Pakistan border. They informed the meeting about progress made to improve the Air Traffic Services (ATS) communication and surveillance capability in this area.

2.25 Additionally, China RMA conducted monthly risk assessments as done by a number of other Asia/Pacific RMAs, and also analysed the contribution of operational risk for each non-nil event to the total risk. A high risk event in December 2014 was a Category M LHD which was the result of a failure to establish communication between controller and pilot, with an assessed duration of 26 minutes.

2.26 The estimate by China RMA of the overall vertical collision risk for the Pyongyang FIR was **1.58 x 10^{-9}** fatal accidents per flight hour, which satisfied the TLS. Based on data from the DPRK, no LHD had occurred during 2014 within the Pyongyang FIR.

2.27 The meeting noted with appreciation the work of China RMA to improve the reporting regime within China, while China thanked the ICAO Regional Office for its efforts to highlight this issue at RASMAG/19. China RMA used the following strategies to change work practices in operational environments and improve LHD reporting:

a) emphasising to controllers what factors contribute to risk;

b) clarifying that coordination errors should be reported as an LHD (controllers tended to emphasise 'deviations' more);

c) updating LHD training materials;

d) simplifying the LHD reporting template;

e) more communications between ATC units concerning LHD reporting; and

f) conducting safety workshops and seminars.

JASMA Vertical Safety Report

2.28 Japan presented the results of the airspace safety assessment of the Fukuoka FIR by the JASMA. The report showed that the Fukuoka FIR did not meet the TLS, with the assessed risk calculated as **7.17 x 10^{-9}**. **Figure 2** presents collision risk estimate trends during 2014.

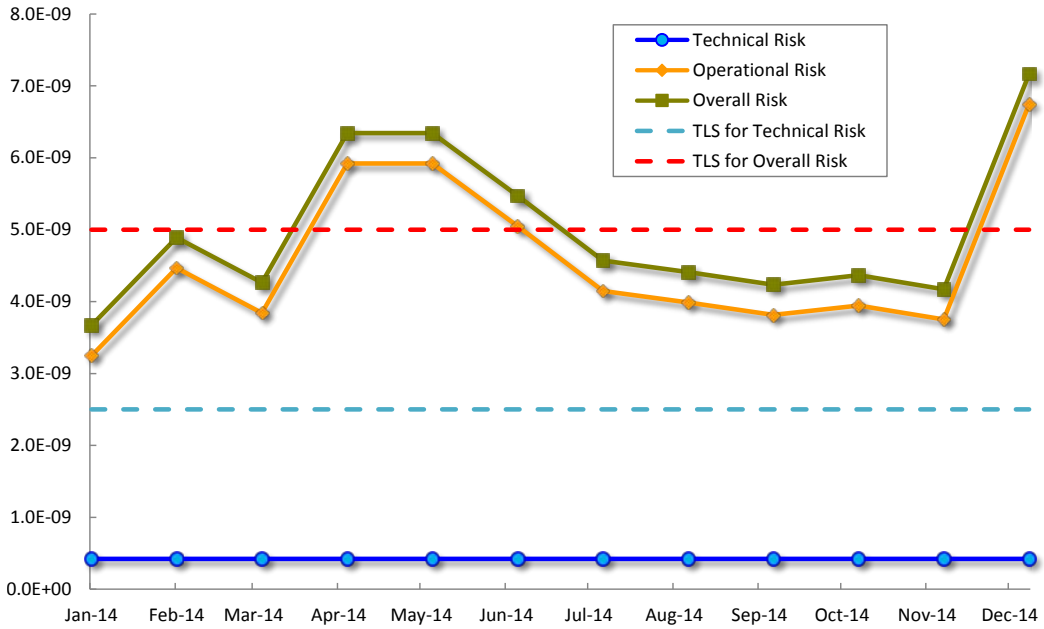

Figure 2: Fukuoka FIR RVSM Risk Estimate Trends

2.29 The Chairman thanked JASMA for the detailed report and noted the group of Traffic Collision Avoidance System (TCAS) occurrences in the south-west of the airspace and asked if there anything significant in relation to these occurrences. JASMA advised that they are undertaking a review of TCAS occurrences and will provide outcomes to a future RASMAG meeting. ICAO noted the number of Category E errors in the south-west area of the FIR which is a critical piece of airspace with high traffic densities. JASMA reported that they were investigating these occurrences with the relevant ACC.

MAAR Safety Report

2.30 The MAAR provided the results of the airspace safety oversight for the RVSM operation in the Bay of Bengal (BOB), Western Pacific/South China Sea (WPAC/SCS), and Mongolian airspace for 2014.

2.31 The BOB RVSM airspace overall risk was estimated to be **18.73 x 10^{-9}**, which did not meet the TLS by a substantial margin. This represented a major increase in apparent risk, which was probably caused by improved reporting. The MAAR stated that the Transfer of Control (TOC) points between the Chennai and Kuala Lumpur FIRs remained the most prominent hot spots in the region. They noted that there had been a series of ATS Inter-Facility Data Link Communications (AIDC) trials between Chennai and Kuala Lumpur FIRs, but it was unclear when this technology would become operational.

2.32 **Figure 3** presents collision risk estimate trends during 2014.

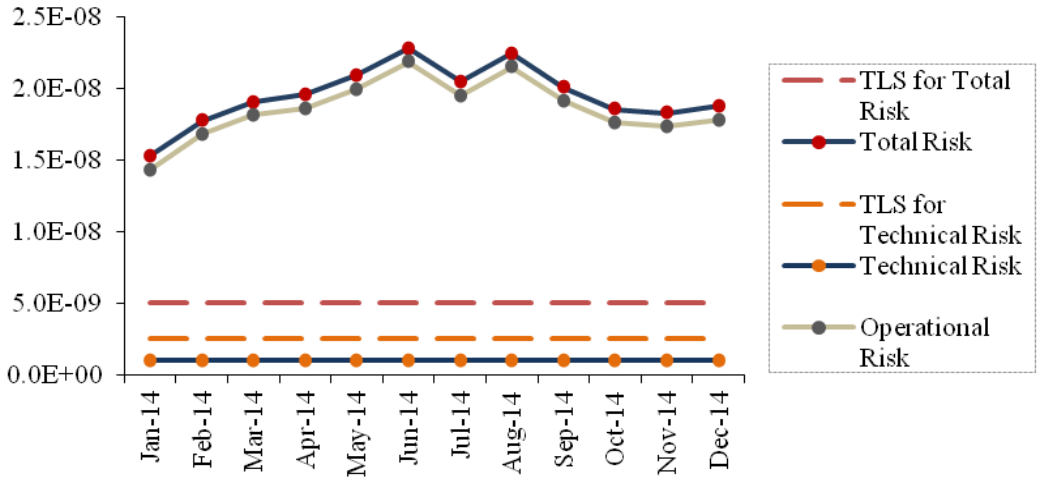

Figure 3: BOB Airspace RVSM Risk Estimate Trends

2.33 In relation to some of the other hotspots identified in the report, the RASMAG Chairman referred to GADER and sought information of what had changed to reduce the numbers of LHDs so significantly. ICAO advised that it probably had been influenced by the new Flight Level Allocation Scheme (FLAS) that has been introduced in Iranian airspace. This resulted in a significant change as controller workload has been reduced and as a result coordination errors had reduced. India advised that in an effort to resolve the hotspots to the east of the airspace, an AIDC trial will start between India and Malaysia in the near future and that an ADS-B data sharing agreement had been signed with Myanmar which should help reduce LHDs.

2.34 The WPAC/SCS RVSM airspace total risk was estimated to be **4.14 x 10^{-9}**, which met the TLS. The meeting recognised that this was an improvement in safety performance since 2013.

2.35 Regarding the WPAC/SCS airspace, NOMAN and SABNO TOC points along the Hong Kong - Manila FIR boundary were the main hot spots. The number of occurrences at DOTMI on the Guangzhou/Hong Kong FIR boundary (all incorrect transfers occurred from China) and OSANU on the Manila/Kota Kinabalu FIR interface (most from flights being transferred from the Philippines) were relatively high. However the LHD durations were low since the accepting ATS units had radar surveillance, but this increased controller workload and still entailed unnecessary risk.

2.36 Even though the overall risk was below the TLS, the meeting recognised that the Philippines, Hong Kong, and Malaysia should still prioritize AIDC implementations between Hong Kong – Manila FIRs and Kota Kinabalu – Manila FIRs.

2.37 The Mongolian RVSM airspace total risk was estimated at **2.98×10^{-9}**, which met the TLS and represented a major advance on 2013's results. RASMAG/20 recalled the positive effect of ATS surveillance in reducing risk within the Ulaanbaatar FIR by allowing rapid intervention, allowing less exposure to risk-bearing events. Due to the high number of LHD occurrences near NIXAL and INTIK, Mongolia had extended Secondary Surveillance Radar (SSR) coverage by about 30NM beyond its FIR boundary since December 2014.

PARMO Vertical Safety Report

2.38 The Pacific Approvals Registry and Monitoring Organization (PARMO) presented a safety assessment of RVSM for the Pacific and the Republic of Korea's (ROK) airspace for 2014. The Pacific airspace total risk was estimated to be **3.86×10^{-9}**, which met the TLS and was a major reduction from the 2013 estimated risk.

2.39 RASMAG/20 noted that although an increase in the number of non-nil LHD reports to 37 LHDs (most being Category B: flight crew climbing /descending without ATC clearance) was observed from 2013 to 2014, a significant decrease in the reported time spent at incorrect flight levels was also reported (239 minutes versus 88 minutes), reducing risk levels.

2.40 The Incheon FIR RVSM total risk was estimated to be **4.13×10^{-9}**, which met the TLS.

PARMO Horizontal Safety Report

2.41 The USA presented the horizontal safety monitoring report for the Anchorage and Oakland FIRs for 2014. The report contained a summary of Large Longitudinal Errors (LLE) and Large Lateral Deviations (LLD) received by the PARMO. The Anchorage and Oakland oceanic airspace horizontal risk estimates all met the 5.0×10^{-9} TLS with lateral risk estimated at **1.35×10^{-9}** (50NM) and **0.53×10^{-9}** (30NM) and longitudinal risk at **2.32×10^{-9}** (50NM) and **3.74×10^{-9}** (30NM).

2.42 In November 2013, analysis was conducted on when an updated forward estimate of position was not provided. During the automated tracking, 109 time error events were identified. Most of these events involved operations using HF radio for communication and were not eligible for the use of 50NM and 30NM longitudinal separation minima. As a result of this activity, improvement had been observed with a few operators. In April 2014, the Federal Aviation Administration (FAA) and ARINC initiated new procedures, which included HF radio read-backs. A 50% decrease in the number of time events was observed from January 2014 to December 2014.

BOBASMA Safety Report

2.43 India presented the horizontal safety monitoring report of the Bay of Bengal Arabian Sea Monitoring Agency (BOBASMA) for 2014. The results of the safety assessment confirmed that the TLS was easily satisfied at **1.08×10^{-9}** (lateral), **1.60×10^{-9}** (50NM longitudinal) and **0.13×10^{-9}** (30NM longitudinal).

2.44 BOBASMSA informed the RASMAG/20 that a Category A LLD that occurred in August 2014 within the Mumbai FIR was due to an eastbound flight deviating more than 15NM due to extensive thunderstorm clouds without ATC clearance, after the pilot was unable to contact ATC to obtain clearance prior to the deviation.

JASMA Horizontal Safety Report

2.45 Japan provided the results of the horizontal airspace safety assessment by JASMA of the time-based longitudinal, distance-based longitudinal and lateral collision risk within the Fukuoka FIR. The calculations yielded an overall safety estimate result of **0.751×10^{-9}** (50NM lateral) and **0.000578×10^{-9}** (30 NM longitudinal), which achieved the TLS.

2.46 JASMA reported the cause of a Category B LLD as being mismatched flight plans between that loaded into the aircraft Flight Management System (FMS) and the version used by ATC, which caused the flight to enter the Oakland FIR instead of the Anchorage FIR before the error was identified.

SEASMA Safety Report

2.47 Singapore provided the horizontal safety assessment report from the South East Asia Safety Monitoring Agency (SEASMA) for operations on the six major ATS routes within the SCS in 2014. The assessment concluded that the TLS was conservatively satisfied for the lateral (**0.045×10^{-9}**) and longitudinal (**0.034×10^{-9}**) separation standards.

2.48 SEASMA noted that all seven reported LLD/LLE occurred as a result of Category E ATC coordination errors (human error).

AAMA Assessment of Non-RVSM Approved Aircraft

2.49 Australia identified eight individual airframes in the data set assessment, with airframes from Australia showing the highest number (3). The overall results showed a significant positive trend, compared to the results presented at RMACG/9 (where 90 airframes were identified representing 11 States of Registry).

2.50 Australia suggested the following policy definition of a 'non-RVSM approved' aircraft for the purposes of identification to the RASMAG and RMACG by RMAs, which sought to avoid problems from a slow approval process or an accidental flight plan. Australia suggested that a 'non-RVSM approved' aircraft was one that was confirmed as not having a current approval over a long period of time:

a) during the last four months; and

b) more than five months ago.

China RMA Assessment of Non-RVSM Approved Aircraft

2.51 WP15 provided the results of a monthly comparison between the RMA approval databases and flight plans operated within the RVSM airspace of Chinese FIRs and Pyongyang FIR (using flight plan data up to April 2015). China RMA stated that experience had shown that the primary reason for failure to match operations and approvals was a delay in notification of the approval status of operators to the appropriate RMA. However, there were also cases that the aircraft are confirmed to be non-approved or had an expired approval. The largest numbers of Asia/Pacific airframes identified as non-RVSM were from the ROK (5), Cambodia (3) and Malaysia (3).

JASMA Assessment of Non-RVSM Approved Aircraft

2.52 JASMA examined approximately 90,000 to 95,000 flight plans of aircraft entering RVSM airspace comparing this data with the global RMA's latest approval databases uploaded to the Knowledge Sharing Network (KSN) website every month. JASMA had identified 15 airframes which had been flying within Fukuoka FIR RVSM airspace with a 'W' on their flight plans, but without registration in the KSN database for a considerable length of time. The main States of registration for such flights were the Philippines (3), Malaysia (2) and ROK (2).

MAAR Assessment of Non-RVSM Approved Aircraft

2.53 At the time of developing WP17, MAAR found a total of 203 aircraft registrations operating within RVSM airspace without proof of valid RVSM approval. The highest representation of Asia/Pacific States in this data was from India (73), Thailand (10) and Malaysia (7). MAAR found that of the 203 aircraft registrations operating within the RVSM airspace without proof of valid RVSM approval, 29 were detected in previous flight plans and nine were State/Military aircraft.

2.54 The meeting discussed the need for India and the Philippines to provide RVSM Approval Data to MAAR in a timely manner and to assist with that process BOBASMA offered to coordinate directly with the Indian DGCA. The offer was accepted by MAAR.

PARMO Assessment of Non-RVSM Approved Aircraft

2.55 PARMO advised that all civil aircraft operations observed in each of the December 2014 traffic samples were compiled into one master traffic sample, or superset, consisting of approximately 36,000 operations. The superset was compared against the collective approvals database as of 31 January 2015. After a verification process, a total of 45 civilian operations from eight States remained on the list of non-approved operations within the PARMO area of responsibility (three from Australia).

AAMA LTHM Burden Estimate Update

2.56 The AAMA determined that the number of RVSM approved aircraft totalled 1,128 as at May 2015. This represents an increase of 100 aircraft since the last report at RASMAG/19 in May 2014. Applying the MMR to the total of approved aircraft resulted in a total monitoring burden of 334 aircraft. Taking into account the aircraft that had already successfully monitored, the current outstanding burden was 113 aircraft, an increase of 34 airframes from that reported to RASMAG/19 in 2014.

2.57 The existing burden comprised 37 Australian registered, 73 Indonesian registered and one Papua New Guinea registered aircraft. The AAMA expects that nearly all of the Australian registered aircraft will be monitored in the medium term as the ADS-B mandate takes effect (approximately 96% of all Australian registered RVSM approved aircraft had been monitored using the AHMS).

China RMA LTHM Burden Estimate Update

2.58 China stated that the monitoring burden list of China RMA had risen rapidly from 51 operators with 2,367 aircraft (biennial monitoring total 252) in 2014 to 61 operators with 2,608 aircraft by the end of March, 2015. China RMA had been using two sets of Enhanced Global Positioning System-based Monitoring Unit (EGMU) to conduct on-board monitoring for Chinese airlines. Since 2014, China RMA started to use AHMS to augment its monitoring programme.

2.59 For the DPRK, China reported that there were 10 aircraft and the biennial monitoring number was three.

JASMA LTHM Burden Estimate Update

2.60 Japan informed the meeting that the total number of RVSM approved airframes was 727 as of 20 April, 2015. Applying the MMR, the total monitoring burden was 139 airframes. Taking into account the aircraft already successfully monitored, the current outstanding burden was 14 airframes. The Chairman acknowledged the very effective monitoring program initiated by Japan.

MAAR LTHM Burden Estimate Update

2.61 MAAR undertook its monitoring programs using a Global Positioning System-based Monitoring Unit (GMU) and an AHMS, with ADS-B data from Bangkok and Taipei FIRs. The resultant monitoring burden for 2,230 approved aircraft from the 21 MAAR States was 638 airframes. As at 01 May 2015, there were 169 airframes remaining to be monitored, a decrease of 31 airframes compared to the same period last year.

2.62 **Figure 4** illustrated the high total remaining monitoring burden as a result of new operators in Thailand and India. Thailand had fulfilled 59% of its total monitoring burden, but 75% of its monitoring burden (27 airframes) was associated with 23 general aviation operators. Though over 81% of India's total burden had been fulfilled, 25 operators accounted for the remaining monitoring burden of 33. Since no annual RVSM approvals update was received from India, MAAR suspected that some of these operators may have ceased operations but their aircraft were never removed from the approvals list.

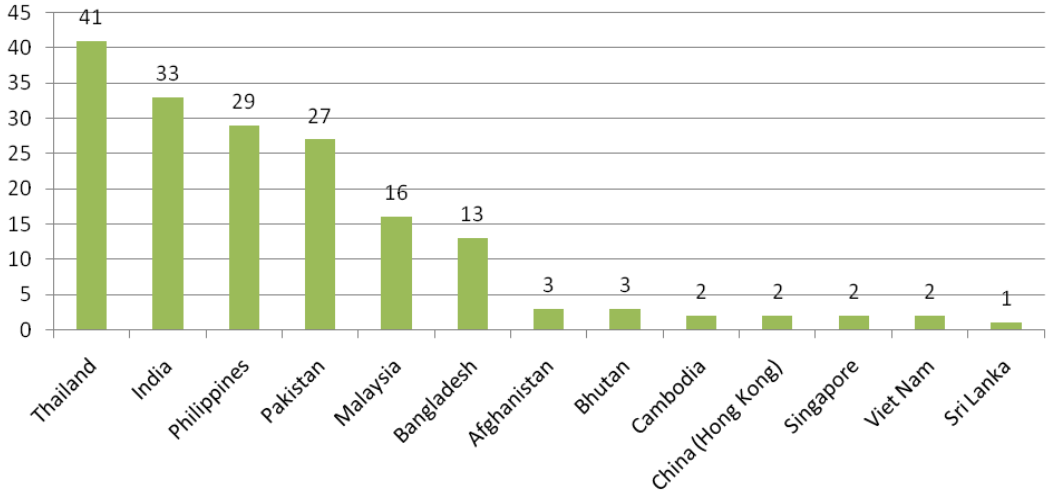

Figure 4: Remaining Monitoring Burden

2.63 MAAR emphasised the sharing of ADS-B data as a means of height monitoring, and informed that many operators were still not aware of their LTHM obligations and they encouraged all States to provide this information to operators.

2.64 Pakistan and the Philippines had relatively high remaining monitoring burdens at 66% and 48% respectively (Bangladesh informed the meeting that their burden would be resolved shortly). ICAO offered to assist MAAR in resolving communications with Pakistan to help reduce the remaining monitoring burden if required.

PARMO LTHM Burden Estimate Update

2.65 PARMO's Long Term Height Monitoring (LTHM) monitoring burden of 20 resulted from a total of 510 airframes with RVSM approval**.** The ROK (11) and New Zealand (7) accounted for the majority of these aircraft.

Regional Safety Monitoring Assessment (WP24)

2.66 ICAO presented an overview of safety assessment results from a regional perspective. **Figure 5** indicated the status as reported to RASMAG/20.

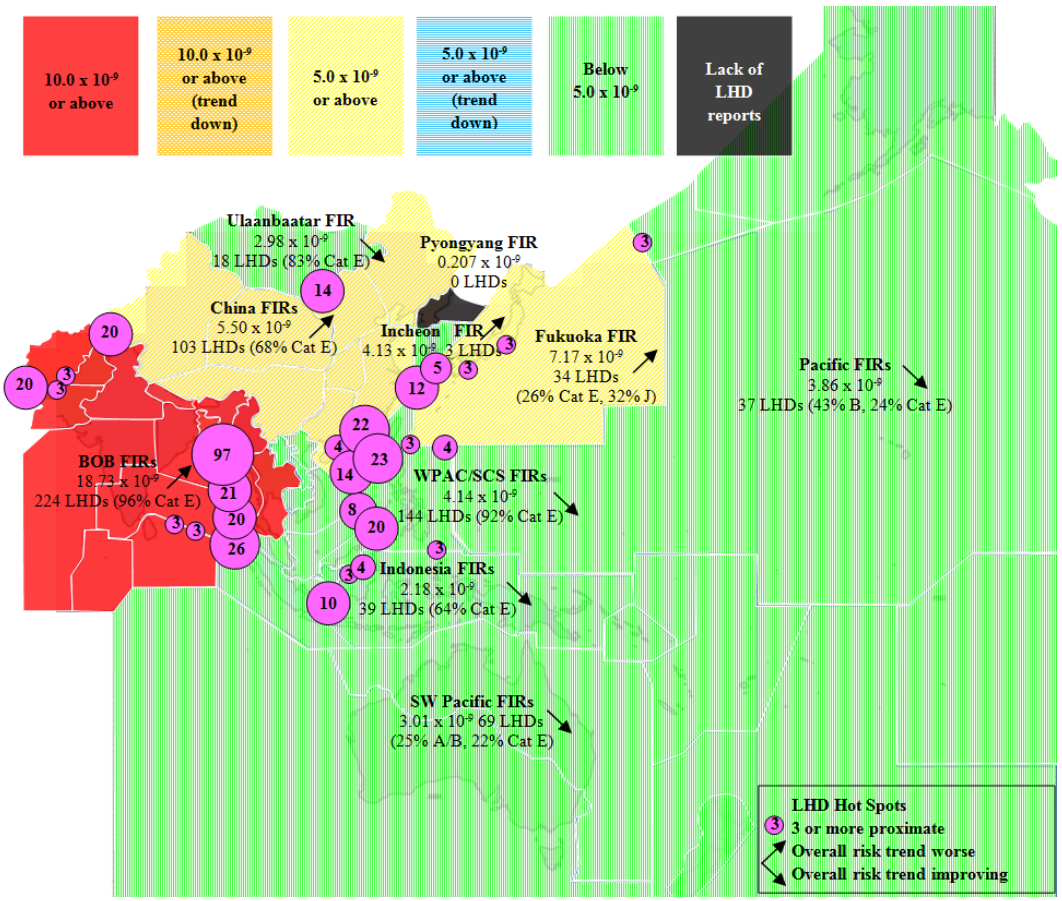

Figure 5: Asia/Pacific TLS compliance reported to RASMAG/20

2.67 **Figure 5** indicated the following sub-regional regional trends.

- **South Asia**: the improved reporting by India has resulted in a further significant degradation in the Bay of Bengal (BOB) safety risk assessment to reflect the true safety performance that had been hidden – one that greatly exceeded the TLS and remained the Asia/Pacific's highest risk area. However, the States concerned were taking a number of ATM improvement actions that were expected to substantially reduce risk during 2015 and 2016 when the new systems were implemented (however, there was no confirmation as to when the new communications and surveillance systems on Great Nicobar Island would be operational).

  While the increased reporting at Indian FIR boundary TOC points was laudable, it appeared unlikely that there could be no LHDs as reported within Indian continental airspace; thus further work was necessary to sensitise ATC to an appropriate reporting culture.

  There were a number of hot spots evident on the Kabul FIR boundary, most notably at position GADER (between the Tehran and Kabul FIRs); however since late 2014 these LHDs had markedly reduced after intervention by MAAR in coordination with the ICAO Middle East (MID) Region.

- **Southeast Asia** reflected an overall improvement in safety risk, even with an increase in reported LHDs. The Philippines airspace remained a major concern, with numerous LHDs evident at all points along the Manila FIR boundary. The greater use of AIDC and ATS surveillance in the South China Sea, and an ATM system upgrade for the Manila FIR continued to require a priority focus.

- **East Asia**: China recorded a dramatic increase in reported LHDs, resulting in its airspace being well over TLS. This reflected a much improved reporting culture, fostered by the efforts of the China RMA. Other than the known hot spots between Pakistan and Chinese airspace near PURPA and between Mongolia and China near NIXAL, new hot spots were revealed between Shanghai/Taibei, Guangzhou/Hong Kong and Sanya/Hong Kong FIRs. China had made significant progress in addressing the PURPA hot spot by improving the communication and surveillance capabilities in this area.

  Attention to the other hot spots in the congested airspace of Eastern China was also required, particularly as these were mainly operational ATC errors in general that could be improved with the use of AIDC and more robust procedures (note: the volume of occurrences between Hong Kong and the Sanya/ Guangzhou FIRs may require an urgent focus on such matters as airspace dimensions, ATS route structures, Flight Level Allocation Scheme (FLAS), ATS coordination procedures and the management of the aerodromes within the Pearl River Delta using a 'metroplex' planning methodology).

  Mongolian airspace observed a downward trend in risk, despite a doubling of the reported LHDs – mainly due to the improved intervention capability using ATS surveillance (note: there were several LHDs reported in MAAR's analysis of the Ulaanbaatar/Beijing FIR boundary at NIXAL and INTIK which do not appear to have been reported to the China RMA; thus the work on improving the reporting culture within China should continue)

  The Pyongyang FIR continued to record no LHDs, which was statistically possible, given the low estimated flight hours. However, no LHDs had been reported for many years; thus it was likely that there was a lack of reporting culture within this airspace, despite China's past efforts to sensitise DPRK ATC.

  Japanese airspace had shown a marked upward (worsening) risk trend; despite the number of LHDs reducing (this was assumed to be due to the longer duration of the LHDs). The significant number of ATC interface errors with the Incheon FIR was concerning, as this was related to the 'AKARA' corridor. The corridor was, a complex airspace serving very high density traffic between China and Japan, and the ROK and the Taibei FIR that used a FLAS, with multiple frequencies and control authorities in the same area. It would appear to be necessary for the involved administrations to urgently review this airspace and its associated procedures (note: AIDC was being used between the ROK and Japan).

- **Southwest Pacific**: all FIRs showed a downward trend, with significant improvement in the performance of Indonesian airspace. However some caution was necessary, as there had still been major interface issues between the Jakarta and Ujung Pandang FIRs, and reporting had been a problem in the past in this airspace. In summary, the result indicated a positive safety result from the efforts of the AAMA, regulators and ANSPs in the FIRs concerned, although Indonesia needed continued focus on its internal improvement programme (note: there were several LHDs reported in MAAR's analysis of the Kota Kinabalu/Jakarta FIR boundary which do not appear to have been reported to AAMA).

- **Pacific**: the Pacific showed a significant risk improvement, even though the number of LHDs more than doubled (mainly occurring in the high density North Pacific Organised Track System (NOPAC) and Hawaiian route system). .

2.68 The Regional analysis of 'hot spots' indicated a number of priority high risk areas where APANPIRG needed to take specific action, in order to reduce risk to an acceptable level. Notwithstanding the establishment of the Asia/Pacific ATS Inter-facility Data Link Communication Implementation Task Force (APA TF/1) and on-going ATM improvement programmes designed to enhance the capability of ATC, RASMAG/20 agreed to the following Draft Conclusion related to Special Coordination Meetings (SCM) in order of assumed risk (as presented to RASMAG) to ensure an urgent reduction of risk for consideration by APANPIRG/26:

Draft Conclusion RASMAG/20-4: Asia/Pacific LHD Hot Spot Action Plans

That, the following Regional Monitoring Agencies (RMAs), States and ATC units should take urgent action* to establish a scrutiny group or an alternate means to address the following Large Height Deviation (LHD) hot spot areas and present Action Plans and details of progress made to the ICAO Regional Office, prior to 01 January 2016:

a) **MAAR**, India, Myanmar and Malaysia – Kolkata/Chennai FIRs interface with Yangon/Kuala Lumpur FIRs;

b) **PARMO**, China RMA, JASMA, MAAR, China, Japan, Republic of Korea and Taibei Area Control Centre (ACC) – Incheon FIR AKARA Corridor interface with Shanghai/Fukuoka/Taibei FIRs;

c) **China RMA**, MAAR, China and Hong Kong China— Hong Kong FIR interface with Guangzhou/Sanya FIRs;

d) **MAAR**, AAMA, JASMA, Hong Kong China, Indonesia, Japan and the Philippines – Manila FIR interface with Fukuoka/Hong Kong China/ Singapore/Ujung Pandang FIRs; and

e) **China RMA**, MAAR, China and Pakistan – Urumqi FIR interface with Lahore FIR.

**Action should be taken as soon as practicable, even prior to APANPIRG/26 if possible.*

Note: the RMAs in bold were expected to take the lead in organising the scrutiny groups or alternative means to address the issues.

2.69 **Table 2** provides a comparison of Asia/Pacific RVSM risk as a measure against the TLS, either by RMA 'sub-region[1]' (Conclusion 20/4 − *Asia/Pacific Performance Metrics* refers), or by FIRs. There had been significant improvement in the region meeting the TLS overall, but three 'sub-regions' – BOB, Chinese and Japanese airspace recorded marked increases in risk assessment.

	RASMAG17	RASMAG18	RASMAG19	RASMAG20
RMA 'sub-regions'	78%	89%	22%	67%
FIRs	73%	90%	16%	53%

Table 2: Comparison of Sub-Regional and Regional RVSM TLS Achievement

[1] (1) Melbourne, Brisbane, Nauru, Honiara FIRs (AAMA); (2) Port Moresby FIR (AAMA); (3) Indonesian FIRs (AAMA); (4) Sovereign airspaces of China (China RMA); (5) Fukuoka FIR (JASMA); (6) Bay of Bengal FIRs (MAAR); (7) Western Pacific/South China Sea FIRs (MAAR); (8) Pacific Area (PARMO); and (9) North-East Asia Incheon FIR (PARMO).

LHD Reporting

2.70 **Table 3** provides a comparison of the estimated flight hours for airspace analysed by an RMA, divided by the reported LHDs at RASMAG/18 and RASMAG/19, in order to assess reporting.

Airspace	RASMAG 19 LHDs	RASMAG 20 LHDs	RASMAG 20 Flight Hours	RASMAG 19 Reporting Ratio	RASMAG 20 Reporting Ratio
Mongolia	9	18	(NC) 108,773	1:10,876	1:6,042
India/BOB	162	(+38%) 224	(+13%) 2,110,809	1:11,540	1:9,423
WPAC/SCS	133	(+8%) 144	(-5%) 1,511,839	1:11,889	1:10,498
SW Pacific	61	69	(+33%) 795,450	1:9,835	1:11,528
Indonesia	45	39	(NC) 761,390	1:18,570	1:19,522
China	35	(+194%) 103	2,124,690	1:72,512	1:20,628
Japan	48	(-31%) 34	(+7%) 1,276,693	1:22,947	1:37,549
ROK	3	3	492,360	1:164,120	1:164,120
Pyongyang	0	0	(-16%) 5,012	0	0
Total	496	634	(-19%) 9,187,016	1: 22,829	1:14,490
Pacific	16	37	+33% 1,669,658	1:78,130	1:45,125

Table 3: Comparison of Estimated Flight Hours and Reported LHDs (NC = no change)

2.71 There appeared to be several inconsistencies and gaps in the data provided by RMAs to RASMAG/20. AAMA and JASMA both advised they were using a 2012 TSD for Indonesian and Japanese airspace respectively due to validation issues in relation to new data. MAAR advised that they were using a 2014 TSD for Mongolian airspace, but the estimated flight hours had remained the same as 2013. There was an implausible value of 99,984 hours for the Incheon FIR, less than 10% of Japan's figure (in 2014 the figure of 492,360 hours was used).

2.72 From the comparison in **Table 3** (separating the Pacific portion of airspace because it was largely oceanic in nature and not directly comparable), the average LHD occurred approximately every 14,490 flight hours. The number of reported LHDs had substantially increased in the Chinese and Indian FIRs. As approximately 68% and 98% respectively of these LHDs were category E ATC coordination errors, this could be largely attributed to a major improvement in reporting.

2.73 China RMA was congratulated for their efforts in promoting a higher reporting culture, which has revealed a much more accurate picture of the safety problems that need urgent attention.

2.74 An analysis of the rate of LHD reporting in Chinese, Indian, Indonesian, Japanese (with a low reporting ratio of 1: 37,549) and ROK airspace indicated that despite an improvement in reporting, there may be further improvements required to paint a true picture of the risk-bearing incidents (especially within Indian domestic airspace), particularly by implementation of all elements of a 'just culture' environment. The indications included a lack of reporting over an entire continental airspace, very low reporting ratios such as is evident in ROK airspace, and the reporting of LHDs by one RMA that were not reported by another on the same RMA boundary.

Regional Horizontal TLS Compliance

2.75 The following Asia/Pacific En-Route Monitoring Agency (EMAs) reported horizontal risk assessments as follows, which all met the TLS of 5.0×10^{-9} (**Table 4**):

Separation Standard	EMA	Estimated Risk
50NM Lateral Risk	BOBASMA	1.07856×10^{-9}
	JASMA	0.751×10^{-9}
	PARMO	1.35×10^{-9}
	SEASMA	0.045×10^{-9}
30NM Lateral Risk	PARMO	0.53×10^{-9}
50NM Longitudinal Risk	BOBASMA	1.59734×10^{-9}
	PARMO	2.32×10^{-9}
	SEASMA	0.034×10^{-9}
30NM Longitudinal Risk	BOBASMA	0.127551×10^{-9}
	JASMA	0.000578×10^{-9}
	PARMO	3.74×10^{-9}

Table 4: Comparison of Horizontal Risk Assessments

2.76 The application of these horizontal standards met the TLS. The risk for 50NM lateral and 50NM longitudinal separation as calculated by SEASMA was notably lower than other implementations, while the risk for 30NM longitudinal separation was noticeably lower than other EMAs as calculated by JASMA. The meeting noted that the AAMA had not provided any assessments and requested that these be made available for the relevant Australian airspace at RASMAG/21.

Non-RVSM Approved Aircraft

2.77 **Table 5** compared the number of non-RVSM airframes reported by each RMA:

Report	AAMA	China RMA	JASMA	MAAR	PARMO
RASMAG/18	98	43	47	118	15
RASMAG/19	90	33	40	130	19
RASMAG/20	8	45	15	203	26

Table 5: Trend of Non-RVSM airframes Observed by Asia/Pacific RMAs

2.78 Overall, the number of non-RVSM aircraft had decreased by 5% in the past year. This indicated that there was still considerable work to do and APANPIRG Conclusion 24/6 (*Repetitive Non-RVSM Approved Aircraft Operating as RVSM Approved Flights* had not yet been effective.

2.79 Of note was the significant reduction in non-RVSM approved airframes detected by the AAMA and JASMA, but this was unfortunately offset by a large increase in non-RVSM approved aircraft identified by MAAR. This was probably because the most prominent States featured in the list of non-RVSM aircraft all came from the MAAR area of responsibility: India, Thailand, Malaysia, Indonesia and the Philippines.

2.80 Given the large disparity in work (in terms of States/FIRs and aircraft monitored, and problems identified) between the MAAR and the other RMAs, special consideration should be made at RASMAG/20 of support mechanisms for MAAR. While it was accepted that the RMAs work together collaboratively, additional support for MAAR was considered by RASMAG. At the next MAWG, the RMAs and EMAs would discuss how to share capabilities to better support those that have a higher workload.

2.81 RASMAG/20 noted that only Bangladesh had a RASMAG-related APANPIRG Deficiency recorded regarding the requirement of Paragraph 3.3.5.1 of Annex 11 (provision of data for monitoring the height-keeping performance of aircraft). RASMAG/20 agreed to propose the deletion of Bangladesh's Deficiency, but proposed new Deficiencies for non-provision of RVSM approvals safety data by India and the Philippines (**Appendix G**).

2.82 Fiji had failed to provide a December Traffic Sample Data (TSD) for 2013. The TSD for 2014 was not provided in time for PARMO's assessment but it was provided during RASMAG/20.

RMA Monitoring Burden

5.1 **Table 6** compares the outstanding monitoring burden reported by each RMA:

Report	AAMA	China RMA	JASMA	MAAR	PARMO
RASMAG/18	102	141	29	189	118
RASMAG/19	79	87	16	200	37
RASMAG/20	113	105	14	169	20

Table 6: Outstanding Monitoring Burden of Asia/Pacific RMAs

2.83 **Table 6** indicates that the monitoring burden for all the RMAs had remained relatively steady, although PARMO significantly reduced its burden for a second year in a row. MAAR carried 40% of all Asia/Pacific's monitoring burden.

Pakistan - China ATC Coordination Errors Update

2.84 In RASMAG/18, China RMA reported there were communication issues between China Urumqi ACC and the Lahore ACC (Pakistan), and the increasing number of LHDs due to ATC coordination errors. China RMA had a side meeting with the Pakistan delegation during CNS SG/18 meeting in July 2014. China planned to establish Very Small Aperture Terminal (VSAT) stations near the borders to improve the communication and surveillance capability between China and Pakistan. A China – Pakistan Communication Coordination meeting was held in Beijing in May 2015 to discuss the VSAT station project requirement.

Brazilian System of RVSM Compliance Enforcement

2.85 Information from the recent Tenth Meeting of the Regional Monitoring Agencies Coordination Group (RMACG/10, Bangkok, Thailand, 18-22 May 2015), regarding the Brazilian process of enforcement action for non-compliant RVSM aircraft operations was presented for consideration by the Asia/Pacific Region. RMACG/10 had been informed that Brazil managed non-complaint Brazilian registered aircraft within Brazilian airspace with a focus on specific monitoring from within their Air Traffic Flow Management (ATFM) unit and a clear enforcement process.

2.86 Brazil requested other States to support their initiative by providing information to Brazil on non-compliant Brazilian aircraft operating in non-Brazilian airspace. The RMACG noted that other States may also consider implementing similar enforcement strategies.

Observed Use of Strategic Lateral Offset Procedure

2.87 The United States provided a summary of the observed usage of the Standard Lateral Offset Procedure (SLOP) within the Oakland Oceanic FIR for data link aircraft using ADS-C. The purpose of SLOP was to reduce the concentration of operations about 'oceanic' route centrelines, which was characteristic of aircraft with highly accurate navigational systems, such as Global Navigation Satellite Systems (GNSS), thus reducing the risk of collision.

2.88 **Table 7** presented the percentage of flights that were observed to be on centreline, 1 NM right offset, and 2NM right offset SLOP procedures (with at least three consecutive ADS-C positions) during April 2014.

Observed SLOP	Number of operations	Percentage
Centreline	3,015	72.2%
1NM right of centreline	966	23.1%
2NM right of centreline	193	4.6%
Total	4,174	

Table 7: Observed SLOP usage within Oakland FIR, April 2014

2.89 The analysis showed that the observed SLOP usage was below the optimal recommended behaviour, where crews are encouraged to use all three options equally, including the centreline. The meeting noted that SLOP was not relevant on User Preferred Routes (UPR).

2.90 The Chairman thanked PARMO for the excellent work, noting that it was the intention of the AAMA to facilitate similar work (results would be provided at RASMAG/21 if possible).

Comparison of Aircraft Group ASE in the Asia/Pacific Region

2.91 The MAAR presented a comparison chart of aircraft group Altimetry System Error (ASE) measured by ground-based height monitoring systems from RMAs in the Asia/Pacific region. The data comparison for A320, A330, A340, A346, A380, B737NX, B744, B748, B767, B772, B773, B787, and MD11 groups is illustrated in **Figure 6**.

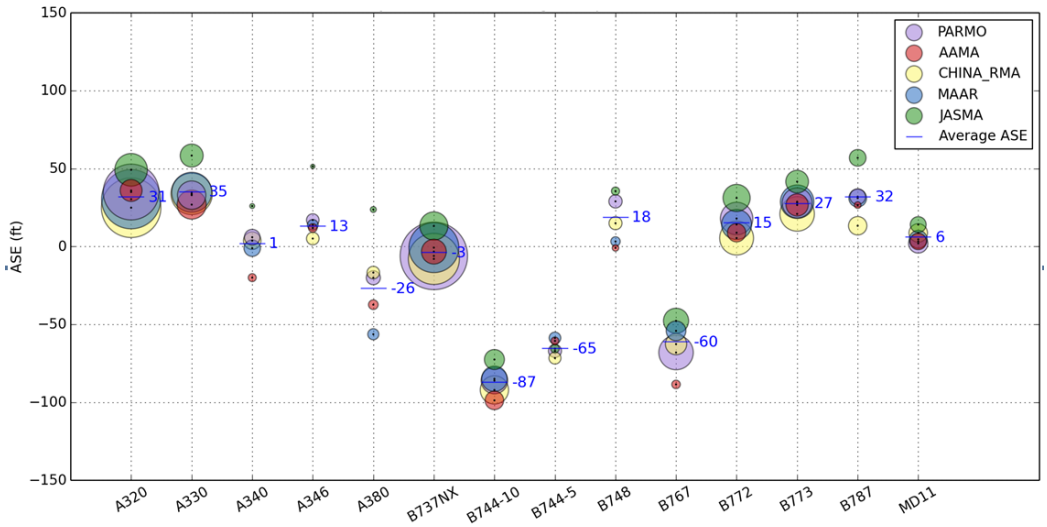

Figure 6: Comparison of Aircraft Group ASE in the Asia/Pacific Region, 2014

2.92 The centre represented the average ASE for each monitoring group observed by each RMA's ground-based monitoring systems, while the circle area represented the number of aircraft monitored by each RMA. An overall average for each aircraft group was calculated and depicted as a blue horizontal line along with the corresponding value.

2.93 The meeting observed from Figure 16 that the average ASE of the B744-10 monitoring group was in excess of 25m (80ft), the limit specified in Minimum Aircraft System Performance Specification (MASPS). The chart also showed that the average ASE values of JASMA were generally higher than those of other RMAs, which was consistent with other results.

ADS-B Out Data Height Reference for Monitoring

2.94 The United States noted that RASMAG, MAWG and RMACG had previously discussed the difficulty in using ADS-B Out data for estimating aircraft height-keeping performance. A determination of the aircraft reference height was possible in some regions, but in some areas it is not possible to determine whether Height Above Ellipsoid (HAE) or Mean Sea Level (MSL) was used as the reference frame.

2.95 One of the key data fields in ADS-B Out messages used to estimate aircraft ASE was the 'Geometric Height Difference from Barometric' subfield. Both the FAA and EUROCONTROL have certification guidance for ADS-B Out installations that guaranteed HAE was used in accordance with guidance in RTCA DO-260A and RTCA DO-260B. The ICAO Aeronautical Surveillance Panel (ASP) Technical Subgroup (TSG) were proposing changes to ICAO Doc 9871 and RTCA DO-260B to facilitate the use of HAE only.

Competent Airspace Safety Monitoring Organizations List Review (WP31)

2.96 ICAO presented the RASMAG *List of Competent Airspace Safety Monitoring Organizations* for review and update (**Attachment A**).

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) note paragraph 2.15 (Draft Conclusion RASMAG/20-1: Data Link Performance Reporting Template and Guidance);

c) note paragraph 2.16 Draft Conclusion RASMAG/20-2: Data Link Performance Guidelines;

d) note paragraph 2.17 Draft Conclusion RASMAG/20-3: ANS Deficiencies Relating to Data Link Performance Monitoring and Analysis;

e) note paragraph 2.68 Draft Conclusion RASMAG/20-4: Asia/Pacific LHD Hot Spot Action Plans; and

f) discuss any relevant matters as appropriate.

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