



Question 5 of

Agenda: Other matters

LHD CAR/SAM (2004-2008) AND LHD MAIQUETIA/PIARCO (2004-2009)

(Presented by CARSAMMA)

SUMMARY

This Working Paper describes the LHD developments in the FIR CAR/SAM, from 2004 until 2008 and a specific study of the LHD occurred in the Piarco and Maiquetia FIR in the same period. It focused on CAR/SAM Airspace System (34 FIR), in RVSM airspace monitoring and the collision risk assessment process of collision between aircraft in cruise flight, adopted by ICAO. The search began with the study of the final reports of ICAO meetings with the CAR/SAM RVSM matter during the period from 2004 until 2008. At the reports were extracted information on the LHD, in particular, its causes and trigger points. It was made a panel with several charts of route, which includes the CAR/SAM regions to determine the precise points of LHD occurrences and create scenarios on the trend of large deviations, between 2004 and 2008, with the objective to improve operational safety.

- 1. Introduction (this chapter is available only at the Spanish version)**
- 2. Theoretical Basis (this chapter is available only at the Spanish version)**
- 3. Data collection**

Under this chapter, all useful data for the investigation are judged, as obtained in the final reports of the following meetings: AP/ATM/09, AP/ATM/10, AP/ATM/11, AP/ATM/12, AP/ATM/13, GTE/4, GTE/5, ATM/CNS/SG/6, GTE/6, GTE/7, GTE/8 and GTE/9, as well as in CARSAMMA' website.

Respecting the time available to complete this survey, the type and quality of the data, preference was provided to the following examples from 2004 until 2009: amount of RVSM certified aircraft, causes and amounts of LHDs; scenarios with dots, lines and areas of appearance of LHDs, measures recommended by ICAO and corrective measures adopted by CAR/SAM States.

3.1 – INDICATORS

Indicators presented in this chapter are: aircraft in operation in the RVSM airspace (certified/approved); LHD (amount and causes); points of occurrence (airway fix, radio navigation aids and navigation indicators, etc).

3.1.1 – RVSM CERTIFIED AND APPROVED AIRCRAFT

There are currently 1,398 aircraft registered en the data base, but 10% of them have their approvals expired and require new monitoring flights. This situation requires constant monitoring, since pilots eventually request the RVSM airspace utilization for non-RVSM approved aircraft or with approvals that have expired.

3.1.2 - LARGE-HEIGHT DEVIATIONS (LHD) 2004-2009.

Table 2 – LHD 2004-2008

CÓDIGO	Año						Total (1)	Total (%)
	2004	2004	2005	2006	2007	2008		
A	2	2	2	-	1	7	14	1,5
B	3	6	-	1	8	8	26	2,8
C	-	-	-	-	1	2	3	0,3
D	-	-	-	-	6	5	11	1,2
E	-	-	-	-	2	7	9	1,0
F	-	-	1	-	2	5	8	0,8
G	-	-	-	-	-	-	-	-
H	-	-	-	-	1	3	4	0,4
I	-	-	6	31	2	9	48	5,1
J	-	-	-	-	-	2	2	0,2
K	-	-	-	-	-	-	-	-
L	-	-	-	-	-	-	-	-
M	16	4	56	76	197	252	601	63,6
N	-	-	-	2	63	144	209	22,1
O	-	-	-	1	-	1	2	0,2
P	-	-	3	2	1	2	8	0,8
Total (2)	21	12	68	113	284	447	945	100

Sources: ICAO meetings final reports: AP/ATM/9, 2004; AP/ATM/10, 2005; AP/ATM/11, 2005; AP/ATM/12, 2006; AP/ATM/13, 2007; GTE/4, 2007; GTE/5, 2008; ATM/CNS/SG/6, 2008; GTE/6, 2008; GTE/7, 2009, GTE/8, 2010; and GTE/9, 2010.

(1) LHD Total, from 2004 until 2008, based on type of cause;

(2) LHD Total by year.

Table 3 – LHD PIARCO/MAIQUETIA (2004-2009)

POSICIÓN	AEROVIA	AÑO							TOTAL LHD	CÓDIGO			
		2004	2004	2005	2006	2007	2008	2009		I	M	N	NO LHD
BOGSI	UA 511	-	-	1	-	4	2	-	7	-	2	5	-
DAREK	UA 561	-	1	1	-	13	6	5	26	1	13	7	6
ITEGO	UA 550	-	-	2	-	23	6	2	33	2	10	12	9
MEGIR	UA 552/UA 563	-	-	2	-	2	2	2	8	1	4	2	1
ONGAL	UA 551	-	-	4	-	10	4	1	19	2	9	5	3
PARIA	UA 562	-	-	-	-	-	1	-	1	-	1	-	-
PELMA	UA 550	-	1	-	-	8	4	5	18	-	11	3	4
PERGA	UA 561	-	-	-	-	-	-	1	1	-	1	-	-
PERRY	UA 551	-	-	-	-	1	7	2	10	-	4	2	4
VUDAL	UL 337	-	-	2	-	5	4	2	13	1	1	8	3
TOTAL		0	2	12	0	66	36	20	136	7	56	44	30

Sources: ICAO meetings final reports: AP/ATM/9, 2004; AP/ATM/10, 2005; AP/ATM/11, 2005; AP/ATM/12, 2006; AP/ATM/13, 2007; GTE/4, 2007; GTE/5, 2008; ATM/CNS/SG/6, 2008; GTE/6, 2008; GTE/7, 2009; GTE/8, 2010; and GTE/9, 2010.

Table 4 – points (fixes and positions) of greater occurrence, extracted from validated LHD – 2004 until 2008






2004		2004		2005		2006		2007		2008	
PUNTOS	QTD	PUNTOS	QTD	PUNTOS	QTD	PUNTOS	QTD	PUNTOS	QTD	PUNTOS	QTD
BUXOS	2	BUXOS	2	VESKA	6	VESKA	10	LIXAS	11	VESKA	26
DUXUN	2	DUXUN	2	GELIS	4	BEROX	6	UGUPI	10	ITEGO	16
KONRI	2	KONRI	2	PIGBI	4	PIGBI	6	BOKAN	9	UGUPI	15
BITIX	1	CRO	2	RETAK	4	ETANO	5	SORTA	9	VAKUD	13
BUFEO	1	LENOM	2	ANKON	3	GELIS	5	GELIS	8	BEROX	12
BUXEX	1	ANKOM	1	BEROX	3	MLO	5	KONRI	8	KONRI	11
CGR	1	BITIX	1	MLO	3	RETAK	4	NANIK	8	ENSOL	10
DIMAS	1	BUFEO	1	ETANO	3	ANKON	3	ENSOL	7	IREMI	10
ETANO	1	CGR	1	ENRUT	2	GERNI	3	DAKMO	6	DAREK	9
FALLA	1	ETANO	1	ETBOD	2	LENOM	3	SISEL	6	BOKAN	8
IREMI	1	FALLA	1	IRGUT	2	POKAK	3	ALCOT	5	LIXAS	8
MLO	1	GELIS	1	VAKUD	2	SELEK	3	BUXOS	5	ONGAL	7
OSAMU	1	IREMI	1	POKAK	2	ANADA	2	ILKIT	5	ANADA	5
OTONI	1	MLO	1	ANADA	1	ARNAL	2	PULTU	5	PADOX	5
PML	1	NELSO	1	ARNEL	1	ENRUT	2	ARNEL	4	PELMA	5
RESUS	1	OSAMU	1	BLESS	1	ETBOT	2	KARAZ	4	VUMPI	5
TBG	1	PML	1	DAREK	1	IREMI	2	TERAS	4	AKROK	4
		RESUS	1	DUXUN	1	IRGUT	2	UKLOS	4	ANKON	4
		RETAK	1	KOXAM	1	NABOL	1	VAKUD	4	ARNEL	4

Sources: ICAO meetings final reports: AP/ATM/9, 2004; AP/ATM/10, 2005; AP/ATM/11, 2005; AP/ATM/12, 2006; AP/ATM/13, 2007; GTE/4, 2007; GTE/5, 2008; ATM/CNS/SG/6, 2008; GTE/6, 2008; GTE/7, 2009; GTE/8, 2010; and GTE/9, 2010.

3.2 – SCENARIOS

Scenarios presented in this survey were created through indicators used by the collision risk assessment process between aircraft, in the RVSM airspace from 2004 until 20089. To observe the tendencies, route charts were arranged, for points, lines and areas identifications. Points refer to a fix, indicators (radio navigation aid) or coordinates, where the LHD was produced. The red circle with dots represents a greater incidence of LHD. For the representation of these indicators, the legend described in table 4 was adopted.

Table 5: legend of the points of appearance, lines and areas represented in scenarios RVSM

SYMBOL		REPRESENTATION
	YELLOW TRIANGLE	01 TO 05 LHD
	ORANGE TRIANGLE	06 TO 10 LHD
	RED TRIANGLE	11 OR MORE
	DOTTED RED CIRCLE	LHD OCCURRENCE AREA
	RED EXPLOSION	GOL 1907 ACCIDENT

The red circular area with dots, not necessarily represents the greater collision risk, but the area in which the greater number of LHD reports was registered (incidence of large errors). This survey does not have mathematical estimations, with so little probability, for the assembling of the scenario. Only data available in LHD reports between 2004 and 2009 were used. Thus, it was possible to create the scenarios from large-height deviations in the CAR/SAM RVSM airspace, from 2004 to 2009, as well as scenarios of deviations in the RVSM MAIQUETIA/PIARCO AIRSPACE, from 2004 until 2010, as follows.

3.2.1 FIR CAR/SAM 2004 (VERIFICATION PHASE)



Figure 13 - FIR CAR/SAM Scenario in 2004.
Source: ICAO meeting final report APATM/9 (2004).

3.2.2 FIR CAR/SAM 2004 (IMPLEMENTATION PHASE)



Figure 14 – FIR CAR/SAM Scenario in 2004.
Source: ICAO meeting final report AP/ATM/10 (2005).

3.2.3 FIR CAR/SAM 2005



Figure 15 – FIR CAR/SAM Scenario in 2005.
Source: ICAO meeting final report AP/ATM/11 (2005) and AP/ATM/12 (2006).

3.2.4 FIR CAR/SAM 2006



Figure 16 – FIR CAR/SAM Scenario in 2006.
Source: ICAO meeting final report AP/ATM/13 (2007).

3.2.5 FIR CAR/SAM 2007



Figure 17 – FIR CAR/SAM Scenario in 2007.
Source: Working Papers from meetings GTE/4 (2007) and GTE/5 (2008).

3.2.6 FIR CAR/SAM 2008



Figure 18 – FIR CAR/SAM Scenario in 2008.
Source: Working Papers from meetings GTE/6 (2008) and GTE/7 (2009).

3.2.7 - FIR MAIQUETIA/PIARCO 2004 (VERIFICATION PHASE)

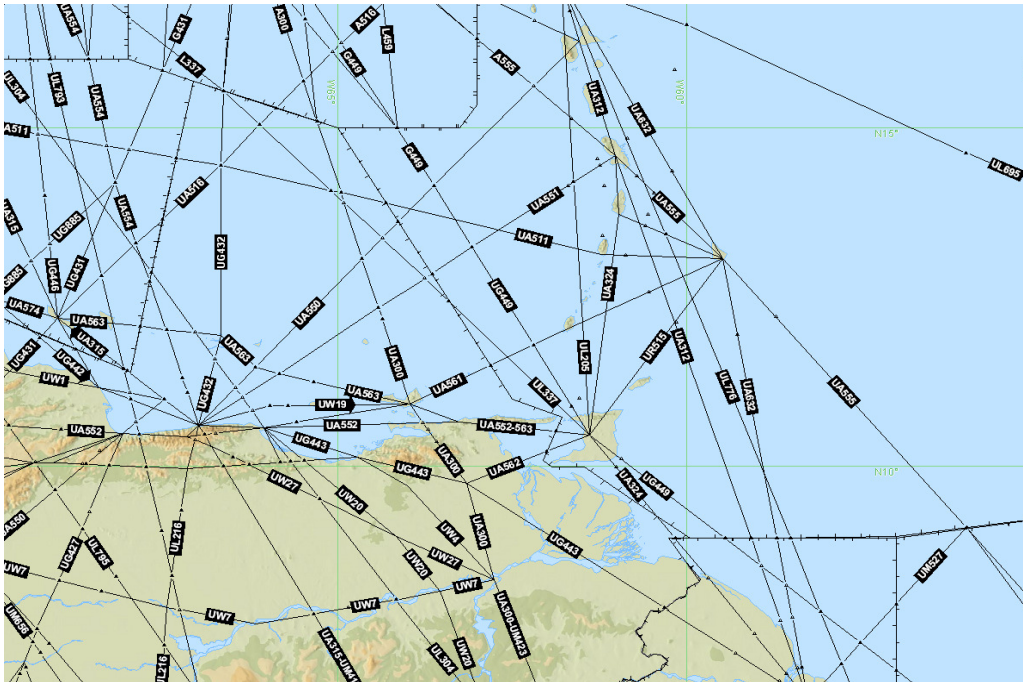


Figure 19 – FIR MAIQUETIA/PIARCO Scenario in 2004.
Source: ICAO meeting final report APATM/9 (2004).

3.2.8 - FIR MAIQUETIA/PIARCO 2004 (IMPLEMENTATION PHASE)

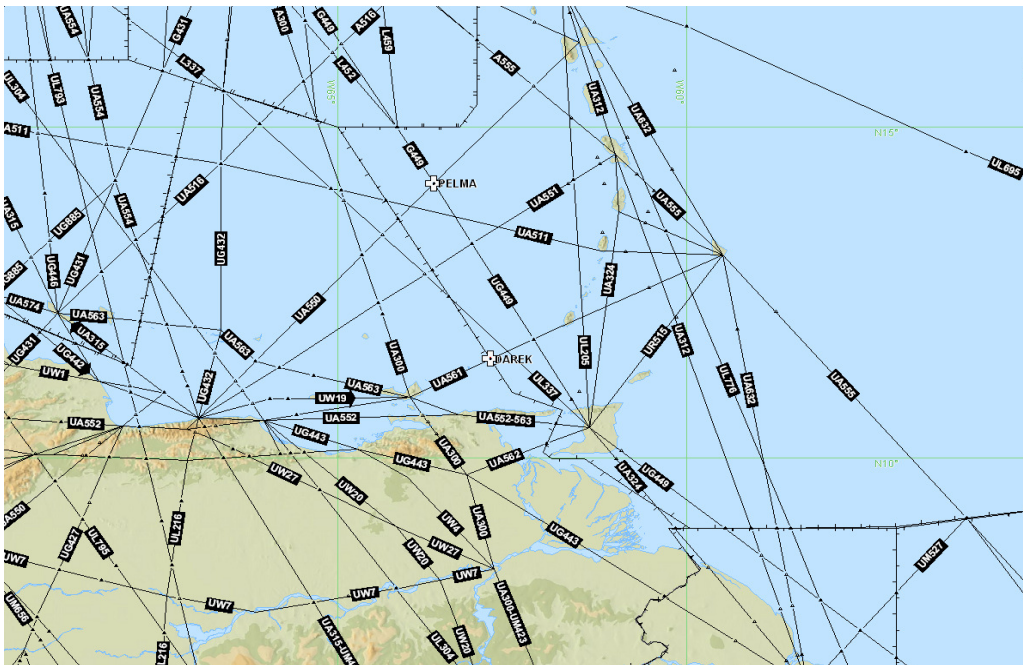


Figure 20 – FIR MAIQUETIA/PIARCO Scenario in 2004.
Source: ICAO meeting final report AP/ATM/10 (2005).

3.2.9 - FIR MAIQUETIA/PIARCO 2005

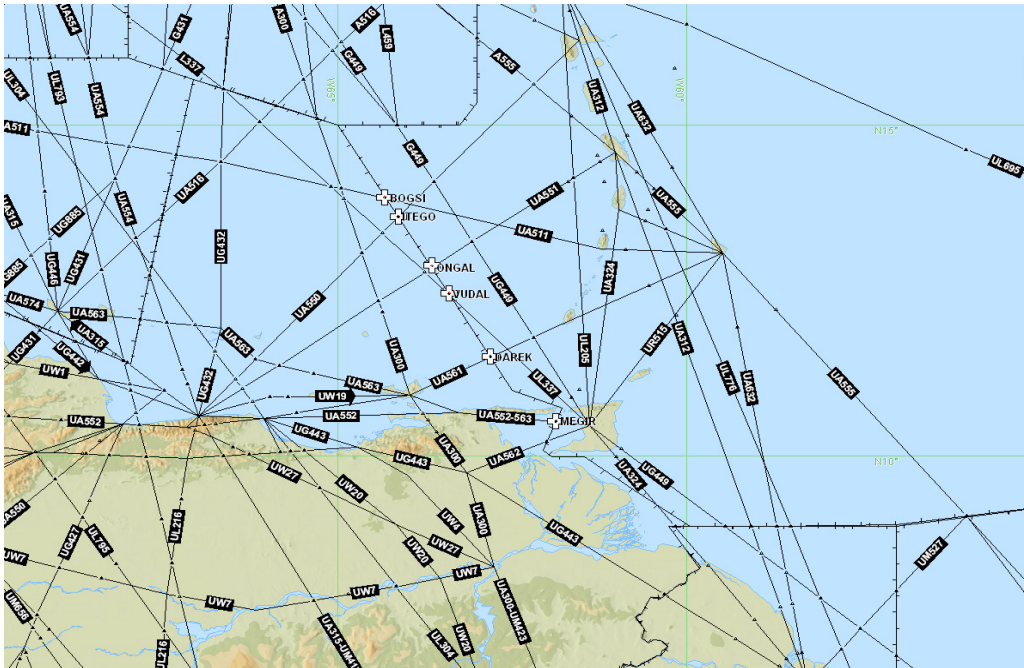


Figure 21 – FIR MAIQUETIA/PIARCO Scenario in 2005.
Source: ICAO meeting final report AP/ATM/11 (2005) and AP/ATM/12 (2006).

3.2.10 - FIR MAIQUETIA/PIARCO 2006

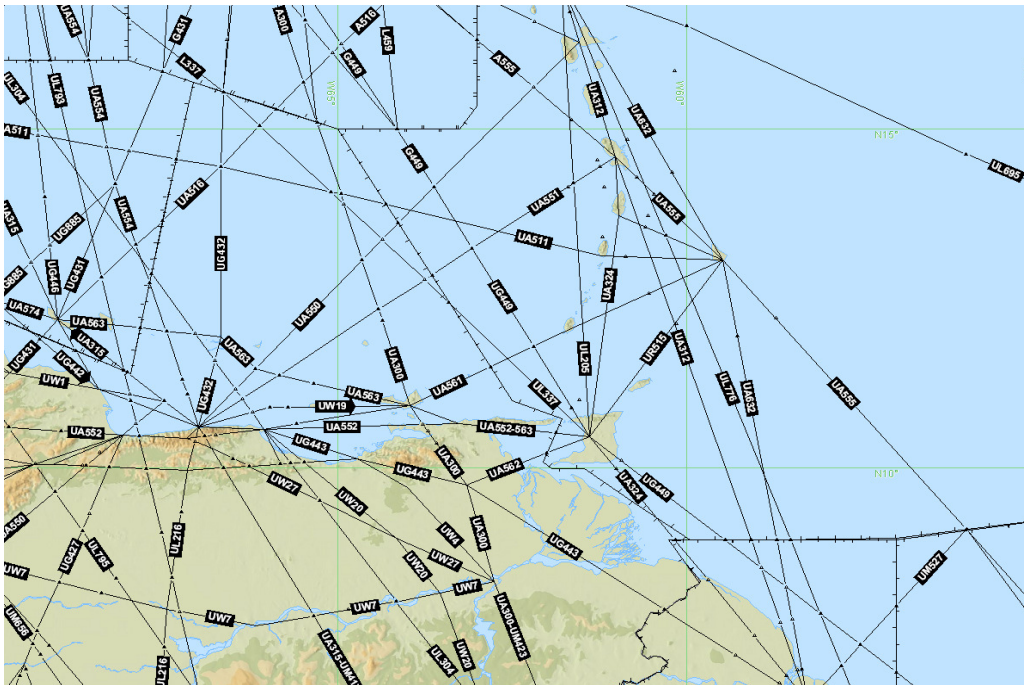


Figure 22 – FIR MAIQUETIA/PIARCO Scenario in 2006.
Source: AP/ATM/13 (2007) Meeting Final Report.

3.2.11 - FIR MAIQUETIA/PIARCO 2007

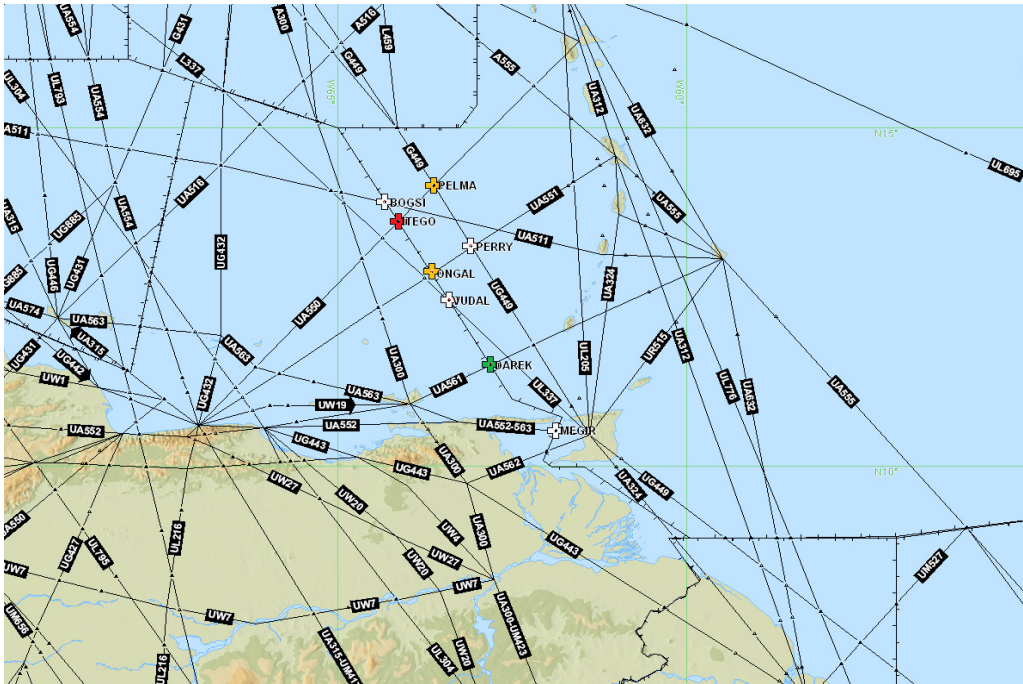


Figure 23 – FIR MAIQUETIA/PIARCO Scenario in 2007.
Source: Working Papers from meetings GTE/4 (2007) and GTE/5 (2008).

3.2.12 - FIR MAIQUETIA/PIARCO 2008

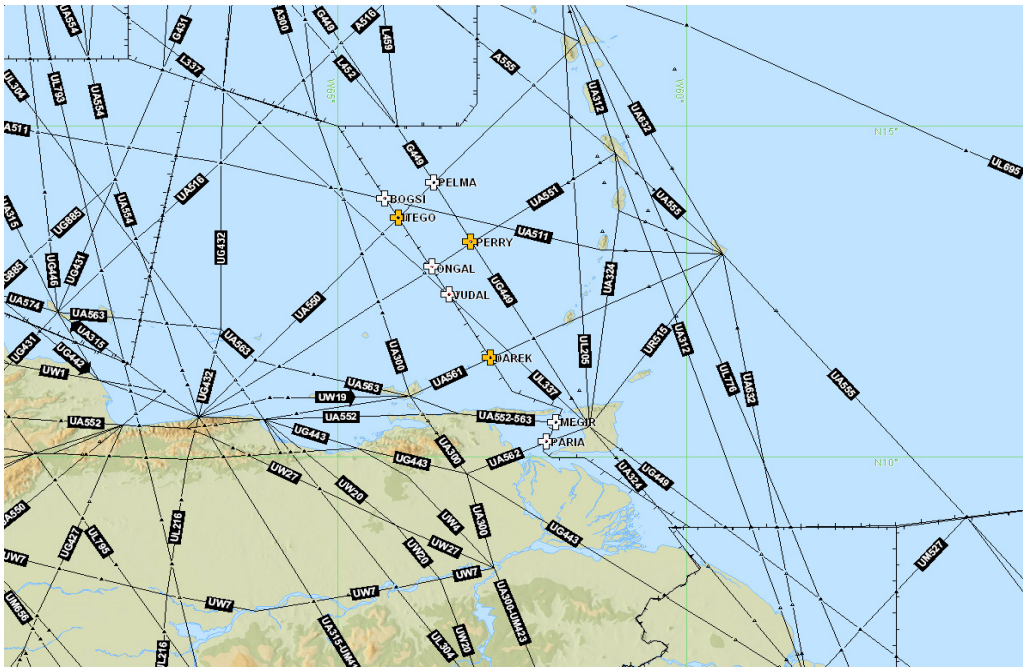


Figure 24 – FIR MAIQUETIA/PIARCO Scenario in 2008.
Source: Working Papers from meetings GTE/6 (2008) and GTE/7 (2009).

3.2.13 - FIR MAIQUETIA/PIARCO (2009)

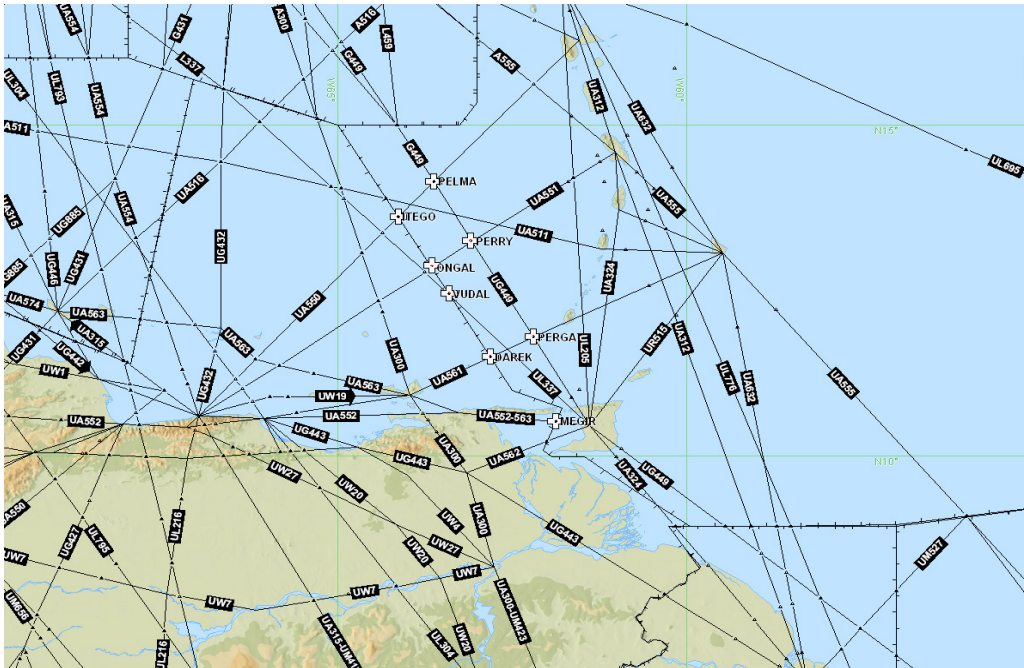


Figure 25 –FIR MAIQUETIA/PIARCO Scenario in 2010.
Source: CARSAAMA

3.2.14 - FIR MAIQUETIA/PIARCO (2010)

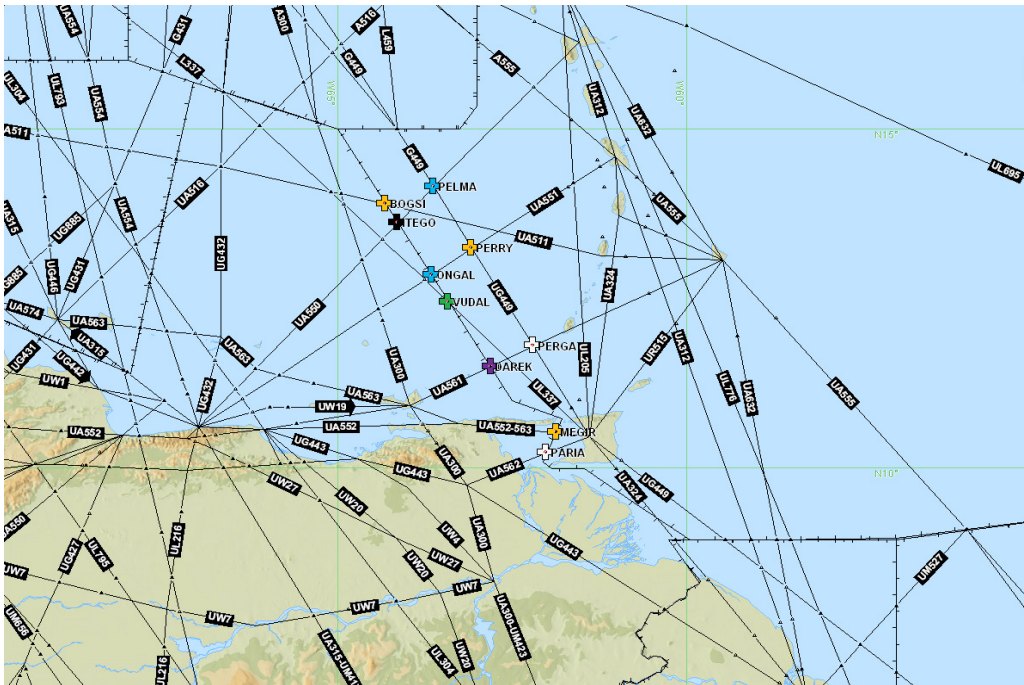


Figure 26 – FIR MAIQUETIA/PIARCO (2010).
Source: CARSAAMA

3.2.15 - FIR MAIQUETIA/PIARCO (2004- 2009)

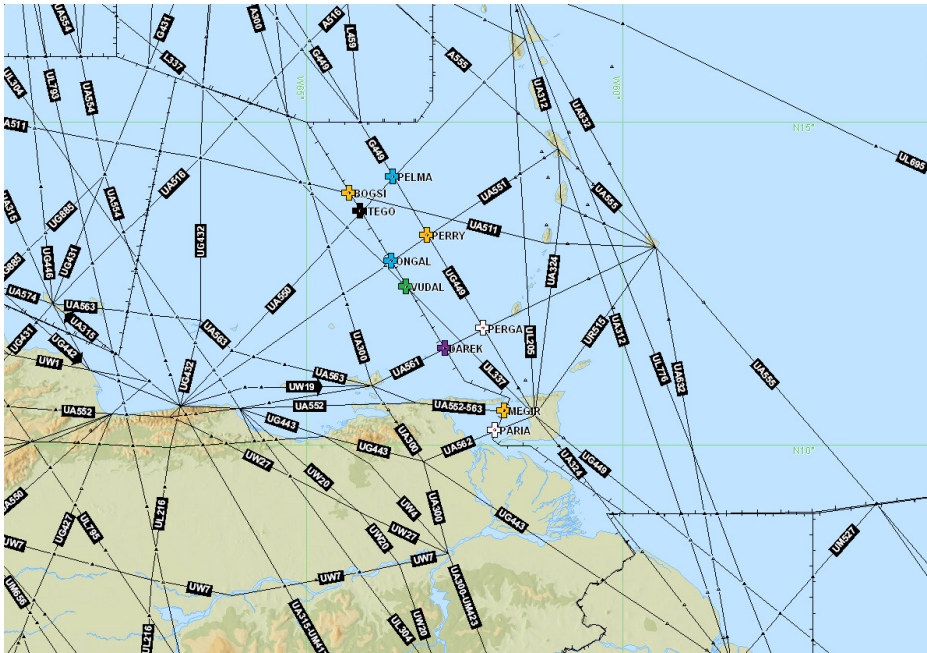


Figure 26 – FIR MAIQUETIA/PIARCO (2004 – 2010).
Source: CARSAMMA

INTENTIONALLY IN BLANK

3.2.16 - FIR MAIQUETIA/PIARCO 2010

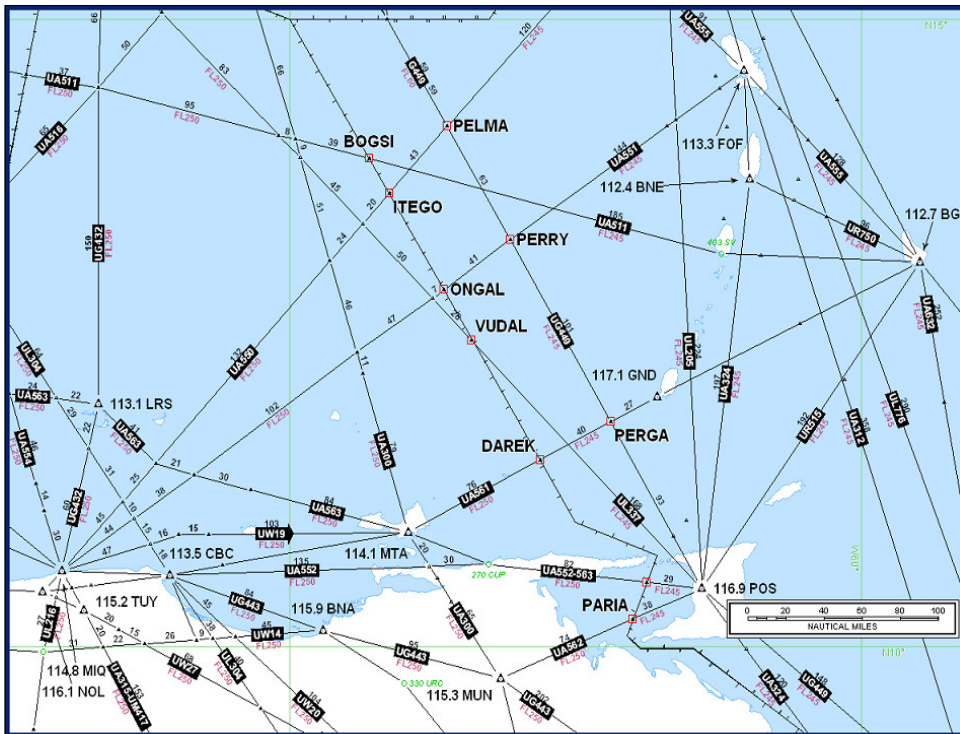


Figure 27 – Lack of notification points Scenario at FIR PIARCO.
Source: CARSAMMA

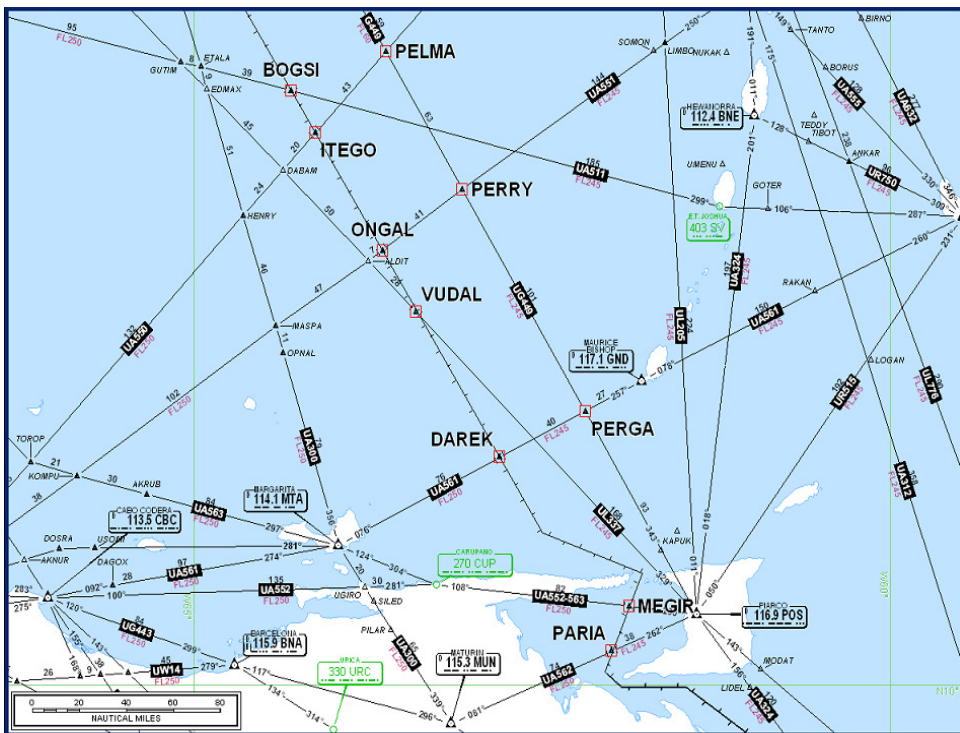


Figure 28 – Notification points scenario at FIR MAIQUETIA.
Source: CARSAMMA

3.2.17 - FIR MAIQUETIA/PIARCO 2010

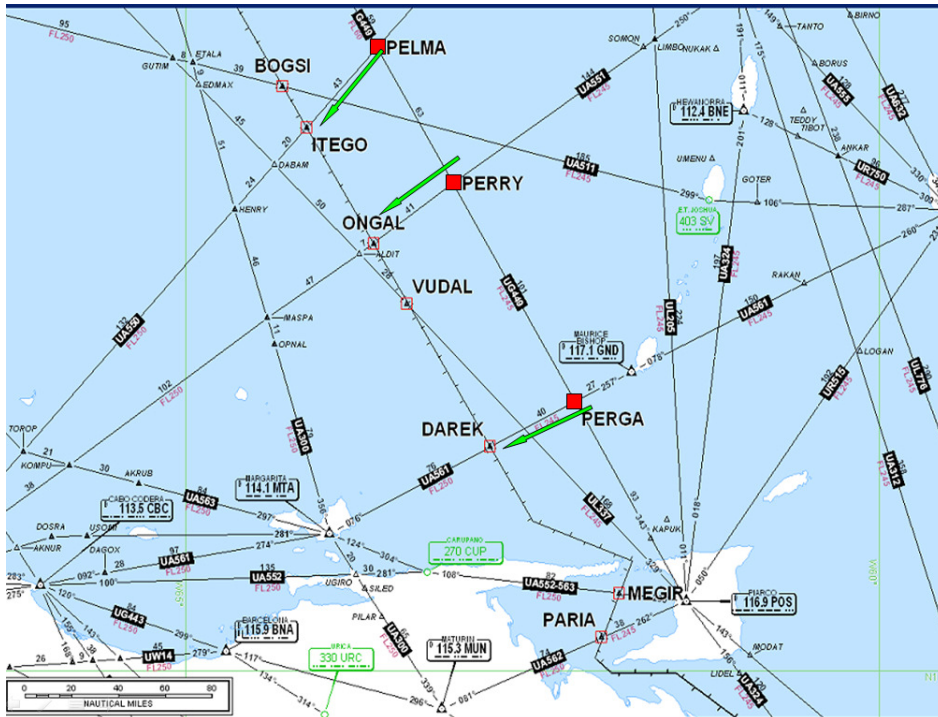


Figure 29 – Transfer analysis scenario (MAIQUETIA-PIARCO-MAIQUETIA).
Source: CARSAMMA

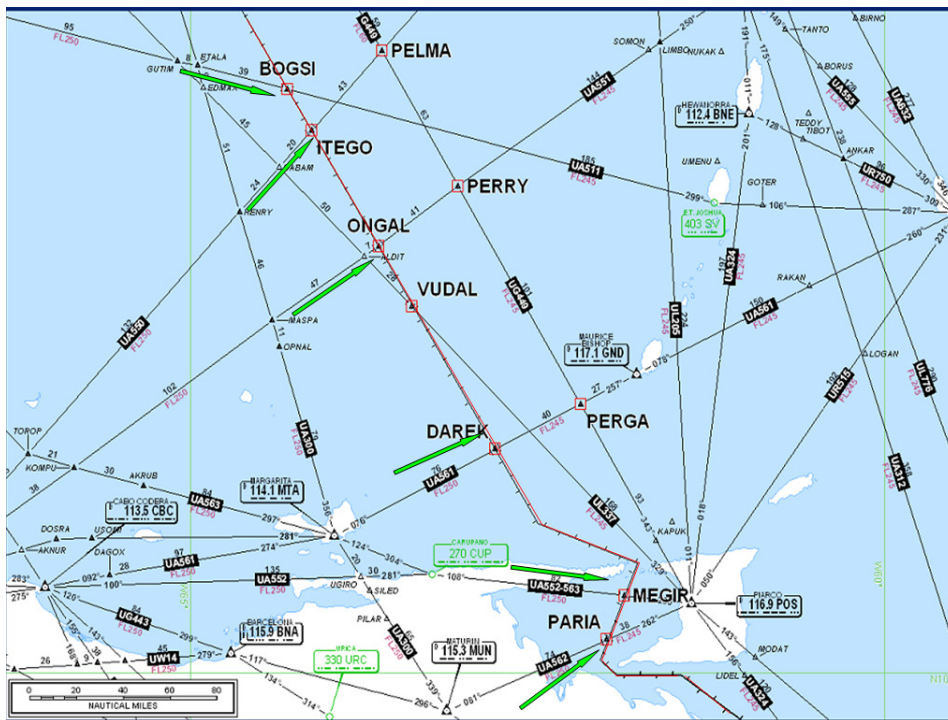


Figure 30 – Transfer analysis scenario (MAIQUETIA-PIARCO-MAIQUETIA).
Source: CARSAMMA

3.2.18 - FIR MAIQUETIA/PIARCO 2010

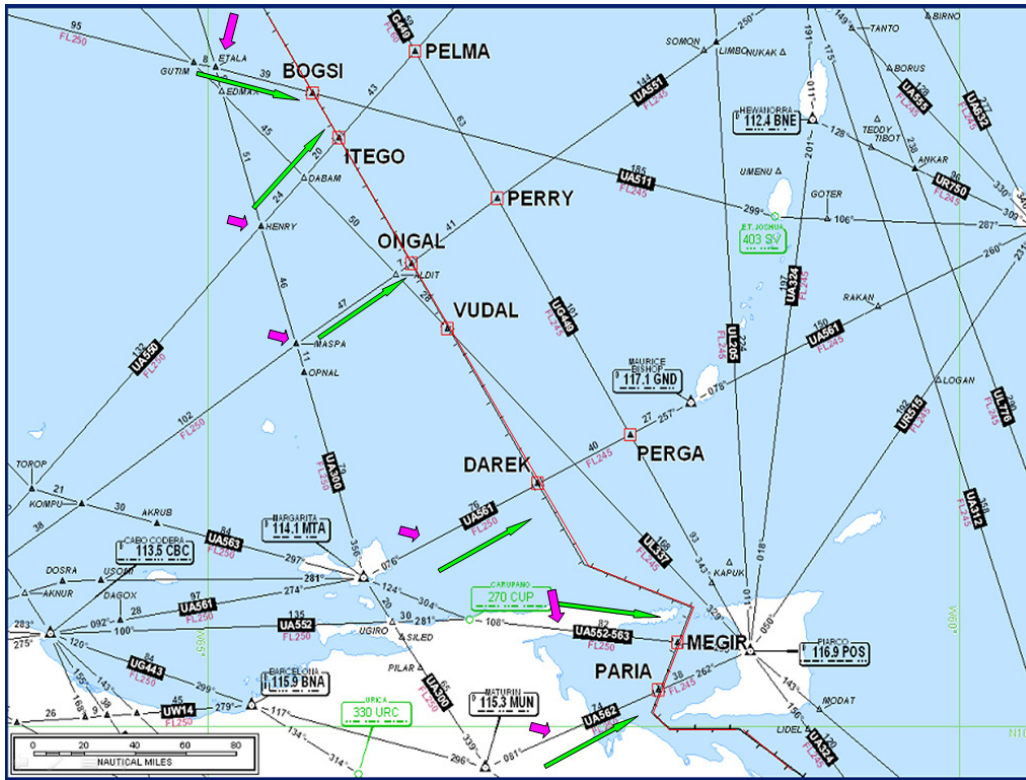


Figure 31 – Transfer proposal scenario (MAIQUETIA-PIARCO).
Source: CARISAMMA

INTENTIONALLY IN BLANK

3.2.19 - FIR PIARCO 2010

CARSAMMA Caribbean and South American Monitoring Agency		The information contained in this form is confidential and will be used for statistical/safety analysis purposes only.	
ALTITUDE DEVIATION FORM Report to the CARSAMMA of an altitude deviation of 300ft or more, including those due to TCAS, Turbulence and Contingency Events			
1. Today's date: 2010-06-28		2. Reporting Unit: PIARCO ACC	
DEVIATION DETAILS			
3. Operator Name: AVIANCA	4. Call Sign: AV1818	5. Aircraft Type: A332/H	6. Mode C Display: NO
7. Date of Occurrence: 2010-06-28		8. Time UTC: 05:45	
9. Occurrence Position (lat/long or FA): PERGA			
10. Cleared Route of Flight: SKBO - HENRY - UAS50 - PPR - 18N060W - LEBL			
11. Cleared Flight Level: F390	12. Estimated Duration at Incurred Flight Level (seconds):	13. Observed Deviation (+/- Ft): N/A	
14. Other Traffic Involved: NONE IN PIARCO FIR			
15. Cause of Deviation (brief description of error - IN-ERROR IN): (Examples: ATC Loop Error, Turbulence, Weather, Equipment Failure)			
AFTER DEVIATION		NARRATIVE	
16. Observed/Reported Final Flight Level: FL390		20. Detailed Description of Deviation (Please give your assessment of the actual track flown by the aircraft and the cause of the deviation)	
17. Is the FL above/below cleared level?		1. PIARCO ACC recorded an estimate from MAIQUETIA ACC on AVA018 at PELMA at 04:45 F390. 2. Route of flight on FPL sent to PIARCO ACC - SKBO - HENRY - UA550 - PPR - 18N060W - LEBL. 3. AVA018 contacted PIARCO at 04:38 UTC estimating position PERGA at 04:45 F390 on a different route of flight - SKBO - MTA - UA561 - BGI - 18N050W - LEBL. 4. MAIQUETIA ACC advised PIARCO ACC that an estimate was passed at position PERGA . 5. Tape investigations revealed that the estimate on AVA018 was passed at position PELMA at 04:45 F390.	
18. Please indicate the source of information - Mode C/P/RA			
19. Remarks			
1. PIARCO ACC recorded an estimate from MAIQUETIA ACC on AVA018 at PELMA at 04:45 F390. 2. Route of flight on FPL sent to PIARCO ACC - SKBO - HENRY - UA550 - PPR - 18N060W - LEBL. 3. AVA018 contacted PIARCO at 04:38 UTC estimating position PERGA at 04:45 F390 on a different route of flight - SKBO - MTA - UA561 - BGI - 18N050W - LEBL. 4. MAIQUETIA ACC advised PIARCO ACC that an estimate was passed at position PERGA. 5. Tape investigations revealed that the estimate on AVA018 was passed at position PELMA at 04:45 F390.			
When complete please forward the report(s) to: Caribbean and South American Monitoring Agency (CARSAMMA) Av. Boy. Faria Lima, 1941 São José dos Campos, SP CEP: 12227-900 - Brasil Telephone: (55-12) 364-3004 or 364-2010 Fax: (55-12) 364-7065 E-Mail: carsamma@comcast.br			
CREW COMMENTS (IF ANY)			

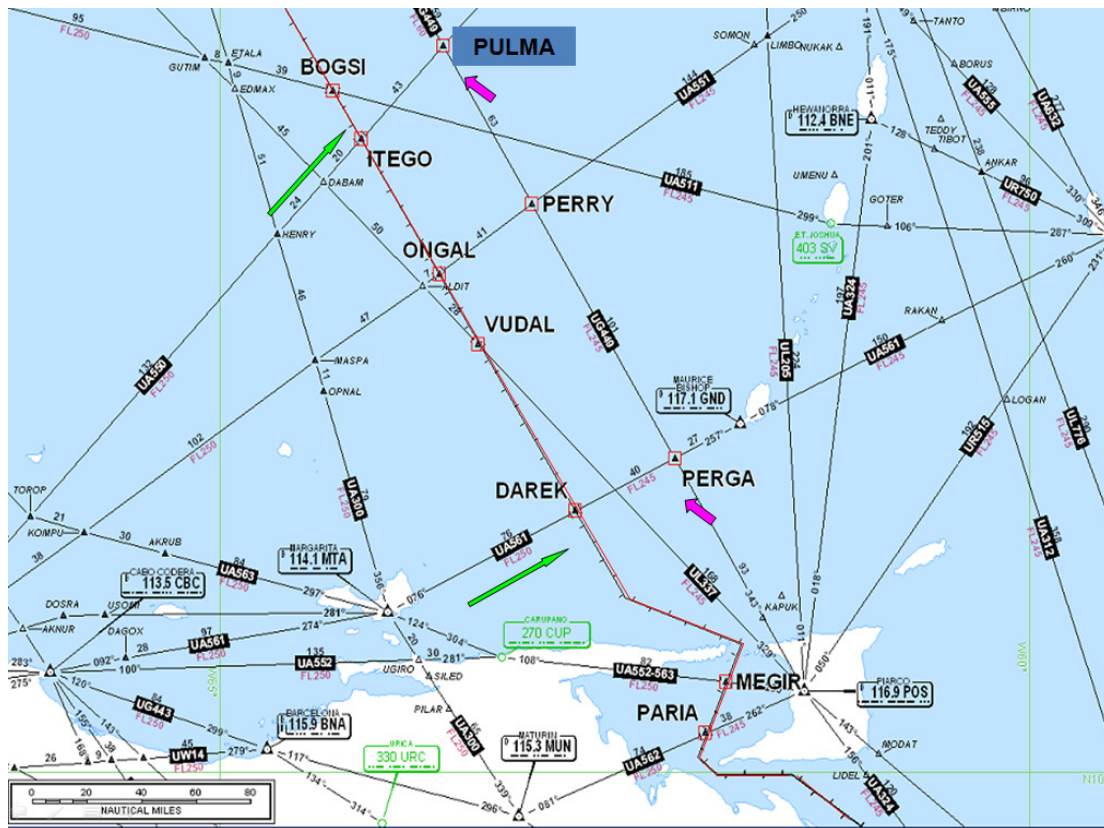


Figure 32 – Proposed change of name of notification point scenario.
Source: CARSAMMA

3.2.20 - FIR PIARCO 2010

CARSAMMA Caribbean and South America Monitoring Agency		The information contained in this form is confidential and will be used for statistical safety analysis purposes only.	
ALTITUDE DEVIATION FORM			
Report to the CARSAMMA of an altitude deviation of 300ft or more, including those due to TCAS, Turbulence and Contingency Events			
1. Today's date: 2008-06-25	2. Reporting Unit: PIARCO ACC		
DEVIATION DETAILS			
3. Operator Name: IBERIA - LINEAS AEREAS DE ESPAÑA, S.A.	4. Call Sign: IBE6464	5. Aircraft Type: A343	6. Mode C Displayed: N/A
7. Date of Occurrence: 2008-06-25	8. Time UTC: 04:25	9. Occurrence Position (lat/long or FA): PERRY	
10. Cleared Route of Flight: SEGU-UASSL-FOF-18N058W (Exit Piarco FIR)-Random Rte-AWYS-LEMD			
11. Cleared Flight Level: FL 330	12. Estimated Duration of Increased Flight Level (seconds): N/A	13. Observed Deviation (+/- Ft): N/A	
14. Other Traffic Involved: None within PIARCO FIR			
15. Cause of Deviation (brief title): ATC Loop Error (Examples: ATC Loop Error, Turbulence, Weather, Equipment Failure)			
AFTER DEVIATION IS REPORTED		NARRATIVE	
16. Observed/Reported Final Flight Level? Pilot report F350	20. Detailed Description of Deviation (Please give your assessment of the actual track flown by the aircraft and the cause of the deviation)		
*Please indicate the source of information - Mode C/FIS	17. Is the FL above the clearance	18. Is the FL below the clearance	
NARRATIVE (Please give your assessment of the actual track flown by the aircraft and the cause of the deviation)			
1. TTZP ACC APPROVED F330 FOR IBE6464 SEGU-UASSL-FOF-18N058W ESTIMATING PERRY AT TIME 0430. 2. IBE6464 REPORTED AT PERRY 0425F350. 3. WHEN QUERIED ON THE ISSUE IT WAS DIFFICULT TO UNDERSTAND THE EXPLANATION FROM SVZM ACC DUE TO POOR ENGLISH. 4. THE PILOT INDICATED THAT SVZM ACC TOLD HIM TTZP ACC CANNOT APPROVE HIS LEVEL AND THAT HE SHOULD EXPECT DESCENT AT PERRY FROM TTZP ACC.			
CREW COMMENTS			
4. THE PILOT INDICATED THAT SVZM ACC TOLD HIM TTZP ACC CANNOT APPROVE HIS LEVEL AND THAT HE SHOULD EXPECT DESCENT AT PERRY FROM TTZP ACC.			
When complete please forward the report(s) to: Caribbean and South America Monitoring Agency (CARSAMMA) Av. Brg. Fania Lima, 5943 San José de Guaymas, SF PRR-155754000 Rucol			

CARSAMMA Caribbean and South America Monitoring Agency		The information contained in this form is confidential and will be used for statistical safety analysis purposes only.	
ALTITUDE DEVIATION FORM			
Report to the CARSAMMA of an altitude deviation of 300ft or more, including those due to TCAS, Turbulence and Contingency Events			
1. Today's date: 08-08-2008	2. Reporting Unit: PIARCO ACC		
DEVIATION DETAILS			
3. Operator Name: IBERIA	4. Call Sign: IBE6464	5. Aircraft Type: A343/H	6. Mode C Displayed: N/A
7. Date of Occurrence: 08-08-2008	8. Time UTC: 04:20	9. Occurrence Position (lat/long or FA): ONCAL	
10. Cleared Route of Flight: SEGU -UA551-FOF-1800N5800W-2300N05000- LEMD			
11. Cleared Flight Level: F310	12. Estimated Duration of Increased Flight Level (seconds): N/A	13. Observed Deviation (+/- Ft): N/A	
14. Other Traffic Involved: DAL211- B764/H - KATL-ANADA -UG449- IBERT-SBGL			
15. Cause of Deviation (brief title): ATC Loop Error (Examples: ATC Loop Error, Turbulence, Weather, Equipment Failure)			
AFTER DEVIATION IS REPORTED		NARRATIVE	
16. Observed/Reported Final Flight Level? Pilot report F330	20. Detailed Description of Deviation (Please give your assessment of the actual track flown by the aircraft and the cause of the deviation)		
*Please indicate the source of information - Mode C/FIS	17. Is the FL above the clearance	18. Is the FL below the clearance	
NARRATIVE (Please give your assessment of the actual track flown by the aircraft and the cause of the deviation)			
• Maiquetia ACC coordinated IBE6464 with Piarco ACC estimating PERRY 0425F330. Piarco ACC approved F310 for the aircraft due to conflicting traffic on the UG449 at and Maintaining F330. • At time 0417UTC IBE6464 contacted Piarco ACC and reported an estimate for PERRY of 0425F330. • Conflicting traffic for this aircraft DAL211- B764/H - KATL-ANADA -UG449- IBERT-SBGL was estimating Perry at 0427F330. • Piarco ACC cleared DAL211 to climb immediately to F340. • IBE6464 was advised by Piarco that F310 was approved by Piarco for crossing the Piarco /Maiquetia FIR boundary and to re-establish contact with Maiquetia for the correct Flight Level assignment. • IBE6464 was subsequently cleared to F311. • After crossing PERGA DAL211 was re-cleared to the correct level for direction of flight F330.			
CREW COMMENTS			
When complete please forward the report(s) to: Caribbean and South America Monitoring Agency (CARSAMMA) Av. Brg. Fania Lima, 5943 San José de Guaymas, SF CEP: 155754000 Rucol Telephone: (55-12) 3944-3004 or 3904-5030 Fax: (55-12) 3944-7055 E-Mail: carsamma@carsamma.pr			

Figure 33 – LHD – English language deficiency MAIQUETIA.
Source: CARSAMMA

3.2.21 – OPERATOR INVOLVED IN LHD.

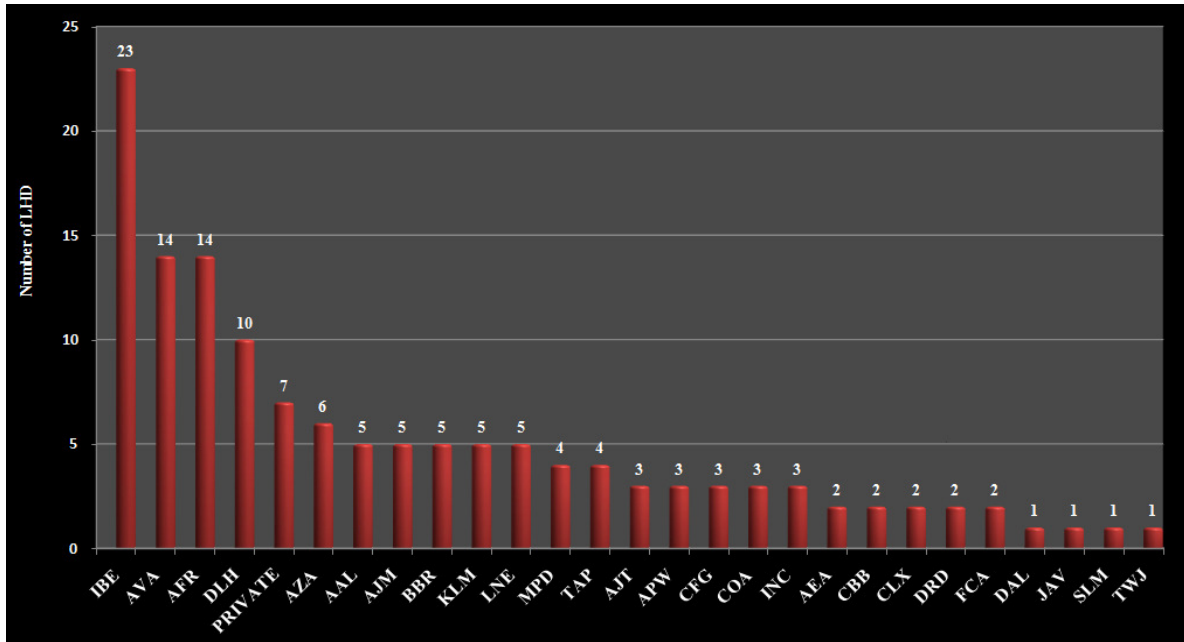


Figure 34 – LHD by operators.
Source: CARSAMMA

3.2.22 –LHD DAY/NIGHT.

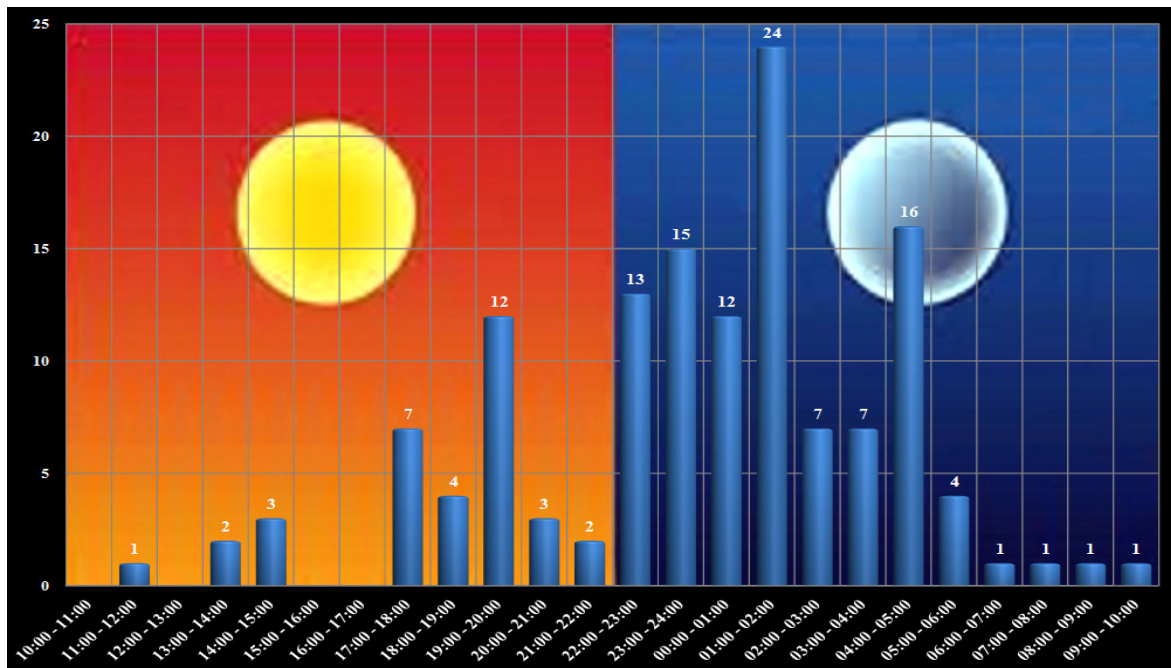


Figure 35 – LHD DAY/NIGHT.
Source: CARSAMMA

3.2.23 - FIR PIARCO 2010



Figure 36 – Proposal of radar site or CPDLC.
Source: CARSAMMA

Scenarios represent the trends that changed in each annual assessment cycle, providing visibility of the trends. In order to continue with the achievement of the objectives of this survey, ICAO recommended measures and corrective actions taken by CAR/SAM States, during the period 2004-2009, will be presented as follows.

4. Actions recommended by ICAO or adopted by CAR/SAM States

The actions recommended by ICAO and the actions carried out by CAR/SAM States were obtained from working papers and final reports of the AP/ATM/09, AP/ATM/10, AP/ATM/11, AP/ATM/12, AP/ATM/13, GTE/4, GTE/5, ATM/CNS/SG/6, GTE/6, GTE/7, GTE/8 and GTE/9 meetings, as well as from CARSAMMA' and ICAO documents.

4.1 – ACTIONS (ICAO/STATES) 2004-2009

- a) Identify the importance of LHD for the collision risk assessment process between aircraft in cruise flight;
- b) Alert sources responsible for the inconsistency of most of the data sent;
- c) Submit to CARSAMMA, until the tenth day of each month, LHD reports occurring in the FIR under your responsibility;

- d) Provide special attention to the record of the flight time in the incorrect level, therefore being able to estimate the proportion of flight hours in incorrect levels;
- e) Alert States on the need to collect data on lateral deviations for the verification of the lateral parameter of typical performance, used in vertical risk assessment;
- f) Alert States on the need to implement a programme to collect performance data for altitude maintenance (TVE);
- g) Give special attention to record the number of steps for a non-authorized level;
- h) Remember that authorizations of ascending/descending were not executed in agreement;
- i) Train ATCOs to avoid coordination errors between air traffic control units in incorrect flights and level crossings without clearance;
- j) Alert States on the need to implement a programme to supervise altimetry system errors (ASE);
- k) Avoid error in the ATC communication cycle (train pilots so that they do not incorrectly interpret the clearance message or the ATC executes the incorrect clearance);
- l) Alert States to, due to the lack of standardization of the occurrence of operational errors (human) between FIRs, there is a great possibility that some States do not send LHD reports.
- m) Encourage States to give special attention to errors due to TCAS reply;
- n) Seek for unknown causes of errors;
- o) Review LHD causes for identification of the most common causes;
- p) Request aircraft flying in oceanic airspaces, 10 minutes in advance of the transference point, make further contact with ACC, to avoid coordination errors between air traffic control units;
- q) Urgently apply a corrective actions programme, to reduce misunderstandings between pilots and ATCOs or issuing incorrect permissions by the air traffic control;
- r) Review LHD causes to identify the most common cause and supervise RVSM airspace; and
- s) Avoid errors due to turbulence or meteorological causes.

4.2 – MITIGATING ACTIONS FOR PIARCO/MAIQUETIA (2010)

- a) Verification of crossing points with no names in PIARCO;
- b) Improve transference conditions between air traffic units, with emphasis in MAIQUETIA for PIARCO, taking into consideration transference points;
- c) Possible error due to similar names
- d) Improvement in the English language;
- e) Guide ATCOs regarding some operators flying within their FIRs with LHD
- f) Guide ATCOs with respect to the difference of the LHD occurrence between day and night;
- g) Need for installing a route radar, with 200 NM approximate coverage, in George F. Charles (TLPC) or in Castries (TLPL) or that it would be of great assistance to mitigate problems; and
- h) Install CPDLC (Control Pilot Data Link Communications) where ground/to/ground or ground/to/earth communications are not totally reliable.

5. Conclusions

In the light of the Systems General Theory, it was possible to identify each detail of subsystems, inter-phases, processes and models adopted in the RVSM airspace surveillance process.

In addition to the Systems General Theory, the study was enriched by the issues: risk, models, processes, organizations environment, decision making process, and indicators (quality tools).

In studying the risk, the new concept was pointed out, the risk causes by technology, especially those related to aviation.

We know the function of Models and we established the process, which provided comprehension of the behavior of the CAR/SAM Airspace Control System, and the importance to establish a control to maintain an acceptable operation level.

Through an explanatory model, they were identified, in detail, the RVSM airspace surveillance measures, and the knowledge flow used in the decision-making process.

The survey focused in ICAO working papers and in final reports of all meeting having the CAR/SAM RVSM matter, between years 2004 and 2009.

From the data collected, information on LHD was obtained, their causes and points with greater occurrence.

These data was processed and knowledge and indicators arisen for the creation of scenarios.

A panel was created with several CAR/SAM routes chart to identify occurrence pints and show the scenarios on LHD evolution, between 2004 and 2009.

The measures recommended by ICAO were extracted from the same working papers and final reports, for the elimination of LHD and for safety improvement.

Assuming that an organic system survives only in balance, and to this end it counts with sensors and regulation devices of its process in the search for homeostasis per analogy, the CAR/SAM airspace also behaves as a life body. And it remains in operation, without interruptions, paying attention to the events that unbalance its service quality and operations safety.

Therefore, in the light of the Systems General Theory and in view of the comparison between scenarios and actions recommended by ICAO or applied by CAR/SAM States, it identified the influence of the of the RVSM airspace surveillance process.

The RVSM airspace surveillance process was essential to maintain safety.

The aircraft control (certified and approved) avoided improper utilization of the RVSM airspace.

As table 2 of this document, it became evident that the main LHD causes were: coordination errors between air traffic units (Code M), lack of coordination of the transmitting air traffic control unit, and the communication gaps between pilots and ATCOs (Code 1) totaling 90.8% of all LHD reports, between 2004 and 2009.

Activation pints were crucial to build scenarios and show that most problems were produced in the adjacent FIR boundaries.

A greater number of LHD was registered in the vertical of the following fixed: LIXAS, UGUPI, VESKA, BOKAN, SORTA, GELIS, KONRI, NANIK, ENSOL, DAKMO, SISEL, BEROX, ITEGO, VAKUD, IREMI, DAREK, ONGAL, ANADA, PADOX, PELMA, VUMPI and PIGBI.

We also reached to some other conclusions:

a) The increase of LHD records, among several factors, was promoted in view of the CAR/SAM States awareness and the policy adopted by CARSAMMA and ICAO;

b) It was noted that the actions recommended by ICAO and corrective measures adopted by CAR/SAM States, in comparison to risk scenarios from 2004 to 2009, demonstrated that they have fixed the problems between Rochambeau, Amazonica and Paramaribo FIRs, in 2005; BOGOTA, BARRANQUILLA, KINGSTON, PANAMA, CENTRAL AMERICA, ANTOFAGASTA and CORDOBA in 2006; LIMA and GUAYAQUIL, in 2007; CURAÇAO, STO. DOMINGO, PORT-AU-PRINCE, AMAZONICA and BRASILIA, and 2008;

c) MAIQUETIA has to improve transference conditions to PIARCO, taking into consideration the transference points;

d) Errors will occur due to similar names'

e) Errors will occur due to the deficient level of English language use;

f) Some operators fly with more LHD in MAIQUETIA and PIARCO FIRs;

g) There is a difference of the number of LHD occurrences between the day and night;

h) In spite of high costs, there is a need for installing a route radar, with approximate coverage of 200NM in George F. Charles (TLPC) or in Castries (TLPL), or that it would be of great assistance to mitigate problems; and

i) Another proposal would be to install CPDLC (Control Pilot Data Link Communications), where ground-ground or air-ground communications are not totally reliable.

This survey did not exhaust the subject matter but served to encourage studies and discussions to improve decision-making in CAR/SAM RVSM airspace safety management, contributing for an integral reflection of the problems and to provide replies so that authorities comply with their responsibilities with greater effectiveness.