International Civil Aviation Organization

Eleventh Meeting of the Air Traffic Management Sub-Group (ATM/SG/11) of APANPIRG

Singapore, 2 – 6 October 2023

Agenda Item 3: Performance Frameworks and Metrics

FIT-ASIA AND RASMAG OUTCOMES

(Presented by the Secretariat)

SUMMARY

This paper presents outcomes relevant to the ATM/SG from the Future Air Navigation Services (FANS) Interoperability Team – Asia (FIT-Asia) and the Regional Airspace Safety Monitoring Advisory Group (RASMAG).

1. INTRODUCTION

1.1 The Thirteenth Meeting of the FANS Interoperability Team-Asia (FIT-Asia/13) and the Twenty-Eighth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/28) were held by video teleconference from 06 to 09 June 2023 and 21 to 24 August 2023 respectively.

1.2 RASMAG is a Sub-Group of APANPIRG, and the FIT-Asia reports to RASMAG.

1.3 Meeting documentation and the final report of the meeting are available on the FIT- Asia/ 32 and RASMAG/28 can be found at the following web-pages:

a. icao.int/APAC/Meetings/Pages/2023-FIT-Asia13.aspx

b. icao.int/APAC/Meetings/Pages/2023-RASMAG-28.aspx

2. DISCUSSION

FIT-Asia Meeting Outcomes

FIT-Asia Problem Reports

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

State	# PR 2023 (to 28 May)	Performance Analysis Reports to FIT
Australia	1	YES
China	0	YES[1]
Fiji	0	YES
France (Polynésie Française)	0	YES
India	0	YES[2]
Indonesia	0	YES[3]
Japan	3	YES
Malaysia	1	YES[4]
Myanmar	0	YES
Maldives	0	NO
Papua New Guinea	4	NO
Philippines	0	YES
New Zealand	4	YES
Singapore	16	YES
Sri Lanka	0	YES
USA	7	YES
Viet Nam	3*	YES

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

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

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

Establishment of service agreement with the APANPIRG-recognized CRA

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

[1] Lanzhou and Urumqi FIRs
[2] Chennai and Kolkata FIRs.
[3] Ujung Pandang FIR.
[4] Kuala Lumpur FIR.
* Unable to investigate due to lack of necessary information.

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

	APANPIRG-recognized CRA	Scope of application	formal service agreement
IPACG, ISPACG (United States)	CRA Boeing	IPACG States, ISPACG States, and NAT States	Yes
Japan	CRA Japan	Japan	Yes
SEASMA (Singapore)	CRA Boeing	Singapore, Philippines, and Viet Nam	Yes
India	CRA Boeing	India	Yes (Not for 2023)

Table 2: Current formal CRA service agreements

2.6 Subsequent to the FIT-Asia/13 meeting, ICAO reviewed the situation and considered that, given the importance of data link problem reporting in States' performance monitoring obligations under Annex 6 Operation of Aircraft Part 1[1] and Annex 11 Air Traffic Services[2], the following Draft Conclusion be considered by APANPIRG:

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

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

PBCS Global Charter

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

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

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

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

[1] Annex 6 Part I 7.1.5 and 7.3.4

[2] Annex 11 2.29 and 3.3.5.2

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

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

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

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

Asia/Pacific Region Combined PBCS Monitoring Report

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

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

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

Table 3: Asia/Pacific Region ASP (RSP180)

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

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

Table 4: Asia/Pacific Region ACP (RCP240)

2.15 It was again noted that HF data link (HFDL) performance results did not meet PBCS performance requirements in all FIRs.

FIT-Asia Task List

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

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

RASMAG/28 Meeting Outcomes

APAC Consolidated Safety Report

2.18 The Monitoring Agency for the Asian Region (MAAR) presented a combined summary of the safety analysis results for the Asia/Pacific Region, on behalf of the Asia/Pacific RMAs and EMAs. The report was divided into the Pacific (PAC) area, and Asia area (**Figure 1**). The full APAC consolidated Safety Report can be found in **Attachment A**.

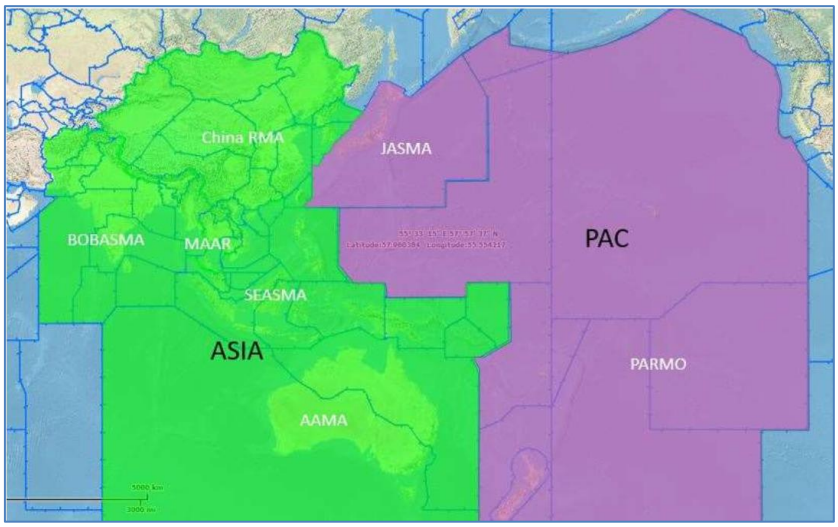


Figure 1: Asia and Pacific Safety Reporting Areas

Pacific Area Vertical Collision Risk

2.19 The estimated vertical collision risk for 2022 for the PAC area did not meet the Target Level of Safety (TLS). (**Table 5**). The overall risk vertical risk had been increasing from 2016 to 2021 due to improvements in reporting culture.

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

Table 5: Pacific Area Vertical Collision Risk 2022

2.20 The PAC vertical collision risk estimates had been above TLS and trending upwards each year from 2016 to 2019. In 2022, there was a slight decrease when compared to the previous year. (**Table 6**)

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

Table 6: Pacific Area Vertical Collision Risk Estimates 2016 – 2022

2.21 There was a total of 118 Large Height Deviations (LHDs) in the Pacific area in 2022 (decreased from 123 in 2021), with total duration 449 minutes and 74 levels crossed. 34 of the occurrences were Category[1] A, B or C (29%), 59 were Category D, E or F (50%), six were Category G or H (5%), 11 in Category I (9%), five were Category J or K (4%), and three were Category L or M (3%).

Pacific Area Horizontal Collision Risk

2.22 The estimated horizontal collision risk for 2022 for the PAC area met TLS in all longitudinal and lateral risk categories. (**Table 7**)

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

Table 7: Pacific Area Horizontal Collision Risk 2022

[1] Categories of LHD events as recognized by RMAs were:

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

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

Category C: Incorrect operation or interpretation of airborne equipment;

Category D: ATC system loop error;

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

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

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

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

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

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

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

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

Category M: Others.

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

Asia Area Vertical Collision Risk

2.24 The estimated vertical collision risk for 2022 for the Asia area met TLS. (**Table 8**). The overall risk continued to decline since 2017 due to various safety improvement initiatives.

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

Table 8: Asia Area Vertical Collision Risk 2022

2.25 The Asia vertical collision risk estimates had been above TLS each year from 2016 to 2020, but trending downwards since 2017 (**Table 9**). The 2022 vertical collision risk estimate was below TLS.

Year	**Vertical Overall Risk Estimate (x 10^{-9} fapfh)**	**Remark**
2022	1.53	Below TLS
2021	4.03	Below TLS
2020	7.42	Above TLS
2019	12.88	Above TLS
2018	15.50	Above TLS
2017	27.30	Above TLS
2016	12.53	Above TLS

Table 9: Asia Area Vertical Collision Risk Estimates 2016 –2022

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

Asia Area Horizontal Safety Assessments

2.27 The estimated horizontal collision risk for 2022 for the Asia area met TLS in all longitudinal and lateral risk categories. (**Table 10**)

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

30NM Lateral Risk	0.0001×10^{-9}	SEA and SA/IO	Below TLS
50NM Longitudinal Risk	0.25×10^{-9}	SEA and SA/IO	Below TLS

Table 10: Asia Area Horizontal Collision Risk 2019 - 2022

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

Safety Reporting – Asia and Pacific Area

2.29 **Table 11** shows the number of LHD, LLD and LLE reports for 2017 to 2022, and the number of reports per flying hours. Total estimated flying hours had been increasing since 2020, 7,234,881 hours in 2020, 7,604,927 in 2021 to 10,240,138 hours in 2022. The overall reporting rate of LHDs/LLDs/LLEs decreased in 2022.

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

2.31 Mongolia and DPR Korea reported Nil LHDs in 2022.

Airspace	# Reports						1 Report : Flying Hrs					
	2017	2018	2019	2020	2021	2022	2017	2018	2019	2020	2021	2022
DPRK	0	0	0	0	0	0	-	-	-	-	-	-
Mongolia	4	1	2	0	1	0	1: 37,771	1: 158,891	1: 82,138	-	1: 121,621	-
SEA	474	205	152	42	70	62	1: 6,548	1: 17,757	1: 22,275	1: 25,106	1: 15,456	1: 32,620
SA/IO	935	681	439	152	135	143	1: 3,166	1: 3,783	1: 7,955	1: 7,907	1: 11,167	1: 21,018
Japan	71	76	77	66	80	75	1: 21,510	1: 20,632	1: 20,762	1: 14,737	1: 13,528	1: 18,751
China	134	110	79	85	105	72	1: 18,248	1: 22,229	1: 31,119	1: 26,867	1: 15,477	1: 18,003
Pacific	42	43	173	134	176	179	1: 54,191	1: 45,064	1: 10,139	1: 6,404	1: 6,638	1: 8,280
Indonesia	34	23	37	18	41	54	1: 10,842	1: 53,603	1: 33,321	1: 17,346	1: 7,402	1: 8,060
SW Pacific	51	53	101	46	47	81	1: 17,572	1: 17,817	1: 9,335	1: 6,954	1: 11,975	1: 5,352
ROK and AKARA	5	12	34	5	24	108	1: 117,090	1: 28,365	1: 18,959	1: 25,965	1: 6,285	1: 1,056
Total	**1,750**	**1,204**	**1,094**	**548**	**679**	**774**	**1: 8,180**	**1: 12,332**	**1: 14,330**	**1: 11,712**	**1: 11,200**	**1:13,230**

Table 11: Total LHD, LLD and LLE Reports, and Reports per Flying Hours, 2017 - 2022

Hot Spots

2.32 **Table 12** summarizes current LHD Hot Spots, the FIRs involved, the year of identification, and status remarks.

Hot Spot	Involved FIRs	Identified	Remarks
A1	Kolkata/Dhaka-Yangon	2015	Cat. E LHDs. Risk reduced.
A2	Chennai – Yangon/Kuala Lumpur	2015	Cat. E LHDs reduced. Risk reduced. Potential non-hot spot 2023 (RASMAG/28)
B	Incheon (AKARA Airspace)	2015	- Risk at Incheon-Fukuoka ACC

			interface mitigated. - Cat. E LHDs and risk at Incheon-Shanghai ACC interface reduced
D	Manila – all adjacent FIRs	2015	- Cat. E LHDs and risk at Manila/ Fukuoka FIR boundary reduced. - Risk at all other Manila FIR boundaries mitigated.
F	Mogadishu – Mumbai	2015	Cat. E LHDs reducing. Risk reducing.
G	Sanaa/Muscat – Mumbai	2015	Cat. E LHDs. Risk reducing.
J	Jakarta – Singapore/Kota Kinabalu	2018	Cat. E LHDs.
M	Colombo – Melbourne	2019	LHDs and risk reducing. Awaiting response to establish a POC before removing from the hot spot list.
N	Oakland USA – Hawaii CEP	2019	Cat. E LHDs increasing. Risk increasing
O	Bangkok /Ho Chi Minh/Kuala Lumpur - Singapore	2023	Cat. E LHDs.

Table 12: LHD Hot Spots in the Asia/Pacific Region

2.33 The meeting discussed the following changes to the Asia Pacific Consolidated report: The meeting agreed that all hot spots except A2 be retained, and monitored for another year before considering their reclassification as potential non-hot spots. One new Hot Spot 'O' has been added.

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

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

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

Analyses for the Incheon FIR AKARA Corridor Interface with Shanghai/Fukuoka/Taibei FIRs

2.37 The vertical collision risk estimates for the AKARA – FUKUE Corridor airspace are shown in **Figure 2**. The 2022 vertical technical risk estimate of 0.24 ×10-9 fapfh meets the Target Level of Safety (TLS) for vertical technical risk, the technical risk TLS is 2.5 × 10-9 fapfh. The overall vertical risk estimate of 0.24 × 10-9 fapfh meets the overall vertical TLS of 5 × 10-9 fapfh.

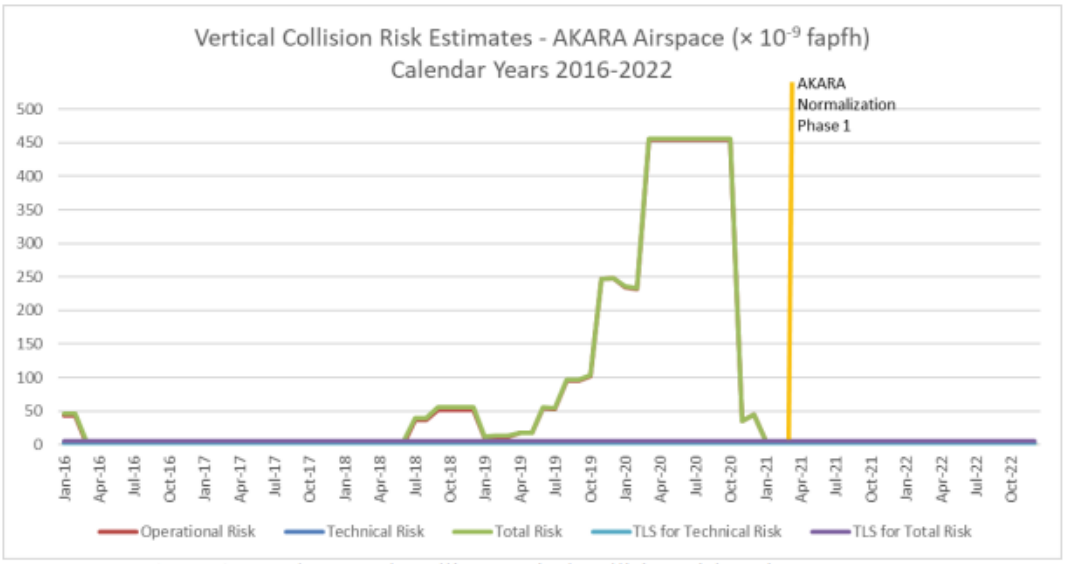


Figure 2: Twelve-month Rolling Vertical Collision Risk Estimates

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

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

RVSM Risk Assessment in the Brisbane, Honiara, Melbourne, Nauru, Port Moresby and the Indonesian FIRs

2.39 The Australian Airspace Monitoring Agency (AAMA) provided an airspace safety review of RVSM airspace risk within the Brisbane, Honiara, Melbourne, Nauru and Port Moresby FIRs. For the period 1 January 2022 to 31 December 2022. The TLS of 5 x 10^{-9} had been met, at 1.50 x 10^{-9}.

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

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

2.42 AAMA also provided an airspace safety review of RVSM airspace risk in in the Indonesian FIR for the period 1 January 2022 to 31 December 2022. The total risk estimate for the Jakarta and Ujung Pandang FIRs at 3.24 x 10^{-9}, met the TLS.

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

at Indonesia's FIR boundaries.

China RMA Vertical Safety Report

2.44 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).

2.45 The 2022 RVSM risk estimates for the Chinese FIRs indicated that the TLS had been met, at 0.19 x 10^{-9} fapfh. The 2022 RVSM risk estimate for the Pyongyang FIR was zero, as no LHD had been reported during 2021 or 2022

JASMA Vertical Safety Report

2.46 The total risk for the reporting period from 1 January to 31 December 2022 was 4.92 x 10-9 fapfh, which met the TLS and was improved from the risk reported to RASMAG/27 (9.52 x 10^{-9} fapfh).

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

JASMA Horizontal Safety Report

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

2.49 **Table 13** provides the North Pacific Ocean airspace horizontal risk estimates during the period January 2022 to December 2022.

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

Table 13: North Pacific Ocean Airspace Horizontal Risk Estimates

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

MAAR Vertical Safety Report

2.51 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

2.52 The 2022 RVSM risk estimate for SA/IO airspace indicated that the TLS had been met at 1.75×10^{-9} fapfh

Southeast Asian Airspace

2.53 The 2022 RVSM risk estimate for Southeast Asia (SEA) airspace indicated that the TLS for total risk had been met at 1.83×10^{-9} fapfh. 57 of the 63 reported LHDs in SEA airspace (90%) were classified as Category E.

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

Mongolian Airspace

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

SEASMA Safety Report

2.56 The South East Asia Safety Monitoring Agency (SEASMA) provided a horizontal safety assessment report for operations on ATS routes N892, L625, N884 and M767 over the South China Sea. The assessment met the Target Level of Safety (TLS) values for lateral and longitudinal separation standards applicable for RNP 10 and RNP 4 operations.

2.57 The 50NM lateral and longitudinal standards were satisfied at 0.017×10^{-9} and 0.375×10^{-9} respectively. In addition, the RNP4 lateral and longitudinal collision risk estimate were also below the TLS at 0.738×10^{-9} and 0.786×10^{-9}.

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

BOBASMA Horizontal Safety Monitoring Report

2.59 The Bay of Bengal Airspace Safety Monitoring Agency (BOBASMA) presented the horizontal safety assessment for the Bay of Bengal/Arabian Sea Indian Ocean airspace during the period January to December 2021. The 50NM lateral and longitudinal risks remained below the Target Level of Safety (TLS) at 1.38017×10^{-9} and 0.484744×10^{-9}.

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

observed compared to 2019.

PARMO Vertical and Horizontal Safety Monitoring Report

2.61 The Pacific Approvals Registry and Monitoring Organization (PARMO) provided a vertical safety assessment for 2022 for the Pacific RVSM airspace and a portion of Northeast Asia RVSM airspace.

2.62 The 2022 RVSM risk estimate for Pacific airspace indicated that the TLS had not been met at 32.6×10^{-9} (**Figure 3**).

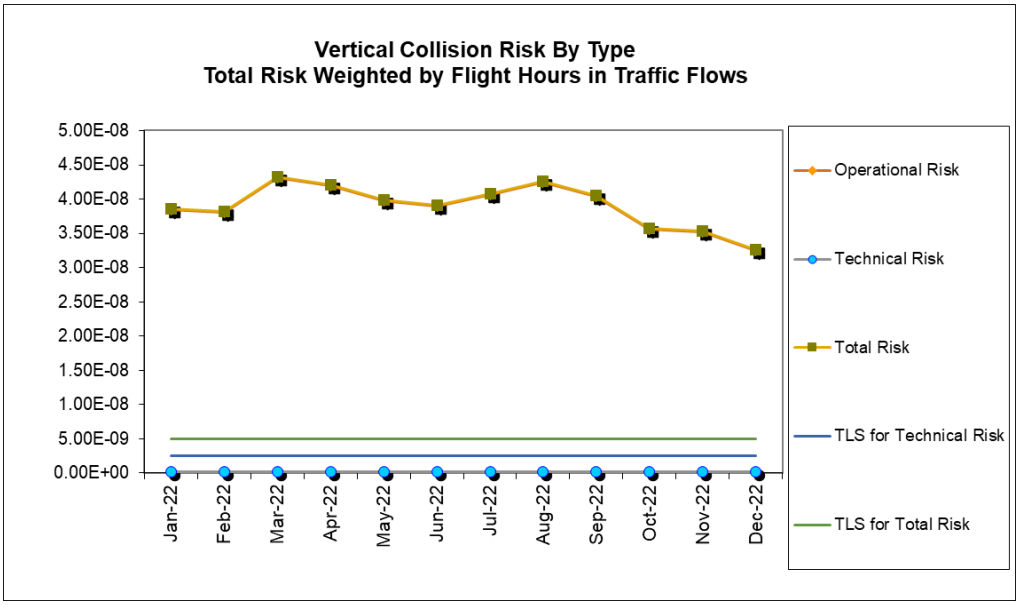


Figure 3: Pacific Airspace RVSM Risk Estimate Trends

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

2.64 North East Asia airspace RVSM total risk estimate met TLS, at 0.09×10^{-9}. There were 108 reported LHDs in calendar year 2022. All reported occurrences had zero duration and zero flight levels crossed without ATC clearance.

PARMO Horizontal Safety Monitoring Report

2.65 PARMO submitted its 2022 horizontal safety monitoring report for the Anchorage, Auckland, Nadi, Oakland, and Tahiti Flight Information Regions (FIRs). The lateral and longitudinal risks were all estimated to meet the TLS at 2.09×10^{-9}, 4.08×10^{-9} and 0.003×10^{-9} respectively.

2.66 Of the 109 reported LLDs and LLEs, 86 (90%) were Category E, while 16 (5%) were Category A & B, four were Category D and two were Category J.

Review of the Guidance Material for Continued Safety Monitoring of APAC RVSM Airspace

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

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

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

That,

1. the Guidance Material for the Continued Safety Monitoring of the Asia Pacific RVSM Airspace Version 2 be adopted; and

2. the Guidance Material Version 2 be uploaded to the ICAO APAC website to replace the existing version.

Guidance of PBCS Non-Compliance Reporting

2.69 ICAO presented guidance for PBCS non-compliance reporting, amendments to the PBCS non–compliance form, Monitoring Agencies Terms of reference and PBCS action list for ANSP

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

Asia Pacific Flight Information Region and Responsible Monitoring Agency

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

2.72 The meeting agreed the following Conclusion:

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

That,

1. *the removal of EMA Handbook Appendix A - Asia Pacific Flight Information Regions and Responsible Monitoring Agency (RASMAG/28 WP/22 refers); and*

2. *the additional guidance for PBCS Non-compliance reporting; be included in amendments to the following:*

    a) *The Revised EMA Handbook at **Appendix C to the Report**;*

    b) *Revised PBCS Action List at **Appendix D to the Report**; and*

    c) *The Asia Pacific Flight Information Regions and Responsible*

*Monitoring Agency document at **Appendix E to the Report**;*

3. *the above-mentioned documents be uploaded to the Asia/Pacific Regional Office website to replace the previous versions.*

4. *states/Administrations are urged to submit timely reports including Nil reports*

Update information on the EUR RMA FPRAVP

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

2.74 Based on the most recent bulletin version (version 21.8), there were still five MAAR State aircraft that continued to be listed on the EUR RMA bulletin, despite their previous inclusion in Bulletin version 17.7 in July 2022. **Table 14** presents a list of aircraft under MAAR's responsibility that were listed on the EUR RMA Bulletin.

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

Table 14: List of MAAR rogue aircraft on the EUR RMA Bulletin

RVSM Approvals and filing of RVSM indicator by State aircraft

5.1 The resultant survey supported by ***Conclusion APANPIRG/32-6*** indicated that the majority of the 15 responding States/administrations, would like Asia Pacific RMAs to continue to cross-check 'W' in State Aircraft's flight plans against RMAs' RVSM database and try to resolve the discrepancies. Therefore, the work of checking State aircraft RVSM approvals would remain with the RMAs

5.2 As the rejection of such flight plans of non-RVSM aircraft started to gain more traction in European region, this could prompt States of non-EU origin to take more actions. It was noted that RVSM approval data for several of the banned aircraft from APAC Region had subsequently been provided to MAAR. However, these appeared to be government transport aircraft, and not military aircraft. However APAC state aircraft operating solely within APAC region may still pose an issue. Therefore the task item RASMAG25/2 should remain open and monitored.

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

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

APAC Consolidated LTHM Compliance Status

2.75 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, based on RVSM approval data as of at 30 June 2023, yielded a remaining monitoring burden in the APAC Region of 503 aircraft, which was a 5% decrease since 2021.

APANPIRG List of Deficiencies Consideration

2.76 **Table 15** lists the States having a remaining monitoring burden of 30% or more, which could be subject to an APANPIRG ATM and Airspace Safety Deficiency.

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

Table 15: List of States having monitoring burden over 30% as of 30 June 2023

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

2.78 The meeting was informed that the 1,000 flight-hour criteria would be applied to the four aircraft from DPRK therefore DPRK can be omitted from the consideration of the APANPIRG ATM and Airspace Safety Deficiency listed in **Table 15**.

JASMA Assessment of Non-PBCS Approved Aircraft

2.79 JASMA presented the trend of the numbers and percentages for the Performance-Based Communications and Surveillance (PBCS)-filed flights and PBCS-approved flights flying in the Pacific Ocean airspace of Fukuoka Flight Information Region (FIR) as of June 2023. The percentage of PBCS-filed flights was steady and approximately 90% in 2022, but it was slightly variable between 87% and 90% for the period of the first half of 2023. On the other hand, the percentage of PBCS-approved flights had maintained by approximately six to seven percent lower than the percentage of PBCS-filed flights.

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

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

2.82 To ensure airspace safety, JASMA had planned to conduct PBCS approval status verification checks with designated RMAs where aircrafts were found to have no PBCS approvals, as a trial in 2023. The meeting noted that the manual process described above to identify and verify such aircraft was workable solution for aircraft that were registered in States that did not issue direct operational approvals.

Regulatory process PBCS operational approvals

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

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

2.85 The meeting agreed to the following Conclusion:

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

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

ANS Deficiencies List

2.86 The meeting reviewed the APANPIRG ATM and Airspace Safety Deficiency List and agreed to make the following recommendation to APANPIRG/34, as recorded in Appendix H to the RASMAG/28 Report. The meeting was informed that the deadline for submission of information to reduce the remaining monitoring burden must reach MAAR by 15 Nov 2023 in order to be processed in time for APANPIRG/34.

a) To be retained in the Deficiencies list

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

b) Removal of Deficiency:

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

- Brunei Darussalam.

c) Add new Deficiency

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

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

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) note the current LHD hot spots, proposal of potential non-spot and new hot spot;

c) note the update on the extension of the Flight Plan RVSM Approval Verification Process (FPRAVP), to reject flight plans of aircraft not approved for RVSM operations within the European airspace.

d) discuss and endorse **Draft Conclusion RASMAG/28-1: Formal Service Arrangements with CRA;**

e) Note and discuss:

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

ii) **Conclusion RASMAG/28-5: Survey for Asia Pacific States PBCS Approval Process;**

f) note the retention of existing, deletion and addition of new, ATM and Airspace Safety Deficiencies; and

g) discuss any relevant matters as appropriate.

…….

2022 Asia Pacific
Consolidated Safety Report

RASMAG/28
21 - 24 Aug 2023

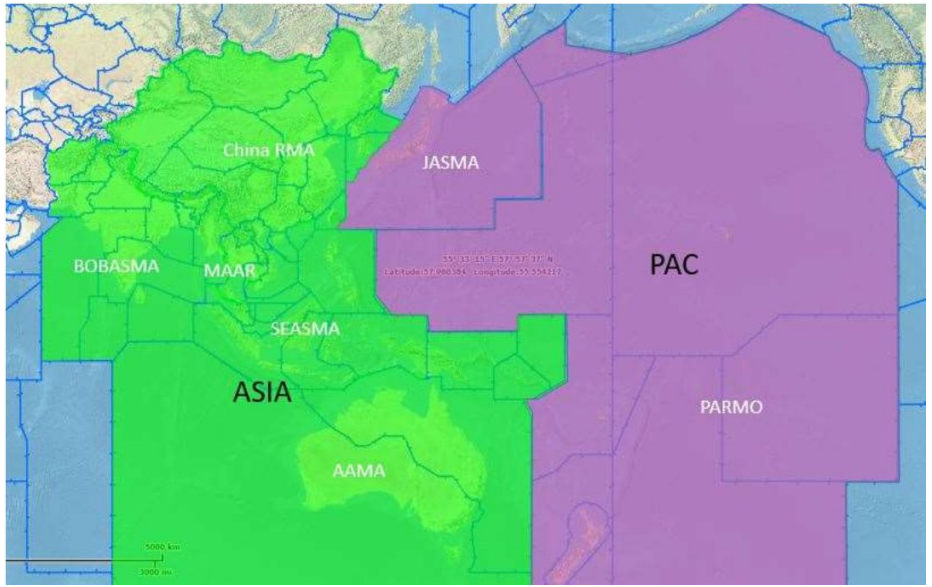
Outline

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

Background

Background

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



The report is divided into:

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

For each area, there will be a summary of:

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

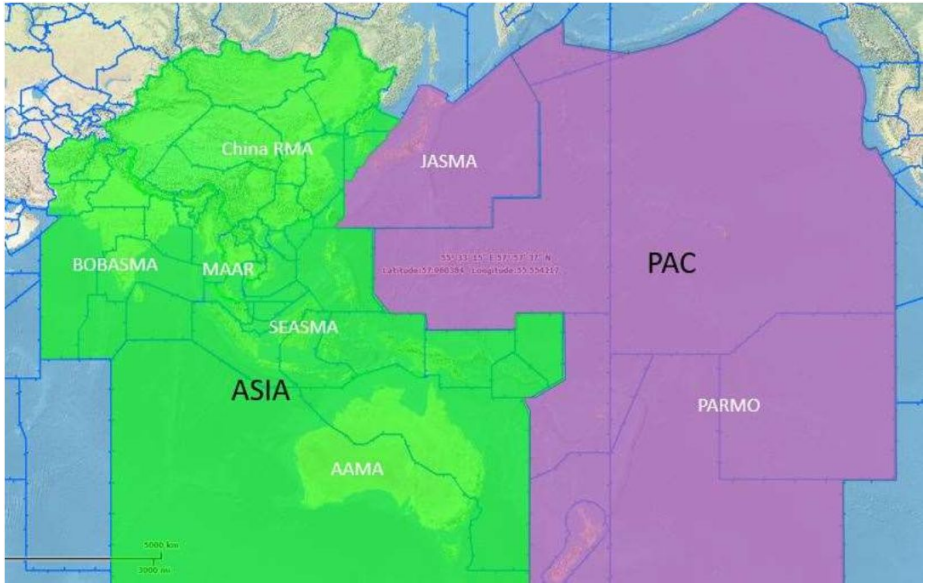
Pacific Area (PAC)

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

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

Monitoring Agencies :

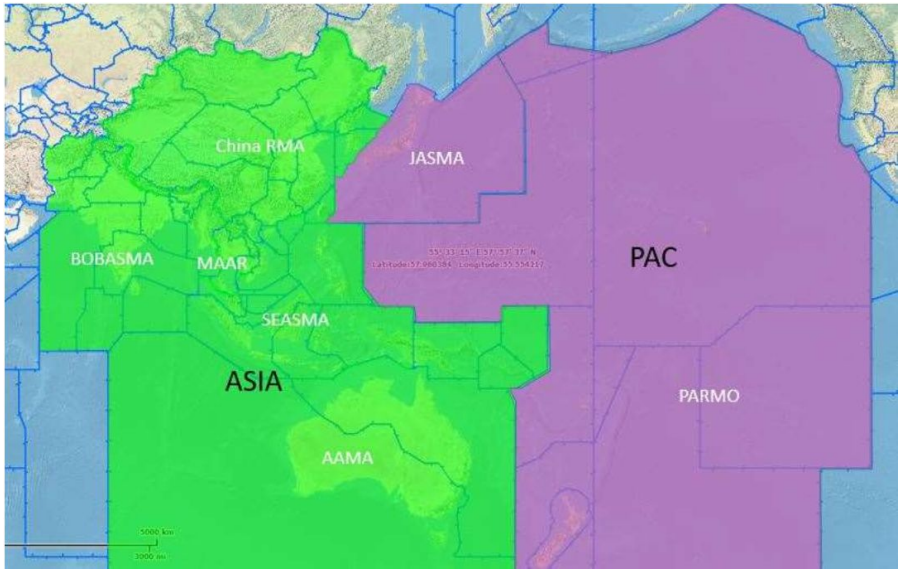
RMAs (Verical): JASMA, PARMO
EMAs (Horizontal): JASMA, PARMO



Asia Area (Asia)

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

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



Monitoring Agencies :

RMAs (Vertical): AAMA, China RMA, MAAR, PARMO
EMAs (Horizontal): AAMA, BOBASMA, PARMO, SEASMA

PAC Area

PAC : Vertical Collision Risk

PAC : Vertical Collision Risk Estimates

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

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

PAC : Vertical Collision Risk Estimates

2016 - 2022

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

PAC : Summary of LHDs

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

PAC : Summary of LHDs

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

PAC : Horizontal Collision Risk

PAC : Horizontal Collision Risk Estimates

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

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

PAC : Summary of LLDs and LLEs

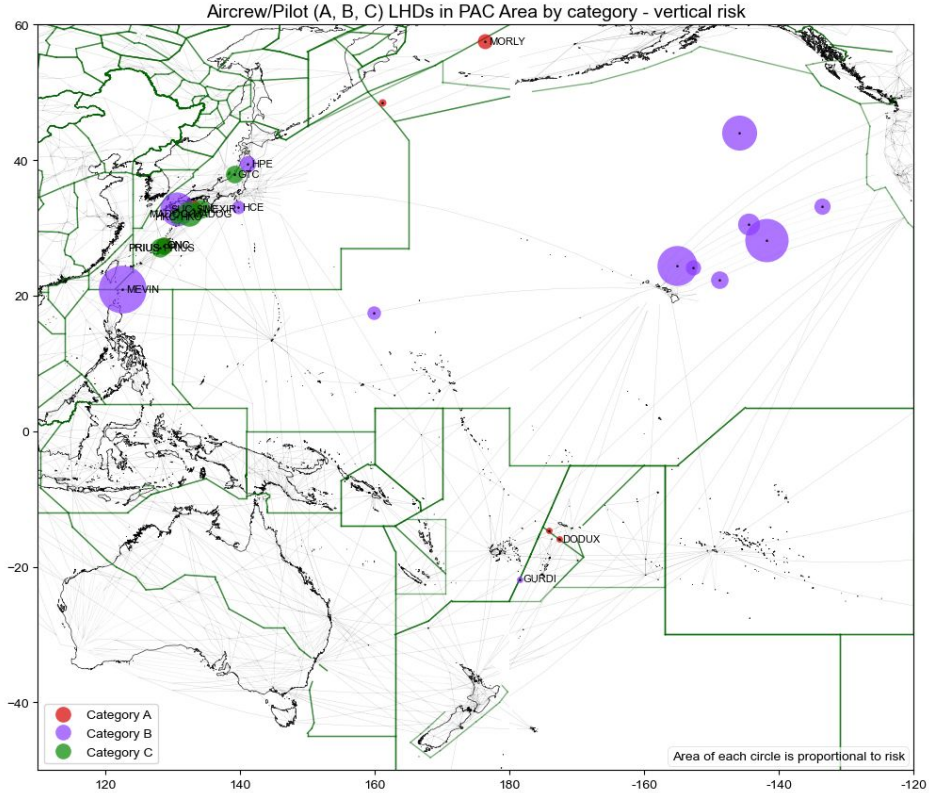
Attributions	Category Code	Description	Number of Occurrences	Duration (minutes)	Number of Tracks/Routes Crossed	Horizontal Deviation (NM)
Aircrew/ Pilot	A	Flight crew deviate without ATC Clearance	16	1.5	1	317
	B	Incorrect estimate or route provided due to incorrect operation or interpretation of airborne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

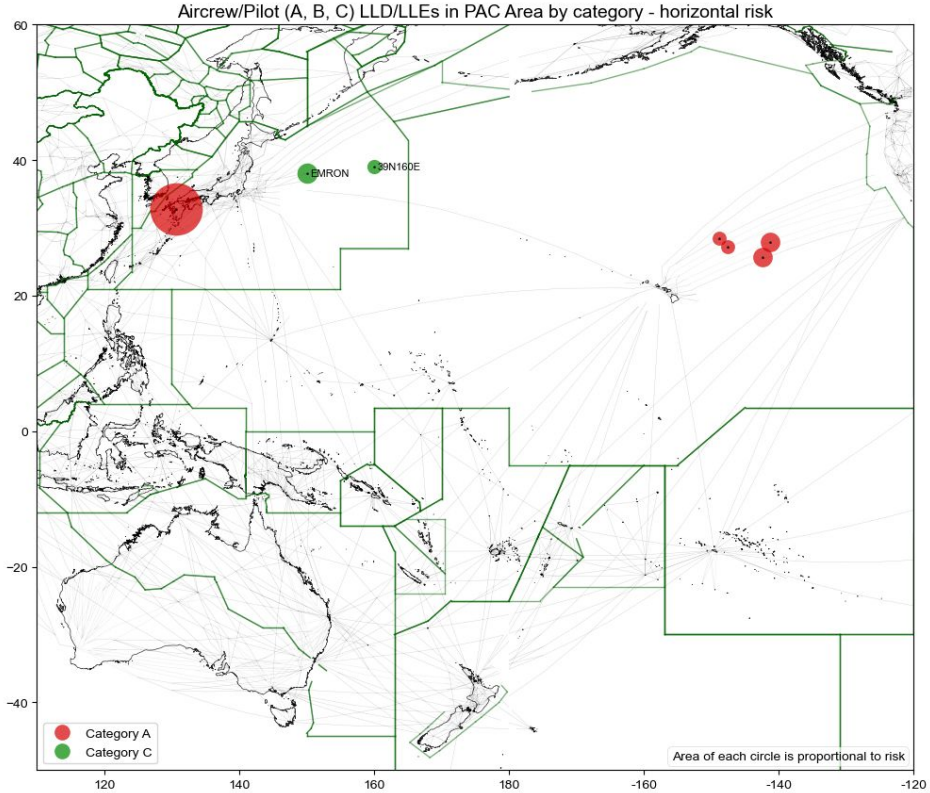
PAC : Summary of LLDs and LLEs

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

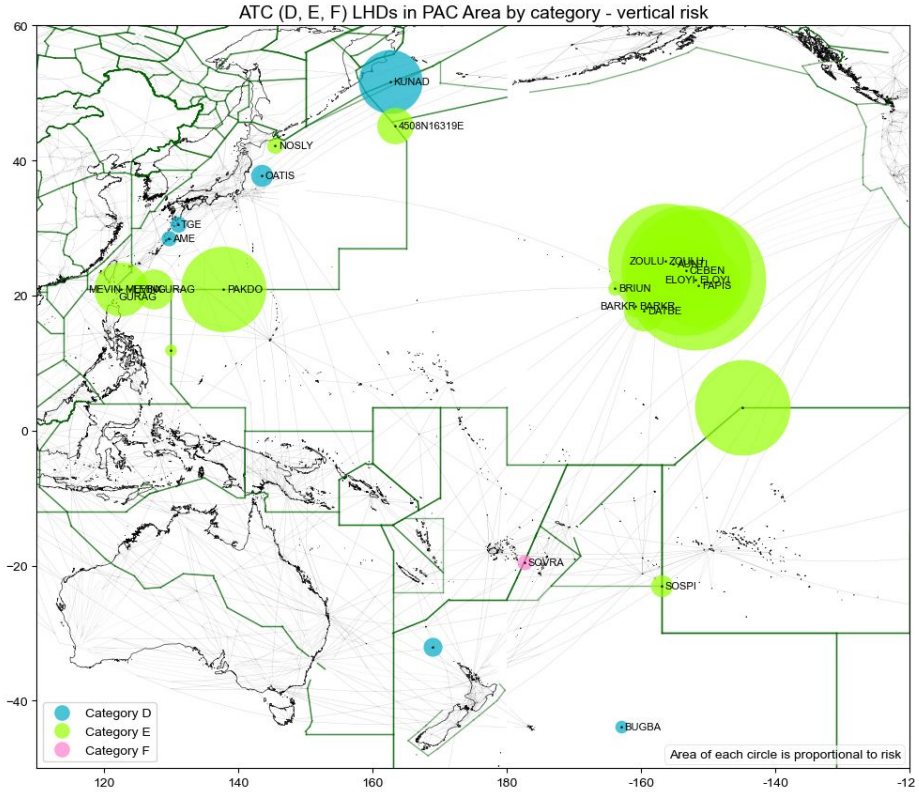
PAC : Geolocation of LHDs/LLDs/LLEs

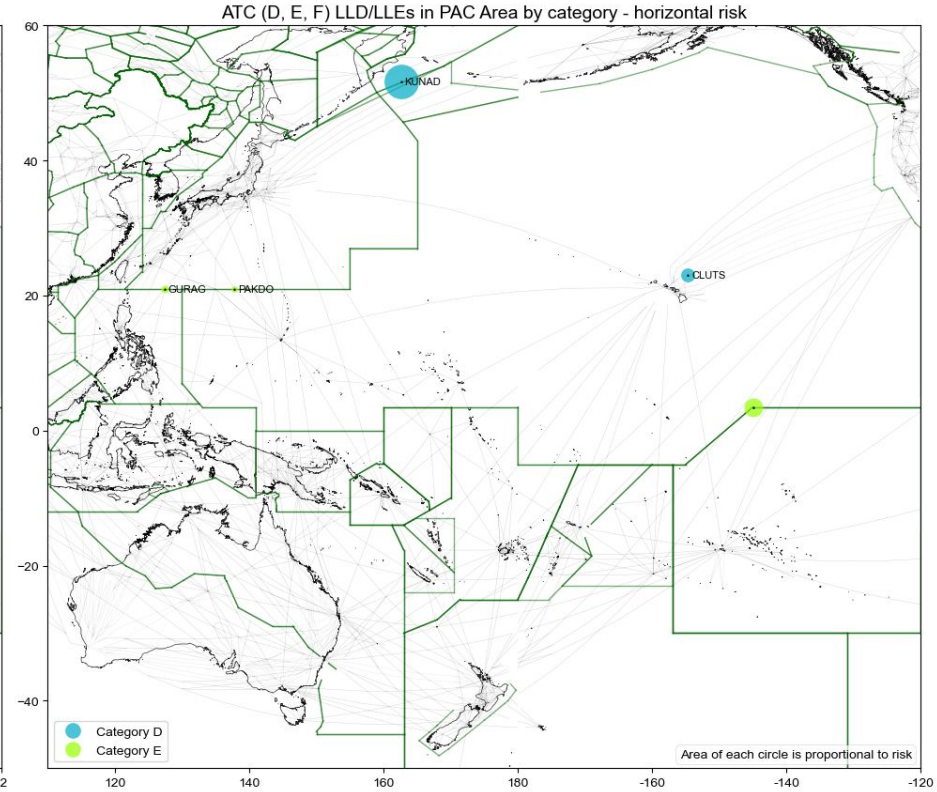
PAC : Aircrew/Pilot (A, B, C)



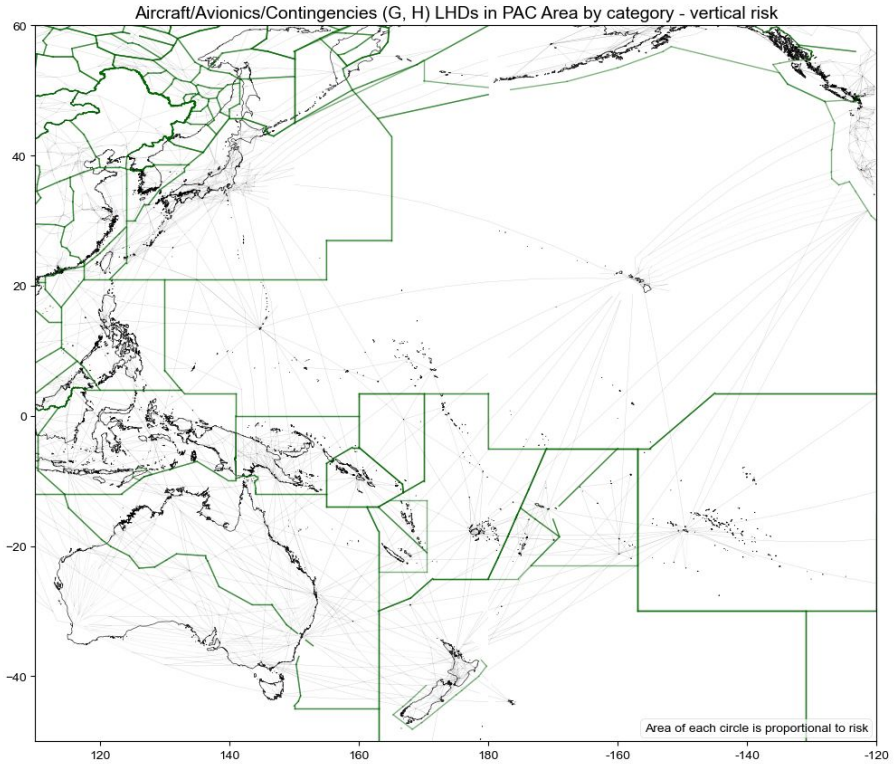


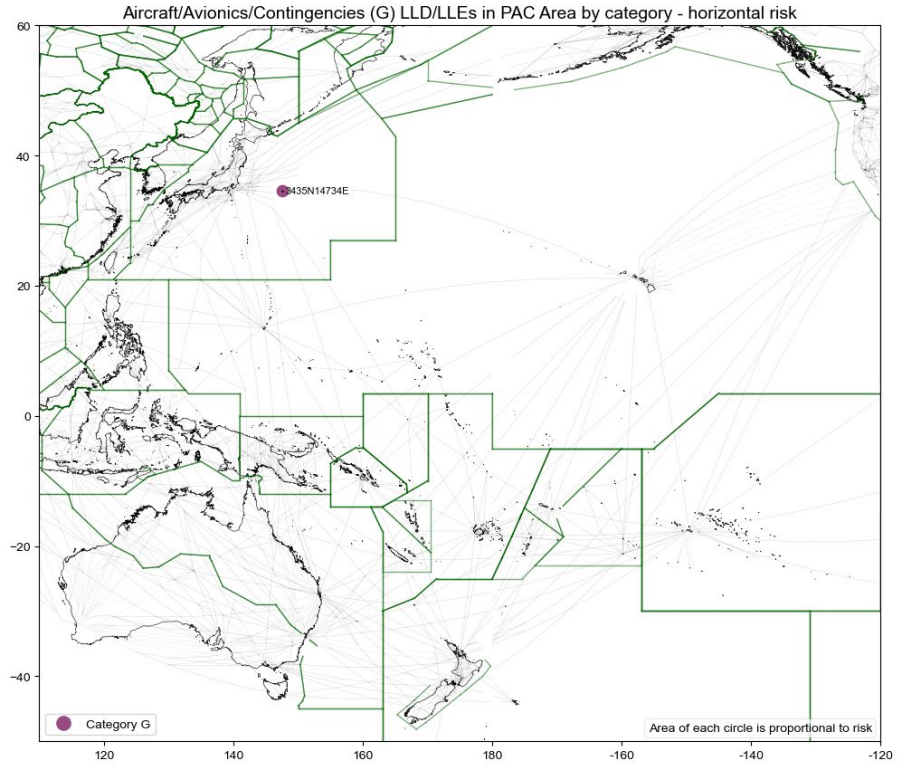
PAC : ATC (D, E, F)


ATC (D, E, F) LHDs in PAC Area by category - vertical risk
KUNAD
4508N16319E
NOSLY
OATIS
TGE
AME
MEVIN
GURAG
PAKDO
ZOULU
ZOULU
CEBEN
ELOYI
FLOYI
PAPIS
BRIUN
BARKR
BARKR
DATBE
SOVRA
SOSPI
BUGBA
Category D
Category E
Category F
Area of each circle is proportional to risk
60
40
20
0
−20
−40
120
140
160
180
-160
-140
-12


ATC (D, E, F) LLD/LLEs in PAC Area by category - horizontal risk
KUNAD
GURAG
PAKDO
CLUTS
Category D
Category E
Area of each circle is proportional to risk
60
40
20
0
−20
−40
120
140
160
180
-160
-140
-120

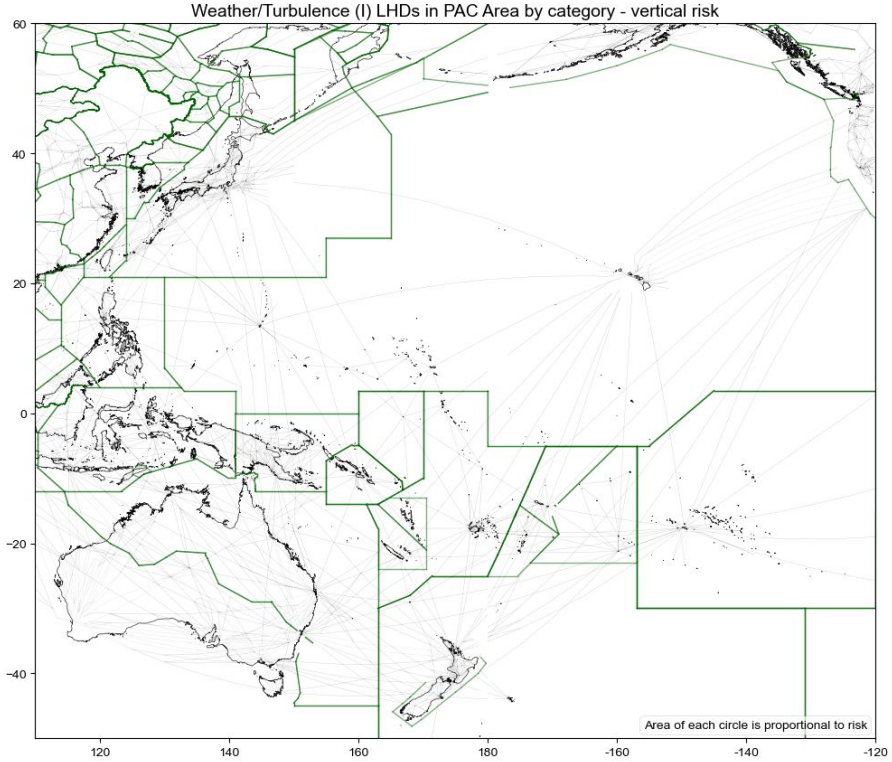
PAC : Aircraft Avionics/Contingencies (G, LHD:H)

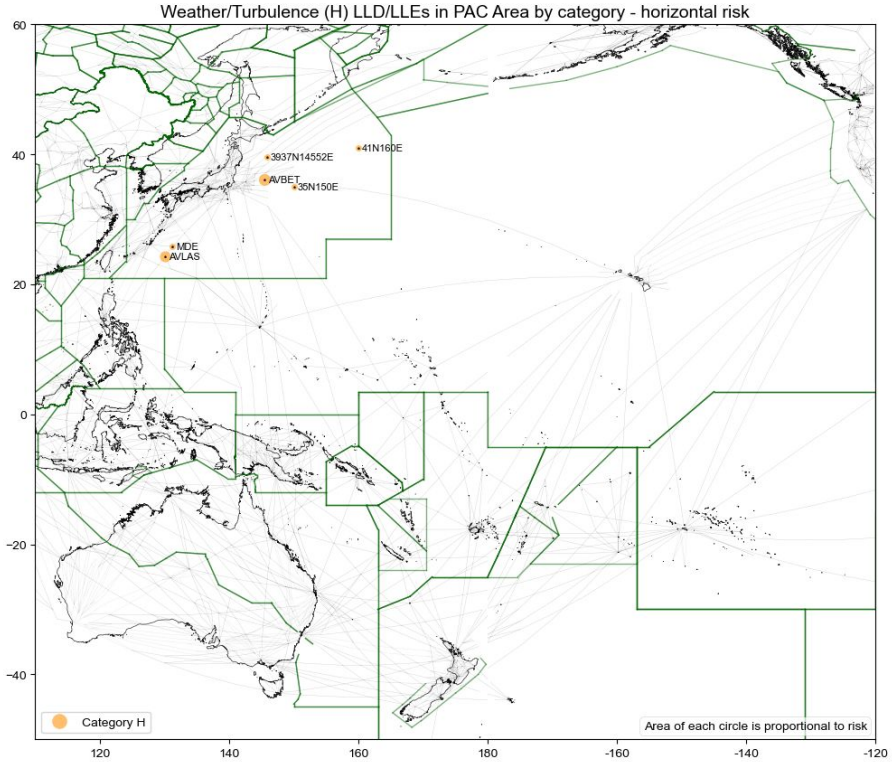




Note: No Category non-zero G and H LHD in 2022

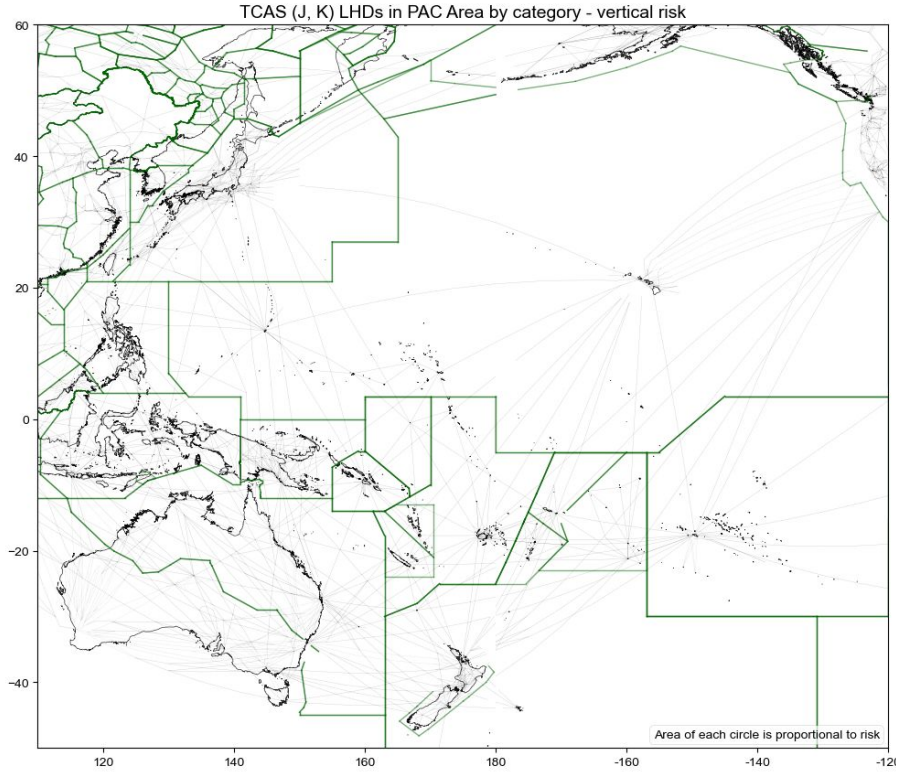
PAC : Weather/Turbulence (LHD:I, LLD/LLE:H)

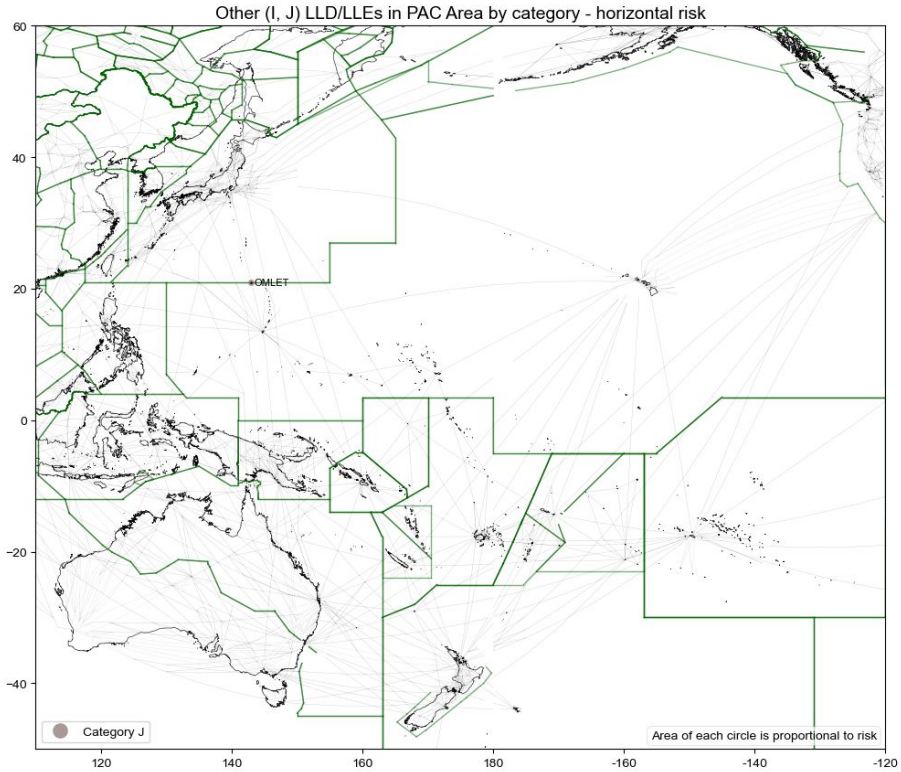




Note: No non-zero Category I LHD in 2022

PAC : TCAS (LHD:J, K)





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

PAC : Hot Spots

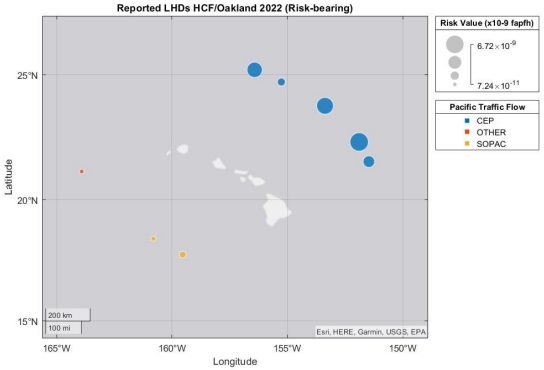
PAC : LHD Hot Spot N (North America - Hawaii CEP)

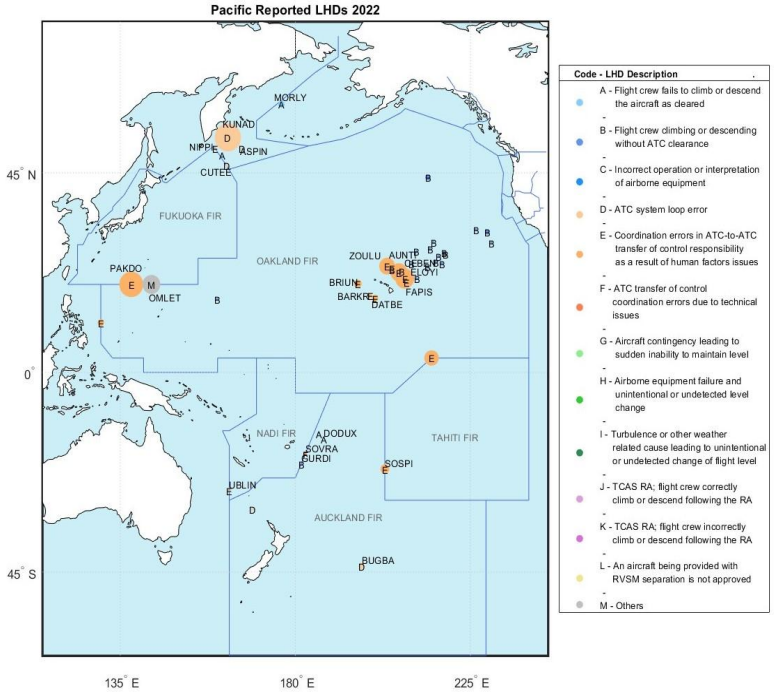
Nature of Occurrences : In 2021, several long duration LHDs were reported. Category E LHDs are the largest contribution to the vertical risk estimate in 2022 (this was also true for 2019, 2020, and 2021).

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

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

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





Asia Region

Asia : Vertical Collision Risk

ASIA : Vertical Collision Risk Estimates

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

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

ASIA : Vertical Collision Risk Estimates

2016 - 2022

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

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

Asia : Summary of LHDs

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

Asia : Summary of LHDs

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

Asia : Horizontal Collision Risk

Asia : Horizontal Collision Risk Estimates

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

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

Asia : Summary of LLDs and LLEs

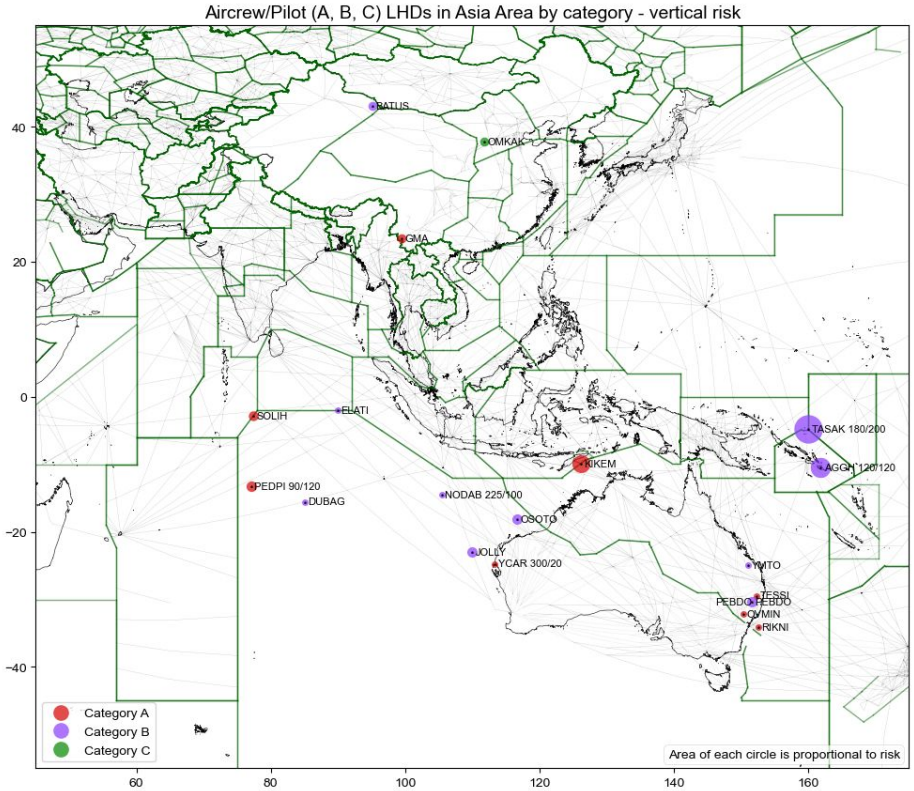
Attributions	Category Code	Description	Number of Occurrences	Duration (minutes)	Number of Tracks/Routes Crossed	Horizontal Deviation (NM)
Aircrew/ Pilot	A	Flight crew deviate without ATC Clearance	1	0	0	15
	B	Incorrect estimate or route provided due to incorrect operation or interpretation of airborne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

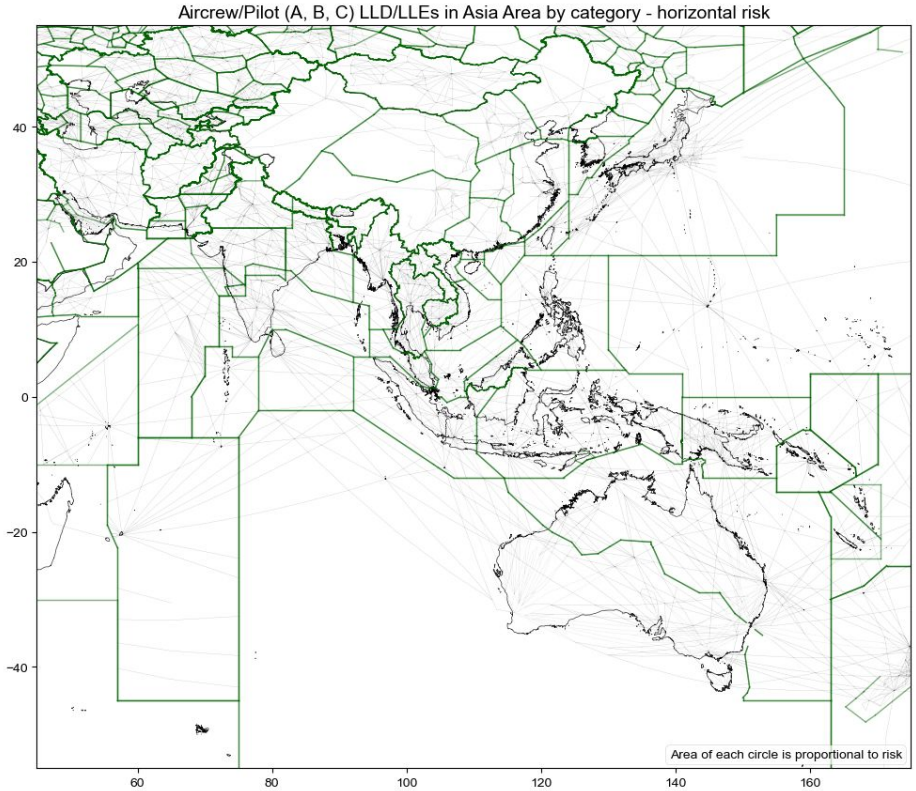
Asia : Summary of LLDs and LLEs

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

Asia : Geolocation of LHDs/LLDs/LLEs

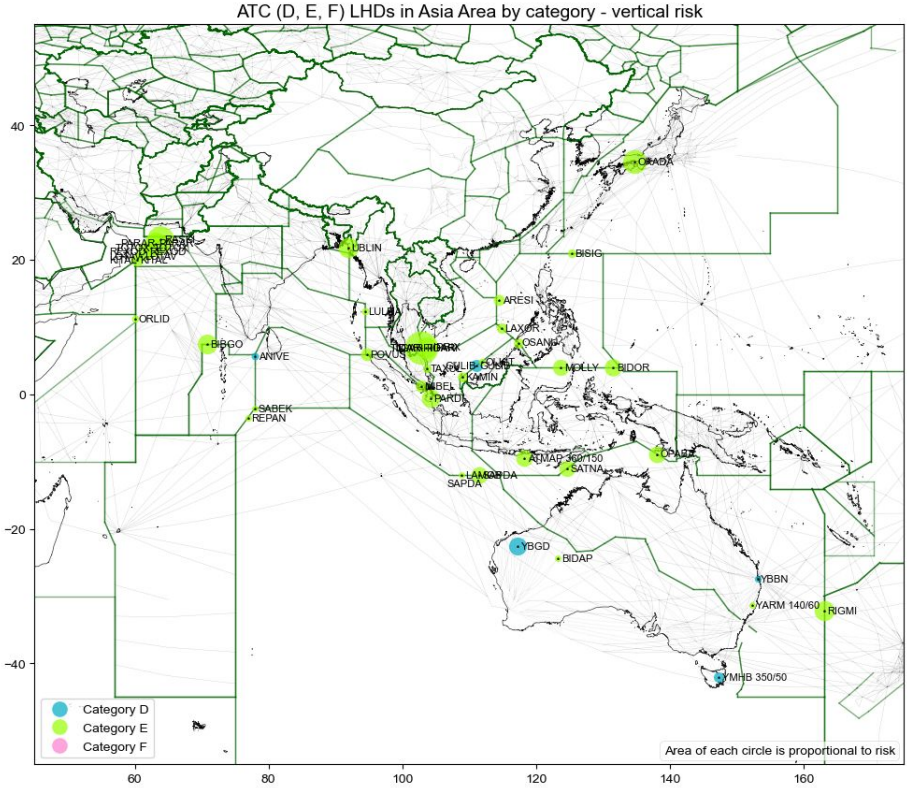
Asia : Aircrew/Pilot (A, B, C)

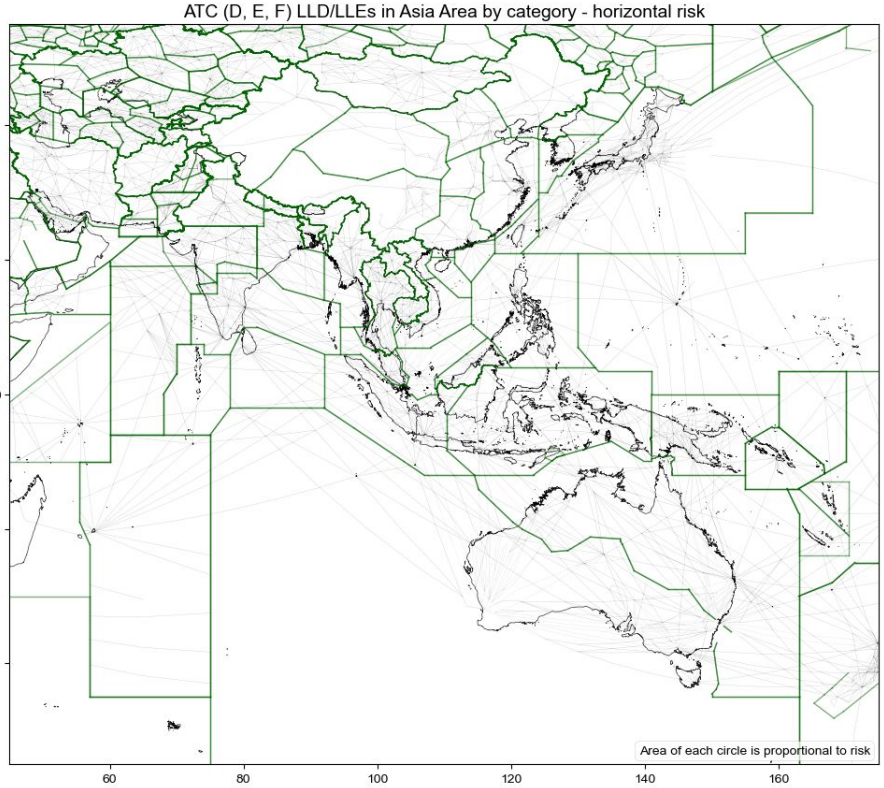




Note: No non-zero Category A, B and C LLD/LLE in 2022

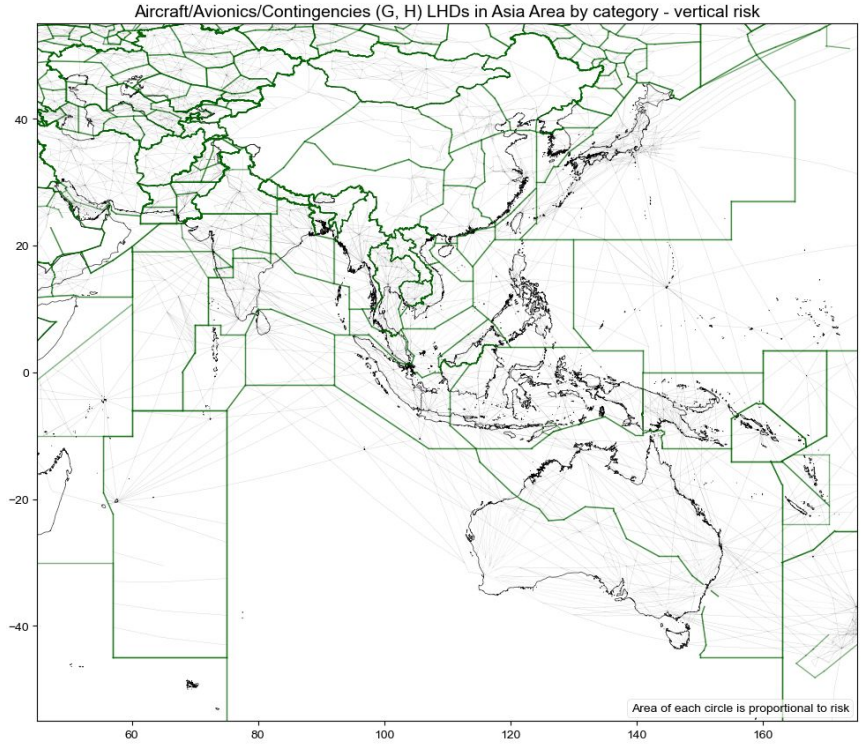
Asia : ATC (D, E, F)



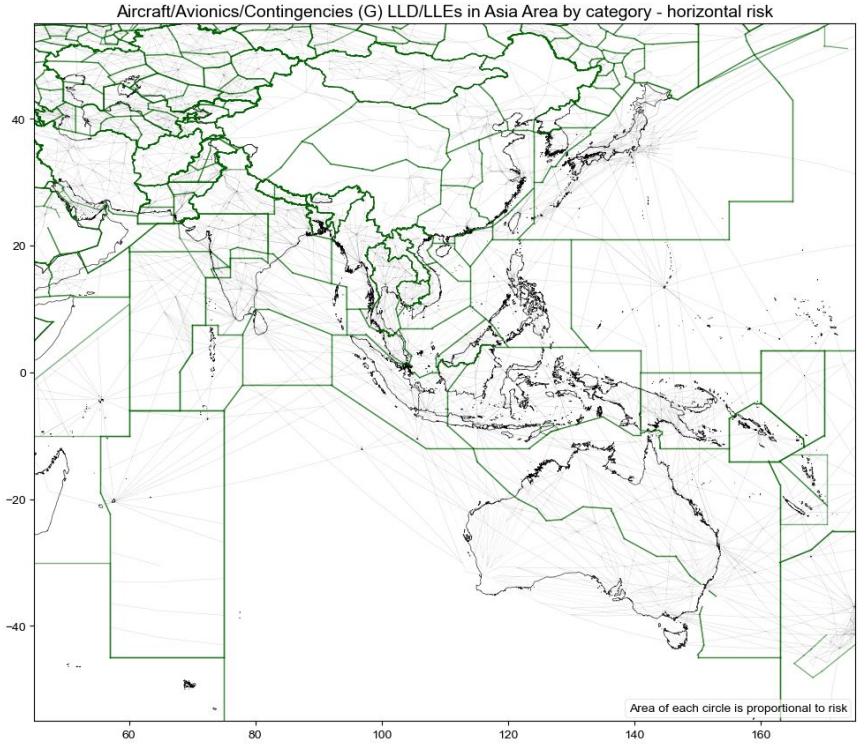


Note: No non-zero Category D, E and F LLD/LLE in 2022

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

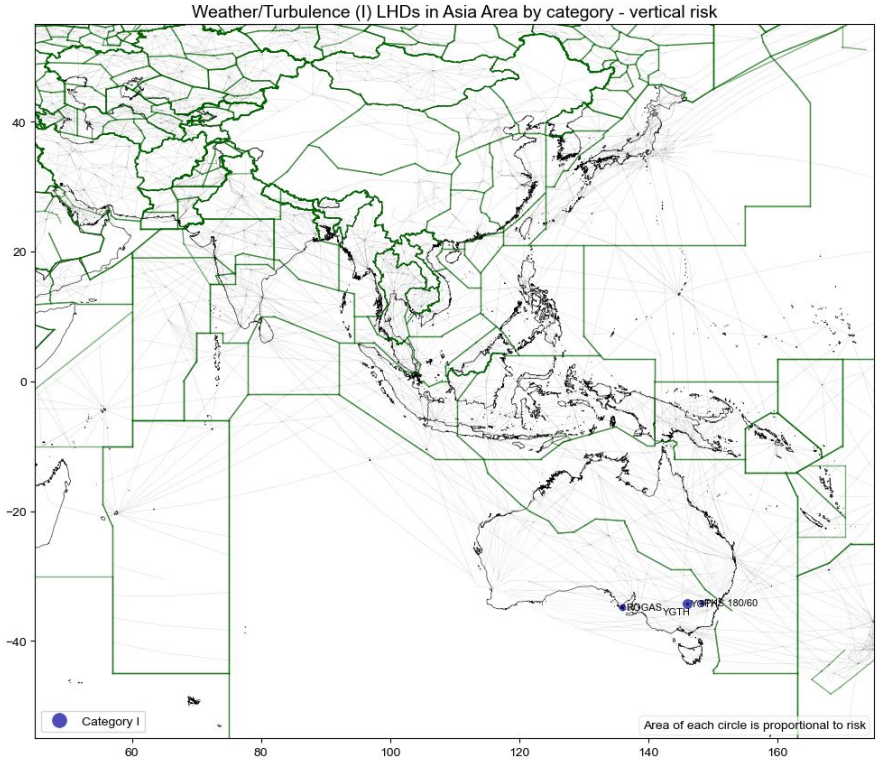


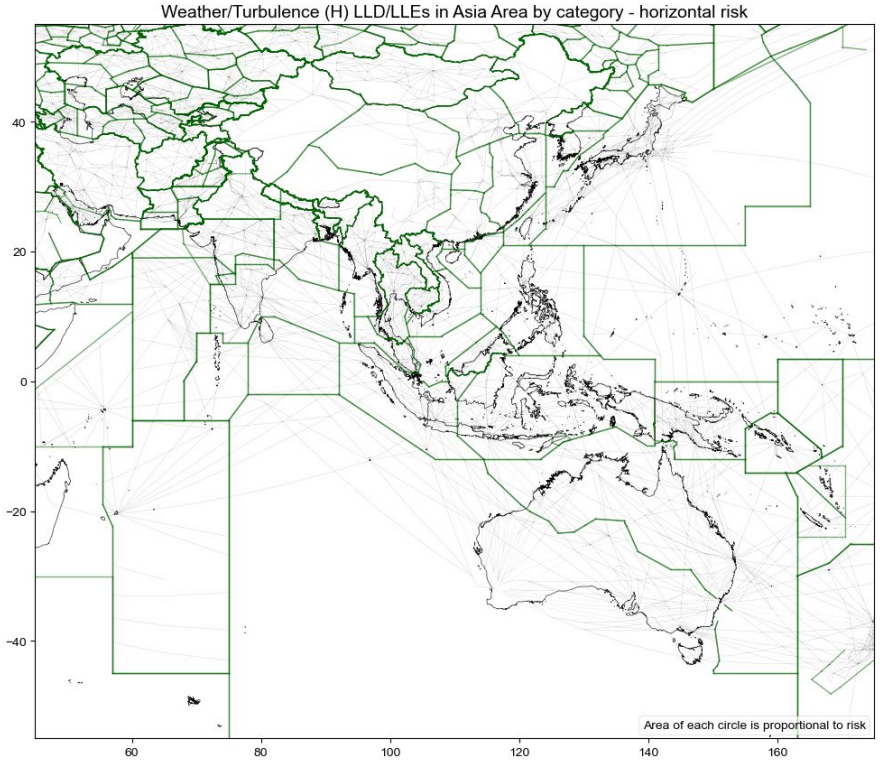
Note: No non-zero Category G and H LHD in 2022



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

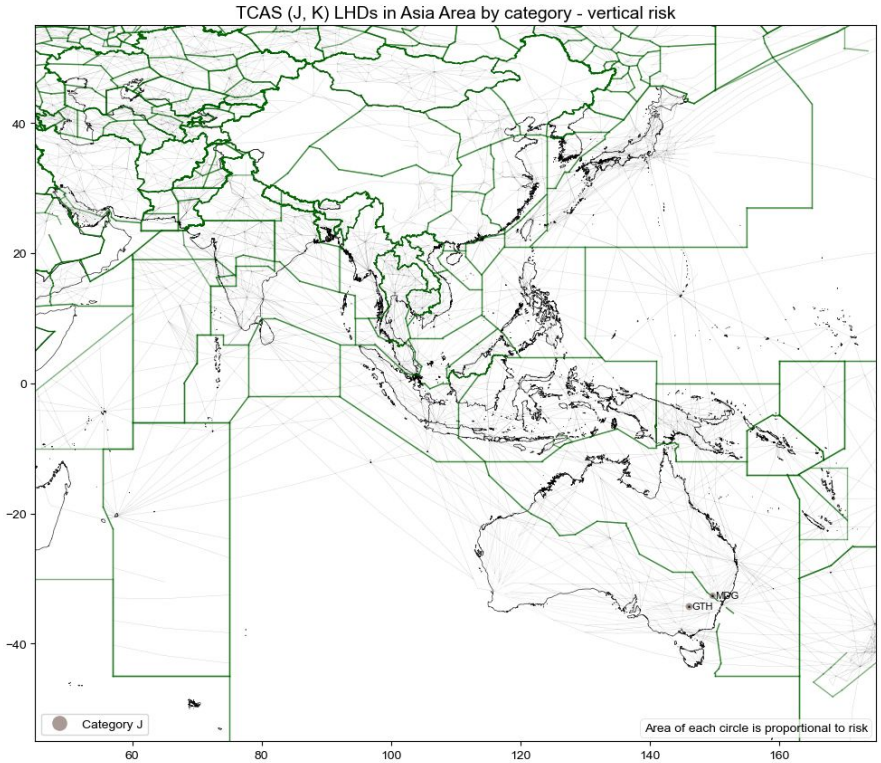
Asia : Weather/Turbulence (LHD:I, LLD/LLE:H)

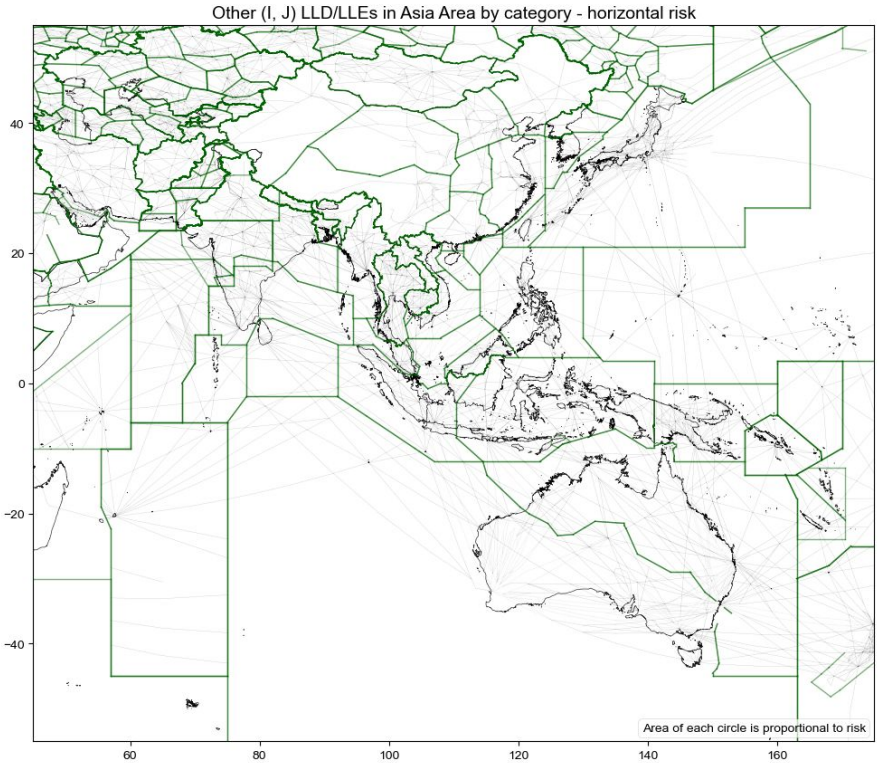




Note: No non-zero Category H LLD/LLE in 2022

Asia : TCAS (LHD:J, K)





Note: No non-zero Category I and J LLD/LLE in 2022

Asia : Hot Spots

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

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

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

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

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

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

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

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

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

Contributing Factors : Some gaps in communication and surveillance coverage.

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

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

Boundary	The Number of LHDs		
	2020	2021	2022
Chennai-KL	13	21	22
Boundary	**Operational Risk (FAPFH)**		
	2020	2021	2022
Chennai-KL	0	0.05×10^{-9}	0

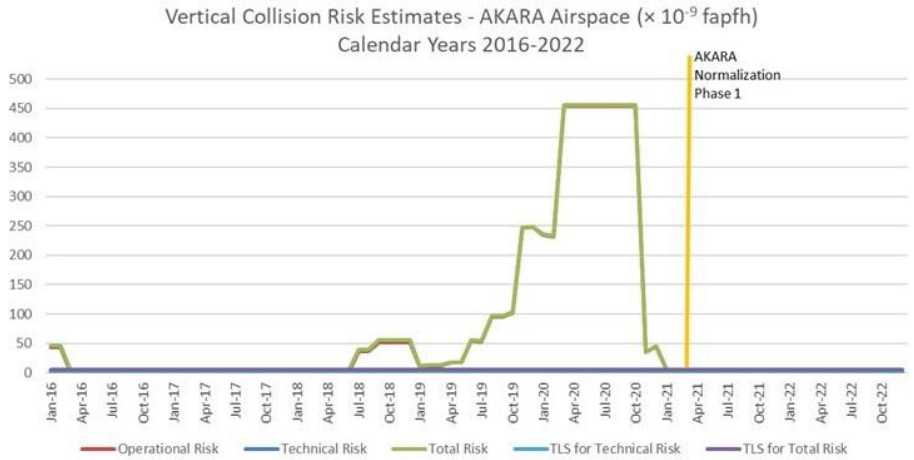
Result from the identifying hot spots process :
- Hot Spot A2 does not satisfy any hot spot criteria.
- **Hot Spot A2 is labelled as the potential non-hot spot.** If this boundary does not satisfy the hot spot criteria again in 2023, Hot Spot A2 can be proposed for removal from the list of hot spots.

Asia : LHD Hot Spot B (AKARA Airspace)

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

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

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



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

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

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

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

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

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

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

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

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

Mitigations :
- Several safety improvement activities such as the new ATM system, ACC sector re-sectorization, enhanced surveillance, ADS-C/CPDLC have been implemented.

- Manila ACC and Fukuoka ACC have bilateral meetings regularly and agreed to implement a mitigation measure that would contribute to a reduction of transfer error due to human factor.

Result from the identifying hot spots process in SEA (MAAR):
The Manila-Fukuoka FIR boundary did not satisfied the hot spot criteria in 2022.

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

Asia : LHD Hot Spot F (Mogadishu – Mumbai)

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

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

Trend : Even thought, the number of LHDs increased in 2022, the operational risk conversely decreased.

Mitigations :
- The Space-Based ADS-B enhances surveillance capability of Indian FIRs.
- AIDC implementation between Mumbai ACC and Mogadishu ACC remains in the testing phase.

Boundary	The Number of LHDs		
	2020	2021	2022
Mogadishu-Mumbai	8	5	9
Boundary	**The Operational Risk (FAPFH)**		
	2020	**2021**	**2022**
Mogadishu-Mumbai	4.8×10^{-9}	0.12×10^{-9}	0.02×10^{-9}

Result from the identifying hot spots process :
- Even though it does not satisfy any hot spot criteria, **Hot Spot F remains on the hot spot list** until further safety improvement initiatives or prevention measures such as AIDC are completed and demonstrate their effectiveness.

Asia : LHD Hot Spot G (Sanaa/Muscat – Mumbai)

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

Contributing Factors : Sanaa-Mumbai and Muscat-Mumbai boundaries are oceanic airspace with poor communication and surveillance coverage.

Trend : The number of LHDs and the operational risk at both boundaries decreased in 2022.

Mitigations :
- The Space-Based ADS-B enhances surveillance capability of Indian FIRs.
- AIDC implementation between Mumbai ACC and Muscat ACC remains in the testing phase.

Boundary	The Number of LHDs		
	2020	2021	2022
Muscat-Mumbai	48	44	43
Sanaa-Mumbai	1	4	2
Boundary	**The Operational Risk (FAPFH)**		
	2020	2021	2022
Muscat-Mumbai	6.37×10^{-9}	1.35×10^{-9}	0.79×10^{-9}
Sanaa-Mumbai	0	0.07	0

Result from the identifying hot spots process :
- Hot Spot G meet the criteria in terms of both the number of LHDs and the operational risk. **Hot Spot G remains on the hot spot list** until further safety improvement initiatives or prevention measures such as AIDC are completed and demonstrate their effectiveness.

Asia : LHD Hot Spot J (Jakarta – Singapore/Kota Kinabalu)

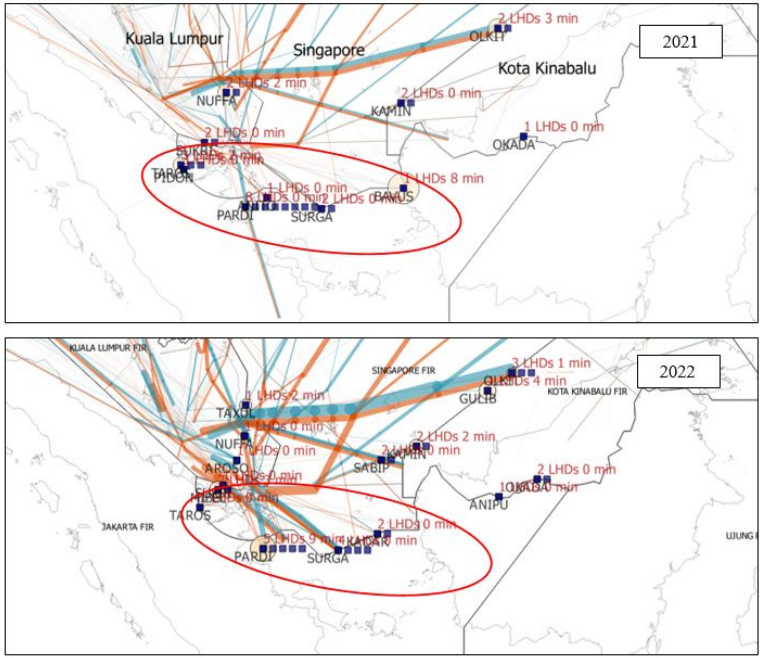
Nature of Occurrences : Coordination errors as a result of human factors issues (Category E)

Contributing Factors : To be analysed

Trend : In SEA airspace, the number of LHDs and operational risk at Singapore-Jakarta boundary slightly decreased in 2022.

Mitigations : AAMA is working with SEASMA to share and confirm the information about LHDs on the Jakarta–Singapore FIR interface. AirNav Indonesia is working towards implementation of AIDC, which could mitigate coordination errors due to human factors issues.

Result from the identifying hot spots process :
This boundary satisfied the hot spot criteria in terms of the number of LHDs for 2 consecutive years (2021 and 2022). Therefore, **Hot Spot J remains on the hot spot list**.



Asia : LHD Hot Spot M (Colombo – Melbourne)

Nature of Occurrences : Category A, B, and E LHDs.

Contributing Factors : A large number were pilot errors involving the Indian Navy.

Trend : Since 2019, the number of LHDs at Hot Spot M has been decreasing, so RASMAG/26 proposed to re-classify as a non-Hot Spot. However, AAMA and MAAR still do not have a suitable contact for the Indian Navy.

Mitigations :
- In 2020, the sectorisation was implemented at Colombo oceanic airspace. Furthermore, awareness and training were promoted to Colombo's ATS.
- AAMA, ICAO, MAAR and Sri Lanka had sent various formal letters to DGCA India for the nomination of a POC from the Indian Navy as a mitigation to the LHD Hotspot (M). However, ICAO, AAMA and MAAR have not received any response from DGCA India. For this reason, **Hot Spot M remains on the hot spot list**.

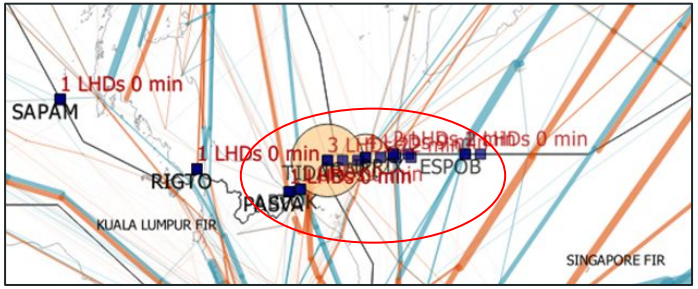
Asia : New LHD Hot Spot O
(Bangkok/Ho Chi Minh/Kuala Lumpur - Singapore)

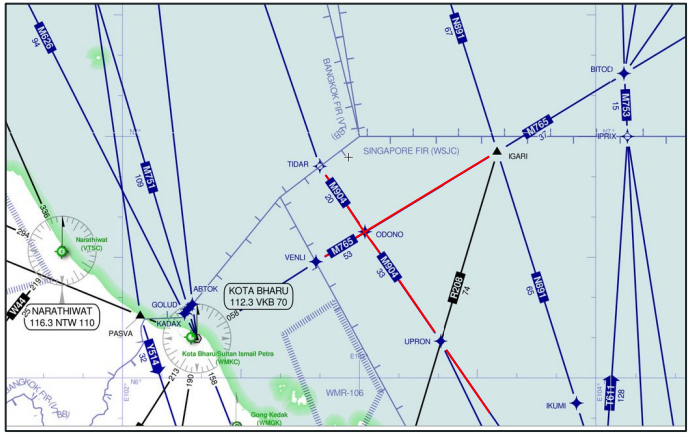
Nature of Occurrences : Coordination errors as a result of human factors issues (Category E).

Contributing Factors : The route structure and ATC procedures of handling crossing traffic over this area can be complex.

Trend : The operational risk increased to reach 51% of the total operational risk in SEA airspace.

Result from the identifying hot spots process : The boundaries of Bangkok, Ho Chi Minh, Kuala Lumpur, and Singapore FIRs satisfied the hot spot criteria in terms of the operational risk in 2022. **Thus, this is included on the hot spot list as a new Hot Spot.**





Reporting Rate
of LHDs/LLDs/LLEs

Reporting Rate of LHDs/LLDs/LLEs

Airspace	# Reports							1 Report : Flying Hrs						
	2016	2017	2018	2019	2020	2021	2022	2016	2017	2018	2019	2020	2021	2022
DPRK	0	0	0	0	0	0	0	-	-	-	-	-	-	-
Mongolia	0	4	1	2	0	1	0	-	1: 37,771	1: 158,891	1: 82,138	-	1: 121,621	-
SEA	426	474	205	152	42	70	62	1: 5,884	1: 6,548	1: 17,757	1: 22,275	1: 25,106	1: 15,456	1:32,620
SA/IO	778	935	681	439	152	135	143	1: 3,689	1: 3,166	1: 3,783	1: 7,955	1: 7,907	1: 11,167	1:21,018
Japan	43	71	76	77	66	80	75	1: 33,834	1: 21,510	1: 20,632	1: 20,762	1: 14,737	1: 13,528	1:18,751
China	117	134	110	79	85	105	72	1: 20,413	1: 18,248	1: 22,229	1: 31,119	1: 26,867	1: 15,477	1:18,003
Pacific	33	42	43	173	134	176	179	1: 63,500	1: 54,191	1: 45,064	1: 10,139	1: 6,404	1: 6,638	1:8,280
Indonesia	32	34	23	37	18	41	54	1: 11,520	1: 10,842	1: 53,603	1: 33,321	1: 17,346	1: 7,402	1:8,060
SW Pacific	52	51	53	101	46	47	81	1: 16,639	1: 17,572	1: 17,817	1: 9,335	1: 6,954	1: 11,975	1:5,352
ROK and AKARA	6	5	12	34	5	24	108	1: 93,291	1: 117,090	1: 28,365	1: 18,959	1: 25,965	1: 6,285	1:1,056
Total	**1,487**	**1,750**	**1,204**	**1,094**	**548**	**679**	**774**	**1: 8,905**	**1: 8,180**	**1: 12,332**	**1: 14,330**	**1: 13,202**	**1: 11,200**	**1:13,230**

Notes:

- The flying hours for Indonesian airspace in 2021 was calculated based on the 2020 TSD.
- The flying hours for SW Pacific and Indonesian airspace in 2022 were calculated based on the 2021 TSD.

2022 Reporting Rate of LHDs/LLDs/LLEs

Airspace	Flying Hours	Aircrew/Pilot		ATC		Other		Total	
		# Reports	1 Report : Flying Hrs	# Reports	1 Report : Flying Hrs	# Reports	1 Report : Flying Hrs	# Reports	1 Report : Flying Hrs
DPRK	10	0	-	0	-	0	-	0	-
Mongolia	44,732	0	-	0	-	0	-	0	-
SEA	2,022,449	3	1:674,150	57	1:35,482	2	1:1,011,225	62	1:32,620
SA/IO	3,005,641	2	1:1,502,821	139	1:21,623	2	1:1,502,821	143	1:21,018
Japan	1,406,330	18	1:78,129	26	1:54,090	31	1:45,365	75	1:18,751
China	1,296,204	4	1:32,4051	11	1:117,837	57	1:22,740	72	1:18,003
Pacific	1,482,049	40	1:37,051	136	1:10,897	3	1:494,016	179	1:8,280
Indonesia	435,220	6	1:72,537	48	1:9,067	0	-	54	1:8,060
SW Pacific	433,496	30	1:14,450	45	1:9,633	6	1:72,249	81	1:5,352
ROK and AKARA	114,006	0	-	108	1:1,056	0	-	108	1:1,056
Total	10,240,138	103	1:99,419	570	1:17,965	101	1:101,388	774	1:13,230

Notes:

- The flying hours for SW Pacific and Indonesian airspace in 2022 were calculated based on the 2021 TSD.

Conclusion

RVSM TLS Compliance - Vertical

- **The 2022 PAC vertical overall risk** was 19.62 x 10^{-9} FAPFH. The vertical overall risk slightly decreased from 2021 and was **higher than the target level of safety (TLS)**.
- **The 2022 ASIA vertical overall risk** was 1.53 x 10^{-9} FAPFH. The vertical overall risk decreased from 2021 and remained **below the TLS**. In addition, there is no individual airspace, where has the risk greater than the TLS.

RVSM TLS Compliance - Horizontal

- **All horizontal risk estimates in 2022** were **below the TLS**.

RASMAG's Hot Spot List

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

Reporting Rate of LHDs/LLDs/LLEs

- The flying hours **increased** from 7,234,881 hours in 2020, 7,604,927 in 2021 to **10,240,138 hours in 2022**.
- The overall reporting rate of LHDs/LLDs/LLEs decreased in 2022:
  - 1 report : 13,202 hours in 2020
  - 1 report : 11,200 hours in 2021
  - 1 report : 13,230 hours in 2022
- The reporting rate in ROK and SW Pacific significantly improved in 2022.
- The reporting rate in SEA and SA/IO dramatically decreased in 2022, because the number of reports in 2022 were similar to the number in 2021, while the flying hours significantly increased.
- Mongolia submitted NIL reports in 2022
- DPRK submits NIL reports since 2016, but maintains a good communication with China RMA.

Thank You