

INTERNATIONAL CIVIL AVIATION ORGANIZATION
**Sixth Meeting of the APIRG Airspace and Aerodrome Operations Sub-Group
(AAO/SG6)**
4 - 8 September 2023, Dakar Senegal
Agenda Item 5: Air Navigation Deficiencies
AFI RVSM DEFICIENCIES
(Presented by ARMA)

SUMMARY
<p>This working paper presents the full report for RVSM Safety in the Africa Indian Ocean Region (AFI) airspace. It contains the results of the Collision Risk Assessment 16, Monitoring Burden for the AFI Region, Implementation requirements for Strategic Lateral Offset Procedure (SLOP), and Identification of LHD Categories for States awareness to improve the reporting culture as AFI States are not proactively report LHDs.</p> <p>Action required is as per paragraph 3</p>
<p>REFERENCE(S):</p> <ul style="list-style-type: none"> - ICAO Doc 9574 - ICAO Annex 6 - ICAO Doc 9937
<p>Related ICAO Strategic Objective(s):</p> <p>A- Aviation Safety B – Air Navigation Capacity and Efficiency</p>

1. INTRODUCTION

The principle activities of an RMA are to verify aircraft/operator RVSM approval status, conduct aircraft height keeping performance monitoring, verify the operator’s compliance with the long-term monitoring requirements and provide annual airspace safety assessments. The RMA monitors aircraft/operator compliance within the precepts of ICAO Annex 6, reporting non-compliance and any associated safety issues to the States, which retain the responsibility for ensuring that appropriate remedial action is taken. To perform this function it is essential that the States provide practical support to the RMA, particularly with regards to coordinating RVSM approval data exchanges and providing operational incident reports for inclusion in the annual safety assessments.

2. 2. DISCUSSION

Monitoring is an on-going program that continues after the RVSM approval process. Long-term minimum monitoring requirements are established in the Annex 6 to the Convention on International Civil Aviation. On a regional basis, a programme shall be instituted for monitoring the height-keeping performance of aircraft operating in RVSM airspace in order to ensure that continued application of this vertical separation minimum meets regional safety objectives. Compliance with the Annex 6 requirements for long term height-keeping monitoring (LTHM) through the globally standardized Minimum Monitoring Requirement (MMR). This data is used to conduct analyses of aircraft group performance, and Evaluation of the stability of altimetry system error, which are quantities factors that contribute to the calculation of the Target Level of Safety.

The AFI Regional Monitoring Agency (ARMA) has a requirement to establish the number (quantity) of AFI Flight Information Regions (FIR's) in which SLOP has been implemented, The primary objective of collecting the information on implementation is to use the data in the AFI Reduced Vertical Separation Minimum (RVSM) Collision Risk Assessments.

The RMA conducts operational environment collision risk estimates using data provided by accredited member States. An event is reportable to the RMA when either an aircraft makes a deviation from a cleared level between FL 280 and FL 420 (cleared or actual) or an ATC clearance results in a risk bearing situation, such as loss of separation or TCAS initiated deviation. The important parameters which must be available if the report is to be used for the quantifiable risk assessment include the magnitude of deviation and duration, which is not made available in many cases. As much information as possible should be provided on the report to assist in the estimation of the required parameters and nature of the event.

Each authority is responsible for reporting LHD to the responsible RMA. An LHD contributes to the risk regardless of whether a loss of separation occurred or not. Detailed descriptions of LHD occurrences are crucial for the RMA to assess the risk of LHD and its duration. Each Authority should have an internal safety management system that defines an internal reporting process and the treatment of each report. The system should take into account the LHD reporting requirements.

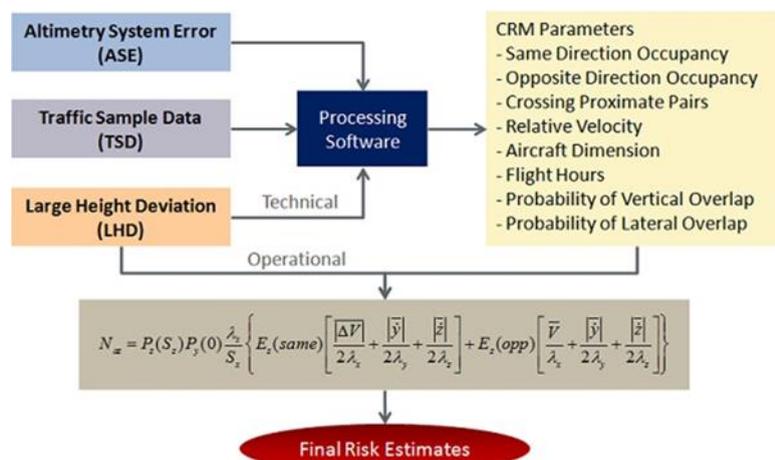


Figure 1: CRM Model for TLS Calculations.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) Note the content of the working paper provided and Appendix A;
- b) Encourage Member States to comply with safety standards in all activities supporting continued safe use of RVSM Airspace in the AFI Region.
- c) Request all Member States to attend an online LHD Training by ARMA on the 07 November 2023.
- d) Member States to use correct forms when submitting data, forms accessible on www.arma.africa
- e) States that do not produce data as required will be added onto the AFI Air Navigations Deficiencies Database.

Traffic Data Sample 2023:

FIR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Accra	Yes	Yes	Yes	Yes	Yes							
Addis Ababa	No											
Asmara	No											
Beira	Yes											
Cape Town	Yes											
Da Es Salaam	No											
Entebbe	Yes	Yes	Yes	Yes	Yes	Yes						
Gaborone	No											
Harare	Yes	Yes	Yes	Yes								
Johannesburg	Yes											
Johannesburg Oceanic	Yes											
Kano	No											
Kinshasa	No											
Lilongwe	No											
Luanda	No											
Lusaka	No											
Mauritius	Yes											
Mogadishu	Yes		Yes	Yes	Yes	Yes						
Nairobi	Yes	Yes	Yes	Yes	Yes	Yes						
Roberts	No											
Seychelles	No											
Windhoek	No											
ZZ Abidjan	No											
ZZ Antananarivo	Yes	Yes	Yes	Yes	No	No	No					
ZZ Bamako	Yes	Yes	Yes	Yes	Yes	Yes						

ZZ Brazzaville	No	No	No	No	No	No	No					
ZZ Dakar*	Yes	Yes	Yes	Yes	Yes	No	No					
ZZ Douala	Yes	Yes	Yes	Yes	Yes	No	No					
ZZ Libreville	No	No	No	No	No	No	No					
ZZ Lome	Yes	Yes	Yes	Yes	Yes	No	No					
ZZ N'djamena	No	No	No	No	No	No	No					
ZZ Niamey	Yes	Yes	Yes	Yes	Yes	No	No					
ZZ Nouakchott	Yes	Yes	Yes	Yes	Yes	No	No					
ZZ Ouagadougou	Yes	Yes	Yes	Yes	Yes	No	No					

****Kigali ACC has recently started submitting monthly TSD from April 2023- August 2023**

LHD Taxonomy with Examples

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>
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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

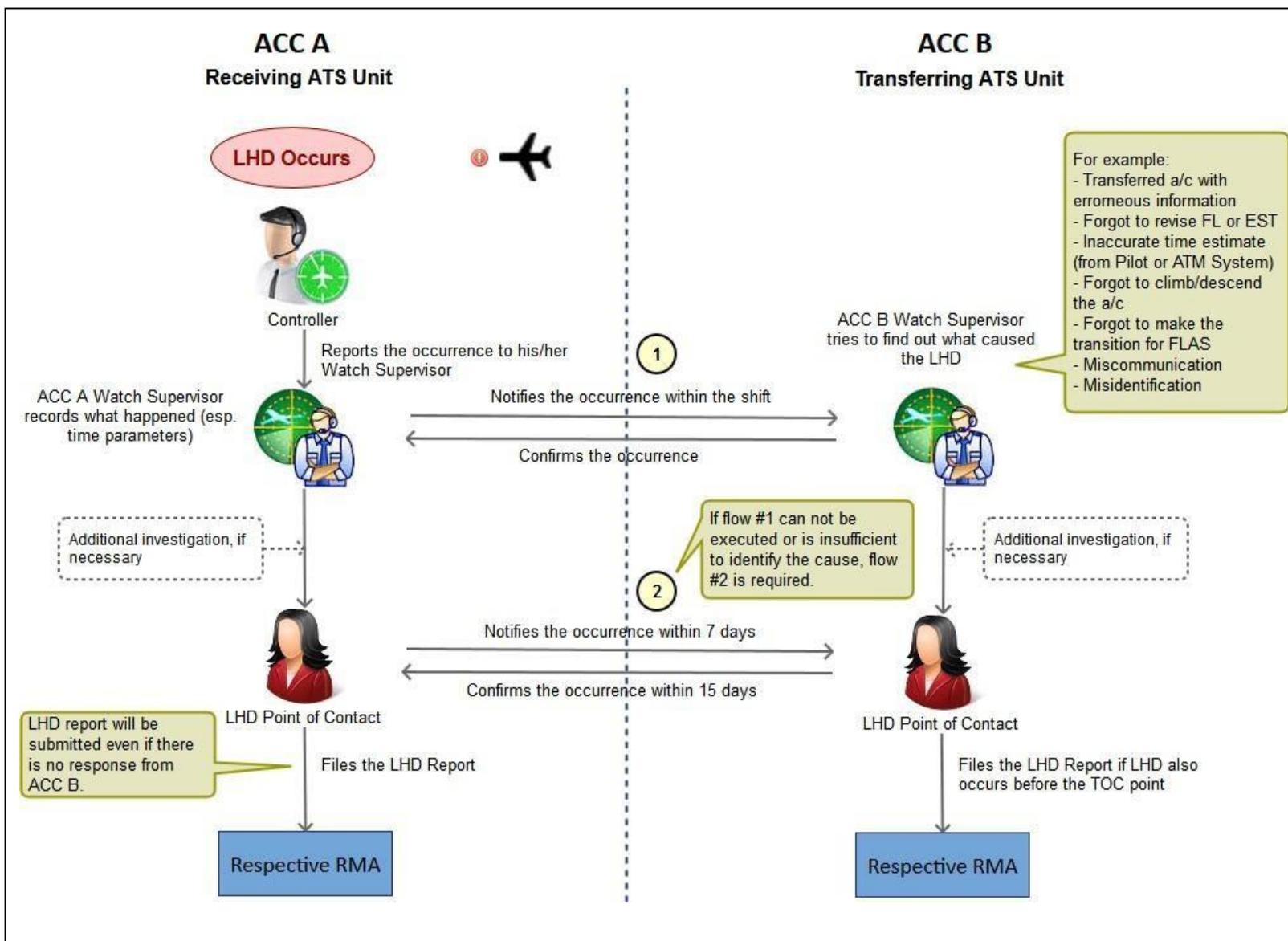
RVSM Large Height Deviation (LHD) Report

Occurrence 1 of 1

<https://arma.africa/resources/forms>

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 afirma@atns.co.za***

- 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 ARMA only. Sensitive information will later be de-identified. If you plan to present this form directly in a 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 afirma@atns.co.za***

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/RASG-AFI/ICAO can assist with related to LHDs? :

