ELEVENTH MEETING OF THE REGIONAL AVIATION SAFETY GROUP - ASIA AND PACIFIC REGIONS (RASG-APAC/11)

(Video Teleconference, 25-26 November 2021 at 10:00-13:00 hrs. Bangkok Time, UTC+7)

Agenda Item 4: ICAO / Member State / Industry Presentations

RASMAG/26 AND ATMSG/9 OUTCOMES

(Presented by the Secretariat)

SUMMARY

This paper provides a summary of the key outcomes from the Twenty-Sixth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/26) and Ninth Meeting of the Air Traffic Management Sub-Group (ATM/SG/9), and its contributory bodies.

1. INTRODUCTION

1.1 The Twenty-Sixth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/25) was held from 27 to 30 October 2020 by Video Teleconference (VTC) from the ICAO Asia and Pacific Regional Office, Bangkok, Thailand. RASMAG is a Sub-Group of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG)

1.2 A total of 119 participants were registered for RASMAG/26 from Australia, Bangladesh, Cambodia, China, Hong Kong China, Fiji, India, Indonesia, Japan, Malaysia, New Zealand, Pakistan, Philippines, Republic of Korea, Singapore, Somalia, Sri Lanka, Thailand, United States of America, Viet Nam, CANSO, IATA, IFALPA IFATCA and ICAO.

1.3 A total of 40 Working Papers (WPs), six Information Papers (IPs) and three flimsies were presented to the meeting.

1.4 The RASMAG/26 Report and all meeting documentation is available on the ICAO Asia/Pacific Regional Office meetings web-pages at:

https://www.icao.int/APAC/Meetings/Pages/default.aspx.

1.5 The Ninth Meeting of the Air Traffic Management Sub-Group (ATM/SG/9) of APANPIRG was held by Video Teleconference (VTC) from the ICAO Asia and Pacific Regional Office, Bangkok, Thailand.

1.6 The meeting was attended by 292 registered participants from 27 States, two Special Administrative Regions of China and six International and Air Traffic Management-related organizations, including Afghanistan, Australia, Bangladesh, Bhutan, Brunei Darussalam, China, Hong Kong China, Macao China, Fiji, India, Indonesia, Japan, Kiribati, Lao People's Democratic Republic (PDR), Malaysia, Maldives, Mongolia, Myanmar, Nepal, New Zealand, Pakistan, Philippines, Republic of Korea (ROK), Singapore, Sri Lanka, Tajikistan, Thailand, USA, Viet Nam, CANSO, IATA, IFAIMA, IFALPA, IFATCA, and ICAO.

1.7 A total of 36 Working Papers (WPs), ten Information Papers (IPs), three flimsies and three presentations were considered by the meeting.

1.8 The full ATM/SG/9 meeting report and all associated papers and presentations are available on the ICAO Asia/Pacific (APAC) Regional Office website at:

https://www.icao.int/APAC/Meetings/Pages/2021-ATM-SG-9.aspx

2. DISCUSSION

Relevant FIT-Asia and RASMAG Outcomes

Datalink Performance

2.1 ICAO provided RASMAG/26 with a summary of the outcomes from the Eleventh Meeting of the FANS Interoperability Team-Asia (FIT-Asia/11, 23 – 26 August 2021).

2.2 The lower number of data link Problem Reports (PRs) submitted to the FIT-Asia Central Reporting Agency (CRA) in the 2020-2021 reporting period (27, compared with 66 in 2019-2020) reflected the decrease in air traffic due to the impact of the COVID-19 pandemic.

2.3 The FIT-Asia/11 meeting had discussed the need for adoption in the Asia/Pacific Region of a common Future Air Navigation Services 1/A (FANS1/A) Controller-Pilot Data Link Communications (CPDLC) Latency Timer value of 300 seconds, as was currently being successfully trialled in the North Atlantic (NAT) Region. The RASMAG/26 meeting agreed to the technical ***Conclusion RASMAG/26-1: FANS1/A CPDLC Latency Timer Value***, which followed up on safety requirement SR-15 of ICAO Doc 9869 *Performance-Based Communications and Surveillance (PBCS) Manual* and proposed a globally standardized latency timer value be implemented in the APAC Region, on a trial

2.4 China had presented the Asia/Pacific Region Combined PBCS Monitoring Report to the FIT-Asia/11 meeting. The report highlighted consolidated performance data and issues associated with Automatic Dependent Surveillance - Contract (ADS-C) Actual Surveillance Performance (ASP) and CPDLC Actual Communications Performance (CPDLC) for the region.

2.5 Overall ASP for the region had met the 95% criterion of the Required Surveillance Performance 180 (RSP180) specification, but fell marginally below the 99.9% criterion[1]. While the volume of data counts had significantly reduced in 2020, the trend of regional performance in both the 95% and 99.9% criteria had generally improved.

2.6 Overall ACP for the region met the 95% criterion (**Table 1**). ACP for most FIRs fell marginally below the 99.9% criterion, but several FIRs failed to meet it[2]. In the first half of 2020 one FIR did not meet the 95% criterion for Actual Communications Technical Performance (ACTP) and two FIRs failed to meet the 99.9% criterion. In the second half of the year all reporting FIRs met the 95% criterion, but four did not meet the 99.9% criterion. Pilot Operator Response Time (PORT) performance requirements were not met by a number of aircraft operators.

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[1] ASP Criteria: 95% of transactions completed within 90 seconds, 99.9% completed within 180 seconds

[2] ACP Criteria: 95% of transactions completed within 180 seconds, 99.9% completed within 210 seconds.

ACTUAL COMMUNICATION PERFORMANCE - FIR AGGREGATE (ALL MEDIA TYPES)										
Region	Asia-Pacific Region									
Performance Criteria	RCP240									
Time Period	2020 January-June					2020 July - December				
Colour key: Meets criteria / Under criteria	Message Counts	ACP Criteria		ACTP Criteria		Message Counts	ACP Criteria		ACTP Criteria	
		95%	99.90%	95%	99.90%		95%	99.90%	95%	99.90%
FIR		% <= 180sec	% <= 210sec	% <= 120sec	% <= 150sec		% <= 180sec	% <= 210sec	% < = 120sec	% <=150sec
PAZA	70739	99.12%	99.33%	99.21%	99.50%	68090	99.06%	99.32%	99.24%	99.48%
RJJJ	34547	99.57%	99.78%	99.65%	99.75%	31739	99.60%	99.76%	99.63%	99.73%
KZAK	192062	99.31%	99.53%	99.65%	99.77%	142934	99.46%	99.64%	99.72%	99.84%
NFFF	3764	99.62%	99.81%	99.81%	99.89%					
NTTT	2939	99.49%	99.78%	99.71%	99.78%	1002	99.40%	99.70%	100.00%	100.00%
NZZO	7999	99.58%	99.73%	99.72%	99.74%	2803	99.82%	99.71%	99.89%	99.89%
YBBB	24042	99.25%	99.29%	99.46%	99.48%	11475	99.29%	99.29%	99.48%	99.48%
YMMM	29335	99.55%	99.48%	99.67%	99.66%	12820	99.38%	99.38%	99.53%	99.53%
RPHI	4665	97.59%	97.84%	98.91%	99.24%	9044	98.24%	98.40%	98.58%	98.82%
VCCF	24214	98.45%	99.53%	99.28%	99.78%	16601	98.37%	99.39%	99.17%	99.76%
VOMF	31266	99.77%	99.86%	99.84%	99.86%	31445	99.77%	99.85%	99.84%	99.86%
VVTS	26896	95.80%	96.31%	99.40%	99.65%	31859	96.26%	96.64%	99.48%	99.72%
WAAF	21900	98.20%	98.45%	99.70%	99.78%	11451	97.80%	98.12%	99.68%	99.75%
WMFC	9261	98.14%	98.71%	98.54%	99.11%	30246	97.67%	98.45%	97.42%	98.40%
WSJC	19113	98.94%	99.29%	98.87%	99.22%	14758	98.93%	99.20%	99.05%	99.29%
ZLLL	2447	97.99%	98.32%	98.40%	98.81%	1140	97.10%	97.28%	98.42%	98.68%
ZWWW	464	95.90%	96.76%	93.31%	96.98%	111	97.29%	98.19%	96.39%	96.39%

Table 1: Asia/Pacific Region ACP (RCP240)

AKARA – FUKUE Corridor

2.1 On 25 March 2021 all Air Traffic Control (ATC) responsibility for ATS route A593 between ONIKU and SADLI had been handed over to Incheon Area Control Centre (ACC) under Phase 1 of the AKARA – FUKUE Corridor improvement plan (**Figure 1**). Prior to that date ATS services for operations on ATS route A593 were provided Shanghai ACC for traffic west of SADLI, and east of SADLI by Fukuoka ACC for east/west traffic and Incheon ACC for north-south traffic, with a Flight Level Allocation Scheme (FLAS) in place.

2.2 Due to the use of ATS Inter-Facility Data Communication (AIDC) there had been no Large Height Deviations (LHDs) at BEDAR and ONIKU (on the boundary between the Fukuoka and Incheon FIRs) reported to JASMA from 25 March to 31 August 2021.

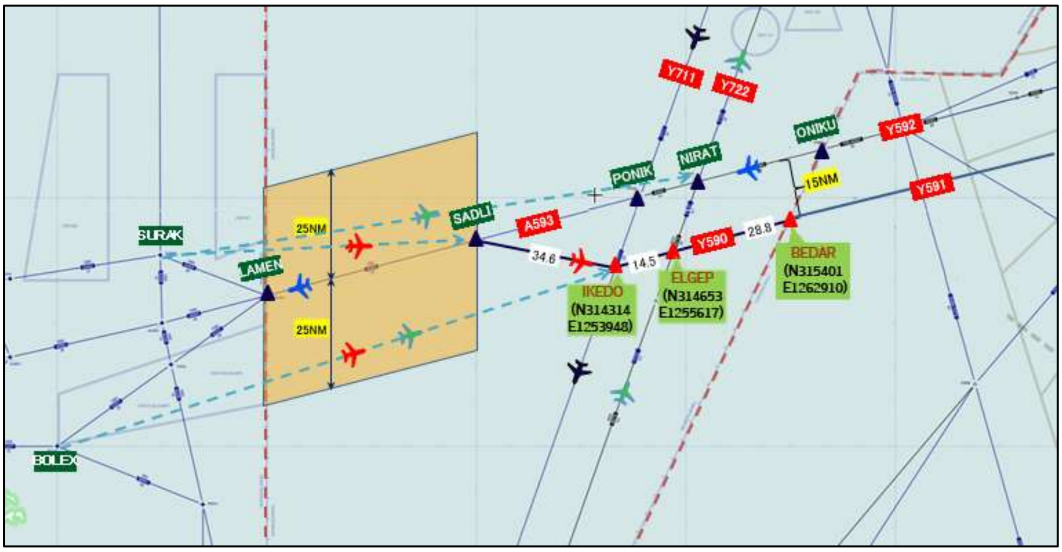

Figure 1: AKARA-FUKUE Corridor Safety Improvement Plan Phase 1

2.3 As at August 2021 the transition from Phase 1 to Phase 2 of the improvement plan had been discussed between China and Republic of Korea, but the transition date had not yet been determined. **Figure 2** shows the ATS route structure of Phase 2.

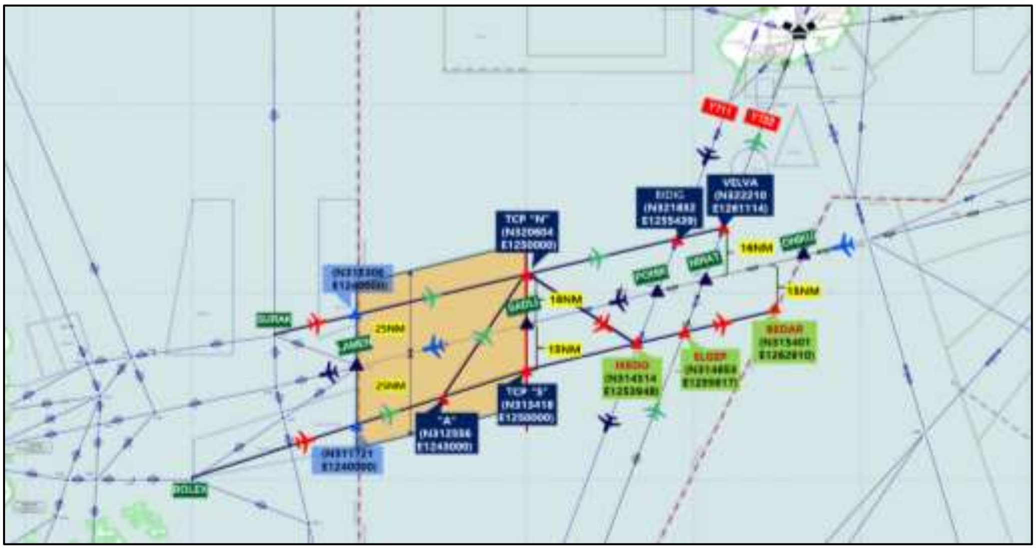

Figure 2: AKARA-FUKUE Corridor Safety Improvement Plan Phase 2.

2.4 The Japan Airspace Safety Monitoring Agency (JASMA) provided the results of a safety assessment in the AKARA – FUKUE corridor airspace conducted by JASMA and the Electronic Navigation Research Institute (ENRI), using fast-time simulation of December 2019 Traffic Sample Data (TSD).

2.5 The technical risk estimate may have met the Target Level of Safety (TLS) following transition to Phase 1. Establishing new parallel routes of A593 as non-bidirectional routes in Phase 1 seemed to decrease the technical risk estimates for the same and opposite directions significantly. Therefore, establishing parallel routes in the entire AKARA corridor airspace under Phase 2 would further decrease the technical risk estimates.

2.6 JASMA had received a report of Category D LHD (ATC system loop error[3]) that occurred more than 100NM East of the AKARA corridor airspace in May 2021. Pilots misunderstood a heading instruction by Fukuoka ACC as a descending clearance to the FLAS altitude. According to the investigation by Fukuoka ACC, pilots flying the AKARA corridor airspace expected flight level change before entering the corridor. JASMA considered the pilots' expectation for altitude change due to FLAS could not be overlooked as a potential risk of LHD.

2.7 The meeting was reminded of the identification of the Corridor as one of the five LHD hot spot areas in the APAC Region (**Hot Spot B**) at RASMAG/20 (May 2015). Republic of Korea informed the meeting that the Pacific Approvals Registry and Monitoring Organization (PARMO) Regional Monitoring Agency (RMA) had conducted safety assessments for the Corridor every year since 2015 (**Table 2**).

Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Overall vertical collision risk	46.2×10^{-9}	2.08×10^{-9}	1.75×10^{-9}	55.1×10^{-9}	247.0×10^{-9}	45.1×10^{-9}

Table 2: Vertical safety assessment of the AKARA - FUKUE Corridor

[3] The Large Height Deviation (LHD), Large Longitudinal Error (LLE) and Large Lateral Deviation (LLD) taxonomy is provided in **Attachment A**.

2.8 The 62% fall in traffic volume in the Corridor due to the coronavirus outbreak had led to the number of LHD reports falling from 29 in 2019 to 5 in 2020. However, the overall vertical collision risk continued to exceed the TLS in 2020 due to the Corridor being highly susceptible to even a single deviation resulting in the airspace not meeting TLS.

2.9 Regarding a proposal that the AKARA – FUKUE Corridor be removed from the list of LHD Hot Spots, the meeting was reminded that usual RASMAG practice was to retain the identification of hot spots for 2 years following the achievement of overall collision risk below the TLS. ICAO proposed that any consideration of removal of hot spots should take into account the current major reduction in traffic and its effect on safety risk calculations. It would not be appropriate to remove hot spots under the prevailing circumstances only to find they had to be re-imposed after traffic volumes returned to more normal levels.

Vertical Safety Risk Assessments

AAMA Vertical Safety Report

2.10 The Australia Airspace Monitoring Agency (AAMA) provided an airspace safety review of RVSM airspace risk within the Brisbane, Honiara, Melbourne, Nauru and Port Moresby FIRs. The TLS of 5×10^{-9} had been met, at **0.0017×10^{-9}.**

2.11 The total 2020 risk estimate for the Jakarta and Ujung Pandang FIRs at **0.181×10^{-9},** reflecting the significant decrease in flying hours and occupancy parameters (2019 vertical risk estimate 10.2×10^{-9}.

China RMA Vertical Safety Report

2.12 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).

2.13 The 2020 RVSM risk estimates for the Beijing, Guangzhou, Kunming, Lanzhou, Pyongyang, Sanya, Shanghai, Shenyang, Urumqi and Wuhan FIRs indicated that the TLS had not been met, at **7.107×10^{-9}**.

2.14 The risk estimate had resulted from 85 reported LHDs, including 34 Category I (*Turbulence or other weather related cause*. 40%), nine Category A (*Flight crew failing to climb/descend the aircraft as cleared*, 11%) and 10 Category E (*Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues*, 12%). Four Category E events had been reported in 2019.

2.15 The 2020 RVSM risk estimate for the Pyongyang FIR indicated that the TLS had been met at **1.04×10^{-9}**, as no LHD had been reported during 2020.

JASMA Vertical Safety Report

2.16 The vertical safety assessment for the RVSM airspace in the Fukuoka FIR's RVSM airspace for the period from January to December 2020, provided by JASMA, indicated that the TLS had not been met at **11.57×10^{-9}** (**Figure 3**).

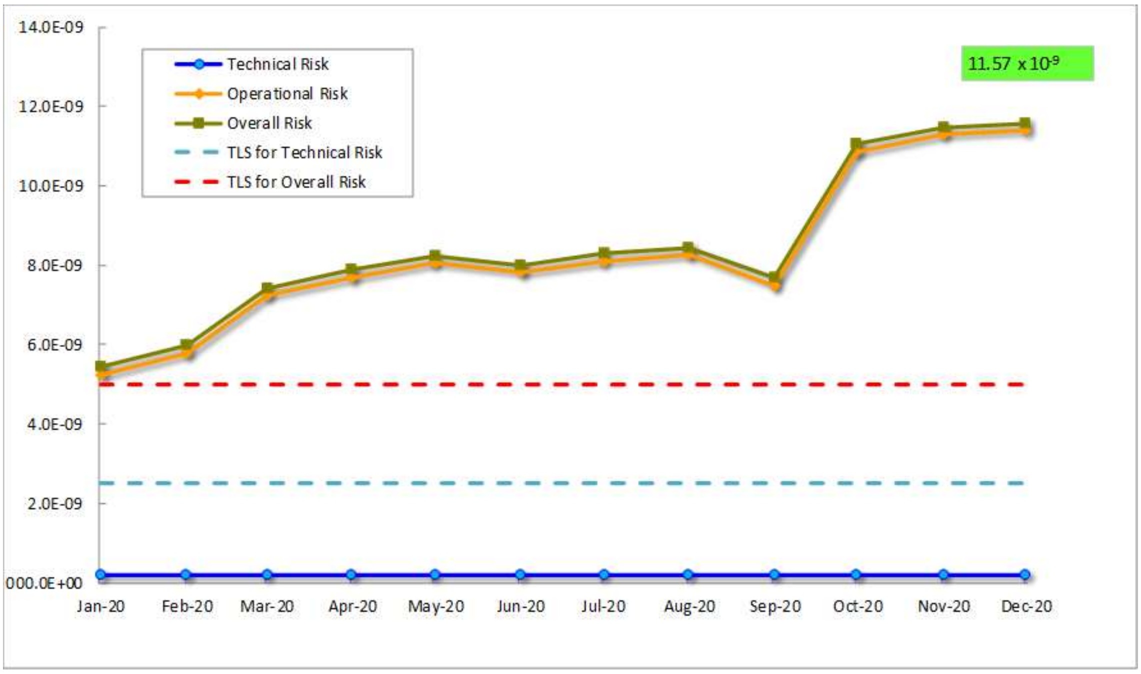

Figure 3: Japanese Airspace RVSM Risk Estimate Trends

2.17 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 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.

MAAR Vertical Safety Report

2.18 The Monitoring Agency for the Asian Region (MAAR) provided the results of the airspace safety oversight for RVSM operations in South Asia/Indian Ocean Airspace (SAIO), Southeast Asia Airspace (SEA), and Mongolian Airspace during 2020.

South Asia Indian Ocean Airspace

2.19 The 2020 RVSM risk estimate for SAIO airspace indicated that the TLS had not been met at **15.67 x 10^{-9}** (**Figure 4**).

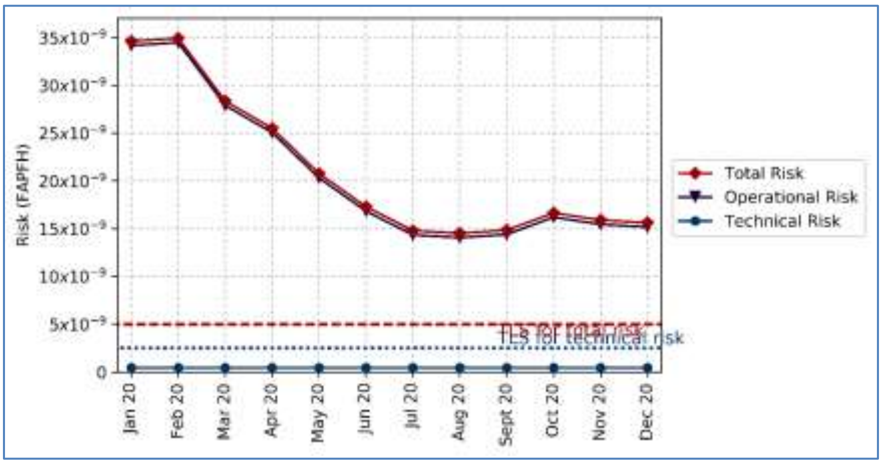

Figure 4: Trends of Risk Estimates for SA/IO Airspace.

2.20 As had been the case in previous years, the vast majority of the 152 LHD cases that had been reported were Category E events, with 138 (91%). The 65% reduction in numbers of LHDs from 434 in 2019 to 152 in 2020 reflected the 66% decrease in estimated annual flight hours.

2.21 LHD **Hot Spot F** (Mogadishu – Mumbai) and LHD **Hot Spot G** (Sanaa/Muscat – Mumbai) at the western boundary of Mumbai FIR remain as LHD hot spots since 2015. In 2020 the number of non-zero duration LHDs of these hot spots accounted for 62% of all non-zero-duration LHDs of the SAIO airspace and the resultant operational risk of **11.17 x 10^{-9} FAPFH** accounted for 74% of the total operational risk of the SA/IO airspace.

2.22 It was strongly recommended that an engineering solution such as AIDC (hard barrier) be implemented with the Mumbai FIR to mitigate the risk. The meeting was informed that Mumbai ACC had conducted AIDC trials with Muscat ACC and Mogadishu ACC in March 2021. Some minor systematic issues were found and remained to be resolved before the AIDC implementation could proceed to the next phase. Space-based Automatic Dependent Surveillance – Broadcast (ADS-B) had been implemented to enhance surveillance capability, particularly in oceanic airspace.

2.23 The number of LHDs at **LHD Hot Spot A1 (Kolkata/Dhaka - Yangon) and LHD Hot Spot A2 (Chennai - Kuala Lumpur)**, first identified as hot spots in 2015, had been decreasing from 275 in 2018 to 24 in 2020. All reported LHDs in 2020 had 0-min duration, resulting in the operational risk of 0 FAPFH. The reduction of operational risk to 0 FAPFH was related to safety enhancement initiatives including ADS-B data sharing between Kolkata and Yangon, and AIDC between Chennai and Kuala Lumpur, as well as the reduction in traffic volume.

2.24 **LHD Hot Spot I (Karachi – Kabul)** was de-identified from being an LHD hot spot by RASMAG/25. In 2020, Kabul ACC identified and reported more of their operational risk from LHD occurrences within their own airspace and at the boundaries with Lahore FIR and Karachi FIR, as depicted in **Figure 5**.

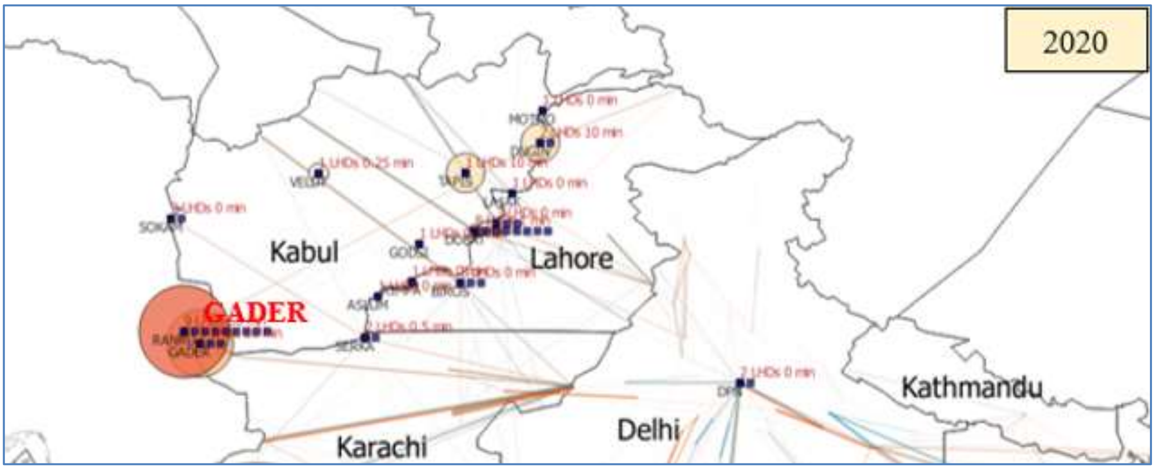

Figure 5: Kabul FIR LHDs

2.25 The number of LHDs and operational risk at GADER and RANRU, most of which were Category E, increased in 2020. Poor communication and surveillance coverage did not allow Kabul ACC to detect and resolve the issues before an aircraft passed the transfer-of-control point. This issue was to be closely monitored together with the dynamic situation over the Kabul airspace in 2021, but such monitoring (and its reporting) are likely to be heavily impacted by the ongoing Kabul FIR ATM contingency situation, continuing since 16 August 2021.

Southeast Asian Airspace

2.26 The 2020 RVSM risk estimate for SEA airspace indicated that the TLS for total risk had been met at **1.82×10^{-9}** FAPFH.

2.27 27 of the 39 reported LHDs in SEA airspace (69%) were classified as Category E, which contributed to most of the operational risk (1.35×10^{-9} FAPFH).

2.28 Even though the situation of **LHD Hot Spot D (Manila and all adjacent FIRs)** seemed to be improving, the majority of the reported LHDs and the operational risk of the SEA airspace still remained along the boundaries of Manila FIR. A total of 24 LHDs at Manila FIR boundaries accounted for 62% of the number of LHDs in the SEA airspace. The resultant operational risk of 1.05×10^{-9} FAPFH accounted for 74% of the operational risk of the SEA airspace. Two out of three long duration LHDs occurred at Manila FIR boundaries.

2.29 **Figure 6** illustrates the trend of LHDs being reported along Manila FIR boundaries together with the timeline of major safety improvement implementation by Manila ACC and the adjacent units. Since the transition to the new ATM centre in 2018, Manila ACC aimed to continually improve their communication and surveillance capabilities with ADS-C/CPDLC, AIDC and ADS-B technology.

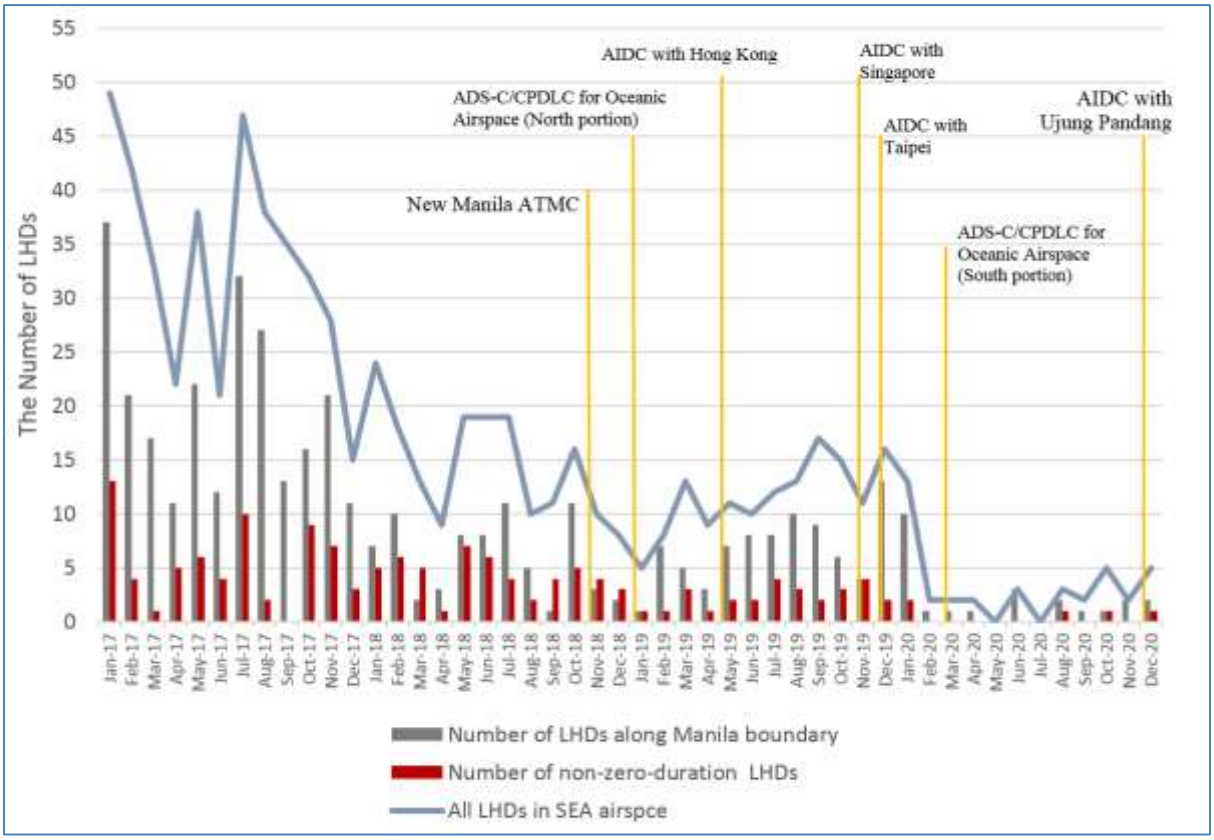

Figure 6: LHDs along Manila FIR Boundary 2017 to 2020

2.30 The number of Category F LHDs (ATC coordination errors as a result of equipment outage or technical issues) slightly decreased from 9 (2019) to 6 LHDs, caused by AIDC system failures and the unsuccessful transfer via AIDC. ICAO noted that system alerts to ATC and robust procedures requiring voice coordination in the event of failure of AIDC message exchange were necessary for all AIDC implementations.

Mongolian Airspace

2.31 The 2019 RVSM risk estimate for Mongolian airspace indicated that the TLS had been met at **0.87 x 10^{-9}**. No LHD was reported in 2020 within or at the boundary of Mongolian airspace.

Pacific Airspace

2.32 The 2020 RVSM risk estimate for Pacific airspace indicated that the TLS had not been met at **22.04 × 10^{-9}** (**Figure 7**).

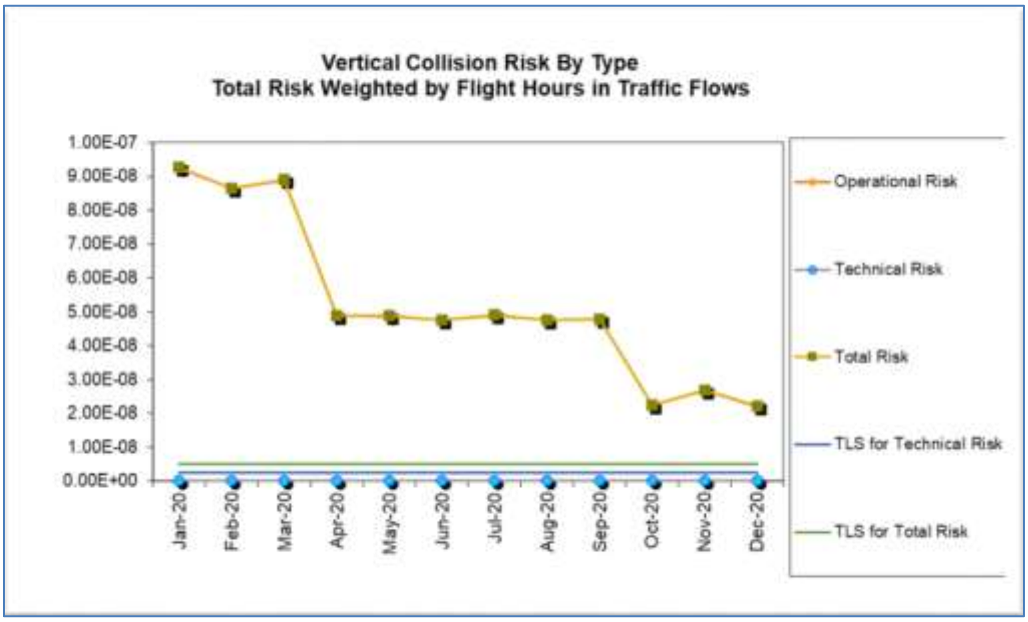

Figure 7: Pacific Airspace RVSM Risk Estimate Trends

2.33 Of the 51 LHDs, 27 were classified as Category E (53%, compared to 81% in 2019). There were also nine Category B *Flight crew climbing /descending without ATC clearance* LHDs (18%). The geographical location of reported Pacific LHDs is depicted in **Figure 8**.

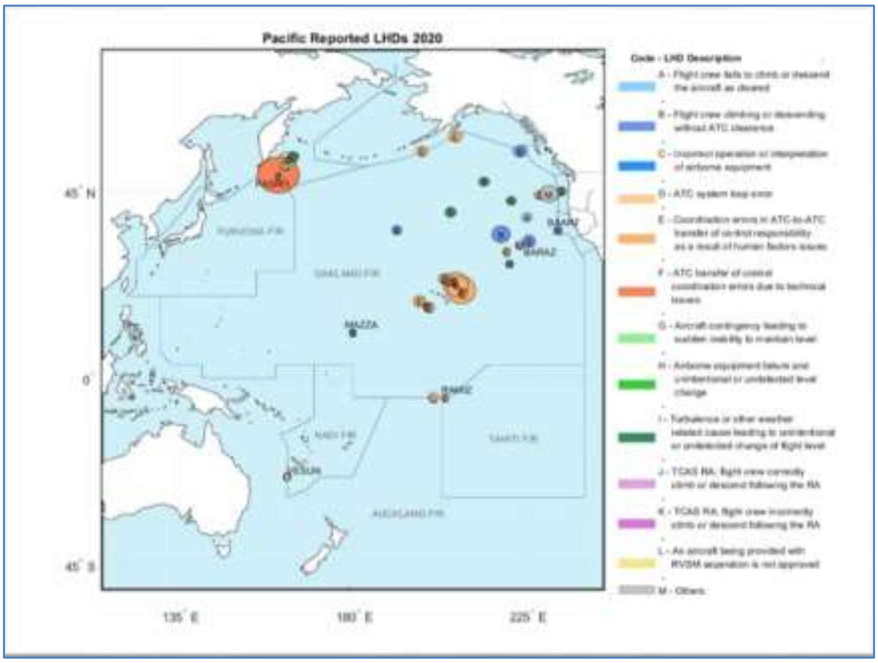

Figure 8: Location of Pacific LHDs, 2020

2.34 The longest reported LHD duration was 33 minutes, which was approximately 20 percent of the total LHD duration for 2020 in Pacific airspace.

2.35 A task force had been established to develop mitigations for the high number of reported Category E occurrences between Honolulu Control Facility (HCF) and Oakland Center.

North East Asia Airspace

2.36 The 2020 RVSM risk estimate for the Incheon FIR (not including the AKARA – FUKUE Corridor) indicated that the TLS had been met at **0.23×10^{-9}**

Hot Spots

2.37 **Table 3** summarizes current LHD Hot Spots, the FIRs involved, the year of identification, and status remarks.

Hot Spot	Involved FIRs	Identified	Remarks
A1	Kolkata/Chennai/Dhaka-Yangon	2015	Cat. E LHDs reducing
A2	Chennai – Kuala Lumpur	2015	Cat. E LHDs reducing
B	Incheon (AKARA Airspace)	2015	Cat. E LHDs
D	Manila – all adjacent FIRs	2015	Cat. E LHDs reducing Cat F LHDs emerging
F	Mogadishu – Mumbai	2015	Cat. E LHDs
G	Sanaa/Muscat – Mumbai	2015	Cat. E LHDs (Sanaa improved)
J	Jakarta – Singapore/Kota Kinabalu	2018	Cat. E LHDs, minor and reducing
M	Colombo – Melbourne	2019	Proposed to re-classify as non-hot spot, subject to further data
N	Oakland USA – Hawaii CEP	2019	Cat. E LHDs increasing

Table 3: LHD Hot Spots in the Asia/Pacific Region

Horizontal Safety Assessments

2.38 Horizontal safety assessments provided by APAC monitoring agencies indicated that the TLS of 5.0×10^{-9} had been met in all FIRs. The contribution of the significantly reduced traffic levels to an overall reduction in the estimated horizontal safety risk across the region was acknowledged. **Table 4** summarizes regional performance-based horizontal risk assessments.

ATC Separation	EMA	2019 Estimated Risk	2020 Estimated Risk
50NM Lateral	BOBASMA	1.59×10^{-9}	0.64×10^{-9}
	JASMA	1.45×10^{-9}	0.65×10^{-9}
	PARMO	-	-
	SEASMA	0.012×10^{-9}	0.012×10^{-9}
30NM Lateral	PARMO	3.35×10^{-9}	0.09×10^{-9}
50NM Longitudinal	BOBASMA	4.97×10^{-9}	0.87×10^{-9}
	PARMO	-	2.22×10^{-9}
	SEASMA	0.38×10^{-9}	0.38×10^{-9}
30NM Longitudinal	BOBASMA	-	-
	JASMA	0.015×10^{-9}	0.015×10^{-9}

	PARMO	4.08×10^{-9}	4.08×10^{-9}

Table 4: Comparison of Horizontal Risk Assessments

APAC Consolidated Safety Report

2.39 MAAR presented a combined summary of the safety analysis results for the Asia/Pacific Regions, on behalf of the Asia/Pacific RMAs and En-route Monitoring Agencies (EMAs). The report was divided into the Pacific (PAC) area, and Asia area.

2.40 The estimated vertical collision risk for 2020 for the PAC area did not meet TLS. (**Table 5**). The overall vertical risk had been increasing from 2016 to 2020 due to improvements in reporting culture.

Pacific Area – annual flying hours = 1,749,178 hours			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
Vertical Technical Risk	0.14×10^{-9}	2.5×10^{-9}	Below Technical TLS
Vertical Operational Risk	16.57×10^{-9}	-	-
2020 Vertical Overall Risk	**16.71×10^{-9}**	5.0×10^{-9}	**Above TLS**

Table 5: Pacific Area Vertical Collision Risk 2020

2.41 The PAC vertical collision risk estimates had been above TLS and trending upwards each year from 2016 to 2019. In 2020 there was a significant fall in the risk estimate, reflecting the reduction in traffic volumes caused by the COVID-19 pandemic **(Table 6**)

Year	**Vertical Overall Risk Estimate (x 10^{-9} FAPFH)**	**Remark**
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 6: Pacific Area Vertical Collision Risk Estimates 2016 - 2020

2.42 The estimated horizontal collision risk for 2020 for the PAC area met TLS in all longitudinal and lateral risk categories.

2.43 The estimated vertical collision risk for 2020 for the Asia area did not meet TLS (**Table 7**). The overall risk continued to decline since 2017 due to various safety improvement initiatives, but remained above TLS.

Asia Area – annual flying hours = 5,404,154 hours			
Source of Risk	**Risk Estimation**	**TLS**	**Remarks**
Vertical Technical Risk	0.33×10^{-9}	2.5×10^{-9}	Below Technical TLS
Vertical Operational Risk	7.09×10^{-9}	-	-
2020 Vertical Overall Risk	**7.42×10^{-9}**	5.0×10^{-9}	**Above TLS**

Table 7: Asia Area Vertical Collision Risk 2020

2.44 The Asia vertical collision risk estimates had been above TLS each year from 2016 to 2019, and trending downwards since 2017. In 2020 there was a significant fall in the risk estimate, while still remaining above TLS, reflecting the reduction in traffic volumes caused by the COVID-19 pandemic **(Table 8**)

Year	Vertical Overall Risk Estimate (x 10^{-9} FAPFH)	Remark
2020	7.42	Above TLS
2019	12.88	Above TLS
2018	15.50	Above TLS
2017	27.30	Above TLS
2016	12.53	Above TLS

Table 8: Asia Area Vertical Collision Risk Estimates 2016 - 2020

2.45 The estimated horizontal collision risk for 2020 for the Asia area met TLS in all longitudinal and lateral risk categories.

Safety Reporting

2.46 **Table 9** shows the total number of LHD, LLD and LLE reports for 2016 to 2020, and the number of reports per flying hours. Total estimated flying hours decreased significantly due to the COVID-19 pandemic, from 15,677,369 in 2019 down to 7,234,881 in 2020 – an overall reduction of 54%. The total number of reports approximately halved, from 1094 in 2019 down to 548 in 2020.

2.47 The number of reports per flying hours in 2020 increased from 2019 in China, Indonesia, Japan, South Asia/Indian Ocean (marginally), South West Pacific and Pacific, leading to an overall reporting rate that was slightly improved from the 2019 reporting rate.

2.48 The number of reports per flying hours decreased in Republic of Korea and South East Asia. China, Republic of Korea and South East Asia were among the lowest recorded reporting rates for the region. Data was not available for DPR Korea or Mongolia.

Airspace	# Reports					1 Report : Flying Hrs				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
DPRK	0	0	0	0	0	-	-	-	-	-
Mongolia	0	4	1	2	0	-	1: 37,771	1: 158,891	1: 82,138	-
China	117	134	110	79	85	1: 20,413	1: 18,248	1: 22,229	1: 31,119	1: 26,867
ROK	6	5	12	34	5	1: 93,291	1: 117,090	1: 28,365	1: 18,959	1: 25,965
SEA	426	474	205	152	42	1: 5,884	1: 6,548	1: 17,757	1: 22,275	1: 25,106
Indonesia	32	34	23	37	18	1: 11,520	1: 10,842	1: 53,603	1: 33,321	1: 17,346
Japan	43	71	76	77	66	1: 33,834	1: 21,510	1: 20,632	1: 20,762	1: 14,737
SA/IO	778	935	681	439	152	1: 3,689	1: 3,166	1: 3,783	1: 7,955	1: 7,907
SW Pacific	52	51	53	101	46	1: 16,639	1: 17,572	1: 17,817	1: 9,335	1: 6,954
Pacific	33	42	43	173	134	1: 63,500	1: 54,191	1: 45,064	1: 10,139	1: 6,404
Total	**1,487**	**1,750**	**1,204**	**1,094**	**548**	**1: 8,905**	**1: 8,180**	**1: 12,332**	**1: 14,330**	**1: 11,712**

Table 9: Total LHD, LLD and LLE Reports, and Reports per Flying Hours, 2016 - 2020

Identification of Non-Approved Airframes Operating in RVSM Airspace

2.49 AAMA informed the meeting of non-RVSM approved airframes indicating RVSM approval status over a period of three months or more. 10 airframes were identified, including six from Australia, and one each from Greece, India, Papua New Guinea and United States. The airframe from India (IN320, Indian Navy, i.e. a State aircraft) and the airframe from Papua New Guinea (M2ZMY) had been operating in RVSM airspace without RVSM approval for 12 months or more.

2.50 Similarly, JASMA reported a total of 21 airframes operating in the RVSM airspace of Fukuoka FIR with no registration of RVSM in the approval databases as of June 2021, including one each from Canada, China, Indonesia and the Solomon Islands, two from Malaysia and 14 from USA. Almost all of the listed aircraft were identified only once in the period from January to June 2021.

2.51 MAAR presented the result of an annual audit that detected 19 aircraft that operated in RVSM airspace without valid RVSM approvals in the RMA's database. The reduction from 26 in the previous year's audit was likely to be due to the reduction of flights during the COVID-19 pandemic. India had the highest number of aircraft on the list (12, all domestic flights and increased from eight reported to RASMAG/25). Others were from Indonesia (four), Australia (one) and Malaysia (two)

2.52 Brunei Darussalam, Myanmar and Pakistan did not submit annual RVSM data snapshots. Myanmar and Viet Nam had not adopted the new F2 form, which included PBCS approvals information.

2.53 Non-approved aircraft detected by China RMA were from Australia (three), Hong Kong China (one), Indonesia (nine), Philippines (three), Republic of Korea (one) and USA (two).

2.54 The PARMO assessment identified three aircraft; one each from Greece, Netherlands (Aruba) and Solomon Islands, which would be further investigated and appropriate parties queried if no additional information was obtained.

RMAs' 'W' Verification of State Aircraft

2.55 The RASMAG Chair presented a paper addressing an action item from the RMACG/14 meeting, which asked all RMAs to request clarification from their respective PIRGs on responsibilities of the RMA regarding verification of the approval status of State aircraft (military and other government aircraft performing non-commercial, sovereign functions) and their relation to civil authorities.

2.56 Aircraft that included 'W' in flight plans but did not have matching RVSM approval were generally called 'rogue' aircraft. The aircraft that persistently remained on the RMAs' lists of rogue aircraft were mostly State aircraft. In order for the rogue State aircraft to be removed from the list either the State aircraft's approval data had to be provided to the designated RMA, or the State aircraft operator had to stop using 'W' in item 10 of the ICAO flight plan.

2.57 A Draft Conclusion was agreed for consideration by APANPIRG/32:

Draft Conclusion RASMAG/26-3: RVSM Approvals Data and Filing of RVSM Indicator in Flight Plans of State Aircraft

That, States are urged to:

1. *Liaise with their State Aircraft operators to:*
    a) *Share State aircraft RVSM approval data with the designated RMA where State aircraft RVSM approval processes are implemented;*
    b) *Confirm the RVSM approval status of State aircraft when queried by the RMA;*
    c) *Not file 'W' in item 10 of the ICAO flight plan of aircraft that are not approved*

for RVSM; and

2. *Respond to a survey on RMA and State responsibility on the matter of RVSM approvals of State aircraft.*

2.58 The Draft Conclusion was presented to the ATM/SG/9 meeting for endorsement. While noting the need for RVSM approval for all aircraft that included the RVSM indicator in flight plans, for the safety of operations in the airspace, the ATM/SG/9 meeting considered that there would be considerable difficulty in items 1 a) and b) which were not supported by ATM/SG, but the remainder was acceptable. The Draft Conclusion will be considered by APANPIRG/32 (01 – 03 December 2021.

Note: The States that did not support the Draft Conclusion at ATM/SG/9 were present at the RASMAG/26 meeting and had supported the Draft Conclusion at that time.

APAC Consolidated LTHM Burden Estimate

2.59 MAAR presented the overview of Long Term Height Monitoring (LTHM) compliance status in the APAC Region, including assessments of five APAC RMAs – AAMA, China RMA, JASMA, MAAR and PARMO. The assessment, which was based on RVSM approval data as of at 30 June 2021, yielded a remaining monitoring burden of 422 aircraft, which was a 5% increase since 2019.

2.60 **Table 10** 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	2019%	2020%
Pakistan (MAAR)	46%	61%
India (MAAR)	46%	51%
Solomon Islands (AAMA)	0%	50%
Philippines (MAAR)	43%	48%
Nepal (MAAR)	45%	46%
Afghanistan (MAAR)	85%	42%
Indonesia (AAMA)	42%	41%
Bhutan (MAAR)	40%	40%
Bangladesh (MAAR)	14%	36%
Malaysia (MAAR)	26%	33%
Papua New Guinea (AAMA)	8%	31%
Mongolia	14%	30%

Table 10: Remaining LTHM Monitoring Burden ≥30% or more

2.61 While noting that RASMAG/23 had agreed that States with a remaining burden 30% or more would be proposed to be added to the APANPIRG Deficiencies List, MAAR observed that operators had been trying to fulfil their height monitoring requirements but could not do so due to the unavailability of Enhanced GPS-based Monitoring Unit services during the pandemic. It was therefore proposed that consideration of new deficiencies be delayed until an alternative means of height monitoring became available.

2.62 However, the RASMAG Chair noted that if the pandemic effects continued the monitoring burden may continue to become more serious. There were other ways to obtain height monitoring data, particularly from ANSPs, that may help to relieve the burden. RMAs were strongly encouraged to investigate available means to obtain data. The meeting further noted that the risks of not taking action to record Deficiencies could result in increased safety risks if and when some normal level of traffic resumed. It was therefore proposed that the meeting report include the statement that new Deficiencies would be recorded by RASMAG/27.

<u>Relevant ATM/SG/9 Outcomes</u>

ANS USOAP Update

2.63 Information was provided on the ICAO Universal Safety Oversight Audit Programme (USOAP) Continuous Monitoring Approach (CMA). The paper discussed the Protocol Questions (PQs) used to assess a State's safety oversight system, and an annual update of ANS USOAP status.

2.64 The meeting was informed that the 2020 edition of the USOAP CMA Protocol Questions (PQs) were available to reflect amendments to the ICAO provisions and reference documents.

2.65 The average ANS Effective Implementation (EI) of APAC region was 68.52%, as at February 2020. **Figure 9** illustrated the EI ratings for ANS-related PQs of the 37 APAC States that had been audited or received USOAP activity:

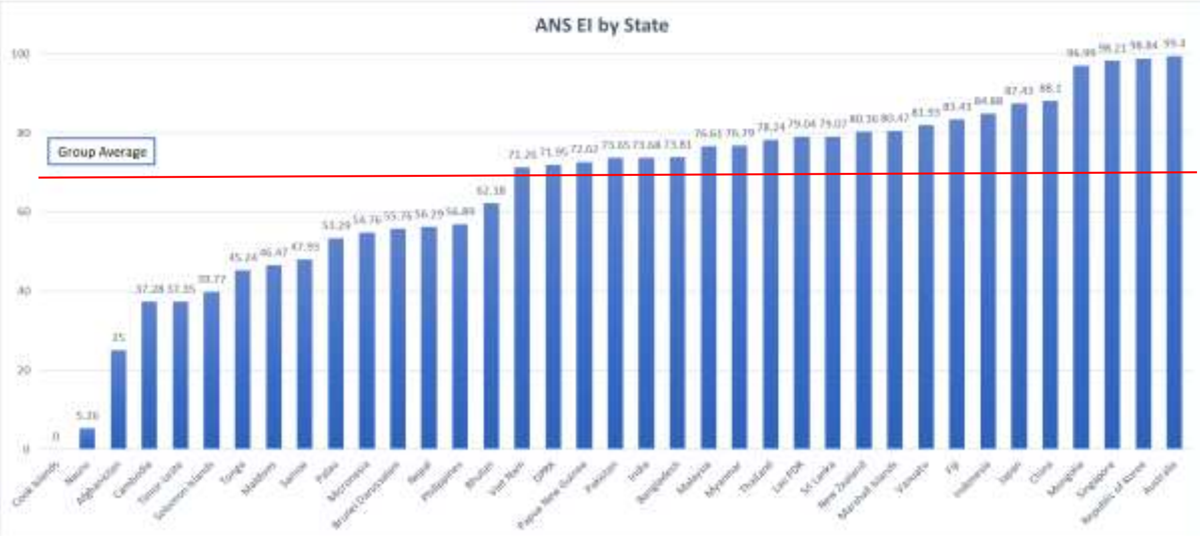

Figure 9: USOAP EI Comparisons by State (October 2021)

2.66 No onsite USOAP activity had been undertaken during the period of the COVID-19 pandemic.

Activation of Danger Areas over High Seas for Prolonged Duration

2.67 IATA presented concerns regarding continued prolonged hours of Danger Area activation over the high seas (over international waters outside territorial seas), and suggested there was a need to enhance processes for the management of such areas in line with the *as civil as possible, as military as necessary* principle of the ICAO Doc 10088 *Manual on Civil-Military Cooperation in Air Traffic Management*.

2.68 Blanket, prolonged activation of Danger areas ignored the needs of other airspace users, and indicated gaps in the coordination mechanisms between States, ATS Units and military authorities. Enhanced coordination between civil and military authorities should focus on minimizing the Danger Area activation window, considering activation timings in periods of less air traffic, accommodating preferred flight levels for civil traffic as far as practicable, and the implications of weather-related factors.

2.69 The meeting was reminded that ICAO Doc 10066 PANS-Aeronautical Information Management (PANS-AIM) procedure required that NOTAMs for Danger Area activation shall be published for all affected FIRs with at least seven days' advance notice. The activation window should be the minimum needed to successfully complete the planned exercise/event. Japan supported the application of seven days' advance notice.

2.70 It was critical that, where any temporary Special Use Airspace (SUA) extended into other FIRs, NOTAMs were published by all FIRs, with the seven days' advance notice as was required in the PANS-AIM procedure.

2.71 In relation to the case study provided by IATA, one of the States concerned informed the meeting that States may declare Danger Areas in high seas airspace, there was a standard operating procedure applied to reduce negative impacts, it was a sensitive matter, and the only issue was that it did not align with Annex 15 requirements. ICAO responded that the non-alignment with Annex 15 standard was a critical safety issue which had been discussed in multiple ICAO APAC meetings since March 2018 (SAIOACG/8), and was the subject of an APANPIRG Air Navigation Deficiency, agreed by APANPIRG/29 in September of that year and which had not yet been addressed by the State concerned.

2.72 ATM/SG/9 agreed to the following technical Conclusion:

Conclusion ATM/SG/9-4: Management of Danger Areas situated over the High Seas

That, acknowledging that safe and sustainable aviation is the prime goal of all stakeholders, and that airspace is a very important shared resource, States are urged to:

1. *act in accordance with the ICAO DOC 10088 principle as civil as possible, as military as necessary; and refrain from prolonged activation of Danger Areas over the High Seas, particularly activations that are repetitive in nature and impact almost all useable flight levels within the given volume of airspace;*
2. *give due consideration to the requirements of other airspace users (e.g. air traffic density, flight levels, enroute weather factors) during the planning, promulgation and activation of Danger Areas;*
3. *establish robust co-ordination between civil and military authorities, as well as with neighboring FIRs; and*
4. *ensure all affected FIRs provide appropriate AIS (NOTAM) notification regarding activation of the Danger Area*

Amendments to Annexes and PANS Relating to the Global Reporting Format for Runway Surface Conditions

2.73 ICAO reminded the ATM/SG/9 meeting of the applicability, from 04 November 2021, of ICAO provisions in various Annexes and PANS for the reporting of runway surface conditions using the Global Reporting Format (GRF), SNOWTAM and revised ATC phraseology.

2.74 IATA informed the meeting that there were some States that would not implement the GRF and associated procedures, some States would implement in accordance with ICAO provisions, and some States would implement a different form of GRF and/or procedure. It was very important that the aerodrome user had clear information in this regard.

Airline Feedback to Airspace Closures and Contingency Response and the Importance of Contingency Planning

2.75 The meeting was presented airline feedback on recent interruptions to ATS in APAC FIRs, provided by IATA, emphasizing the importance of contingency planning for all States. ATM Contingency events in 2021 had served as good reminders for all States to have relevant, updated and practiced ATM contingency plans in place at all times, with clear agreements and instructions for their timely activation.

2.76 IATA provided information on the Yangon (Myanmar) FIR contingency response to the unavailability of ATC services from 08 to 16 February 2021, and on the current, ongoing contingency operations in the Kabul (Afghanistan) FIR that had commenced on 16 August 2021.

2.77 Feedback was provided on positive aspects of the contingency operations, challenges, and on the additional costs to airlines. Operational and safety challenges included limited contingency routes and flight levels, increased en-route holding, confusion as to applicable Traffic Information Broadcast by Aircraft (TIBA) frequencies, restricted communication with States, and confusing NOTAM management at the resumption of normal operations.

2.78 **Table 11** summarized additional costs to airlines avoiding the Kabul FIR:

Costs*	**Time (mins)**	**Fuel (ton)**	**Distance (NM)**	**CO2 (ton)**	**Fuel (USD)**
Max	120	13.7	825	206.1	10378
Min	5	0.5	26.8	51	2168
Ave	55	4	245	111	5574
Mean	39	3	109	96	4958
Median	47.5	3.8	71.5	92.6	5116.5
* columns are not always directly related to each other - they represent a range of individual figures provided for each category.					

Table 11: Summary of Additional Flight Costs – Avoidance of Kabul FIR

2.79 IATA feedback included a list of considerations for future contingency planning including the **layering** of plans, inclusion of all stakeholders in plan development, safety assessment of plans and the entry/exit of contingency operations, alternative communications, annual review of plans and associated safety assessments in collaboration with all stakeholders, publication of relevant components of the plan in AIP, NOTAM management and the use of NOTAM to activate plans, and the availability of IATA to coordinate international airline input into the development and review of plans.

Regional ATM Contingency Planning and Status Reporting

2.80 ICAO presented information on the *Asia/Pacific Regional ATM Contingency Plan* with regard to State reporting of implementation of its performance expectations, a brief outline of recent ATM contingency events in the APAC Region, and a proposal to conduct an update of the Regional contingency plan.

2.81 The performance expectations of the plan, including the expectation that States would provide a status report at least once annually, were expected to be implemented by 10 November 2016, reflecting the Annex 11 standard that had been applicable since November 2003.

2.82 Implementation status was assessed as *robust* (90 – 100% of expectations implemented), *marginal* (70 – 89%) or *incomplete* (0 – 69%).

2.83 Only Indonesia, Singapore and United States were assessed as having robust implementation.

2.84 22 Administrations had never provided an implementation status report.

Afghanistan, Bhutan, Brunei Darussalam, China, Cook Islands, Fiji, France (French Polynesia), DPR Korea, India, Kiribati, Lao PDR, Marshall Islands, Micronesia, Nauru, New Zealand, Palau, Samoa, Solomon Islands, Timor Leste, Tonga, Tuvalu, Vanuatu.

2.85 **Figure 10** illustrated the overall regional implementation status:

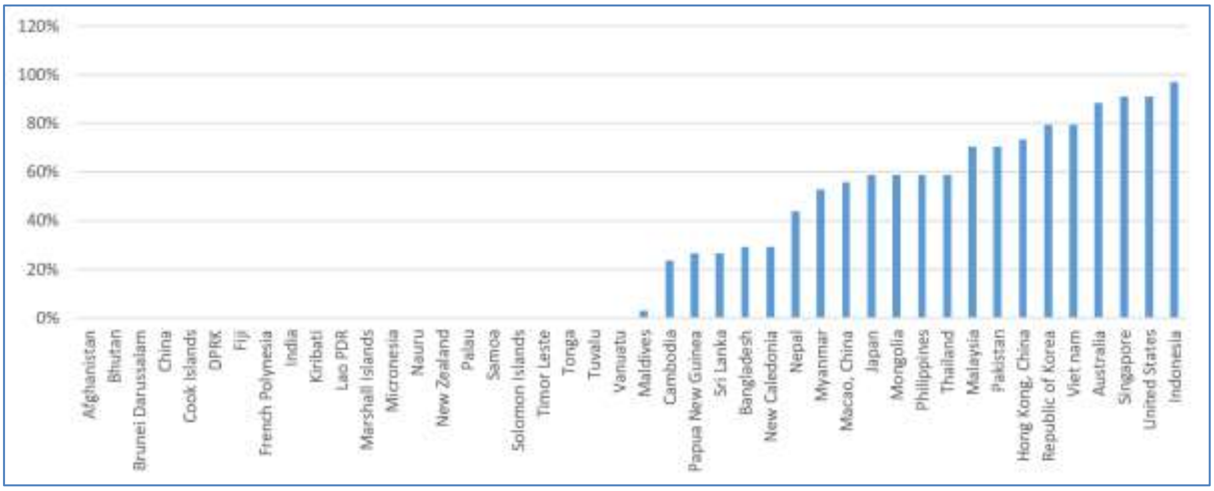

Figure 10: Regional ATM Contingency Plan – Overall Implementation Status

2.86 The meeting was reminded of COVID-19 pandemic-related contingency information, and the *APAC Regional Strategy for COVID-19-related ATM Contingency Recovery*.

2.87 The meeting was provided with the ICAO APAC Regional Office summary of the Yangon FIR contingency operations of February 2021, including discussion of Annex 11 provisions and the formation of CCTs, the communications (or lack thereof) during the contingency operation, CCT bulletins, the validity, update and publication of the Myanmar Level 2 contingency plan, CCT teleconference, NOTAM management, operational impact and key issues to be considered among lessons learned.

2.88 A Regional Office summary of the current, ongoing ATM contingency operations in the Kabul FIR was also provided. Information provided included the sequence of events leading up to the withdrawal of all ATS and AIS on 16 August 2021 and the formation of the Kabul FIR CCT, current flight operations in the Kabul FIR, CCT bulletins and key issues for lessons learned.

2.89 The Asia/Pacific Region had experienced three major ATM contingency events in the last three years. Some lessons learned from the 2019 Pakistan airspace closure had been included in a 2019 update of the Regional ATM Contingency Plan. Lessons learned from the Yangon and Kabul FIRs' contingency operations would be included in a planned review of the Regional contingency plan, which would also include editorial corrections and amendments where necessary to ensure full alignment with Annex 11 provisions. ATM/SG/9 was invited to nominate experts to participate in the review of the Regional contingency plan.

Refresher Training to Support Resumption of Traffic Demand

2.90 Noting the unprecedented disruption to global air travel and associated drastic and sustained drop in air traffic volume, Singapore's experience in the implementation of continuous and preparatory training for ATC readiness to handle post-COVID-19 traffic surges was shared with the meeting. Singapore proposed that the Region consider sharing experiences to enhance regional collective readiness for resumption of normal traffic levels.

1.9 Singapore proposed that the experience of ANSPs be shared either through an update of the *Asia/Pacific Regional Strategy for COVID-19-related ATM Contingency Recovery*, or other platform as appropriate.

Asia/Pacific Search and Rescue Update

2.91 The meeting was provided with an update of Search and Rescue (SAR) matters for the Asia/Pacific Region, including outcomes from the Asia/Pacific SAR Working Group (APSAR/WG).

2.92 The meeting was also informed of global SAR developments, Autonomous Distress Tracking (ADT) implementation and the Location of Aircraft in Distress Repository (LADR), the status of the Cospas-Sarsat programme, air operators workshops, and the SAR operation following the crash of Sriwijaya Air flight SJ189 on 09 January 2021.

2.93 Regarding SRR verification, 21 of 42 APAC Administrations had submitted Proposals for Amendment (PfAs) to the Asia/Pacific Regional Air Navigation Plan (ANP) Volume I, which were pending circulation to ICAO Headquarters Secretariat for approval before circulation to all States:

2.94 **Figure 11** indicated the status of SRR verification as at 04 May 2021:

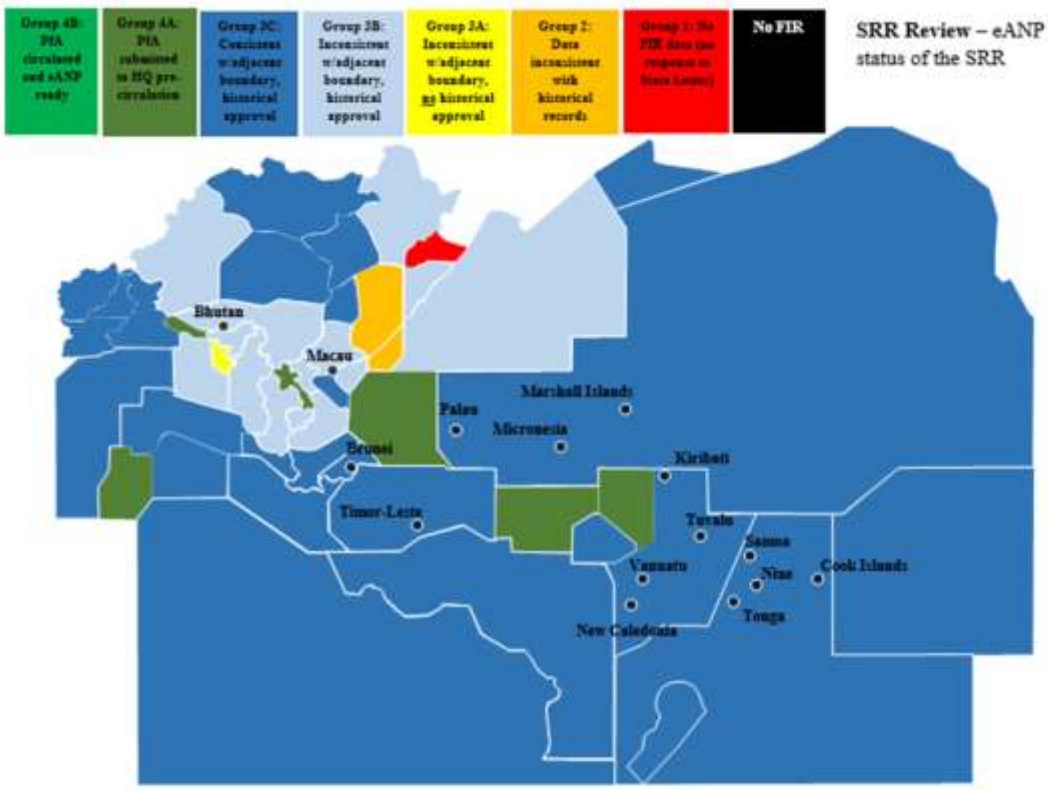

Figure 11: SRR Verification Status as at 04 May 2021

2.95 **Figure 12** illustrated the implementation status of the 41 elements of the Asia/Pacific Regional SAR Plan as at 04 May 2021. Only 10 APAC Administrations had reported *robust* implementation of 90% or more:

Australia, Hong Kong China, India, Indonesia, Japan, New Zealand, Republic of Korea, Singapore, USA and Viet Nam

Figure 12: Asia/Pacific SAR Plan Implementation Status as at 04 May 2021

2.96 All other APAC Administrations had APANPIRG Air Navigation Deficiencies recorded in the field of SAR Capability.

2.97 APSAR/WG was developing a template Memorandum of Understanding (MoU) between national SAR and Accident Investigation authorities for inclusion in the APAC SAR Plan, with a view to its later inclusion in the International Aeronautical and Maritime SAR (IAMSAR) Manual.

Proposals for ATM Safety Management Activities in the APAC Region

2.98 ICAO provided information on ATM safety management activities, with the aim of stimulating discussion on what activities should be undertaken in the region to support the application of safety risk management processes in ATM operations and projects.

2.99 The ICAO APAC Regional Sub-Office had conducted two rounds of workshops on *ATM Safety Risk Assessment in Change Management* and *Safety Culture in ATM*.

2.100 The meeting agreed to the proposal that an APAC region-wide ATM safety management survey be conducted, and that regional ATM safety management activities be continued.

3. ACTION BY THE MEETING

3.1 The Meeting is invited to:

a) note the information in this paper;

b) note:

   i. CPCLC ACP, and the impact of Pilot-Operator Response Times (PORT);

   ii. AKARA Corridor airspace improvements;

   iii. overall regional vertical risk estimates not meeting TLS;

   iv. overall regional horizontal risk estimates meeting TLS;

   v. non-RVSM approved airframes and 'rogue' aircraft;

vi. the effect of the pandemic on LHTM burdens;
vii. issues associated with the management of danger areas over the high seas;
viii. the new GRF for runway surface conditions and associated promulgation of information, applicable from 04 November 2021;
ix. ATM contingency events in the Asia/Pacific Region;
x. regional SAR implementation; and

c) discuss any other relevant matter.

— END —

ATTACHMENT A – LARGE HEIGHT DEVIATION (LHD), LARGE LONGITUDINAL ERROR (LLE) AND LARGE LATERAL DEVIATION (LLD) TAXONOMY

Source: Guidance Material for the Continued Safety Monitoring of the Asia/Pacific RVSM Airspace Version 1.0

LHD TAXONOMY

LHD Code	LHD Category Description
A	Flight crew failing to climb/descend the aircraft as cleared
B	Flight crew climbing /descending without ATC clearance
C	Incorrect flight level provided due to incorrect operation or interpretation of airborne equipment (e.g. incorrect operation of fully functional FMS, incorrect transcription of ATC clearance or re-clearance in FMS, flight plan followed rather than ATC clearance, original clearance followed instead of re-clearance, etc.)
D	ATC system loop error; (e.g. ATC issues incorrect flight level clearance or flight crew misunderstands the flight level clearance message)
E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues (e.g. late or non-existent coordination of flight level)
F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues (e.g. late or non-existent coordination of flight level)
G	Aircraft contingency event leading to sudden inability to maintain assigned flight level (e.g. pressurization failure, engine failure);
H	Airborne equipment failure leading to unintentional or undetected change of flight level (e.g. altimetry errors)
I	Turbulence or other weather related causes leading to unintentional or undetected change of flight level
J	TCAS resolution advisory; flight crew correctly climb or descend following the resolution advisory
K	TCAS resolution advisory; flight crew incorrectly climb or descend following the resolution advisory
L	An aircraft being provided with RVSM separation is not RVSM approved (e.g. flight plan indicating RVSM approval but aircraft not approved, ATC misinterpretation of flight plan)
M	Others

Table A1: LHD Taxonomy

LLE/LLD TAXONOMY

LLE/ LLD Code	LLE and LLD Category Description
A	Flight crew deviate without ATC Clearance in the horizontal dimension
B	Incorrect estimate or route provided due to incorrect operation or interpretation of airborne equipment (e.g. incorrect operation of fully functional FMS, incorrect transcription of ATC clearance or re-clearance, original clearance followed instead of re-clearance in FMS, incorrect time estimate sourced from flight deck, etc.)
C	Flight crew waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position
D	ATC system loop error (e.g. ATC issues incorrect route clearance, Flight crew misunderstands route clearance message, etc.)
E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues (e.g. late or non-existent coordination, incorrect time estimate/actual, ATS route, etc. not in accordance with agreed parameters)
F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues (e.g. non-existent coordination, incorrect time estimate, or ATS route attributed to technical causes)
G	Navigation errors due to airborne equipment failure leading to a deviation in the horizontal dimension of which notification was not received by ATC or notified too late for action
H	Turbulence or other weather related causes (other than approved) leading to a deviation in the horizontal dimension
I	An aircraft was provided with reduced horizontal separation minima but did not meet the RNP/RSP/RCP specification;
J	Others

Table A2: LLE/LLD Taxonomy