2019 Asia Pacific
Consolidated Safety Report

Asia Pacific EMAs/RMAs

For RASMAG/25

Outline

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  - Horizontal Collision Risk Estimates and Summary of LLDs and LLEs
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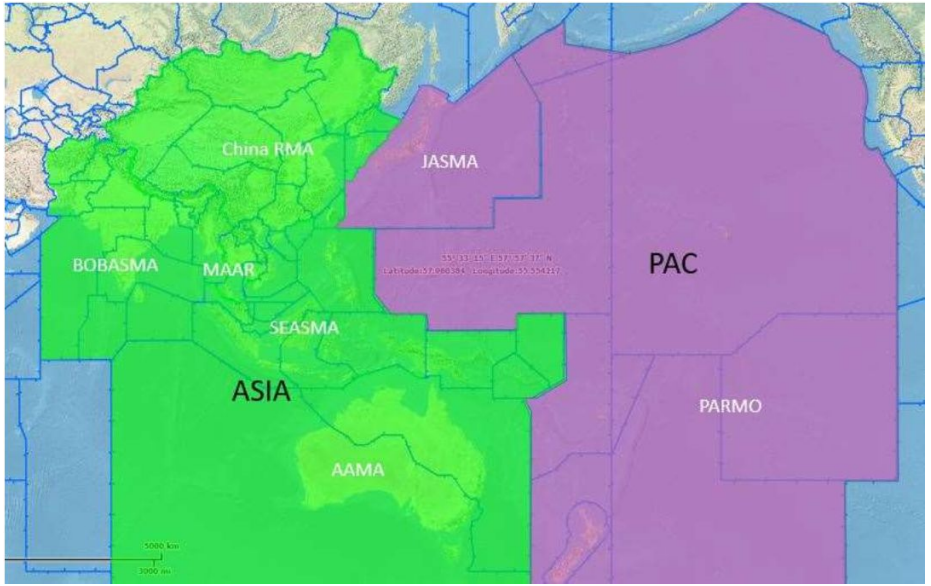
  - Hot Spots
- Asia Sub-Region
  - Vertical Collision Risk Estimates, Summary of LHDs
  - Horizontal Collision Risk Estimates and Summary of LLDs and LLEs
  - Geolocations of LHDs/LLDs/LLEs
  - Hot Spots
- Reporting Rate of LHDs/LLDs/LLEs
- Conclusion

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) Sub-Region**
- **Asia Sub-Region**

In each sub-region, there will be a summary of:

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

Pacific Sub-Region (PAC)

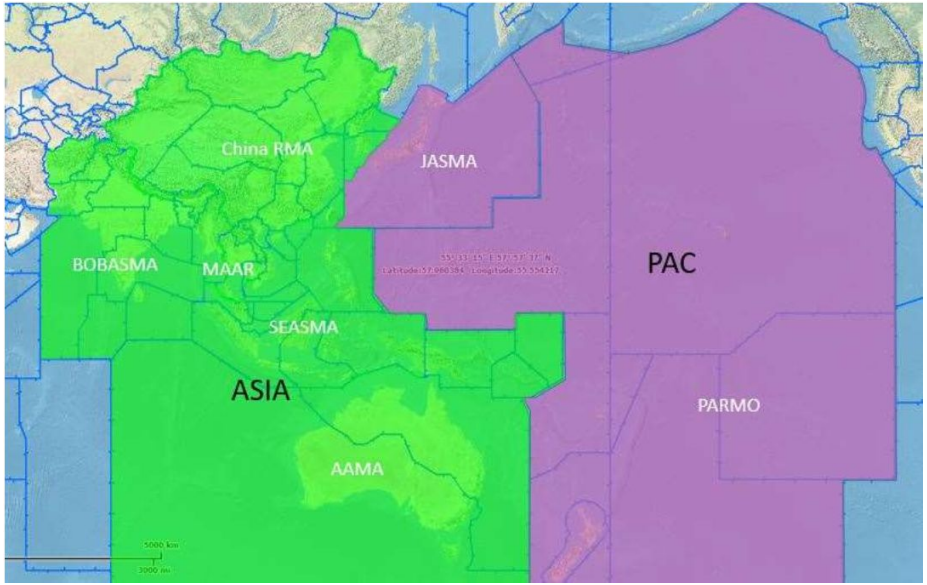
Traffic between North America and Asia, or North America and South Pacific States

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

Monitoring Agencies :

RMAs : JASMA, PARMO

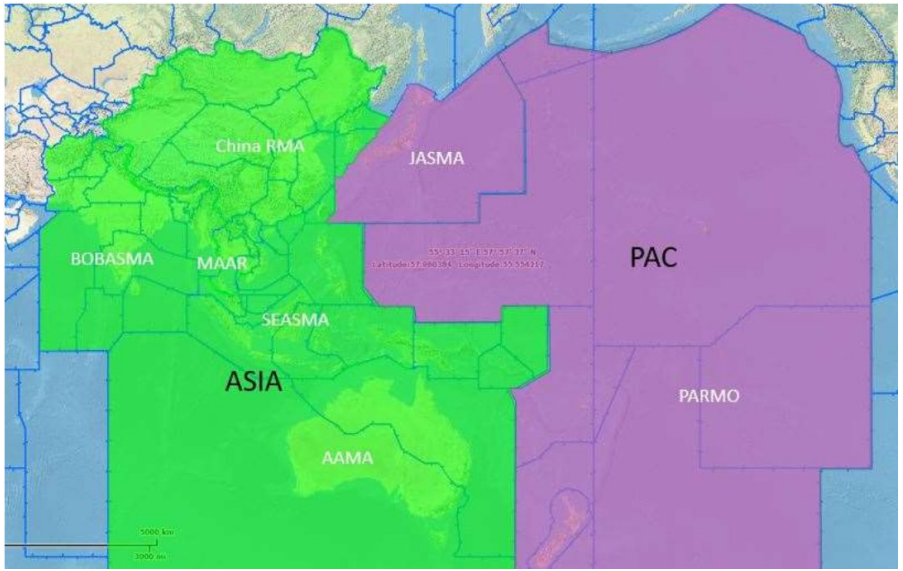
EMAs : JASMA, PARMO



Asia Sub-Region (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, Taipei, Ujung Pandang, Ulaanbaatar, Urumqi, Vientiane, Wuhan, and Yangon



Monitoring Agencies :

RMAs : AAMA, China RMA, MAAR, PARMO

EMAs : AAMA, BOBASMA, PARMO, SEASMA

PAC Sub-Region

PAC : Vertical Collision Risk

PAC : Vertical Collision Risk Estimates

Number of annual flying hours: 3,352,872 hours/year

2019 PAC Sub-Region	Vertical Risk Estimate	Remark
Vertical Technical Risk	**0.20 x 10^{-9} FAPFH**	**Below Technical TLS**
Vertical Operational Risk	30.01 x 10^{-9} FAPFH	
2019 Vertical Overall Risk	**30.21 x 10^{-9} FAPFH**	**Above TLS**

2018 Vertical Overall Risk	**19.40 x 10^{-9} FAPFH**	**Above TLS**
2017 Vertical Overall Risk	**7.30 x 10^{-9} FAPFH**	**Above TLS**
2016 Vertical Overall Risk	**5.01 x 10^{-9} FAPFH**	**Above TLS**

PAC : Summary of LHDs

Attributions	Category Code	Description	Number of Occurrences	Duration (minute)	Number of Levels Crossed
Aircrew/ Pilot	A	Flight crew failing to climb/descend the aircraft as cleared	6	18	4
	B	Flight crew climbing/descending without ATC Clearance	4	15	3
	C	Incorrect operation or interpretation of airborne equipment	2	18	0
ATC	D	ATC system loop error	10	14.5	7
	E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues	**79**	**362.5**	**3**
	F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues	3	130	0
Aircraft/ Avionics/ Contingencies	G	Aircraft contingency event leading to sudden inability to maintain assigned flight level	3	2	7
	H	Airborne equipment failure leading to unintentional or undetected change of flight level	0	0	0

PAC : Summary of LHDs

Attributions	Category Code	Description	Number of Occurrences	Duration (minute)	Number of Levels Crossed
Weather/ Turbulence	I	Turbulence or other weather related causes leading to unintentional or undetected change of flight level	13	10.5	15
TCAS	J	TCAS resolution advisory, flight crew correctly climb or descend following the resolution advisory	**27**	**2.9**	**2**
	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	0	0	0
		Total	**147**	**573.4**	**41**

PAC : Horizontal Collision Risk

PAC : Horizontal Collision Risk Estimates

Number of annual flying hours: 3,352,872 hours/year

2019 PAC Sub-Region	Horizontal Risk Estimate	Airspace	Remark
Lateral Risk (All operation)	3.35×10^{-9} FAPFH	Pacific	Below TLS
50NM Lateral Risk	1.45×10^{-9} FAPFH	Japan	Below TLS
30NM Longitudinal Risk	4.10×10^{-9} FAPFH	Pacific and Japan	Below TLS
50NM Longitudinal Risk	2.02×10^{-9} FAPFH	Pacific	Below TLS
10MIN Longitudinal Risk	20.1×10^{-9} FAPFH	Japan	Above TLS
2018 PAC Sub-Region	**Horizontal Risk Estimate**	**Airspace**	**Remark**
30NM Lateral Risk	0.15×10^{-9} FAPFH	Pacific and Japan	Below TLS
30NM Longitudinal Risk	3.9×10^{-9} FAPFH	Pacific and Japan	Below TLS
50NM Longitudinal Risk	2.1×10^{-9} FAPFH	Pacific and Japan	Below TLS

In 2019, PARMO applied new methodology for risk estimation, presented in a paper in RASMAG/25. JASMA also estimates as 50NM lateral risk and 10MIN longitudinal risk, which are different to last year and PARMO's methodology

PAC : Summary of LLDs and LLEs

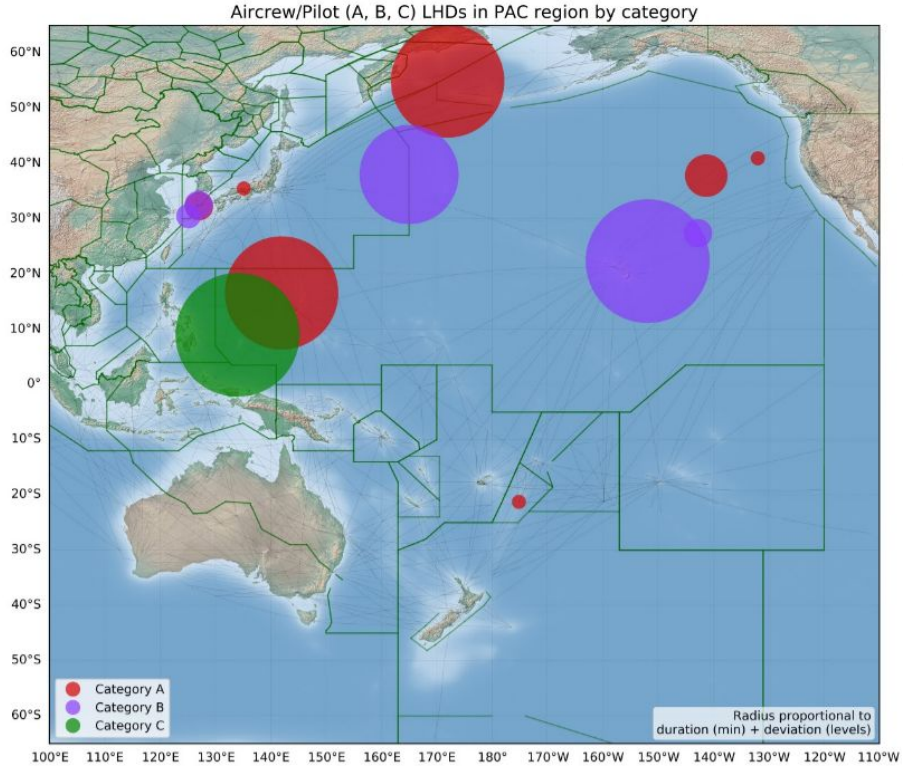
Attributions	Category Code	Description	Number of Occurrences	Duration (minute)	Number of Tracks/Routes Crossed	Horizontal Deviation (NM)
Aircrew/ Pilot	A	Flight crew deviate without ATC Clearance	14	91	2	175
	B	Incorrect estimate or route provided due to incorrect operation or interpretation of airborne equipment	3	0	0	11
	C	Flight crew waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position	2	18	0	110
ATC	D	ATC system loop error	5	25	0	219
	E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues	**75**	**319**	**0**	108
	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

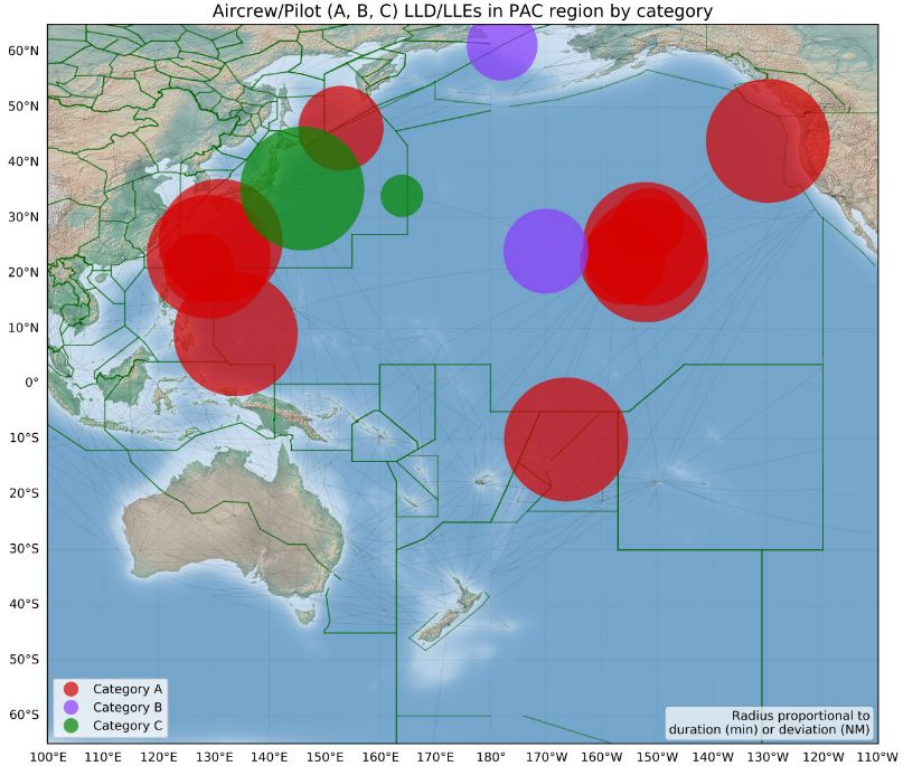
PAC : Summary of LLDs and LLEs

Attributions	Category Code	Description	Number of Occurrences	Duration (minute)	Number of Tracks/Routes Crossed	Horizontal Deviation (NM)
Aircraft/ Avionics/ Contingencies	G	Navigation errors due to airborne equipment failure	3	0	0	15
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 specifications	0	0	0	0
	J	Other	1	13	0	0
		Total	**103**	**466**	**2**	**638**

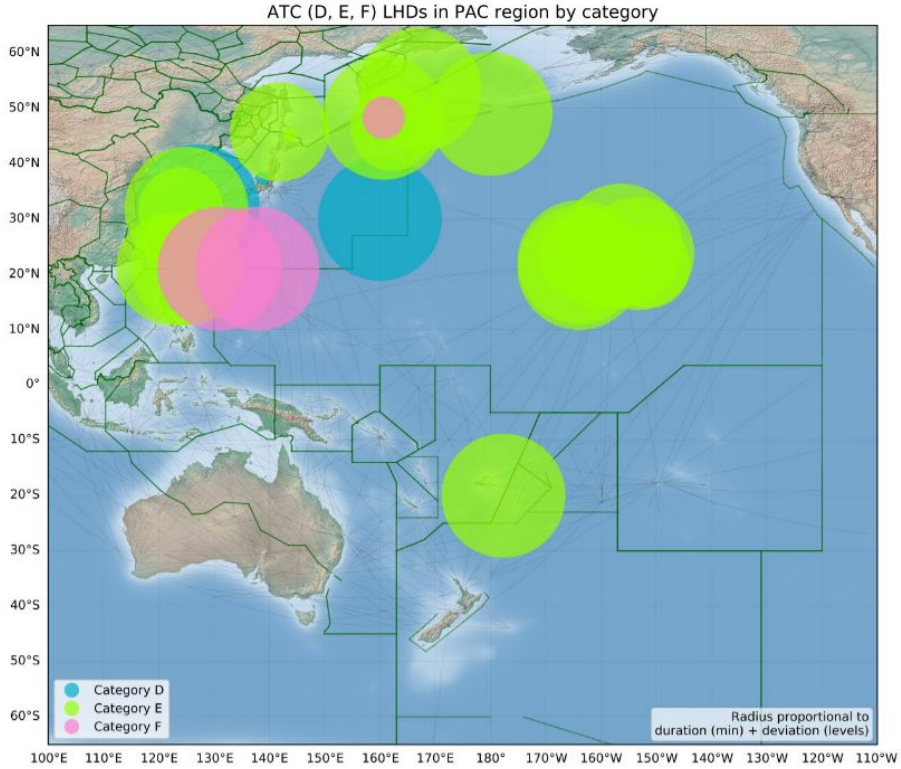
PAC : Geolocation of LHDs/LLDs/LLEs

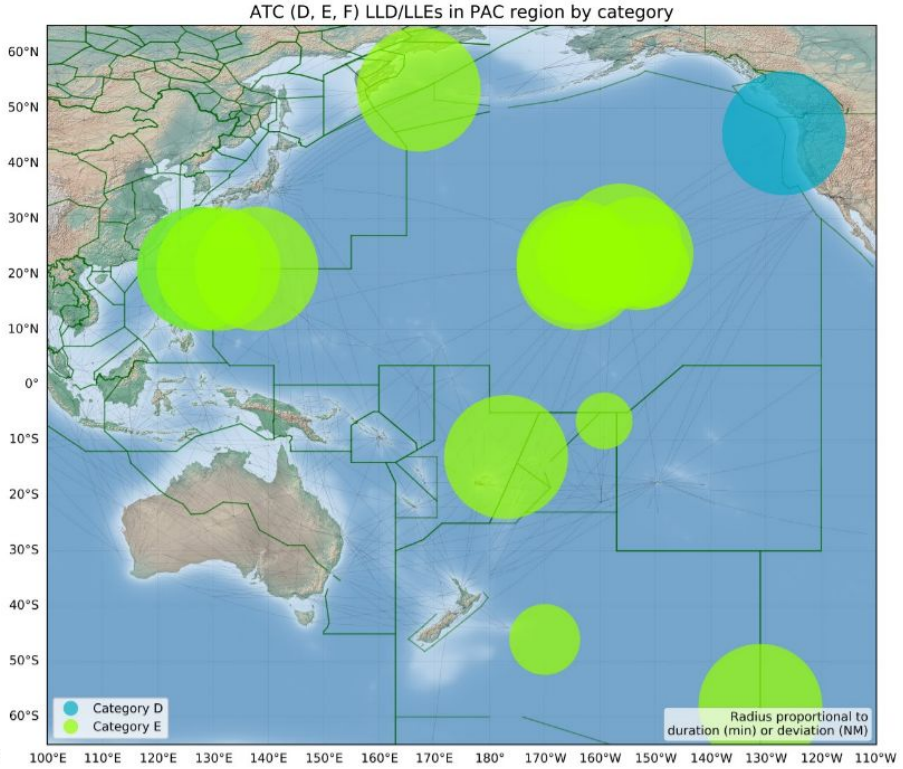
PAC : Aircrew/Pilot (A, B, C)



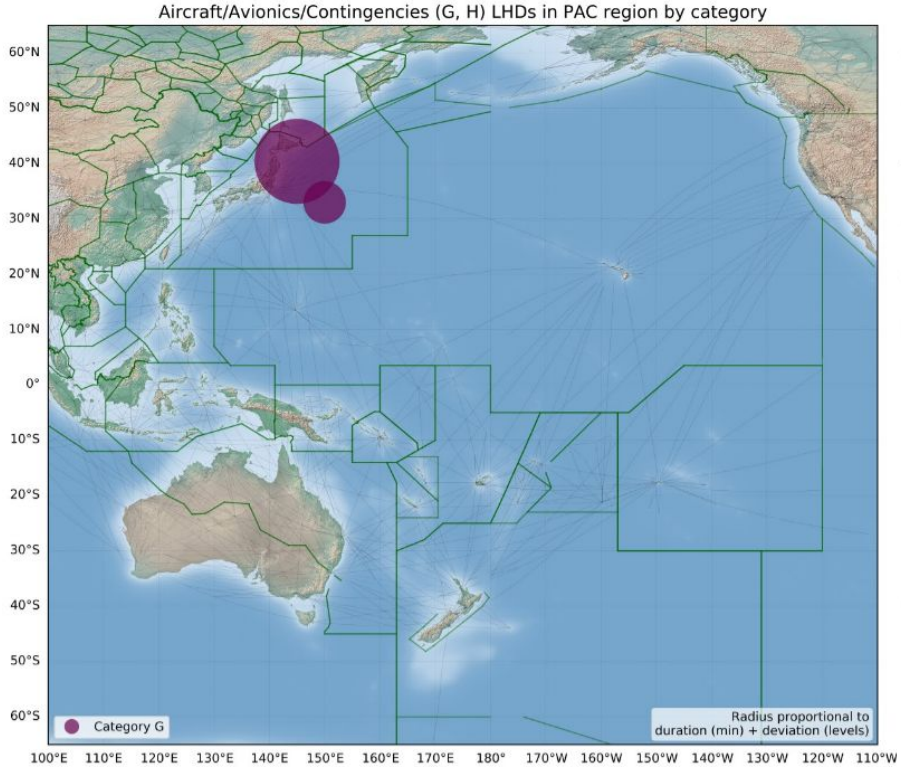


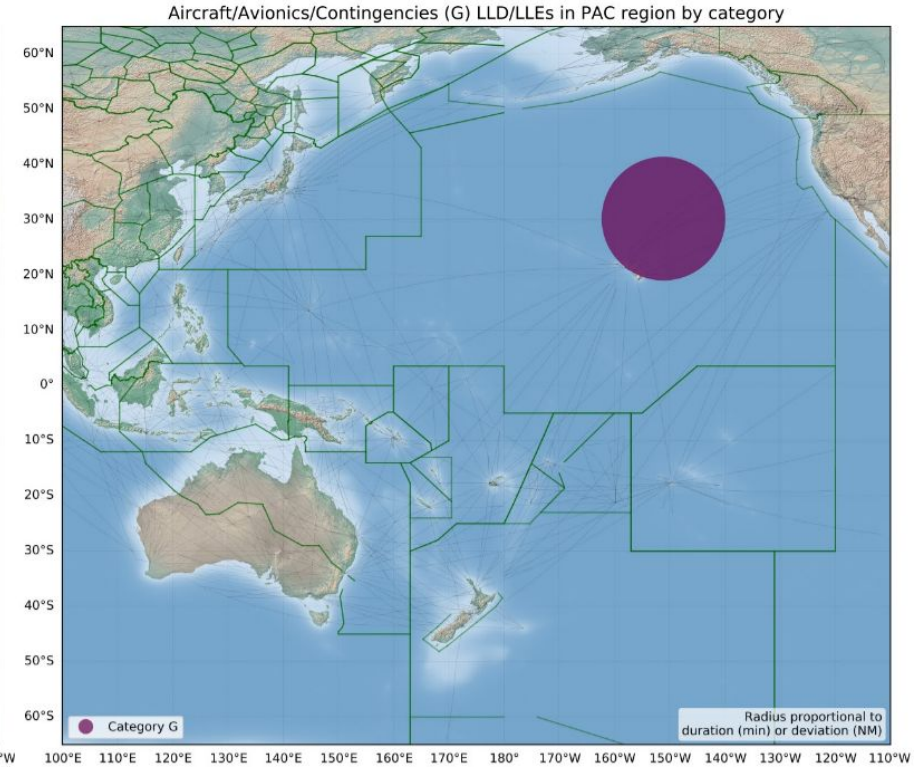
PAC : ATC (D, E, F)


ATC (D, E, F) LHDs in PAC region by category
60°N
50°N
40°N
30°N
20°N
10°N
0°
10°S
20°S
30°S
40°S
50°S
60°S
100°E 110°E 120°E 130°E 140°E 150°E 160°E 170°E 180° 170°W 160°W 150°W 140°W 130°W 120°W 110°W
Category D
Category E
Category F
Radius proportional to duration (min) + deviation (levels)

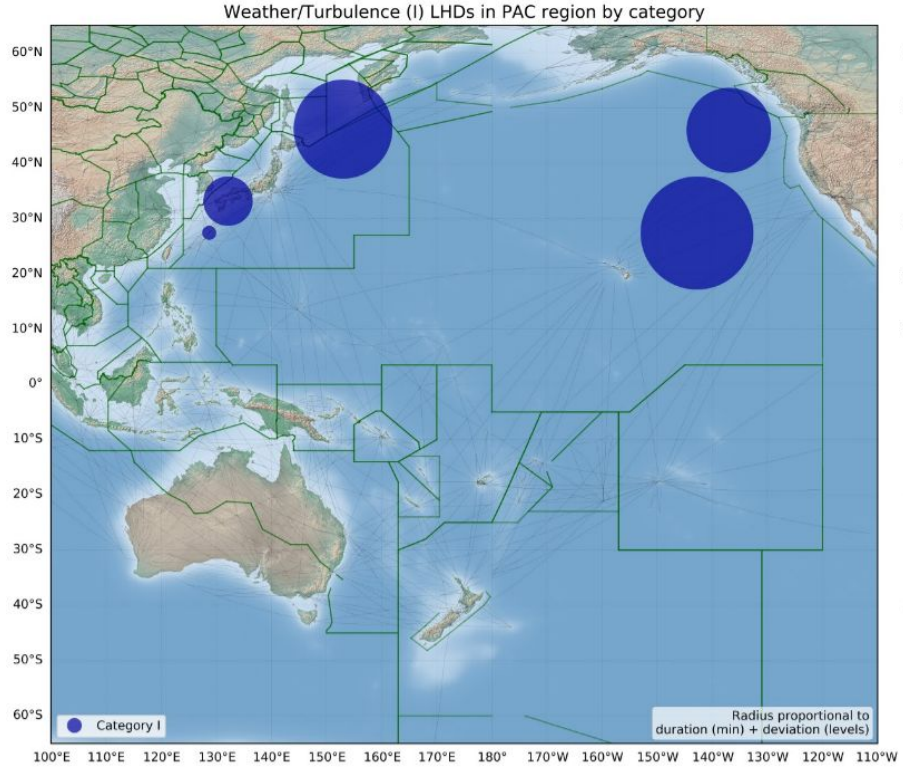

ATC (D, E, F) LLD/LLEs in PAC region by category
60°N
50°N
40°N
30°N
20°N
10°N
0°
10°S
20°S
30°S
40°S
50°S
60°S
100°E 110°E 120°E 130°E 140°E 150°E 160°E 170°E 180° 170°W 160°W 150°W 140°W 130°W 120°W 110°W
Category D
Category E
Radius proportional to duration (min) or deviation (NM)

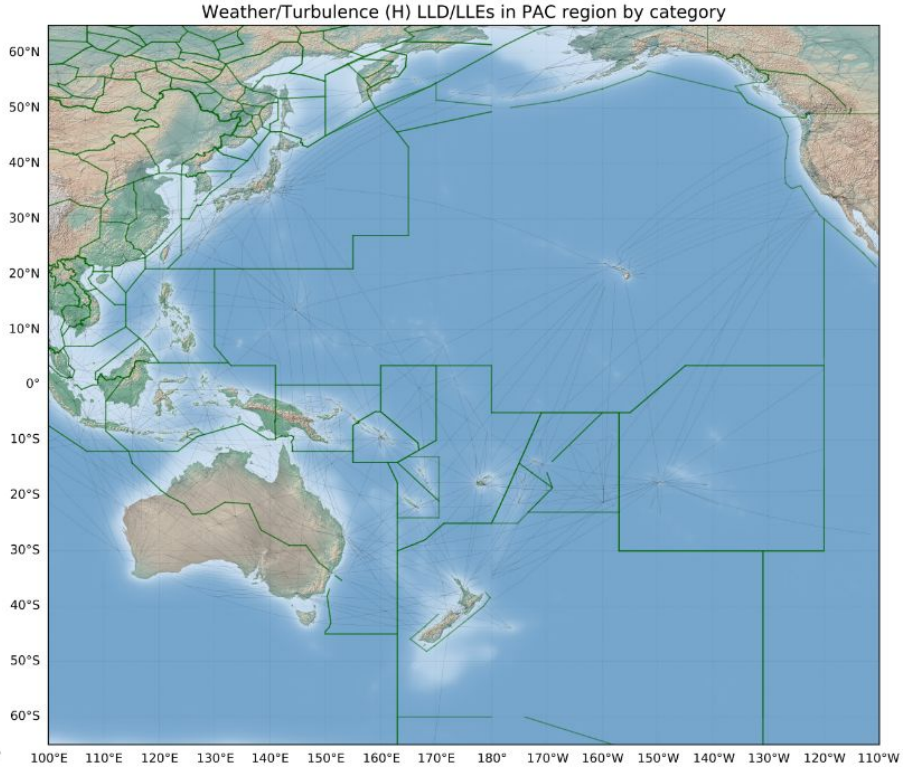
PAC : Aircraft Avionics/Contingencies (G, LHD:H)



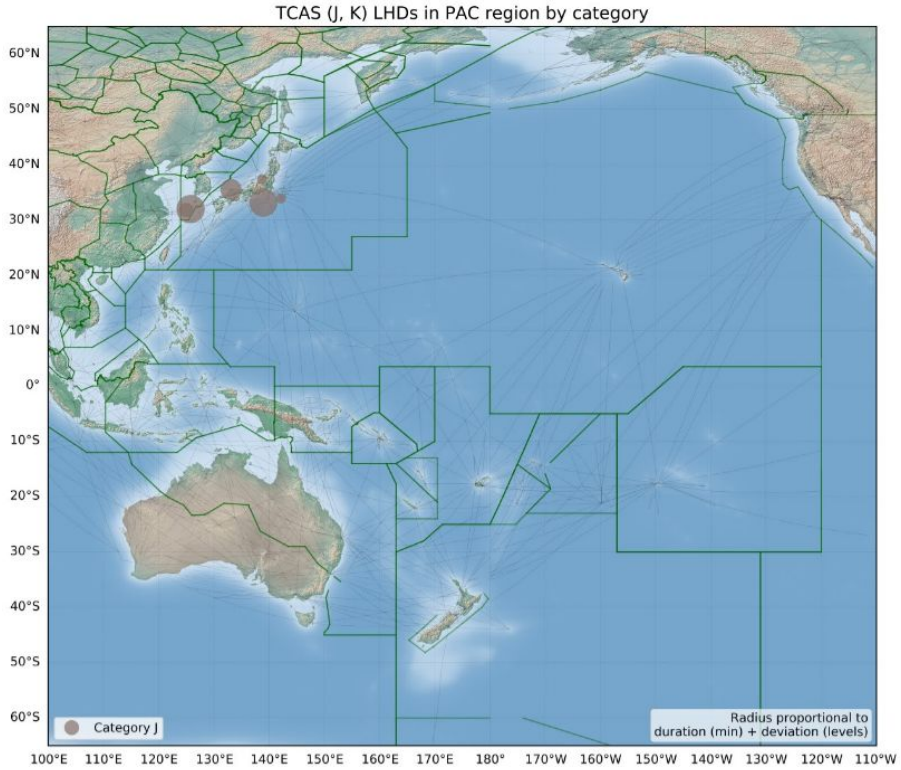


PAC : Weather/Turbulence (LHD:I, LLD/LLE:H)





PAC : TCAS (LHD:J, K)



PAC : Hot Spots

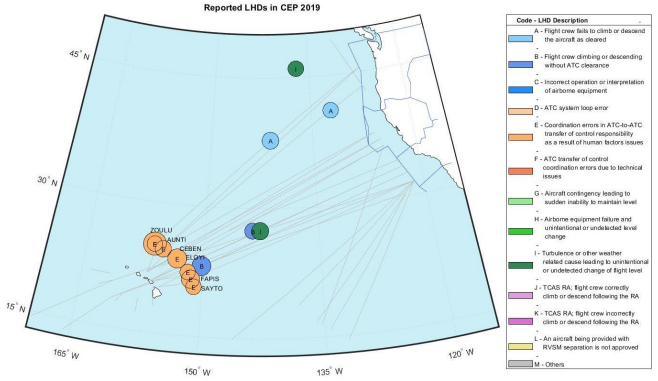
PAC : LHD Hot Spot N (North America - Hawaii CEP)

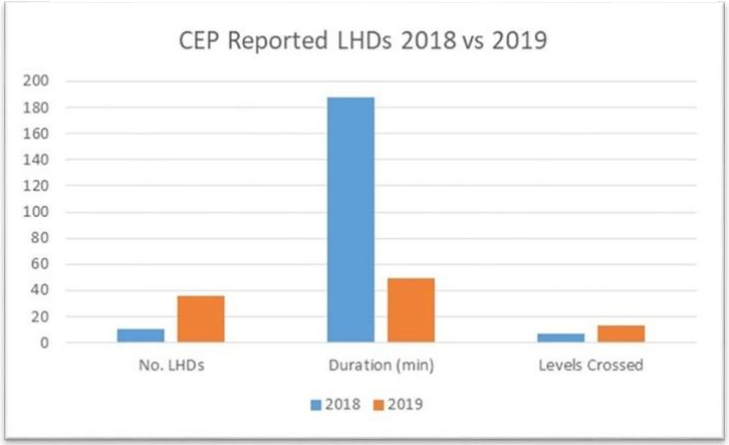
Nature of Occurrences : In 2018, several long duration LHDs were reported

Contributing Factors : Flight operations using only HF voice for communication provide fewer opportunities for ATC to identify errors

Trend : Zero long duration LHDs reported in 2019, resulting in decreased vertical risk estimate. An increase in category E LHDs observed in 2019.

Mitigations : A task force has been established to work on the category E occurrences, the task force includes personnel from both facilities





Asia Region

Asia : Vertical Collision Risk

ASIA : Vertical Collision Risk Estimates

Number of annual flying hours: 12,324,4974 hours/year

2019 Asia Sub-Region	Vertical Risk Estimate	Remark
Vertical Technical Risk	**0.74 x 10^{-9} FAPFH**	**Below Technical TLS**
Vertical Operational Risk	12.14 x 10^{-9} FAPFH	
Vertical Overall Risk	**12.88 x 10^{-9} FAPFH**	**Above TLS**

2018 Vertical Overall Risk	**15.50 x 10^{-9} FAPFH**	**Above TLS**
2017 Vertical Overall Risk	**27.30 x 10^{-9} FAPFH**	**Above TLS**
2016 Vertical Overall Risk	**12.53 x 10^{-9} FAPFH**	**Above TLS**

Asia : Summary of LHDs

Attributions	Category Code	Description	Number of Occurrences	Duration (minute)	Number of Levels Crossed
Aircrew/ Pilot	A	Flight crew failing to climb/descend the aircraft as cleared	**45**	**10.5**	**20**
	B	Flight crew climbing/descending without ATC Clearance	**34**	**5.73**	**28**
	C	Incorrect operation or interpretation of airborne equipment	9	0	2
ATC	D	ATC system loop error	**40**	**14.4**	**27.5**
	E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues	**597**	**2,269.75**	**1**
	F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues	12	0	0
Aircraft/ Avionics/ Contingencies	G	Aircraft contingency event leading to sudden inability to maintain assigned flight level	2	0.5	1
	H	Airborne equipment failure leading to unintentional or undetected change of flight level	3	0	4

Asia : Summary of LHDs

Attributions	Category Code	Description	Number of Occurrences	Duration (minute)	Number of Levels Crossed
Weather/ Turbulence	I	Turbulence or other weather related causes leading to unintentional or undetected change of flight level	**37**	**6**	**24**
TCAS	J	TCAS resolution advisory, flight crew correctly climb or descend following the resolution advisory	19	1	8
	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	3	95	0
	M	Other	26	9.5	0.5
		Total	**827**	**2,412.38**	**116**

Asia : Horizontal Collision Risk

Asia : Horizontal Collision Risk Estimates

Number of annual flying hours: 12,324,497 hours/year

2019 Asia Sub-Region	Horizontal Risk Estimate	Remark
30NM Lateral Risk	0.0001 x 10^{-9} FAPFH	Below TLS
50NM Longitudinal Risk	0.25 x 10^{-9} FAPFH	Below TLS
2018 Asia Sub-Region	**Horizontal Risk Estimate**	**Remark**
30NM Lateral Risk	0.52 x 10^{-9} FAPFH	Below TLS
50NM Longitudinal Risk	3.91 x 10^{-9} FAPFH	Below TLS

Asia : Summary of LLDs and LLEs

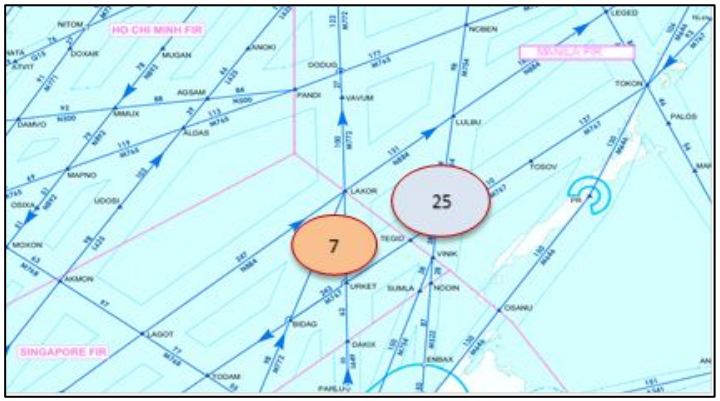
Attributions	Category Code	Description	Number of Occurrences	Duration (minute)	Number of Tracks /Routes Crossed	Horizontal Deviation (NM)
Aircrew/ Pilot	A	Flight crew deviate without ATC Clearance	1	0	0	50
	B	Incorrect estimate or route provided due to incorrect operation or interpretation of airborne equipment	1	3	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	10	0	0	503
	F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues	4	2	0	0

Asia : Summary of LLDs and LLEs

Attributions	Category Code	Description	Number of Occurrences	Duration (minute)	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;	1	0	0	10
	J	Other	0	0	0	0
		Total	**17**	**5**	**0**	**563**

Asia : Summary of LLDs and LLEs (SEA Airspace)

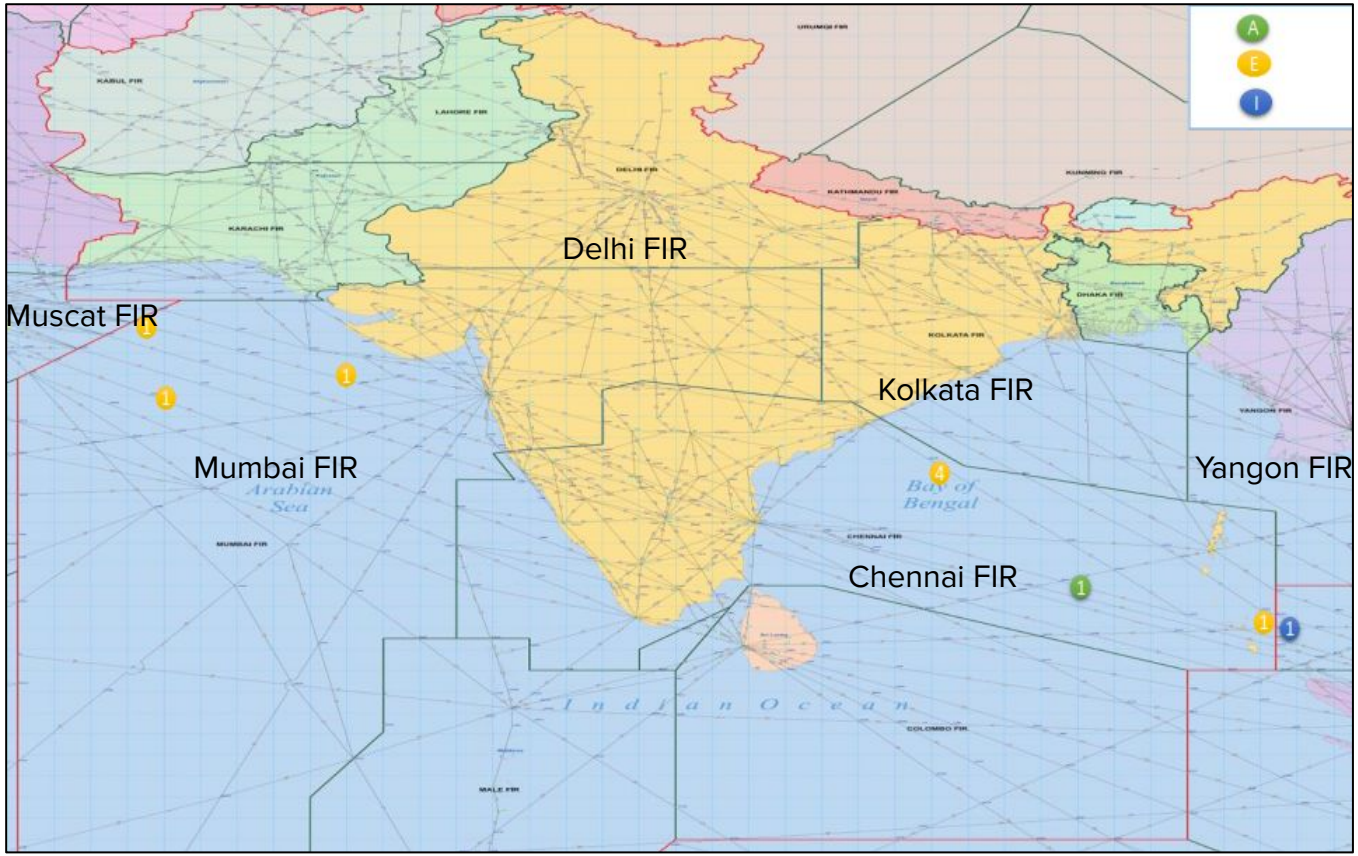
- ***Location*** : Boundary of Singapore & Manila
- ***Natures of Occurrences*** : Top Categories, CAT B and CAT F.
- ***Contributing Factors*** : Inaccurate pilots' estimate, negative flight plans leading to AIDC non transfer.
- ***Trend*** : First identified as a hot spot in 2014. This interface improved 72%, compared to 2018.
- ***Mitigation in 2019*** : Continual proactive safety awareness and lesson sharing, focused on types of AIDC failures. Use of improved system estimates generated from multiple surveillance sources.



The number of LLDs and LLEs in 2019

The number of LLDs and LLEs in 2018

Asia : Summary of LLDs and LLEs (SA/IO Airspace)

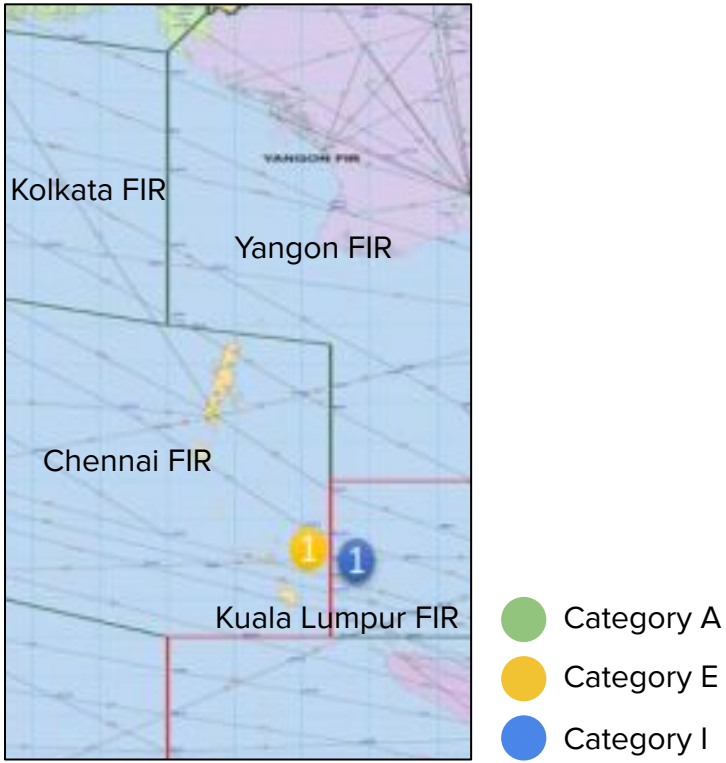


Asia : Summary of LLDs and LLEs (SA/IO Airspace)

- ***Location*** : Mumbai/Muscat Boundary
- ***Nature of Occurrences*** : Category E.
- ***Contributing Factors*** : Poor communication and surveillance leading to late realization of traffic by ATC.
- ***Trend*** : -
- ***Mitigation in 2019*** : AIDC trials conducted in 2018 and Mumbai awaiting response from Muscat. Meanwhile data sharing and video conference between Mumbai and Muscat ATC being conducted to reduce coordination errors. Space-based ADS-B could help mitigate the duration of LLDs and LLEs.

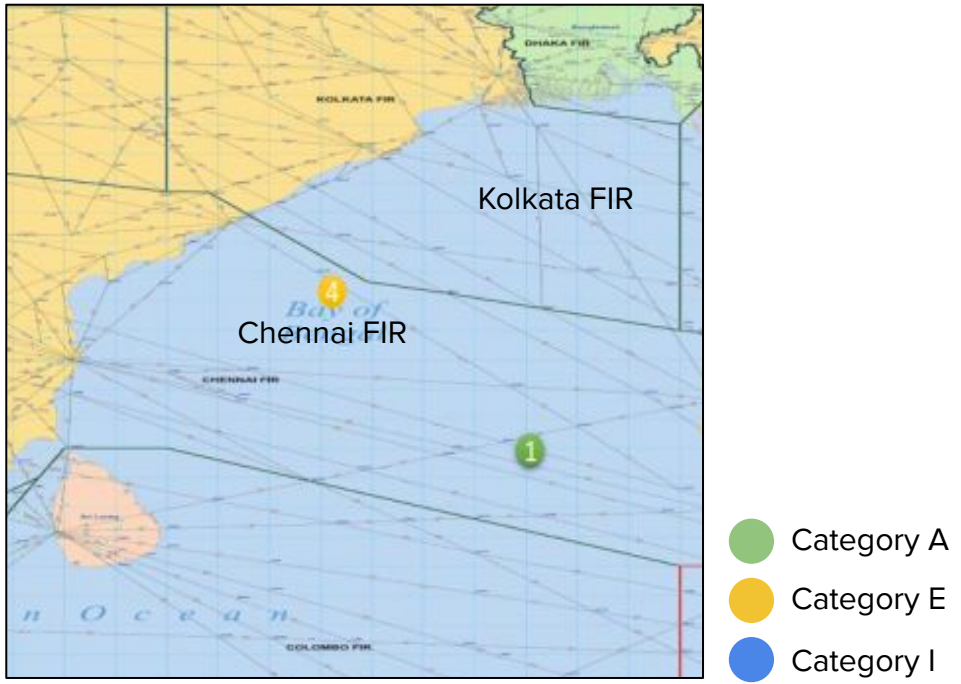
Asia : Summary of LLDs and LLEs (SA/IO Airspace)

- ***Location*** : Chennai/Kuala Lumpur Boundary
- ***Nature of Occurrences*** : Category E.
- ***Contributing Factors*** : Bad weather resulting in aircraft deviation that was not communicated by transferring unit to receiving unit.
- ***Trend*** : -
- ***Mitigation in 2019*** : AIDC trials operations since May 2017. MOU for operationalization of AIDC from 1st April 2020 was signed and now AIDC fully operational. AIDC MOU to be part of new LoA to be signed shortly. Space-based ADS-B could help mitigate the duration of LLDs and LLEs.



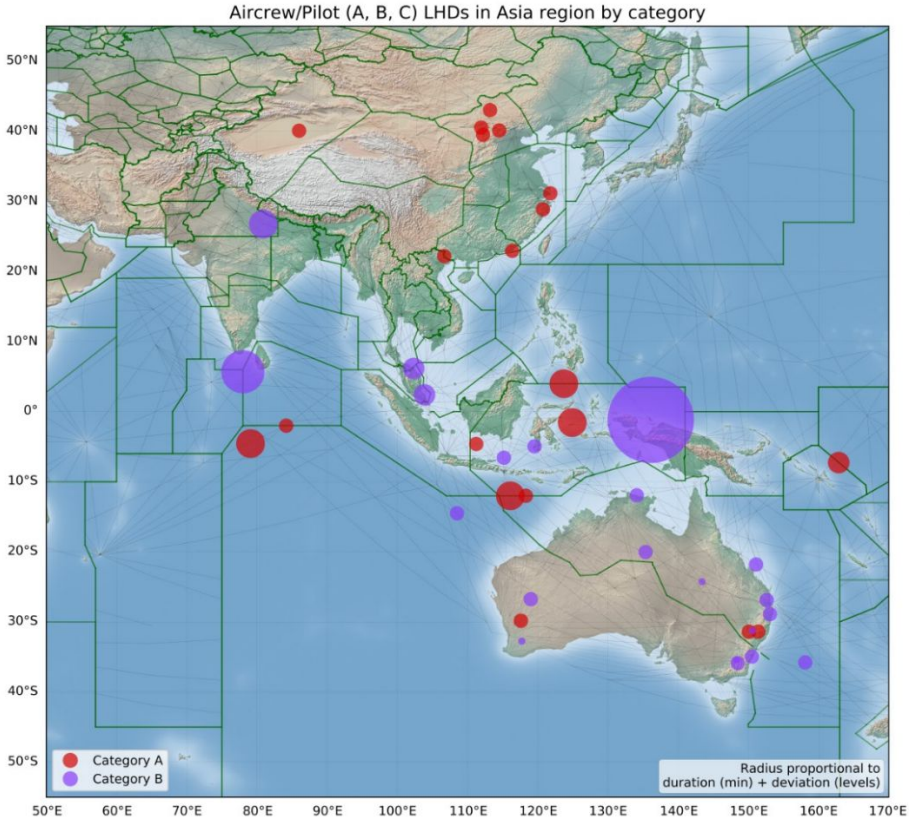
Asia : Summary of LLDs and LLEs (SA/IO Airspace)

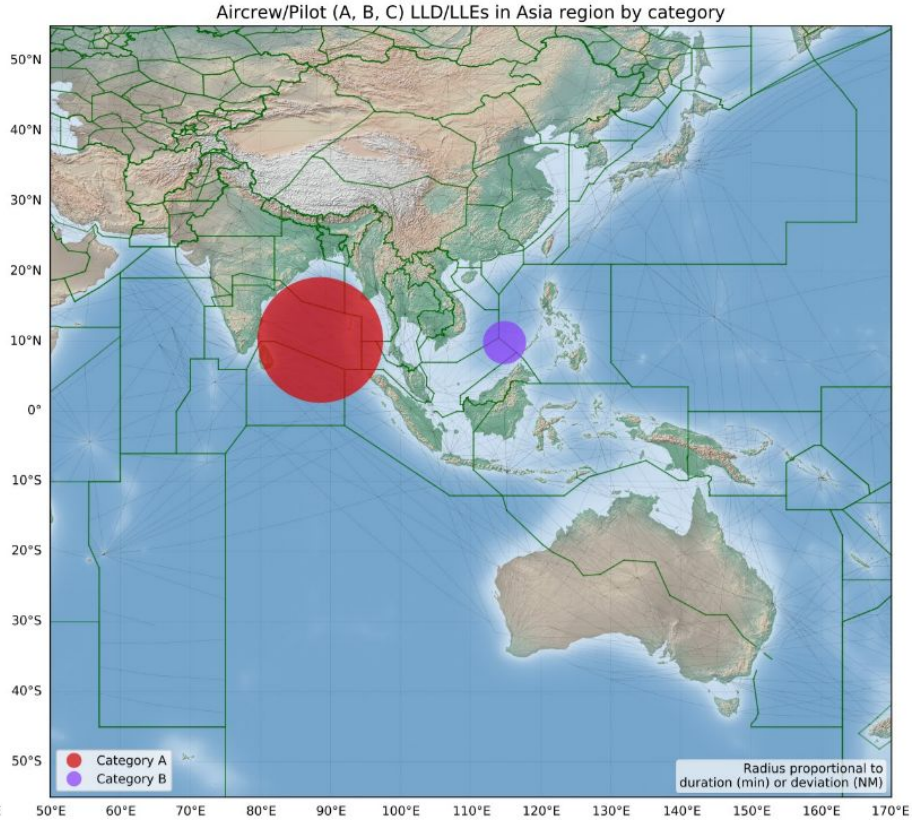
- ***Location*** : Chennai/Kolkata Boundary
- ***Nature of Occurrences*** : Category E.
- ***Contributing Factors*** : Bad weather resulting in aircraft deviation that was not communicated by transferring unit to receiving unit. (Occurred in one day)
- ***Trend*** : -
- ***Mitigation in 2019*** : AIDC trial operation between Chennai ACC and Kolkata ACC commenced from November 2019. Phase 2 of AIDC trials between Chennai OCC and Kolkata had to be postponed and will commence shortly.



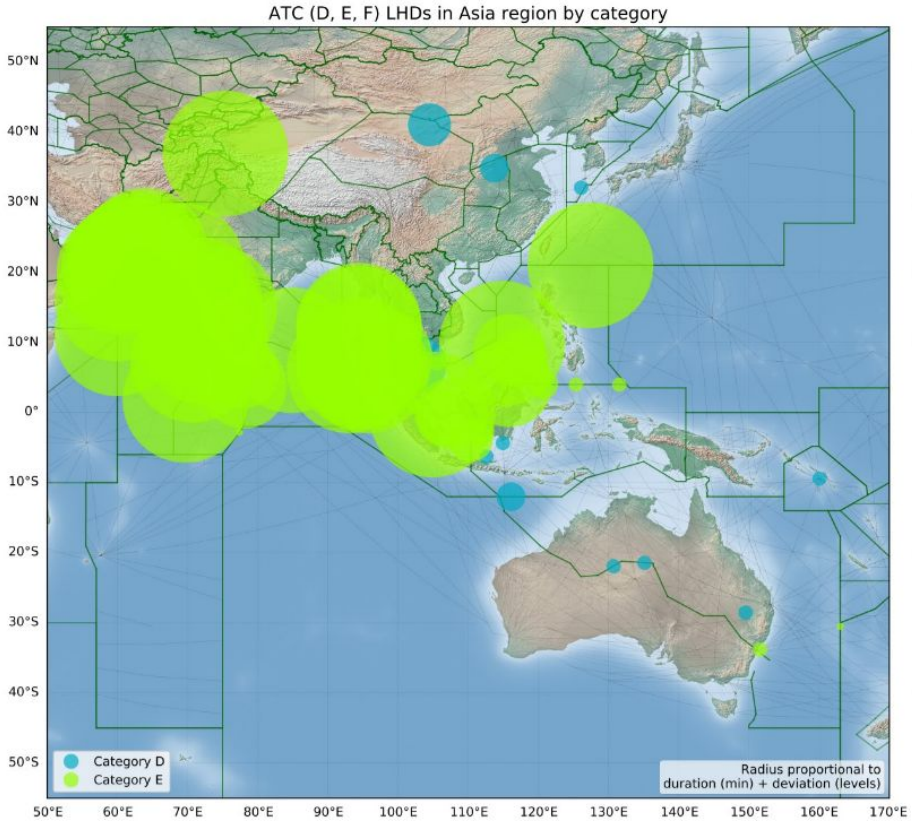
Asia : Geolocation of LHDs/LLDs/LLEs

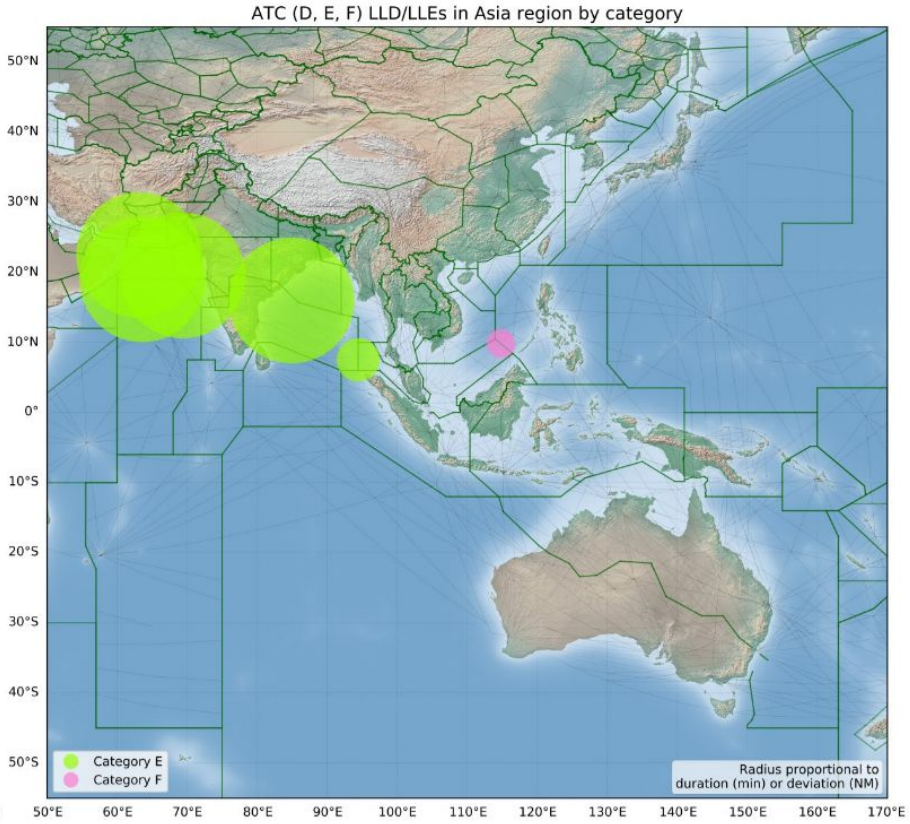
Asia : Aircrew/Pilot (A, B, C)



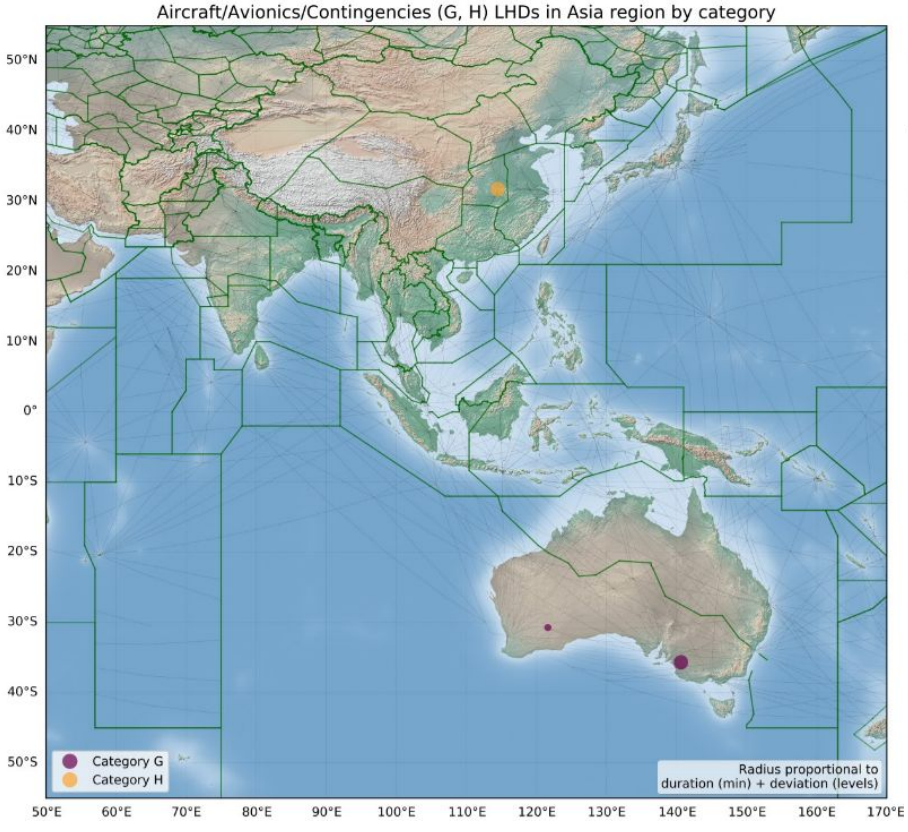


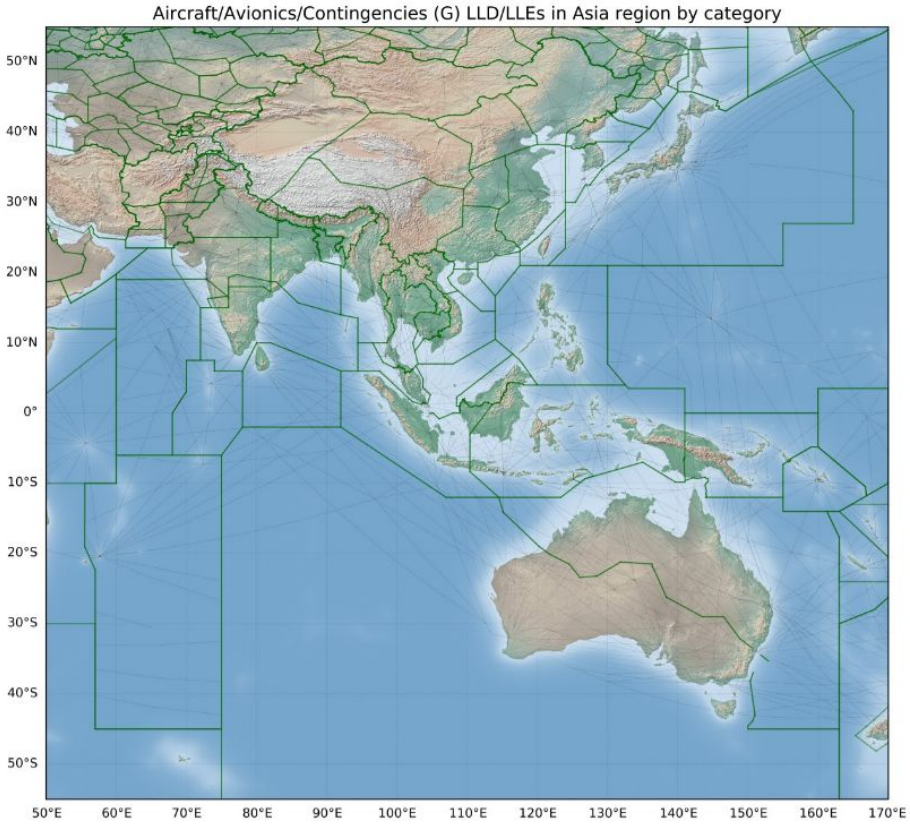
Asia : ATC (D, E, F)


ATC (D, E, F) LHDs in Asia region by category
50°N
40°N
30°N
20°N
10°N
0°
10°S
20°S
30°S
40°S
50°S
50°E
60°E
70°E
80°E
90°E
100°E
110°E
120°E
130°E
140°E
150°E
160°E
170°E
Category D
Category E
Radius proportional to duration (min) + deviation (levels)

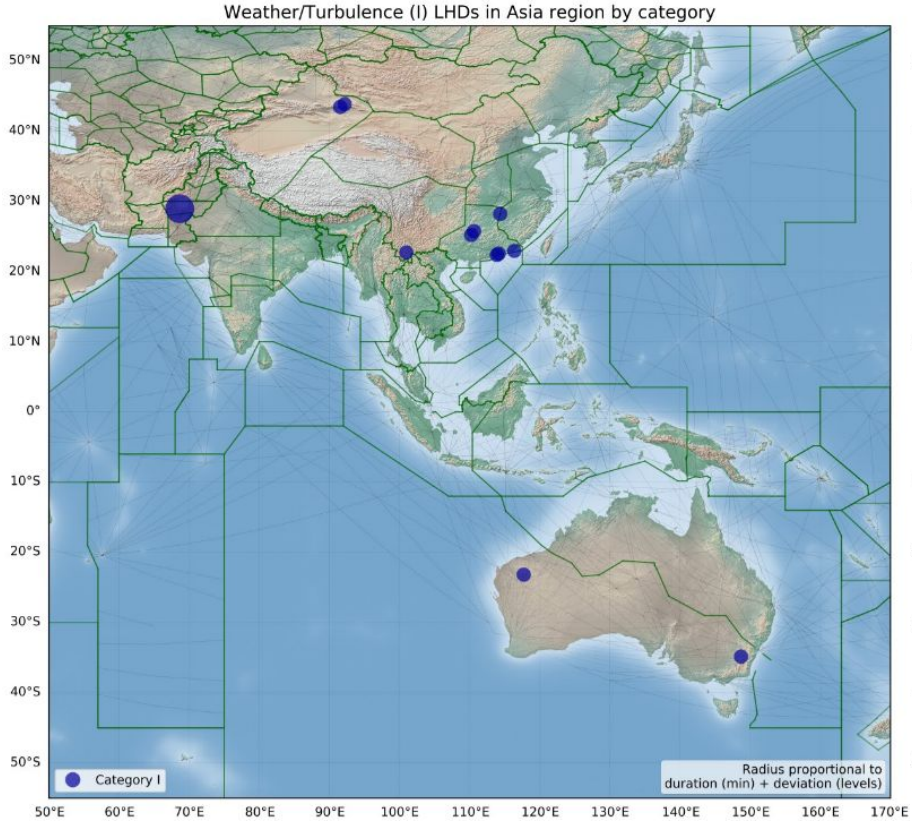

ATC (D, E, F) LLD/LLEs in Asia region by category
50°N
40°N
30°N
20°N
10°N
0°
10°S
20°S
30°S
40°S
50°S
50°E
60°E
70°E
80°E
90°E
100°E
110°E
120°E
130°E
140°E
150°E
160°E
170°E
Category E
Category F
Radius proportional to duration (min) or deviation (NM)

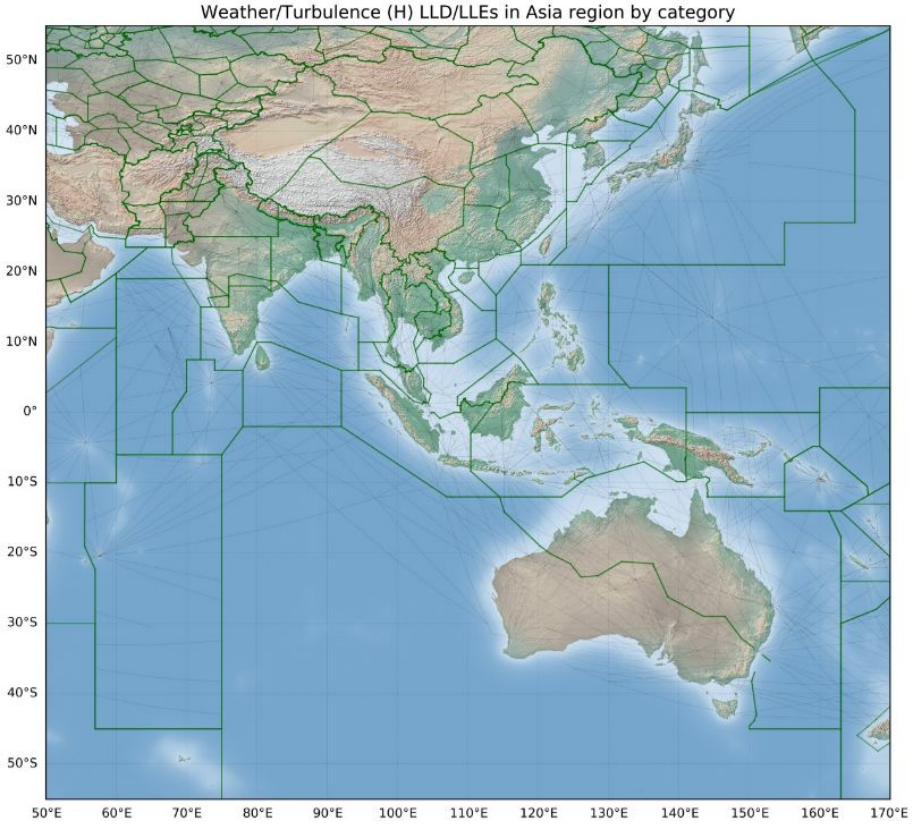
Asia : Aircraft Avionics/Contingencies (G, LHD:H)



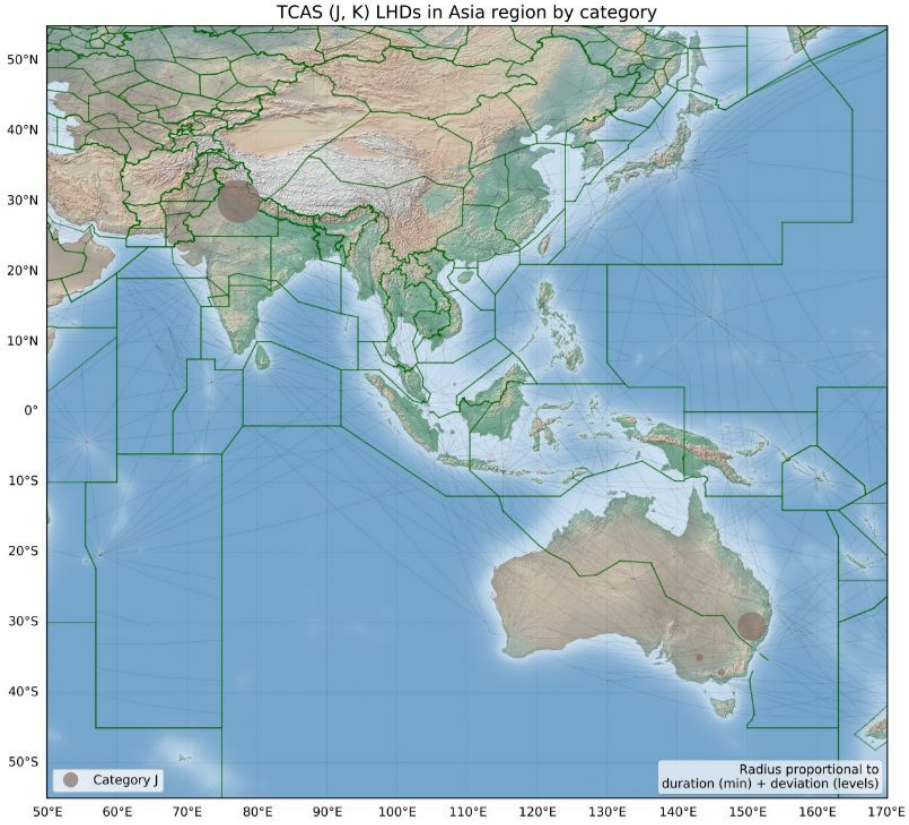


Asia : Weather/Turbulence (LHD:I, LLD/LLE:H)





Asia : TCAS (LHD:J, K)



Asia : Hot Spots

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

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

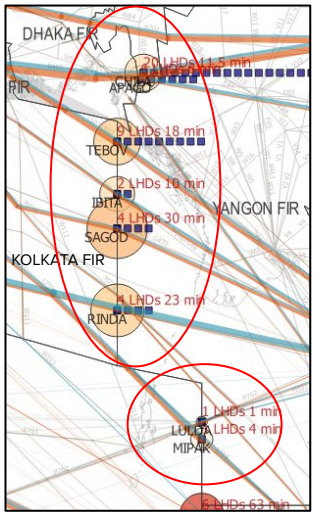
Contributing Factors : The interfaces are oceanic airspace, which has some gaps in communication and surveillance coverage.

Trend : The number of LHDs and the operational risk from 2017 to 2019 significantly decreased at the interface between Kolkata/Dhaka and Yangon FIR but increased at the interface between Chennai and Yangon FIR.

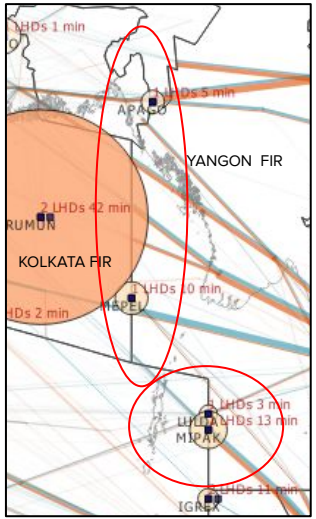
Mitigations : ADS-B data sharing between Kolkata and Yangon FIR commenced in June 2018. The remaining non-zero-duration LHDs are now concentrated around LULDA and MIPAK, where no ADS-B data sharing. AIDC implementation is also expected to help reduce LHD occurrences. Also it might be beneficial to review the procedure of handling an aircraft on route L759 between MIPAK and LIBDI where there is a brief crossing into Chennai FIR.

Operational risk (FAPFH)		
2017	2018	2019
2.06 x 10^{-9}	**0.66** x 10^{-9}	**0.80** x 10^{-9}

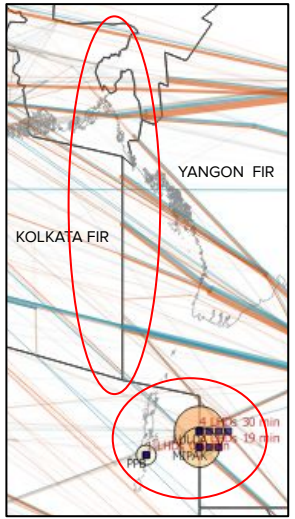
2017



2018



2019



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

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

Contributing Factors : There are still some gaps in communication and surveillance coverage along the Chennai and Kuala Lumpur boundary.

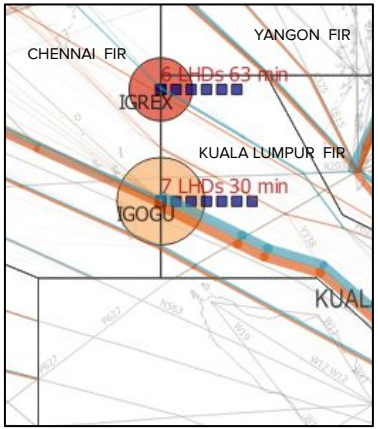
Trend : The operational risk decreased by 1/3 from 2017 to 2018, but increased again in 2019

Mitigation :

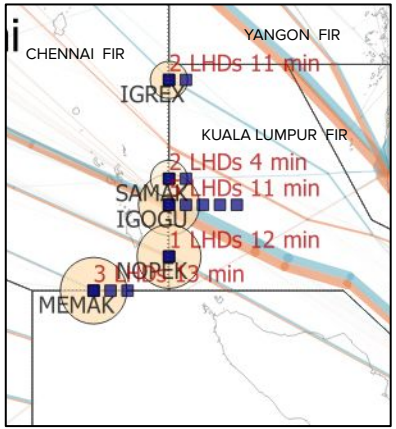
- AIDC between Chennai and Kuala Lumpur is fully operational from 1st April 2020.
- Surveillance data sharing planned for 2021

Operational risk (FAPFH)		
2017	2018	2019
0.91 x 10^{-9}	**0.66** x 10^{-9}	**1.14** x 10^{-9}

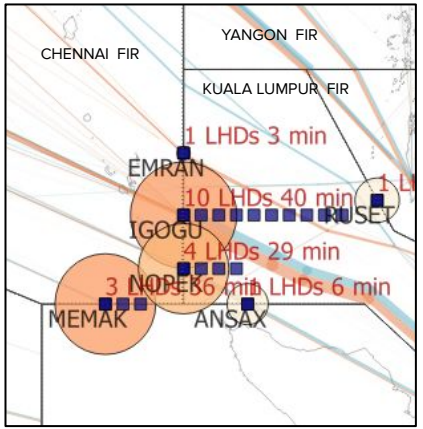
2017



2018



2019



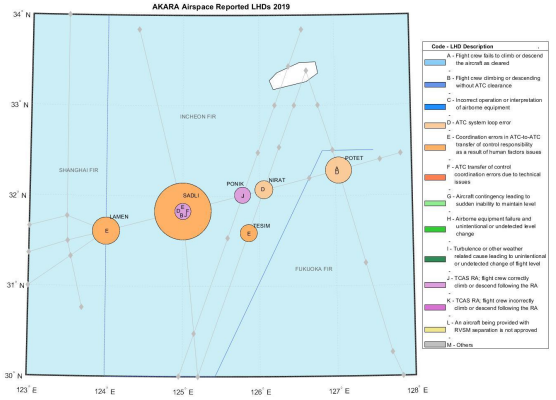
Asia : LHD Hot Spot B (AKARA Airspace)

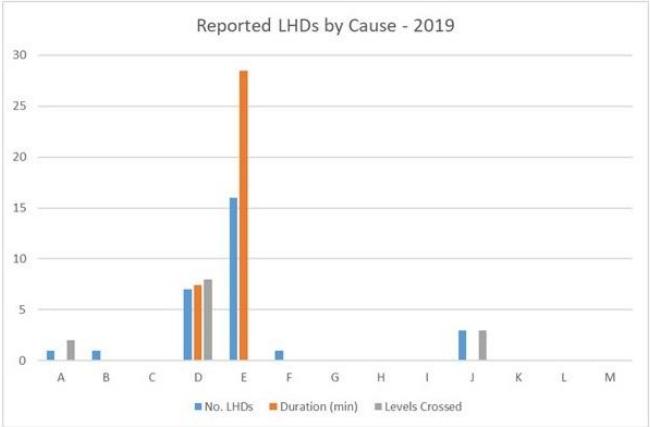
Nature of Occurrences : Category D, E, and F occurrences. Category E and F occurrences are usually mitigated due to available surveillance but are complex to investigate due to unique ATS agreements.

Contributing Factors : High vertical risk due to high opposite direction vertical passing frequency. This is caused by traffic volume and limited availability of flight levels.

Trend : Identified as a hot spot since 2015. Increased reporting of occurrences in 2019 over previous years.

Mitigation : In 2018, a Task Force was formed; FUKUE-AKARA Corridor Technical Working Group (TWG).





Asia : LHD Hot Spot C (Hong Kong – Guangzhou)

Nature of Occurrences : Transfer Error

Contributing Factors : The major cause of the category E LHDs reported in this area was the late revision of flight information (including time and altitude) to the next ATSU.

Trend : The number of category E & F LHDs in this area has greatly reduced from 2015 to 2019. China RMA has not yet receive any event in this area since 2018.

Mitigations : China RMA took remedial actions to reduce the events and coordinated with other RMAs to mitigate the risk. The South China Sea Scrutiny Group meeting for Large Height Deviations (LHDs) was held in Haikou, China in July 2015. Hong Kong, Guangzhou, Zhan Jiang, Sanya and Shanghai ATC all assigned a point of contact for LHD reporting and established LHD data exchanging mechanism to confirm the events respectively. Guangzhou, Zhanjiang, Sanya and Shanghai ATC also refined their internal procedures for LHD reporting, especially coordination errors, after the scrutiny group meeting.

Proposed to be re-classified as a non-hot spot

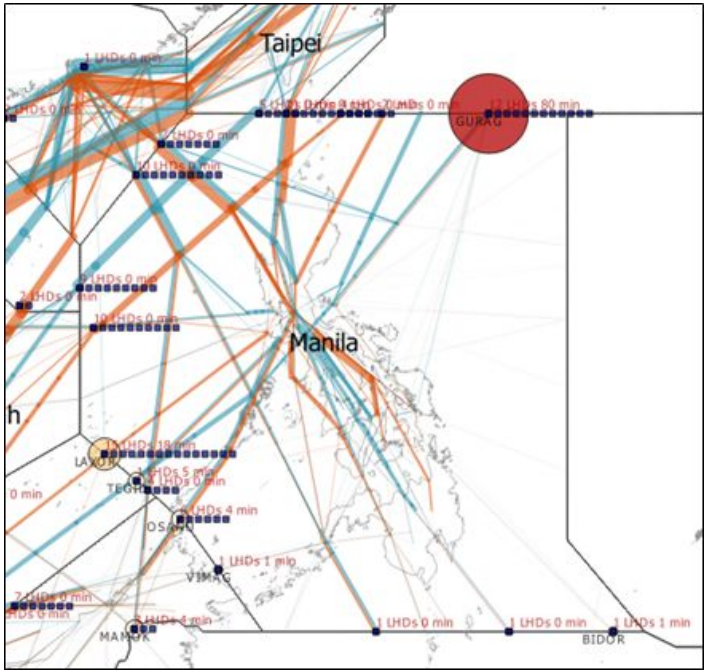
Asia : LHD Hot Spot D (Manila - Hong Kong/ Singapore/Taipei)

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

Contributing Factors : Even though Manila FIR now has much improved communication and surveillance coverage, there are still some gaps in communication and surveillance coverage along the boundaries of Manila FIR.

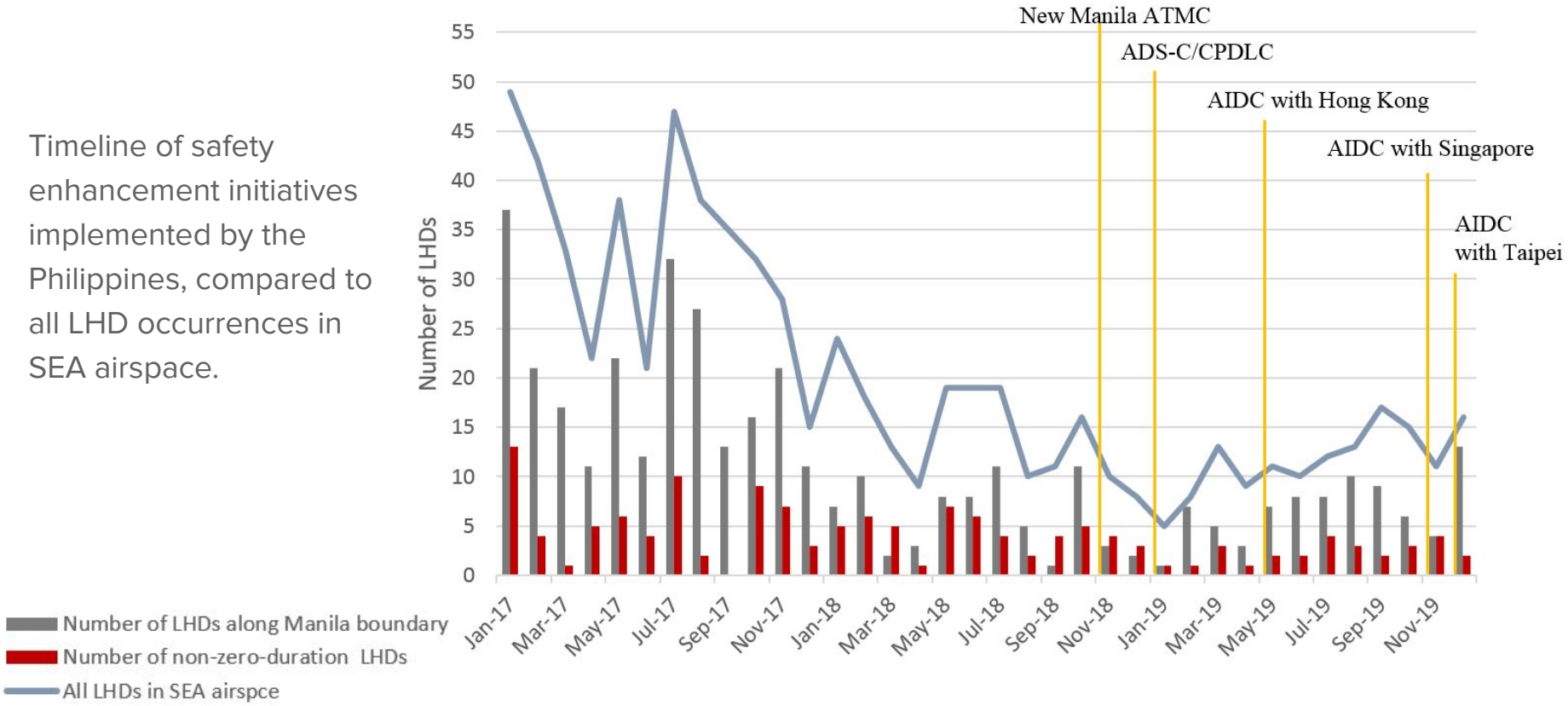
Trend : The operational risk slightly decreased in 2019. The most frequent LHDs were Category E while a number of Category F LHDs can be observed this year.

Mitigation : In November 2018, the Manila ACC upgraded to the new ATM system. This upgrade included the enhanced capabilities of VHF radio, radar and ADS-B coverage, and allowed ATC workload to be split into more sectors. In 2019, ADS-C/CPDLC in oceanic airspace, AIDC with Hong Kong, Singapore and Taipei FIRs were implemented. Further improvements are planned and presented to RASMAG/24 and 25 by the Philippines' representatives.



Asia : LHD Hot Spot D (Manila - Hong Kong/ Singapore/Taipei)

Timeline of safety enhancement initiatives implemented by the Philippines, compared to all LHD occurrences in SEA airspace.

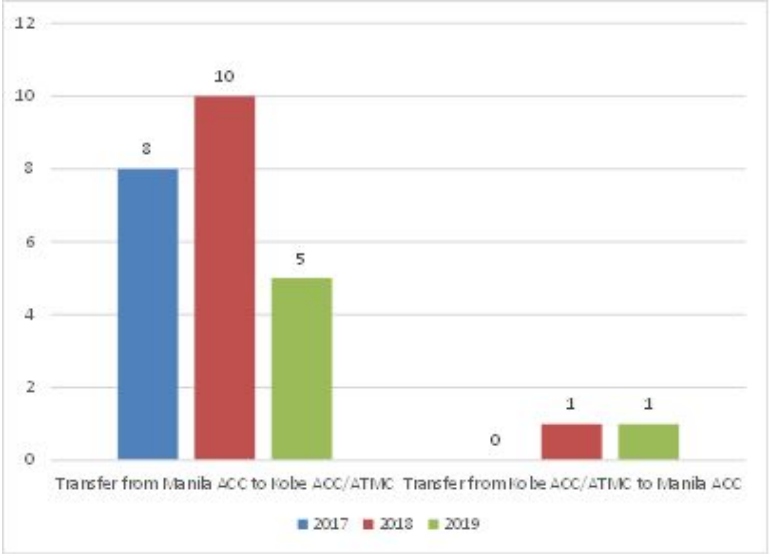


Asia : LHD Hot Spot D (Manila - Fukuoka)

Nature of Occurrences : Transfer error

Contributing Factors : There were six Category-E LHD events, five transfer errors from Manila ACC to Kobe ACC and one transfer error from Kobe ACC to Manila ACC. All factors were forgetting to send revised transfer information of altitude.

Trend : The number of the category E LHD events decreased from 2018 in 2019.



Mitigations :

- LHD Preventive/Mitigation Measures presented by the Philippines at the RASMAG/24
- Timely LHD information sharing between Kobe ACC/ATMC and Manila ACC

Asia : LHD Hot Spot E (Lahore – Urumqi)

Nature of Occurrences : Transfer Error

Contributing Factors : The category E LHDs reported in this area were mainly due to COM deficiencies between China and Pakistan

Trend : Urumqi and Lahore FIR has confirmed that the communication and surveillance ability has been enhanced and the number of LHDs is reducing year by year. There was only one LHD reported due to coordination error occurred in 2018 and 2019.

Mitigation : In order to address the issue and develop a solution to the identified COM deficiencies between China and Pakistan, the Communication (COM) coordination meeting between China and Pakistan hosted by ICAO Regional Office organized in May 2015 at headquarters of ATMB, Beijing, China. After that, Xinjiang regional ATMB established a VHF station with 2 channels and an ADS-B station at Taxkorgan in 2015 and an ADS-B station at Shache airport in 2017. Now the signal coverage for PURPA of communication and surveillance has been greatly enhanced.

Proposed to be re-classified as a non-hot spot

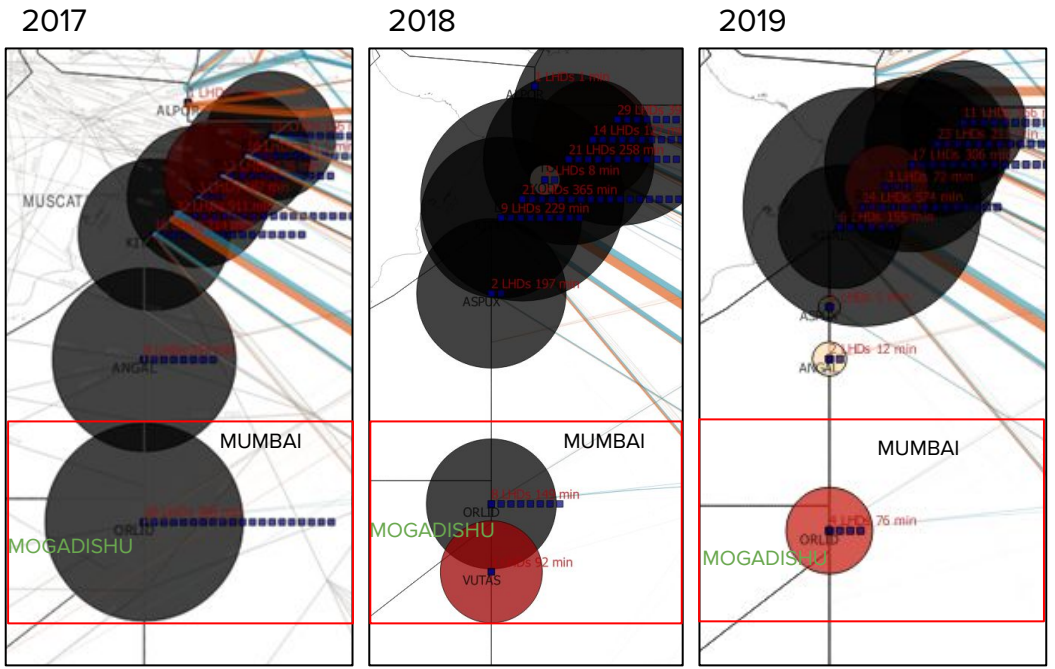
Asia : LHD Hot Spot F (Mogadishu – Mumbai)

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

Contributing Factors : The interface of Mogadishu FIR and Mumbai FIR (Waypoint: ORLID, Route: G450) is in oceanic airspace, which has poor communication and surveillance coverage. Most of LHDs were in Category E (Negative transfer and FL information in transfer estimates was incorrect).

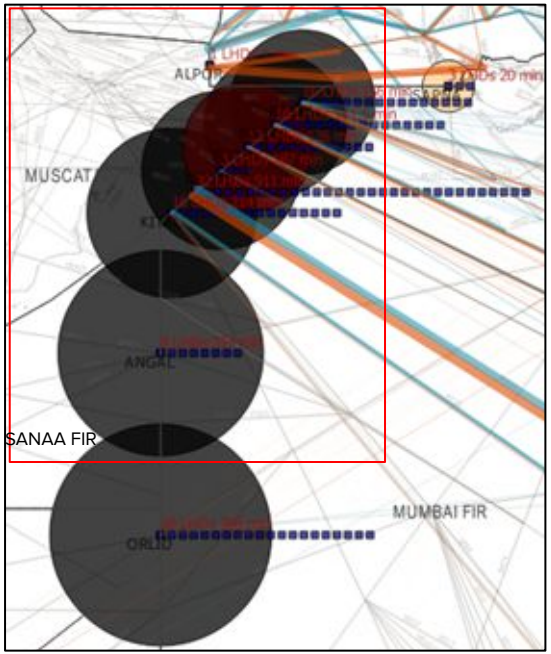
Trend : The number of LHDs and operational risk significantly decreased in 2018 and 2019.

Mitigation : AIDC implementation and surveillance coverage enhancement are recommended to help reduce and mitigate the LHDs.

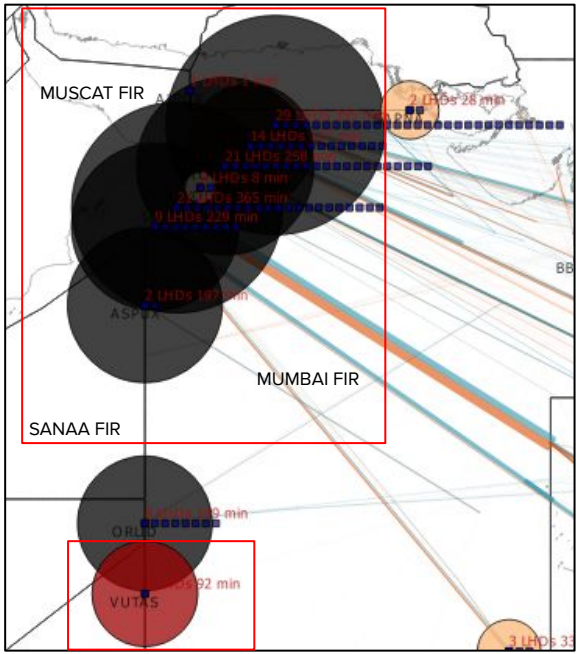


Asia : LHD Hot Spot G (Sanaa/Muscat – Mumbai)

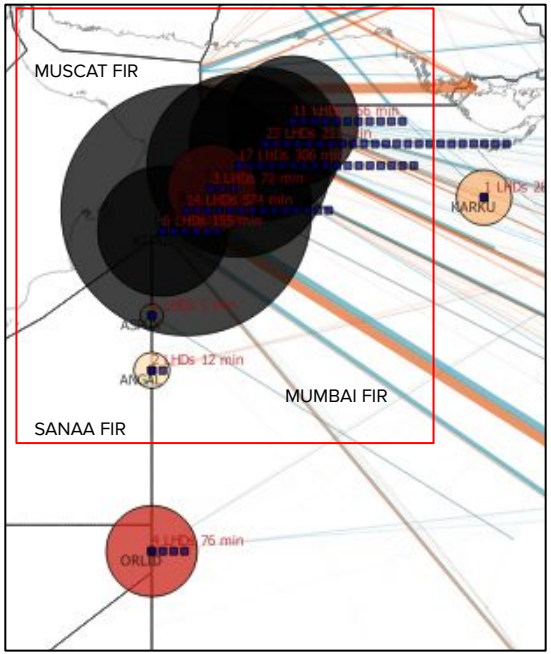
2017



2018



2019



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

Nature of Occurrences : Coordination errors as a result of human factors issues. (Cat E - Negative transfer and wrong FL in the transfer)

Contributing Factors : The interfaces of Sanaa/Muscat and Mumbai FIR are oceanic airspace with poor communication and surveillance coverage. Therefore, long duration LHDs were still prevalent on these interfaces.

There was also an effect from Pakistan airspace closure during 27 February to 16 July 2019 rerouting traffic to Muscat FIR with L301 (RASKI waypoint) as the closest route next to the Pakistani border.

Trend : The number of LHDs and operational risk at Mumbai-Muscat interface decreased slightly from 2017 to 2019. However, the number of LHDs and operational risk are still very high comparing to other areas.

Risk at Mumbai-Sanaa interface decreased significantly from the previous years.

Interface	Operational Risk (x 10^{-9} FAPFH)		
	2017	**2018**	**2019**
Mumbai-Muscat	32.82	30.38	24.71
Mumbai-Sanaa	6.25	2.28	0.20
Total	**39.07**	**32.66**	**24.91**

Mitigation : AIDC trials were conducted in 2018 and Mumbai awaiting response from Muscat. Meanwhile information sharing and video conference between Mumbai and Muscat ATCOs are being conducted to reduce the coordination errors. Space-based ADS-B could help mitigate the duration of LHDs.

Asia : LHD Hot Spot H (Guangzhou – Wuhan)

Nature of Occurrences : Communication failure.

Contributing Factors : Flight crews were unable to establish normal air-ground communications with the responsible ATS unit.

Trend : The number of communication failure events have greatly reduced, especially the long duration events. The communication failure event without flight level change has not been considered as LHD events since RASMAG23 meeting.

Mitigation : China RMA has conducted a number of investigations and a series of Scrutiny Group meetings with representatives from China RMA, ATMB, regional ATMBs, and China Airline Pilots Association. CAAC issued CCAR-129R1 on 18 December 2017, adding the mandatory requirement for foreign flight crews to keep monitoring the VHF emergency frequency 121.5MHz. Moreover, China RMA is cooperating with IATA and has established investigation mechanism for the foreign airlines.

Proposed to be re-classified as a non-hot spot (ref. a separate paper by China RMA)

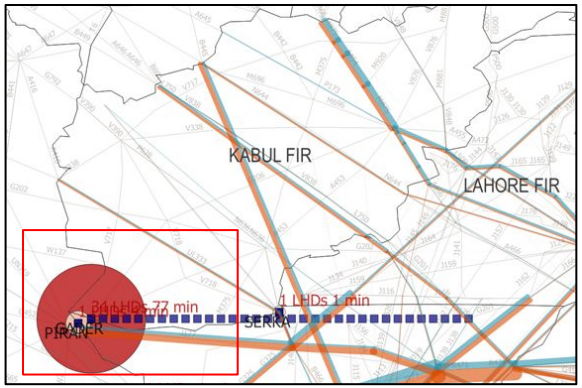
Asia : LHD Hot Spot I (Karachi – Kabul)

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

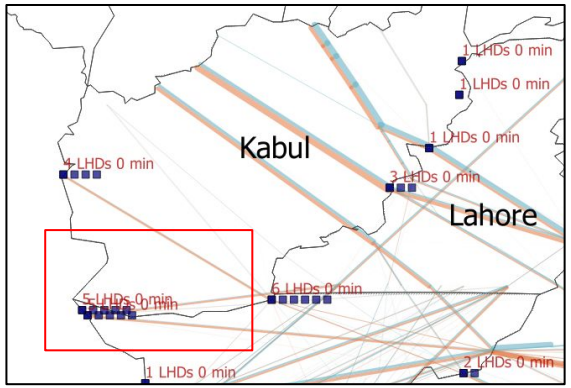
Contributing Factors : The A453 route segment between GADER and PIRAN is a short distance and involves Kabul, Karachi, and Tehran FIR. Thus, the aircraft transfer in this area was rather complicated.

Trend : The number of LHDs and risk between Karachi and Kabul FIR significantly decreased from 2017 to 2019.

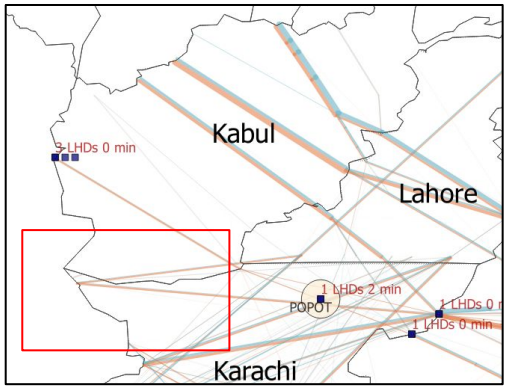
2017



2018



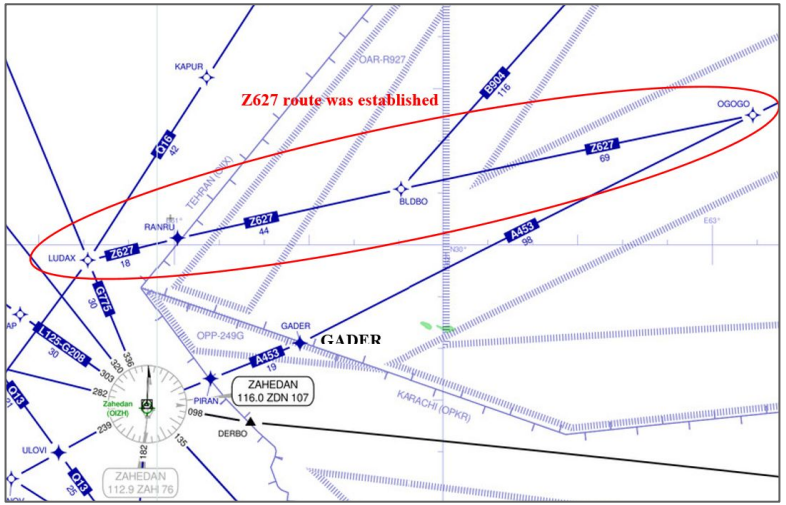
2019



Asia : LHD Hot Spot I (Karachi – Kabul)

Mitigation : The new route, Z627, between Tehran FIR to Kabul FIR was established in July 2019. Since then, the traffic, the number of LHDs and the risk at GADER on route A453 has significantly decreased. The complication of handling an aircraft among the 3 units is avoided.

Proposed to be re-classified as a non-hot spot from the improved situation in 2018 and 2019.



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

Nature of Occurrences : In 2019, there were 21 reports of LHDs
- 18 are coordination errors between Singapore and Jakarta
- 3 are coordination errors between Kota Kinabalu and Jakarta

Contributing Factors :
- The majority of the LHDs involved not revising FL change to the accepting ACC (both Jakarta and Singapore) due to having multiple changes in flight levels so as to facilitate optimal flight level safely.
- Roughly half of the occurrences involving transfers to Singapore ACC are negative transfers.
- Three occurrences involved route deviations due to weather.

Trend : The number of LHDs in 2019 stay roughly the same as in 2018.

Transferring → Accepting	Non-Zero-Duration LHDs		All LHD Reports	
	2018	2019	2018	2019
Singapore → Jakarta	5	**11**	5	**11**
Jakarta → Singapore	5	**1**	16	**7**
Jakarta → Kota Kinabalu	1	**0**	4	**3**

Mitigations :
- Continual proactive safety awareness and lesson sharing, minimise last minute revision of flight levels near the boundary to prevent revision errors.
- Use of surveillance to detect incorrect flight levels well in advance before boundary.
- AirNav Indonesia have reached out to SEASMA via AAMA to collaborate on developing additional mitigating measures to reduce coordination errors. This discussion has been put on hold as a result of the COVID-19 pandemic.

Asia : LHD Hot Spot K (Jakarta – Ujung Pandang)

Nature of Occurrences : In 2019, there were five reports of LHDs, all involving coordination errors as a result of human factors issues. The majority of these involved the incorrect level information being passed. One LHD involved a readback error by Jakarta ATC, which was not detected by Ujung Pandang ATC. The majority of the LHDs occurred at TAVIP.

Contributing Factors : Contributing factors included readback errors and late revision of flight level.

Trend : There was a slight increase of LHDs in 2019, with one in 2018 and three in 2017.

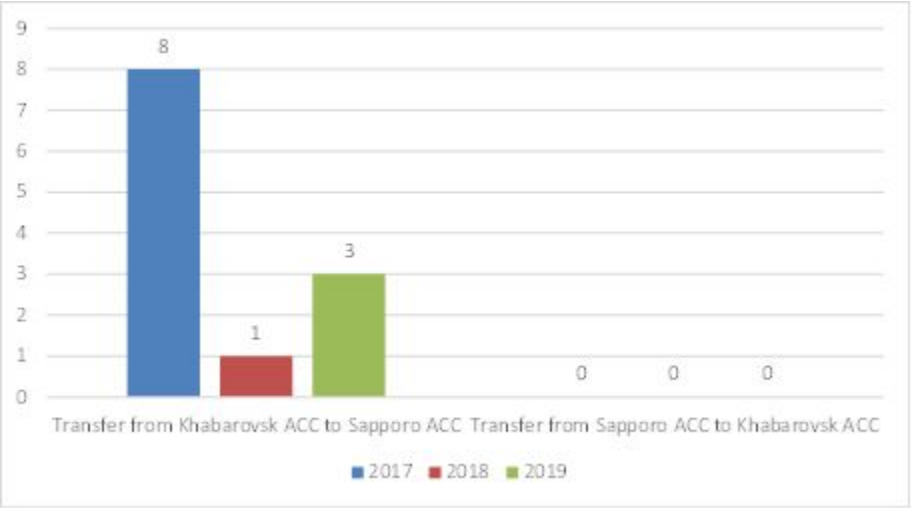
Mitigation : AirNav Indonesia reports on contributing factors/causes, possible mitigations, target date for these mitigations, progress, and effectiveness to AAMA. This ongoing reporting and discussion appears to be having a positive overall effect on coordination errors in Hot Spot K.

Proposed to be re-classified as a non-hot spot

Asia : LHD Hot Spot L (Fukuoka – Khabarovsk)

Nature of Occurrences : Transfer error

Contributing Factors : There were three category E LHD events, transfer errors from Khabarovsk ACC to Sapporo ACC.
There were two factors, one was not receiving revised transfer information for altitude change, and the other was misunderstanding of transfer altitude.



Trend : There was a significant reduction of category E LHD events after 2017, but they still occurred a few times per year in 2018 and 2019.

Mitigation : Japan Civil Aviation Bureau plans to introduce the AIDC between Khabarovsk ACC and Sapporo ACC near the future.

Proposed to be re-classified as a non-hot spot from the improved situation in 2018 and 2019.

Asia : LHD Hot Spot M (Colombo – Melbourne)

Nature of Occurrences : In 2019, there was one LHD involving Hot Spot M. The occurrence was a coordination error involving incorrect readback by Melbourne ATC. Colombo ATC did not detect the incorrect readback, and the error was detected when Melbourne ATC received the first ADS-C return for the aircraft. The error was assessed as being resolved prior to entering the Melbourne FIR, and was therefore assessed as zero-duration.

Contributing Factors : Incorrect readback.

Trend : Hot spot M was newly identified as a hot spot in 2019, following three LHDs in 2017 and four LHDs in 2018. The number of LHDs involving Hot Spot M has decreased in 2019.

Mitigation : In 2017 - 2018, a number of the coordination errors between Colombo and Melbourne ATC resulted from Male ATC coordinating the incorrect level to Colombo ATC. The number of LHDs of this nature appears to have decreased.

Proposed to be re-classified as a potential non-hot spot.

Reporting Rate
of LHDs/LLDs/LLEs

2019 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	3,341	0	-	0	-	0	-	0	-
Mongolia	164,276	1	1: 164,276	0	-	1	1: 164,276	2	1: 82,138
Indonesia	1,232,871	6	1: 205,479	30	1: 41,096	1	1: 1,232,871	37	1: 33,321
China	2,458,432	19	1: 129,391	9	1: 273,159	51	1: 48,205	79	1: 31,119
SEA	3,385,767	7	1: 483,681	138	1: 24,535	7	1: 1,692,883	152	1: 22,275
Japan	1,598,660	8	1: 199,833	28	1: 57,095	41	1: 38,992	77	1: 20,762
ROK	644,602	4	1: 161,151	26	1: 24,792	4	1: 161,151	34	1: 18,959
Pacific	1,754,212	23	1: 76,270	144	1: 12,182	4 6	1: 292,368	173	1: 10,139
SW Pacific	942,831	48	1: 19,642	33	1: 28,571	20	1: 47,142	101	1: 9,335
SA/IO	3,492,377	5	1: 698,475	427	1: 8,179	7	1: 498,911	439	1: 7,955
Total	**15,677,369**	**121**	**1: 129,565**	**835**	**1: 18,775**	**138**	**1: 113,604**	**1,094**	**1: 14,330**

Reporting Rate of LHDs/LLDs/LLEs

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

Notes: - Indonesia resolved the issues with TSD collection in 2018. The flying hours and, hence, the reporting rate significantly changed in 2018.

- ROK, Pacific, and SW Pacific have significantly improved their reporting rates in 2019.

Conclusion

RVSM TLS Compliance - Vertical

- 2019 PAC vertical overall risk is 30.21 x 10^{-9} FAPFH (above the TLS) with an increasing trend since 2016 from the improved reporting culture.
- 2019 ASIA vertical overall risk is 12.88 x 10^{-9} FAPFH (above the TLS) with a decreasing trend since 2017 from various safety improvement initiatives.

RVSM TLS Compliance - Horizontal

- 10MIN longitudinal risk estimate of Japan airspace is 20.1 x 10^{-9} FAPFH (above the TLS).
- All else are below the TLS.

Hot Spot Proposals

LHD Hot Spots

- C (Hong Kong - Guangzhou),
- E (Lahore - Urumqi),
- H (Guangzhou - Wuhan),
- I (Karachi - Kabul),
- K (Jakarta - Ujung Pandang), and
- L (Fukuoka – Khabarovsk)

are proposed to be reclassified as non-hot spots.

Reporting Rate of LHDs/LLDs/LLEs

- The reporting rate of LHDs/LLDs/LLEs is improving in general.
- DPRK: no LHD/LLD/LLE report in 2017, 2018 or 2019.
- Mongolia: the reporting rate in 2019 was significantly lower than others.
- ROK, Pacific States and SW Pacific States: the reporting rate in 2019 significantly improved.

Thank You