International Civil Aviation Organization

The Twenty-First Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/21)

Bangkok, Thailand, 14-17 June 2016

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

REGIONAL SAFETY MONITORING ASSESSMENT

(Presented by the Secretariat)

SUMMARY

This paper presents an overview of safety assessment results from a regional perspective.

1. INTRODUCTION

1.1 Since APANPIRG/22, RASMAG has provided APANPIRG with an overall assessment of Asia/Pacific FIR RVSM TLS Compliance in order to meet Asia/Pacific Objective 1 (*Airspace Safety Monitoring to Achieve Regional Target Level of Safety - TLS*).

1.2 At RASMAG17, the meeting agreed to focus much more on operational issues than technical capability. The following was an extract from the RASMAG/17 report:

> *IATA expressed support for the operational emphasis and requested RMAs to provide material that could be used to assist pilot education. The meeting noted that ANSP education and information on detailed recommended operational responses was also necessary to reduce this form of risk. The meeting agreed that a strengthened focus on the minimization of operational risk was appropriate.*

1.3 RASMAG/17 agreed to a new task (17/4), which required AAMA, PARMO, IATA, and IFALPA to conduct an analysis of material and processes required from Regional Monitoring Agencies (RMAs) to assist airline/ATC education and responses on minimisation of operational errors, including information on hot spots[1] and recommended operational responses.

2. DISCUSSION

Regional RVSM TLS Compliance

2.1 **Figure 1** is the state of Asia/Pacific regional RVSM Target Level of Safety (TLS) compliance reported to RASMAG/20:

[1] Defined for the purposes of this paper as areas where there were more than two proximate (100NM or less) risk bearing occurrence.

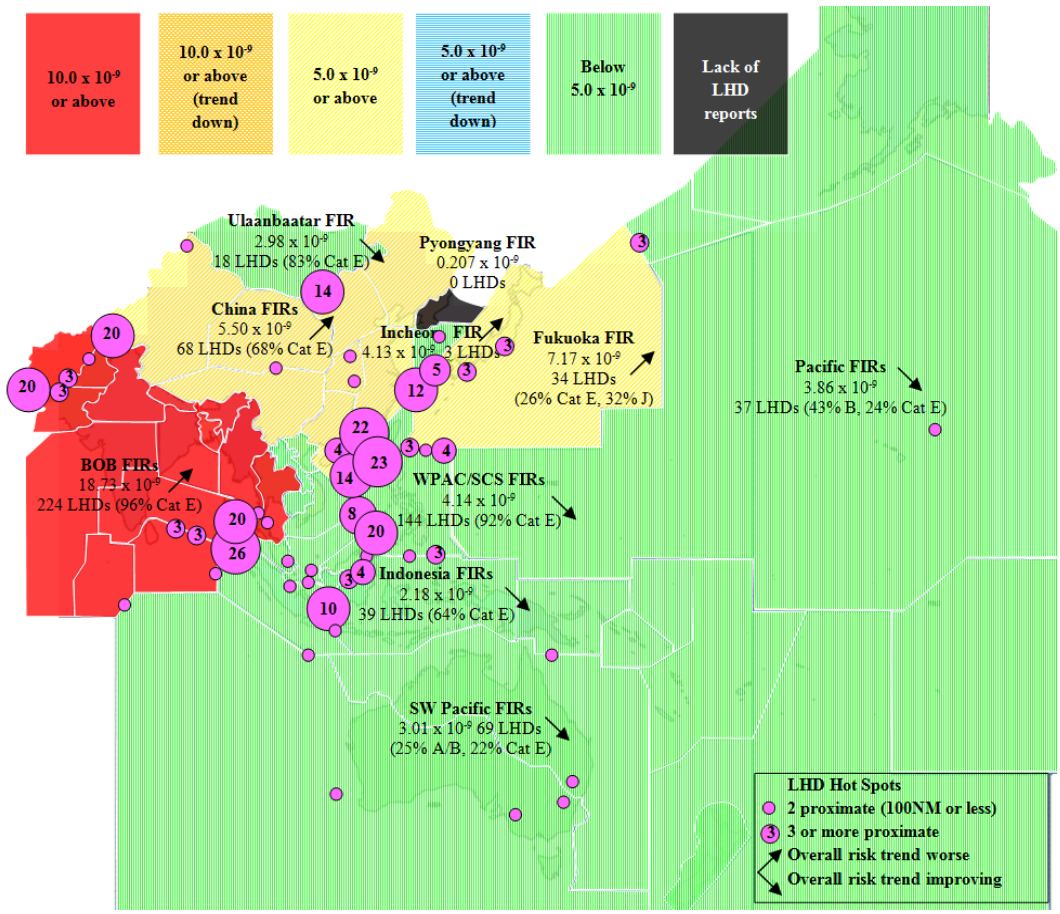

Figure 1: Asia/Pacific TLS compliance reported to RASMAG/20

2.2 **Figure 2** is the RASMAG/21 regional RVSM Target Level of Safety (TLS) compliance:

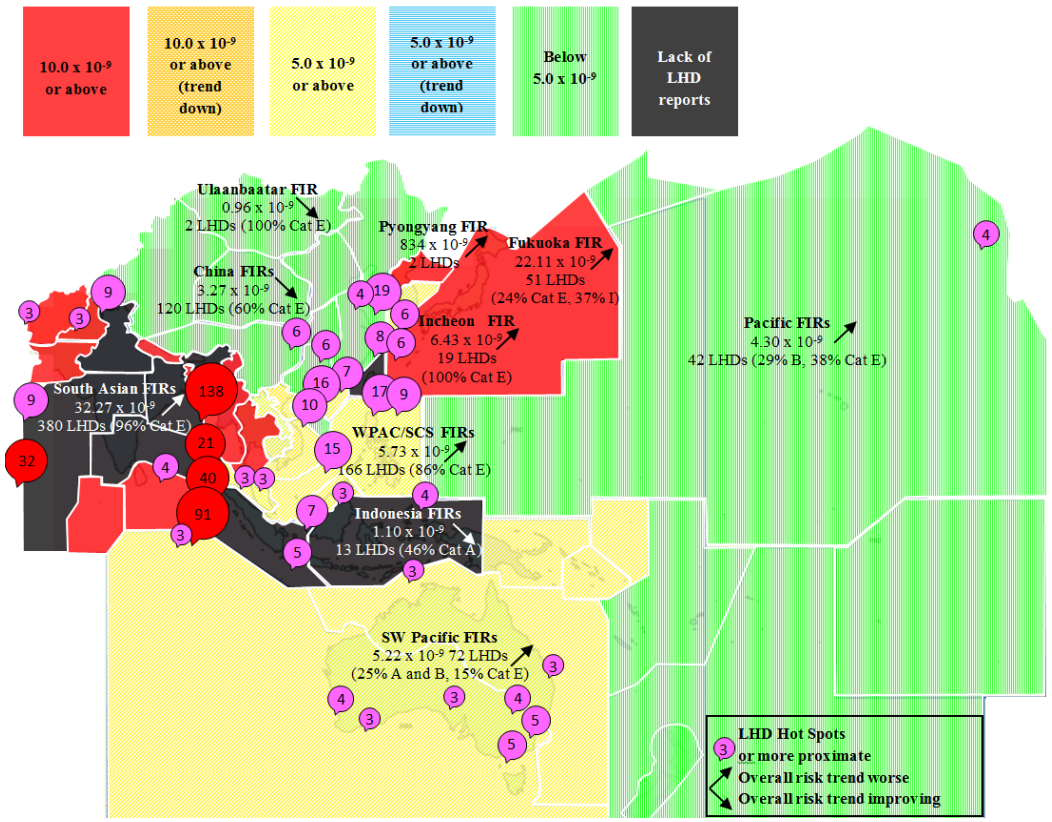

Figure 2: Asia/Pacific TLS compliance reported to RASMAG/21

2.3 **Figures 1 and 2** indicated the following sub-regional regional RVSM trends.

- **South Asia**: The South Asian FIRs exhibited the highest risk area in the Asia/Pacific, with troubling estimated risk levels more than six times the TLS, and major hot spots between the Indian FIRs and Bangladesh, Myanmar, Malaysian and Indonesian FIRs. These hot spots had been previously identified in RASMAG/20, and had increased in risk since then, despite plans for operational improvement.

  India has reportedly commenced plans for the installation of Automatic Dependent Surveillance (ADS-B) and Very High Frequency (VHF) communications in the Great Nicobar Islands but this would not solve the systemic issues evident in the interface between India and Bangladesh/Myanmar airspace in the northern Bay of Bengal (BOB) area. RASMAG needs to highlight this problem to the Director Generals of the States concerned to ensure the highest priority is given to urgent improvements in both system capability and human performance.

  Note: APANPRG Conclusion 26/28 Asia/Pacific LHD Hot Spot Action Plans refers – BOBASIO (Bay of Bengal Arabian Sea Indian Ocean) in agreement with MAAR has been identified as the scrutiny group leader for the Kolkata/Chennai FIRs interface with Yangon/Kuala Lumpur.

  The major hot spot on the western boundary of the Indian FIRs and the African FIRs (and to a lesser extend with the Muscat FIR) can be partly explained by the temporary closure of the Sana'a FIR and contingency routes during 2015. However, Large Height Deviation (LHDs) continues to be reported in this area, suggesting the need for closer collaboration between India and the concerned African States, including risk mitigation measures such as the implementation of ATS Inter-facility Datalink Communications (AIDC).

- **Southeast Asia**: The Southeast Asian area has also not met the TLS, with a slow degradation in compliance that can largely be attributed to the poor performance of the Manila FIR, with numerous category E LHDs (ATC transfer of control coordination errors due to human factors). The Philippines has had an improvement plan to modernize their Air Traffic Control (ATC) system for some years but this has not yet yielded any improvement in performance. RASMAG needs to highlight this problem to the Director General of the Philippines to ensure the highest priority is given to urgent changes within the Manila FIR.

  Note: APANPRG Conclusion 26/28 Asia/Pacific LHD Hot Spot Action Plans refers – MAAR has been identified as the scrutiny group leader for the Manila FIR interface with Fukuoka/Hong Kong China/ Singapore/Ujung Pandang FIRs.

- **East Asia**: Chinese airspace had shown marked improvement to meet the TLS, even though a large increase in LHD reports was noted. It is evident that a concerted effort had been made by China to systematically mitigate identified hot spot risks. Notwithstanding this, there were several significant hot spots still evident – in the interface with the Lahore FIR (Pakistan), Fukuoka FIR (Japan), and Manila FIR (Philippines).

  China RMA has again identified hot spot areas between mainland China and Hong Kong, China's airspace that were also evident in 2014.

  Note: APANPRG Conclusion 26/28 Asia/Pacific LHD Hot Spot Action Plans refers – China RMA has been identified as the scrutiny group leader for the Hong Kong FIR interface with Guangzhou/Sanya FIRs, and the Urumqi FIR interface with Lahore FIR.

Japanese airspace had also been adversely affected by the poor performance of the Manila FIR so this has contributed to the failure to meet TLS within the Fukuoka FIR. However some 35% of LHDs were caused by turbulence in a localised area southwest of Japan, which suggested a greater emphasis on special meteorological forecasting in that area was required so that avoidance action may be taken, or a temporary reversion to 2,000ft separation made if appropriate.

Mongolian airspace met TLS. However there was an absence of LHD reports that would typically be expected at a higher level in this airspace.

The Pyongyang FIR did not meet TLS, although the number of LHDs was only two. It should be noted that these were the first LHD reports from this FIR for years, which indicates the successful coordination work being conducted with China.

The Incheon FIR did not meet TLS, due to a number of reported LHDs between the Pyongyang FIR and the Incheon FIR. Notably, analysis of seven LHDs reported by China and Japan indicated a severe safety risk in the AKARA corridor.

Note: APANPRG Conclusion 26/28 Asia/Pacific LHD Hot Spot Action Plans refers – PARMO has been identified as a scrutiny group leader for Incheon FIR AKARA Corridor interface with Shanghai/Fukuoka/Taibei FIRs.

- **Southwest Pacific**: Southwest Pacific FIRs failed to meet the TLS by a very small margin. Category A and B flight crew errors were the predominant causes of LHDs, which had no specific pattern that could be identified by AAMA.
- **Pacific**: Pacific airspace met the TLS, although the compliance level was slowly deteriorating.

2.4 **Table 1** provides a comparison of Asia/Pacific RVSM risk as a measure against the TLS, either by RMA 'sub-region[2]' (Conclusion 20/4 − *Asia/Pacific Performance Metrics* refers), or by FIRs. There had been significant degradation in the region's performance meeting the TLS. This result could be even worse if the two Indonesian FIRs (which reported compliance with TLS) were found on further evaluation to have not achieved TLS.

2.5 The dramatic reduction in TLS compliance of Asia/Pacific FIRs can be largely explained by the significantly increased reporting in many FIRs, which is showing the 'hot spot' problem areas that had been previously unidentified.

	RASMAG18	**RASMAG19**	**RASMAG20**	**RASMAG21**
RMA 'sub-regions'	89%	22%	67%	33%
FIRs	90%	16%	53%	32%

Table 1: Comparison of Sub-Regional and Regional RVSM TLS Achievement

[2] (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

2.6 **Table 2** provides a comparison of the estimated flight hours for airspace analysed by an RMA, divided by the reported LHDs at RASMAG/20 and RASMAG/21, in order to assess reporting.

Airspace	RASMAG 20 LHDs	RASMAG 21 LHDs	RASMAG 21 Estimated Flight Hours	RASMAG 20 Reporting Ratio	RASMAG 21 Reporting Ratio
Mongolia	18	*2	116,664	1: 6,042	1:58,332
Indonesia	39	13	343,100	1: 19,522	1:26,392
Japan	34	51	1,101,469	1: 32,396	1:21,597
China	103	120	2,285,269	1:20,628	1:19,043
SW Pacific	69	72	821,496	1:11,528	1:11,410
WPAC/SCS	144	166	1,769,352	1: 10,498	1:10,659
ROK	3	19	178,800	1:164,120	1:9,410
India/BOB	224	380	2,326,493	1: 9,423	1:6,122
DPRK	0	2	3,387	0	1:1,693
Total	634	825	8,946,030	1:14,214	1:10,844
Pacific	37	42	1,670,790	1:45,125	1:39,780

Table 2: Comparison of Estimated Flight Hours and Reported LHDs (NC = no change)

*MAAR indicates that there was only one report at position NIXAL

2.7 The RASMAG/21 analysis shows major improvements in reporting for Chinese, DPRK, Japanese and ROK airspace, which is probably the result of State and RMA intervention. The States and RMAs concerned should be encouraged for this effort, which is producing a much clearer picture of risk.

2.8 Australian/SW Pacific airspace has demonstrated a consistent result over several years, indicating a mature reporting culture in the ratio band of 1:10,000 – 1:12,000. Therefore a ratio at or below this band in high density airspace is assumed to represent a good reporting culture (but it may also be due to a large number of incidents that indicate major safety problems). A ratio 50% or more above this band (1:18,000+) in high density airspace may indicate a lack of safety reporting. Therefore there is probably further improvement possible regarding Chinese and Japanese airspace.

2.9 The RASMAG/20 report had described a lack of reporting in several airspaces:

> *5.29 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.*

2.10 **Figures 3**, **4**, **5** and **6** provide a comparative analysis between the Australian/SW Pacific, Chinese, Indian and Indonesian FIRs.

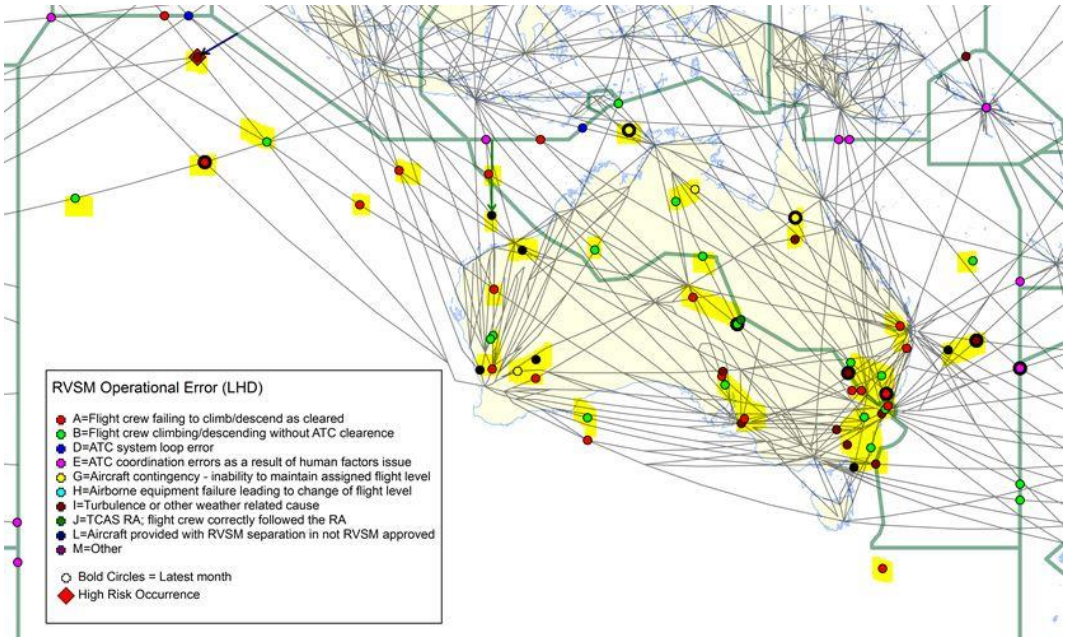

Figure 3: LHD Reporting – Australian FIRs (internal LHDs highlighted)

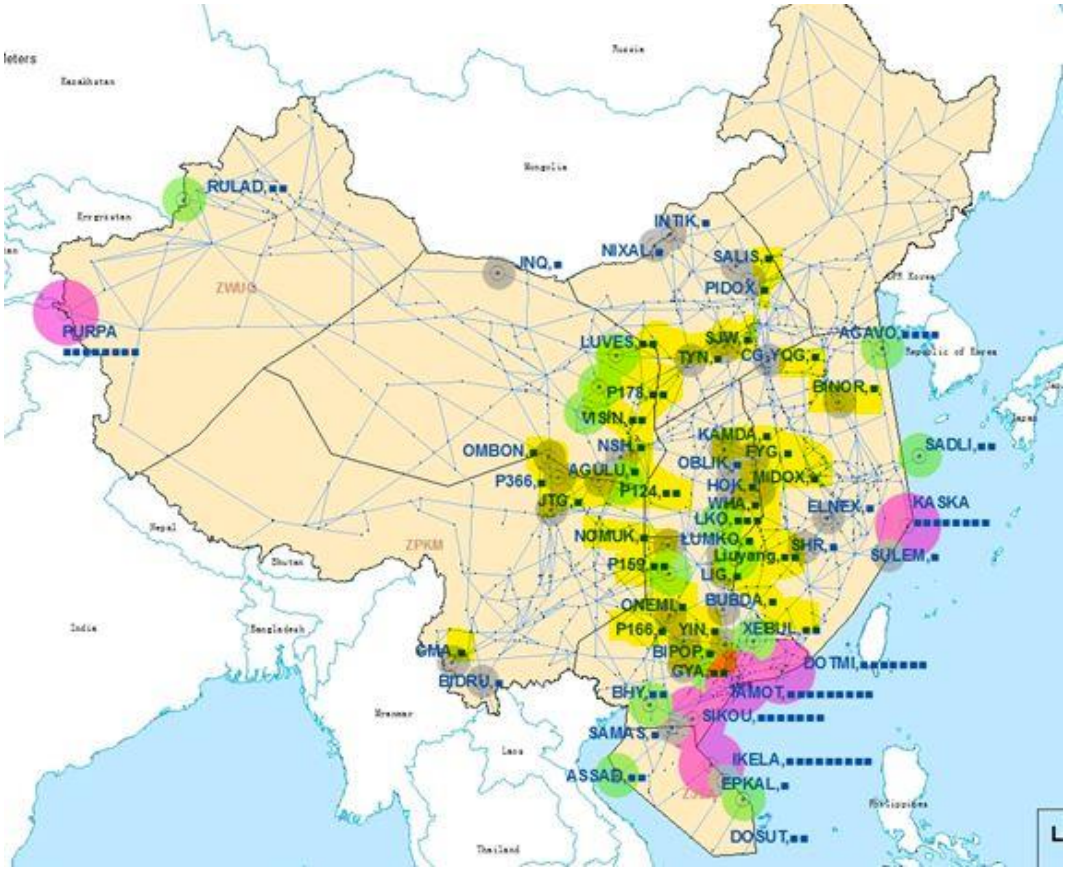

Figure 4: LHD Reporting – Chinese FIRs (internal LHDs yellow highlighted)

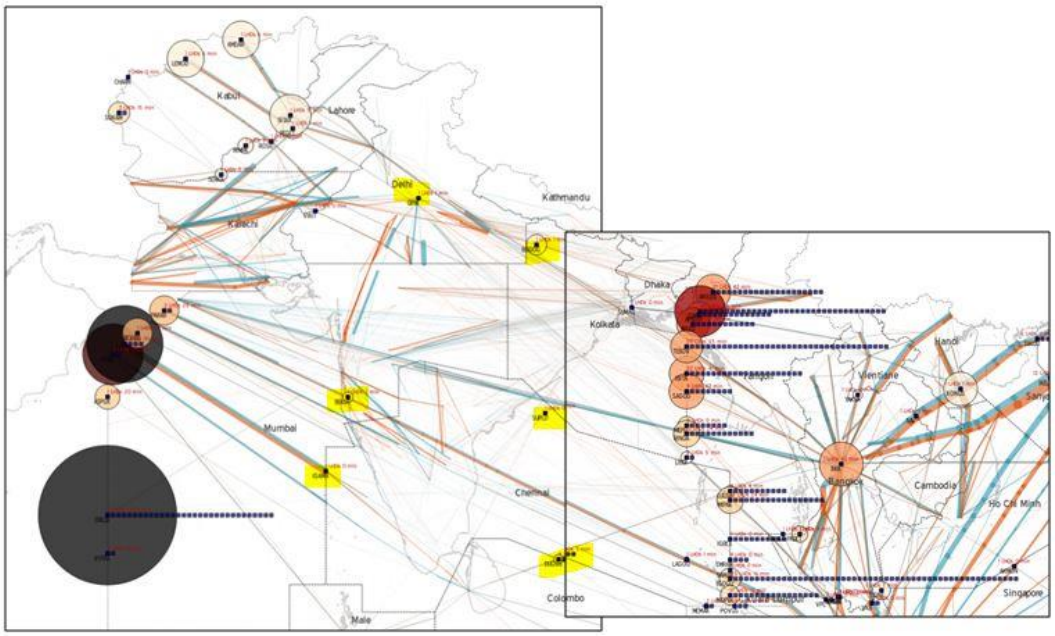

Figure 5: LHD Reporting – Indian FIRs (internal LHDs highlighted)

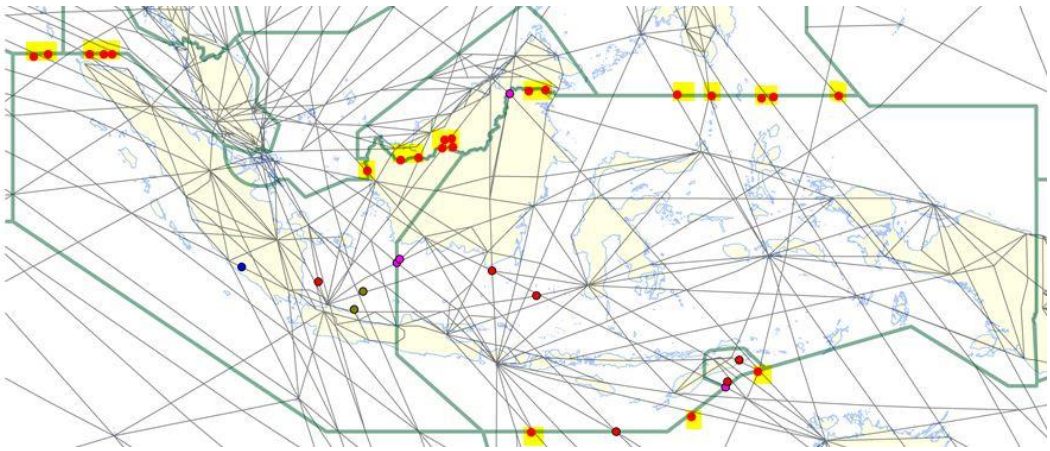

Figure 6: LHD Reporting – Indonesian FIRs (boundary reports not reported by Indonesia highlighted).

2.11 Australian airspace analysis revealed about 77% of LHDs were within the Brisbane and Melbourne FIR boundaries, while China's data improved from 2014 to indicate about 40% of LHDs to be 'internal'. While the Australian, Chinese, Indian and Indonesian FIRs all have different operating characteristics, it is noticeable that within the Indian and Indonesian FIRs there were very few LHDs being reported. Less than 3% of LHD reports were made within the boundary of Indian FIRs. This was acknowledged as being statistically not possible by the Indian expert at RASMAG/20, and may be an indication of substantial under-reporting.

2.12 On the other hand, approximately 85% of boundary reports that were made by adjacent States appeared to have been not reported by Indonesia, The AAMA report noted that:

> *2.2 Additionally, the AAMA observed what appeared to have been a reduction in reporting compared to previous years which could not be explained. As a result, the AAMA was unable to effectively validate monthly assessments with any confidence.*

2.13 The Indonesian reporting ratio had deteriorated substantially from 1:19,522 to 1:26,392. This was more than double that which might be expected in a mature reporting culture within higher density airspace. Moreover, the proportion of missing boundary reports indicates that the number of unreported events could be as much as six times more than those that were reported, underlining the lack of confidence by AAMA in Indonesia's reporting at times during the year. Recalling that both India and Indonesia were noted by RASMAG/20 as having problems with reporting, RASMAG21 should discuss a means of encouraging an increase in safety reporting in these States.

2.14 Regarding Mongolian airspace, MAAR indicated that there was only one report at position NIXAL on the boundary with China, whereas the China RMA reported a second LHD at position INTIK which was apparently not reported to MAAR. The Mongolian reporting ratio was the most difficult to explain. While improved ATC surveillance and procedures partially account for the dramatic reduction in reported LHDs from 18 to only two, the ratio is still much worse than what might be expected, even accounting for a medium density airspace. Therefore some action should be taken by MAAR to discuss this with Mongolia, to assess if there were any systemic reporting issues.

2.15 It was noted that despite the enhanced reporting from the Incheon FIR, China RMA reported four LHDs on the boundary with the Shanghai FIR at position AGAVO, which did not appear in the Incheon FIR analysis. Moreover, there were three LHDs reported by JASMA (two by China RMA) at position SALDI, which was within the Incheon FIR along the 'AKARA Corridor'. These were not reported by Incheon (presumably because the aircraft were not on Incheon's frequency). In the same AKARA corridor near position ONIKU another four LHDs were reported by JASMA, several of them caused by severe turbulence. Therefore it is probable that the operation of a Flight Level Orientation Scheme (FLAS) with three different ATC units providing services within the same airspace had the potential for very high risk levels if vertical separation cannot be assured.

Non-RVSM Approved Aircraft

2.16 **Table 3** 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	234	26
RASMAG/21	5	6	15	106	11

Table 3: Trend of Non-RVSM airframes Observed by Asia/Pacific RMAs

2.17 Aircraft from Asia/Pacific States that were observed for a significant length of time by the RMAs were as follows:

- AAMA: New Zealand aircraft registered ZKJTQ;
- China RMA: Hong Kong, China registered aircraft BLBD and Republic of Korea registered aircraft HL8049, HL8050 (both Jeju Air) and HL8056 (T'way Air);
- JASMA: Republic of Korea registered aircraft HL8049, HL8050 and HL8056;
- MAAR: Indian registered aircraft totalled 60, of which 26 had expired approvals and 34 had no RVSM approval, and the following aircraft from other States which were confirmed as being non-RVSM approved:
  - Australian aircraft registered VHFIX;
  - Indonesian aircraft registered PKMYI; and
  - Vietnamese aircraft registered VNB444; and
- PARMO: Chinese registered aircraft LKE (Lucky Air).

2.18 Overall, the trend was rapidly dropping, with a 56.4% reduction in observed non-compliant airframes from 2014 to 2015. This suggests that the proactive work of State authorities, RMAs and APANPIRG *Conclusion 24/26 Repetitive Non-RVSM Approved Aircraft Operating as RVSM Approved Flights* were having a positive effect. RASMAG would recall that *Conclusion 24/26* urged Asia/Pacific States, except where a specific non-RVSM operation is authorized – to deny entry to operate within RVSM airspace for aircraft that have been confirmed as non-RVSM approved over a significant length of time, or by intensive checking, and was in accordance with Annex 6:

> *7.2.8 All States that are responsible for airspace where RVSM has been implemented, or that have issued RVSM approvals to operators within their State, shall establish provisions and procedures which ensure that appropriate action will be taken in respect of aircraft and operators found to be operating in RVSM airspace without a valid RVSM approval.*

2.19 Notwithstanding the positive downward trend, the large number of Indian registered aircraft found to have no RVSM approval may indicate systemic issues. In 2014 India was observed to have 73 aircraft registrations found operating without proof of RVSM approval, so this appeared to be a long-term problem. Therefore, India should be considered for an APANPIRG Deficiency, for not meeting the requirements of Annex 6 (paragraph 7.2.8).

RMA Monitoring Burden

2.20 **Table 4** compares the outstanding monitoring burden reported by each RMA:

Report	AAMA	China RMA	JASMA	MAAR	PARMO
RASMAG/19	79	87	16	200	37
RASMAG/20	113	105	14	176	20
RASMAG/21	85	72	14	172	20

Table 4: Outstanding Monitoring Burden of Asia/Pacific RMAs

2.21 **Table 4** indicates that all RMAs have been either reducing their monitoring burden or the burden is at the same level as 2015, with the overall Asia/Pacific burden reducing by 15.2% (428 to 363). The MAAR burden still constitutes approximately 47.4% of the Asia/Pacific's total, so it is clear that the States it serves need to take increased action to ensure aircraft are monitored in accordance with Annex 6 requirements.

2.22 **Table 5** indicates the States that had relatively high remaining monitoring burdens:

State	2014%	Requirement	Burden	2015%
Solomon Is. (AAMA)	0%	1	1	**100%**
Tonga (PARMO)	0%	1	1	**100%**
Bhutan (MAAR)	75%	4	3	**75%**
Bangladesh (MAAR)	68%	20	13	**65%**
Pakistan (MAAR)	66%	42	27	**64%**
DPRK (China RMA)	89%	10	6	**60%**
Indonesia (AAMA)	61%	119	57	**48%**
Myanmar (MAAR)	0%	11	5	**46%**
Malaysia (MAAR)	39%	39	17	**44%**
Thailand (MAAR)*	41%	108	46	**43%**
Philippines (MAAR)	48%	49	15	**31%**
China (China RMA)	29%	311	66	21%
New Zealand (PARMO)	17%	27	7	25%
ROK (PARMO)	15%	59	11	18%
India (MAAR)	18%	197	33	17%
Australia (AAMA)	18%	198	27	14%
Japan (JASMA)	10%	148	14	10%

Table 5: Comparison of State Monitoring Burden

2.23 **Table 5** indicated that the following States could be considered for remedial action, for not meeting the requirements of Annex 6 (paragraph 7.2.7), in respect of a monitoring burden of more than 25% airframes remaining to be monitored:

- Bangladesh;
- Bhutan;
- DPRK;
- Indonesia;
- Malaysia;
- Pakistan;
- Thailand; and
- The Philippines.

2.24 Myanmar, the Solomon Islands and Tonga were not considered deficient in 2016 due to their small fleet size and the fact that this the burden had only occurred since 2015 (i.e.: it was not necessarily indicating a systemic problem). However these States should be recommended for an APANPIRG Deficiency in 2017 if the situation did not improve.

2.25 Although the Philippines had improved its burden since 2014 (from 48% to 31%), the percentage remained high for a nation with significant aviation activity.

2.26 In addition, India and Thailand should be urged to provide the required data to the MAAR as these States did not provide 2015 RVSM Approval Data. India also did not provide 2014 RVSM Approval Data, so remedial action needs to be considered by RASMAG in terms of the following APANPIRG Conclusions:

- *19/15 (Enhanced communications between States and RVSM RMAs): That, noting the Annex 6 provisions for the global long term monitoring of airframes used in RVSM operations and the critical role of Asia/Pacific RVSM Regional Monitoring Agencies (RMAs) in monitoring the safety of RVSM operations, the Regional Office draw the attention of States to the Long Term Height Monitoring Actions promulgated by RASMAG. In particular, States are encouraged to immediately strengthen relationships with their respective RMAs to ensure that information in relation to RVSM approval status is continuously available to RMAs.*
- *23/15 (Long-Term Non- RVSM Approved Aircraft): That, States are urged in a timely manner to (a) update Regional Monitoring Agency data on RVSM approved aircraft; and (b) respond to, and take action regarding RMA queries on long-term data indicating that aircraft were not approved.*
- *23/16 (Safety Monitoring Data Provision): That, recognizing the importance of data collection for safety monitoring purposes, States be urged to (a) provide data as requested by Regional and En-Route Monitoring Agencies (RMA/EMA) in accordance with the RMA Manual (Doc 9937) and EMA Manual (either through a formal agreement or an informal understanding as appropriate); and (b) provide available ADS-B data for height-keeping monitoring to RMAs when requested.*

Regional Horizontal TLS Compliance

2.27 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 6**):

Separation Standard	**EMA**	**Estimated Risk**
50NM Lateral Risk	BOBASMA	1.70×10^{-9}
	JASMA	0.49×10^{-9}
	SEASMA	0.66×10^{-9}
30NM Lateral Risk	PARMO	0.51×10^{-9}
50NM Longitudinal Risk	BOBASMA	3.97×10^{-9}
	PARMO	2.32×10^{-9}
	SEASMA	0.38×10^{-9}
30NM Longitudinal Risk	BOBASMA	0.14×10^{-9}
	JASMA	0.04×10^{-9}
	PARMO	3.74×10^{-9}

Table 6: Comparison of Horizontal Risk Assessments

2.28 The application of all horizontal standards easily met the TLS. In addition, JASMA's assessment of the 10 minute longitudinal standard without Mach Number Technique was also within TLS at 3.96×10^{-9}.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) discuss the extremely elevated safety issues concerning:

i) Indian airspace (western and eastern FIR boundaries);

ii) Philippines airspace;

iii) the Pakistan-China interface, and

iv) the AKARA Corridor (WP13 refers);

c) discuss the possible lack of reporting within Indian, Indonesian and Mongolian airspace for remediation action;

d) review the long-term non-RVSM airframes identified for corrective action;

e) note the downward trend of aircraft operating without proof of RVSM approval

f) discuss the remedial action required by India regarding aircraft found operating without proof of RVSM approval (Annex 6, paragraph 7.2.8 refers);

g) discuss the remedial action required by the following States, for not meeting the requirements of Annex 6 (paragraph 7.2.7), in respect of the monitoring burden:

i) Bangladesh;

ii) Bhutan;

iii) DPRK;

iv) Indonesia;

v) Malaysia;

vi) Pakistan;

vii) Thailand; and

viii) The Philippines.

h) discuss the remedial action required by India and Thailand to ensure RVSM Approvals Data is provided to the RMA;

i) note that 30NM and 50NM horizontal separation application easily met TLS (underlining that these separation standards were conservative);

j) consider the establishment of informal sub-regional scrutiny groups managed by States, Air Navigation Service Providers, and airspace users, with input from RMAs to address operational errors and develop remedial actions (including encouraging States to work to establish a reporting culture that ensures capture of all safety related incidents within their airspace effectively and to transmit the LHDs identified in the reports to the relevant RMA/EMA in a timely manner); and

k) discuss any other relevant matters as appropriate.

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