International Civil Aviation Organization
South American Regional Office
South Atlantic Safety Oversight Group – First Meeting (SAT SOG/01)
(Miami, Florida, United States, 13 to 17 March 2023)

Agenda Item 5: **Collision Risk Assessment and LHD**

ARMA REPORT ON SAT STATES FROM THE AFI REGION

(Prepared by ARMA)

SUMMARY

This working paper presents an overview of Agenda 5 of the first SAT SOG contributions from 6 SAT States in the AFI Region, it also includes the collision risk assessment results for the AFI Region for CRA 16. SAT States contributions of RVSM Data for 2022 and 2023.

References:

- ICAO Doc 9574
- ICAO Doc 9937
- ICAO Doc 9930
- Aircraft movements in AFI RVSM airspace in 2021, 2022.

1. Background

1.1 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.

1.2 To ensure an effective service and to minimise workload for both the RMA and individual authorities, States should ensure that the list of RVSM approvals for which it is responsible for are kept up to date and communicated regularly to the RMA as the RMA collects and manages more than 3 types of data(RVSM/PBCS Approvals,Withdrawal, Height Monitoring Data, Collision Risk Assessment Data etc) from 48 States/27 FIRs. States should also ensure that they have introduced procedures for receiving reports of possible non-approved aircraft from the RMA and conducting follow up investigations to verify the true status of the aircraft reported. In addition to transmitting new approvals to the RMA it is equally important that the RMA is informed when approvals are withdrawn or when aircraft are de- or re-registered. It has been demonstrated that the most effective mechanism is for each State to maintain a single centralised database of RVSM approvals which should be communicated to the RMA on a regular basis.

2. **Analysis**

State Responsibilities on Height Monitoring

2.1 The participation of State operators of aircraft flying RVSM, in the RVSM monitoring programmes – including sharing information related to aircraft RVSM status and participation in technical height monitoring programmes – will support safety monitoring programmes. By coordination with their accredited Regional Monitoring Agency, operators of State aircraft would benefit directly by independent ongoing monitoring of aircraft height keeping performance as well as the identification of incorrect flight planning of non-RVSM approved aircraft, thus ensuring the safety of crew and passengers. There are obviously political and security considerations which could impact the level of inclusion of State aircraft in RMA approval databases, however, the safety impact on civil operations equally cannot be ignored.

2.2 It is of critical importance to aviation safety that RMAs be able to quickly ascertain the RVSM approval status of a particular aircraft flying RVSM airspace. Member States as well as civil and State aircraft operators are therefore invited to cooperate with RMAs and timely respond to their information requests. Specific points of contact available to the RMAs are considered essential to swiftly coordinate the receipt of reports of potentially non-RVSM approved aircraft, and reports of technically non-compliant aircraft, so that appropriate action can be taken by appropriate Member State Authorities.

2.3 It is the relevant States responsibility to ensure that operators comply with regional and global monitoring targets. States responsibility to ensure provisions for receiving reports from RMA and implementing measures to correct the performance of an aircraft not compliant with height keeping requirements.

2.4 States that have issued RVSM Approvals shall ensure that the operator complies with the biennial fleet monitoring targets.

No.	ARMA States	RVSM A/C	VALID HM	NOT VALID	Valid %	%REQ HM	REMARKS
1	Angola	26	20	6	77%	23	2 scheduled
15	Ghana	27	0	27	0%	100%	
23	Namibia	22	13	9	59%	19	
28	Senegal	12	12	0	100%	0	
30	South Africa	389	262	127	67%	33	4 scheduled
	Cote d'Ivoire	10	0	10	0%	100%	2 scheduled
	Totals	486	307	179			

2.5 **Collision risk assessment: ARMA**

FIR/UIR	2022		2021	
	Months with no or a blank ARMA Form 1 submitted	Months with a completed ARMA Form 1 submitted, text provided	Months with no or a blank ARMA Form 1 submitted	Months with a completed ARMA Form 1 submitted, text provided
Accra				
Accra	5	7		12
Lome	1	11, 1 event summary		12
Cape Town	3	9	10	2, 2 event summary
Dakar				
Abidjan		12		12
Bamako	2	10		12
Dakar		12		12
Nouakchott		12		12
Johannesburg		12		12
Johannesburg Oceanic		12		12
Luanda	12		12	
Windhoek	12			12

Table 1: Summary of ARMA Form 1 information provided by 27 FIR/UIRs for 2022 (2021 included for reference)

2.5.1

FIR/UIR	Nr of Months with Form 3 submitted	Nr of Coordination failures	Nr of Communication failures	Nr of Turbulence events	Nr of ACAS events
Accra					
- Accra	7	1	2	5	0
- Lomé	11	0	1	1	0
Cape Town	9	0	0	0	0
Dakar					
- Abidjan	12	0	0	0	0
- Bamako	10	0	0	0	0
- Dakar	12	0	0	0	0
- Nouakchott	12	4	0	59	0
Johannesburg	12	14	11	8	0
Johannesburg Oceanic	12	2	7	0	0
Luanda	0	-	-	-	-
Windhoek	0	-	-	-	-
Total	**97**	**21**	**21**	**73**	**0**

Table 2: Summary of other operational considerations reported in ARMA Form 3 by 27 FIR/UIRs

$$N_{az}^{total} = 9.64 \times 10^{-12} + 1.92 \times 10^{-9} + 13.5 \times 10^{-9} + 1.00 \times 10^{-9} + 2.44 \times 10^{-10} = \mathbf{16.6 \times 10^{-9}}$$

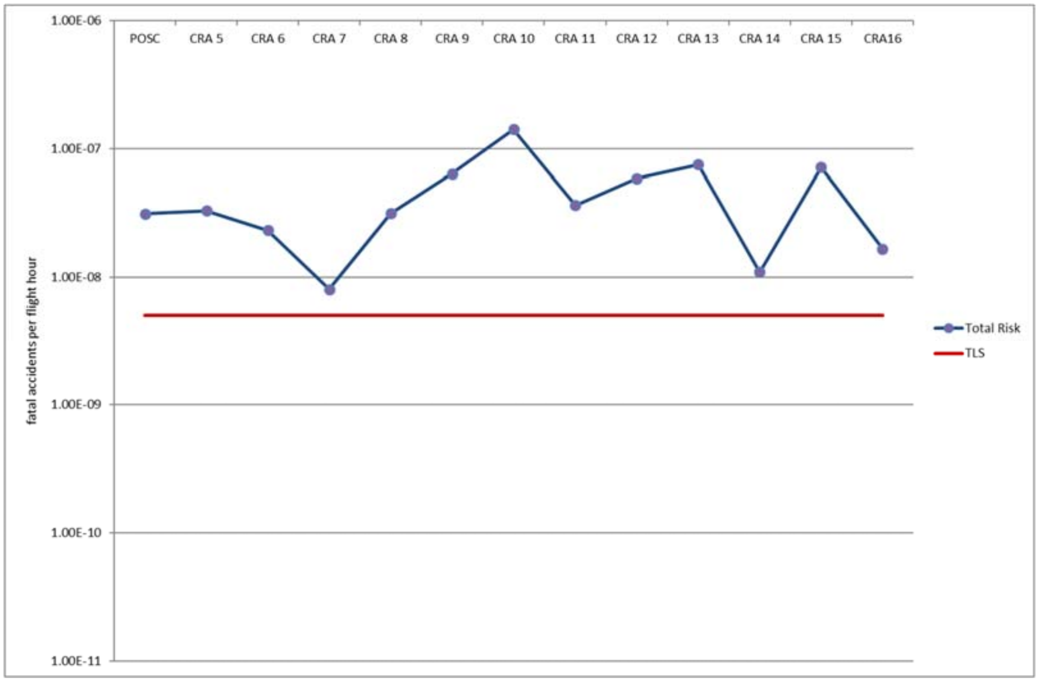


Figure 1: The total vertical collision risk estimates of the successive post-implementation CRAs on a normal scale (top figure) as well as on a logarithmic scale (bottom figure). The red horizontal lines indicate the TLS of 5.0 × 10-9 fatal accidents per flight hour.

2.5.2 The CRA16 total vertical collision risk is made up of five components and the largest component of the total vertical collision risk was due to aircraft levelling off at a wrong opposite- or same-direction flight level. The estimates of the different collision risk components depend first of all on the estimates of the probabilities of vertical overlap for the different categories of large atypical height deviations, where these probabilities are defined as the proportions of flight time in which aircraft are in vertical overlap as a result of such deviations. The main quantities to be estimated are the total time spent at wrong flight levels (opposite direction as well as same direction), the number of improper flight level crossings (opposite direction as well as same direction), and the total amount of flight time.

2.6 **Incident Reports from SAT States**

Event ID	FIR/UIR	Event Code	Duration	Crossing angle (θ)
Form1_7	Accra/Lomé (ACC)	LHD(900)	2.5 min	-
Form3_2	Johannesburg Oceanic	CO + WS	94 min	-
UCR8466	Dakar	No RVSM risk	-	-

Table 3 : Event list reported by SAT States

2.7

Event type	Event Code
Crossing through FL, opposite direction	CO
Crossing through FL, same direction	CS
Crossing through FL, intersecting routes	CC
Wrong FL, opposite direction	WO
Wrong FL, intersecting (crossing) routes	WC
Wrong FL, same direction	WS
Large Height Deviation of X ft	LHD(X)
Out of the boundary of the AFI RVSM airspace (horizontal or vertical)	OB
No RVSM risk	No RVSM risk
Insufficient information	Insufficient information
Horizontal (single route)	H(SFL)
Horizontal (intersecting routes)	H
Horizontal/vertical (intersecting routes)	H/WC

T*able 4: Event types and coding*

2.7.1 In a similar manner as for the previous CRAs, the events have been classified into the categories shown in Table 4. The first six categories concern "vertical events" of the "whole numbers of flight levels" type. The second letter of each event code refers to the configuration of conflict, i.e. with an aircraft in level flight at an opposite or same direction flight level of the same route or with/by an aircraft on an intersecting (crossing) route. The "crossing through FL" category should be self-explanatory. For the "wrong FL" category, the incorrectness of the flight level was inferred from the event and the applicable RVSM cruising levels. The next vertical category covers all Large Height Deviations (LHDs) of the "non-whole numbers of flight levels" type where "X" represents the magnitude of the deviation.

2.7.2 Not all events have been able to be classified as one of the seven vertical event types from Table 4. Review of some events showed that although the events were clearly related to the vertical dimension, the events did not actually involve vertical collision risk. Such events have been classified as "No RVSM risk". This is followed by the category "Insufficient information", which denotes events in the vertical dimension that have not been included in the CRA, mainly because it was impossible to infer from the report what had actually happened.

2.8

2.8.1 The estimate of the total vertical collision risk was 16.6 × 10-9 fatal accidents per flight hour, i.e. approximately 3 times the total vertical TLS. This estimate of the total vertical collision risk is the two but lowest of the post-implementation estimates of the total vertical collision risk under AFI RVSM. The total vertical collision risk is made up of five components and the largest component is the risk due to aircraft leveling off at a wrong opposite- or same-direction flight level.

2.8.2 There remain several factors that require the estimate of the total vertical collision risk to be treated with caution. The estimate is most likely affected by under-reporting of vertical events involving large height deviations as well as lack of details in the reporting. Continued efforts to bring the total vertical risk further down to below the total vertical TLS and to improve the event reporting in AFI must be sustained.

CRA	TOTAL VERTICAL TLS	TOTAL VERTICAL TLS EXCEEDED BY A FACTOR OF
CRA 16 2021	16.6×10^{-9}	
CRA 15 2020	71.9×10^{-9}	
CRA 14 2019	10.9×10^{-9}	**2.2**
CRA 13 2018	75.4×10^{-9}	**15.0**
CRA 12 2017	58.6×10^{-9}	**11,7**
CRA 11 2016	36.4×10^{-9}	**7.3**
CRA 10 2015	141.2×10^{-9}	**28.2**
CRA 9 2014	63.7×10^{-9}	**12.7**
CRA 8 2013	31.4×10^{-9}	**6.3**
CRA 7 2012	8.0×10^{-9}	**1.6**

2.9 Analysis on RMAs issues on data reporting quality and format

2.9.1 **Accra**

For the Accra FIR, data has been provided for its two constituent ACCs: Accra and Lomé. Six months' worth of Form 2 data and seven months' worth of Form 4 data was received in the correct format for Accra ACC. Eleven months' worth of ARMA Form 2 and Form 4 data was received for Lomé ACC. Form 4 contained only 2 waypoints per flight for both ACCs. Compared to the number of flights reported in Form 2, Form 4 contained 122% of the flights for Accra ACC and 100% of the flights for Lomé ACC. A fraction of 10.5% of the flights from Accra and 0.6% of the flights from Lomé were invalid and has been discarded. Compared to 2020, the total annual flight hour estimate for Accra for 2020 decreased from 35,742.68 flight hours to 29,654.73 flight hours .

2.9.2 **Cape Town**

All twelve months' worth of Form 4 data and 2 months' worth of data was received. Compared to Form 2, Form 4 contained 97% of useable flights. For each flight, multiple waypoints were recorded. A fraction of 34.5% of the flights was invalid and has been discarded. Compared to 2020, the total annual flight hour estimate for Cape Town FIR increased from 11,272.12 flight hours to 12,186.15 flight hours.

2.9.3 **Dakar**

For the Dakar FIR, data has been provided for its four constituent ACCs: Abidjan ACC, Bamako ACC, Dakar ACC and Nouakchott ACC. For each of the four ACCs all twelve months' worth of Form 2 and Form 4 data was provided except for Bamako ACC which only provided ten months' worth of data. Dakar ACC did not provide any Form 2 data. Compared to the number of flights reported in Form 2, Form 4 contained 100% of useable flights for all three ACCs. Abidjan ACC provided multiple waypoints per flight, Bamako ACC between 2 and 3 waypoints per flight, Dakar ACC provided between 2 and 5 waypoints per flight, and Nouakchott ACC provided between 1 and 14 waypoints per flight. A total fraction of 8.8%, 0.6%, 20.2% and 18.4% of the flights was invalid and has been removed for Abidjan ACC, Bamako ACC, Dakar ACC, and Nouakchott ACC respectively. Compared to 2020, the total annual flight hour estimate for Dakar FIR increased from 39,552.03 flight hours to 51,477.08 flight hours.

2.9.4 **Johannesburg**

For the Johannesburg, all 12 months' of Form 2 and Form 4 data was received. For each flight, multiple waypoints were recorded. Compared to the number of flights reported in Form 2, Form 4 contained 100% of useable flight. A fraction of 7.2% of the flights was invalid and has been discarded. Compared to 2020, the total annual flight hour estimate increased from 25,995.29 flight hours to 38,533.99 flight hours.

2.9.5 Johannesburg Oceanic

For the Johannesburg Oceanic, 11 months' of Form 2 and Form 4 data was received. For each flight, multiple waypoints were recorded. Compared to the number of flights reported in Form 2, Form 4 contained 100% of useable flight except for the months January, February and March for which Form 4 only a fraction of the data was recorded. A fraction of 2.4% of the flights was invalid and has been discarded. Compared to 2020, the total annual flight hour estimate decreased from 3,069.99 flight hours to 1,430.51 flight hours.

2.9.6 **Luanda**

Five months' worth of Form 4 data was received. This year has been the third year that data was received from Luanda UIR. In 2005 also Form 4 data was received from Luanda (Ref. **Error! Reference source not found.**) as well as in 2020. Unfortunately no Form 2 data was received. Between 2 or 4 waypoints per flight were provided in Form 4. A fraction of 34.5% of the flights was invalid and has been discarded. Compared to 2020, the total annual flight hour estimate increased from 9,474.10 flight hours to 7,947.16 flight hours.

2.9.7 **Windhoek**

Not any ARMA Form 2 or Form 4 data was received for the Windhoek FIR.

FIR	Does NPM Respond	Traffic Data Jan- Dec 2022	Traffic Data Jan-Feb 2023	SLOP Implemented
Accra	Yes	12 months	2months	Yes
Cape Town	Yes	12 months	2months	Yes
Dakar	Yes	12 months	2 months	Yes
Johannesburg	Yes	12 months	2 months	Yes
Johannesburg Oceanic	Yes	12 months	2 months	Yes
Luanda	Yes	7 months	0 months	Yes
Windhoek	Yes	0 months	0 months	No proof provided

Table 5: RVSM Data submitted by SAT States and SLOP Implementation.

3. **Reduction in Collision Risk Assessment and Mitigation of Large Height Deviation LHD**

3.1 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.

3.2 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 ARMA has come to develop material to promote awareness to LHD within the Region and hope it will assist in spreading awareness resulting in reduced LHD occurrences. The package includes:

- **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.
- **Attachment 2** to this paper is the LHD taxonomy. It provides a comprehensive list of generic LHD classification.
- **Attachment 3** to this paper is the LHD reporting form which will be on the ARMA Website www.arma.agency.
- **Attachment 4** 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.

3.3 States are encourage to have a LHD Preventative/Mitigation Measures in place. States / ANSPs to keep track of the mitigation measures which are identified and planned, as well as the effectiveness of those measures.

3.4 States are encourage to have trained Human Factor Specialists, so that the State is able to recognize HP considerations in their daily work activities, including in their own internal organization, and to know when the help of a qualified and experienced HP professional should be sought.

4. **Suggested actions**

4.1 The Meeting is invited to:

a) Note the information contained in this paper;

b) consider distributing the LHD FAQ (Attachment 1) to promote LHD reporting among relevant units in the SAT States;

c) consider the scope of the LHD point of contacts if needed to expand for all SAT States in the AFI Region, and update the point of contact, if necessary;

d) consider the application of the Cross-Boundary LHD coordination procedure (Attachment 4) with the LHD Point of contacts;

e) endorsement of point 3.3 and 3.4 to help mitigate LHD occurrences;

f) encourage States to enforce regional biennial fleet height monitoring targets for compliance with Annex 6 Part I/II; and

g) State of Namibia to report on status of SLOP implementation.

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 Regional Monitoring Agency (RMA). If the time difference is big, such an occurrence would be an LHD;

LHD Taxonomy

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

LHD Category Code	LHD Category Description
A	Flight crew failing to climb/descend the aircraft as cleared 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.
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.) 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.
D	ATC system loop error (e.g. ATC issues incorrect flight level clearance or flight crew misunderstands flight level clearance message.) 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.
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) Example 1: Sector A coordinated Aircraft 1 to Sector B at FL380. The aircraft was actually at FL400. 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.

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) 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.
G	Aircraft contingency event leading to sudden inability to maintain assigned flight level (e.g. pressurization failure, engine failure) Example: Aircraft 1 descended from FL400 to FL300 with a pressurization issue.
H	Airborne equipment failure leading to unintentional or undetected change of flight level (e.g. altimetry errors) 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.
I	Turbulence or other weather related causes leading to unintentional or undetected change of flight level Example: During the cruise at FL400, the aircraft encountered severe turbulence, resulting the aircraft descending 1,000 ft. without a clearance.
J	TCAS resolution advisory, flight crew correctly climb or descend following the resolution advisory 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.
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)

	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. 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.
M	Others

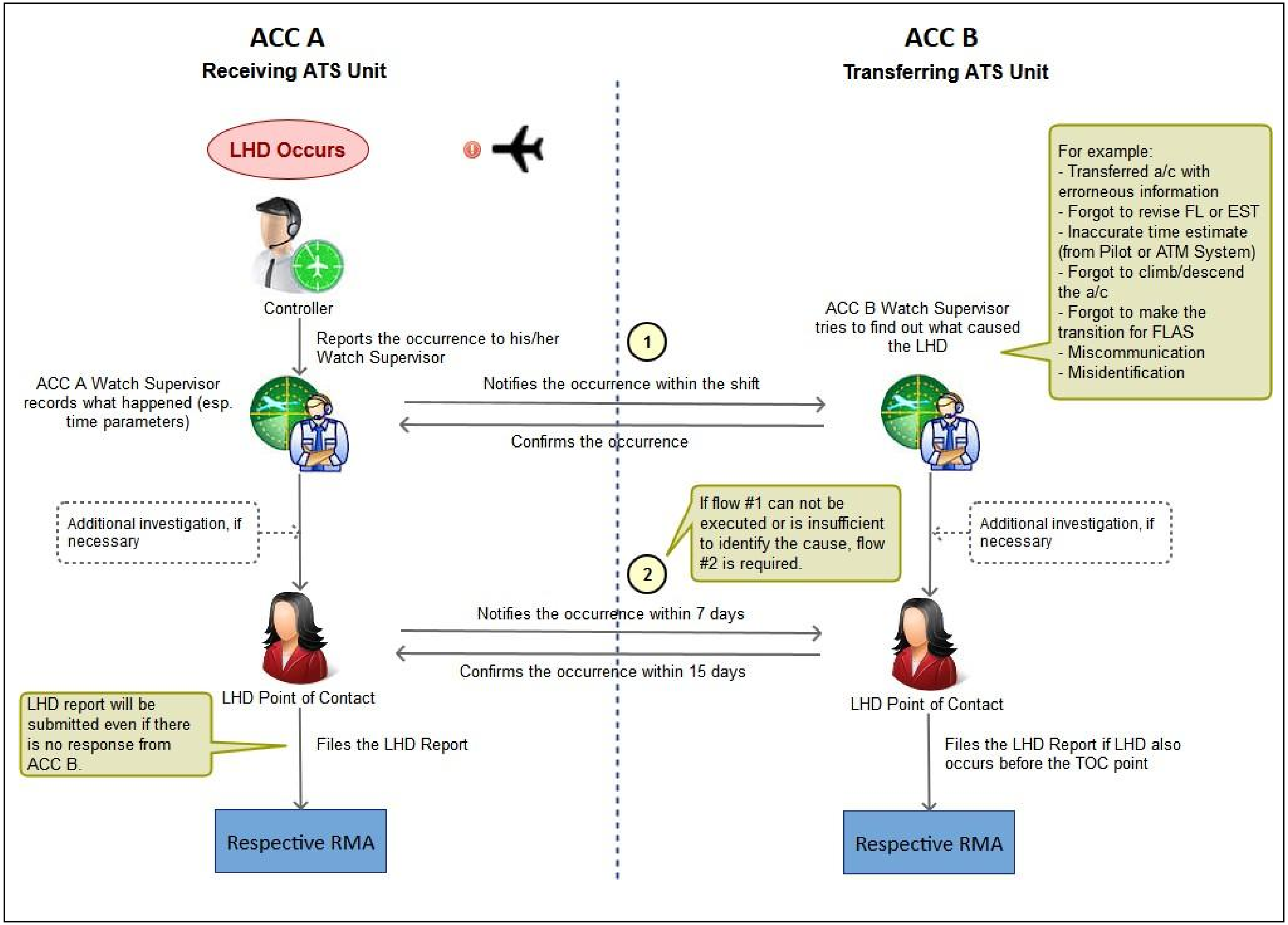
RVSM Large Height Deviation (LHD) Report

Occurrence **1** of **1**

https://arma.agency/resources/forms/lhd

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 ***all*** factors leading to such occurrence(s) -**Mitigations/controls/barriers**: Please describe any measure which could be used to prevent/detect LHD occurrence(s), or reduce 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 callsign.

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? :