



ICAO

*International Civil Aviation Organization*

**Twenty-Seventh Meeting of the Regional Airspace Safety  
Monitoring Advisory Group (RASMAG/27)**

Video Teleconference, 22 – 25 August 2022

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

**MANAGEMENT PROCESS OF APAC HOT SPOTS**

(Presented by the Monitoring Agency for Asia Region)

**SUMMARY**

The process of identifying, monitoring and removing Large Height Deviation (LHD) hot spots had been developed informally over several years to gear RASMAG's focus towards areas that should require special attention. To fulfill RASMAG Action Item 26/5, the RASMAG Monitoring Agency Working Group (MAWG) agreed to conduct a trial on the drafting process in 2022 for consideration by RASMAG/27.

**1. INTRODUCTION**

1.1 To meet its objectives, the RASMAG has been reviewing airspace safety performance in the Asia and Pacific (APAC) region. In 2015, the RASMAG/20 meeting decided to identify and prioritize high risk areas as LHD, LLD and LLE hot spots. These hot spots together with the analysis were reported to the APANPIRG so that specific actions could be initiated to reduce risk to an acceptable level. The EMAs, RMAs, States, and ATC units were also urged to take actions to establish scrutiny groups or alternate means to address the hot spots and present action plans and details of progress to the RASMAG.

1.2 The monitoring of operational risks as LHD, LLD, and LLE hot spots has evolved over recent years but the process has never been formally documented for RASMAG participants. During the RASMAG/26 meeting in 2020, the Chair, hence, invited the MAWG to consider drafting a formalized process of identifying, monitoring and removing hot spots for consideration by RASMAG.

**2. DISCUSSION**

2.1 To fulfill RASMAG Action Item 26/5, the RASMAG Monitoring Agency Working Group (MAWG) discussed a drafting process of identifying, monitoring and removing hot spots during its video conference in February 2022. The process was detailed in WP/07 of the RASMAG-MAWG/9 (**Attachment**). The results of trial on MAAR's data and related hot spots were also provided to demonstrate how the process would be applied to the real data set.

2.2 The MAWG agreed that the process should be conducted as a trial for 2022 before making a decision. Therefore, all monitoring agencies would try using the approach in their safety reports for RASMAG/27.

**3. ACTION BY THE MEETING**

3.1 The meeting is invited to:

- a) review the process of LHD/LLD/LLE hot spot management, as detailed in the **Attachment**;
- b) review the trial outcomes of applying the proposed process by EMAs and RMAs in their safety reports; and
- c) discuss any relevant matters as appropriate.

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**The 9<sup>th</sup> Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG) Monitoring Agency Working Group (MAWG/9)**

Video Teleconference, 14 – 18 February 2022

**Agenda Item 4: EMA/RMA Safety Monitoring**

**MANAGEMENT PROCESS OF HOT SPOTS FOR RASMAG**

(Presented by MAAR)

**SUMMARY**

The process of identifying, monitoring and removing Large Height Deviation (LHD) hot spots had been developed informally over several years to gear RASMAG's focus towards areas that should require special attention. To fulfill RASMAG Action Item 26/5, this paper proposes a process of identifying, monitoring and removing LHD hot spots for Asia Pacific (APAC) RMAs and EMAs to review and adjust before presenting to the RASMAG.

**1. INTRODUCTION**

1.1 The objectives of the Regional Airspace Safety Monitoring Advisory Group (RASMAG) are to:

- facilitate the safe implementation of reduced separation minima and CNS/ATM applications within the Asia and Pacific Regions in regard to airspace safety monitoring; and
- assist States to achieve the established levels of airspace safety for international airspace within the Asia and Pacific Regions.

1.2 To meet these objectives, the RASMAG has been reviewing airspace safety performance in the Asia and Pacific (APAC) Regions at the regional level and within international airspace. **Table 1** shows the vertical overall risk estimates of APAC airspaces from 2013 to 2020, as an example of safety monitoring activities. The red highlight indicates that the particular vertical overall risk estimate exceeds the target level of safety of  $5 \times 10^{-9}$  FAPFH.

Airspace	Vertical Overall Risk Estimates ( $10^{-9}$ FAPFH)							
	2013	2014	2015	2016	2017	2018	2019	2020
China	1.51	5.5	3.27	4.661	27.95	1.18	1.37	7.11
Incheon	0.6	4.13	6.43	5.3	0.12	4.06	1.07	0.23
Indonesia	3.82	2.18	1.1	4.12	7.2	2.94	10.2	0
Japan	3.66	7.17	22.11	9.16	9.63	10.61	11.57	11.57
Pacific	8.05	3.86	4.3	2.12	5.74	26.46	31.41	22.04
Pyongyang	1.58	0.21	0	0.444	0	1.62	3.02	1.04
SA/IO	13.47	18.73	32.27	27.75	62.39	56.06	36.78	15.67
SEA	5.22	4.14	5.73	9.44	9.38	5.07	3.59	1.82
SW Pacific	3.43	3.01	5.22	2.8	2.1	4.84	1.37	0.017

**Table 1** The vertical overall risk estimates of APAC airspaces from 2013 to 2020.

1.3 The types of operational errors that are used for RASMAG's monitoring activities are Large Height Deviations (LHDs), Large Lateral Deviations (LLDs) and Large Longitudinal Errors

(LLEs). These are indicative of operational risks inherent in the APAC airspace. They became visible with the mature reporting culture of service providers and States. In 2015, the RASMAG/20 meeting decided to identify and prioritize high risk areas as LHD, LLD and LLE hot spots. These hot spots together with the analysis were reported to the APANPIRG so that specific actions could be initiated to reduce risk to an acceptable level. The EMAs, RMAs, States, and ATC units were also urged to take actions to establish scrutiny groups or alternate means to address the hot spots and present action plans and details of progress to the RASMAG.

1.4 **Table 2** presents the hot spots in APAC that have been identified since 2015.

Hot Spot	Involved FIRs	Responsible RMA(s) or EMA(s)	Identified Year	Status
A1	Kolkata/Chennai/Dhaka – Yangon	MAAR	2015	Cat. E LHDs reducing
A2	Chennai – Kuala Lumpur	MAAR	2015	Cat. E LHDs reducing
B	Incheon (AKARA Corridor)	PARMO, China RMA and JASMA	2015	Cat. E LHDs
C	Hong Kong – Guangzhou/Sanya	China RMA and MAAR	2015	Removed in 2020
D	Manila – all adjacent FIRs	MAAR, JASMA, PARMO and AAMA	2015	Cat. E LHDs reducing Cat. F LHDs emerging
E	Lahore – Urumqi	China RMA and MAAR	2015	Removed in 2020
F	Mogadishu – Mumbai	MAAR	2016	Cat. E LHDs
G	Sana’a/Muscat – Mumbai	MAAR	2016	Cat. E LHDs (Sanaa improved)
H	Guangzhou – Wuhan	China RMA	2015	Removed in 2020
I	Karachi – Kabul	MAAR	2018	Removed in 2020
J	Jakarta – Singapore/Kota Kinabalu	AAMA and MAAR	2018	Cat. E LHDs reducing
K	Jakarta – Ujung Pandang	AAMA	2018	Removed in 2020
L	Fukuoka – Khabarovsk	JASMA	2018	Removed in 2020
M	Colombo - Melbourne	AAMA and MAAR	2019	Potential non-hot spot
N	Oakland USA – Hawaii CEP	PARMO	2019	Cat. E LHDs increasing

**Table 2** List of LHD hot spots that had been identified since 2015

1.5 Hot Spot A1 to E as detailed in **Table 2** were the first 6 hot spots identified during the RASMAG/20 meeting in 2015. The responsible RMAs and EMAs were also identified to assist States and ANSPs of the involved FIRs to address the issues of specific hot spots. Up to present, a total of 15 hot spots were identified as A1 to N. Out of 15 hot spots, 6 hot spots were already resolved and marked as ‘Removed’ in the status column. The removal of a hot spot was usually proposed by the responsible RMA or EMA, then the RASMAG meeting agreed with the proposal after reviewing the safety analysis which showed that the risk was reduced to an acceptable level of safety for at least 2 consecutive years.

1.6 Now that the RASMAG maintains the list of LHD, LLD, and LLE hot spots as a focus of the meeting, the EMAs, RMAs, States, and ATC units are expected to present action plans and details of progress during the annual meeting.

1.7 The monitoring of operational risks as LHD, LLD, and LLE hot spots has evolved over recent years but the process has never been formally documented for RASMAG participants. During the RASMAG/26 meeting in 2020, the Chair, hence, invited the MAWG to consider drafting a formalized process of identifying, monitoring and removing hot spots for consideration by RASMAG.

## 2. DISCUSSION

2.1 Rather than relying on a single determining criterion, the current practices conducted by RASMAG make use of multiple criteria such as the geographical distribution of occurrences, the number of occurrences and the risk estimate of those occurrences. When the operational risk of a hot spot has been successfully reduced with substantial evidences for at least 2 years, the hot spot would be proposed to the RASMAG for its removal from the hot spot list.

2.2 In an attempt to formalize the management process of LHD, LLE, and LLE hot spots in APAC, the following steps are proposed.

### Identifying an LHD/LLD/LLE hot spot

2.3 Cluster Identification - the monitoring agency will explore, perhaps by plotting a map, if any occurrences are reported in close proximity (i.e. an area where the traffic flows are controlled by multiple ATS units, an area along the FIR/sector boundaries between adjacent ATS units, or an area with a specific traffic route system). This step requires a subjective judgement by the responsible monitoring agency. The identified clusters of occurrences will be determined if they fit criteria of being hot spots in the next step. The RASMAG meeting can also identify such a cluster and request the monitoring agency to investigate if it fits the hot spot criteria.

2.4 Hot Spot Criteria - the cluster of occurrences will be identified as an LHD, LLD or LLE hot spot if it fits **at least one** of the following criteria:

- a. The number of occurrences - the number of all occurrences in the cluster takes up a “relatively big portion” of the total number of occurrence reports of that specific region.

To be a “relatively big portion” in number,

$$\text{the number of occurrences in the cluster} \geq \frac{\text{the total number of occurrences in the region}}{n + 1}$$

where ‘n’ is the number of clusters in the region.

- b. The risk estimate - the sum of operational risk estimates of all occurrences in the cluster takes up a “relatively big portion” of the region’s operational risk estimate.

To be a “relatively big portion” in risk,

$$\text{the sum of operational risk of the cluster} \geq \frac{\text{the region's operational risk estimate}}{n + 1}$$

where ‘n’ is the number of clusters in the region.

- c. Exceeding the TLS - the sum of operational risk estimate of all occurrences in the cluster reaches or exceeds the overall TLS of  $5 \times 10^{-9}$  FAPFH.

2.5 There are some circumstances where LHDs, LLDs and LLEs are scattered throughout the region and, hence, a hot spot cannot be identified even though the overall TLS is exceeded. It can be

caused by a few occurrences with high operational risk. No patterns or commonalities can be found. These cases should be individually addressed, not as hot spots.

2.6 After LHD, LLD or LLE hot spots are identified, the responsible monitoring agency will report details to the RASMAG meeting for consideration. With concurrence from the RASMAG, the monitoring process of these hot spots will start.

Monitoring an LHD/LLD/LLE hot spot

2.7 The list of LHD, LLD or LLE hot spots in APAC is maintained by RASMAG with details of the involved FIRs, the 'lead' monitoring agency, the year of identification, and the current status.

2.8 During the annual RASMAG meeting, working papers or information papers are expected from the relevant States and administrations to update the meeting on the actions being taken to address each hot spot.

2.9 The 'lead' monitoring agencies are also expected to have the hot spots analysed in their safety assessment reports for the annual RASMAG meeting.

2.10 After its annual meeting, the RASMAG will report updates to the APANPIRG in a consolidated manner and, if required, request for further actions.

Removing an LHD/LLD/LLE hot spot

2.11 To remove an LHD, LLD, or LLE hot spot from the list maintained by the RASMAG, proof of mitigation and/or prevention measures should be presented to the RASMAG meeting and the implementation results should reflect the effectiveness of risk controls in terms of reduction in the number of occurrences and operational risk of the hot spot.

2.12 The risk assessment report from the responsible monitoring agency should demonstrate that the hot spot no longer satisfies any of the criteria listed in 2.4 for at least 2 consecutive years. With approval from the RASMAG meeting, the hot spot will be labelled as 'potential non-hot spot' after the first year and 'removed' after the second year. However, the RASMAG may decide to continue monitoring certain hot spots (retaining the 'potential non-hot spot' status) even if they no longer satisfy the criteria for at least 2 consecutive years when other circumstantial factors could have temporarily reduced the number of occurrences and the risk.

2.13 When a hot spot is marked as 'removed', the specific monitoring process for that particular hot spot will stop; the hot spot will be monitored under regular process.

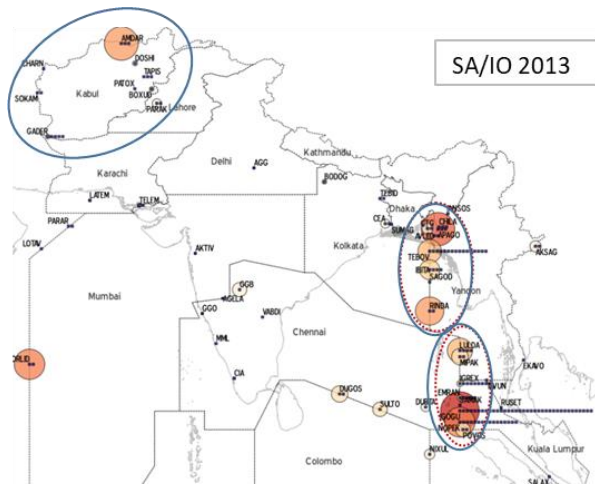
2.14 For record control purposes, the hot spot details will not be removed from the list but the status will reflect its being non-hot spots. However, the same hot spot record maybe reused if the operational errors of the same issues re-emerge in the same area.

2.15 Once finalized by the MAWG meeting, MAAR will present the draft process to the next RASMAG.

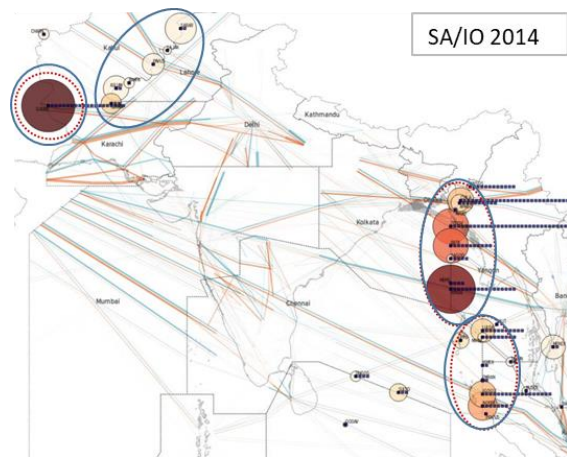
Trial #1: hot spot identification and criteria with existing hot spots

2.16 To demonstrate the proposed steps and the criteria of hot spot identification as detailed in paragraph 2.3 - 2.5, MAAR conducts a trial by applying the proposed steps and criteria to MAAR's areas of responsibility. Specifically, data from the South Asia Indian Ocean (SA/IO) region and South East Asia (SEA) region is analyzed against the proposed criteria to see how well the results correlate with the previously identified hot spots A1 (Kolkata/Chennai/Dhaka – Yangon), A2 (Chennai – Kuala Lumpur), D (Manila – all adjacent FIRs), F (Mogadishu – Mumbai), G (Sana'a/Muscat – Mumbai) and I (Karachi – Kabul).

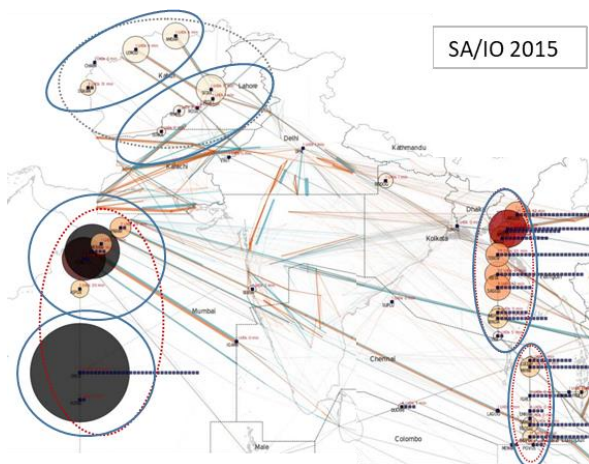
2.17 Cluster Identification - the geographical plots of LHDs in SA/IO and SEA regions between 2013 - 2020 are explored. The LHDs clusters are identified for each region and year as depicted in blue ovals in **Figure 1 - Figure 16**.



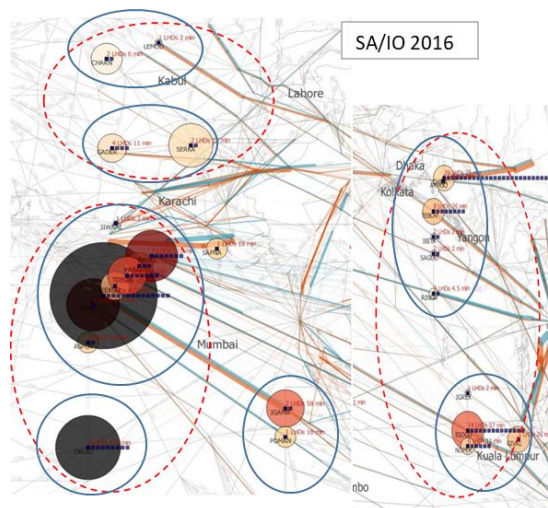
**Figure 1** SA/IO 2013 LHD clusters (blue ovals)



**Figure 2** SA/IO 2014 LHD clusters (blue ovals)



**Figure 3** SA/IO 2015 LHD clusters (blue ovals)



**Figure 4** SA/IO 2016 LHD clusters (blue ovals)

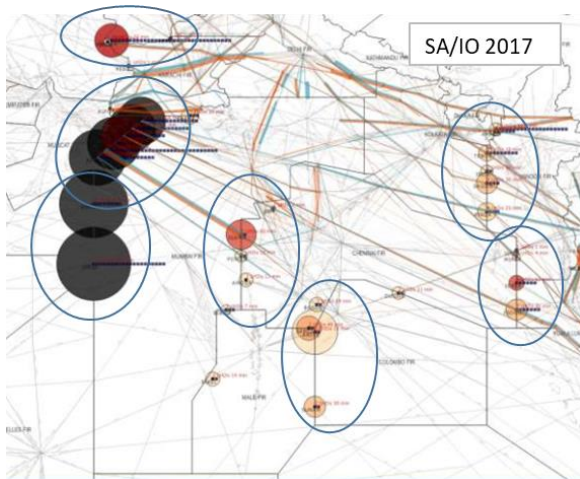


Figure 5 SA/IO 2017 LHD clusters (blue ovals)

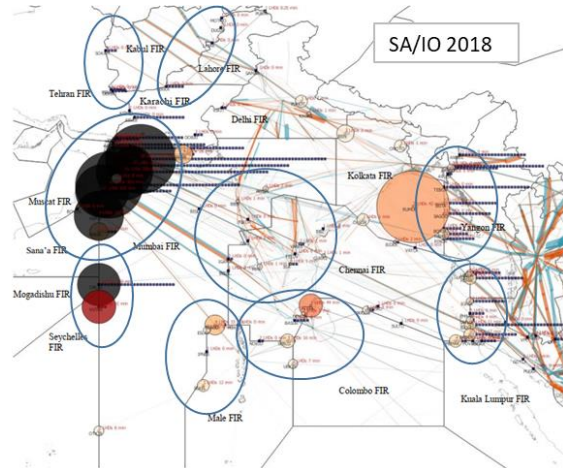


Figure 6 SA/IO 2018 LHD clusters (blue ovals)

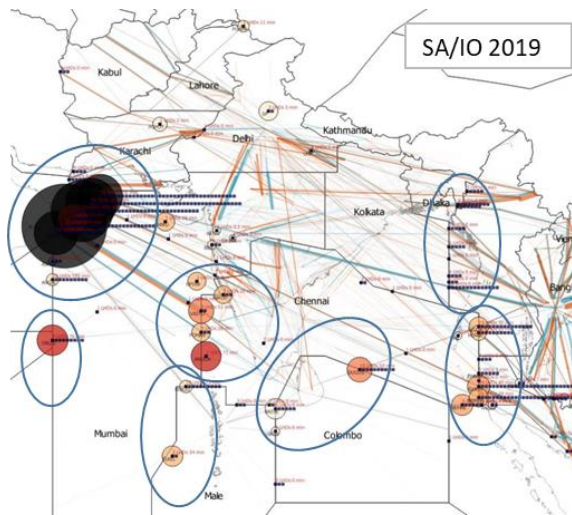


Figure 7 SA/IO 2019 LHD clusters (blue ovals)

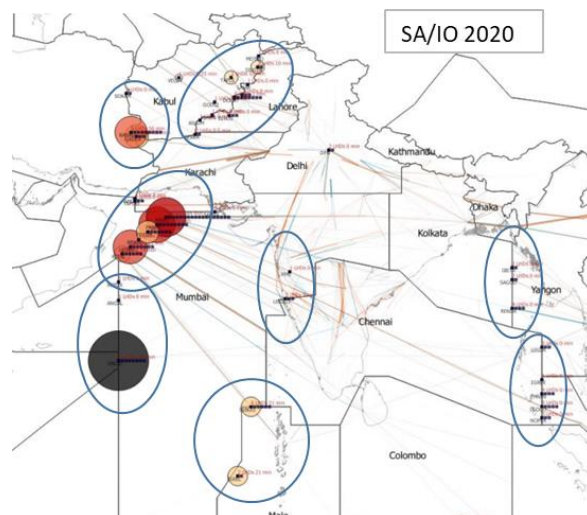


Figure 8 SA/IO 2020 LHD clusters (blue ovals)

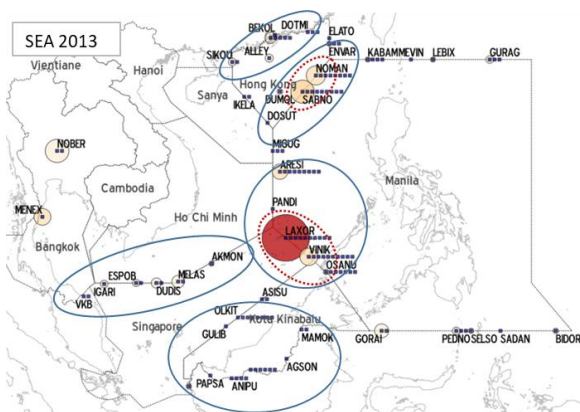


Figure 9 SEA 2013 LHD clusters (blue ovals)

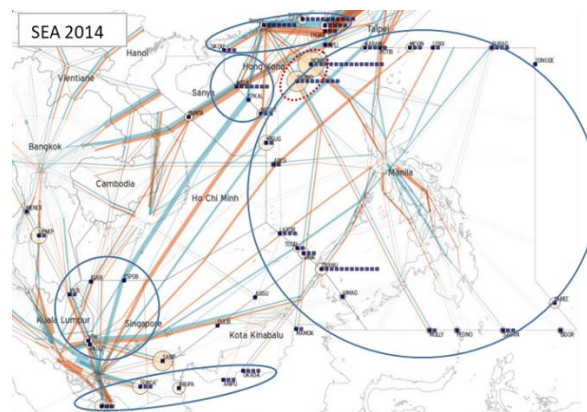


Figure 10 SEA 2014 LHD clusters (blue ovals)

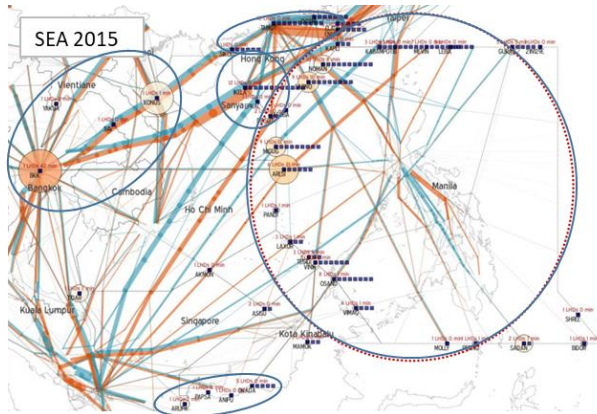


Figure 11 SEA 2015 LHD clusters (blue ovals)

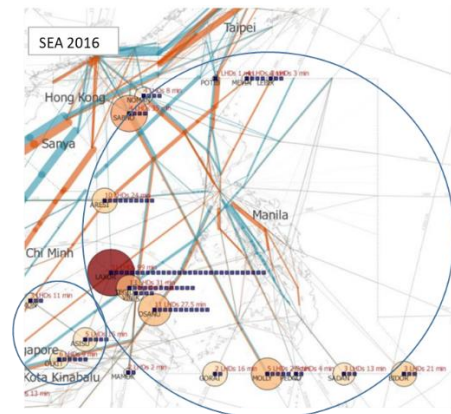


Figure 12 SEA 2016 LHD clusters (blue ovals)

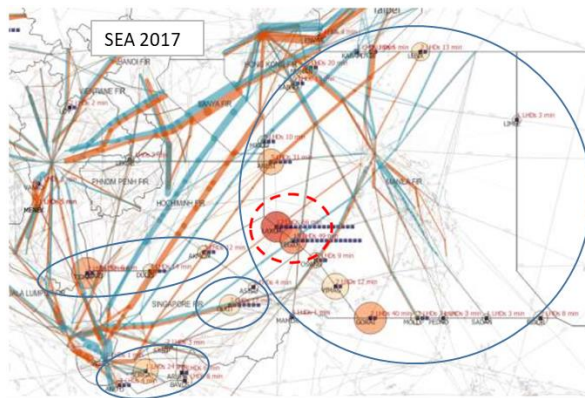


Figure 13 SEA 2017 LHD clusters (blue ovals)

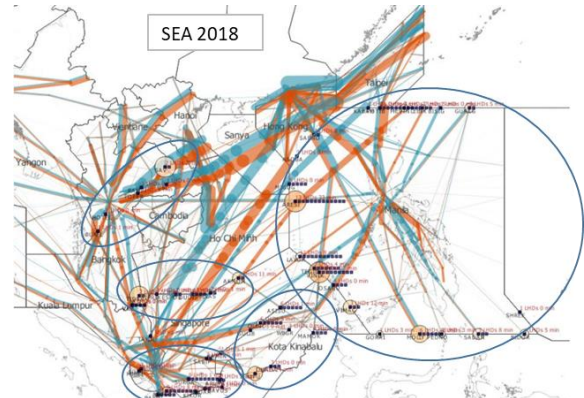


Figure 14 SEA 2018 LHD clusters (blue ovals)

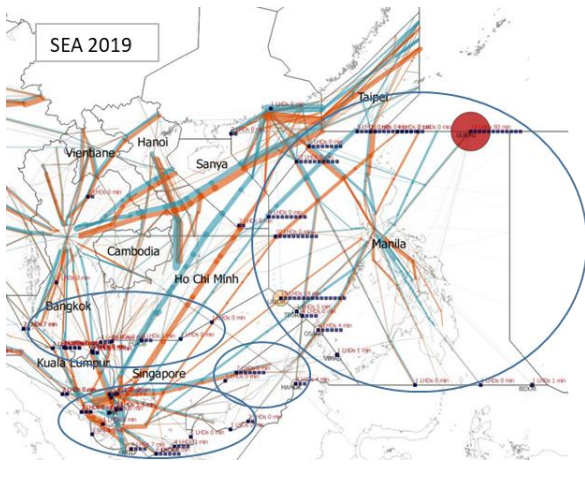


Figure 15 SEA 2019 LHD clusters (blue ovals)

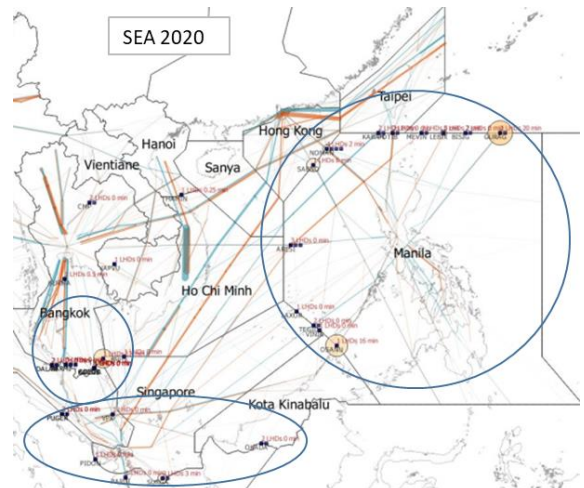


Figure 16 SEA 2020 LHD clusters (blue ovals)

2.18 The first row of **Table 3** and **Table 4** shows the number of identified LHD clusters between 2013 and 2020 for SA/IO and SEA region, respectively.

SA/IO Region	2013	2014	2015	2016	2017	2018	2019	2020
SA/IO Number of Clusters	3	4	6	7	7	9	7	8
SA/IO Number of LHDs	162	224	380	758	924	666	434	152
SA/IO Risk (x10 <sup>-9</sup> FAPFH)	12.82	17.78	31.44	26.88	61.25	55.13	35.99	15.19
Criteria: Number	40.50	44.80	54.29	94.75	115.50	66.60	54.25	16.89
Criteria: Risk (x10 <sup>-9</sup> FAPFH)	3.21	3.56	4.49	3.36	7.66	5.51	4.50	1.69
Criteria: TLS (x10 <sup>-9</sup> FAPFH)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00

**Table 3** LHD profiles of SA/IO region between 2013 - 2020 and the hot spot criteria

SAE Region	2013	2014	2015	2016	2017	2018	2019	2020
SEA Number of Clusters	5	5	5	2	4	5	4	3
SEA Number of LHDs	133	144	166	363	400	176	145	39
SEA Risk (x10 <sup>-9</sup> FAPFH)	4.41	2.98	4.25	8.25	7.96	3.92	2.09	1.42
Criteria: Number	22.17	24.00	27.67	121.00	80.00	29.33	29.00	9.75
Criteria: Risk (x10 <sup>-9</sup> FAPFH)	0.74	0.50	0.71	2.75	1.59	0.65	0.42	0.36
Criteria: TLS (x10 <sup>-9</sup> FAPFH)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00

**Table 4** LHD profiles of SEA region between 2013 - 2020 and the hot spot criteria

2.19 Hot Spot Criteria - There are 3 criteria to check if the identified clusters can be considered as hot spots. The first criteria, the number of occurrences of a cluster, is calculated by the formula in 2.4 (a) and shown in the fourth rows, labelled as 'Criteria: Number', of **Table 3 and Table 4**. The second criteria, the risk estimate of a cluster, is calculated by the formula in 2.4 (b) and shown in the fifth rows, labelled as 'Criteria: Risk', of **Table 3 and Table 4**. The third criteria, exceeding TLS, is compared against the constant value of 5 x10<sup>-9</sup> and shown in the sixth rows, labelled as 'Criteria: TLS', of **Table 3 and Table 4**.

2.20 **Table 5** shows the number of LHDs and the risk of the previously identified hot spots as well as the results of checking against the criteria. A 'Negative' result means that the cluster does not satisfy that particular criterion. Conversely, a 'Positive' result means that the cluster satisfies that particular criterion and can be identified as a hot spot. The results from applying the process are detailed in **Table 5**, indicating that:

- Hot Spot A1 fits the hot spot criteria from 2014 to 2019;
- Hot Spot A2 fits the hot spot criteria from 2015 to 2019;
- Hot Spot D fits the hot spot criteria from 2013 to 2020;
- Hot Spot F fits the hot spot criteria in 2015, 2017, 2018 and 2020;
- Hot Spot G fits the hot spot criteria from 2015 to 2020; and
- Hot Spot I fits the hot spot criteria in 2017 and 2020. (This hot spot might be marked as 'removed' from being a hot spot in 2019 from applying this process.)

Hot Spot A1 (SA/IO)	2013	2014	2015	2016	2017	2018	2019	2020
Number of LHDs	-	134	195	246	165	168	59	8
Check Criteria: Number	-	Positive	Positive	Positive	Positive	Positive	Positive	Negative
Risk	-		6.81	1.07	2.04	0.6	0.31	0
Check Criteria: Risk	-	Negative	Positive	Negative	Negative	Negative	Negative	Negative
Check Criteria: TLS	-	Negative	Positive	Negative	Negative	Negative	Negative	Negative

Hot Spot A2 (SA/IO)	2013	2014	2015	2016	2017	2018	2019	2020
Number of LHDs	-	44	115	280	200	107	104	16
Check Criteria: Number	-	Negative	Positive	Positive	Positive	Positive	Positive	Negative
Risk	-		0.85	2.07	0.93	0.72	1.6	0
Check Criteria: Risk	-	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Check Criteria: TLS	-	Negative	Negative	Negative	Negative	Negative	Negative	Negative

Hot Spot D (SEA)	2013	2014	2015	2016	2017	2018	2019	2020
Number of LHDs	75	73	60	254	156	148	99	24
Check Criteria: Number	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive
Risk	-	-	3.8	5.87	5.17	2.72	1.74	1.05
Check Criteria: Risk	-	-	Positive	Positive	Positive	Positive	Positive	Positive
Check Criteria: TLS	-	-	Negative	Positive	Positive	Negative	Negative	Negative

Hot Spot F (SA/IO)	2013	2014	2015	2016	2017	2018	2019	2020
Number of LHDs	2	0	31	9	21	24	9	8
Check Criteria: Number	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Risk	-	-	11.57	3.11	7.28	5.13	0.74	4.8
Check Criteria: Risk	-	-	Positive	Negative	Negative	Negative	Negative	Positive
Check Criteria: TLS	-	-	Positive	Negative	Positive	Positive	Negative	Negative

Hot Spot G (SA/IO)	2013	2014	2015	2016	2017	2018	2019	2020
Number of LHDs	3	0	16	114	85	170	157	50
Check Criteria: Number	Negative	Negative	Negative	Positive	Negative	Positive	Positive	Positive
Risk	-	-	6.09	14.6	39.07	32.66	24.91	6.37
Check Criteria: Risk	-	-	Positive	Positive	Positive	Positive	Positive	Positive
Check Criteria: TLS	-	-	Positive	Positive	Positive	Positive	Positive	Positive

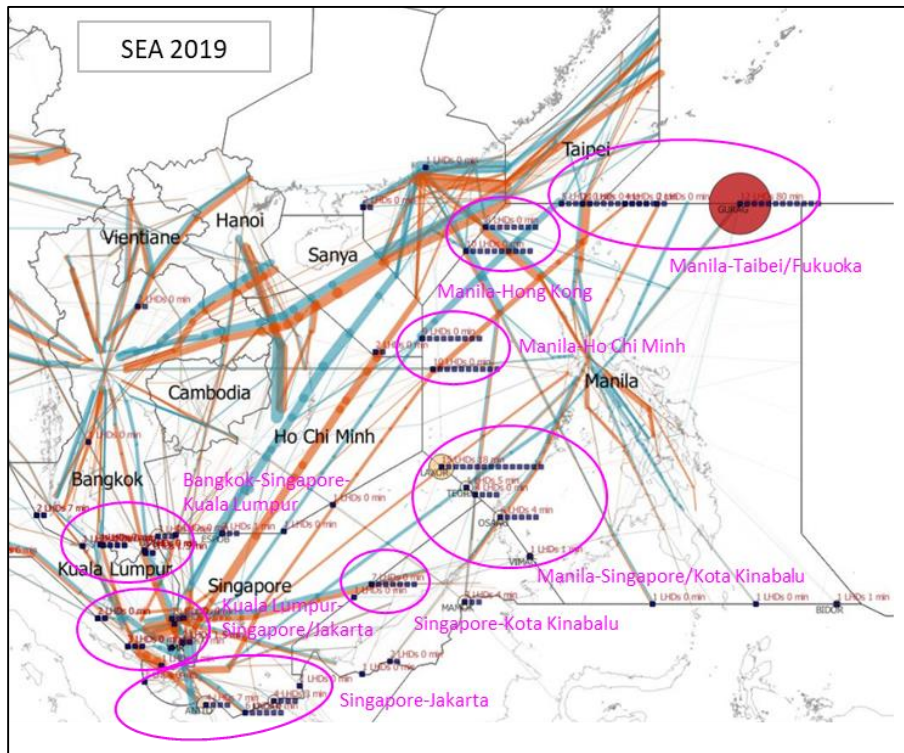
Hot Spot I (SA/IO)	2013	2014	2015	2016	2017	2018	2019	2020
Number of LHDs	-	20	9	9	123	10	0	12
Check Criteria: Number	-	Negative	Negative	Negative	Positive	Negative	Negative	Negative
Risk	-	-	-	-	1.57	0	0	2.11
Check Criteria: Risk	-	-	-	-	Negative	Negative	Negative	Positive
Check Criteria: TLS	-	-	-	-	Negative	Negative	Negative	Negative

**Table 5** The results of checking against the hot spot criteria for LHD Hot Spots A1, A2, D, F, G and I

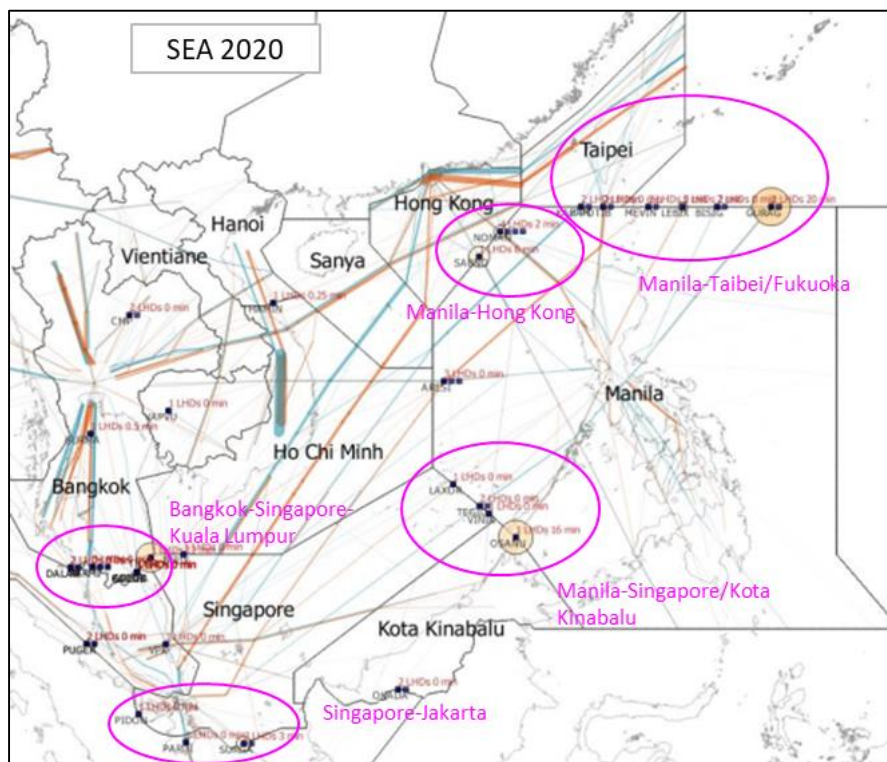
Trial #2: hot spot identification and criteria (clusters at the interface level)

2.21 It can be observed that **Table 5** only focuses on the already identified hot spots as listed in **Table 2**. On one hand, the proposed process seems to agree with what the RASMAG is doing. On the other hand, the number and the shape of clusters in trial #1 can be biased. And there can be other hot spots being overlooked. Another trial is conducted as an example for the SEA region between 2019 and 2020.

2.22 As shown in **Figure 17** and **Figure 18**, the LHD clusters are re-identified at the FIR interface levels without considering the already identified hot spots. The number of clusters in SEA region increases from 4 to 8 in 2019 and from 3 to 5 in 2020.



**Figure 17** SEA 2019 LHD clusters (magenta ovals), re-identified at interface level



**Figure 18** SEA 2020 LHD clusters (magenta ovals), re-identified at interface level

2.23 **Table 6** shows the LHD profile of SEA region between 2019 and 2020 with the updated clusters and criteria.

SAE Region	2019	2020
SEA Number of Clusters	8	5
SEA Number of LHDs	145	39
SEA Risk (x10 <sup>-9</sup> FAPFH)	2.09	1.42
Criteria: Number	16.11	6.50
Criteria: Risk (x10 <sup>-9</sup> FAPFH)	0.23	0.24
Criteria: TLS (x10 <sup>-9</sup> FAPFH)	5.00	5.00

**Table 6** LHD profile of SEA region in 2019 - 2020, updated with new clusters and criteria

2.24 **Table 7** and **Table 8** show the number of LHD and risk of each clusters which are re-identified at the interface level. The risk criteria are also re-calculated. The results from applying the process indicates that:

- the northern and eastern interfaces of Manila FIR satisfy the hot spot criteria in 2019 and 2020;
- the Bangkok-Singapore/Kuala Lumpur interface satisfy the hot spot criteria in 2019 and 2020;
- all other interfaces among Singapore, Jakarta, Kuala Lumpur and Kota Kinabalu do not satisfy the hot spot criteria in 2019 and 2020.

2019 Clusters (SEA)	Manila-Singapore/ Kota Kinabalu	Manila-Taibei/ Fukuoka	Manila-Hong Kong	Manila-Ho Chi Minh	<i>Singapore-Jakarta</i>	Bangkok-Singapore/ Kuala Lumpur	<i>Kuala Lumpur-Singapore/ Jakarta</i>	<i>Singapore-Kota Kinabalu</i>
Number of LHDs	28	31	17	20	14	13	12	9
Check Criteria: Number	Positive	Positive	Positive	Positive	Negative	Negative	Negative	Negative
Risk	0.36	1.36	0	0	0.17	0.32	0	0.02
Check Criteria: Risk	Positive	Positive	Negative	Negative	Negative	Positive	Negative	Negative
Check Criteria: TLS	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative

**Table 7** The results of checking against the hot spot criteria for 2019 LHD clusters in SEA region

2020 Clusters (SEA)	Manila-Singapore/ Kota Kinabalu	Manila-Taibei/Fukuoka	Manila-Hong Kong	<i>Singapore-Jakarta</i>	Bangkok-Singapore/ Kuala Lumpur
Number of LHDs	5	8	5	4	9
Check Criteria: Number	Negative	Positive	Negative	Negative	Positive
Risk	0.37	0.49	0.19	0.07	0.28
Check Criteria: Risk	Positive	Positive	Negative	Negative	Positive
Check Criteria: TLS	Negative	Negative	Negative	Negative	Negative

**Table 8** The results of checking against the hot spot criteria for 2020 LHD clusters in SEA region

2.25 The results of the second trial demonstrate that the criteria remain effective for Hot Spot D (Manila FIR interfaces) even when all other clusters at the interfaces among Singapore, Jakarta, Kuala Lumpur and Kota Kinabalu (in *italics*) are excluded. Interestingly, the process also identifies a new LHD hot spot at the Bangkok-Singapore/Kuala Lumpur interface in both years.

**3. ACTION BY THE MEETING**

3.1 The meeting is invited to:

- a) review the proposed process of LHD/LLD/LLE hot spot management in paragraph 2.3 - 2.14; and
- b) discuss other relevant matters as appropriate.

— END —