



ICAO

International Civil Aviation Organization

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

Video Teleconference, 22 – 25 August 2022

Agenda Item 4: Airspace Safety Monitoring Documentation and Regional Guidance Material

LHD MATERIAL PACKAGE 2022

(Presented by the Monitoring Agency for Asia Region)

SUMMARY

This paper presents consolidated LHD material as a package to capture the current situation of LHD reporting process. This package includes LHD frequently asked questions (FAQ), LHD taxonomy, LHD reporting form, and LHD point of contacts (POC).

1. INTRODUCTION

1.1 ICAO Doc9574 RVSM Implementation Manual section 6.4 specifies that ATC authorities are responsible for reporting Large Height Deviations (LHD) to the responsible Regional Monitoring Agency (RMA). The RMA will use this information to assess the overall risk of RVSM airspace as LHDs are main contributing factors to the risk of mid-air collision.

1.2 Over years of safety promotion by States, ATC authorities, and RMAs, there were many changes in personnel, procedures, and circumstances. Ambiguous LHD events were raised and clarified. LHD taxonomy was redefined. The LHD reporting and analysis forms were adopted for use with the region. The 'LHD Material Package 2016' was created to consolidate LHD material as a package to capture the current situation of LHD reporting process. The 2016 package included LHD frequently asked questions (FAQ), LHD taxonomy, LHD reporting form, and LHD point of contacts (POC).

2. DISCUSSION

2.1 During its teleconference in February 2022, the RASMAG Monitoring Agencies Working Group (MAWG) decided that the LHD Material Package should be reviewed and presented to the RASMAG as it would help States and ANSPs better understand the LHD definition, criteria, and the reporting process.

2.2 **Attachment 1** to this paper is the LHD frequently asked questions (LHD FAQ). It is intended to promote a common understanding of LHD in one page. The questions and answers which are updated in the 2022 version are:

2.2.1 Q: What is the benefit of LHD reporting while it may be perceived as additional workload by some units?

A: Reporting safety significant occurrences is a key process of a good safety management system since it enables an organization to have the necessary information to be able to manage the associated risk. LHDs are considered 'hazards' in the RVSM airspace as they

could potentially lead to a catastrophic outcome - a mid-air collision. Do not fall into a trap where we get too comfortable with the risk just because nothing has not happened yet.

2.2.2 Q: A controller does not receive a transfer or the appropriate revision of the transfer of an aircraft from the transferring unit, but surveillance system enables the accepting controller to determine the location of the incoming aircraft well before the Transfer-of-Control (TOC) point, allowing the accepting controller to call the transferring controller back to confirm the aircraft's intent. Should this incident be reported?

A: Yes. Although such occurrences typically do not contribute to the quantitative estimate of risk, these occurrences should still be reported as LHDs to the responsible RMA. Even though the individual event has been mitigated, those errors were still made by the transferring ACC unit. With our online LHD reporting system, such an occurrence will be notified to the transferring ACC unit's POC. If such occurrences are not reported, then the transferring ACC unit would not have known about these transfer errors. States are strongly encouraged to collaborate with their neighboring ACC to prevent such occurrences in the future.

2.2.3 Q: The traffic doesn't arrive at the transferred time. The controller calls the transferring unit to get an updated transferred time. Should this occurrence be reported?

A: Yes, but it should be reported to your designated Enroute Monitoring Agency (EMA). If the time difference is big, such an occurrence would be an LHD; the EMA will relay the report to the RMA

2.3 **Attachment 2** to this paper is the LHD taxonomy. It provides a comprehensive list of generic LHD classification. It was revised by MAWG/6 and later presented RASMAG/24 in 2019.

2.4 **Attachment 3** to this paper is the LHD reporting form. This form remains unchanged since March 2016. However, many States/ATSPs in APAC have been using the online LHD reporting system starting November 2016. Please contact your RMA for the preferred options to report LHDs.

2.5 **Attachment 4** to this paper is the current LHD point of contacts (POC) of ATS units within MAAR's area of responsibility. The list of LHD POC is an example how each ATS unit can directly get in touch and share LHD information among themselves, as many LHD resolutions require collaboration between units. If interested and agreed by the RASMAG/27 meeting, the list can be expanded to include all LHD POC of ATS units within and adjacent to the Asia Pacific Region so that each unit would have a direct contact with one another.

2.6 **Attachment 5** to this paper is the Cross-Boundary LHD coordination procedure. To ensure that there is coordination between the two involving ATS units to uncover the cause and prevent future occurrences, the following additional coordination procedure is recommended for every LHD occurrence that involves another ATS unit.

2.7 **Attachment 6** to this paper is the LHD Analysis Form (Form A). Form A aims to assist States / ATSPs to understand the underlying root causes of LHDs in order to develop safety mitigations to prevent reoccurrence.

2.8 **Attachment 7** to this paper is the LHD Preventative/Mitigation Measures Form (Form B). Form B aims to assist States / ATSPs to keep track of the mitigation measures which are identified and planned, as well as the effectiveness of those measures.

2.9 Any changes to the LHD package will be updated to the RASMAG meeting.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information contained in this paper and all attachments;
- b) consider distributing the LHD FAQ (**Attachment 1**) to promote LHD reporting among relevant units;
- c) consider the scope of the LHD point of contacts (**Attachment 4**) if needed to expand for all Asia Pacific Region, and update the point of contact, if necessary;
- d) consider the application of the Cross-Boundary LHD coordination procedure (**Attachment 5**) with the LHD Point of contacts; and
- e) consider adopting the LHD Analysis Form (**Attachment 6**) and the LHD Preventative/Mitigation Measures Form (**Attachment 7**) especially for those LHDs of long-duration or LHD hot spots, and presenting progress to the RASMAG.

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LHD FAQs (Large Height Deviation Frequently-Asked-Questions)

General

Q: What is an LHD?

A: An RVSM Large Height Deviation (LHD) is defined as any vertical deviation of 300 feet (90 m.) or more from the flight level expected to be occupied by the flight. The deviation may be the result of any operational error or technical condition affecting the flight and includes any operational error that causes the aircraft to be at a location (position and/or time) that is unexpected by the controller.

In other words, an LHD occurs when a controller expects an aircraft to be at one location, but the aircraft is actually at another location.

Q: Why States are required to submit LHD report?

A: ICAO Doc9574 RVSM Implementation Manual section 6.4 specifies that ATC authorities are responsible to report LHD for any reason to their responsible RMA for collision risk assessment.

Q: How does an LHD contribute to mid-air collision risk?

A: An aircraft occupies space unexpected by a controller. Not knowing that the space is occupied, the controller may clear another aircraft to that location, which may cause a mid-air collision.

Q: What is the benefit of LHD reporting while it may be perceived as additional workload by some units?

A: Reporting safety significant occurrences is a key process of a good safety management system since it enables an organization to have the necessary information to be able to manage the associated risk. LHDs are considered 'hazards' in the RVSM airspace as they could potentially lead to a catastrophic outcome - a mid-air collision. Do not fall into a trap where we get too comfortable with the risk just because nothing has not happened yet.

To report to the RMA or not

Q: Some states impose flow restrictions by issuing NOTAMs or AFTN service message. If the incoming traffic violates the flow restriction but complies with separation agreed in the LOA, should this incident be reported as an LHD?

A: No. This operational error may be reported internally, but does not need to be reported as an LHD to the RMA.

Q: A controller does not receive a transfer or the appropriate revision of the transfer of an aircraft from the transferring unit, but surveillance system enables the accepting controller to determine the location of the incoming aircraft well before the Transfer-of-Control (TOC) point, allowing the accepting controller to call the transferring controller back to confirm the aircraft's intent. Should this incident be reported?

A: Yes. Although such occurrences typically do not contribute to the quantitative estimate of risk, these occurrences should still be reported as LHDs to the responsible RMA. Even though the individual event has been mitigated, those errors were still made by the transferring ACC unit. With our online LHD reporting system, such an occurrence will be notified to the transferring ACC unit's POC. If such occurrences are not reported, then the transferring ACC unit would not have known about these transfer errors. States are strongly encouraged to collaborate with their neighboring ACC to prevent such occurrences in the future.

Q: The transferred SSR code does not match the incoming traffic. The controller sees the incoming traffic, but cannot identify it. Should this be reported?

A: Yes. The RMA will analyze this type of occurrence case by case.

Q: The traffic doesn't arrive at the transferred time. The controller calls the transferring unit to get an updated transferred time. Should this occurrence be reported?

A: Yes, but it should be reported to your designated Enroute Monitoring Agency (EMA). If the time difference is big, such an occurrence would be an LHD; the EMA will relay the report to the RMA

LHD Taxonomy

Presented in RASMAG/24 (Revised by MAWG/6)

LHD Category Code	LHD Category Description
A	Flight crew failing to climb/descend the aircraft as cleared
B	Flight crew climbing/descending without ATC Clearance
C	Incorrect flight level provided due to incorrect operation or interpretation of airborne equipment (e.g. incorrect operation of fully functional FMS, incorrect transcription of ATC clearance or re-clearance in FMS, flight plan followed rather than ATC clearance, original clearance followed instead of re-clearance etc.)
D	ATC system loop error (e.g. ATC issues incorrect flight level clearance or flight crew misunderstands flight level clearance message.)
E	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues (e.g. late or non-existent coordination of flight level)
F	Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues (e.g. late or non-existent coordination of flight level)
G	Aircraft contingency event leading to sudden inability to maintain assigned flight level (e.g. pressurization failure, engine failure)
H	Airborne equipment failure leading to unintentional or undetected change of flight level (e.g. altimetry errors)
I	Turbulence or other weather related causes leading to unintentional or undetected change of flight level
J	TCAS resolution advisory, flight crew correctly climb or descend following the resolution advisory
K	TCAS resolution advisory, flight crew incorrectly climb or descend following the resolution advisory
L	An aircraft being provided with RVSM separation is not RVSM approved (e.g. flight plan indicating RVSM approval but aircraft not approved, ATC misinterpretation of flight plan)
M	Others

LHD Taxonomy with Examples

(The examples are added for MAAR's safety communication)

LHD Category Code	LHD Category Description
A	<p>Flight crew failing to climb/descend the aircraft as cleared</p> <p>Example: Aircraft A was at FL300 and assigned FL360. A CLAM alert was seen as the aircraft passed FL364. The Mode C level reached FL365 before descending back to FL360.</p>
B	<p>Flight crew climbing/descending without ATC Clearance</p>
C	<p>Incorrect flight level provided due to incorrect operation or interpretation of airborne equipment (e.g. incorrect operation of fully functional FMS, incorrect transcription of ATC clearance or re-clearance in FMS, flight plan followed rather than ATC clearance, original clearance followed instead of re-clearance etc.)</p> <p>Example: The aircraft was maintaining a flight level below the assigned altitude. The altimeters had not been reset at transition. The FL assigned was 350. The aircraft was maintaining FL346 for in excess of 4 minutes.</p>
D	<p>ATC system loop error (e.g. ATC issues incorrect flight level clearance or flight crew misunderstands flight level clearance message.)</p> <p>Example: All communications between ATC and aircraft are by HF third party voice relay. Aircraft 1 was maintaining FL360 and requested FL380. A clearance to FL370 was issued, with an expectation for higher levels at a later point. A clearance was then issued to Aircraft 2 to climb to FL390, this was correctly read back by the HF operator, but was issued to Aircraft 1. The error was detected when Aircraft 1 reported maintaining FL390.</p>
E	<p>Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues (e.g. late or non-existent coordination of flight level)</p> <p>Example 1: Sector A coordinated Aircraft 1 to Sector B at FL380. The aircraft was actually at FL400.</p> <p>Example 2: The Sector A controller received coordination on Aircraft 1 for Waypoint X at FL370 from Sector B. At 0504 Aircraft 1 was at Waypoint X at FL350 requesting FL370.</p>

F	<p>Coordination errors in the ATC-to-ATC transfer of control responsibility as a result of equipment outage or technical issues (e.g. late or non-existent coordination of flight level)</p> <p>Example: Controller in FIR A attempted to send AIDC message to coordinate transfer of aircraft at FL320. Messaging was unsuccessful to contact adjacent FIR by telephone fail. Aircraft contacted adjacent FIR without coordination being completed.</p>
G	<p>Aircraft contingency event leading to sudden inability to maintain assigned flight level (e.g. pressurization failure, engine failure)</p> <p>Example: Aircraft 1 descended from FL400 to FL300 with a pressurization issue.</p>
H	<p>Airborne equipment failure leading to unintentional or undetected change of flight level (e.g. altimetry errors)</p> <p>Example: Aircraft 1 cruising at FL380. ATC receives alert indicating aircraft climbing through FL383. Flight crew advises attempting to regain cleared level with autopilot and navigation system failure.</p>
I	<p>Turbulence or other weather related causes leading to unintentional or undetected change of flight level</p> <p>Example: During the cruise at FL400, the aircraft encountered severe turbulence, resulting the aircraft descending 1,000 ft. without a clearance.</p>
J	<p>TCAS resolution advisory, flight crew correctly climb or descend following the resolution advisory</p> <p>Example: Aircraft 1 was cruising at FL350. Flight crew received "Traffic Alert" from TCAS and almost immediately after an "RA Climb" instruction. Flight crew responded and climbed Aircraft 1 to approx FL353 to comply with TCAS instruction. TCAS display indicated that opposite direction Aircraft 2 descended to approx FL345 and passed below Aircraft 1.</p>
K	<p>TCAS resolution advisory, flight crew incorrectly climb or descend following the resolution advisory</p>
L	<p>An aircraft being provided with RVSM separation is not RVSM approved (e.g. flight plan indicating RVSM approval but aircraft not approved, ATC misinterpretation of flight plan)</p>

	<p>Example 1: Original flight plan details submitted by FIR A for outbound leg showed Aircraft 1 as negative RVSM. Subsequent flight plan submitted by FIR B showed Aircraft 1 as RVSM approved. FIR A controller checked with aircraft shortly after entering FIR A and pilot confirmed negative RVSM.</p> <p>Example 2: Aircraft 2 cruising FL310 was handed off to the Sector X controller who noticed the label of Aircraft 2 indicated RVSM approval. The Sector X controller had controlled the aircraft the day before. It was then a non-RVSM aircraft. The controller queried the status of Aircraft 2 with the pilot who advised the aircraft was negative RVSM.</p>
M	Others

RVSM Large Height Deviation (LHD) Report

Occurrence 1 of 1

A RVSM Large Height Deviation (LHD) is defined as any vertical deviation of 300 feet (90 m.) or more from the flight level expected to be occupied by the flight. The deviation may be the result of any operational error or technical condition affecting the flight and includes any operational errors that cause the aircraft to be at a location (position and/or time) that is unexpected by the controller.

Name of FIR: Enter the name of your FIR.

Date of Occurrence (UTC Date): Enter the date of occurrence based on UTC.

Call Sign: Enter the call sign.

Departure Aerodrome: ICAO Designator.

Destination Aerodrome: ICAO Designator.

Aircraft Type: Enter the ICAO aircraft type.

Location of Occurrence (Point): Enter a point or coordinate. **FLOS Transition Area?:** Yes/No

Location of Occurrence (Route): Enter the route name. **Route Type:** Enter or choose the route type.

Flight Level Expected by the Controller: (e.g. last assigned or last coordinated FL)

Actual Flight Level: Enter the actual FL. **Detected via:** Enter or choose an item.

Duration at the Incorrect FL: Enter or choose time duration at incorrect FL, fill in time parameters in the next section instead for Category E occurrence.

Other Traffic (if any): Enter the identification and description of conflicting traffic, if any.

If this occurrence is a breakdown in ATC-to-ATC coordination (Category E or F), please fill in the following additional information:

Reporter's Role: Choose the role. **The Other ATS Unit:** Enter the name of involving ATS unit.

Was there any collaboration between the watch supervisors of both ATS units to uncover the cause of the error? Yes/No

Check all that describe the nature of the occurrence:

Late/non-existent coordination Miscommunicated transfer conditions

Late/non-existent FL/time/route information Aircraft did not transfer at the coordinated FL

Other (please, describe below)

Time aircraft expected to arrive at the TOC Point (UTC): Enter the last coordinated arrival time.

Actual time aircraft arrived at the TOC point (UTC): Enter the actual arrival time.

Time the Controller detected the actual position of the aircraft (UTC): Enter the time of detection. If there was a conflict, enter the time the conflict was resolved.

Additional Description of the Occurrence (please attach a copy of your internal occurrence report, if available): Enter textual description of the occurrence, including crew comments, if available.

To start a new occurrence, insert a page break, then copy and paste the content on this page over.

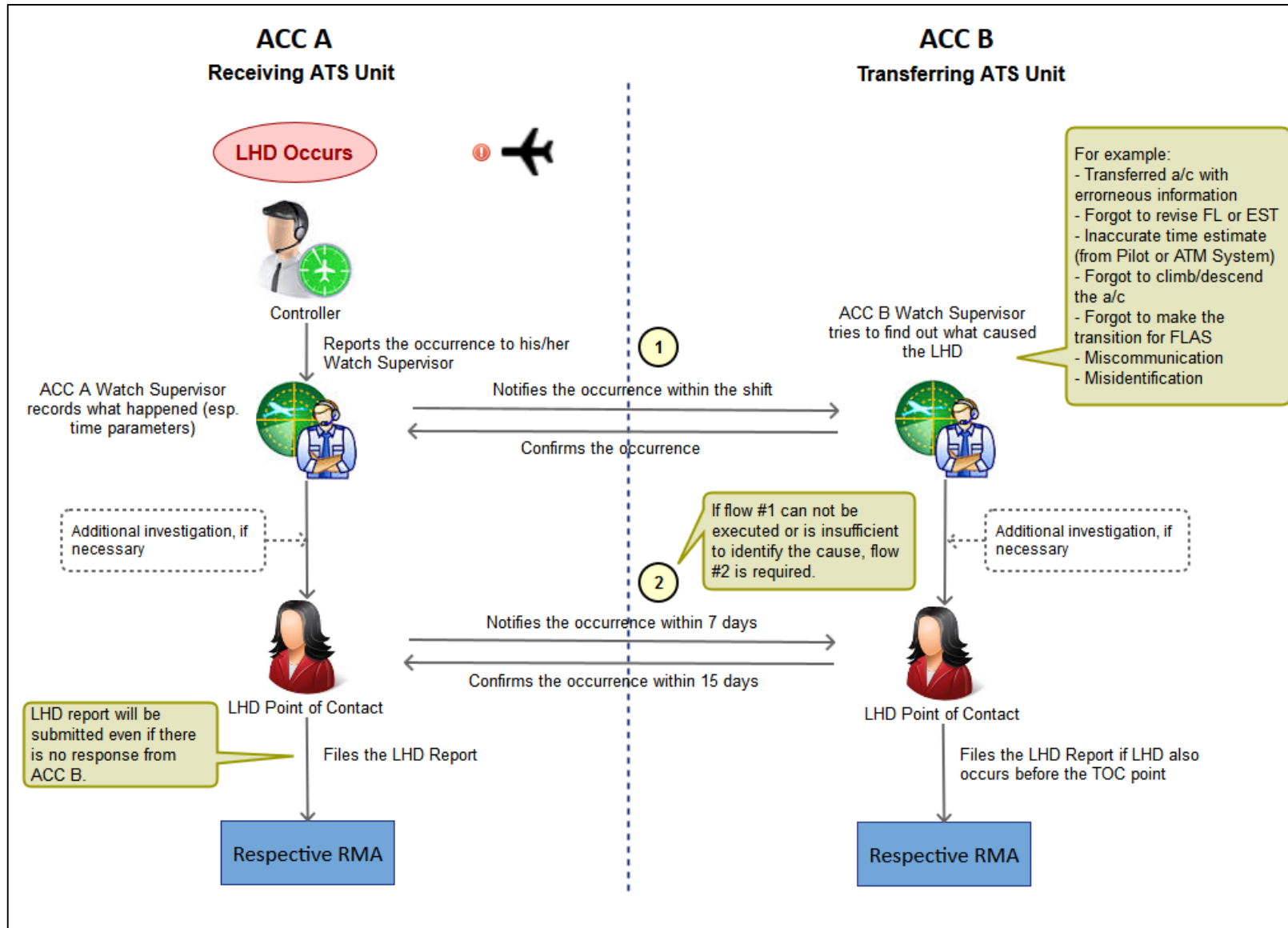
LHD Point of Contacts
(MAAR)

State	FIR	Name	Email
Afghanistan	Kabul	Mr. Doug Tyson, Mr. James Hermsdorfer	doug.tyson123@yahoo.com, James.Hermsdorfer@iapws.com
Bangladesh	Dhaka	Station Air Traffic Officer (SATO), Hazrat ShahJalal International Airport, Dhaka Tel: +88-02-8901460	satohsia@caab.gov.bd
		Duty Flight Information Officer (FIO), Area Control Center Tel: +88-02-8901462 +88-02-8901463	
Cambodia	Phnom Penh	Tith Phoumith	tphoumith9999@gmail.com
Hong Kong, China	Hong Kong	Grace Wong	gkywong@cad.gov.hk
India	Chennai	Watch Supervisory Officer Mr. Udayanarayanan	bobasmachennai@gmail.com
	Delhi		
	Kolkata		
	Mumbai		
Lao PDR	Vientiane	Mr. Amdounla Salinthon	asalinthon@gmail.com
Malaysia	Kuala Lumpur	Mr. Abdul Rali Bin Kassim	abdulrali@dca.gov.my
	Kota Kinabalu	Er. Mond Massalo Batti	ermond@dca.gov.my
Maldives	Male	Mr. Hussain Didi	didi@macl.aero
Mongolia	Ulaanbaatar	Mr. Myagmardorj Serdamba	safety-atc@mcaa.gov.mn
Myanmar	Yangon	Mr. Aung Zaw Thein	azawthein@gmail.com
Nepal	Kathmandu	Sitaram Bhandari	sitarambhandari@yahoo.com
Pakistan	Karachi	Mr. Zubair Ghazi	RFC.JIAP@caapakistan.com.pk zubair.ghazi@caapakistan.com.pk

State	FIR	Name	Email
	Lahore	Radar Facility Chief	AIAP@caapakistan.com.pk
Philippines	Manila	Ms. Anna Joy C. Papag	ats_en-route@caap.gov.ph
Singapore	Singapore	Mr. Chew Han Jun	chew_han_jun@caas.gov.sg
Sri Lanka	Colombo	Mr. Sumith Tennakoon	sumithatc.ans@airport.lk
Taiwan, China	Taipei	Ms. Tzu-Chi (Kiki) Weng	tcweng@mail.caa.gov.tw
Thailand	Bangkok	Mrs. Duenpen Mahatthanatham	duenpen.ma@aerOTHai.co.th
Vietnam	Hanoi	Mr. Mai Hongquan	mhongquan@yahoo.com
	Ho Chi Minh	Mr. Mai Hongquan	mhongquan@yahoo.com

CROSS-BOUNDARY LHDS

Cross-boundary LHDS are mostly, but not limited to, Category E "coordination errors in the ATC-to-ATC transfer of control responsibility as a result of human factors issues". Category E LHDS constitute about 90% of all LHD occurrences and usually most of the risk in RVSM. To ensure that there is coordination between the two involving ATS units to uncover the cause and prevent future occurrences, the following additional coordination procedure is recommended for every LHD occurrence that involves another ATS unit.





FORM A - LHD Analysis

Due to the continuing prevalence of LHDs, States are encouraged to conduct further investigation and provide in-depth analyses of LHDs, especially those induced by their responsible ATS units. The purpose is not to apportion blame on any organizations but to understand the underlying root causes in order to develop safety mitigations to prevent reoccurrence. In case of significant occurrences (such as long duration LHDs), States are encouraged to provide an analysis for each occurrence. For other occurrences, States can provide analysis of a group of similar occurrences. **Please, return the filled form to maar@aerothai.co.th.**

1. Organization:
2. Date of Analysis:
3. If it is a single occurrence - Please provide occurrence date, call sign*, and location:
4. If it is a group of occurrences – Please describe the nature of occurrences:

5. Details of the analysis: Please provide detailed description of the followings

Description of Occurrence(s)	
Contributing Factors and Mitigations	
-Contributing factors/causes: Please describe <u>all</u> factors leading to such occurrence(s)	
-Mitigations/controls/barriers: Please describe any measure which could be used to <u>prevent/detect</u> LHD occurrence(s), or <u>reduce</u> their duration. Also, please describe existing barriers which could be improved.	
Procedures/LOAs –which could be non-existent, inappropriate, not strictly adhered to, or needed review	
Contributing factors/causes	Mitigations/controls/barriers
Human Factor Issues –ex. fatigue, workload, competency, English proficiency, teamwork, situational awareness	
Contributing factors/causes	Mitigations/controls/barriers
Systems/Equipment –ex. equipment failures, unserviceability, usability, reliability, poor design	
Contributing factors/causes	Mitigations/controls/barriers
Other Factors – ex. training, staffing, clearly defined roles and responsibilities, workplace condition, weather	
Contributing factors/causes	Mitigations/controls/barriers

*This information is used for reference by the MAAR only. Sensitive information will later be de-identified. If you plan to present this form directly to RASMAG and other meeting, you can omit call sign.



FORM B - LHD Preventive/Mitigation Measures

Due to the continuing prevalence of LHDs, States are urged to provide a list of measures planned or taken to minimize LHDs (including detection of LHD occurrences and actions taken to reduce LHD duration). Please list all actions planned or taken by your organization, including comments on their effectiveness and *return the completed form to maar@aerOTHai.co.th*.

1. Organization:
2. Date of analysis:
3. Hotspot/Area (example: eastern boundary of FIR A):
4. Please provide detailed description of the followings:

No.	Preventive/mitigation measures planned/taken	Target/actual effective date	Progresses/difficulties	Comments on effectiveness of mitigations
1				
2				
3				
4				
5				
6				

5. Is there anything the RMA/RASMAG/ICAO can assist with related to LHDs? :