International Civil Aviation Organization

Twenty-Ninth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/29)

Bangkok, Thailand, 19 – 22 August 2024

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

ASIA/PACIFIC CONSOLIDATED SAFETY REPORT

(Presented by MAAR on behalf of Asia Pacific RMAs and EMAs)

SUMMARY

This paper presents a combined summary of the safety analysis results for the Asia Pacific Region to be considered by RASMAG. It consolidates the risk estimates, geolocations of LHDs, LLDs, and LLEs, hotspot analysis, and reporting rates of operational errors during the calendar year 2023.

1. INTRODUCTION

1.1 In an effort to provide a comprehensive overview of airspace safety risks in the Asia Pacific region, the monitoring agencies agreed during the RASMAG MAWG/6 meeting in 2019 to present the safety report in a presentation format, facilitating more effective communication of the analysis results.

2. DISCUSSION

2.1 The data presented in this paper and its attachment is derived from the analysis of airspace risk conducted by the Australian Airspace Monitoring Agency (AAMA), the Bay of Bengal Arabian Sea and Indian Ocean Safety Monitoring Agency (BOBASMA), the China Regional Monitoring Agency (China RMA), the Japan Airspace Safety Monitoring Agency (JASMA), the Monitoring Agency for Asia Region (MAAR), the Pacific Approvals Registry and Monitoring Organization (PARMO), and the South East Asia Safety Monitoring Agency (SEASMA). In this report, each monitoring agency bases their analysis on December Traffic Sample Data (TSD) and Large Height Deviations (LHDs), Large Longitudinal Errors (LLEs), and Large Lateral Deviations (LLDs) collected throughout 2023.

2.2 The 2023 Asia Pacific Consolidated Safety Report is presented in **Attachment A** of this paper.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matters as appropriate.

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2023 Asia Pacific
Consolidated Safety Report

RASMAG/29
19 - 22 August 2024

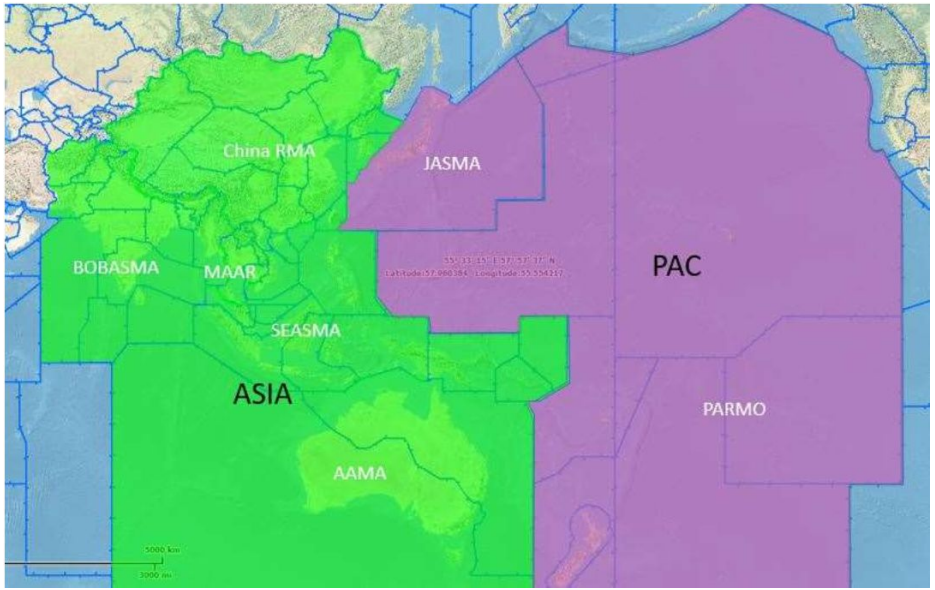
Outline

- 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).

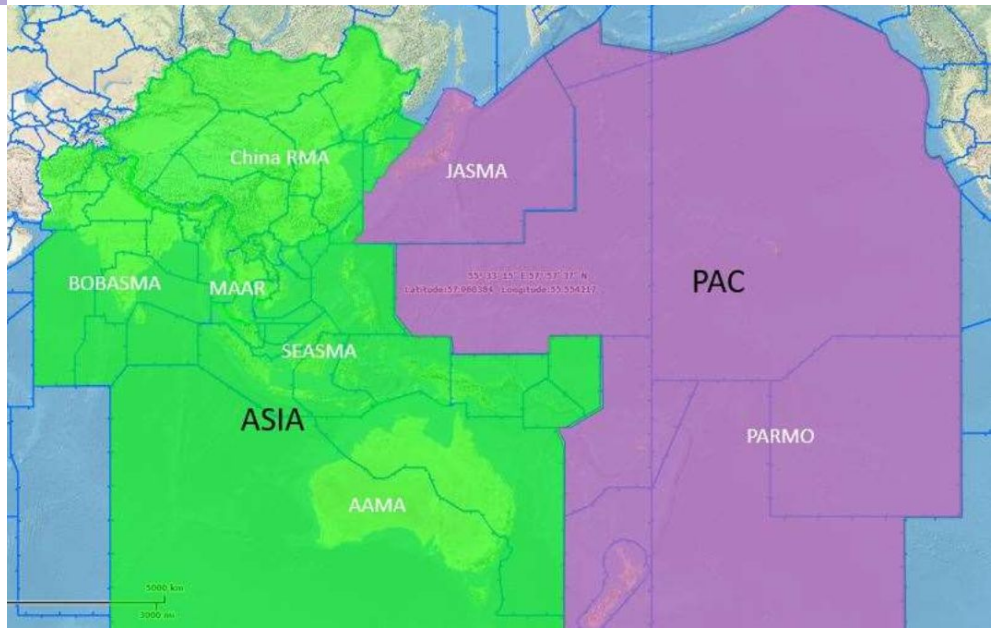
Pacific Area (PAC)

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

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

Monitoring Agencies :

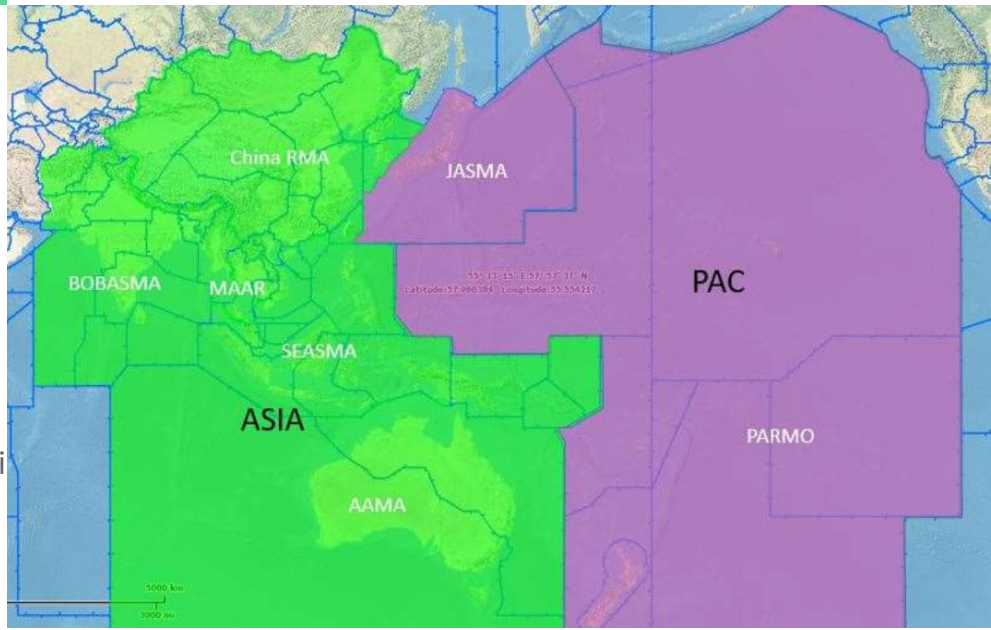
RMAs (Verical): JASMA, PARMO
EMAs (Horizontal): JASMA, PARMO



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: 3,462,071 hours/year

2023 PAC Area	Vertical Risk Estimate	Remark
Vertical Technical Risk	0.22 x 10^{-9} FAPFH	Below Technical TLS
Vertical Operational Risk	10.55 x 10^{-9} FAPFH	
Vertical Overall Risk	10.77 x 10^{-9} FAPFH	Above TLS

PAC : Vertical Collision Risk Estimates

2016 - 2023

Year	Vertical Overall Risk Estimate	Remark
2023	10.77×10^{-9} FAPFH	Above TLS
2022	19.62×10^{-9} FAPFH	Above TLS
2021	19.74×10^{-9} FAPFH	Above TLS
2020	16.71×10^{-9} FAPFH	Above TLS
2019	30.21×10^{-9} FAPFH	Above TLS
2018	19.40×10^{-9} FAPFH	Above TLS
2017	7.30×10^{-9} FAPFH	Above TLS
2016	5.01×10^{-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	**16**	**4.98**	**9**
	B	Flight crew climbing/descending without ATC Clearance	**14**	**14.22**	**13**
	C	Incorrect operation or interpretation of airborne equipment	**3**	**2.13**	**2**
ATC	D	ATC system loop error	**6**	**2.50**	**3**
	E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues	**57**	**224.18**	**6**
	F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues	**1**	**7.00**	**0**
Aircraft/ Avionics/ Contingencies	G	Aircraft contingency event leading to sudden inability to maintain assigned flight level	**0**	**0.00**	**0**
	H	Airborne equipment failure leading to unintentional or undetected change of flight level	**0**	**0.00**	**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	20	59.93	1
TCAS	J	TCAS resolution advisory, flight crew correctly climb or descend following the resolution advisory	16	21.63	2
	K	TCAS resolution advisory, flight crew incorrectly climb or descend following the resolution advisory	0	0.00	0
Other	L	An aircraft being provided with RVSM separation is not RVSM approved	0	0.00	0
	M	Other	1	25.00	0
		Total	134	361.58	36

PAC : Horizontal Collision Risk

PAC : Horizontal Collision Risk Estimates

Number of annual flying hours: 1,892,881 hours/year

2023 PAC Area	Horizontal Risk Estimate	Airspace	Remark
Total Lateral Risk	0.09×10^{-9} FAPFH	Pacific	Below TLS
Total Longitudinal Risk	0.17×10^{-9} FAPFH	Pacific	Below TLS
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

Notes:

- The 2023 Horizontal collision risk estimates are combined into a single value using a weighted average.

PAC : Summary of LLDs and LLEs

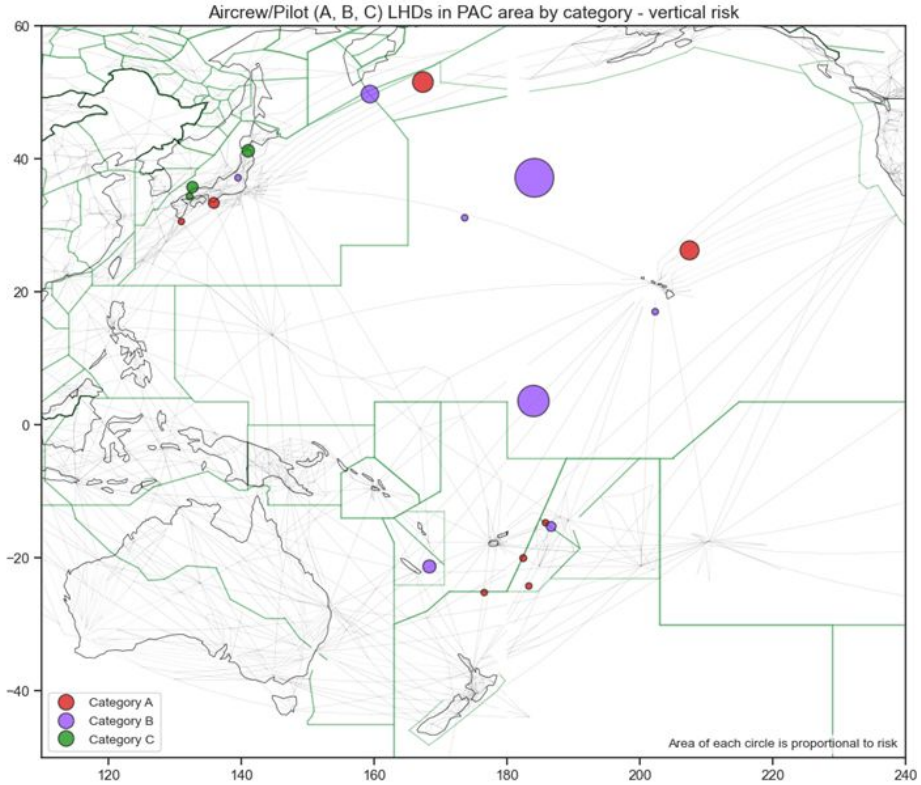
Attributions	Category Code	Description	Number of Occurrences	Duration (minutes)	Number of Tracks/Routes Crossed	Horizontal Deviation (NM)
Aircrew/ Pilot	A	Flight crew deviate without ATC Clearance	10	10.00	3	100
	B	Incorrect estimate or route provided due to incorrect operation or interpretation of airborne equipment	3	1.00	1	15
	C	Flight crew waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position	3	15.00	0	75
ATC	D	ATC system loop error	2	5.00	1	61
	E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues	109	1614.00	0	158
	F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues	1	11.00	0	0

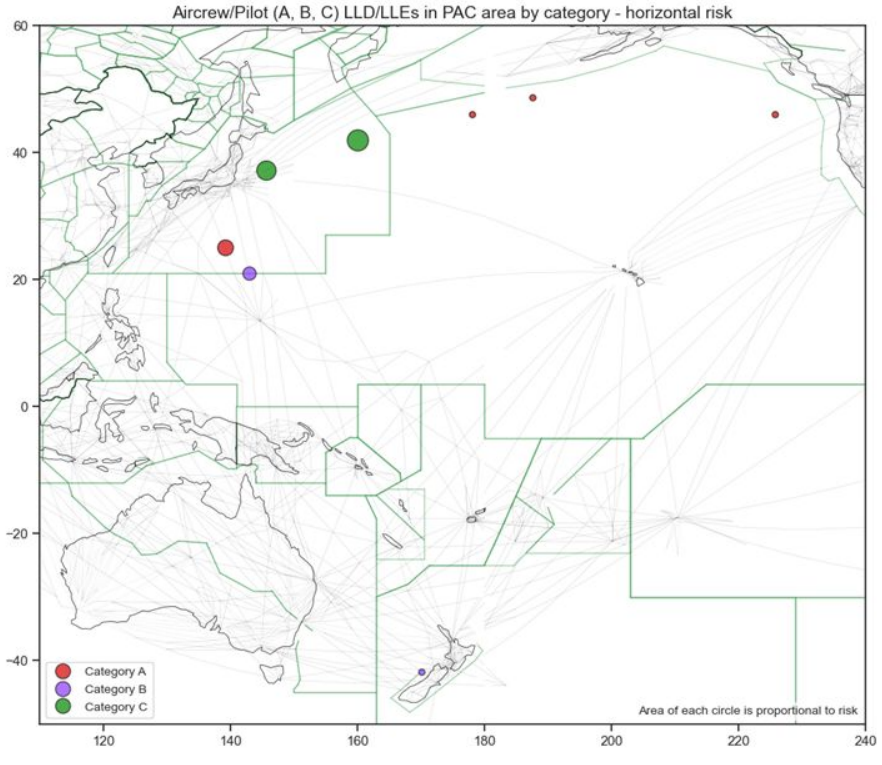
PAC : Summary of LLDs and LLEs

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	1	20.00	0	128
Weather/ Turbulence	H	Turbulence or other weather related causes leading to a deviation in the horizontal dimension	11	98.00	0	255
Other	I	An aircraft was provided with reduced horizontal separation minima but did not meet the RNP/RSP/RCP specification;	0	0.00	0	0
	J	Other	1	0.00	1	20
		Total	141	1774.00	6	812

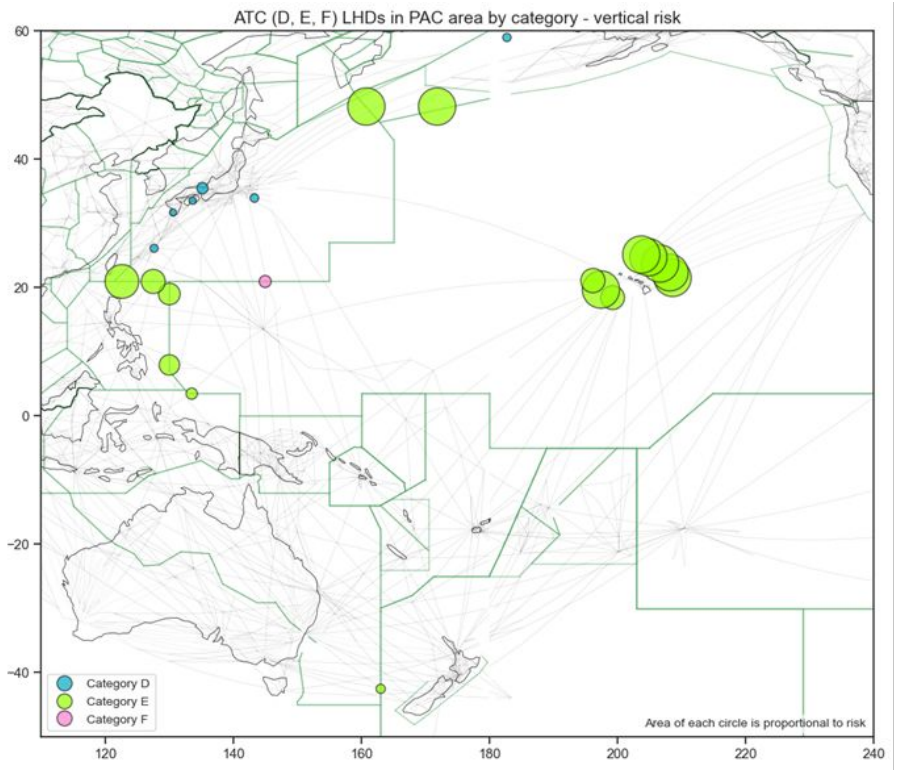
PAC : Geolocation of LHDs/LLDs/LLEs

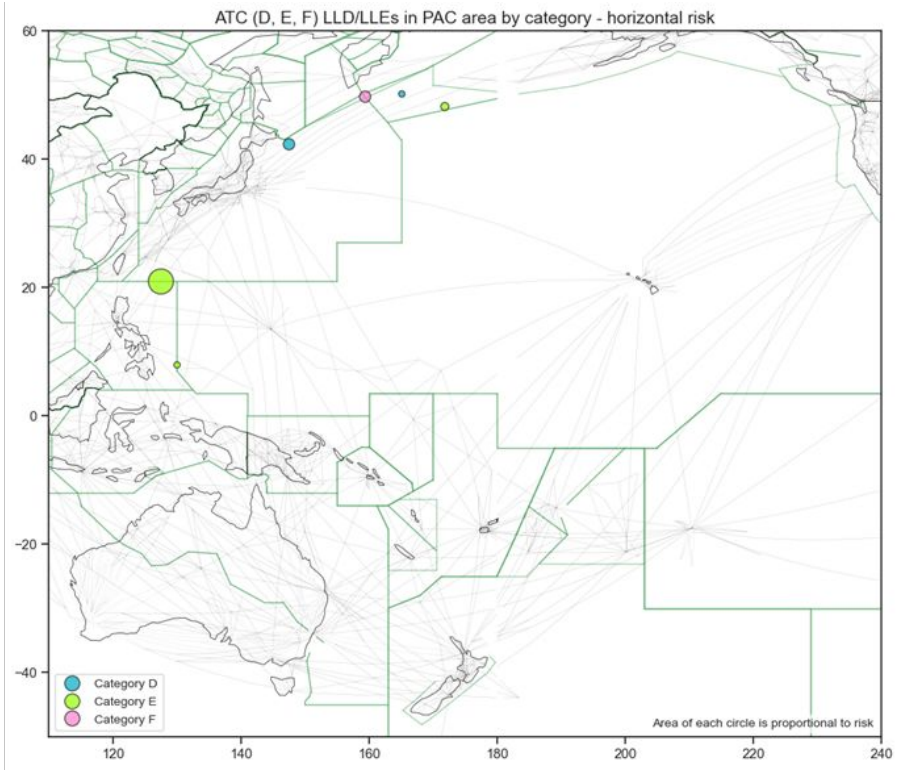
PAC : Aircrew/Pilot (A, B, C)



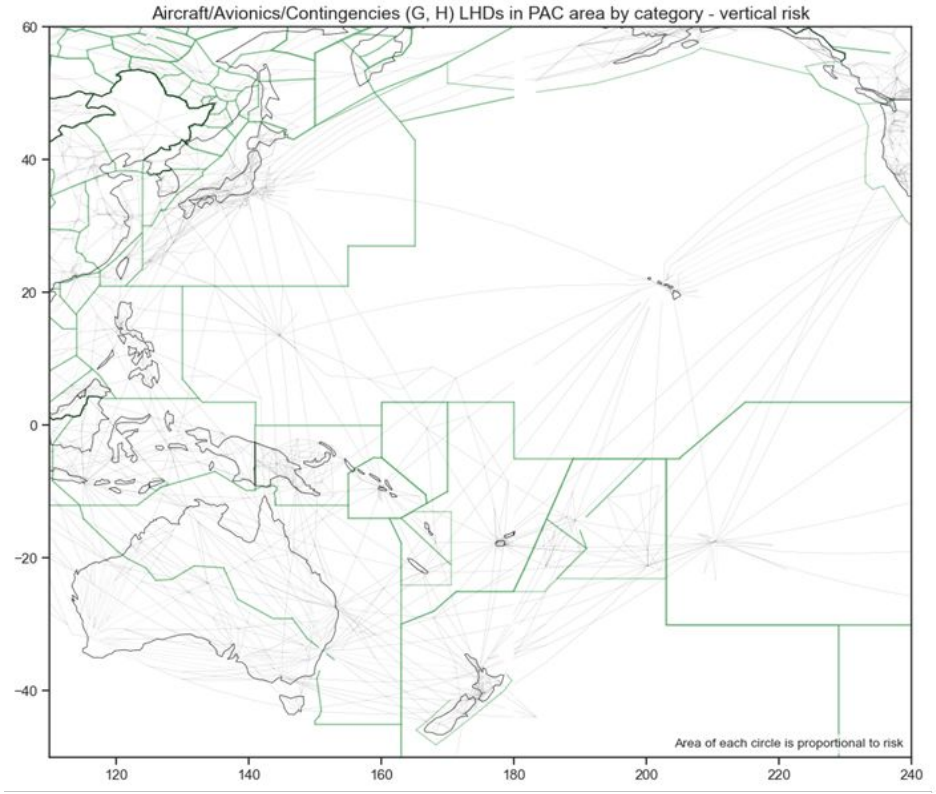


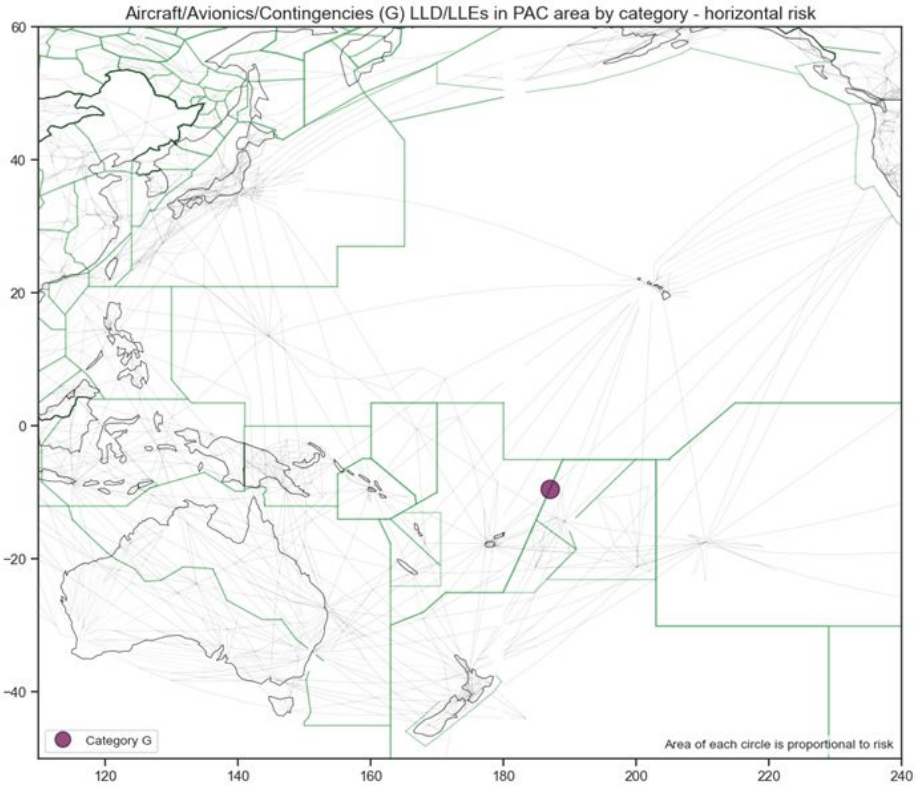
PAC : ATC (D, E, F)


ATC (D, E, F) LHDs in PAC area by category - vertical risk
Category D
Category E
Category F
Area of each circle is proportional to risk
60
40
20
0
−20
−40
120
140
160
180
200
220
240


ATC (D, E, F) LLD/LLEs in PAC area by category - horizontal risk
Category D
Category E
Category F
Area of each circle is proportional to risk
60
40
20
0
−20
−40
120
140
160
180
200
220
240

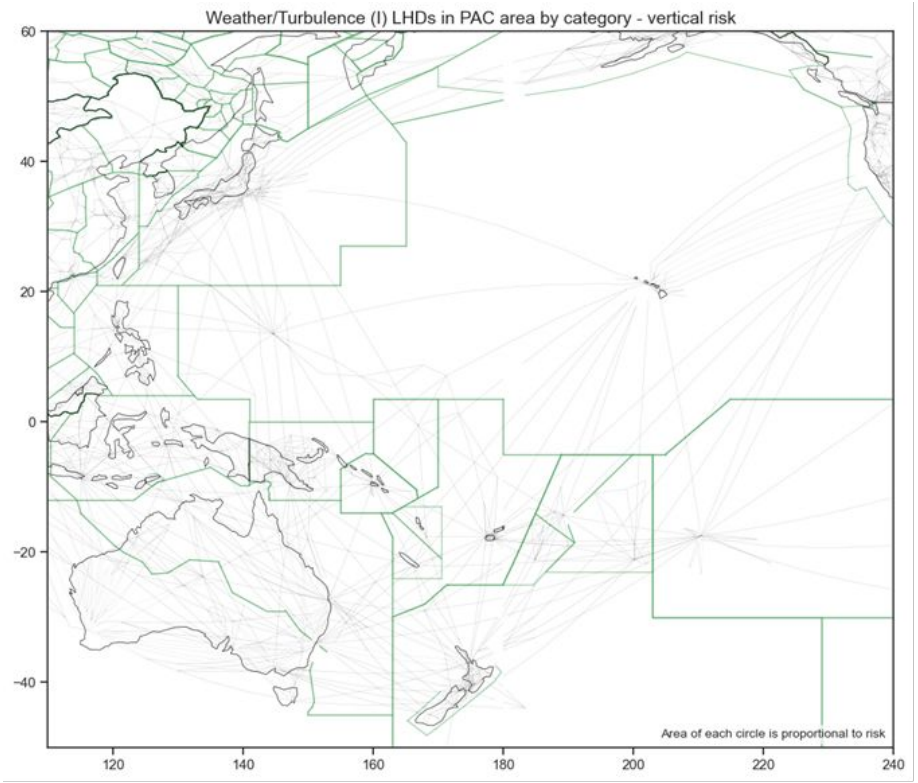
PAC : Aircraft Avionics/Contingencies (LHD:G,H, LLD/LLE:H)

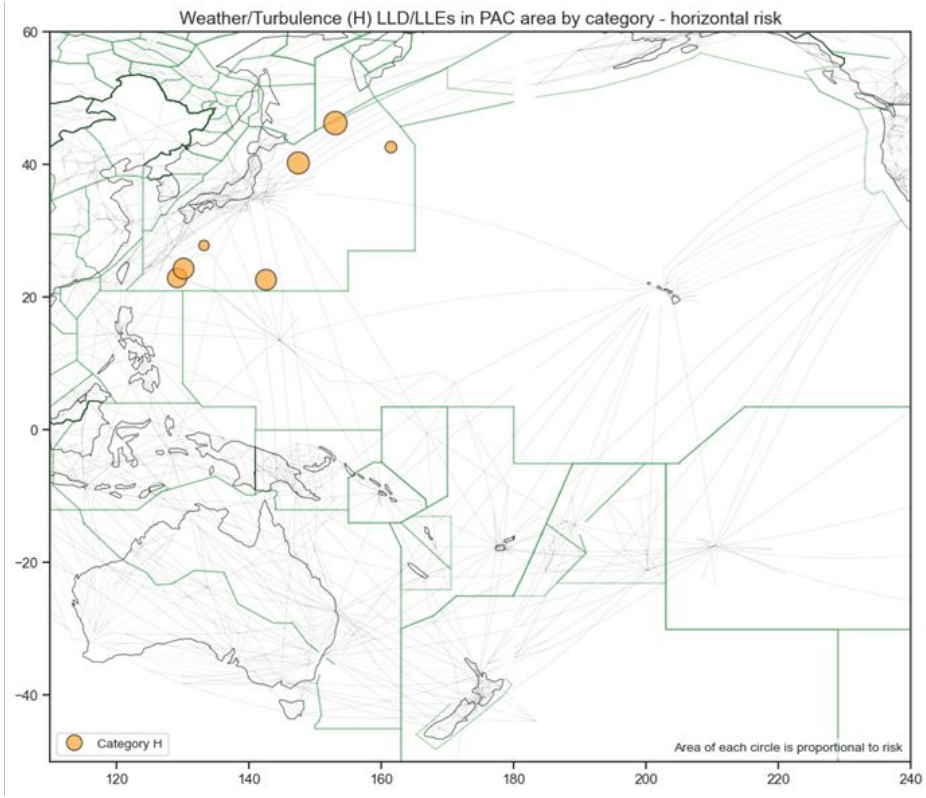




Note: No non-zero Category G and H LHD in 2023

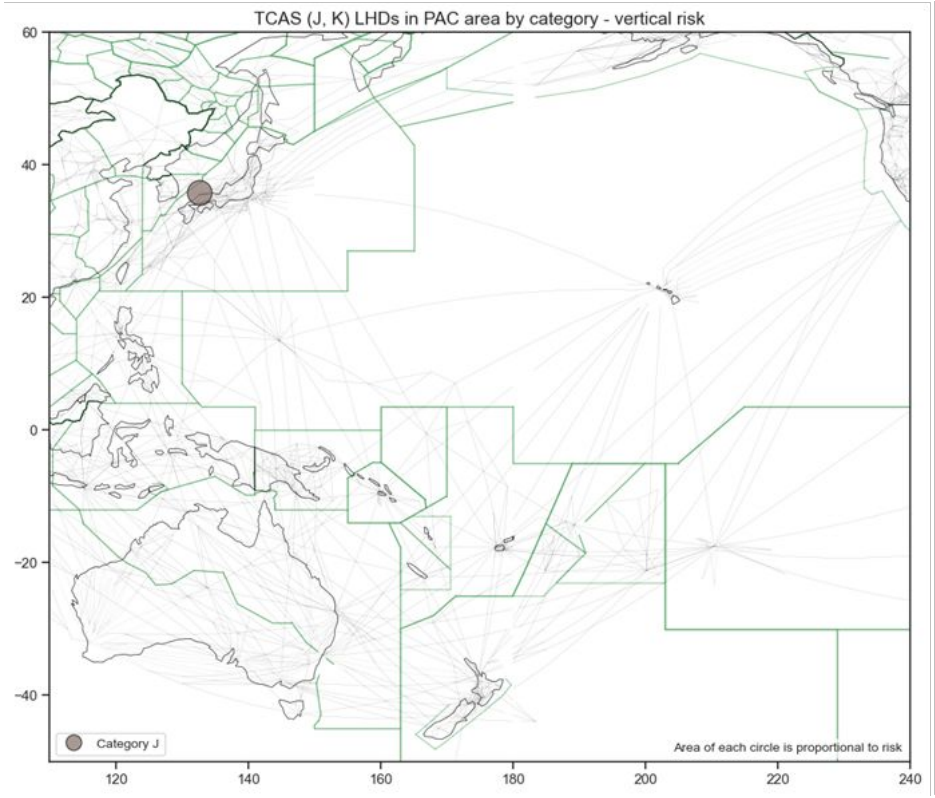
PAC : Weather/Turbulence (LHD:I, LLD/LLE:H)



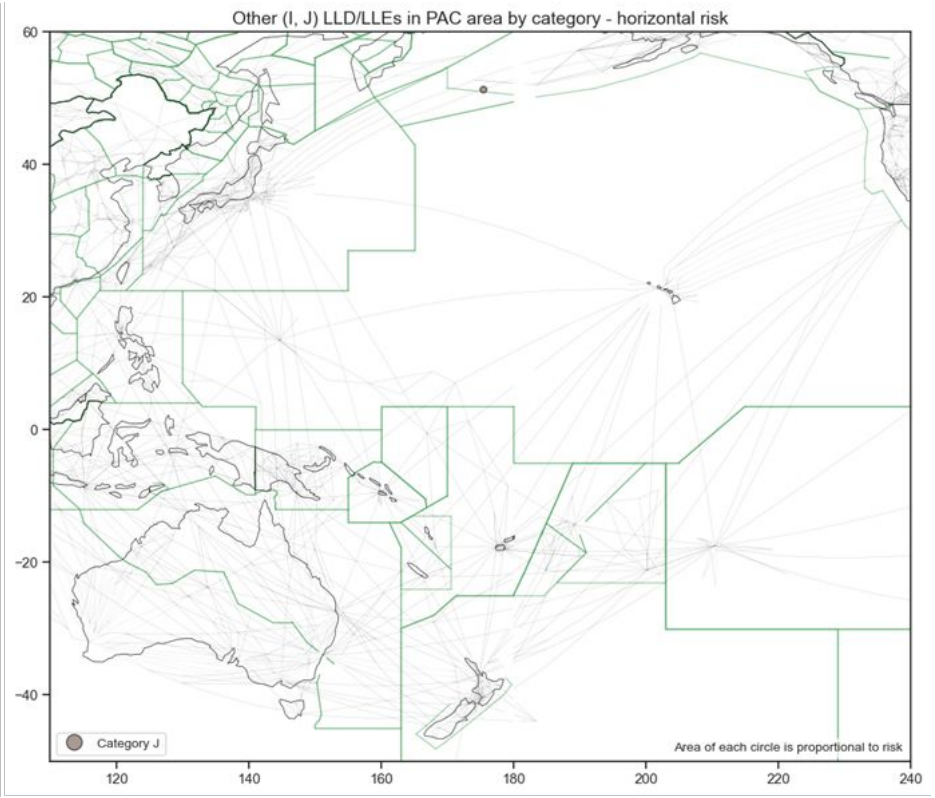


Note: No non-zero Category I LHD in 2023

PAC : TCAS (LHD:J, K)



Note: No non-zero Category K LHD in 2023



Note: No non-zero Category I LLD/LLE in 2023

PAC : Hot Spots

PAC : LHD Hot Spot N (Hawaii CEP/Oakland USA)

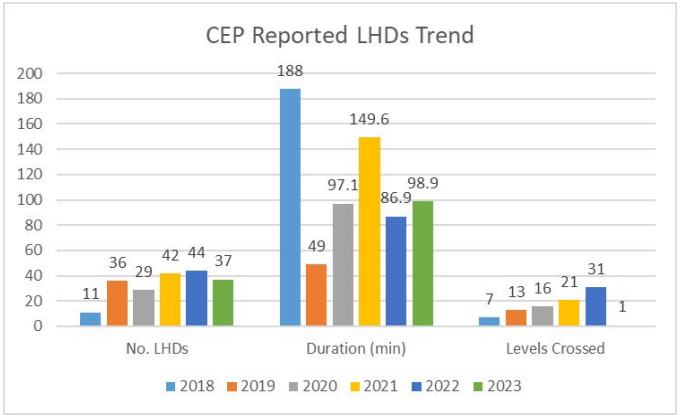
Nature of Occurrences : Coordination errors as a result of human factors issues (Category E)

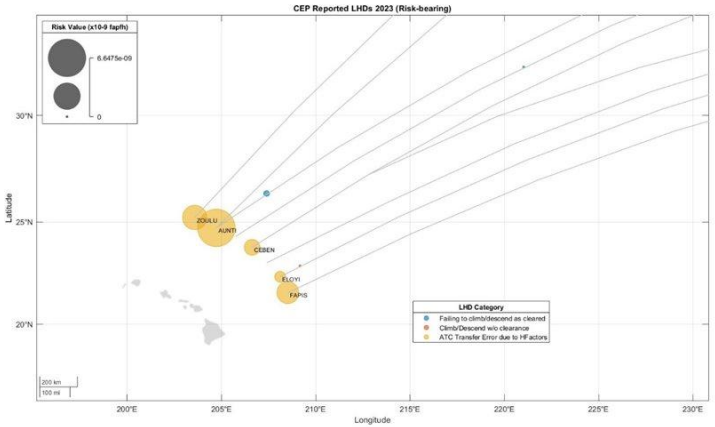
Contributing Factors : The reported LHDs occur within the high traffic volume in the Central East Pacific (CEP). These occurrences affect the CEP traffic and the user-preferred routes that cross the CEP airways.

Trend : Modifications were made to the vertical risk calculations to account for the one-way routes in the traffic flow. These adjustments have resulted in a lower vertical collision risk estimate, but still exceeds the TLS.

Mitigations : North America and Hawaii CEP have developed mitigation procedures. The long term mitigation is a new ATC system scheduled to be implemented at the Honolulu Control Facility in 2025.

Result from the hot spot identification process : This boundary continues to satisfy the hot spot criteria. Therefore, **Hot Spot N remains on the hot spot list**.





Asia Region

Asia : Vertical Collision Risk

ASIA : Vertical Collision Risk Estimates

Number of annual flying hours: 10,153,474 hours/year

2023 ASIA Area	Vertical Risk Estimate	Remark
Vertical Technical Risk	0.56×10^{-9} FAPFH	Below Technical TLS
Vertical Operational Risk	2.84×10^{-9} FAPFH	
Vertical Overall Risk	3.40×10^{-9} FAPFH	Below TLS

ASIA : Vertical Collision Risk Estimates

2016 - 2023

Year	Vertical Overall Risk Estimate	Remark
2023	3.40×10^{-9} FAPFH	Below TLS
2022	1.53×10^{-9} FAPFH	Below TLS
2021	4.03×10^{-9} FAPFH	Below TLS
2020	7.42×10^{-9} FAPFH	Above TLS
2019	12.88×10^{-9} FAPFH	Above TLS
2018	15.50×10^{-9} FAPFH	Above TLS
2017	27.30×10^{-9} FAPFH	Above TLS
2016	12.53×10^{-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	**25**	**15.00**	**19**
	B	Flight crew climbing/descending without ATC Clearance	**12**	**12.75**	**12**
	C	Incorrect operation or interpretation of airborne equipment	**19**	**26.00**	**1**
ATC	D	ATC system loop error	**25**	**26.00**	**6**
	E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues	**519**	**304**	**106**
	F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues	**21**	**21.00**	**0.00**
Aircraft/ Avionics/ Contingencies	G	Aircraft contingency event leading to sudden inability to maintain assigned flight level	**1**	**1.00**	**1**
	H	Airborne equipment failure leading to unintentional or undetected change of flight level	**6**	**0.00**	**6**

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	82	0.20	62
TCAS	J	TCAS resolution advisory, flight crew correctly climb or descend following the resolution advisory	19	1.50	19
	K	TCAS resolution advisory, flight crew incorrectly climb or descend following the resolution advisory	0	0.00	0
Other	L	An aircraft being provided with RVSM separation is not RVSM approved	0	0.00	0
	M	Other	95	7.00	5
		Total	824	414.45	237

Asia : Horizontal Collision Risk

Asia : Horizontal Collision Risk Estimates

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

2023 Asia Area	Horizontal Risk Estimate	Airspace	Remark
Total Lateral Risk	1.517 x 10^{-9} FAPFH	ASIA	Below TLS
Total Longitudinal Risk	4.444 x 10^{-9} FAPFH	ASIA	Below TLS
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

Notes:

- The 2023 Horizontal collision risk estimates are combined into a single value using a weighted average.

Asia : Summary of LLDs and LLEs

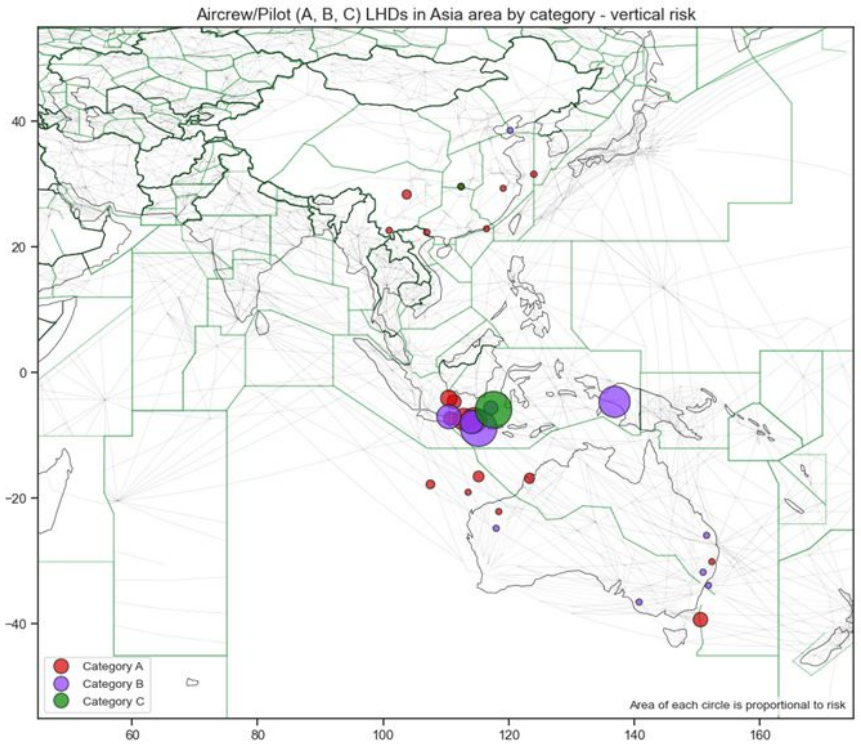
Attributions	Category Code	Description	Number of Occurrences	Duration (minutes)	Number of Tracks/Routes Crossed	Horizontal Deviation (NM)
Aircrew/ Pilot	A	Flight crew deviate without ATC Clearance	**5**	**0.00**	**0.00**	**104.00**
	B	Incorrect estimate or route provided due to incorrect operation or interpretation of airborne equipment	**1**	**0.00**	**0.00**	**32.00**
	C	Flight crew waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position	**0**	**0.00**	**0.00**	**0.00**
ATC	D	ATC system loop error	**0**	**0.00**	**0.00**	**0.00**
	E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues	**4**	**0.00**	**1.00**	**0.00**
	F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues	**0**	**0.00**	**0.00**	**0.00**

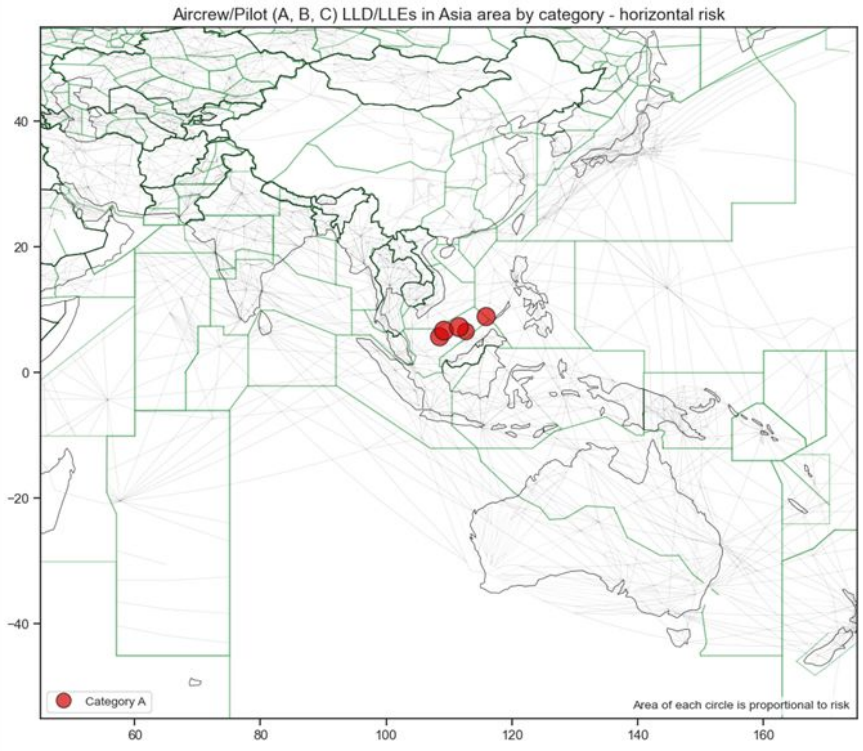
Asia : Summary of LLDs and LLEs

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	0.00	0.00	0.00
Weather/ Turbulence	H	Turbulence or other weather related causes leading to a deviation in the horizontal dimension	0	0.00	0.00	0.00
Other	I	An aircraft was provided with reduced horizontal separation minima but did not meet the RNP/RSP/RCP specification;	0	0.00	0.00	0.00
	J	Other	0	0.00	0.00	0.00
		Total	**10**	**0.00**	**1.00**	**136.00**

Asia : Geolocation of LHDs/LLDs/LLEs

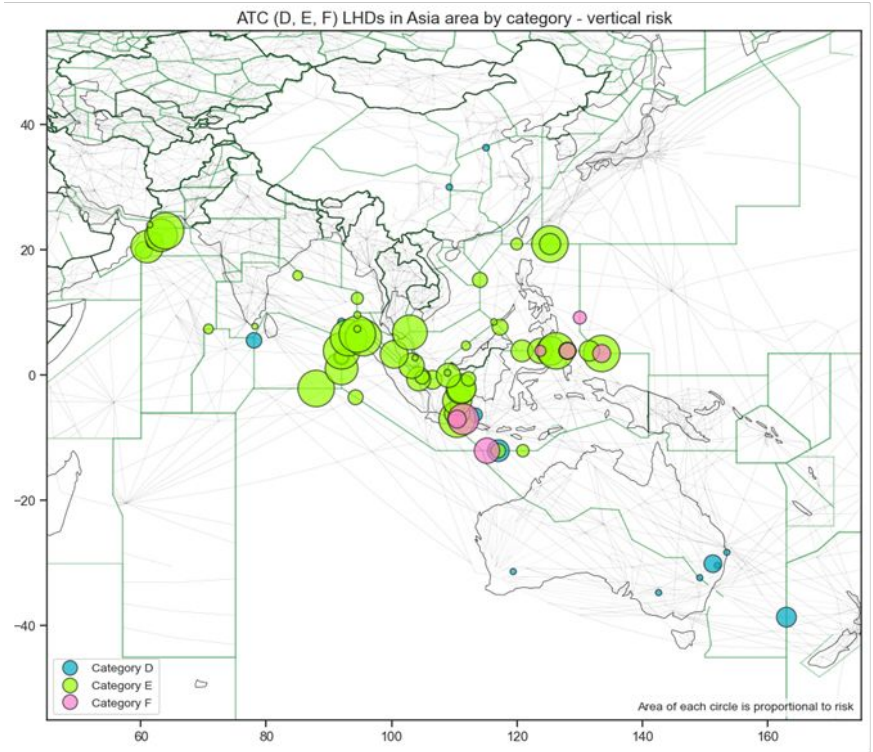
Asia : Aircrew/Pilot (A, B, C)

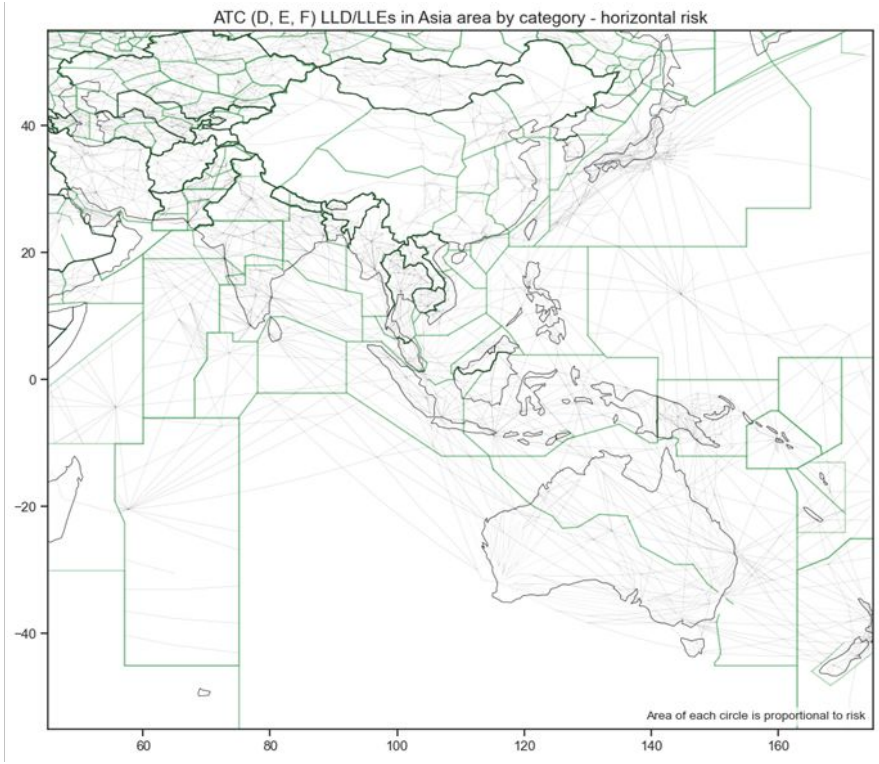




Note: No non-zero Category B and C LLD/LLE in 2023

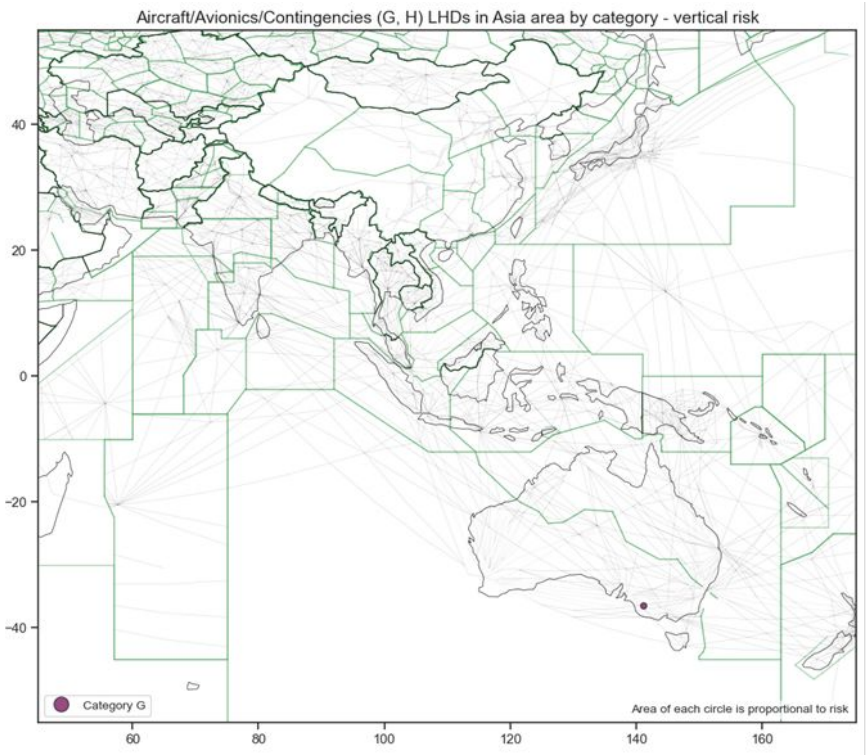
Asia : ATC (D, E, F)



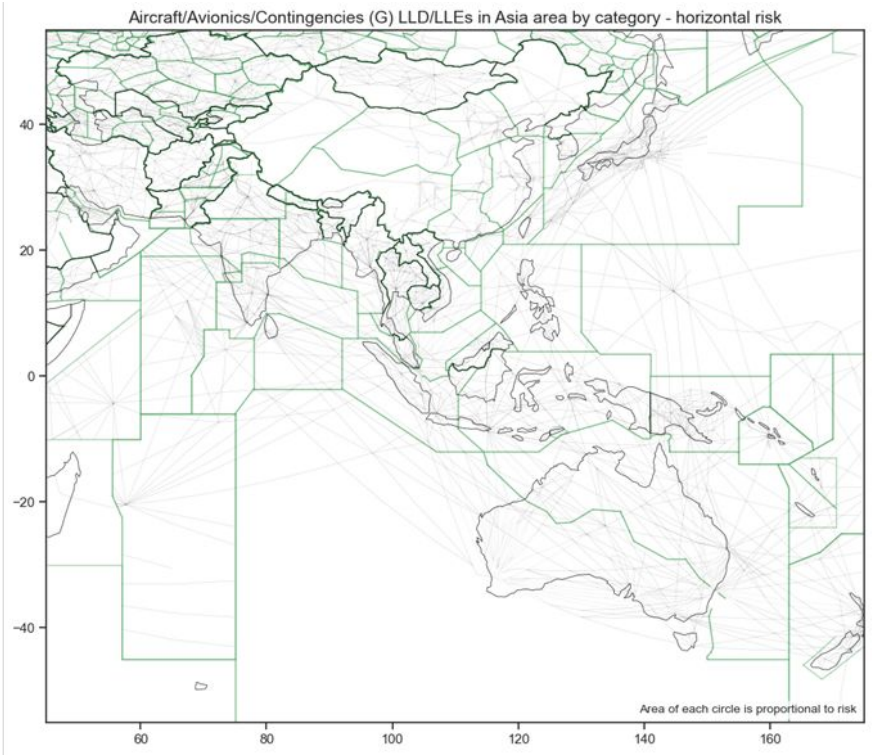


Note: No non-zero Category D, E and F LLD/LLE in 2023

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

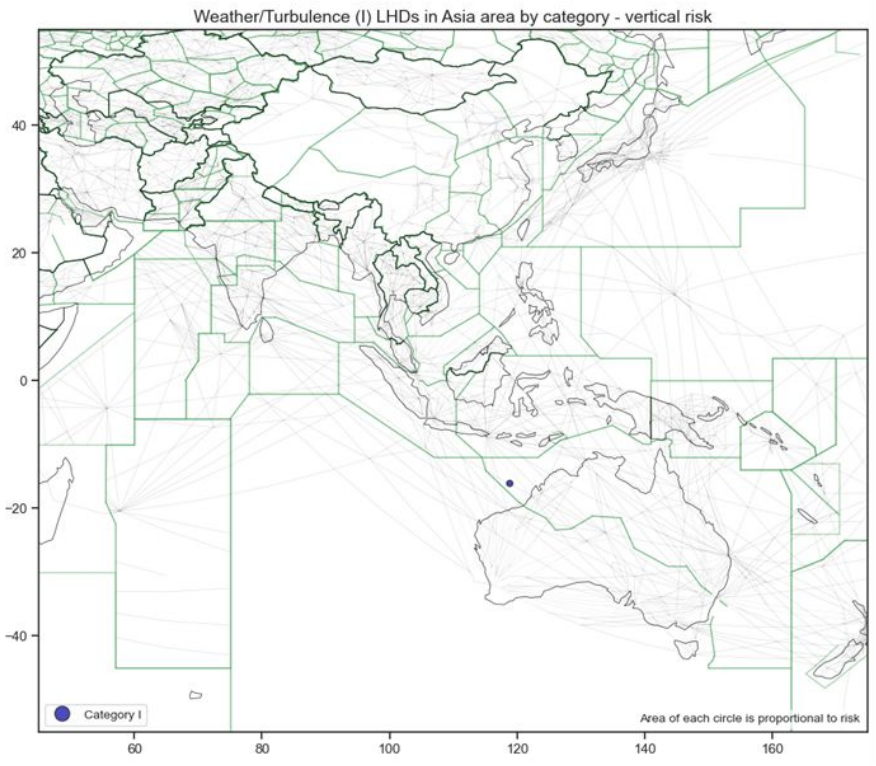


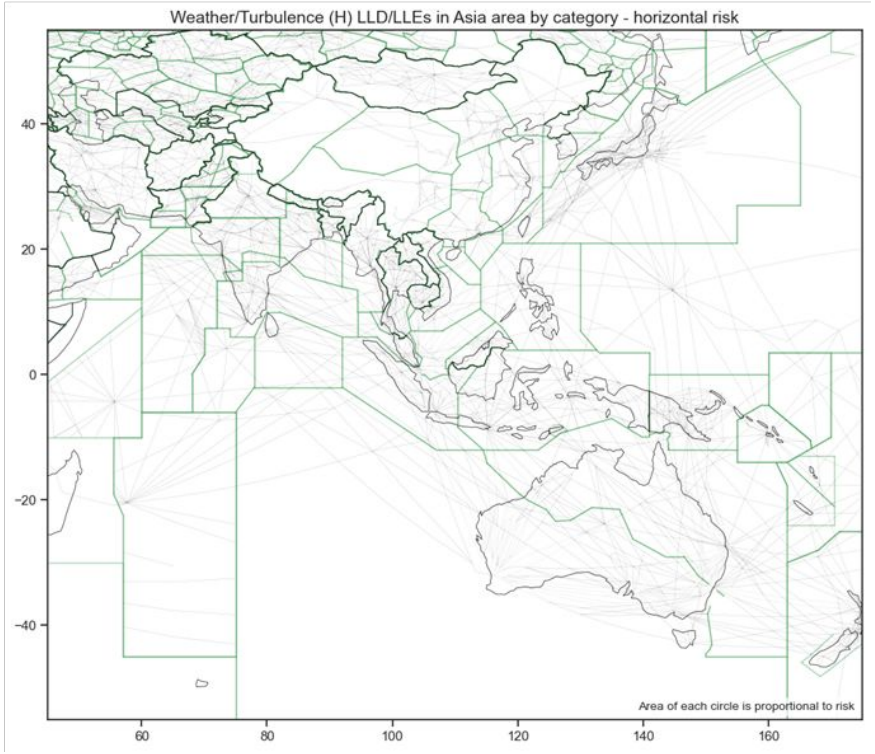
Note: No non-zero Category H LHD in 2023



Note: No non-zero Category G LLD/LLE in 2023

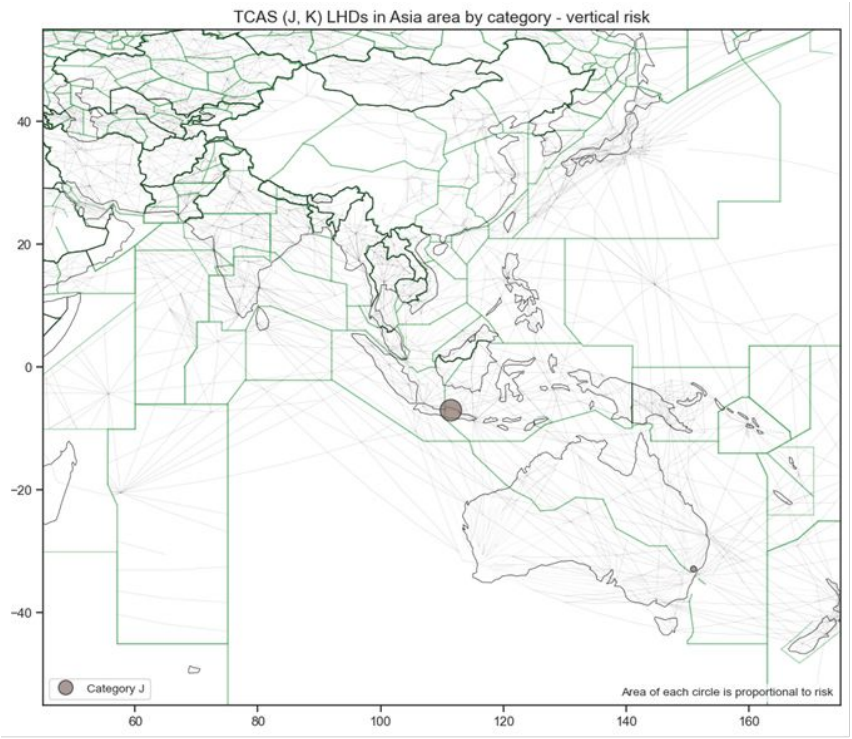
Asia : Weather/Turbulence (LHD:I, LLD/LLE:H)



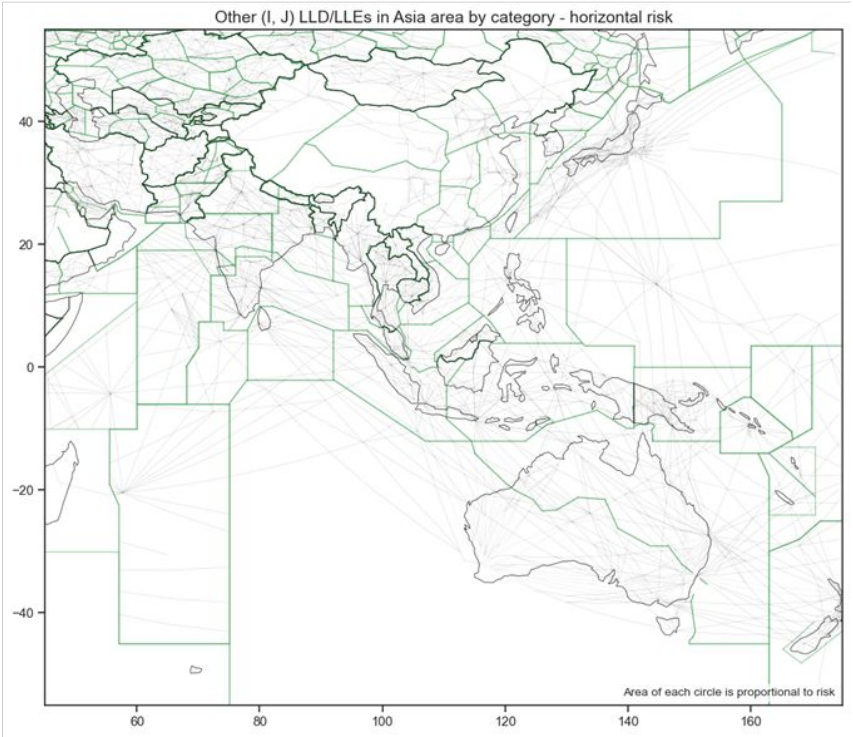


Note: No non-zero Category H LLD/LLE in 2023

Asia : TCAS (LHD:J, K)



Note: No non-zero Category K LHD in 2023



Note: No non-zero Category I and J LLD/LLE in 2023

Asia : Hot Spots

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

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 decreased in 2023. There was one non-zero-duration LHD, contributing to the operational risk of 0.06 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 is initiated between Kolkata ACC/Chennai ACC and Yangon ACC, but has not been successfully operated yet.

Result from the hot spot identification process :
- Hot Spot A1 does not meet the hot spot criteria.
- However, **Hot Spot A1 remains on the hot spot list** and should be monitored until further safety improvement initiatives are implemented.

Boundary	The Number of LHDs		
	2021	2022	2023
Kolkata-Yangon	1	17	11
Chennai-Yangon	8	23	15
Boundary	**Operational Risk (FAPFH)**		
	2021	2022	2023
Kolkata-Yangon	0	0	0.00
Chennai-Yangon	0	0.02x10^{-9}	0.06x10^{-9}

Asia : LHD Hot Spot A2 (Chennai/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 decreased in 2023, but the operational risk increased from 0 to 0.23 x 10^{-9} FAPFH.

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

Result from the identifying hot spots process :
- Hot Spot A2 does not satisfy any hot spot criteria for two consecutive years.
- **Hot Spot A2 is proposed for removal from the hot spot list,** because the safety improvement initiatives such as Spaced-Based ADS-B and the AIDC have been successfully operated.

Boundary	The Number of LHDs		
	2021	2022	2023
Chennai-KL	21	22	13
Boundary	**Operational Risk (FAPFH)**		
	2021	**2022**	**2023**
Chennai-KL	0.05 x 10^{-9}	0	0.23 x 10^{-9}

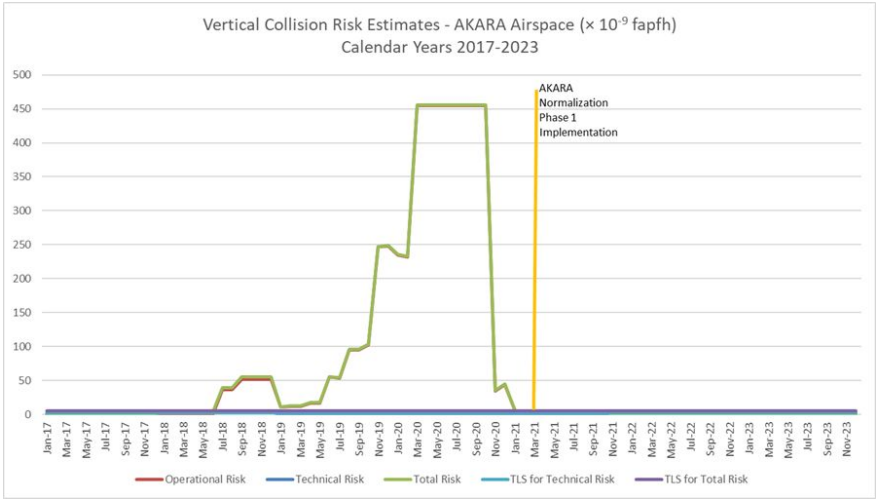
Asia : LHD Hot Spot B (AKARA Airspace)

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

Contributing Factors : The Flight Level Allocation Scheme (FLAS) limits available flight levels due to high traffic volume in the area. Existing LOA for provision of ATS.

Trend :
- Continued trend in the number of LHDs at Incheon-Shanghai FIR boundary.
- No reported LHD at Fukuoka-Incheon FIR boundary and within the Incheon FIR from 2021 to 2023. As a result, the vertical operational risk estimate was zero.

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.



Asia : LHD Hot Spot B (AKARA Airspace)

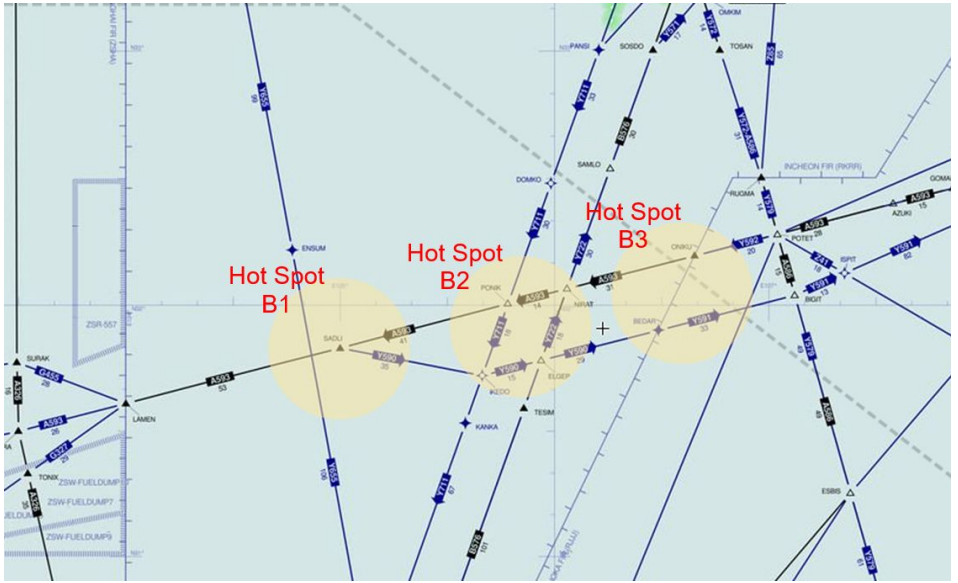
Subdivision of Hot Spot B :
During RASMAG MAWG/11, APAC monitoring agencies agreed to subdivide Hot Spot B into :

- B1 - Incheon/Shanghai
- B2 - Intersection points of A593, Y590, Y711, and Y722
- B3 - Fukuoka/Incheon

Result from the identifying hot spots process :
In 2022 and 2023, only B1 met the criteria in terms of the number of LHDs.

B1 remains on the Hot Spot list, because the subdivision remains to meet the hot spot criteria and should be monitored until further safety improvement initiatives such as AIDC are implemented.

B2 and B3 are proposed for removal from the Hot Spot list, because no LHD has been reported at those areas for more than two years and the reorganization of route structure in Phase I was completed.



Asia : LHD Hot Spot D (Manila and 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 2023, the total number of LHDs and the operational risk increased.

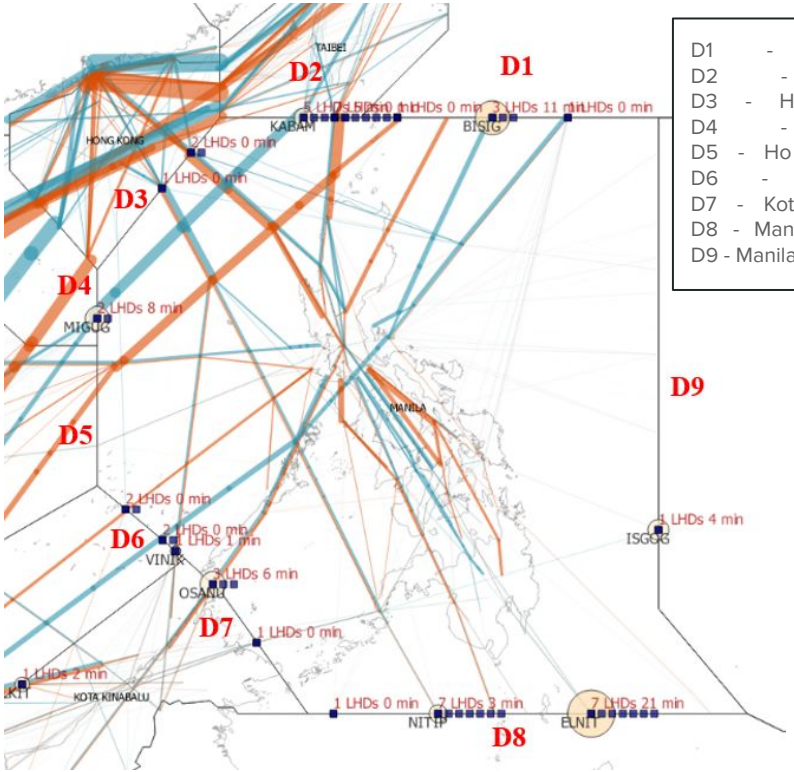
Mitigations :
- Several safety improvement activities such as the new ATM system, ACC sector re-sectorization, enhanced surveillance, and ADS-C/CPDLC have been implemented.

- 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 factors.

Boundary	Number of LHDs			Operational Risk (x 10^{-9} FAPFH)		
	2021	2022	2023	2021	2022	2023
Fukuoka/Manila	11	4	4	0.45	0.03	0.19
Ho Chi Minh/Manila	7	3	2	0.77	0.05	0.10
Hong Kong/Manila	2	1	3	0.00	0.00	0.00
Kota Kinabalu/Manila	2	3	5	0.00	0.04	0.13
Manila/Sanya	0	0	0	0.00	0.00	0.00
Manila/Singapore	2	2	4	0.00	0.04	0.00
Manila/Taibei	4	3	12	0.07	0.00	0.06
Manila/Ujung Pandang	7	2	15	0.36	0.11	0.41
Manila/Oakland	2	0	1	0.00	0.00	0.07
Total	**37**	**18**	**46**	**1.65**	**0.27**	**0.96**

Note: The number of LHDs and the operational risk in this table are based solely on the LHDs collected in MAAR's analysis.

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



D1 - Fukuoka/Manila
D2 - Manila/Taibei
D3 - Hong Kong/Manila
D4 - Manila/Sanya
D5 - Ho Chi Minh/Manila
D6 - Manila/Singapore
D7 - Kota Kinabalu/Manila
D8 - Manila/Ujung Pandang
D9 - Manila/Oakland

Subdivision of Hot Spot D :
During RASMAG MAWG/11, APAC monitoring agencies agreed to subdivide Hot Spot D to 9 interfaces (D1 to D9).

Result from the identifying hot spots process :
D1 met the criteria in terms of the operational risk in 2022.
D8 met the criteria in terms of the operational risk in 2023.

The remaining subdivisions did not meet any of the hot spot criteria in the last two years. However, AIDC was successfully implemented at D2, D3, D4, D6, and D9.

Thus, D2, D3, D4, D6, and D9 are proposed for removal from the Hot Spot list.

D1, D5, D7, and D8 remain on the Hot Spot list and should be monitored until further safety improvement initiatives such as AIDC are implemented.

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 FIR boundary (Waypoint: ORLID, Route: G450) is in the oceanic airspace with poor communication and surveillance coverage.

Trend : The number of LHDs slightly increased in 2023. The operational risk conversely decreased to 0 FAPFH.

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

Boundary	The Number of LHDs		
	2021	2022	2023
Mogadishu-Mumbai	5	9	10
Boundary	**The Operational Risk (FAPFH)**		
	2021	2022	2023
Mogadishu-Mumbai	0.12×10^{-9}	0.02×10^{-9}	0.00×10^{-9}

Result from the identifying hot spots process :
- Even though this area 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 (Mumbai/Muscat/Sanaa)

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

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

Trend : At Mumbai-Muscat, the number of LHDs and the operational risk significantly increased in 2023. Conversely, at Mumbai-Sanaa, the number of LHDs remained low over the past three years, with the operational risk being zero in both 2022 and 2023.

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

Result from the identifying hot spots process :
- Hot Spot G, particularly at Mumbai-Muscat FIR boundary, met the criteria in terms of both the number of LHDs and the operational risk in 2023.
- **Hot Spot G remains on the hot spot list** until further safety improvement initiatives or prevention measures such as AIDC are completed and demonstrate their effectiveness.

Boundary	The Number of LHDs		
	2021	2022	2023
Mumbai-Muscat	44	43	138
Mumbai-Sanaa	4	2	3
Boundary	**The Operational Risk (FAPFH)**		
	2021	**2022**	**2023**
Mumbai-Muscat	1.35×10^{-9}	0.79×10^{-9}	2.79×10^{-9}
Mumbai-Sanaa	0.07×10^{-9}	0.00×10^{-9}	0.00×10^{-9}

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

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

Contributing Factors : To be analysed

Trend : The number of LHDs and operational risk significantly increased in 2023. However, the operational risk remained below the TLS.

Mitigations : AAMA is working with SEASMA to share and confirm the information about LHDs on the Jakarta–Singapore FIR boundary. 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 from 2021 to 2023. Therefore, **Hot Spot J remains on the hot spot list**.

Boundary	The Number of LHDs		
	2021	2022	2023
Jakarta – Singapore	16	14	27
Boundary	**The Operational Risk (FAPFH)**		
	2021	**2022**	**2023**
Jakarta – Singapore	0.23×10^{-9}	0.18×10^{-9}	0.33×10^{-9}

Asia : LHD Hot Spot M (Colombo/Melbourne)

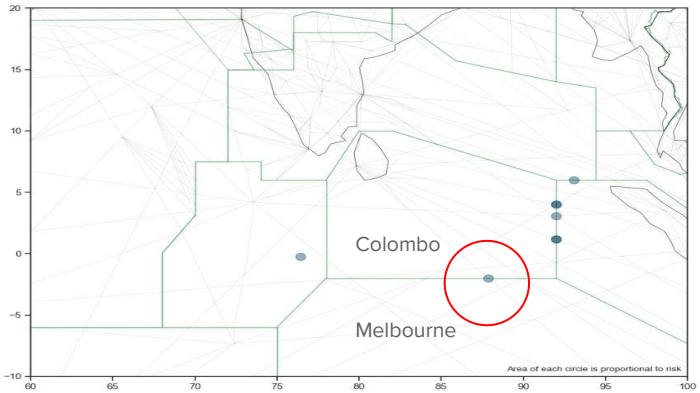
Nature of Occurrences : Category A, B, and E LHDs.

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.

ICAO had also issued the State Letter to DGCA India (dated 08 Feb 2023) to provide the relevant Point/s of Contact for the India 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 has remained on the hot spot list since 2019.**



Asia : 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 due to the different Transfer of Control and Communication Points and the involvement of multiple ATS units.

Trend : The operational risk and the number of LHDs slightly decreased in 2023. However, the proportion of operational risk, at 28%, remains high compared to the total operational risk in SEA airspace.

Result from the identifying hot spots process : This area satisfied the hot spot criteria in terms of the operational risk in 2022 and 2023. Therefore, **Hot Spot O remains on the hot spot list**.

Boundary	The Number of LHDs		
	2021	2022	2023
Hot Spot O	5	7	5
Boundary	**The Operational Risk (FAPFH)**		
	2021	2022	2023
Hot Spot O	0.14×10^{-9}	0.58×10^{-9}	0.51×10^{-9}

Reporting Rate
of LHDs/LLDs/LLEs

2023 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	-	0	-	0	-	0	-	0	-
Mongolia	83,708	0	-	0	-	0	-	0	-
SEA	2,969,413	6	1: 494,902	92	1: 32,276	3	1: 98,804	101	1: 29,400
Japan	1,688,572	12	1: 140,714	16	1: 105,536	44	1: 38,377	72	1: 23,452
SW Pacific	1,182,067	33	1: 35,820	28	1: 42,217	4	1: 295,517	65	1: 18,186
China	2,346,976	9	1: 260,775	19	1: 123,525	195	1: 12,036	223	1: 10,525
SA/IO	2,642,401	1	1: 2,642,41	256	1: 10,322	1	1: 2,642,401	258	1: 10,242
Pacific	1,773,499	37	1: 47,932	160	1: 11,084	6	1: 295,583	203	1: 8,736
Indonesia	762,410	13	1: 58,647	111	1: 6,869	1	1: 762,410	125	1: 6,099
ROK and AKARA	166,500	0	-	75	1: 2,220	0	-	75	1: 2,220
Total	13,615,545	111	1: 122,663	757	1: 17,986	254	1: 53,605	1,122	1: 12,135

Notes:

- No aircraft flying in the RVSM airspace of DPRK due to public health crisis in 2023. As a result, there were no flying hours and no reported LHDs, LLDs, or LLEs for DPRK.

Reporting Rate of LHDs/LLDs/LLEs

Airspace	# Reports							1 Report : Flying Hrs						
	2017	2018	2019	2020	2021	2022	2023	2017	2018	2019	2020	2021	2022	2023
DPRK	0	0	0	0	0	0	0	-	-	-	-	-	-	-
Mongolia	4	1	2	0	1	0	0	1: 37,771	1: 158,891	1: 82,138	-	1: 121,621	-	-
SEA	474	205	152	42	70	62	95	1: 6,548	1: 17,757	1: 22,275	1: 25,106	1: 15,456	1:32,620	1:29,400
Japan	71	76	77	66	80	75	67	1: 21,510	1: 20,632	1: 20,762	1: 14,737	1: 13,528	1:18,751	1:23,452
SW Pacific	51	53	101	46	47	81	65	1: 17,572	1: 17,817	1: 9,335	1: 6,954	1: 11,975	1:5,352	1:18,186
China	134	110	79	85	105	72	223	1: 18,248	1: 22,229	1: 31,119	1: 26,867	1: 15,477	1:18,003	1:10,525
SA/IO	935	681	439	152	135	143	254	1: 3,166	1: 3,783	1: 7,955	1: 7,907	1: 11,167	1:21,018	1:10,242
Pacific	42	43	173	134	176	179	193	1: 54,191	1: 45,064	1: 10,139	1: 6,404	1: 6,638	1:8,280	1:8,736
Indonesia	34	23	37	18	41	54	125	1: 10,842	1: 53,603	1: 33,321	1: 17,346	1: 7,402	1:8,060	1:6,099
ROK and AKARA	5	12	34	5	24	108	75	1: 117,090	1: 28,365	1: 18,959	1: 25,965	1: 6,285	1:1,056	1:2,220
Total	**1,750**	**1,204**	**1,094**	**548**	**679**	**774**	**1,122**	**1: 8,180**	**1: 12,332**	**1: 14,330**	**1: 13,202**	**1: 11,200**	**1:13,230**	**1:12,135**

The reporting rate for SEA, China, SA/IO and Indonesia improved in 2023.
The reporting rate for SW Pacific dropped because of the huge increase in the estimated flying hours.

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.

Conclusion

RVSM TLS Compliance - Vertical

- **The 2023 PAC vertical overall risk is** 10.77 x 10^{-9} FAPFH, above the TLS.
- **The 2023 ASIA vertical overall risk is** 3.40 x 10^{-9} FAPFH, below the TLS .

RVSM TLS Compliance - Horizontal

- **All horizontal risk estimates in 2023 are below the TLS.**

RASMAG's Hot Spot List

Hot Spot	Involved FIRs	Identified	Remarks
A1	Chennai/Dhaka/Kolkata/Yangon	2015	Cat. E LHDs and risk reducing.
A2	Chennai/Kuala Lumpur	2015	Cat. E LHDs reducing. Risk slightly increasing Proposed for removal from the Hot Spot list in 2024 (RASMAG/29).
B1	Incheon/Shanghai	2015	Cat. E LHDs and risk reducing.
B2	Intersection points of A593, Y590, Y711, and Y722	2015	Proposed for removal from the Hot Spot list in 2024 (RASMAG/29).
B3	Fukuoka/Incheon	2015	Proposed for removal from the Hot Spot list in 2024 (RASMAG/29).
D1	Fukuoka/Manila	2015	Cat. E LHDs reducing. Risk slightly increasing
D2	Manila/Taibei	2015	Proposed for removal from the Hot Spot list in 2024 (RASMAG/29).
D3	Hong Kong/Manila	2015	Proposed for removal from the Hot Spot list in 2024 (RASMAG/29).
D4	Manila/Sanya	2015	Proposed for removal from the Hot Spot list in 2024 (RASMAG/29).
D5	Ho Chi Minh/Manila	2015	Cat. E LHDs reducing. Risk slightly increasing
D6	Manila/Singapore	2015	Proposed for removal from the Hot Spot list in 2024 (RASMAG/29).

RASMAG's Hot Spot List

Hot Spot	Involved FIRs	Identified	Remarks
D7	Kota Kinabalu/Manila	2015	Cat. E LHDs and risk slightly increasing
D8	Manila/Ujung Pandang	2015	Cat. E & F LHDs and risk increasing
D9	Manila/Oakland	2015	Proposed for removal from the Hot Spot list in 2024 (RASMAG/29).
F	Mogadishu/Mumbai	2015	Cat. E LHDs slightly increasing. Risk reducing.
G	Mumbai/Muscat/Sanaa	2015	Cat. E LHDs and risk increasing.
J	Jakarta/Kota Kinabalu/Singapore	2018	Cat. E LHDs and risk increasing.
M	Colombo/Melbourne	2019	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	Hawaii CEP/Oakland USA	2019	Cat. E LHDs and Risk reducing.
O	Bangkok/Ho Chi Minh/Kuala Lumpur/ Singapore	2023	Cat. E LHDs and Risk reducing.

Reporting Rate of LHDs/LLDs/LLEs

- The estimated flying hours significantly increased from

  7,604,927 hours in 2021 and
  10,240,138 hours in 2022 to
  13,615,545 hours in 2023.

- The overall reporting rate of LHDs/LLDs/LLEs slightly improved from

  1 report per 13,230 hours in 2022 to
  1 report per 12,135 hours in 2023.

- The reporting rate for SEA, China, SA/IO and Indonesia improved in 2023.
- The reporting rate for SW Pacific dropped because of the huge increase in the estimated flying hours.
- The reporting rate for DPRK could not be calculated because there were no flying hours and no reported LHDs, LLDs, or LLEs due to a public health crisis (no aircraft flying in DPRK's RVSM airspace in 2023.)
- The reporting rate for Mongolia could not be calculated because no LHDs, LLDs, or LLEs were reported. Mongolia submitted NIL reports for all months in 2023.

Thank You