International Civil Aviation Organization

Twenty-Ninth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/30)

Bangkok, Thailand, 14 – 17 July 2025

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 2024.

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 the Asia Pacific Consolidated Safety Report 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 the report, each monitoring agency bases their analysis on Traffic Sample Data (TSD) on December 2024 and Large Height Deviations (LHDs), Large Longitudinal Errors (LLEs), and Large Lateral Deviations (LLDs) collected throughout 2024.

2.2 The 2024 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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2024 Asia Pacific Consolidated Safety Report

Thirtieth Meeting of the Regional Airspace Safety Monitoring Advisory Group

(RASMAG/30)

Bangkok, Thailand

14 – 17 July 2025

Prepared by APAC RMAs and EMAs

Outline

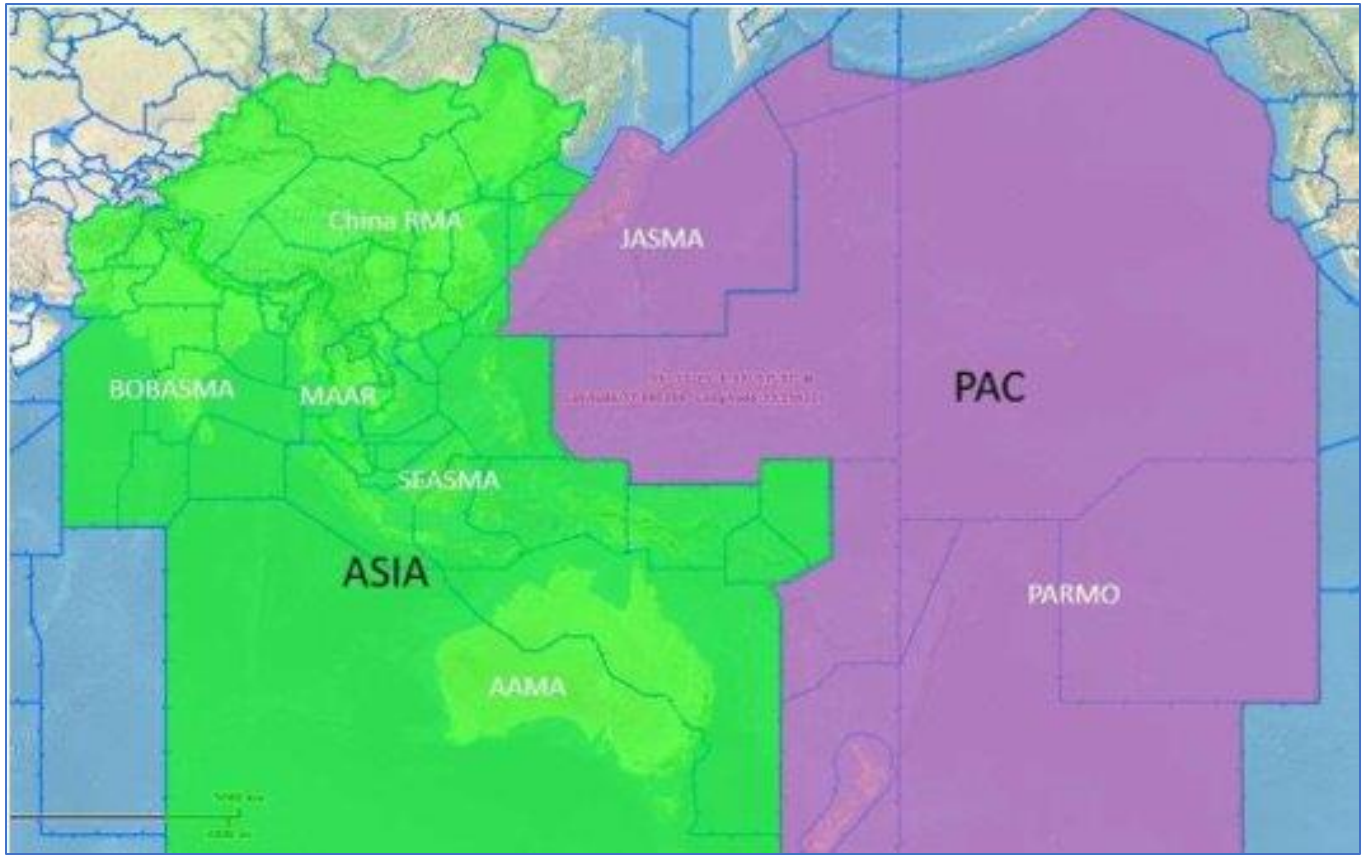
- Background
- PAC Area
  - Vertical Collision Risk Estimates and Summary of LHDs
  - Horizontal Collision Risk Estimates and Summary of LLDs and LLEs
  - Geolocations of LHDs/LLDs/LLEs
  - Hot Spots
- Asia Area
  - Vertical Collision Risk Estimates and Summary of LHDs
  - Horizontal Collision Risk Estimates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

Background

In 2019 (MAWG/6), 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.

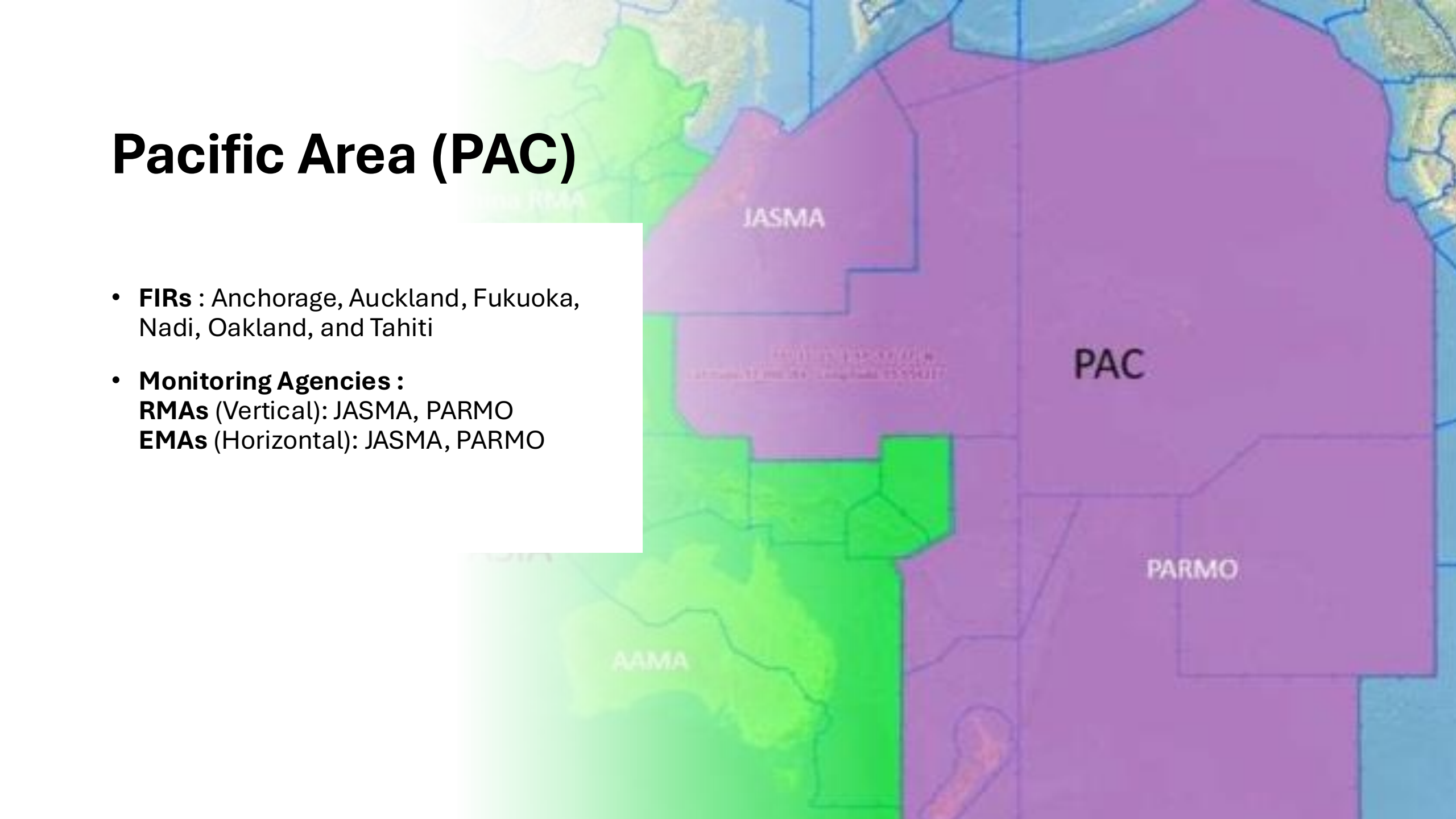
The report is divided into:

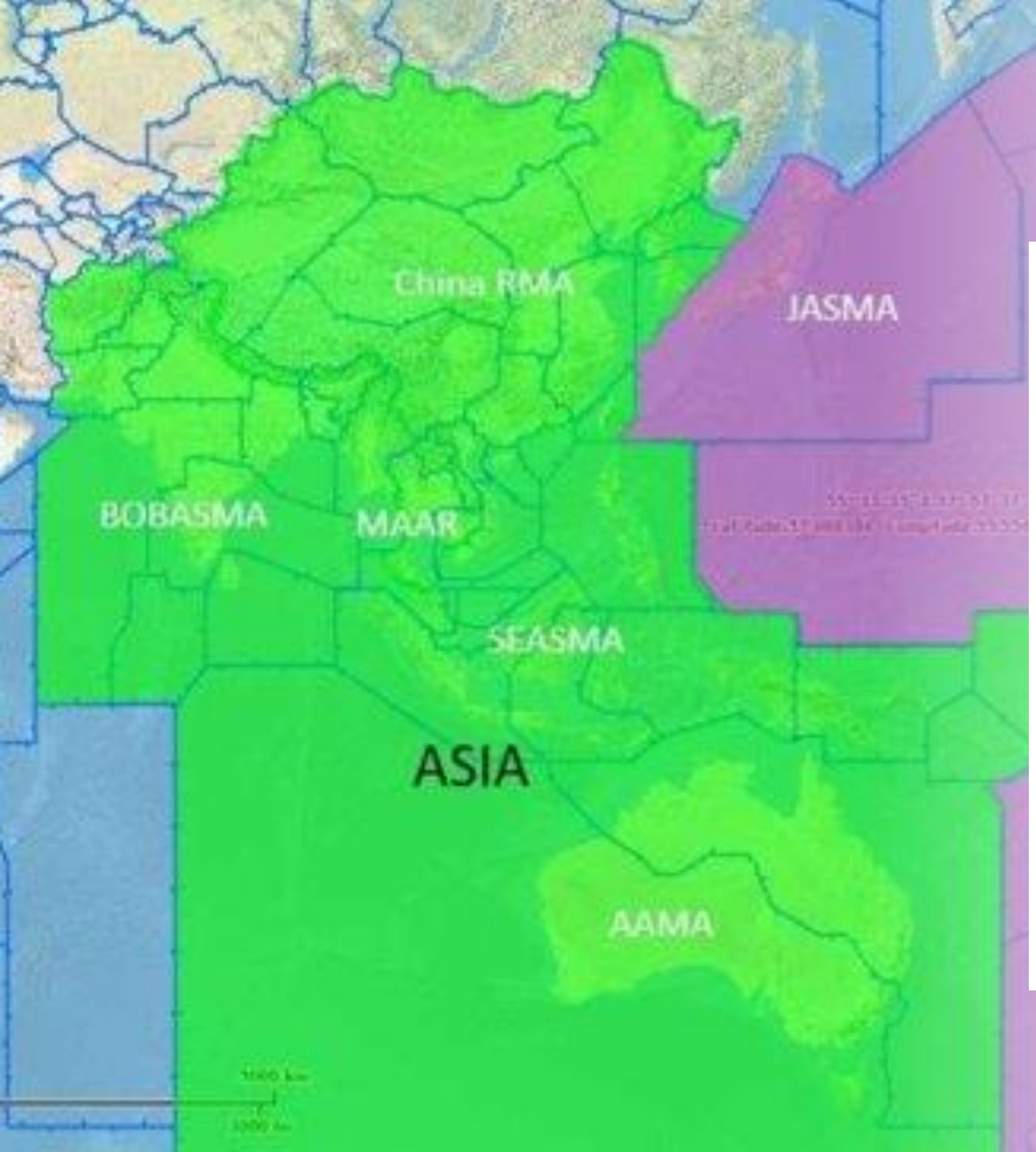
- **Pacific (PAC) Area**
- **Asia Area**



Pacific Area (PAC)

- **FIRs** : Anchorage, Auckland, Fukuoka, Nadi, Oakland, and Tahiti
- **Monitoring Agencies :**
  RMAs (Vertical): JASMA, PARMO
  EMAs (Horizontal): JASMA, PARMO





Asia Area (Asia)

- **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): BOBASMA, SEASMA

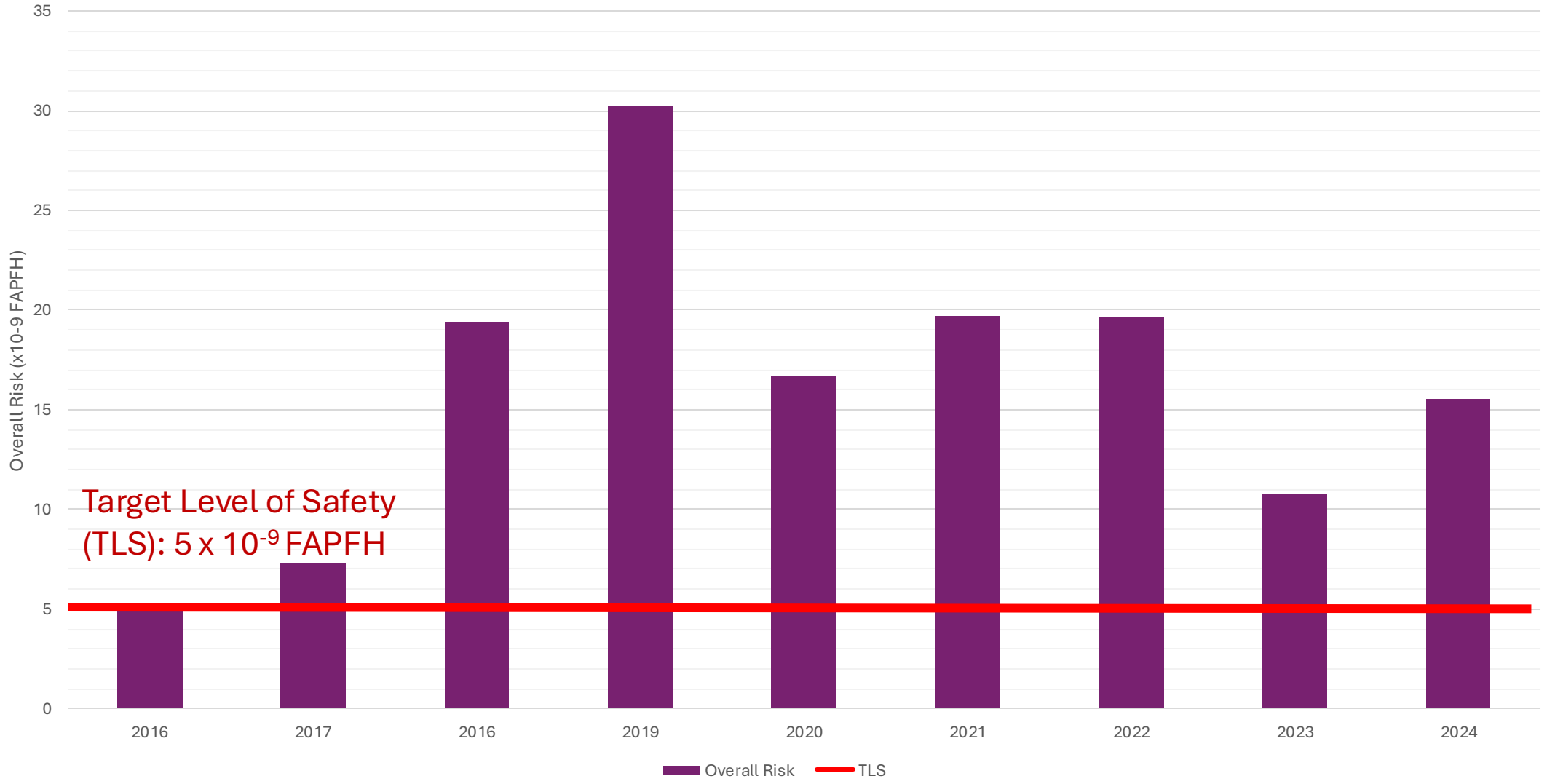
PAC : Vertical Collision Risk

PAC: Vertical Collision Risk Estimates

Annual flying hours: 3,727,882 hours/year

Risk Estimates		Remark
Vertical Technical Risk	0.20×10^{-9} FAPFH	Below Technical TLS
Vertical Operational Risk	15.33×10^{-9} FAPFH	
Vertical Overall Risk	15.53×10^{-9} FAPFH	Above TLS

PAC: Vertical Collision Risk Estimates



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	7	5	3
	B	Flight crew climbing/descending without ATC Clearance	27	45	31
	C	Incorrect operation or interpretation of airborne equipment	4	352	6
ATC	D	ATC system loop error	6	67	3
	E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues	55	442	1
	F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues	4	108	0

PAC: Summary of LHDs

Attributions	Category Code	Description	Number of Occurrences	Duration (minutes)	Number of Levels Crossed
Aircraft/ Avionics/ Contingencies	G	Aircraft contingency event leading to sudden inability to maintain assigned flight level	1	28	25
	H	Airborne equipment failure leading to unintentional or undetected change of flight level	1	1	0
Weather/ Turbulence	I	Turbulence or other weather-related causes leading to unintentional or undetected change of flight level	15	48	4
TCAS	J	TCAS resolution advisory, flight crew correctly climb or descend following the resolution advisory	17	23	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	2	0	2
		Total	**139**	**1,119**	**75**

PAC : Horizontal Collision Risk

PAC: Horizontal Collision Risk Estimates

Annual flying hours: 2,069,133 hours/year

2024 Horizontal Risk Estimates		Remark
Total Lateral Risk	1.22×10^{-9} FAPFH	Below TLS
Total Longitudinal Risk	0.014×10^{-9} FAPFH	Below TLS
2023 Horizontal Risk Estimates		**Remark**
Total Lateral Risk	0.24×10^{-9} FAPFH	Below TLS
Total Longitudinal Risk	0.038×10^{-9} FAPFH	Below TLS

Note: JASMA's longitudinal risk estimates include values based on both the 30 NM and 10-minute separation standards. However, the PAC's total longitudinal risk value is based on the 30 NM separation standard.

PAC: Summary of LLDs and LLEs

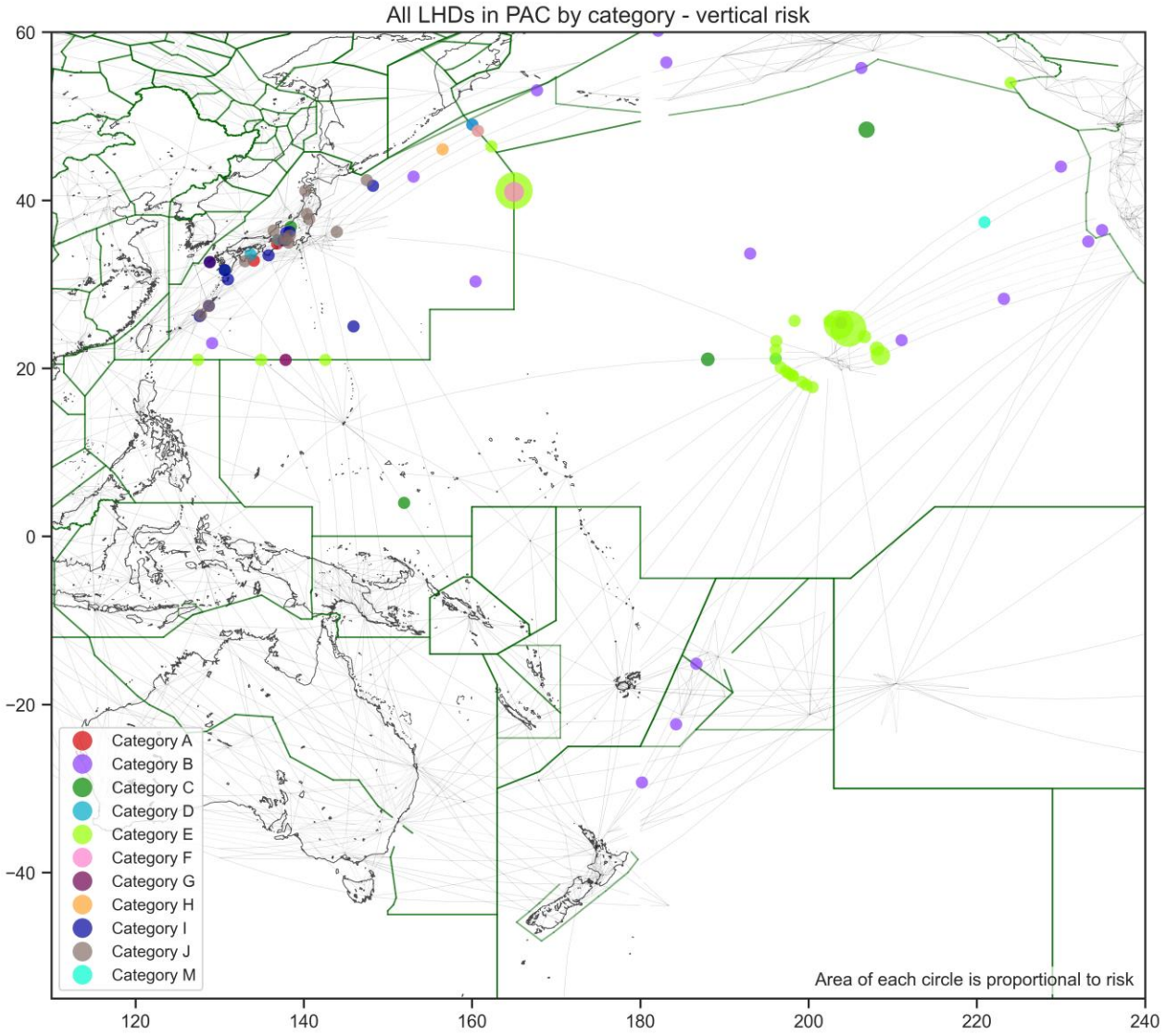
Attributions	Category Code	Description	Number of Occurrences	Duration (minutes)	Horizontal Deviation (NM)
Aircrew/ Pilot	A	Flight crew deviate without ATC Clearance	27	69	1100
	B	Incorrect estimate or route provided due to incorrect operation or interpretation of airborne equipment	12	438	93
	C	Flight crew waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position	9	162	420
ATC	D	ATC system loop error	5	64	5
	E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues	107	1176	151
	F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues	2	58	50

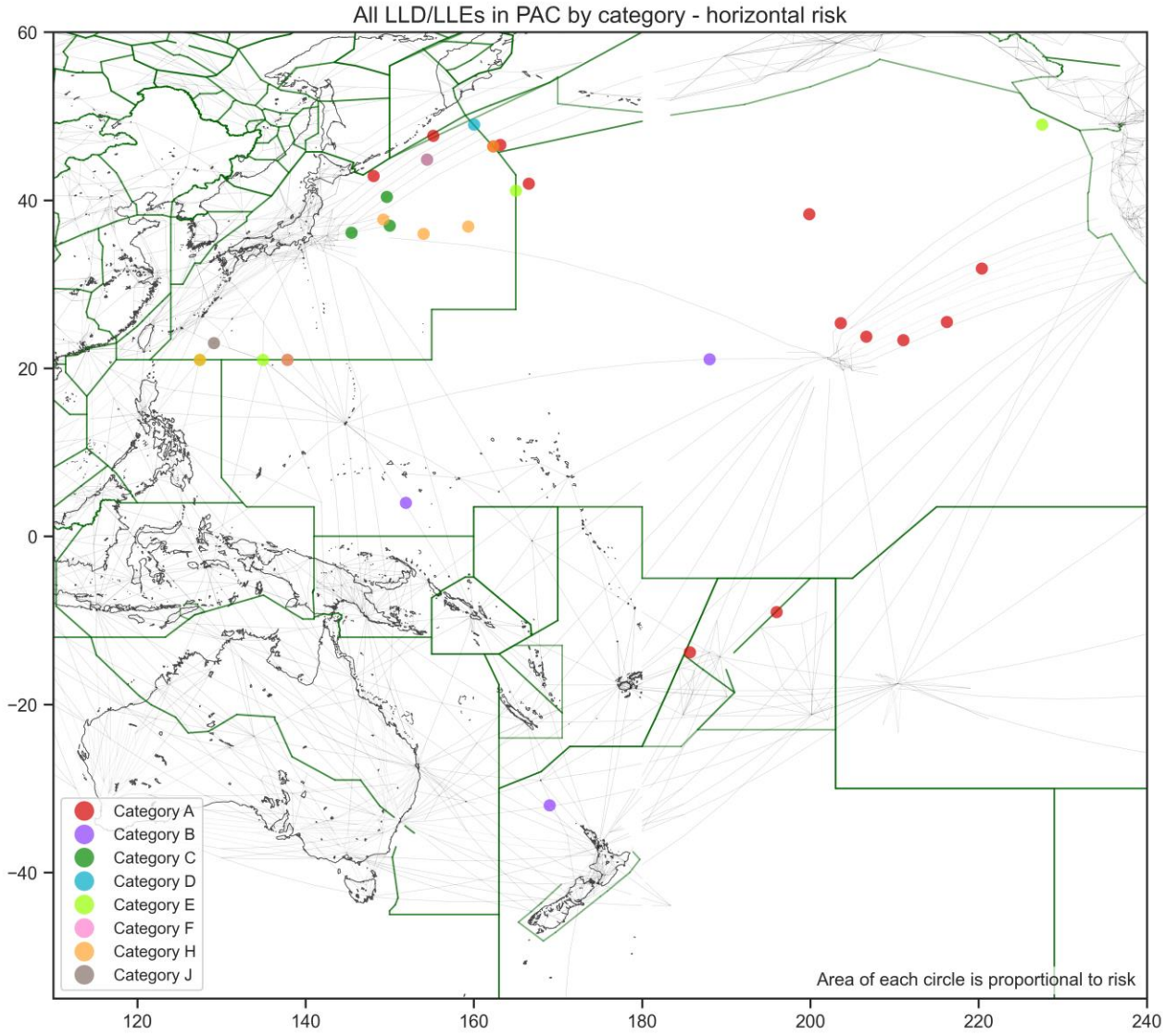
PAC: Summary of LLDs and LLEs

Attributions	Category Code	Description	Number of Occurrences	Duration (minutes)	Horizontal Deviation (NM)
Aircraft/ Avionics/ Contingencies	G	Navigation errors due to airborne equipment failure	0	0	0
Weather/ Turbulence	H	Turbulence or other weather-related causes leading to a deviation in the horizontal dimension	8	106	166
Other	I	An aircraft was provided with reduced horizontal separation minima but did not meet the RNP/RSP/RCP specification;	0	0	0
	J	Other	1	12	30
		Total	**171**	**2085**	**2015**

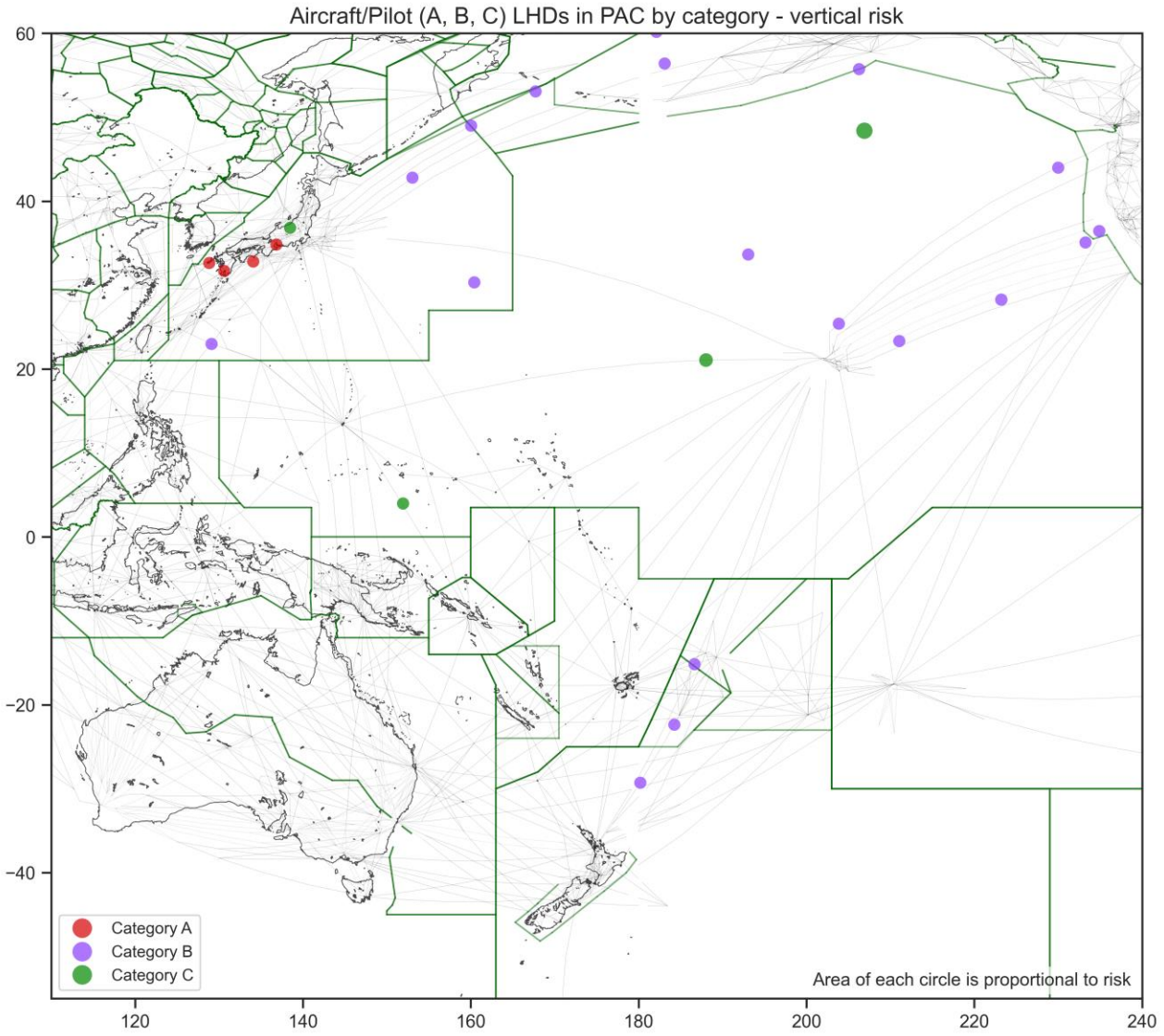
PAC : Geolocation of LHDs/LLDs/LLEs

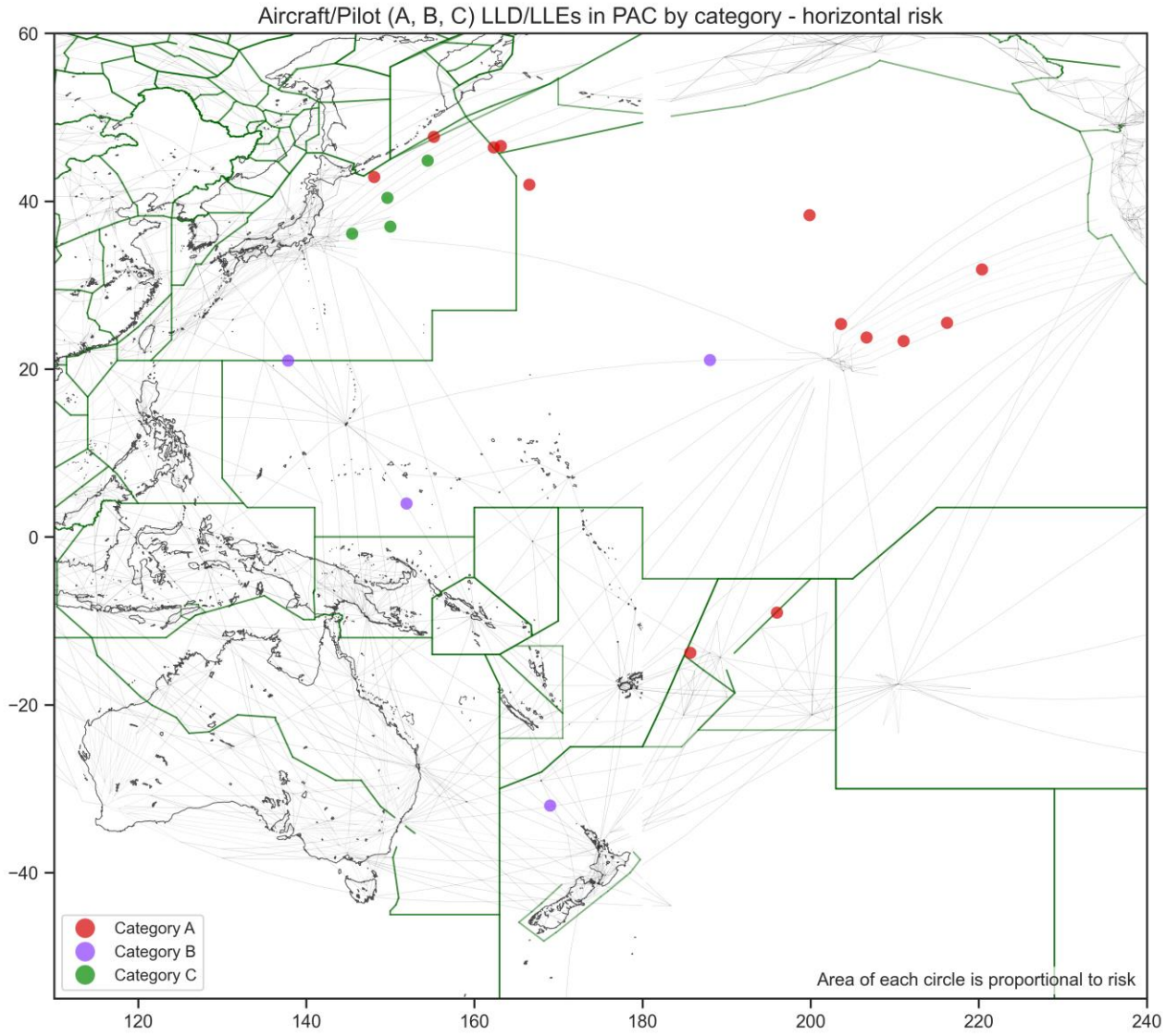
PAC: All Categories



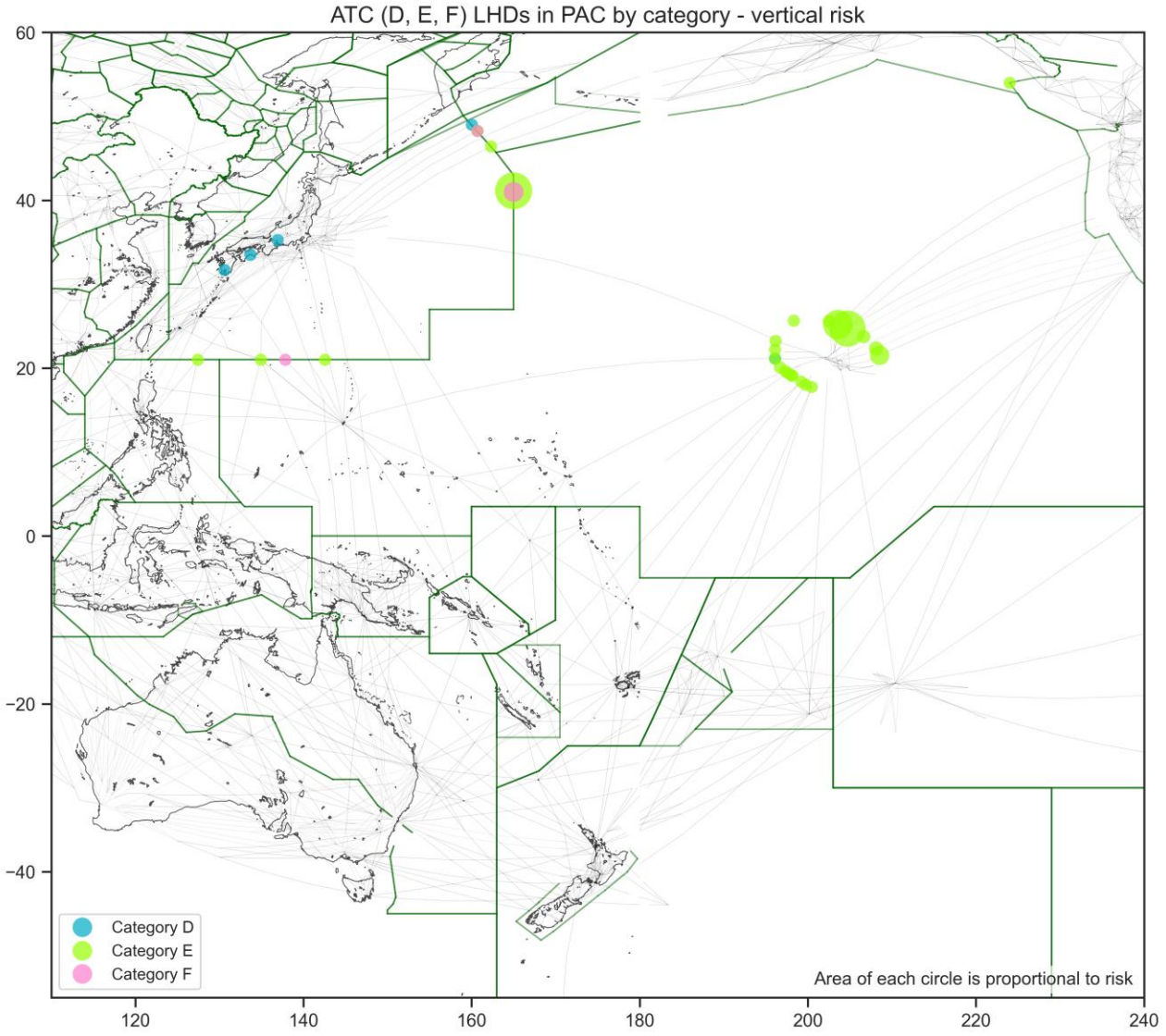


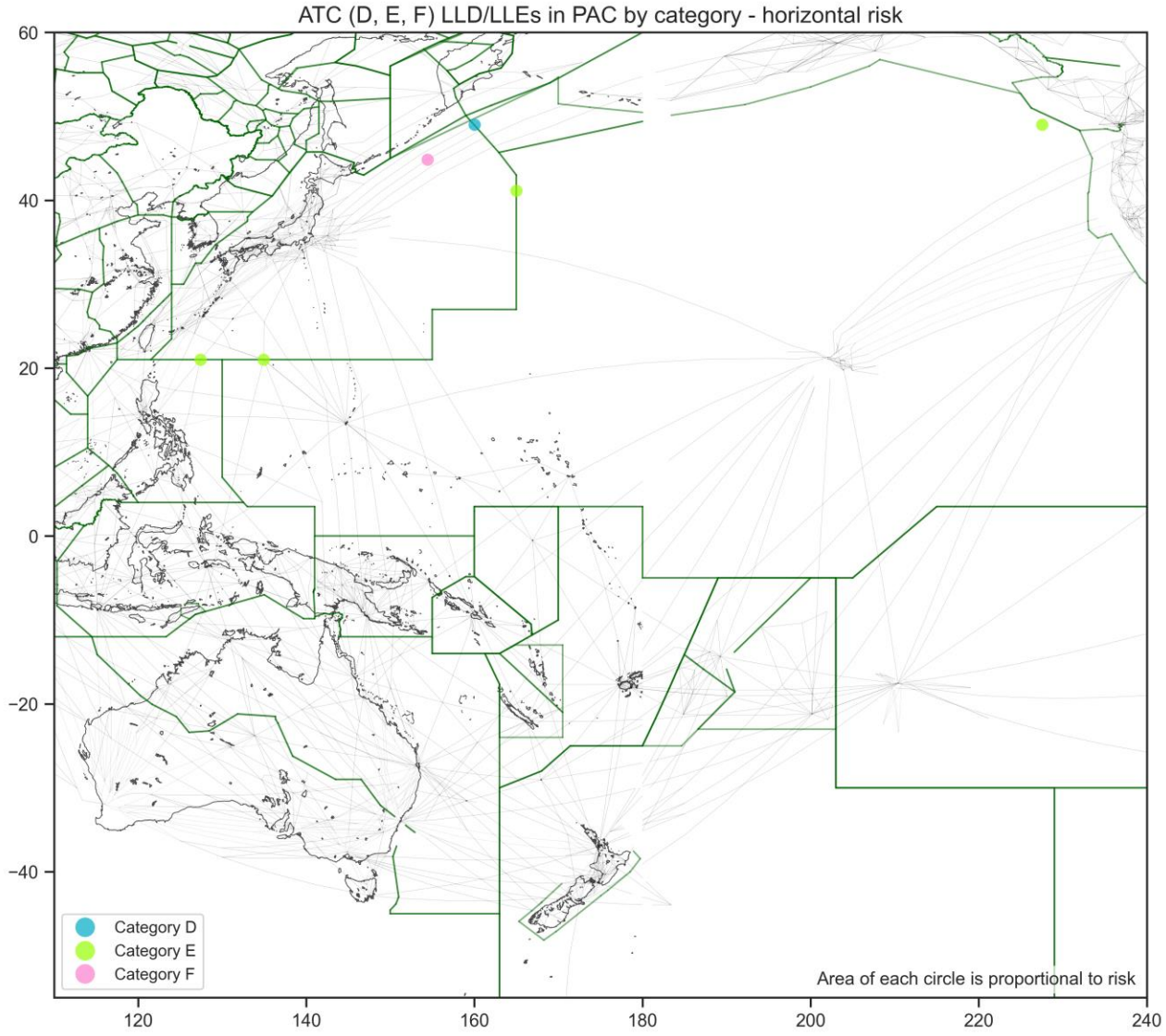
PAC: Aircrew/Pilot (A, B, C)





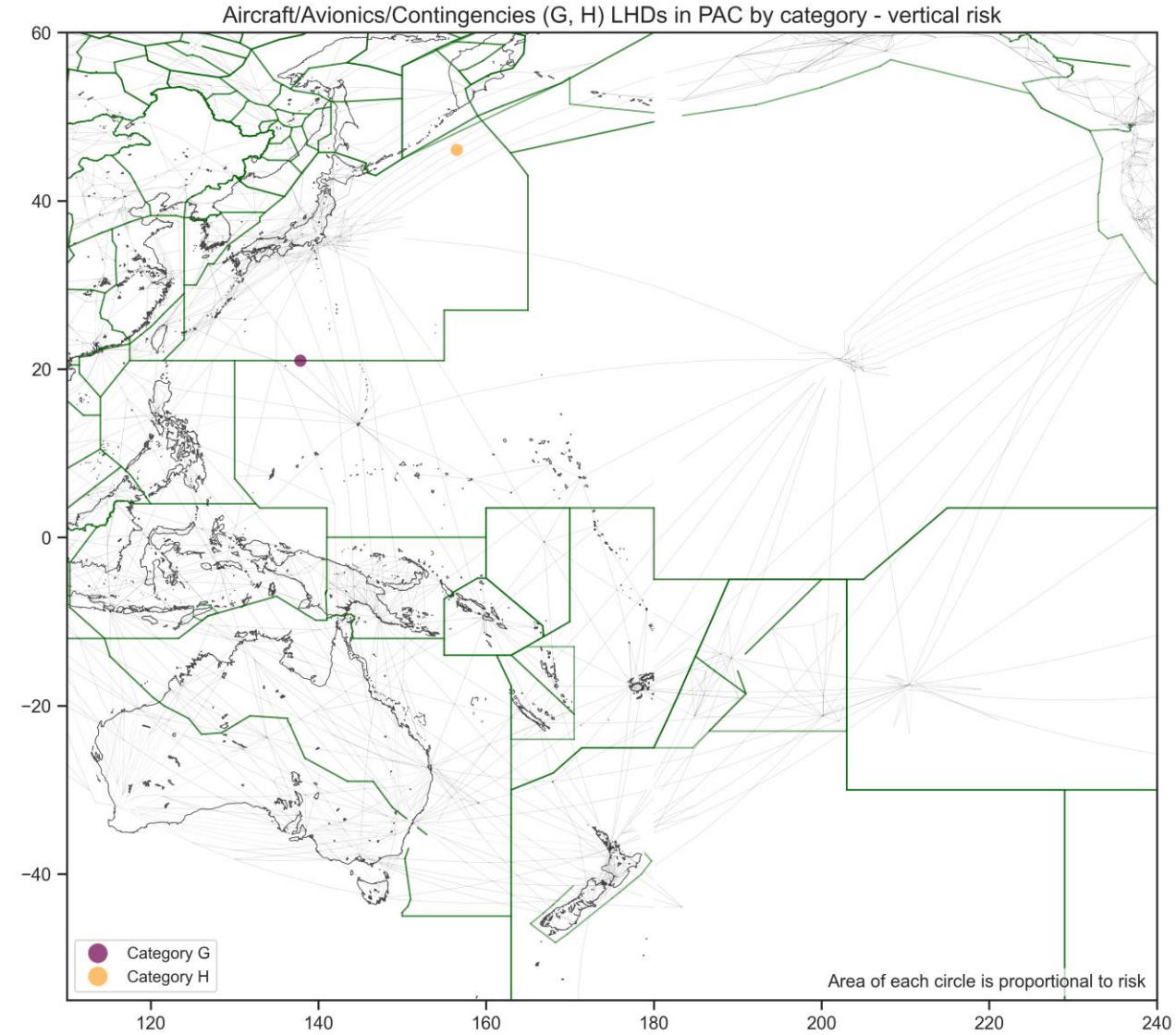
PAC: ATC (D, E, F)

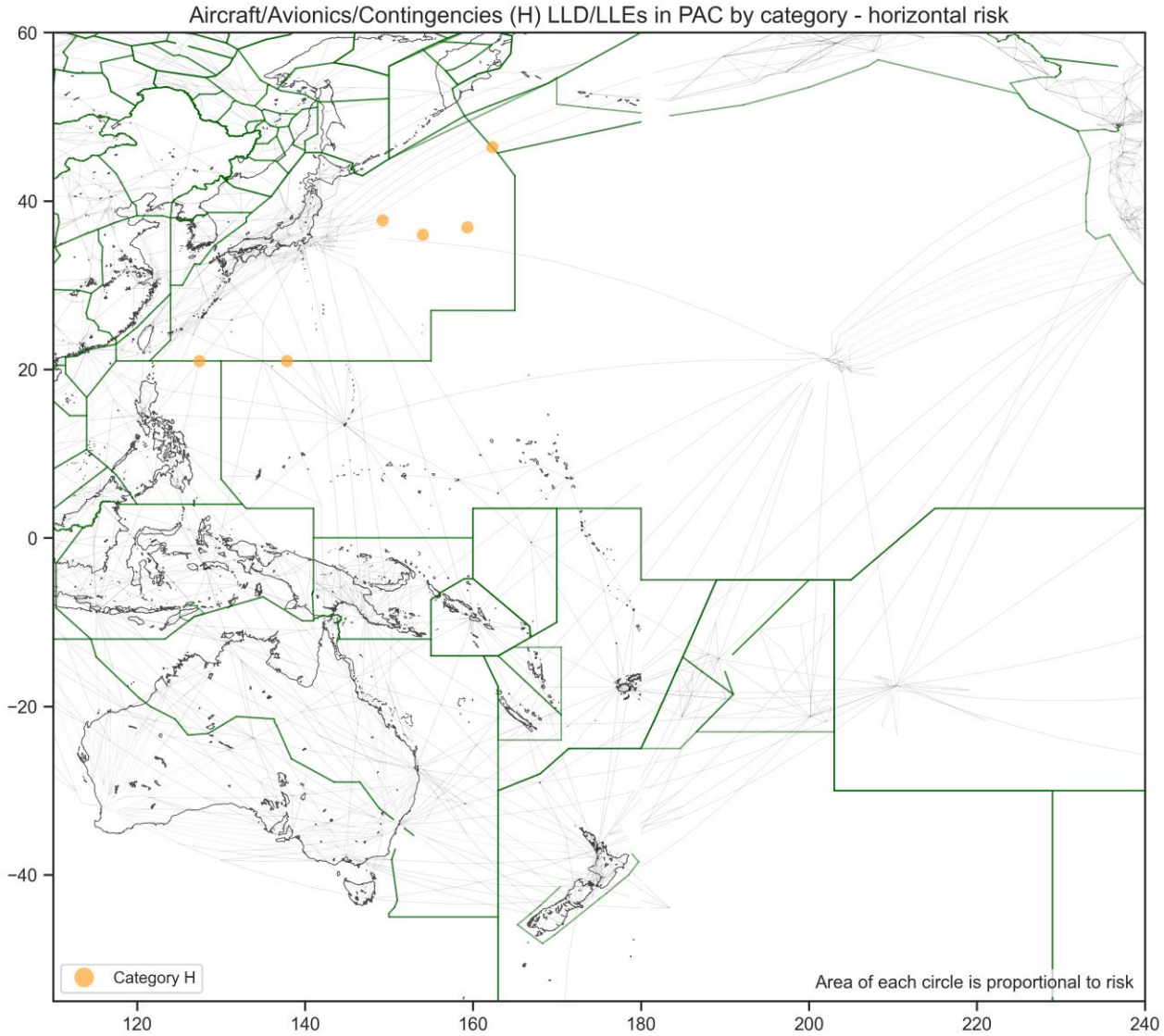

ATC (D, E, F) LHDs in PAC by category - vertical risk
60
40
20
0
−20
−40
120
140
160
180
200
220
240
Category D
Category E
Category F
Area of each circle is proportional to risk


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

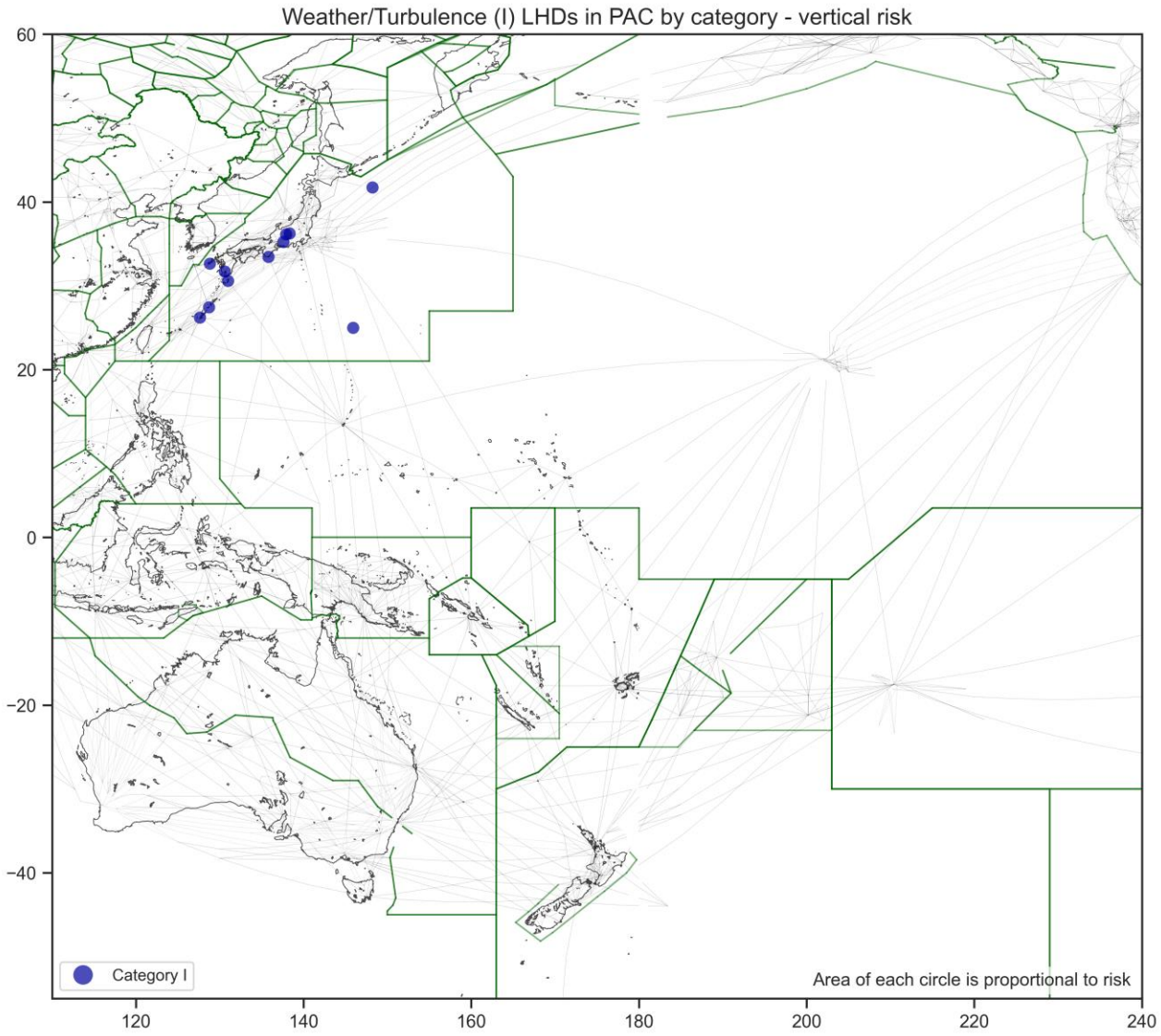
PAC: Aircraft Avionics/Contingencies

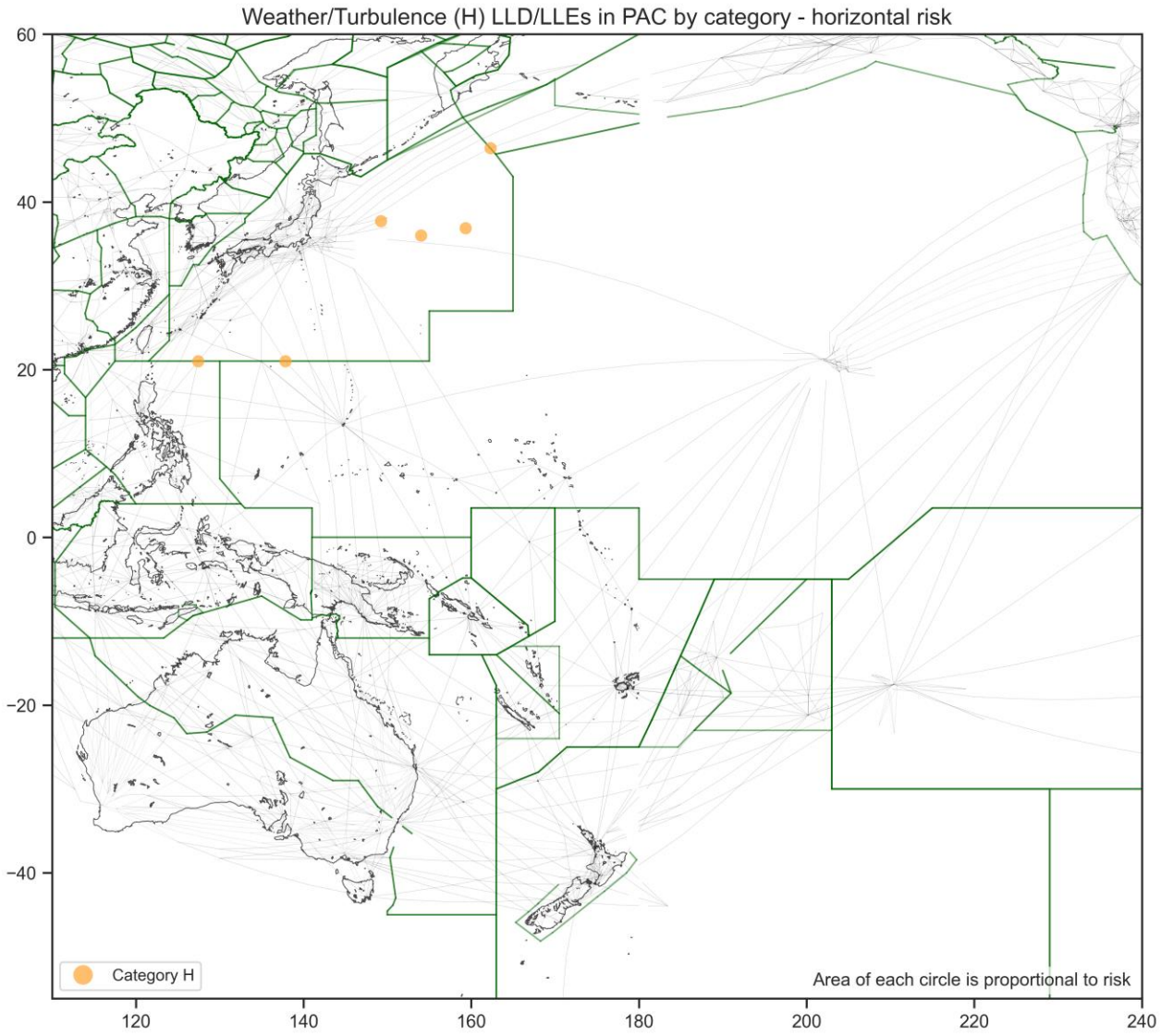
(LHD:G,H, LLD/LLE:H)



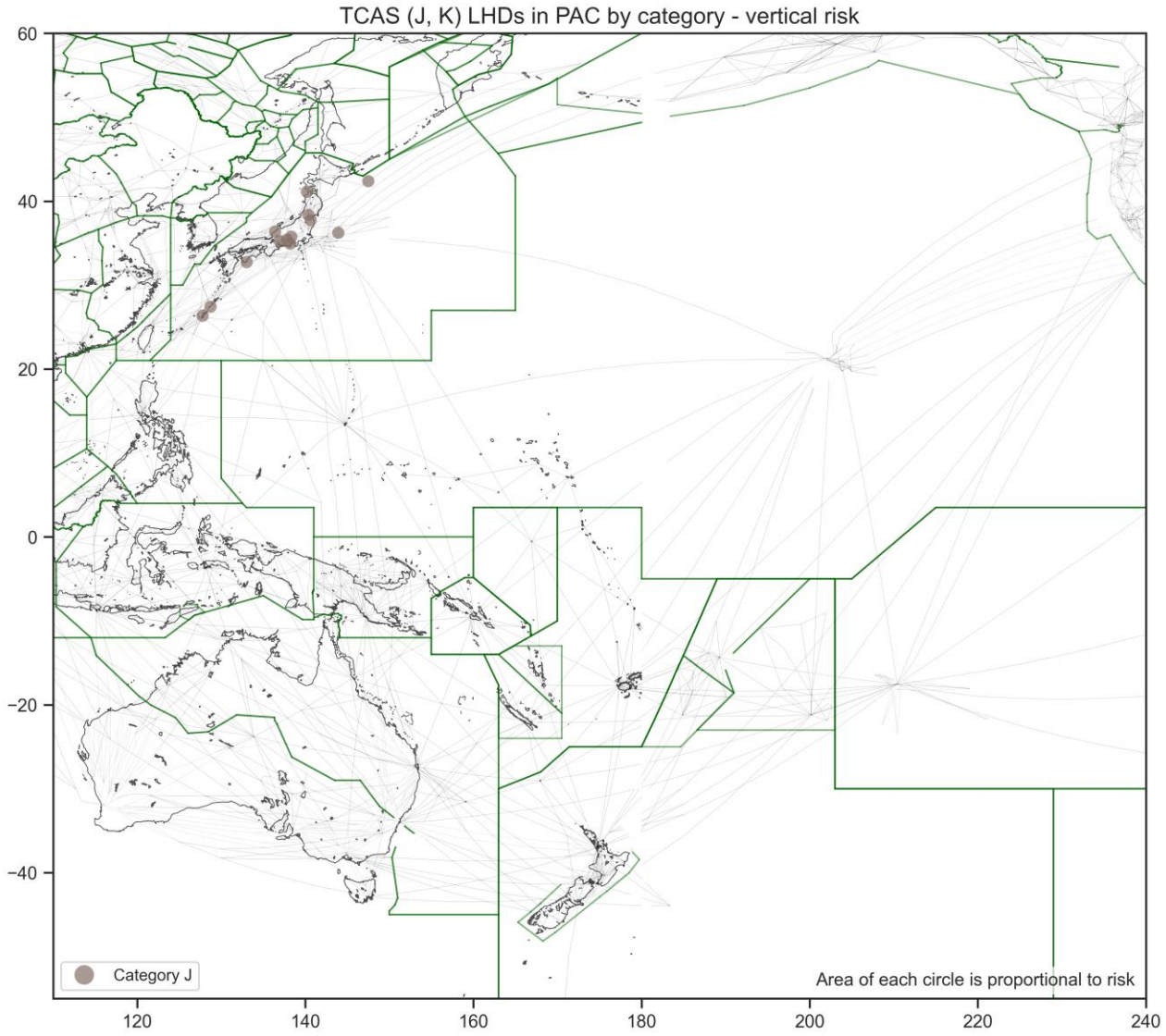


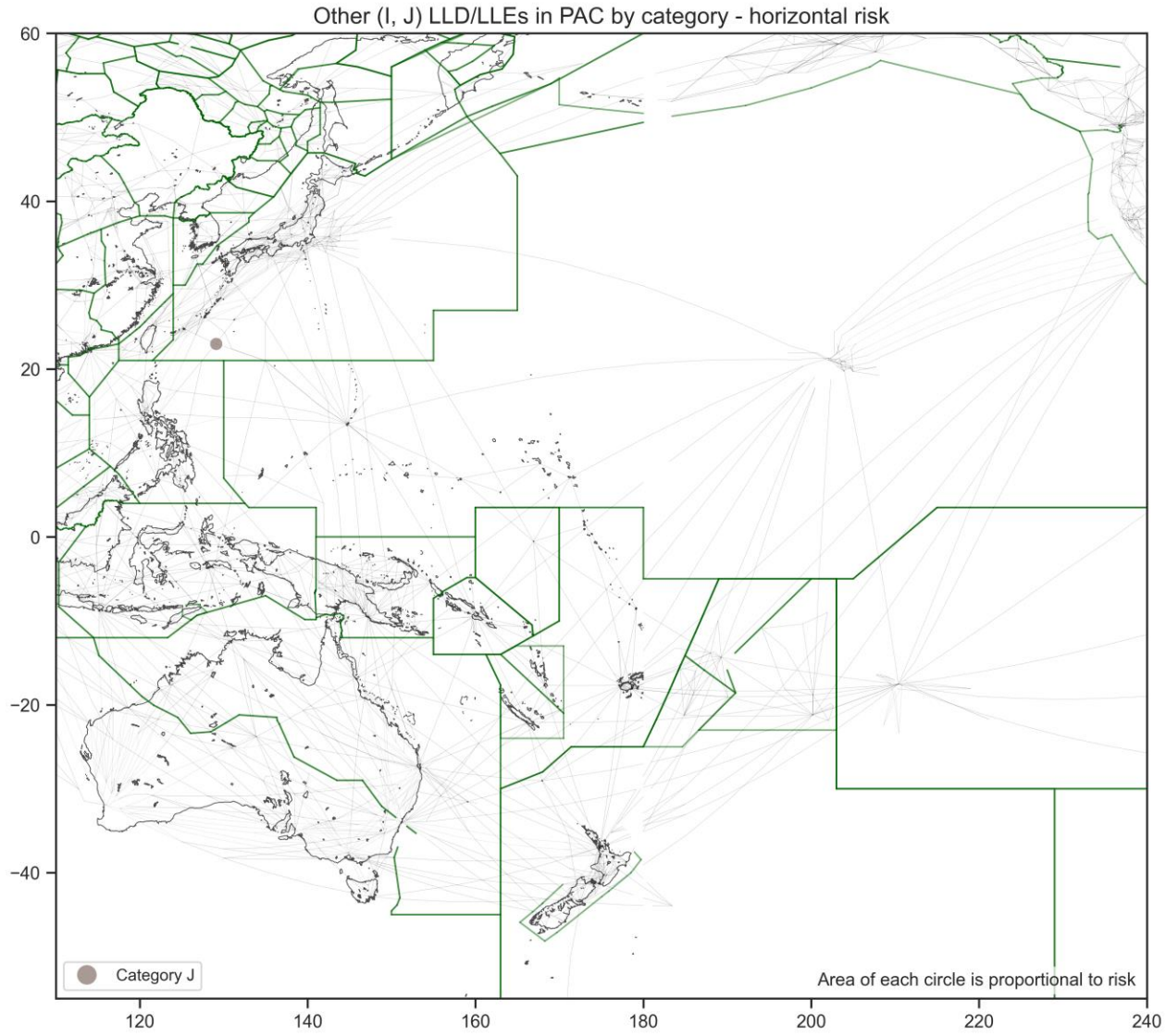
PAC: Weather/Turbulence (LHD:I, LLD/LLE:H)





PAC: TCAS (LHD:J, K, LLD/LLE:I,J)





PAC : Hot Spots

PAC: LHD Hot Spot N (Central East Pacific Traffic Flow; Hawaii – North America)

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

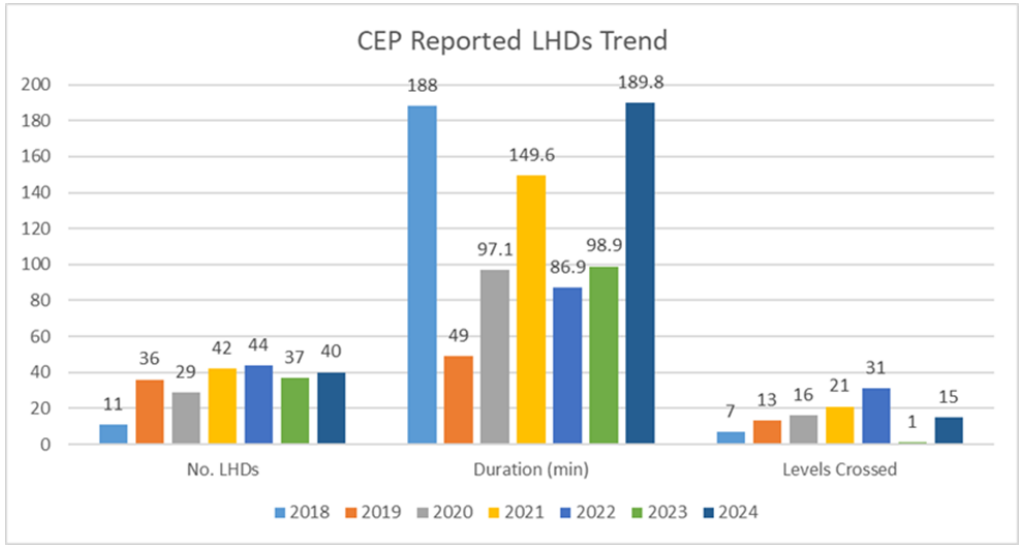
Contributing Factors : High-volume Central East Pacific (CEP) traffic flow and the user-preferred routes that cross the CEP airways.

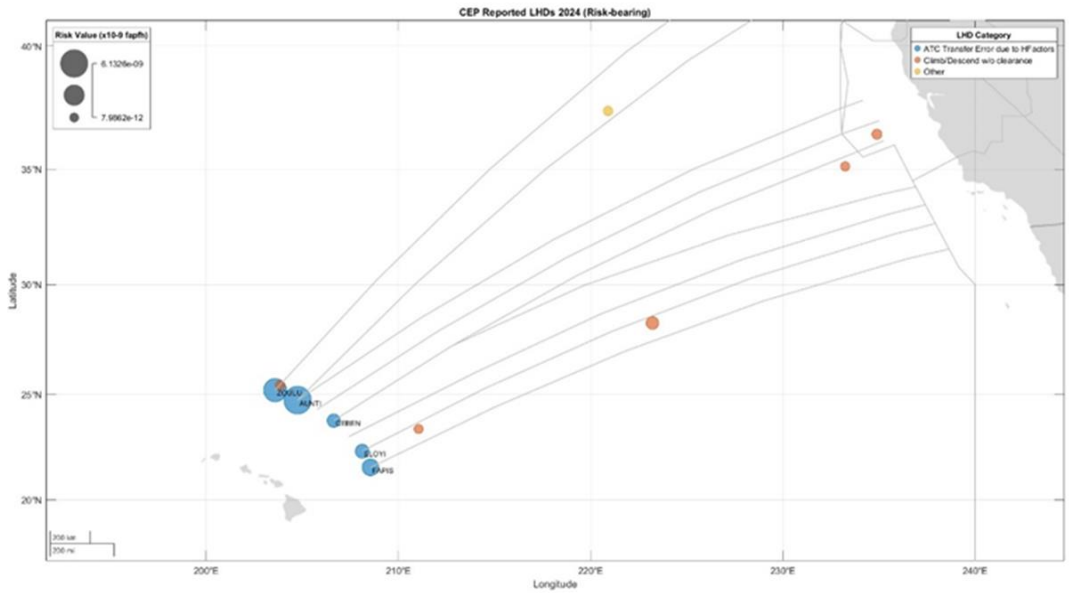
Trend: The number of LHDs in 2024 remained consistent with previous years.

Mitigations: Oakland ARTCC and Honolulu Control Facility (HCF) have developed mitigation procedures. The long term mitigation is a new ATC system scheduled to be implemented at the HCF in 2027.

Result from the hot spot identification process:

Hot Spot N remains on the list of hot spots and should continue to be monitored until the LHDs and risk are decreased and further safety improvement initiatives are implemented.





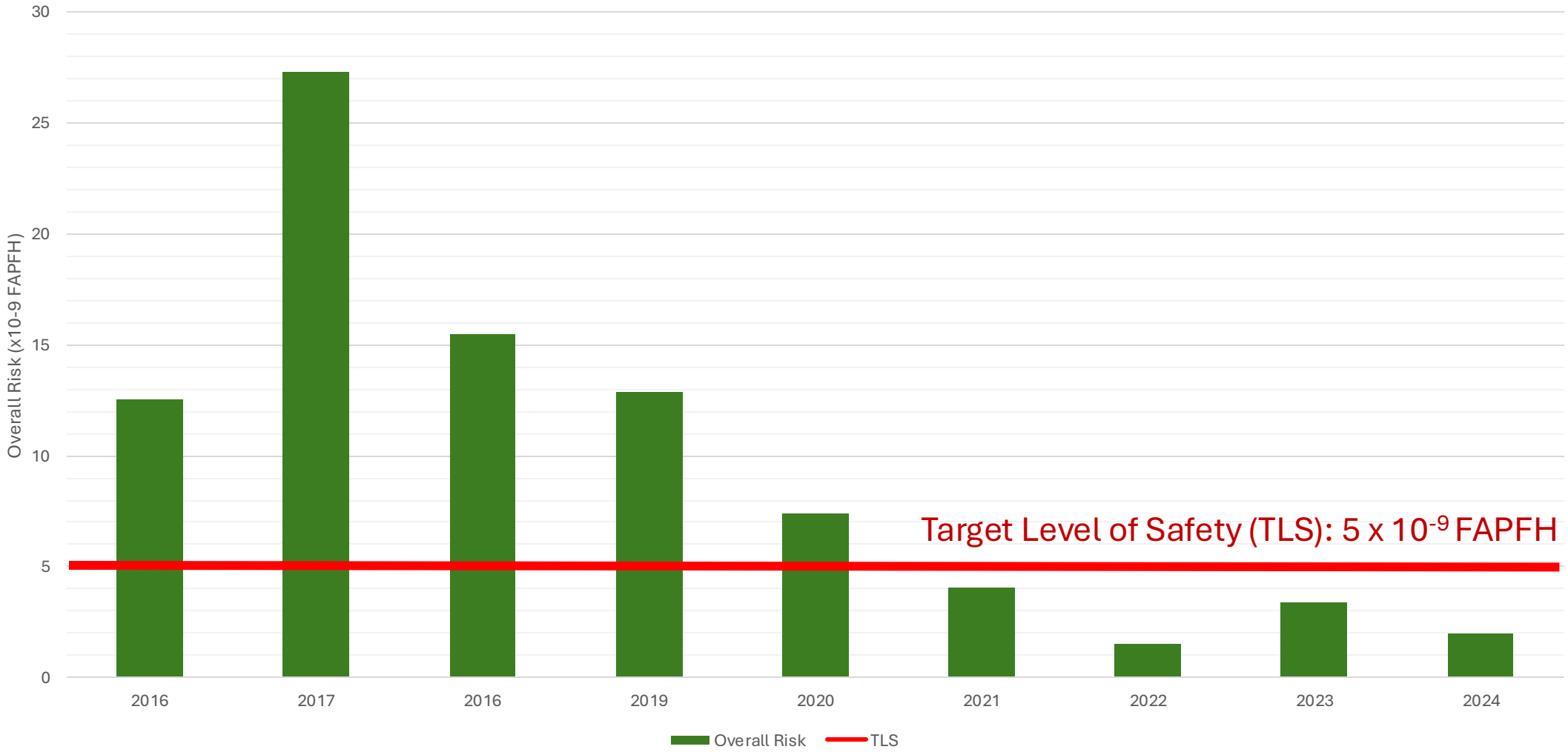
ASIA : Vertical Collision Risk

ASIA: Vertical Collision Risk Estimates

2024 Annual flying hours: 11,413,712 hours/year

Vertical Risk Estimates		Remark
Vertical Technical Risk	0.70×10^{-9} FAPFH	Below Technical TLS
Vertical Operational Risk	1.29×10^{-9} FAPFH	
Vertical Overall Risk	1.99×10^{-9} FAPFH	Below TLS

ASIA: Vertical Collision Risk Estimates



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	22	6	15.5
	B	Flight crew climbing/descending without ATC Clearance	26	12	21.1
	C	Incorrect operation or interpretation of airborne equipment	19	4	14.5
ATC	D	ATC system loop error	14	6	9.5
	E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues	488	156	80.3
	F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues	13	3	1

ASIA: Summary of LHDs

Attributions	Category Code	Description	Number of Occurrences	Duration (minutes)	Number of Levels Crossed
Aircraft/ Avionics/ Contingencies	G	Aircraft contingency event leading to sudden inability to maintain assigned flight level	4	4	9
	H	Airborne equipment failure leading to unintentional or undetected change of flight level	2	0	2
Weather/ Turbulence	I	Turbulence or other weather-related causes leading to unintentional or undetected change of flight level	58	2	57.3
TCAS	J	TCAS resolution advisory, flight crew correctly climb or descend following the resolution advisory	16	1	12
	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	98	16	3
		Total	**760**	**210**	**225.2**

ASIA : Horizontal Collision Risk

ASIA : Horizontal Collision Risk Estimates

2024 Annual flying hours: 789,118 hours/year

2024 Horizontal Risk Estimates		Remark
Total Lateral Risk	1.54×10^{-9} FAPFH	Below TLS
Total Longitudinal Risk	1.62×10^{-9} FAPFH	Below TLS
2023 Horizontal Risk Estimates		**Remark**
Total Lateral Risk	1.517×10^{-9} FAPFH	Below TLS
Total Longitudinal Risk	4.444×10^{-9} FAPFH	Below TLS

ASIA : Summary of LLDs and LLEs

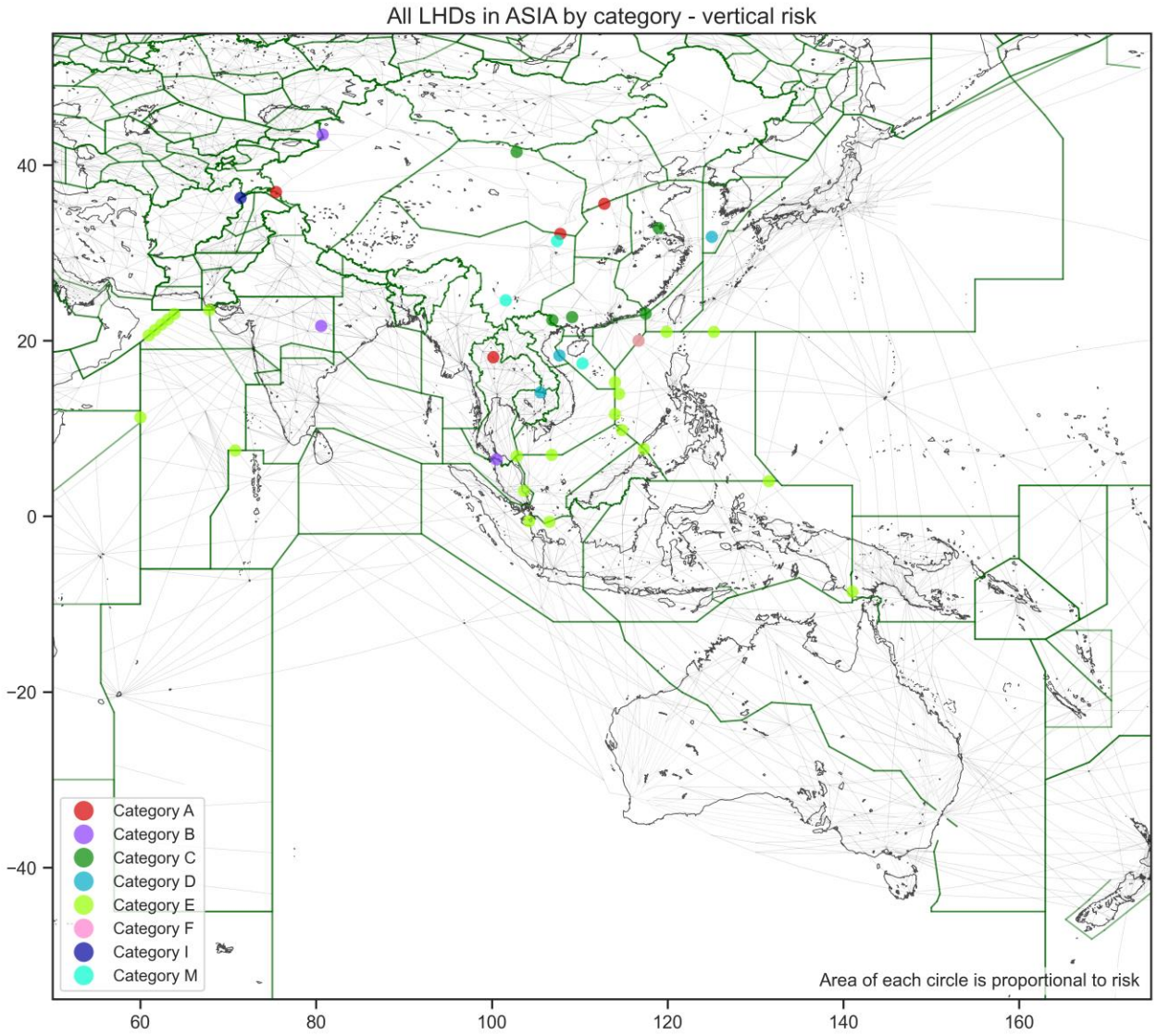
Attributions	Category Code	Description	Number of Occurrences	Duration (minutes)	Horizontal Deviation (NM)
Aircrew/ Pilot	A	Flight crew deviate without ATC Clearance	0	0	0
	B	Incorrect estimate or route provided due to incorrect operation or interpretation of airborne equipment	0	0	0
	C	Flight crew waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position	0	0	0
ATC	D	ATC system loop error	0	0	0
	E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues	3	0	114
	F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues	0	0	0

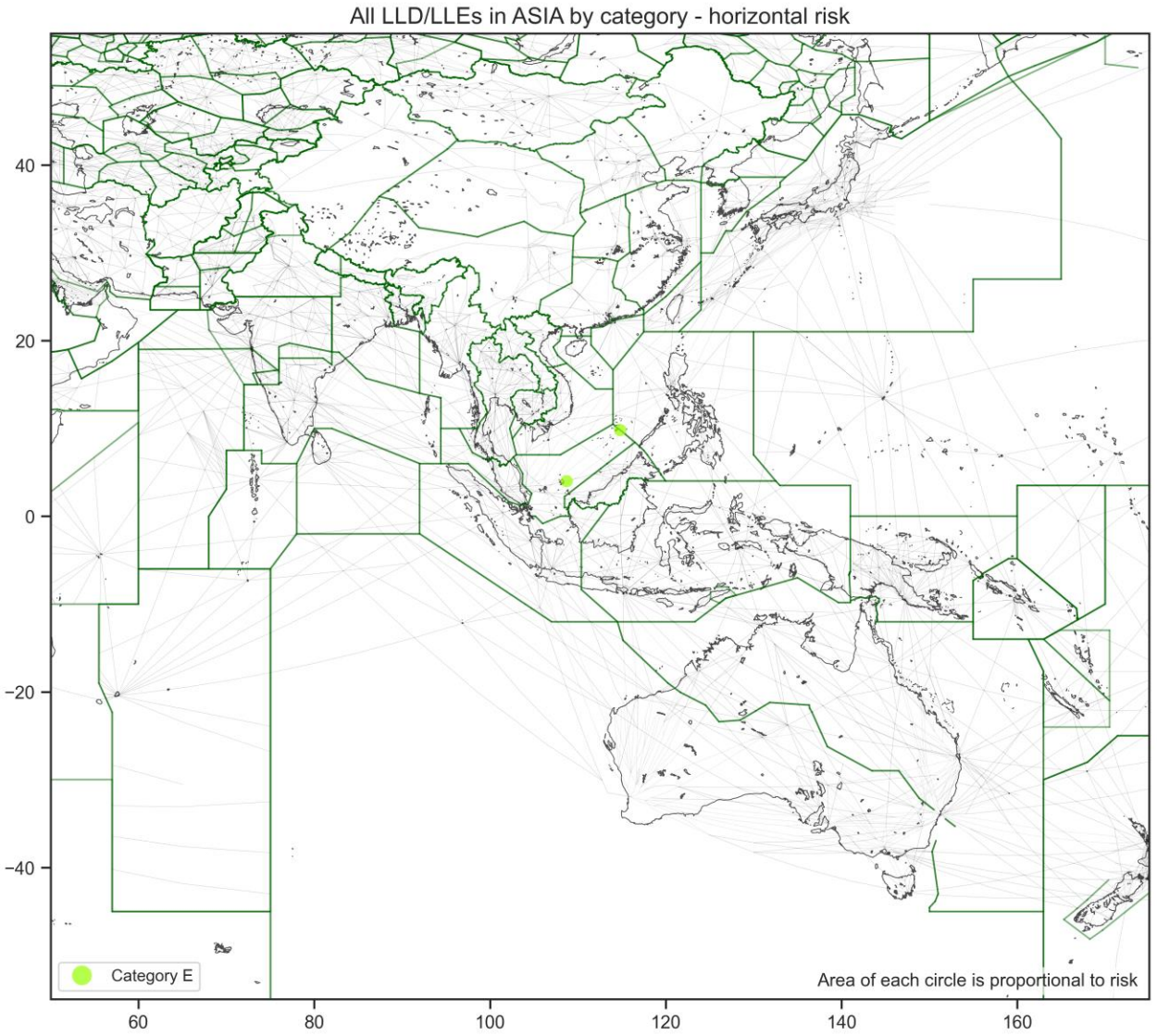
ASIA : Summary of LLDs and LLEs

Attributions	Category Code	Description	Number of Occurrences	Duration (minutes)	Horizontal Deviation (NM)
Aircraft/ Avionics/ Contingencies	G	Navigation errors due to airborne equipment failure	0	0	0
Weather/ Turbulence	H	Turbulence or other weather-related causes leading to a deviation in the horizontal dimension	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
	J	Other	0	0	0
		Total	**3**	**0**	**114**

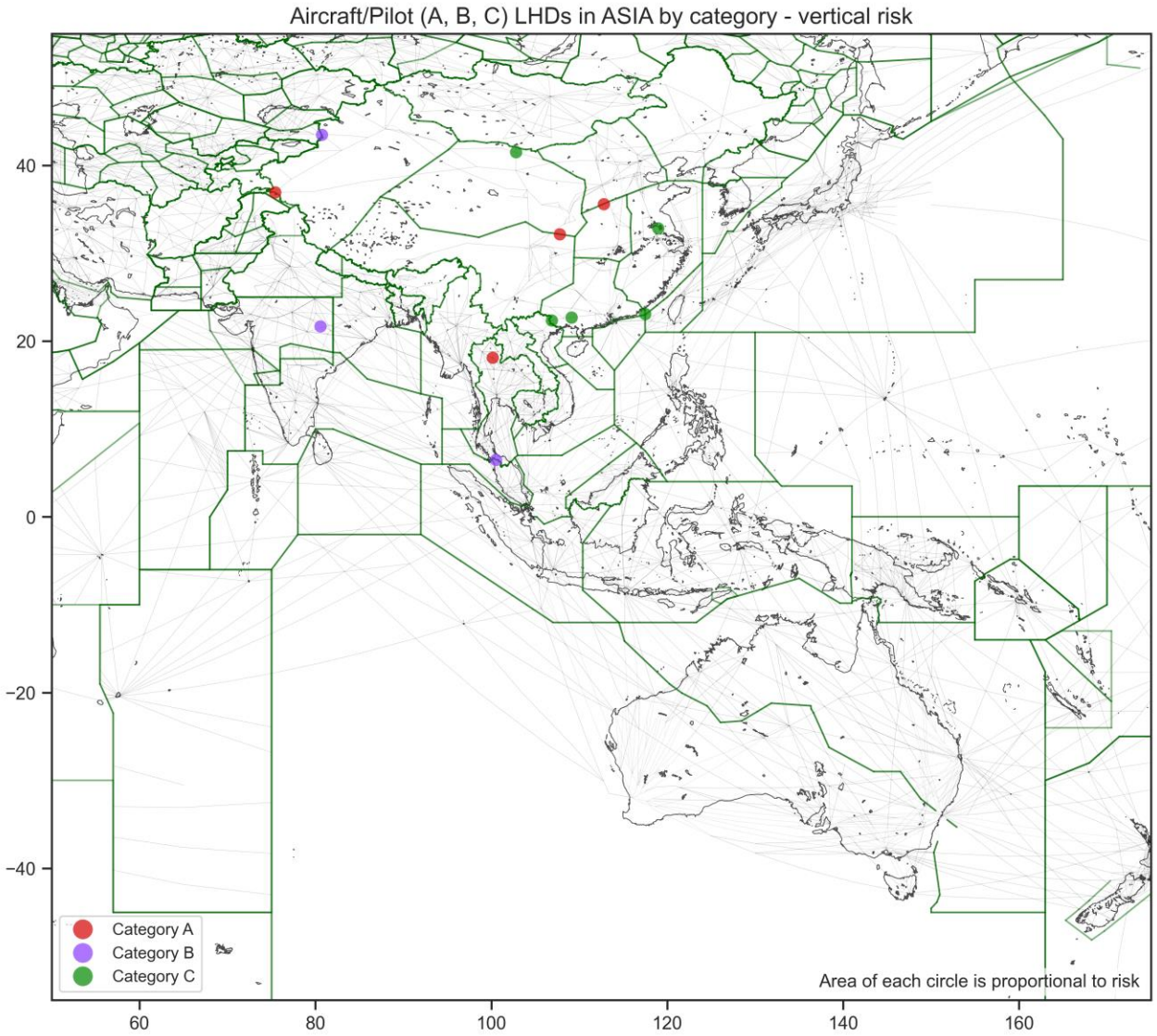
ASIA : Geolocation of LHDs/LLDs/LLEs

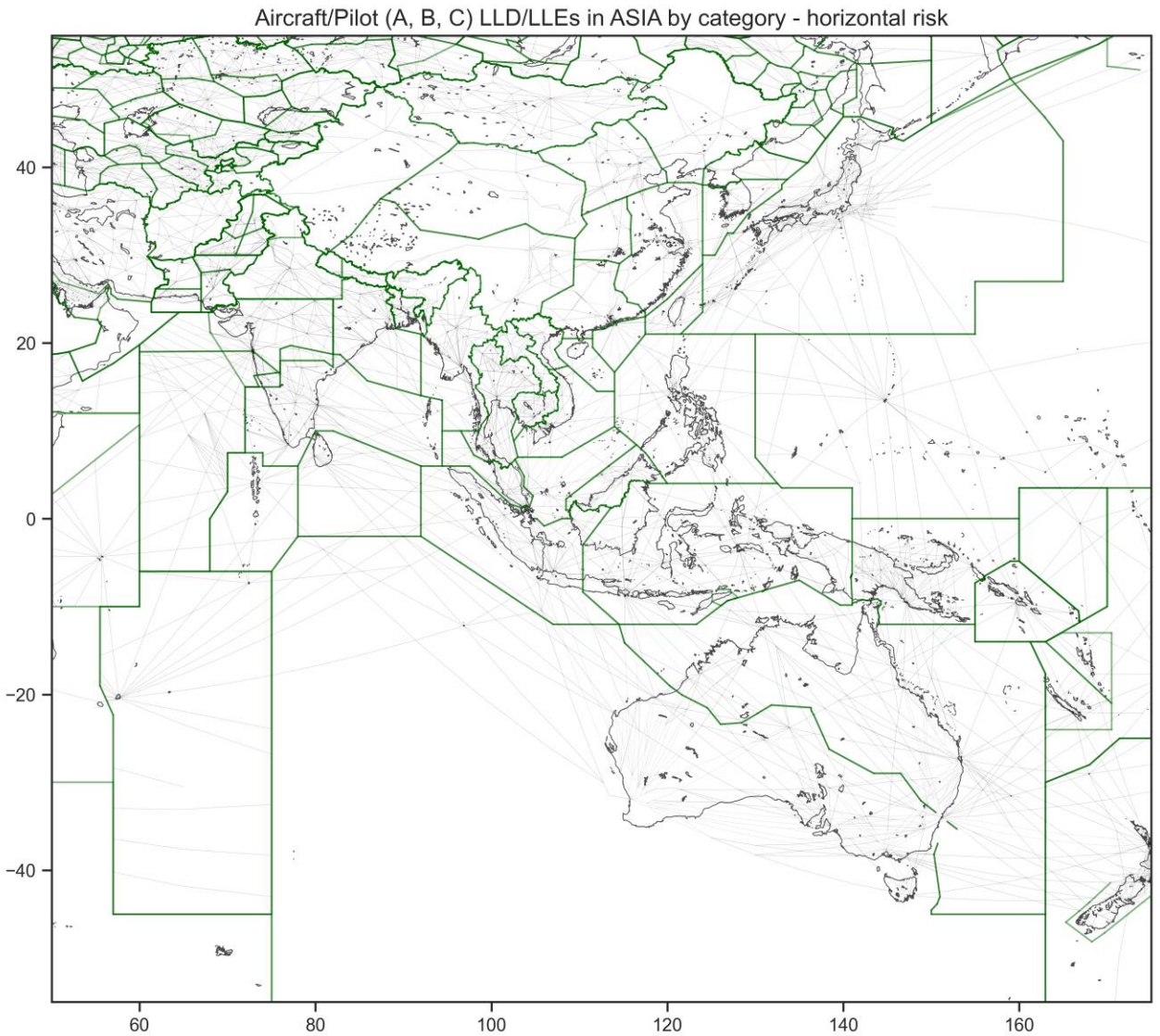
ASIA : All Categories



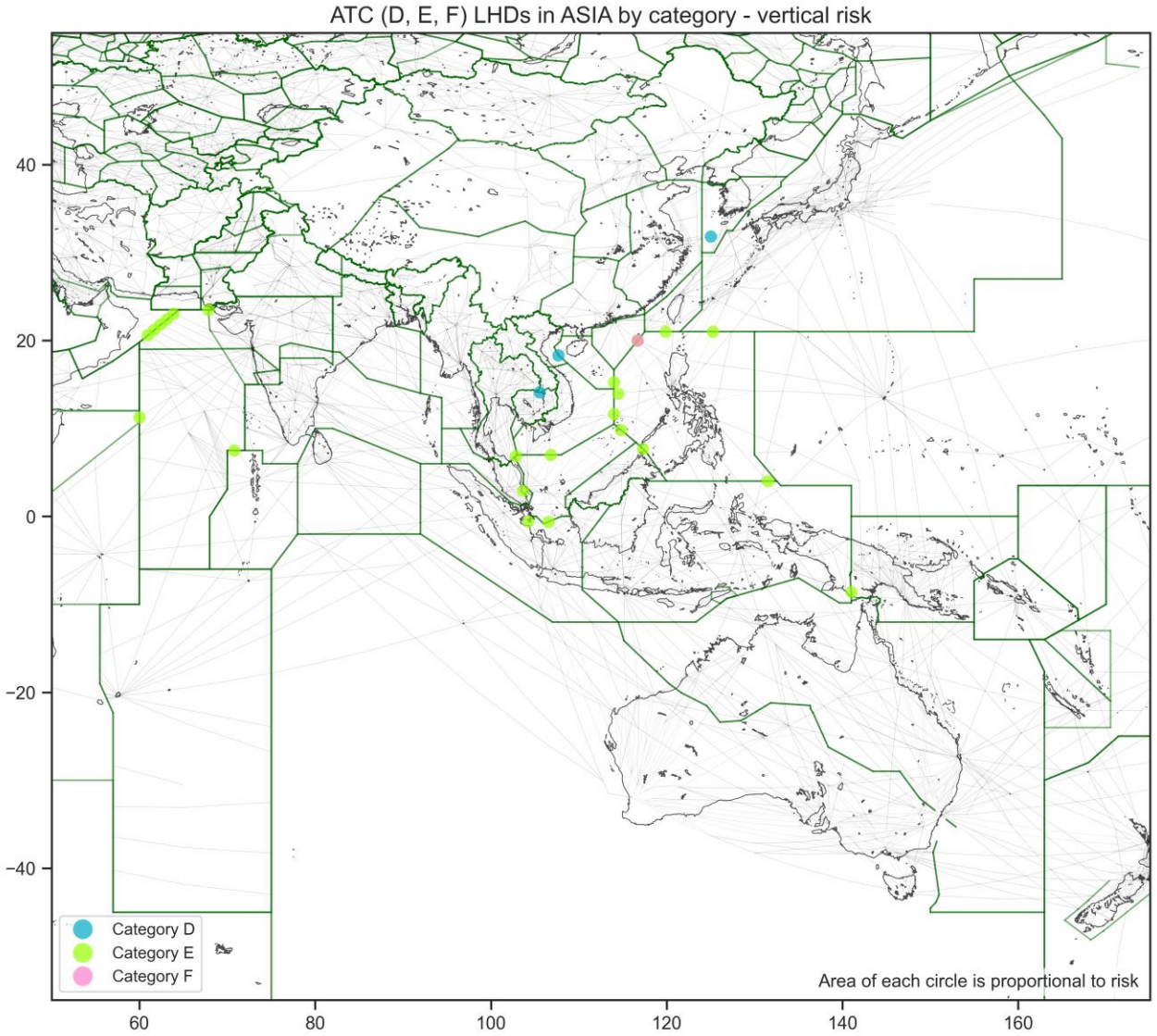


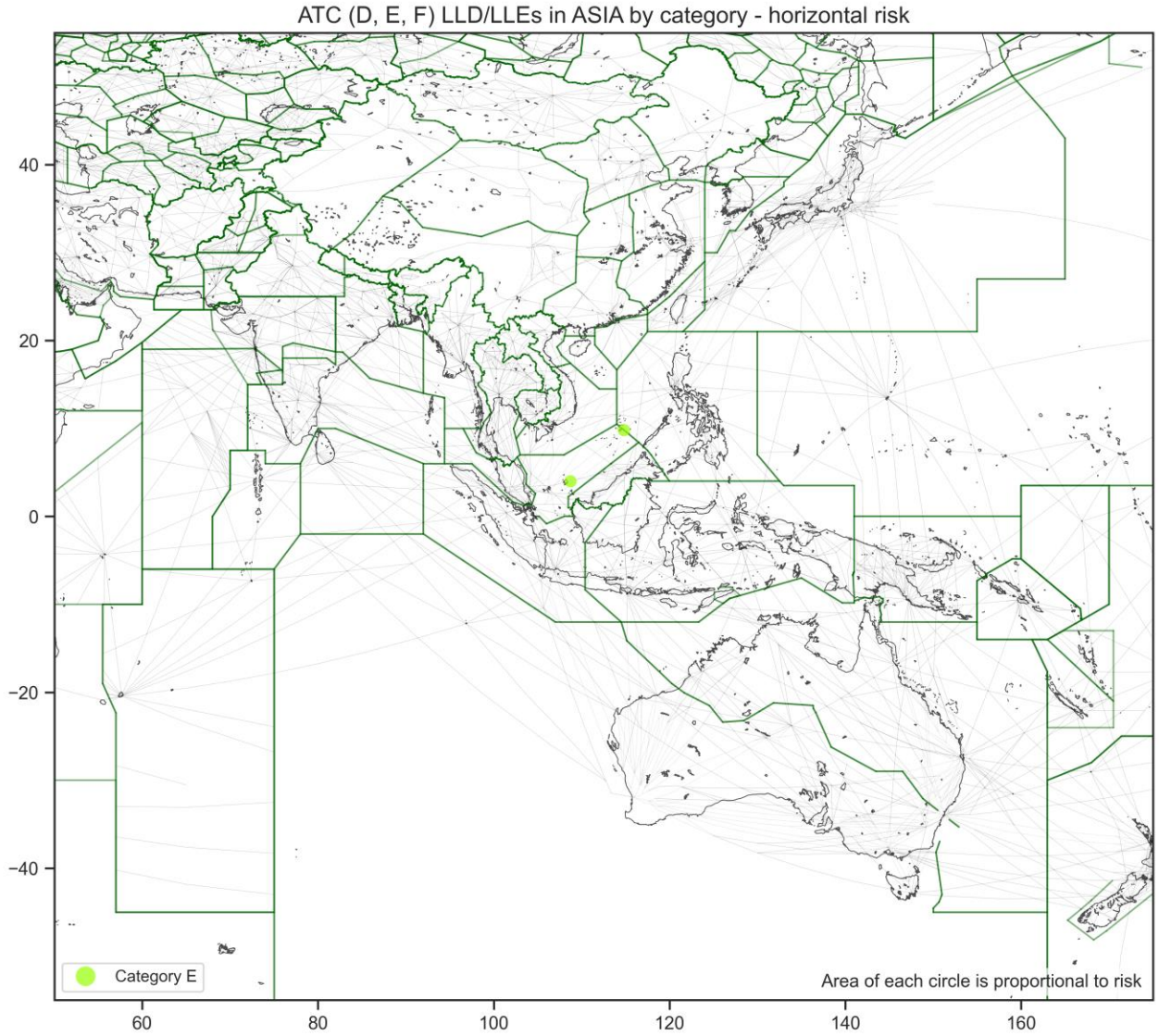
ASIA : Aircrew/Pilot (A, B, C)





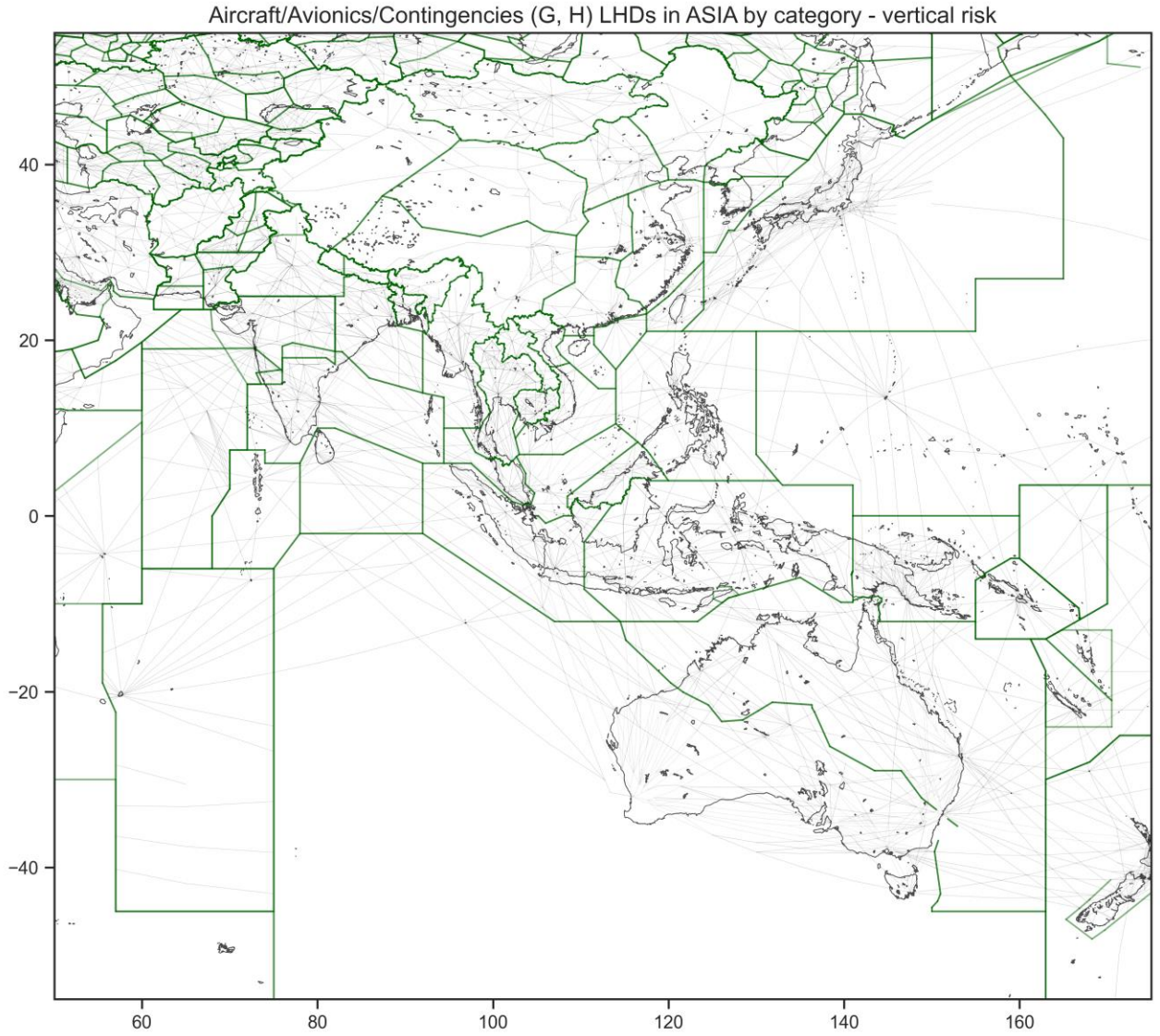
ASIA : ATC (D, E, F)

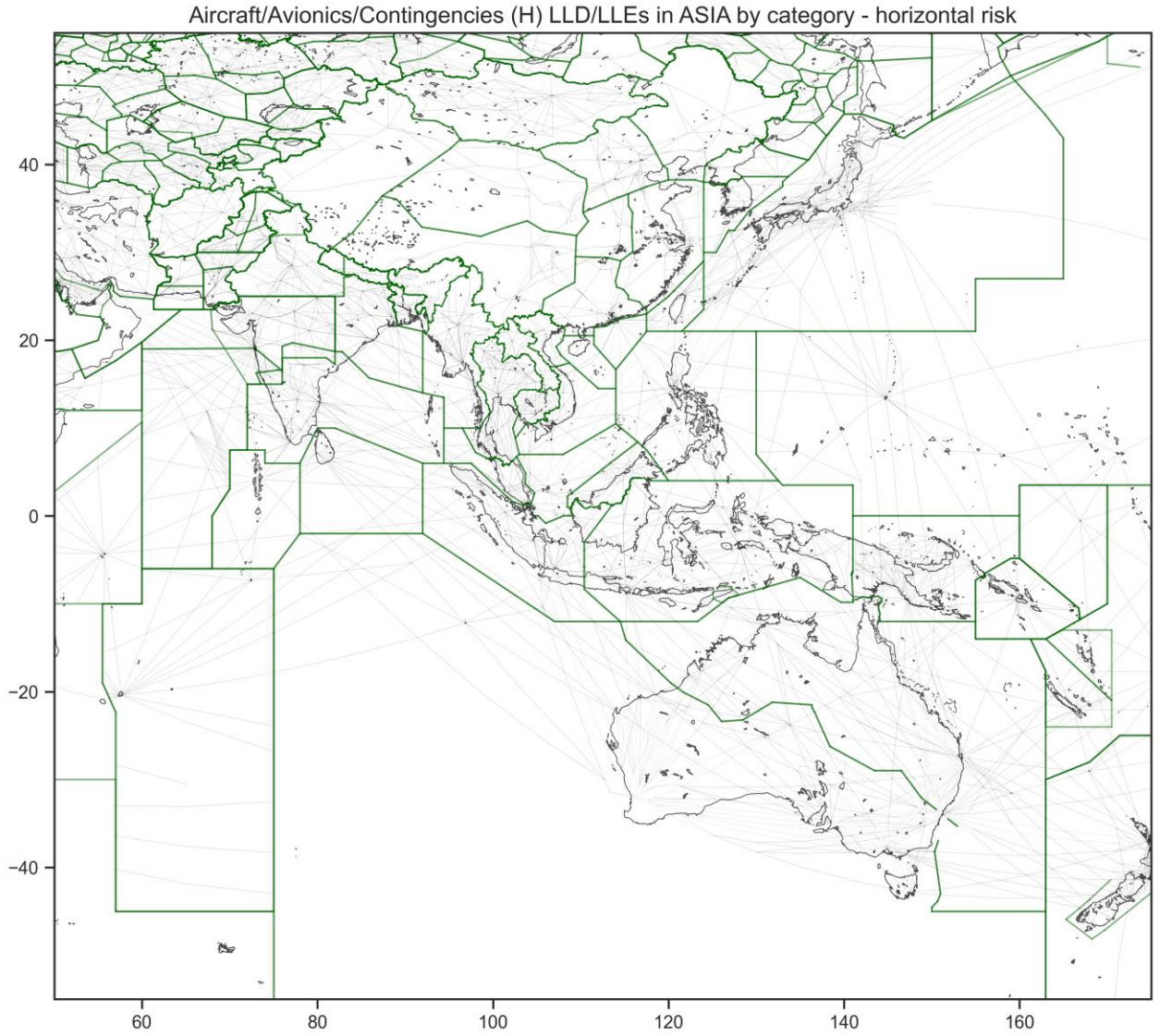

ATC (D, E, F) LHDs in ASIA by category - vertical risk
40
20
0
−20
−40
60
80
100
120
140
160
Category D
Category E
Category F
Area of each circle is proportional to risk


ATC (D, E, F) LLD/LLEs in ASIA by category - horizontal risk
40
20
0
−20
−40
60
80
100
120
140
160
Category E
Area of each circle is proportional to risk

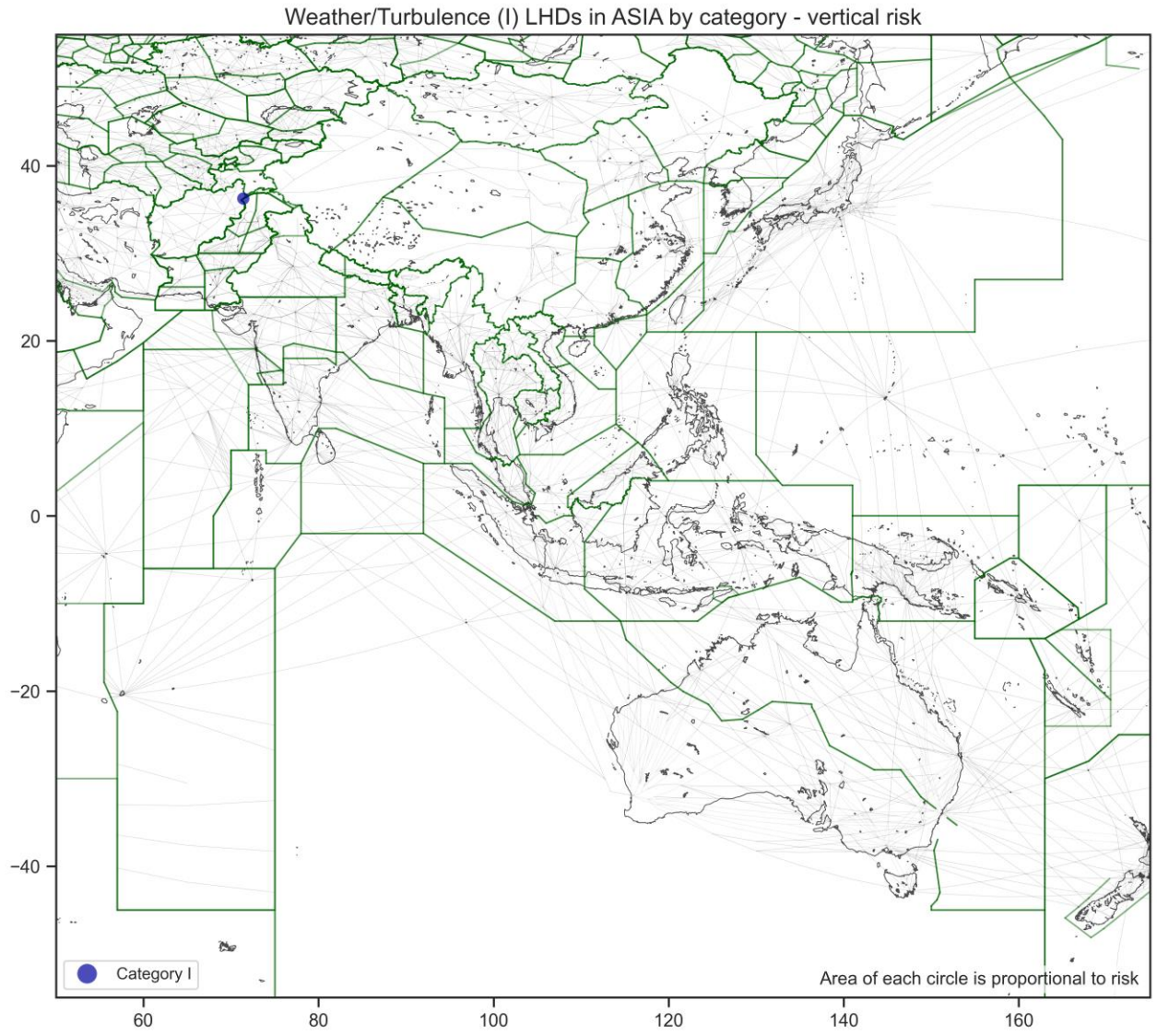
ASIA : Aircraft Avionics/Contingencies

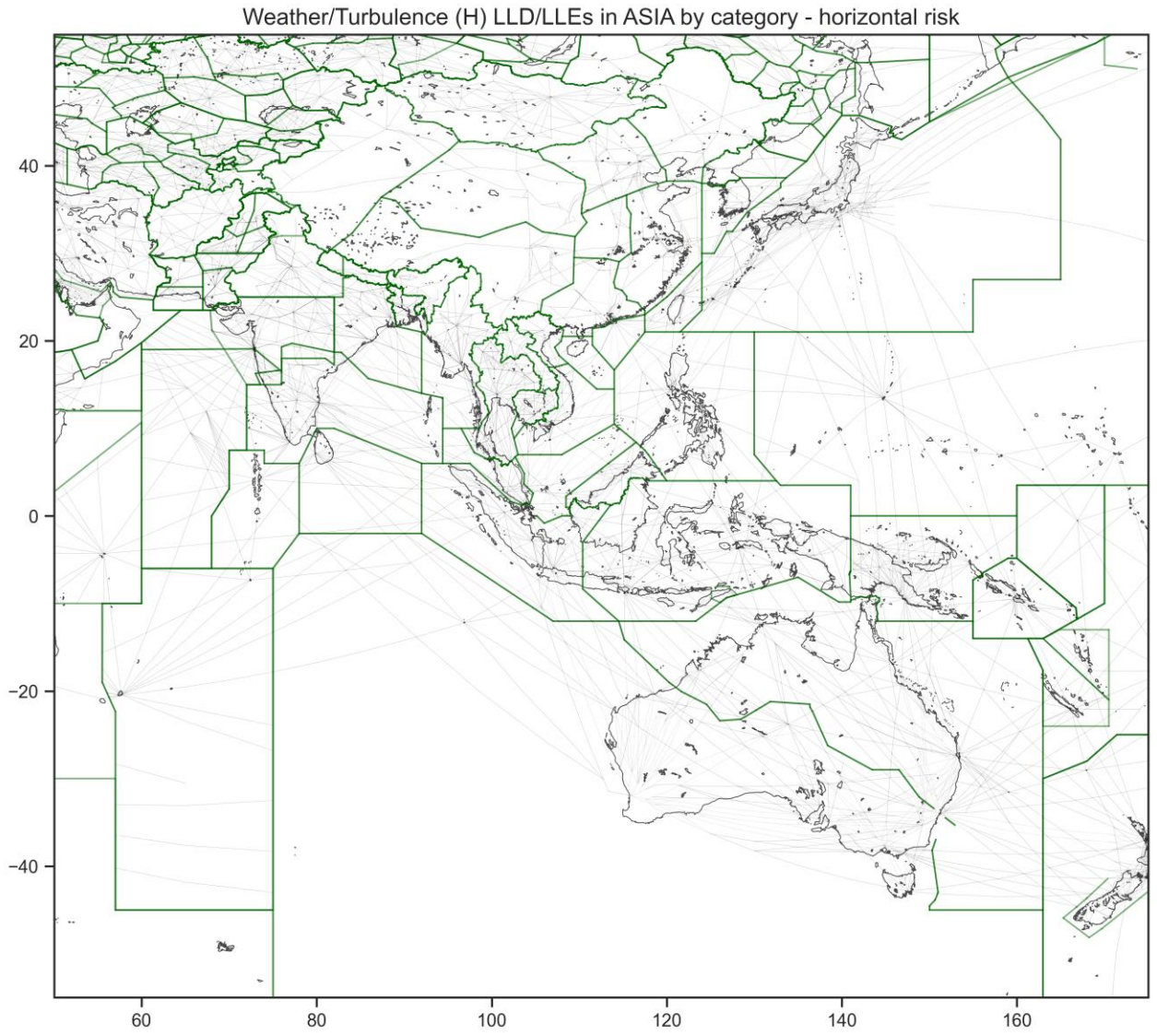
(LHD:G,H, LLD/LLE:H)



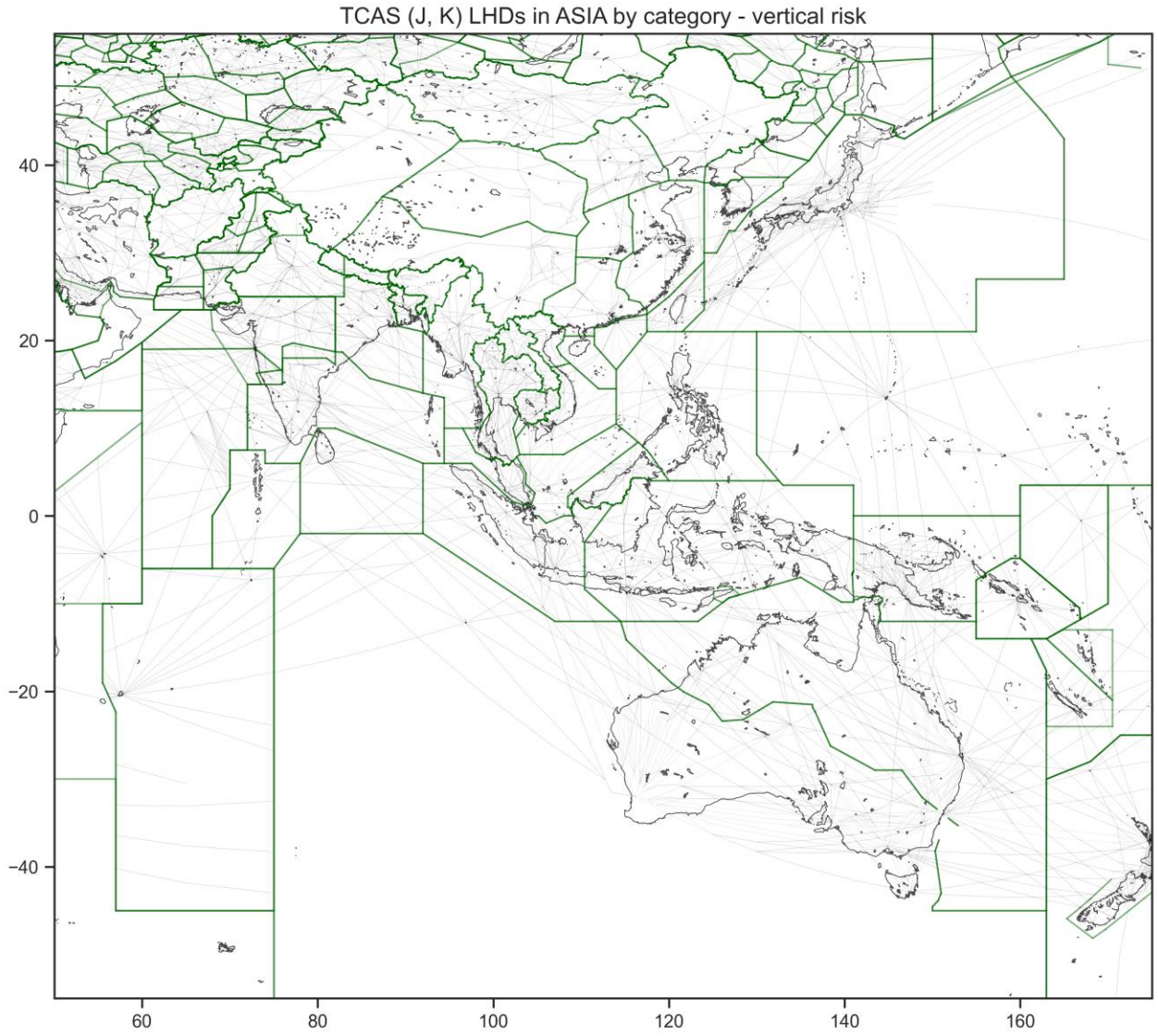


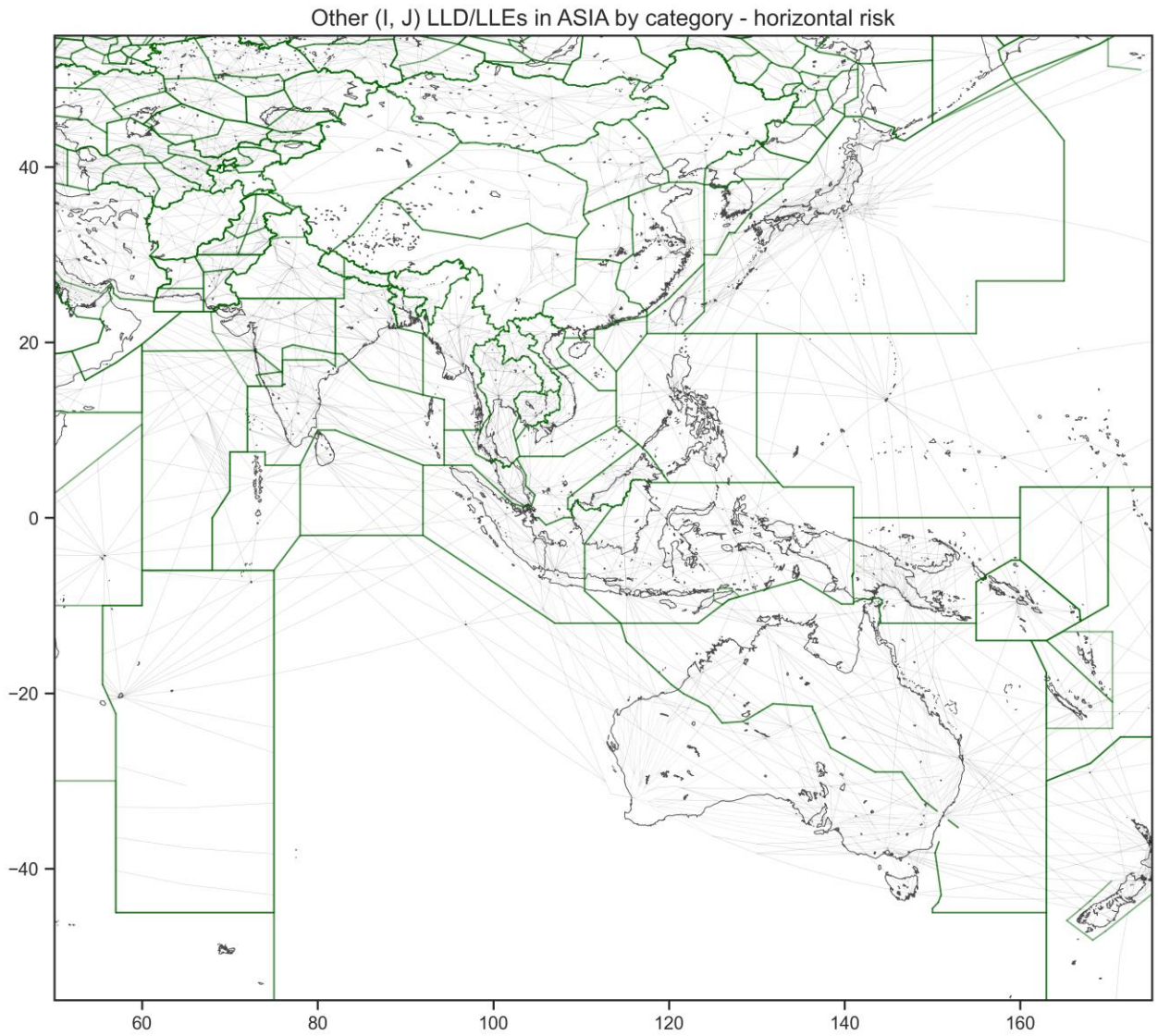
ASIA : Weather/Turbulence (LHD:I, LLD/LLE:H)





ASIA : TCAS (LHD:J, K, LLD/LLE:I,J)





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 : Gaps in communication and surveillance among Chennai, Kolkata and Yangon ACC.

Area	Number of LHDs			Operational Risk (10^{-9} FAPFH)		
	2022	2023	2024	2022	2023	2024
Kolkata/Yangon	17	11	6	0.00	0.00	0.00
Chennai/Yangon	23	15	6	0.02	0.06	0.00

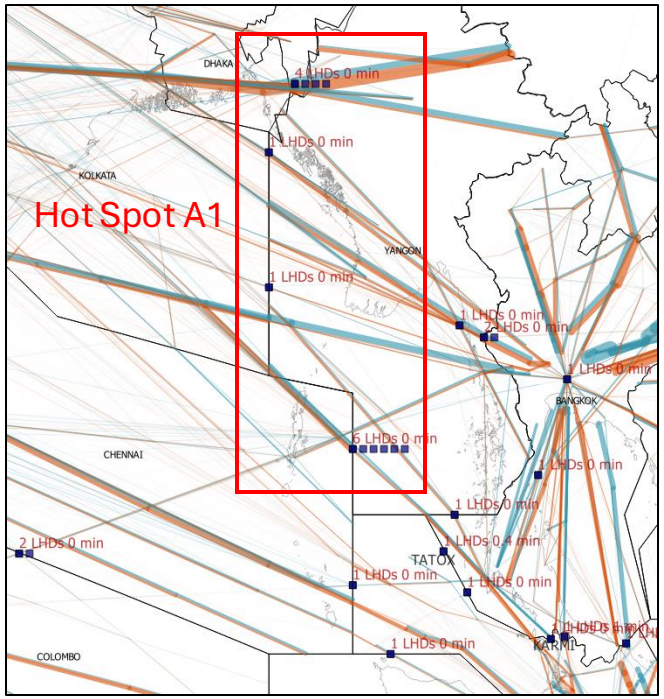
Trend:

-The number of LHDs gradually decreased.

-The operational risk reduced to zero.

Mitigations:

- Surveillance has been enhanced by Space-Based ADS-B in Indian FIRs and ADS-B data sharing among Kolkata, Chennai, and Yangon ACCs.
- The AIDC was initiated between Kolkata ACC/Chennai ACC and Yangon ACC, but full operational implementation has not been achieved.



Result from the hot spot identification process:

- Hot Spot A1 does not satisfy the hot spot criteria.
- However, AIDC implementation or other mitigation measures have not been completed.
- Consequently, **Hot Spot A1 remains on the list of hot spots** and should continue to be monitored until further mitigation are implemented.

ASIA : LHD Hot Spot B1

Incheon (Transfer-of-Control Point between Incheon ACC and Shanghai ACC)

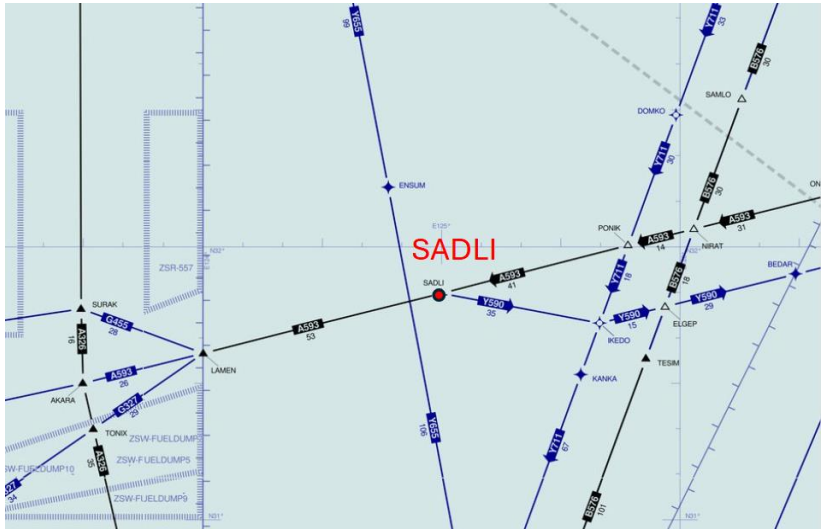
Nature of Occurrences: Coordination errors as a result of human factors issues (Category E)

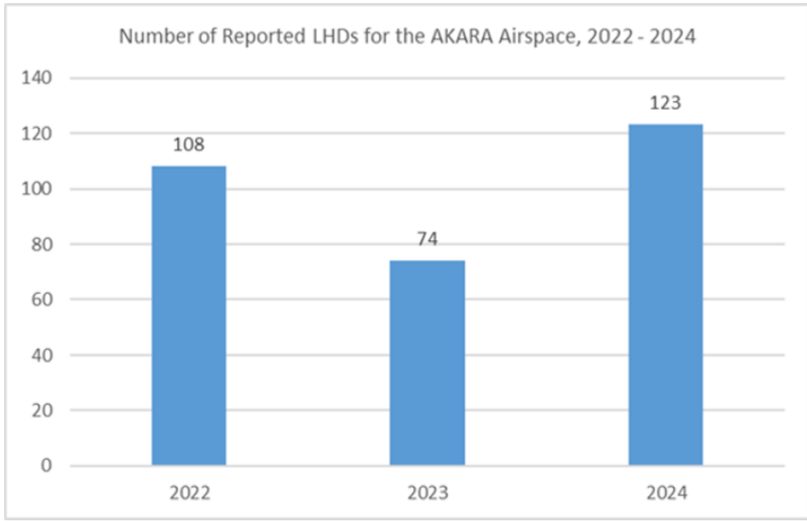
Contributing Factors:

- Lack of communication between stakeholders, including insufficient exchange and mutual understanding of LHD-related information
- High traffic volume with limited route capacity.

Trend :

- In 2024, the number of LHDs increased compared to 2023.
- The operational risk has been zero since 2021 because all reported occurrences are mitigated by available surveillance and direct speech circuit .





ASIA : LHD Hot Spot B1

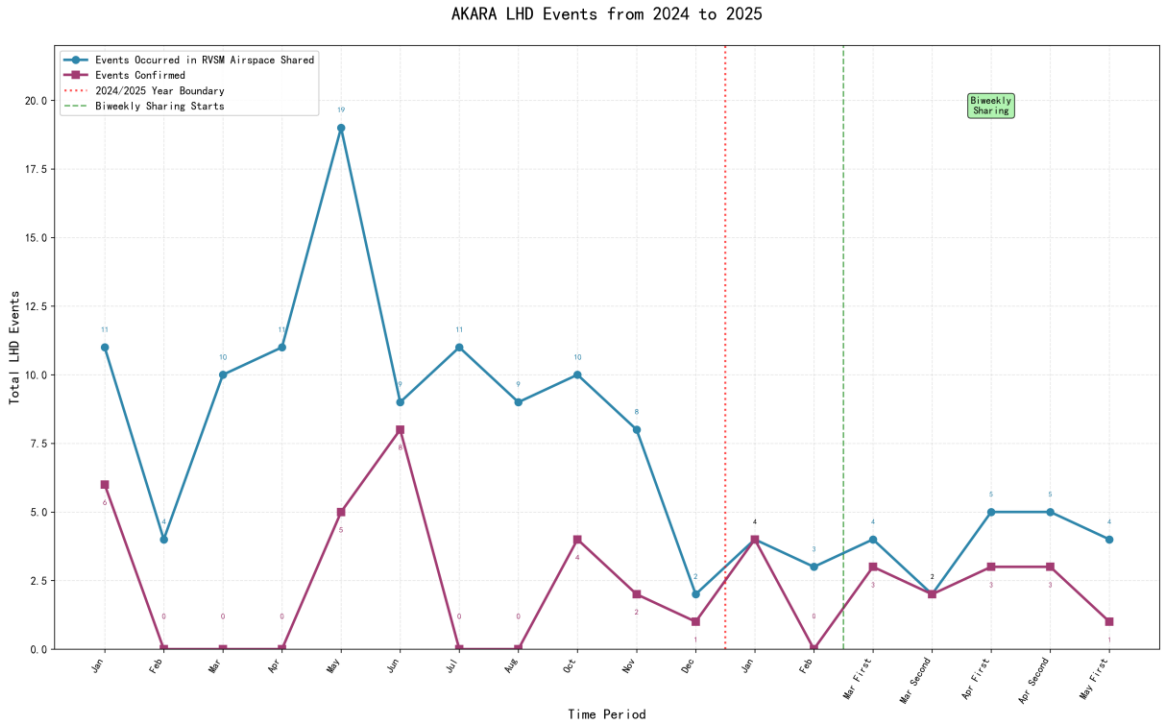
Incheon (Transfer-of-Control Point between Incheon ACC and Shanghai ACC)

Mitigations :

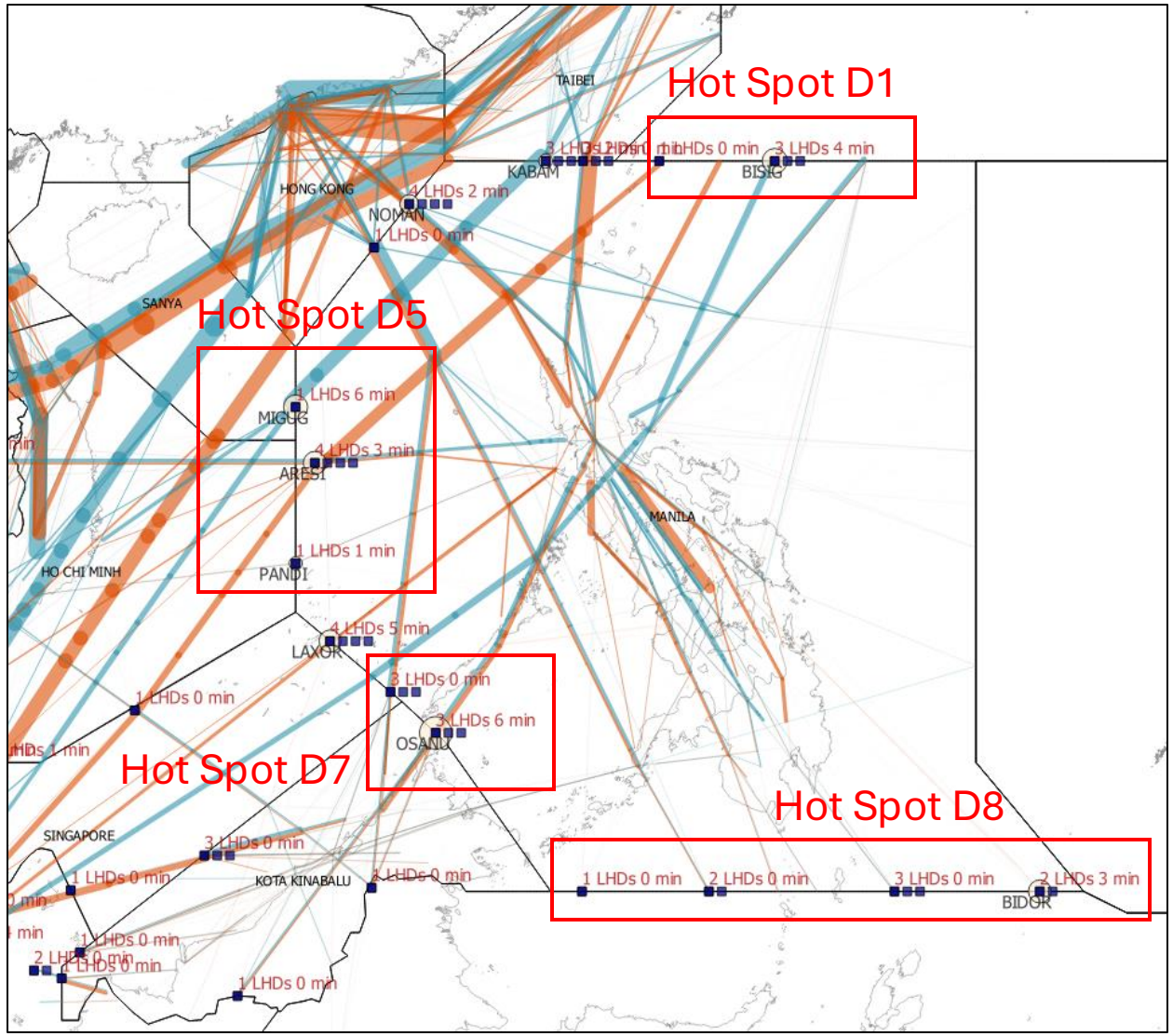
- China and ROK held bilateral meetings, contributing to mutual understanding of transfer errors and strengthened safety awareness.
- The LHD report-sharing mechanism was enhanced by doubling the sharing frequency to enable more timely and effective validation.
- Route capacity has been improved since March 2021, with introducing a parallel airway Y590 as Phase I.
- Surveillance coverage was expanded, and a direct speech circuit was established to support coordination.

Result from the hot spot identification process:

- **Hot Spot B1 remains on the list of hot spots** and should continue to be monitored until the number of LHDs decreases and further safety improvement initiatives or mitigation measures are completed.



ASIA : LHD Hot Spot D1, D5, D7 and D8



Hot Spot D1: Fukuoka/Manila FIR boundary

Hot Spot D5: Ho Chi Minh/Manila FIR boundary

Hot Spot D7: Kota Kinabalu/Manila FIR boundary

Hot Spot D8: Manila/Ujung Pandang FIR boundary

Remark:

In 2024, Hot Spot D, which was represented the entire Manila FIR boundary, was subdivided into nine hot spots: D1 through D9.

Each subdivision was re-analyzed with the hot spot identification process using the historical data up to 2023. As a result, Hot Spots D2, D3, D4, D6, and D9 were removed from the list of hot spots due to continuous improvements achieved through existing mitigations.

ASIA : LHD Hot Spot D1 (Fukuoka/Manila)

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

Contributing Factors :

- Gaps in communication and surveillance
- Complexity in the aircraft transfer procedure from Manila ACC to Fukuoka ACC

Trend:

- The number of LHDs and operational risk decreased.

Area	Number of LHDs			Operational Risk (10^{-9} FAPFH)		
	2022	2023	2024	2022	2023	2024
Hot Spot D1 (Fukuoka/Manila)	7	6	5	1.74	0.96	0.22

Note: The number of LHDs and operational risk include submissions from both the Manila FIR (MAAR) and the Fukuoka FIR (JASMA).

Mitigations:

- The timing for sending transfer information from Manila ACC to Fukuoka ACC was adjusted from 30 minutes to 20 minutes prior to the estimated time over the FIR boundary. This change reduced the complexity by allowing the transfer to be coordinated within a single sector instead of across two sectors.

Result from the hot spot identification process:

- Hot Spot D1 does not satisfy the hot spot criteria.
- In addition, Fukuoka and Manila ACCs have actively collaborated to investigate the causes and implement mitigations.
- As a result, **Hot Spot D1 is marked as a potential non-hotspot**.

ASIA : LHD Hot Spot D5 (Ho Chi Minh/Manila)

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

Contributing Factors :

- Gaps in communication and surveillance

Trend:

- The number of LHDs and operational risk increased.

Area	Number of LHDs			Operational Risk (10^{-9} FAPFH)		
	2022	2023	2024	2022	2023	2024
Hot Spot D5 (Ho Chi Minh/Manila)	3	2	6	0.05	0.10	0.14

Mitigations:

- Since 2018, the Philippines has implemented safety improvement initiatives, including new ATM system, sector redesign, enhanced surveillance and ADS-C/CPDLC coverage, controller training, coordination with adjacent ACCs, and AIDC.

Result from the hot spot identification process:

- Hot Spot D5 does not satisfy the hot spot criteria.
- However, AIDC implementation has not been completed yet.
- Therefore, **Hot Spot D5 remains on the list of hot spots** and should continue to be monitored until further safety improvement initiatives are implemented.

ASIA : LHD Hot Spot D7 (Kota Kinabalu/Manila)

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

Contributing Factors :

- Gaps in communication and surveillance

Trend:

- The number of LHDs slightly increased.
- Operational risk slightly decreased.

Area	Number of LHDs			Operational Risk (10^{-9} FAPFH)		
	2022	2023	2024	2022	2023	2024
Hot Spot D7 (Kota Kinabalu/Manila)	3	5	6	0.04	0.13	0.12

Mitigations:

- Since 2018, the Philippines has implemented safety improvement initiatives, including new ATM system, sector redesign, enhanced surveillance and ADS-C/CPDLC coverage, controller training, coordination with adjacent ACCs, and AIDC.

Result from the hot spot identification process:

- Hot Spot D5 does not satisfy the hot spot criteria.
- However, AIDC implementation is currently in the operational trial phase, with full implementation expected in the fourth quarter of 2025.
- Consequently, **Hot Spot D7 remains on the list of hot spots** and should continue to be monitored until further safety improvement initiatives are implemented.

ASIA : LHD Hot Spot D8 (Manila/Ujung Pandang)

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

Contributing Factors :

- Gaps in communication and surveillance

Trend:

- The number of LHDs and operational risk decreased.

Area	Number of LHDs			Operational Risk (10^{-9} FAPFH)		
	2022	2023	2024	2022	2023	2024
Hot Spot D8 (Manila/Ujung Pandang)	2	15	8	0.11	0.41	0.06

Mitigations:

- Since 2018, the Philippines has implemented safety improvement initiatives, including new ATM system, sector redesign, enhanced surveillance and ADS-C/CPDLC coverage, controller training, coordination with adjacent ACCs, and AIDC.

Result from the hot spot identification process:

- Hot Spot D8 does not satisfy the hot spot criteria.
- In addition, AIDC has been successfully operated since 2020.
- Thus, **Hot Spot D8 is marked as a potential non-hotspot**.

ASIA : LHD Hot Spot F (Mogadishu/Mumbai)

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

Contributing Factors : Gaps in communication and surveillance between Mogadishu and Mumbai ACC.

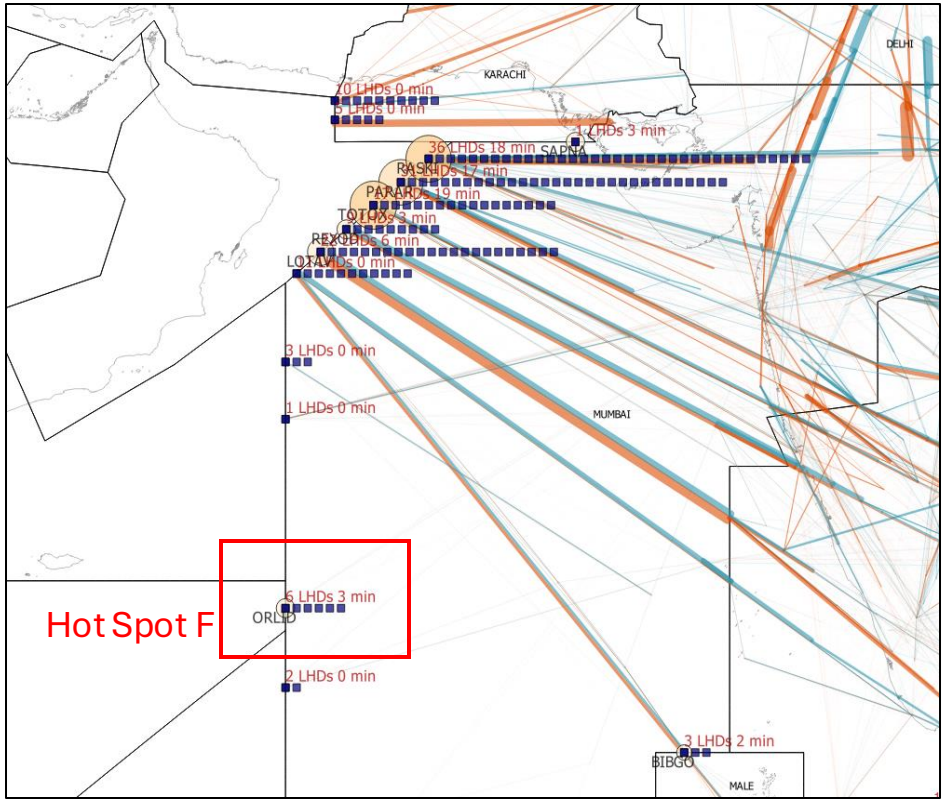
Area	Number of LHDs			Operational Risk (10^{-9} FAPFH)		
	2022	2023	2024	2022	2023	2024
Hot Spot F (Mogadishu/Mumbai)	9	10	7	0.02	0.00	0.05

Trend:
- The number of LHDs slightly decreased.
- Operational risk increased, but remains at a low level.

Mitigations:
- Surveillance has been enhanced through Space-Based ADS-B coverage in Indian FIRs.
- AIDC implementation between Mogadishu and Mumbai ACCs was initiated but remained in the testing phase.

Result from the hot spot identification process:

- Hot Spot F does not satisfy the hot spot criteria.
- However, AIDC implementation or other mitigation measures have not been completed yet.
- Thus, **Hot Spot F remains on the list of hot spots**



ASIA : LHD Hot Spot G1 (Mumbai/Muscat)

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

Contributing Factors : Gaps in communication and surveillance among Mumbai, Muscat and Sanaa ACCs.

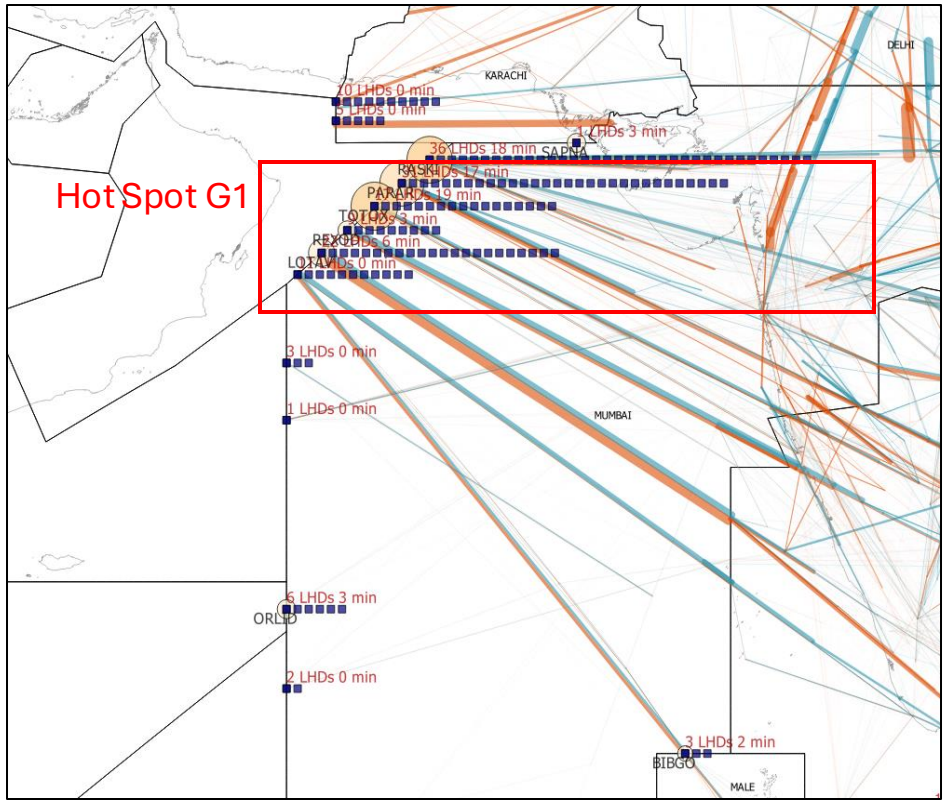
Area	Number of LHDs			Operational Risk (10^{-9} FAPFH)		
	2022	2023	2024	2022	2023	2024
Hot Spot G1 (Mumbai/Muscat)	43	138	132	0.79	2.79	1.09

Trend:
- The number of LHDs slightly decreased from 2023, but remains high.
- Operational risk at Mumbai/Muscat significantly decreased.

Mitigations:
- Surveillance was enhanced through Space-Based ADS-B coverage in Indian FIRs.
- The AIDC implementation between Mumbai and Muscat ACCs was initiated but remained in the testing phase.

Result from the hot spot identification process:

- Hot Spot G1 satisfies the hot spot criteria in terms of the number of LHDs.
- Therefore, **Hot Spot G1 remains on the list of hot spots** and should continue to be monitored until the number of LHDs decreases and further safety improvement initiatives or mitigation measures, such as AIDC, are completed.



ASIA : LHD Hot Spot G2 (Muscat/Sanaa)

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

Contributing Factors : Gaps in communication and surveillance among Mumbai, Muscat and Sanaa ACCs.

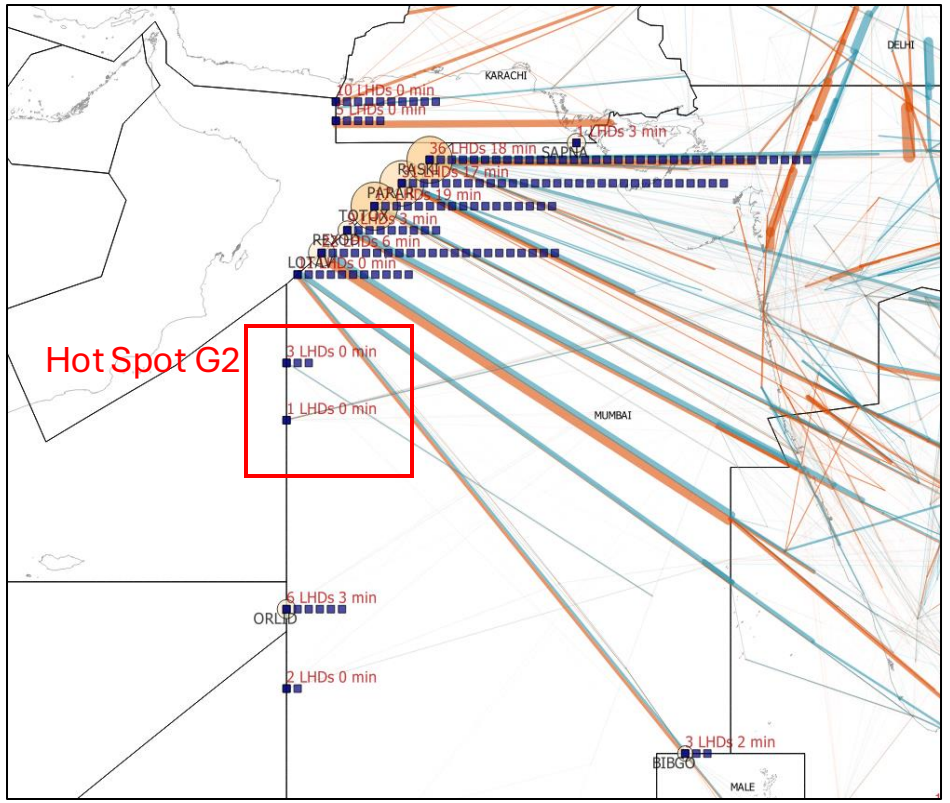
Area	Number of LHDs			Operational Risk (10^{-9} FAPFH)		
	2022	2023	2024	2022	2023	2024
Hot Spot G2 (Mumbai/Sanaa)	2	3	4	0.00	0.00	0.00

Trend:
- The number of LHDs slightly increased
- Operational risk at Mumbai/Sanaa was zero.

Mitigations:
- Surveillance was enhanced through Space-Based ADS-B coverage in Indian FIRs.

Result from the hot spot identification process:

- Hot Spot G2 does not satisfy the hot spot criteria.
- However, further mitigation such as AIDC implementation have not been planned.
- Therefore, **Hot Spot G2 remains on the list of hot spots** and should continue to be monitored until further safety improvement initiatives or mitigation measures, such as AIDC, are completed



ASIA : LHD Hot Spot J (Jakarta/Singapore)

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

Contributing Factors : Gaps in communication and surveillance between Jakarta and Singapore ACC.

Trend:

- The number of LHDs and operational risk significantly decreased.

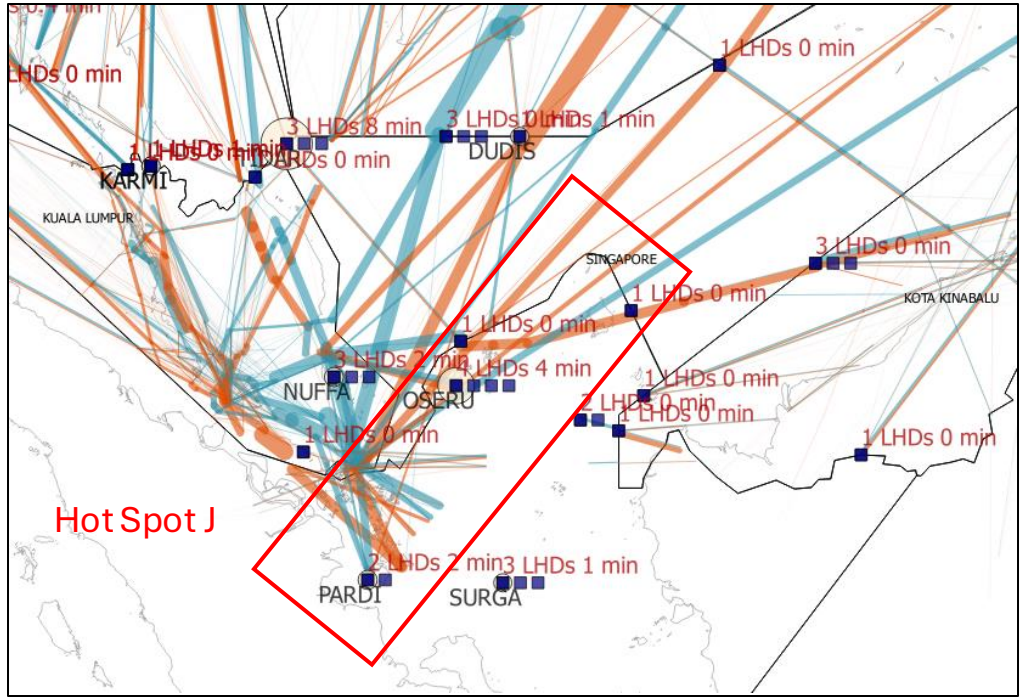
Mitigations:

- As of 21 March 2024, the FIR boundary between Jakarta and Singapore was realigned. To support the transition and maintain safety, the operational coordination meetings between both ACCs were regularly held since 2024, and planned to continue in 2025.
- The results of the LHD analysis were shared with controllers to enhance safety awareness.

Result from the hot spot identification process:

- Hot Spot J does not satisfy the hot spot criteria.
- In addition, the decrease in the number of LHDs and operational risk reflects the successful implementation of mitigation measures.
- Thus, **Hot Spot J is marked as a potential non-hotspot**.

Area	Number of LHDs			Operational Risk (10^{-9} FAPFH)		
	2022	2023	2024	2022	2023	2024
Jakarta/Singapore (Hot Spot J)	14	27	11	0.18	0.33	0.12



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.

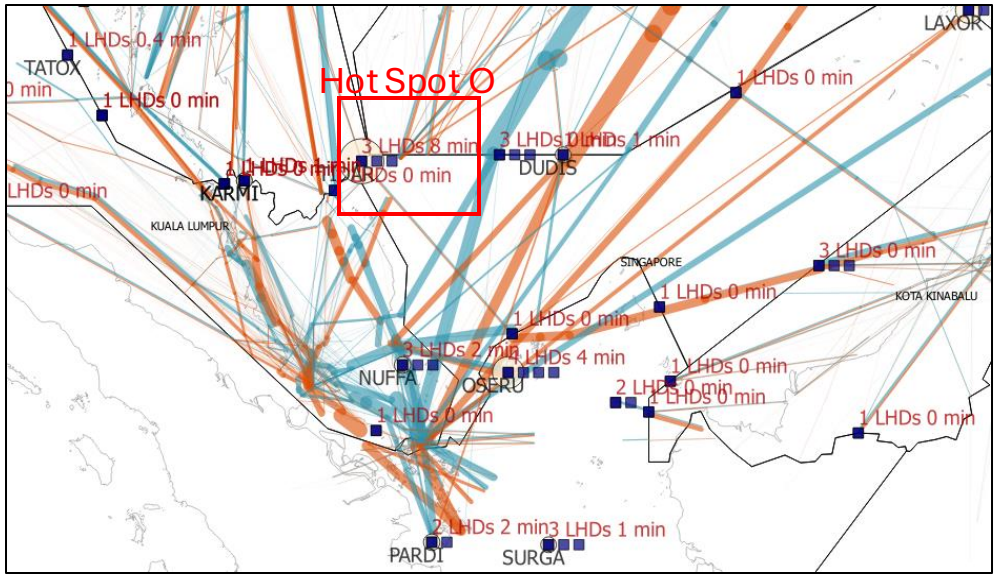
Trend:

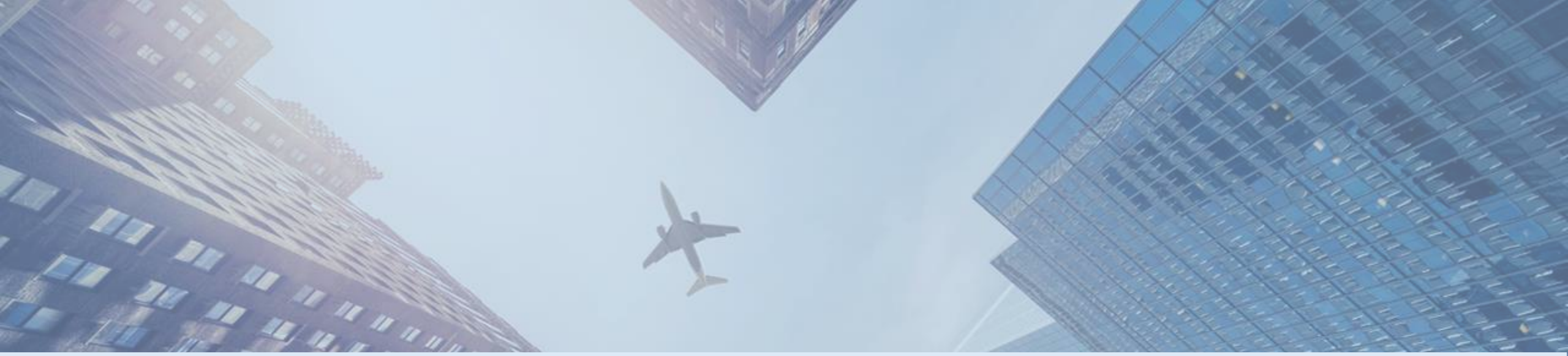
- The number of LHDs and operational risk decreased.

Result from the hot spot identification process:

- Hot Spot O have satisfied the hot spot criteria in terms of the operational risk since 2022.
- No mitigation measures were identified.
- Therefore, **Hot Spot O remains on the list of hot spots** and should continue to be monitored until further safety improvement initiatives or mitigation measures are completed

Area	Number of LHDs			Operational Risk (10^{-9} FAPFH)		
	2022	2023	2024	2022	2023	2024
Hot Spot O (Bangkok/Ho Chi Minh /Kuala Lumpur/ Singapore)	7	5	3	0.58	0.51	0.15





Reporting Rate of LHDs/LLDs/LLEs

Reporting Rate of LHDs/LLDs/LLEs in 2024

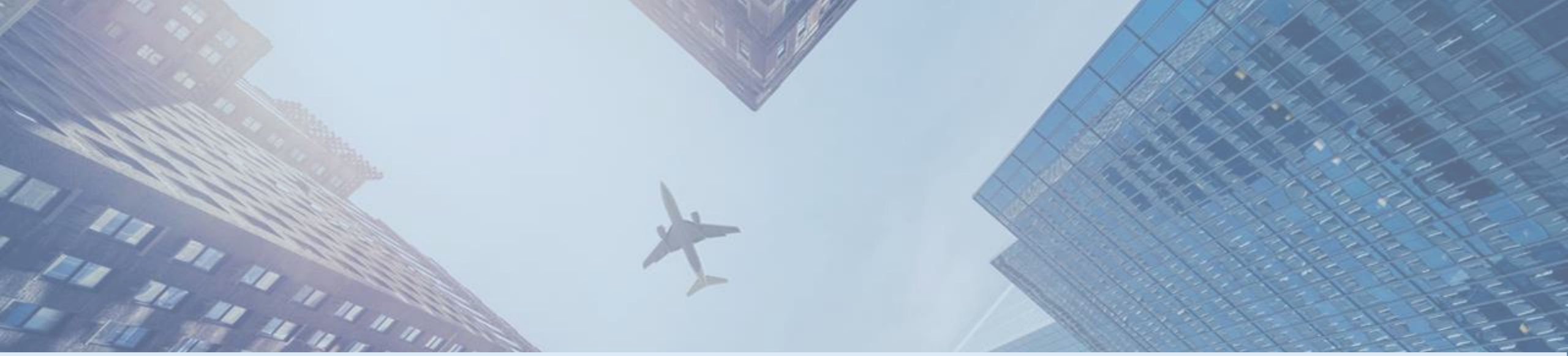
Airspace	Flying Hours	Aircrew/Pilot		ATC		Other		Total	
		# Reports	1 Report : Flying Hrs	# Reports	1 Report : Flying Hrs	# Reports	1 Report : Flying Hrs	# Reports	1 Report : Flying Hrs
DPRK	-	0	-	0	-	0	-	0	-
Mongolia	103,477	0	-	0	-	0	-	0	-
SEA	3,108,056	0	-	74	1: 42,001	0	-	74	1: 42,001
Japan	1,929,397	24	1:80,392	10	1: 192,940	42	1: 45,938	76	1: 25,387
SA/IO	4,143,123	3	1:1,381,041	194	1: 21,356	7	1: 591,875	204	1: 20,309
SW Pacific	1,245,193	35	1:35,577	25	1: 49,808	11	1: 113,199	71	1: 17,538
China	2,878,308	11	1:261,664	19	1: 151,490	160	1: 17,989	190	1: 15,149
Pacific	1,933,809	62	1:31,190	169	1: 11,443	3	1: 644,603	203	1: 8,264
Indonesia	548,638	18	1:30,480	84	1: 6,531	0	-	102	1: 5,379
ROK and AKARA	197,566	0	-	123	1: 1,606	0	-	123	1: 1,606
Total	16,087,567	153	1:105,147	689	1: 23,048	223	1: 72,142	1,074	1: 14,979

Note:

- There was no flying hours for DPRK in 2024, as no aircraft operated in its RVSM airspace.
- Both DPRK and Mongolia submitted NIL reports for all months in 2024.

Reporting Rate of LHDs/LLDs/LLEs in 2024

Airspace	# Reports							1 Report : Flying Hours						
	2018	2019	2020	2021	2022	2023	2024	2018	2019	2020	2021	2022	2023	2024
DPRK	0	0	0	0	0	0	0	-	-	-	-	-	-	-
Mongolia	1	2	0	1	0	0	0	1: 158,891	1: 82,138	-	1: 121,621	-	-	-
SEA	205	152	42	70	62	95	74	1: 17,757	1: 22,275	1: 25,106	1: 15,456	1:32,620	1:29,400	1: 42,001
Japan	76	77	66	80	75	67	76	1: 20,632	1: 20,762	1: 14,737	1: 13,528	1:18,751	1:23,452	1: 25,387
SA/IO	681	439	152	135	143	254	204	1: 3,783	1: 7,955	1: 7,907	1: 11,167	1:21,018	1:10,242	1: 20,309
SW Pacific	53	101	46	47	81	65	71	1: 17,817	1: 9,335	1: 6,954	1: 11,975	1:5,352	1:18,186	1: 17,538
China	110	79	85	105	72	223	190	1: 22,229	1: 31,119	1: 26,867	1: 15,477	1:18,003	1:10,525	1:15,149
Pacific	43	173	134	176	179	193	203	1: 45,064	1: 10,139	1: 6,404	1: 6,638	1:8,280	1:8,736	1:8,264
Indonesia	23	37	18	41	54	125	102	1: 53,603	1: 33,321	1: 17,346	1: 7,402	1:8,060	1:6,099	1:5,379
ROK and AKARA	12	34	5	24	108	75	123	1: 28,365	1: 18,959	1: 25,965	1: 6,285	1:1,056	1:2,220	1:1,606
Total	**1,204**	**1,094**	**548**	**679**	**774**	**1,122**	**1,074**	**1: 12,332**	**1: 14,330**	**1: 13,202**	**1: 11,200**	**1:13,230**	**1:12,135**	**1:14,979**



Conclusion

RVSM TLS Compliance - Vertical

- **The 2024 PAC vertical overall risk is 15.53 x 10^{-9} FAPFH, above the TLS,**
  driven by Hot Spot N (Hawaii CEP/Oakland, USA). To address this hot spot, the responsible units have implemented mitigation procedures and are planning an ATM system upgrade, scheduled to be implemented in 2027.
- **The 2024 ASIA vertical overall risk is 1.99 x 10^{-9} FAPFH, below the TLS.**

RVSM TLS Compliance - Horizontal

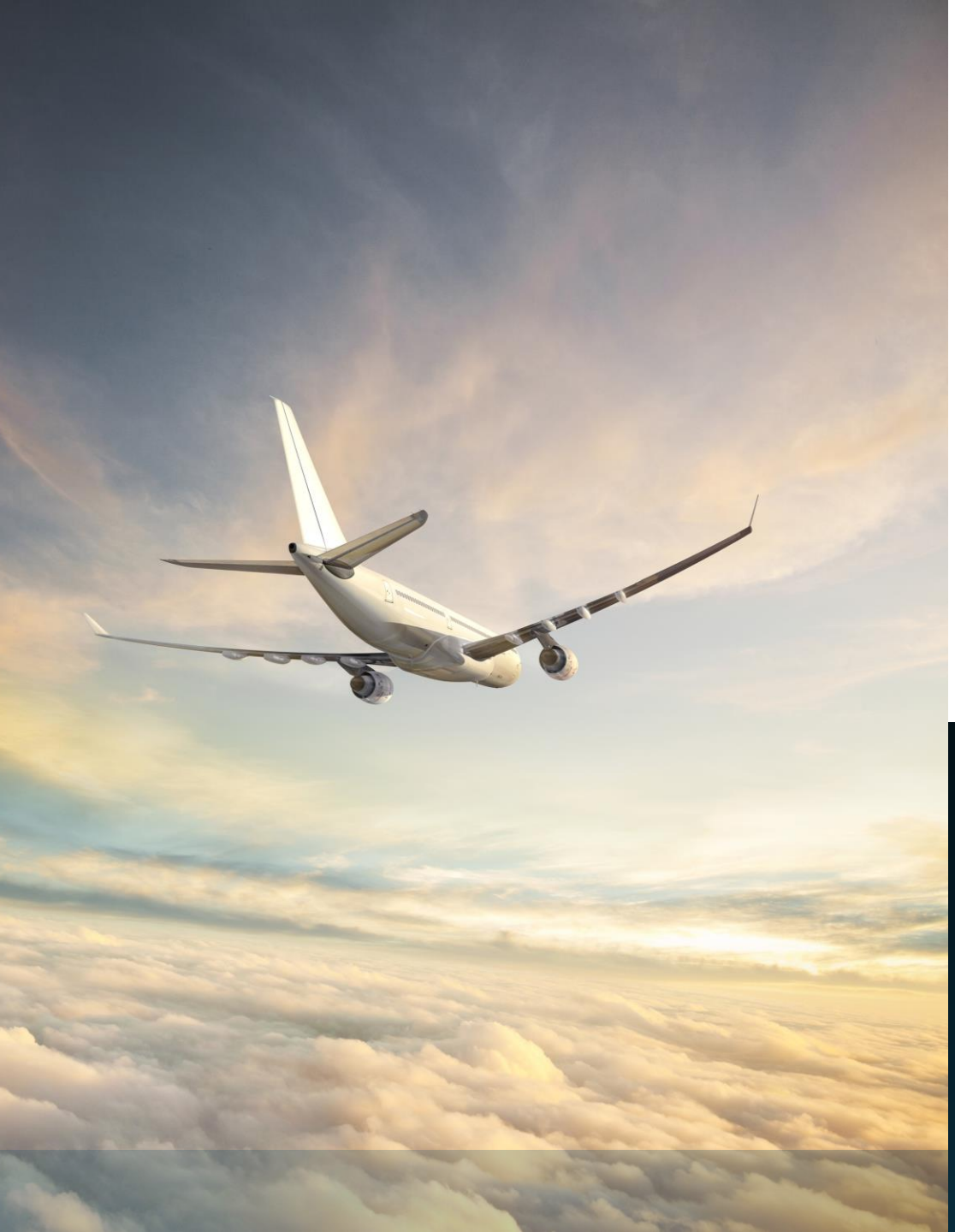
- **All horizontal risk estimates in 2024 are below the TLS.**

RASMAG's Hot Spot List

Hot Spot	Involved FIRs	Identified	Remarks
A1	Chennai/Dhaka/Kolkata/Yangon	2015	Cat. E LHDs and risk decreasing.
B1	Incheon (Transfer-of-Control Point between Incheon ACC and Shanghai ACC)	2015	Cat. E LHDs increasing. Risk decreasing.
D1	Fukuoka/Manila	2015	Cat. E steady; risk decreasing. Mitigation in place. **Potential non-hotspot**.
D5	Ho Chi Minh/Manila	2015	Cat. E LHDs and risk slightly increasing.
D7	Kota Kinabalu/Manila	2015	Cat. E LHDs slightly increasing. Risk slightly decreasing.
D8	Manila/Ujung Pandang	2015	Cat. E LHDs and risk decreasing. Mitigation in place. **Potential non-hotspot**.
F	Mogadishu/Mumbai	2015	Cat. E LHDs decreasing. Risk slightly increasing
G1	Mumbai/Muscat	2015	Cat. E LHDs slightly decreasing. Risk decreasing.
G2	Mumbai/Sanaa	2015	Cat. E LHDs slightly increasing. Risk decreasing.
J	Jakarta/Kota Kinabalu/Singapore	2018	Cat. E LHDs and risk decreasing. Mitigation in place. **Potential non-hotspot**.
N	Hawaii CEP/Oakland USA	2019	Cat. E LHDs and risk slightly increasing.
O	Bangkok/Ho Chi Minh/Kuala Lumpur/ Singapore	2023	Cat. E LHDs and risk decreasing.

Reporting Rate of LHDs/LLDs/LLEs

- **The estimated flying hours significantly increased** from
  13,615,545 hours in 2023 to
  16,087,567 hours in 2024.
- **The overall reporting rate of LHDs/LLDs/LLEs slightly degraded**, from
  1 report per 12,135 hours in 2023 to
  1 report per 14,979 hours in 2024.
- The reporting rate for **SEA, China, and SA/IO significantly dropped in 2024** due to the decrease in the number of LHDs with the increase in flying hours.
- The reporting rates for **other areas in 2024** were **close to 2023 values**.
- The reporting rate for **DPRK could not be calculated**, as there were no flying hours and no reported LHDs, LLDs, or LLEs. No aircraft operated in DPRK's RVSM airspace in 2023 and 2024, and DPRK submitted NIL reports for all months in 2024.
- The reporting rate for **Mongolia could not be calculated**, as no LHDs, LLDs, or LLEs were reported. Mongolia submitted NIL reports for all months in 2024.



THANK YOU

Thirtieth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/30)
Bangkok, Thailand
14 – 17 July 2025

Link for RASMAG meeting:
https://www.icao.int/APAC/Meetings/Pages/2025-RASMAG-30.aspx