ANALYSIS OF FANS SERVICES IN THE EUR/SAM CORRIDOR (CANARIAS AIRSPACE) 2012 REPORT

APPROVALS

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CHANGE RECORD

Issue	Date	Affected Pages	Changes
0.1	21/02/13	All	First draft version.
0.2	01/03/13	All	Second draft after internal review.
1.0	05/03/13	All	First Edition.

The Change Record reflects, at least, the last three modifications made in the document.

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INDEX

FIGURE INDEX

TABLE INDEX

EXECUTIVE SUMMARY

This report presents the FANS services performance and use for flights in the Canarias airspace of the EUR/SAM Corridor, presenting traffic data, data link utilization, CPDLC exchange, etc., as well as a brief description of potential issues, to be further investigated and for which actions might be agreed, identified during the period of research.

This report is based on records from the ADS/CPDLC System of the Canarias FIR (SACCAN). For this analysis, data from January 2012 to December 2012 has been used in the study.
Data from SAL ACC were also received for four months (February, April, May and August). However, as data did not comprise the whole year and data analysis area extends beyond the EUR/SAM Corridor, they have not been used for the development of this report. Nevertheless, these data seem to be in line with those obtained for SACCAN.

For Canarias data analysis, "EUR/SAM Corridor flights" are considered as those flights either overflying EDUMO, TENPA, IPERA or GUNET, or flying those RANDOM routes with NELSO and/or ROSTA as route waypoints and with exit points at the south of Canarias airspace defined by coordinates.

Traffic data in this period are depicted in Table ES-1, where it can be appreciated that the amount of air traffic making use of FANS services (ADS/CPDLC) is quite stable and that nearly all FANS equipped aircraft connect to SACCAN, most of them performing CPDLC exchange. This table also evinces that traffic in the EUR/SAM Corridor using FANS services in 2012 was almost 60% of total traffic.

	2012 Mean Value	Max Value	Min Value
Number of connected flights (Monthly average)	1651	1813	1347
Percentage referred to total number of flights in the EUR/SAM Corridor	59,16%	63,72%	54,71%
Percentage referred to flights in the EUR/SAM Corridor indicating data link and ADS capacity in the Flight Plan	95,34%	>100,00%[1]	91,89%
Number of flights with CPDLC connection (Monthly average)	1539	1711	1266
Number of different aircraft (aircraft registration) connecting to SACCAN (Monthly average)	236	242	226

Table ES-1
Traffic data summary

Figure ES-1 shows, for the most significant airlines, their percentages referred to the total number of connected flights for the whole time of study. Figure ES-2 shows the percentage of the different types of connected aircraft for each of these airlines.

[1] This case occurred in November, probably due to the presence of aircraft connecting to SACCAN without declaring ADS capacity in their flight plans. See Subsection 6.1.1.

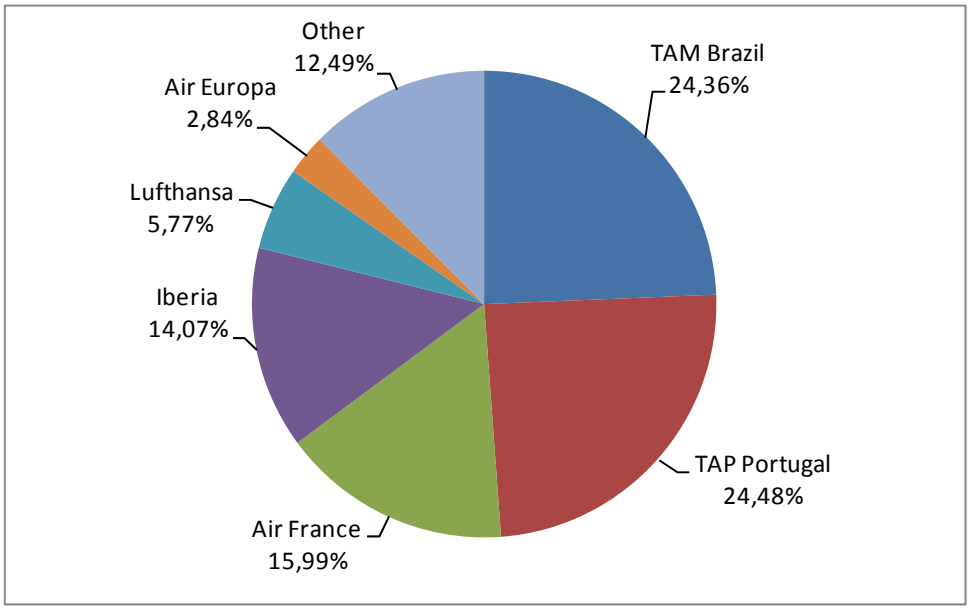

Figure ES-1
Average percentage of most significant airlines

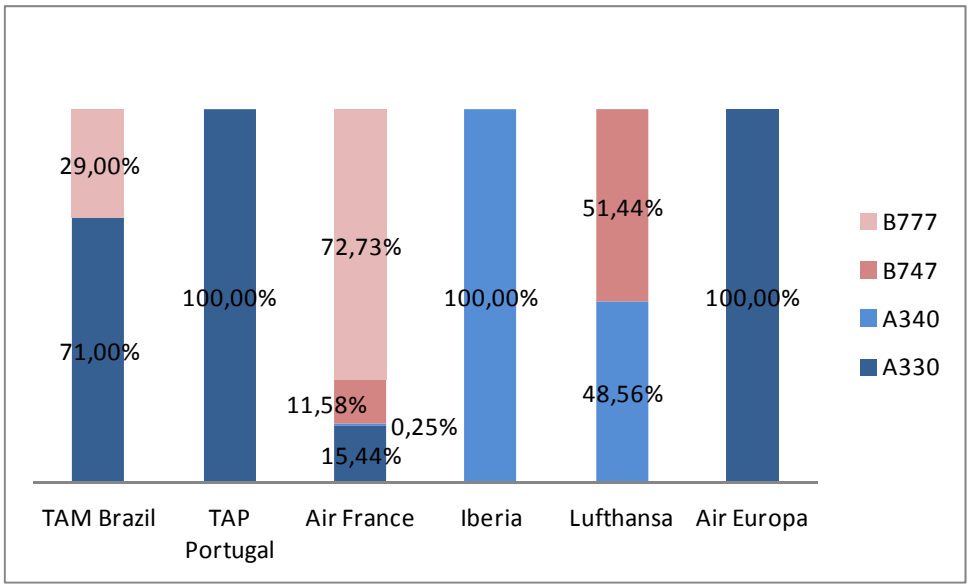

Figure ES-2
Different types of connected aircraft for the most significant airlines

With respect to ADS functionality, in the Canaries FIR a 15 minutes periodic contract and an event contract (for waypoint change and 5 NM lateral deviation) are requested to all logged aircraft. Occasionally demand contracts, and non initial periodic and event contracts (very rarely including vertical rate change or altitude range events) have been also requested.

As far as ADS surveillance data accuracy is concerned, almost all (99,96%) of the analyzed ADS messages in the studied time report a FOM value equal to or better than 6 (FOM parameter, Figure of

Merit, provides information about how precise the A/C position notified in an ADS report is, FOM 6 meaning that the position error is lower than 0.25NM with a probability of 95%).

Regarding the use of CPDLC communications, Table ES-2 shows the most frequent CPDLC message elements (those representing more than 5% from the total number of transmitted elements in, at least, one month), on both uplink and downlink directions.

Type	Message element	Percentage referred to total		
		2012 Mean Value	Max Value	Min Value
UPLINK	NEXT DATA AUTHORITY [icaofacilitydesignation]	17,73%	30,30%	0,67%
	END SERVICE	9,42%	22,35%	0,93%
	[freetext][2]	31,14%	55,61%	14,00%
	SQUAWK [beaconcode]	12,30%	16,14%	9,44%
	CONTACT [icaounitname] [frequency]	10,71%	14,56%	8,37%
	REPORT LEVEL [altitude]	5,72%	7,22%	0,09%
	CLIMB TO AND MAINTAIN [altitude]	4,17%	5,23%	2,65%
	MAINTAIN [altitude]	3,46%	5,83%	1,24%
DOWNLINK	WILCO	31,32%	39,15%	25,07%
	ROGER	23,60%	31,25%	14,34%
	POSITION REPORT [positionreport]	14,48%	16,17%	12,61%
	[freetext][3]	6,82%	8,33%	5,35%
	DEVIATING [distanceoffset] [direction] OF ROUTE	6,46%	7,59%	4,74%
	LEVEL [altitude]	5,71%	8,43%	0,12%

Table ES-2
Most frequent CPDLC message elements

Regarding data link media use for air-to-ground communications, data analysis shows that similar percentages are obtained for the different data link during all the analyzed months, being the utilization of satellite link about 70% of the times whilst VHF link is used for approximately 30% of the air-to-ground transmissions.

[2] Both UM169 and UM170 uplink message elements are included.
[3] Both DM67 and DM68 downlink message elements are included.

With regard to downlink (air-to-ground) messages delays, figures are also quite stable during the studied period. These data are presented in Table ES-3:

Month	Downlink messages delay (seconds)	
	95% delays	99% delays
Jan 2012	40,184	93,610
Feb 2012	40,458	92,320
Mar 2012	42,528	98,212
Apr 2012	43,646	99,720
May 2012	45,996	99,611
Jun 2012	46,356	99,838
Jul 2012	46,618	105,160
Aug 2012	43,536	101,352
Sept 2012	41,248	90,752
Oct 2012	43,508	97,424
Nov 2012	45,433	100,603
Dec 2012	46,656	101,368

Table ES-3
Downlink (Air-to-ground) delays (AFN, CPDLC and ADS)

Finally, concerning FANS system upgrades, it is worth mentioning that on November 27th, transition to SACCAN Phase 3 took effect, which included both HMI improvements and the migration from X.25 to IP protocol for G/G data communications.
It is also to be highlighted that from April, 15th, FANS (ADS-C/CPDLC) transfer procedures are officially in use between Canarias and SAL ACCs.

1. INTRODUCTION

The present report shows data relative to the performance and use of FANS services for the year 2012, concerning aircraft flying in the Canarias airspace of the EUR/SAM Corridor.

The EUR/SAM Corridor covers the routes between Europe and South America crossing the Information Regions (FIR/UIR) of Atlantico, Dakar Oceanic, Sal Oceanic and Canarias. For Canarias data analysis, "EUR/SAM Corridor flights" are considered as those flights either overflying EDUMO, TENPA, IPERA or GUNET, or flying those RANDOM routes with NELSO and/or ROSTA as route waypoints and with exit points at the south of Canarias airspace defined by coordinates (see Figure 1).

Per SAT FIT/7 conclusion number 6, CFRA functions are included in the activity of SATMA, the South Atlantic Monitoring Agency. One of CFRA's duties is the production of annual reports on FANS-1/A activity within the area of interest for review by the SAT FANS-1/A Interoperability Team (FIT). In this regard, AENA, on behalf of SATMA, conducted the corresponding activities for the year 2012, which results are depicted in the present report.

As the provider responsible for ATS in Canarias, AENA monthly oversees FANS 1/A service in Canarias airspace. This report is the data summary of such monitoring activities for 2012 (from January 2012 to December 2012, both included), focusing on traffic overflying the EUR/SAM Corridor part lying in Canarias. Consequently, it only takes into account records from the ADS/CPDLC System of the Canarias FIR (SACCAN). This report describes the FANS services performance and use in terms of traffic data, data link utilization by aircraft, CPDLC exchange, etc., and includes a brief description of issues found during the research period.
Although valuable data from SAL ACC were also received, as they did not comprise the whole year, they are not presented here.

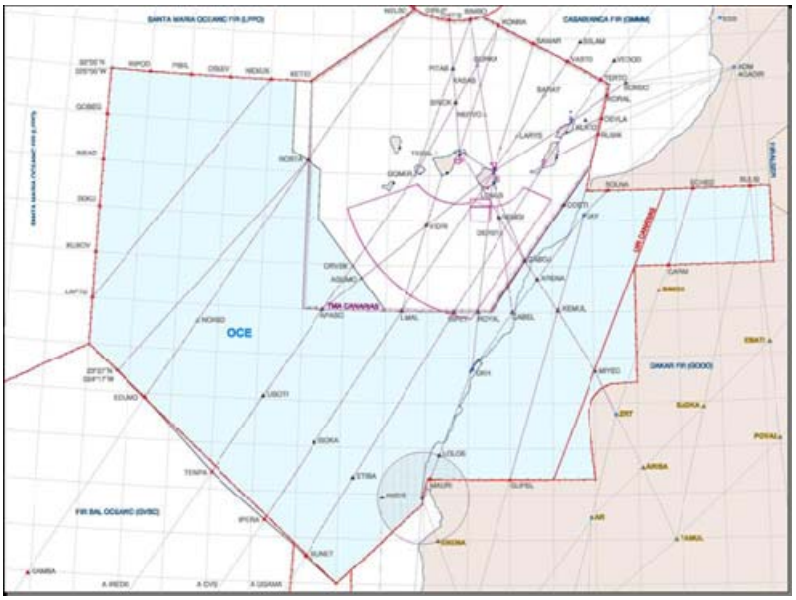

Figure 1
Canarias FIR / UIR

2. TRAFFIC ANALYSIS

This section presents data of traffic flying in the EUR/SAM corridor[4] and making use of FANS1/A services.

Table 1 shows a summary of the analyzed traffic in the EUR/SAM Corridor, from January to December 2012.

Traffic data					
Month	**Number of connected flights**	**Percentage referred to total number of flights in the EUR/SAM Corridor**	**Percentage referred to flights in the EUR/SAM Corridor indicating data link and ADS capacity in the Flight Plan[5]**	**Number of flights with CPDLC connection**	**Number of different aircraft (aircraft registration) connecting to SACCAN**
Jan 2012	1522	55,85%	94,77%	1437	242
Feb 2012	1347	54,71%	94,39%	1266	234
Mar 2012	1654	57,31%	95,50%	1580	239
Apr 2012	1508	59,37%	97,10%	1433	235
May 2012	1659	62,02%	94,75%	1592	234
Jun 2012	1793	63,72%	95,58%	1711	240
Jul 2012	1805	60,29%	94,80%	1710	226
Aug 2012	1797	60,02%	92,63%	1661	236
Sep 2012	1767	61,08%	91,89%	1530	241
Oct 2012	1813	61,60%	95,62%	1593	240
Nov 2012	1516	55,82%	> 100,00%[1]	1391	231
Dec 2012	1636	57,28%	97,56%	1569	230
Average (2012 Mean Value)	1651[6]	59,16%	95,34%	1539[6]	236[6]

Table 1
Traffic data summary

As it can be inferred from the table above, approximately 60% out of the total flights within the EUR/SAM Corridor connect to SACCAN (though percentage dropped down the last two months), having connected nearly all of FANS equipped aircraft (around 95%). Also, the vast majority of logged-on flights connect to CPDLC application (all months except September and October, between 91% and 96% of the logged-on

[4] It must be borne in mind that, wherever data are presented throughout this document, "EUR/SAM Corridor" means "EUR/SAM Corridor part within Canarias airspace".
[5] It is to be noted that Flight Plan format was changed in November 2012 according to ICAO Amendment 1 to PANS-ATM. It has been detected that ADS-C capacity has not always been correctly reported since then (see section 6.1.1 for further details).
[6] Monthly average.

flights). Finally, the number of aircraft (i.e. number of different aircraft registrations) flying over the EUR/SAM Corridor and making use of FANS services is between 226 and 242 per month.

The following table (Table 2) shows the percentage of connected flights for the most significant airlines. As it is shown, airlines with the highest number of connections in the EUR/SAM Corridor are TAP Portugal (about 20% in the first couple of months, following an uptrend to a 25-26% at the summer, and maintaining steady values for the rest of the year) and TAM Brazil (around 25-27% in the first five months of the year, falling to a 22-23%, and rising again up to a 25% in the last two months of the year), comprising about 50% out of the total connected flights between the two of them. The next ones, Air France and Iberia, are about 15% each. These four airlines (TAP Portugal, TAM Brazil, Air France and Iberia) comprise about 80% of the total number of connected flights. Adding Lufthansa and Air Europa to the previous four ones, percentage increases up to about 86-89%.

Month	Airline (% referred to connected flights)					
	TAP Portugal	TAM Brazil	Air France	Iberia	Lufthansa	Air Europa
Jan 2012	20,37%	26,81%	18,46%	11,96%	6,24%	3,15%
Feb 2012	20,94%	27,69%	16,56%	13,96%	4,97%	2,90%
Mar 2012	23,34%	24,97%	16,32%	15,48%	6,11%	2,48%
Apr 2012	20,76%	26,59%	18,10%	13,93%	5,50%	1,92%
May 2012	24,95%	24,89%	14,95%	16,34%	5,00%	1,99%
Jun 2012	25,54%	22,31%	14,61%	15,73%	7,64%	2,23%
Jul 2012	25,76%	22,83%	15,68%	14,46%	7,31%	2,77%
Aug 2012	26,10%	22,98%	15,08%	13,36%	6,40%	3,01%
Sep 2012	26,43%	22,18%	15,39%	14,04%	5,32%	3,57%
Oct 2012	28,19%	22,28%	14,51%	13,84%	6,23%	3,20%
Nov 2012	24,13%	25,77%	17,01%	12,06%	4,35%	3,03%
Dec 2012	25,12%	24,94%	16,14%	13,20%	3,48%	3,79%
Type of airplane (Average)	100% A330	71% A330 29% B777	72,73% B777 15,44% A330 11,58% B747 0,25% A340	100% A340	51,44% B747 48,56% A340	100% A330

Table 2
Most significant airlines data

In the previous table, the percentage of different types of connected aircraft from these airlines (averaged along the analyzed year) is also represented: all their connected aircraft are either Airbus A330, Airbus

A340, Boeing B747 or Boeing B777. These airlines and aircraft percentages are also shown in Figure 2 and Figure 3.

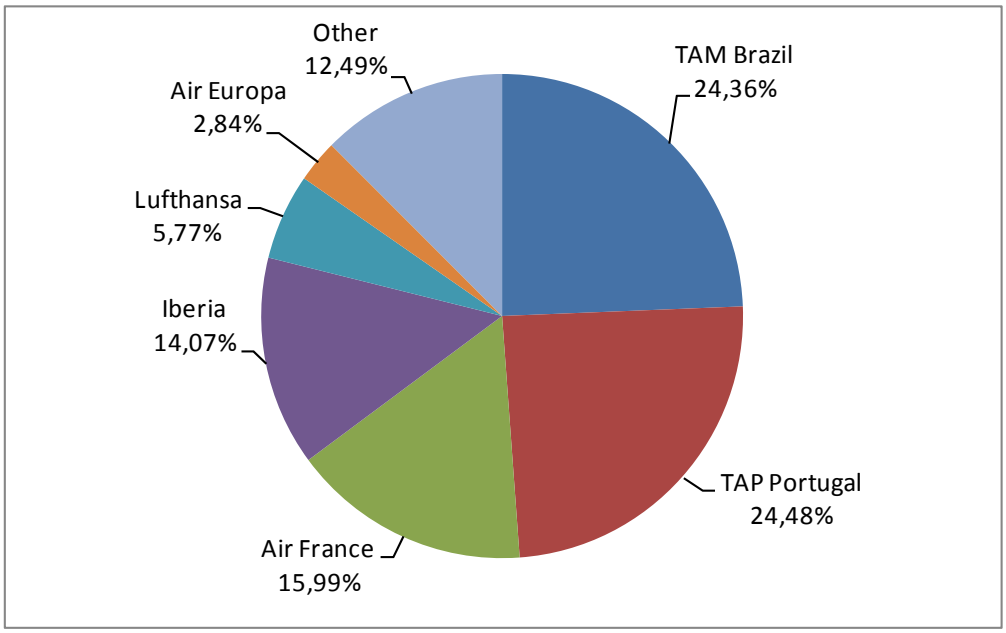

Figure 2
Average percentage of the most significant airlines

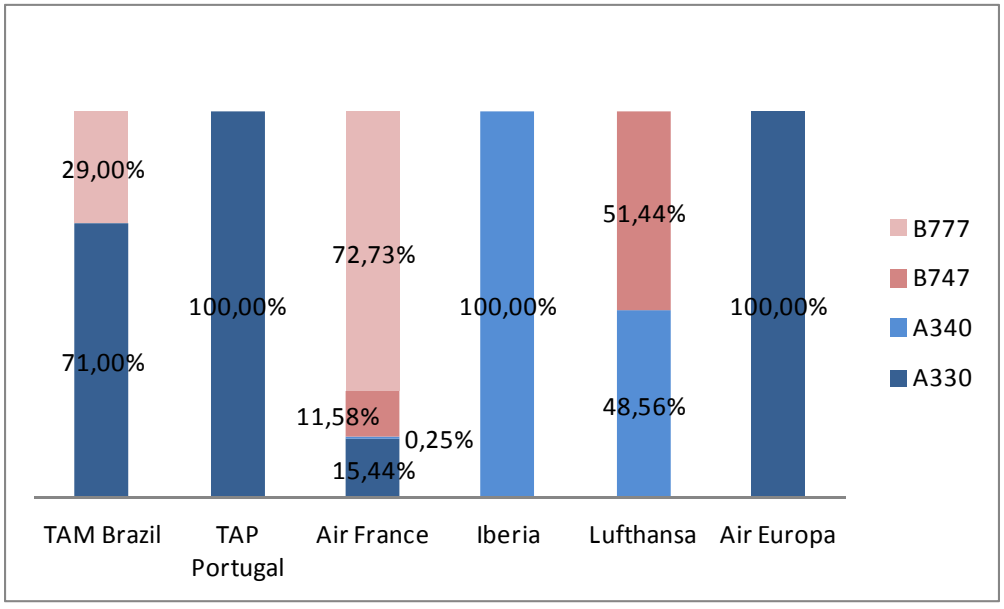

Figure 3
Different types of connected aircraft for the most significant airlines

In addition, Figure 4 illustrates the total percentage of each principal type of connected aircraft flying in the EUR/SAM Corridor.

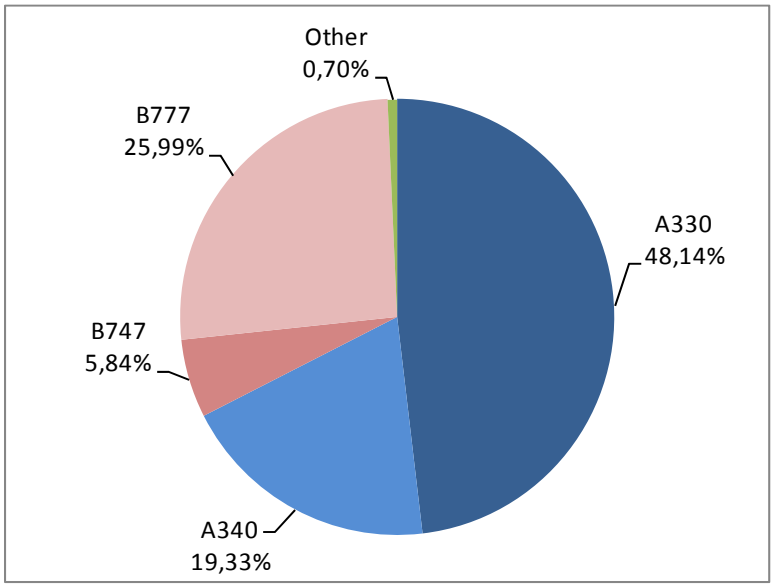

Figure 4
Total percentage of different types of connected aircraft

3. COMUNICATIONS NETWORK PERFORMANCE

The following subsections present the communications network performance, showing the data link media used, as well as the message delay percentages obtained for the months under study.

3.1 DATA LINK MEDIA

The percentage utilization value per data link media used for air-to-ground (i.e. downlink) communications is depicted in Table 3. It shows that the satellite link is primarily used (around 70% of the times), maintaining similar values over the entire year of study.

Month	Percentage of utilization of data link media	
	Satellite Link	VHF Link
Jan 2012	69,73%	30,27%
Feb 2012	70,03%	29,97%
Mar 2012	68,13%	31,87%
Apr 012	70,58%	29,42%
May 012	66,50%	33,50%
Jun 2012	67,21%	32,79%
Jul 2012	68,42%	31,58%
Aug 2012	66,19%	33,81%
Sept 2012	67,05%	32,95%
Oct 2012	69,17%	30,83%
Nov 2012	72,21%	27,79%
Dec 2012	71,69%	28,31%
Total Average	68,80%	31,20%

Table 3
Percentage of data link utilization in 2012

3.2 AIR-TO-GROUND MESSAGES DELAYS

Percentage data for annual downlink messages delays, and annual maximum and minimum values are shown in Table 4, providing indication of the time elapsed in surveillance (ADS) and communications (CPDLC) downlink messages delivery. This table presents delay values for which 95% and 99% of air-to-ground transit times (calculated from message time stamp and message reception time in SACCAN)

remain below, grouped by message type (AFN messages, ADS reports and CPDLC messages in an individual approach, as well as all messages altogether) and data link media (VHF, Satellite and Satellite plus VHF together). As it is seen in Table 4, 95% of calculated times are never greater than 60 seconds whilst 99% of calculated delays are well below 180 seconds. Figures are not constant throughout the analyzed year but, generally speaking, there are not major differences from mean values except in rare cases. As expected, data largely depend on data link media, being satellite delays greater than VHF delays. For monthly percentage data for downlink messages delays, see "ANNEX I: Air-to-Ground Messages Delays per Month".

Parameter	2012 value	Max value [month]	Min value [month]
AFN messages			
95% VHF delay	31,840 s.	48,521 s. [December]	26,438 s. [February]
95% SAT delay	55,799 s.	68,860 s. [May]	49,496 s. [February]
95% Global delay	48,704 s.	59,736 s. [May]	42,588 s. [February]
99% VHF delay	67,520 s.	1503,496 s. [November][7]	44,544 s. [February]
99% SAT delay	97,152 s.	115,318 s. [May]	88,257 s. [September]
99% Global delay	94,208 s.	126,416 s. [December]	78,344 s. [February]
ADS reports			
95% VHF delay	25,208 s.	29,520 s. [November]	22,248 s. [September]
95% SAT delay	52,960 s.	59,624 s. [December]	46,540 s. [February]
95% Global delay	44,120 s.	47,548 s. [July]	39,232 s. [January]
99% VHF delay	67,146 s.	88,503 s. [April]	50,760 s. [September]
99% SAT delay	104,736 s.	115,938 s. [July]	99,338 s. [February]
99% Global delay	99,495 s.	109,168 s. [July]	91,884 s. [September]
CPDLC AT			
95% VHF delay	27,657 s.	42,565 s. [October]	16,432 s. [July]
95% SAT delay	33,648 s.	41,712 s. [June]	28,279 s. [April]
95% Global delay	32,724 s.	40,228 s. [June]	27,788 s. [April]
99% VHF delay	73,007 s.	150,036 s. [August]	48,652 s. [July]
99% SAT delay	86,330 s.	108,772 s. [June]	71,079 s. [August]
99% Global delay	85,216 s.	103,458 s. [December]	70,418 s. [September]

[7] Very high delays have been detected for a limited number of aircraft (see section 6.2.1).

AFN, ADS reports and CPDLC AT			
95% VHF delay	26,043 s.	30,140 s. [November]	23,866 s. [September]
95% SAT delay	51,337 s.	57,806 s. [May]	45,497 s. [February]
95% Global delay	43,946 s.	46,656 s. [December]	40,184 s. [January]
99% VHF delay	67,545 s.	82,243 s. [April]	53,157 s. [September]
99% SAT delay	102,846 s.	112,516 s. [June]	97,372 s. [September]
99% Global delay	98,396 s.	105,160 s. [July]	90,752 s. [September]

Table 4
Delay parameters (January 2012 to December 2012)

4. AUTOMATIC DEPENDENT SURVEILLANCE

4.1 ADS CONTRACT REQUESTS

In the Canaries FIR, initial ADS contracts are automatically set with every logged-on aircraft. These initial contracts consist of a 15 minute periodic contract, requesting the transmission of earth reference and predicted route groups with every periodic report, and an event contract including waypoint change and lateral deviation events, the latter with a 5 nautical miles threshold. Though new periodic or event contracts can be subsequently requested, it is seldom done. Event contracts including vertical rate change or altitude range events are very rarely established. At times, demand contracts are also requested.

Initial Contracts (monthly average)	Non initial contracts (monthly average)		
	Periodic	Event	Demand
1803	117	120	113

Table 5
ADS contract request (monthly average)

Also, in 2012, emergency contracts have been requested to 8 flights (17 emergency periodic contracts and 1 emergency demand contract in total). The CPDLC link was always active except in two of these flights and, when a dialogue existed, it did not show any unusual or emergency situation.

4.2 FIGURE OF MERIT (FOM) ANALYSIS

This subsection presents the Figure of Merit parameter (FOM) analysis from ADS messages transmitted by A/Cs and received by SACCAN. FOM is a parameter included in every ADS report that provides information about how precise the notified A/C position is and, therefore, of the quality of the ADS surveillance data.

The cumulative percentage values per FOM figures in 2012 are shown in Table 6. The complete cumulative percentage values corresponding to FOM figures received for each month in 2012 are indicated in “ANNEX II: FOM Values per Month”.

FOM Figure	Annual cumulative percentage
FOM = 7 (Error < 0,05 NM)	1,73%
FOM ≥ 6 (Error < 0,25 NM)	99,96%
FOM ≥ 5 (Error < 1 NM)	99,97%
FOM ≥ 4 (Error < 4 NM)	99,98%
FOM ≥ 3 (Error < 8 NM)	99,99%

FOM Figure	Annual cumulative percentage
FOM ≥ 2 (Error < 15 NM)	99,99%
FOM ≥ 1 (Error < 30 NM)	99,99%
FOM ≥ 0[8]	100,00%

Table 6
FOM cumulative percentages (2012)

As can be seen on the table above, 99,96 % of ADS reports received on ground, reported a FOM value equal to 6 or 7, meaning that the position error is always estimated as being either lower than 0.25NM (FOM = 6) or lower than 0.05 NM (FOM = 7), with a probability of 95%.

[8] All of them from aircraft already on ground, see section 6.2.2.

5. CONTROLLER - PILOT DATA LINK COMUNICATIONS

In areas of Canarias airspace where appropriate VHF coverage does not exist, CPDLC (Controller - Pilot Data Link Communications) is used as a communication means between ATCos and suitable trained flight crews of FANS equipped aircraft.

This section provides a snapshot of CPDLC utilization by pilots and controllers, indicating the CPDLC message elements interchanged, as well as presenting the uplink and downlink percentage use per element types.

Table 7 and Table 8 show the percentage of the most frequently transmitted uplink and downlink CPDLC message elements with respect to the total of transmitted elements (only those elements with a usage greater than 5% in at least one month are presented in these two tables). For a complete table of the vast majority of transmitted CPDLC message elements (those that have been sent more than once at least in one month) see “ANNEX III: Transmitted CPDLC Message Elements per Month”.

Month	UL message element (percentage referred to total)							
	NEXT DATA AUTHORITY [icaofacilitydesignation]	END SERVICE	[freetext] (UMs 169 & 170)	SQUAWK [beaconcode]	CONTACT [icaounitname] [frequency]	REPORT LEVEL [altitude]	CLIMB TO AND MAINTAIN [altitude]	MAINTAIN [altitude]
Jan 2012	-	1,71%	51,01%	14,84%	10,46%	7,22%	5,23%	2,93%
Feb 2012	-	1,74%	51,99%	16,14%	10,37%	6,48%	4,88%	2,77%
Mar 2012	-	1,22%	51,76%	13,55%	12,42%	6,82%	4,79%	2,85%
Apr 012	0,67%	0,93%	55,61%	16,03%	8,37%	6,68%	4,85%	2,36%
May 012	9,61%	1,86%	47,65%	13,52%	9,64%	5,96%	4,44%	2,92%
Jun 2012	26,56%	8,24%	26,94%	11,01%	8,41%	4,74%	3,53%	2,91%
Jul 2012	26,41%	13,79%	16,73%	11,34%	10,85%	7,05%	5,14%	3,83%
Aug 2012	28,35%	11,81%	18,37%	11,62%	8,98%	6,78%	3,70%	5,83%
Sept 2012	30,09%	9,52%	18,72%	10,47%	10,74%	5,65%	2,65%	4,46%
Oct 2012	30,30%	14,61%	14,00%	9,44%	10,47%	6,98%	3,49%	4,60%
Nov 2012	23,30%	16,74%	15,40%	11,04%	12,46%	6,25%	3,14%	5,82%
Dec 2012	23,42%	22,35%	16,38%	10,95%	14,56%	0,09%	3,88%	1,24%

Table 7
Uplink message elements transmitted

Month	DL message element (percentage referred to total)					
	WILCO	ROGER	POSITION REPORT [positionreport]	[freetext] (DMs 67 & 68)	DEVIATING [distanceoffset] [direction] OF ROUTE	LEVEL [altitude]
Jan 2012	26,63%	28,02%	15,50%	7,92%	6,09%	5,42%
Feb 2012	28,92%	29,34%	13,61%	6,85%	5,93%	5,60%
Mar 2012	27,50%	30,56%	12,61%	7,23%	5,45%	5,38%
Apr 012	25,07%	30,48%	14,18%	8,33%	6,14%	5,15%
May 012	28,98%	31,25%	12,71%	6,15%	6,00%	5,45%
Jun 2012	29,25%	24,44%	16,05%	5,49%	7,45%	5,45%
Jul 2012	34,91%	15,46%	15,83%	5,93%	7,59%	8,10%
Aug 2012	33,69%	17,25%	15,66%	5,35%	7,42%	7,95%
Sept 2012	36,27%	20,53%	13,03%	6,71%	4,74%	6,82%
Oct 2012	36,36%	14,34%	14,98%	5,85%	7,09%	8,43%
Nov 2012	34,14%	15,69%	16,17%	7,19%	7,29%	6,75%
Dec 2012	39,15%	17,61%	14,02%	7,96%	6,62%	0,12%

Table 8
Downlink message elements transmitted

Although at the beginning of the year the most frequent uplink message elements were the “freetext”, when the address forwarding process became operative, “NEXT DATA AUTHORITY [icaofacilitydesignation]” and “END SERVICE” elements were finally more used (being the NEXT DATA AUTHORITY element percentage higher and the most used, with a 26-30% since June, and END SERVICE element more gradually, since October, around 15-22%). For downlink elements, the most common ones are the responses “WILCO” and “ROGER”; the “Position Report”, the “freetext” elements and the “lateral offset report” (dM80) are also usually transmitted though not as often as the other ones. As far as “ROGER” message element use is concerned, it is to be noticed that ROGER is required as a response to an uplink freetext, except for those cases in which the freetext message element is included in a CPDLC message also comprising a message element requiring a WILCO/UNABLE response, so as it can be seen, the use of “ROGER” element has decreased in the second half of the year, as the use of uplink “freetext” messages diminished.

As it can be seen in Table 8, the other frequent downlink message element was “LEVEL [altitude]” (around 5-7% each month, although its use dramatically fell down the last month of the year; analysis of 2013 data will show whether it is a punctual situation). Also, as can be seen in “ANNEX III: Transmitted CPDLC Message Elements per Month”, “REQUEST [altitude]” (above 3% nearly every month) and “REQUEST CLIMB TO [altitude]” (above 2%, surpassing 3% in August and December) are also frequent

downlink message elements. As a result, tables of total percentage per types of message elements are shown below (Table 9 and Table 10).

Type	2012 value	Max value [month]	Min value [month]
Responses / Acknowledgements	0,76%	1,36% [December]	0,47% [September]
Vertical clearances	7,72%	9,57% [August]	5,22% [December]
Crossing constraints	0,02%	0,08% [September]	0,00% [8 months]
Lateral offsets	0,00%	N/A	N/A
Route modifications	0,06%	0,18% [April]	0,00% [2 months]
Speed Changes	0,04%	0,19% [October]	0,00% [7 months]
Contact / Monitor / Surveillance requests	23,65%	26,61% [February]	19,74% [June]
Report / Confirmation requests	8,51%	10,33% [January]	3,34% [December]
Negotiation requests	0,02%	0,08% [November]	0,00% [8 months]
Air Traffic advisories	0,12%	0,33% [August]	0,00% [3 months]
System management messages	28,58%	47,10% [December]	3,07% [April]
Additional messages	30,53%	55,61% [April]	14,00% [October]
TOTAL MESSAGE ELEMENTS	**2572 [monthly Average]**	**3297 [December]**	**2131 [February]**

Table 9
Uplink message element type

Type	2012 value	Max value [month]	Min value [month]
Responses	55,24%	60,38% [May]	50,17% [November]
Vertical requests	6,70%	8,19% [December]	5,53% [September]
Lateral offsets requests	0,00%	0,04% [December]	0,00% [11 months]
Speed requests	0,13%	0,54% [October]	0,00% [2 months]
Voice contact requests	0,19%	0,45% [September]	0,05% [October]
Route modification requests	0,49%	0,92% [November]	0,21% [June]
Reports	28,35%	32,87% [August]	23,40% [December]
Negotiation requests	0,10%	0,19% [March]	0,00% [February]
Emergency messages	0,00%	N/A	N/A
System management messages	0,37%	1,28% [June]	0,09% [July]
Additional messages	8,43%	10,08% [December]	6,94% [June]
TOTAL MESSAGE ELEMENTS	**2327 [monthly Average]**	**2736 [April]**	**1773 [September]**

Table 10
Downlink message element type

6. POTENTIAL PROBLEMS IDENTIFIED

This section presents a brief summary of those issues identified during data analysis of A/C connected to SACCAN (Canarias ACC) during 2012 and that should be further analyzed by the relevant stakeholders in the context of a CFRA. Though issues have been detected through SACCAN records analysis, they are considered of generic nature. The different issues are presented in a totally anonymous manner; therefore, no company, aircraft type, etc. are mentioned in any way. It is to be noticed that almost all of them were already identified during 2011 analysis.

Issues have been allocated to the following categories: operational (operative), technical and related to interoperability. However, it must be taken into account that, as only a basic analysis on these issues has been carried out, such a classification should be considered as preliminary.

6.1 OPERATIVE ISSUES

The following subsections list identified aspects which, in principle, only deal with the operation of FANS services, subdivided in two categories: “Air side” (i.e. those which probably deal with flight crew actions) and “Ground side” (i.e. those which probably deal with ATSPs).

6.1.1 “Air side” issues

- Log-On received from aircraft that are not flying towards Canarias airspace. Different situations have been observed:
  - A/C Log-On received from aircraft that do not overfly Canarias airspace (i.e. during flight Canarias airspace is never overflown).
  - A/C Log-On received after A/Cs have left Canarias airspace. Some of them did not connect to SACCAN during Canarias airspace overflight.

  According to the current ground system (SACCAN) configuration, all these cases imply the appearance in the HMI of flights that are not and will not be under the responsibility of the controller.

- A/C Log-On received when A/Cs are flying far away from Canarias airspace (various hours before estimated time of entering Canarias airspace), prior to enter an airspace where ADS/CPDLC is operational. Afterwards, ADS and CPDLC applications are disconnected. Not in all cases aircraft log on again to SACCAN before entering Canarias airspace.
  Apart from the appearance in the HMI of flights that are not under the responsibility of the controller (due to current SACCAN configuration), taking into account that aircraft sent these Log-On prior to enter an airspace where ADS/CPDLC is operational, it might have happened that the connection with the corresponding control center had not been established.

- A/C Log-On with incorrect flight identification: It is detected that some aircraft Log-On to SACCAN with incorrect flight identification. The following situations have been identified:
  - A/C that Log-On with a two-letter company code in the Flight Identification instead of the expected three-letter code, as contained in the flight plan (i.e. “AAnnnn” instead of “AAAnnnn”).
  - A/C Log-On with an erroneous Flight Number.

Among these situations, it is to be noticed three cases in which the erroneous Flight Number coincided with the Flight Number of another aircraft that, in turn, unsuccessfully tried to Log-On with its own correct Flight Number, because the first one was still connected to SACCAN.

- A/C Log-On with duplicated company code in the Flight Identification part of the message (i.e. Flight identification notified in the log on is “ABCABCnnnn”, where “ABC” is the correct company code).

With a different SACCAN configuration, such situations would lead to a rejection of the corresponding Log-On. With the current one, it prevents involved flights from an appropriate flight plan correlation, leading to the appearance in the controller situation display of an ADS track with an incorrect flight identification along with a synthetic track (based on flight plan data) with the correct one.

- Reception of character-oriented applications messages (i.e. applications other than AFN, ADS, CPDLC or "ACARS Free Text" messages) from A/C, such as “Request Oceanic Clearance” (Oceanic Clearance application) or “Request ATIS Report” (ATIS application). This situation occurs in a monthly basis.
  SACCAN treats these messages as if they were “ACARS Free Text” messages. Consequently, if the message is the first one from the concerned aircraft, SACCAN records the aircraft with the flight ID associated to the message. This may lead to the rejection of any subsequent Log-On received while the aircraft is still registered in such a way, if the flight identification notified in the Log-On does not coincides with the one associated to the character-oriented application message.

- Aircraft not declaring ADS capacity in their flight plans have been detected connecting to SACCAN; additionally, flights without CPDLC capability in the flight plan have established a CPDLC connection with SACCAN (Spanish AIC 7/12 requests the notification of ADS and CPDLC capabilities in the flight plan).
  Additionally, since the Amendment 1 to PANS-ATM (Doc. 4444) came into force, a significant number of aircrafts declaring ADS capacity with ATN capabilities in their flight plans has been detected.

- Some A/Cs remain ADS connected after exiting Canarias airspace and some of them even after landing (out of Canarias FIR), still sending reports when on ground. A part of the latter also remains connected after taking off.
  As this causes the A/Cs continue registered in the ground system, when A/Cs take off again (new flight), the system associates the aircraft ADS information with its previous FID. In the specific cases in which the new flight overflies Canarias airspace (A/Cs fly over Canarias airspace in the two flights), this results in Log-On with the new FID being rejected (apart from the presentation of an ADS track with incorrect flight identification along with a synthetic track with the correct one (becoming a radar track when already under radar coverage)), as it is still logged in the system with the previous FID.

6.1.2 “Ground side” issues

- Flight Plans with incorrect aircraft registration (i.e. it does not match the one notified in the A/C Log-On) or without any aircraft registration are found in ground flight plan database. Log-On for such aircraft are currently accepted but, with a different SACCAN configuration, such situations would lead to their rejection.

- CPDLC downlink messages “Not Current Data Authority” have been received as reply to an uplink CPDLC message. An analysis of received “Not Current Data Authority” messages showed that some of them were received while the aircraft was already flying over Canarias airspace or just before entering it. Therefore, in these cases CPDLC communication with aircraft overflying the Canarias area of responsibility is not possible. These situations may have occurred because either the previous data authority did not send the CPDLC message “END SERVICE” on time or concerned aircraft did not receive it.

- Sending of ACARS Free Text messages by controllers; in the considered year, almost always to FANS equipped aircraft with CPDLC link active and connected. More than half of them have been notified as undelivered within the aircraft (a Type B message with Standard Message Identifier “REJ” (Undelivered Uplink Report) is received from the DSP for the corresponding ACARS message).

- “END SERVICE” CPDLC messages has been sent with additional message elements which response attribute is not Wilco/Unable. This should have resulted in an aircraft disconnection of the inactive CPDLC data link (next ATC center), if it existed, apart from the disconnection of the active CPDLC data link, as it is stated in paragraph 2.2.3.12.4.1 of “Global Operational Data Link Document”.

6.2 TECHNICAL OR INTEROPERABILITY ISSUES

This subsection presents those issues that may entail some technical aspects or that concern the interaction of aircraft and ground systems. As former subsection, they are subdivided in categories: general (issues related to the global process or which are not specific to an application), ADS (those ones regarding the ADS functionality) and CPDLC (those ones concerning CPDLC). For issues in which avionics may be involved, no pattern (regarding e.g. aircraft model) has been identified for the time being.

6.2.1 General issues

- Some AFN and CPDLC downlink messages are received including an issuing time stamp incoherent with ground clock: message time stamp is later than the time of reception. Some affected messages are CPDLC “Position Report” messages, in which “timeatpositioncurrent” field does not seem to be incoherent with ground clock.
  In the same way, there have been detected “AFN Response” messages with time stamp sooner than the time stamp of their corresponding “AFN Contact Advisory” messages (which is set by the ground system). This is probably due to the same problem as the issue stated before.

- Uplink and downlink messages are being probably sent more than once by the Datalink Service Provider (DSP): 1% of the downlink messages received on ground are duplicated downlink messages and, in the same way, some of the received downlink messages seem to be the consequence of uplink messages received on board more than once.

- In some cases, received Service Messages (SVCs) do not seem to have a justification:
  - SVCs of reason code 234, indicating that some messages can't be transmitted via SATCOM link because aircraft is not logged on, despite previous messages from aircraft having been received via SATCOM.
  - Some SVCs were received to messages that require a subsequent response, being this response received afterwards. This situation occurs in a monthly basis.

- A higher quantity of non transmissible SVCs was received during September and October (~2000), and in a lesser extent, in August and November (~600). The reason codes of these SVCs were 234 (as stated in the previous issue) and 231 (message can't be transmitted because it has not been possible to determine the ground station the message has to be sent). This resulted in a failed connection to 40-140 flights per month (primary from TAP Portugal). The subsequent investigation revealed that the problem was a result of one DSP not sending the corresponding "Media Advisory" message (MED) to SITA (the DSP SACCAN directly connects to); SITA notified this problem had been solved at November 15th, 2012.

- A large amount of AFN Complete messages with reason 1 (Protocol Error) have been received in May and June. It is observed that the difference of time stamp between AFN Response and AFN Complete is about 10 minutes. Therefore, these messages were probably caused due to the aircraft did not receive in time (or did not receive at all) the necessary Acknowledge message to the Log On sent as a consequence of the AFN Contact Advisory message. All of them have been sent notifying the same ATC center as the next ATC centre.

- Messages with excessively high delays have been received for a limited number of aircraft.

6.2.2 ADS issues

- Disconnection messages with no reason included are received from an aircraft: bits that define the reason are not present in the message.

- Different reports not generated at the same time, even sometimes with a difference of some minutes, are sent together in the same ADS message, instead of being sent in different messages.

- Identical reports of Waypoint Change event are received within an ADS message (i.e. the same Waypoint Change event report appears more than once within the ADS message).

- ADS Acknowledgement messages (ACK messages) with a contract number not corresponding to any contract request demanded by the concerned ground system are received.

- Altitude Range event messages are received from some aircraft though no Altitude Range event contract have been requested to them from ground system.

- ADS messages containing unasked optional groups, such as Air Reference and Meteorological, are received without being included by the ground system in the requested contract.

- ADS reports notifying FOM equal to zero (0) are received. All of them from aircraft already on ground.

6.2.3 CPDLC issues

- Incorrect downlink CPDLC messages have been received:
  - A CPDLC message containing an initial CPDLC message element (DM48) with illogical data and erroneous characters.
  - A CPDLC message containing an initial CPDLC message element (DM48) with illogical data and erroneous characters, which probably causes the second element to be unknown. The message indicated that there should have been two more additional message elements, which were not present, but this information may be corrupted as well.
  - CPDLC messages with more data than those indicated in the header of the message (header notifies the containment of a single CPDLC element, but after it more data are present). Even more, the first CPDLC message element seems to include incoherent data, and the third element is unknown.
  - A CPDLC message is received, which lacked essential information: specifically, this message did not have enough bits to constitute even the message element number. As expected, an uplink CPDLC error message was sent.

- After sending a CPDLC Disconnect Request to some aircraft (after that, SACCAN considers the aircraft is CPDLC disconnected), it is detected that they continue sending downlink messages which correspond to the CPDLC application. The analysis of these situations has concluded that all of them correspond to B747-400 aircraft, which ignore uplink CPDLC Disconnect Request messages. It is an already known and documented behavior.

- A/Cs that do not accept CPDLC connection request messages after receiving an uplink CPDLC disconnect request message. The A/C rejects the CPDLC connection by sending a downlink disconnect request message (without any CPDLC message element) instead of a connection confirm message.

- "Insufficient Message Storage Capacity" error messages are received from B747-400 A/C due to the reception on board of uplink CPDLC Freetext messages containing a text string superior to 80 characters. B747-400 A/Cs do not accept text length over 80 characters, so they answer with a CPDLC Error message. It is an already known and documented behavior.

7. CONCLUSIONS

From the analysis of 2012 data, it can be concluded that:

- As far as aircraft using FANS services is concerned, nearly 60% of the EUR/SAM Corridor flights (Canarias area) connect to SACCAN (95% of flights notifying FANS equipage in its flight plan connect to SACCAN). It represents a slight increase from 2011.
- CPDLC information is interchanged with the vast majority of connected aircraft.
- Major users of FANS services are TAP Portugal, TAM Brazil, Air France and Iberia: same top four than in 2011 but with TAP bypassing TAM in the first position.
- With regard to downlink messages delay, more than 95% of the times they are 60 second or below. 99% delays figures are well below 180s. In these two cases, both per media and globally.
- Position accuracy notified in ADS-C reports is not worse than 0.25 NM 99.96% of the times (i.e. 99.96% of the times FOM 6 or 7 is notified, being FOM 6 the most common value).
- Regarding CPDLC message elements used:
  - As the year went by, NEXT DATA AUTHORITY and END SERVICE elements became the most used by controllers and “Feetext” use decreased (in the first four months, more than 50% of the elements were free text. On the contrary, usage was around 15% in the last three months). This is probably a consequence of the entry into operation of the Address forwarding process with Cape Verde and the implementation of a new HMI version of SACCAN.
  - For downlink elements, about 55% are response elements (mainly WILCO and ROGER). The second most used message group (Reports) is about 28%.

There are not major differences with 2011 data analysis. However, as highlighted above, there is a different use of CPDLC by controllers due to the new operational procedure for data link transfer.

- Several issues (either operative, technical or involving interaction between aircraft and ground systems), have been detected and listed in the report. Most of them were already identified during 2011 analysis, but there are also some new ones. Coordination between stakeholders should be established in order to appropriately investigate them.

Finally, it should be highlighted that FANS services in the EUR/SAM Corridor have been improved in 2012, from both a technical and an operational perspective:

- Technically, through the transition to SACCAN Phase 3 in late November. Phase 3 comprises an improvement to SACCAN HMI and a more up-to-date G/G data communication protocol (our connection to SITA migrated to IP).
- Operationally, through the entry into operation, by mid of April, of FANS (ADS-C/CPDLC) transfer procedures between Canarias and SAL ACCs.

8. ACRONYMS

ACARS	Aircraft Communication Addressing and Reporting System
ACC	Area Control Centre
ACK	Acknowledgement
ADS	Automatic Dependent Surveillance
ADS-C	Automatic Dependent Surveillance – Contract
AENA	Aeropuertos Españoles y Navegación Aérea
AFN	ATS Facilities Notification
ASECNA	Agence pour la Sécurité de la Navigation Aérienne en Afrique et Madagascar
ARF	Air Reference Group
ATCo	Air Traffic Controller
ATSP	Air Traffic Service Provider
ATS	Air Traffic Services
CFRA	Central FANS Reporting Agency
CPDLC	Controller to Pilot Data Link Communications
DL	Downlink
DM	CPDLC Downlink Message Element
DSP	Datalink Service Provider
ETA	Estimated Time of Arrival
EUR	Europe
FANS	Future Air Navigation System
FID	Flight Identification
FIR	Flight Information Region
FIT	FANS-1/A Interoperability Team
FOM	Figure of Merit
HMI	Human Machine Interface
MET	Meteorological Group
NM	Nautical Mile
NW	Next Waypoint
SACCAN	Sistema ADS/CPDLC en el FIR Canarias (ADS/CPDLC System in the Canarias FIR)
SAM	South America
SAT	Satellite
SATMA	South Atlantic Monitoring Agency
UL	Uplink
UIR	Upper Information Region
UM	CPDLC Uplink Message Element
VHF	Very High Frequency

ANNEX I: AIR-TO-GROUND MESSAGES DELAYS PER MONTH

The following table shows the delay values split up into each month of 2012.

Parameter	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012	Nov 2012	Dec 2012
AFN messages												
95% VHF delay	30,194 s.	26,438 s.	31,080 s.	35,816 s.	31,188 s.	29,112 s.	27,664 s.	32,068 s.	31,884 s.	30,693 s.	40,260 s.	48,521 s.
95% SAT delay	63,600 s.	49,496 s.	64,906 s.	56,594 s.	68,860 s.	51,968 s.	53,830 s.	50,168 s.	50,135 s.	53,754 s.	57,704 s.	49,816 s.
95% ALL delay	53,418 s.	42,588 s.	51,392 s.	49,690 s.	59,736 s.	46,446 s.	46,976 s.	45,992 s.	44,662 s.	47,883 s.	52,484 s.	49,232 s.
99% VHF delay	53,412 s.	44,544 s.	64,168 s.	68,440 s.	63,719 s.	56,700 s.	58,940 s.	71,299 s.	82,632 s.	59,711 s.	1503,496 s.	1400,419 s.
99% SAT delay	91,565 s.	95,262 s.	96,616 s.	96,756 s.	115,318 s.	90,895 s.	98,668 s.	99,560 s.	88,257 s.	97,974 s.	94,414 s.	99,328 s.
99% ALL delay	89,830 s.	78,344 s.	90,188 s.	92,374 s.	104,732 s.	85,340 s.	90,248 s.	99,443 s.	86,296 s.	96,176 s.	96,074 s.	126,416 s.
ADS reports												
95% VHF delay	24,554 s.	27,072 s.	25,152 s.	27,156 s.	24,582 s.	26,198 s.	24,446 s.	24,056 s.	22,248 s.	22,656 s.	29,520 s.	24,881 s.
95% SAT delay	46,580 s.	46,540 s.	51,672 s.	50,384 s.	58,582 s.	56,886 s.	57,749 s.	53,510 s.	49,744 s.	51,981 s.	54,680 s.	59,624 s.
95% ALL delay	39,232 s.	40,841 s.	42,669 s.	44,142 s.	45,818 s.	46,856 s.	47,548 s.	43,744 s.	41,329 s.	43,426 s.	45,245 s.	47,144 s.
99% VHF delay	67,210 s.	62,030 s.	70,329 s.	88,503 s.	70,760 s.	66,300 s.	79,330 s.	64,547 s.	50,760 s.	60,248 s.	75,683 s.	63,212 s.
99% SAT delay	99,546 s.	99,338 s.	107,036 s.	103,658 s.	104,719 s.	106,940 s.	115,938 s.	111,355 s.	99,404 s.	103,556 s.	106,348 s.	104,317 s.
99% ALL delay	94,986 s.	93,712 s.	101,251 s.	101,878 s.	99,788 s.	101,508 s.	109,168 s.	103,447 s.	91,884 s.	98,176 s.	101,270 s.	100,056 s.

Parameter	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012	Nov 2012	Dec 2012
CPDLC AT												
95% VHF delay	22,906 s.	26,165 s.	26,992 s.	25,356 s.	27,347 s.	32,121 s.	16,432 s.	39,012 s.	21,656 s.	42,565 s.	30,247 s.	31,299 s.
95% SAT delay	32,344 s.	31,364 s.	30,542 s.	28,279 s.	38,816 s.	41,712 s.	35,092 s.	28,437 s.	30,916 s.	31,792 s.	38,204 s.	36,264 s.
95% ALL delay	30,668 s.	30,697 s.	29,876 s.	27,788 s.	35,976 s.	40,228 s.	31,932 s.	29,444 s.	30,324 s.	34,292 s.	38,204 s.	35,688 s.
99% VHF delay	59,386 s.	54,312 s.	84,176 s.	48,688 s.	73,007 s.	66,680 s.	48,652 s.	150,036 s.	69,165 s.	94,056 s.	106,712 s.	91,392 s.
99% SAT delay	85,120 s.	90,796 s.	80,888 s.	84,423 s.	86,298 s.	108,772 s.	89,084 s.	71,079 s.	71,778 s.	85,776 s.	86,596 s.	103,480 s.
99% ALL delay	77,754 s.	82,076 s.	80,888 s.	81,812 s.	86,298 s.	95,428 s.	82,824 s.	83,436 s.	70,418 s.	89,848 s.	86,596 s.	103,458 s.
AFN, ADS reports and CPDLC AT												
95% VHF delay	25,261 s.	27,069 s.	26,104 s.	27,444 s.	26,000 s.	26,883 s.	24,916 s.	25,249 s.	23,866 s.	24,494 s.	30,140 s.	26,326 s.
95% SAT delay	46,976 s.	45,497 s.	50,276 s.	48,557 s.	57,806 s.	55,113 s.	55,068 s.	50,800 s.	48,584 s.	50,844 s.	52,815 s.	55,656 s.
95% ALL delay	40,184 s.	40,458 s.	42,528 s.	43,646 s.	45,996 s.	46,356 s.	46,618 s.	43,536 s.	41,248 s.	43,508 s.	45,433 s.	46,656 s.
99% VHF delay	66,084 s.	59,772 s.	70,329 s.	82,243 s.	70,760 s.	65,577 s.	74,052 s.	69,924 s.	53,157 s.	62,424 s.	77,633 s.	68,675 s.
99% SAT delay	97,912 s.	98,468 s.	103,113 s.	101,248 s.	104,008 s.	105,011 s.	112,516 s.	107,373 s.	97,372 s.	101,996 s.	104,116 s.	103,765 s.
99% ALL delay	93,610 s.	92,320 s.	98,212 s.	99,720 s.	99,611 s.	99,838 s.	105,160 s.	101,352 s.	90,752 s.	97,424 s.	100,603 s.	101,368 s.

Table 11
Monthly delay parameters (January 2012 to December 2012)

ANNEX II: FOM VALUES PER MONTH

This table presents the cumulative percentages for the FOM parameter, divided into each month of 2012.

FOM	Percentage referred to total[9]											
	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012	Nov 2012	Dec 2012
FOM = 7 (Error < 0,05 NM)	2,03%	3,20%	1,59%	3,77%	2,17%	1,21%	0,72%	0,64%	0,97%	1,15%	2,74%	1,35%
FOM ≥ 6 (Error < 0,25 NM)	100,00%	99,97%	99,81%	100,00%	99,98%	99,97%	100,00%	99,97%	99,98%	99,94%	99,97%	100,00%
FOM ≥ 5 (Error < 1 NM)	100,00%	99,97%	99,86%	100,00%	99,98%	99,97%	100,00%	99,99%	99,99%	99,94%	99,97%	100,00%
FOM ≥ 4 (Error < 4 NM)	100,00%	99,97%	99,92%	100,00%	100,00%	99,97%	100,00%	100,00%	100,00%	99,94%	99,97%	100,00%
FOM ≥ 3 (Error < 8 NM)	100,00%	99,99%	100,00%	100,00%	100,00%	99,97%	100,00%	100,00%	100,00%	99,94%	99,97%	100,00%
FOM ≥ 2 (Error < 15 NM)	100,00%	99,99%	100,00%	100,00%	100,00%	99,97%	100,00%	100,00%	100,00%	99,94%	99,97%	100,00%
FOM ≥ 1 (Error < 30 NM)	100,00%	99,99%	100,00%	100,00%	100,00%	99,97%	100,00%	100,00%	100,00%	99,94%	99,97%	100,00%
FOM ≥ 0	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%

Table 12
Monthly FOM values (January 2012 to December 2012)

[9] In May 2012, a FOM = 5 message was received (which corresponds to 0,0044% of the total number of reports). Its percentage has been deemed insignificant and consequently not considered. In the same way, a FOM = 5 message was received in September 2012 (0,0046% of the full amount), which have not been considered as well.

ANNEX III: TRANSMITTED CPDLC MESSAGE ELEMENTS PER MONTH

Table 13 and Table 14 show the percentage of the vast majority of transmitted uplink and downlink CPDLC message elements with respect to the total of transmitted elements (the message elements presented are those that have been utilized more than once at least in one month).

Uplink message element	Percentage referred to total uplink message elements in the month											
	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012	Nov 2012	Dec 2012
NEXT DATA AUTHORITY [icaofacilitydesignation]	-	-	-	0,67%	9,61%	26,56%	26,41%	28,35%	30,09%	30,30%	23,30%	23,42%
END SERVICE	1,71%	1,74%	1,22%	0,93%	1,86%	8,24%	13,79%	11,81%	9,52%	14,61%	16,74%	22,35%
[freetext][10]	51,01%	51,99%	51,76%	55,61%	47,65%	26,94%	16,73%	18,37%	18,72%	14,00%	15,40%	16,38%
SQUAWK [beaconcode]	14,84%	16,14%	13,55%	16,03%	13,52%	11,01%	11,34%	11,62%	10,47%	9,44%	11,04%	10,95%
CONTACT [icaounitname] [frequency]	10,46%	10,37%	12,42%	8,37%	9,64%	8,41%	10,85%	8,98%	10,74%	10,47%	12,46%	14,56%
REPORT LEVEL [altitude]	7,22%	6,48%	6,82%	6,68%	5,96%	4,74%	7,05%	6,78%	5,65%	6,98%	6,25%	0,09%
CLIMB TO AND MAINTAIN [altitude]	5,23%	4,88%	4,79%	4,85%	4,44%	3,53%	5,14%	3,70%	2,65%	3,49%	3,14%	3,88%
MAINTAIN [altitude]	2,93%	2,77%	2,85%	2,36%	2,92%	2,91%	3,83%	5,83%	4,46%	4,60%	5,82%	1,24%
ERROR [errorInformation]	1,80%	1,60%	1,90%	1,47%	2,47%	2,18%	0,92%	0,99%	0,99%	0,69%	1,02%	1,33%
REPORT PASSING [position]	1,17%	2,02%	2,12%	0,58%	0,68%	1,87%	0,46%	0,92%	2,13%	1,19%	1,49%	2,12%
REQUEST POSITION REPORT	1,13%	0,47%	0,05%	0,45%	0,30%	1,35%	1,31%	0,70%	0,59%	0,84%	1,18%	0,27%
MONITOR [icaounitname] [frequency]	0,32%	0,05%	0,18%	0,18%	0,04%	0,24%	0,53%	0,04%	2,53%	1,07%	0,35%	0,52%
CONFIRM ALTITUDE	0,50%	0,52%	0,68%	0,71%	0,15%	0,59%	0,35%	0,55%	0,20%	0,38%	0,63%	0,09%

[10] Both UM169 and UM170 uplink message elements are included.

Uplink message element	Percentage referred to total uplink message elements in the month											
	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012	Nov 2012	Dec 2012
ROGER	0,68%	0,61%	0,63%	0,40%	0,30%	0,59%	0,25%	0,07%	0,16%	0,23%	0,12%	0,52%
STANDBY	0,14%	0,19%	0,18%	0,18%	0,19%	0,21%	0,21%	0,37%	0,32%	0,35%	0,20%	0,36%
CONFIRM SPEED	0,18%	0,05%	0,14%	0,18%	0,04%	0,28%	0,21%	0,15%	0,20%	0,08%	0,04%	0,61%
AT [position] CONTACT [icaounitname] [frequency]	0,32%	0,05%	0,27%	-	0,08%	0,07%	-	0,11%	0,08%	0,31%	-	0,15%
UNABLE	0,05%	0,05%	0,09%	-	-	0,07%	0,11%	0,11%	-	0,31%	0,16%	0,30%
RADAR CONTACT [position]	0,05%	-	-	-	-	0,03%	0,25%	0,33%	0,24%	0,12%	0,04%	-
PROCEED DIRECT TO [position]	-	-	-	0,13%	0,08%	0,03%	0,04%	0,07%	0,04%	0,15%	0,04%	0,03%
DESCEND TO AND MAINTAIN [altitude]	0,05%	0,05%	-	0,13%	-	0,03%	0,04%	-	-	0,04%	0,08%	0,03%
CRUISE CLIMB TO [altitude]	0,05%	-	0,14%	0,04%	-	0,03%	0,04%	-	0,04%	0,04%	0,04%	0,03%
RADAR SERVICES TERMINATED	-	-	0,09%	-	-	0,03%	-	-	0,04%	0,04%	0,08%	0,06%
MAINTAIN [speed]	-	-	0,05%	-	-	-	0,04%	-	0,04%	0,08%	0,08%	-
DUE TO TRAFFIC	-	-	-	-	-	-	-	-	-	-	0,04%	0,21%
WHEN CAN YOU ACCEPT [altitude]	-	-	-	-	-	-	0,04%	-	-	0,04%	0,08%	0,06%
AFFIRM	-	-	-	-	-	0,03%	-	-	-	-	-	0,09%
REPORT REACHING [altitude]	-	-	-	-	-	-	0,07%	-	-	-	-	0,03%
NEGATIVE	-	-	-	-	-	-	-	0,04%	-	-	0,04%	0,09%
CONFIRM ASSIGNED ROUTE	-	-	-	-	-	-	-	-	-	-	-	0,12%
REPORT DISTANCE [tofrom] [position]	0,09%	-	-	-	-	-	-	-	-	-	-	-

Table 13
Percentage of uplink message elements transmitted for each month in the phase of study

Downlink message element	Percentage referred to total downlink message elements in the month											
	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012	Nov 2012	Dec 2012
WILCO	26,63%	28,92%	27,50%	25,07%	28,98%	29,25%	34,91%	33,69%	36,27%	36,36%	34,14%	39,15%
ROGER	28,02%	29,34%	30,56%	30,48%	31,25%	24,44%	15,46%	17,25%	20,53%	14,34%	15,69%	17,61%
POSITION REPORT [positionreport]	15,50%	13,61%	12,61%	14,18%	12,71%	16,05%	15,83%	15,66%	13,03%	14,98%	16,17%	14,02%
[freetext][11]	7,92%	6,85%	7,23%	8,33%	6,15%	5,49%	5,93%	5,35%	6,71%	5,85%	7,19%	7,96%
DEVIATING [distanceoffset] [direction] OF ROUTE	6,09%	5,93%	5,45%	6,14%	6,00%	7,45%	7,59%	7,42%	4,74%	7,09%	7,29%	6,62%
LEVEL [altitude]	5,42%	5,60%	5,38%	5,15%	5,45%	5,45%	8,10%	7,95%	6,82%	8,43%	6,75%	0,12%
REQUEST [altitude]	3,06%	3,03%	3,02%	3,62%	3,45%	2,81%	3,61%	3,18%	2,31%	3,65%	3,25%	4,29%
REQUEST CLIMB TO [altitude]	2,28%	2,12%	2,36%	2,49%	2,45%	2,68%	2,82%	3,81%	2,43%	3,44%	2,91%	3,23%
DUE TO AIRCRAFT PERFORMANCE	1,16%	0,83%	1,55%	1,24%	1,11%	1,40%	2,18%	1,69%	1,35%	1,56%	1,55%	1,77%
PASSING [position]	0,67%	0,91%	1,04%	0,33%	0,44%	1,23%	0,42%	0,77%	2,31%	0,91%	1,41%	1,85%
REQUEST CRUISE CLIMB TO [altitude]	0,67%	0,62%	0,62%	0,29%	0,41%	0,38%	1,16%	0,43%	0,73%	0,54%	0,68%	0,59%
PRESENT ALTITUDE [altitude]	0,41%	0,41%	0,58%	0,51%	0,11%	0,64%	0,46%	0,72%	0,28%	0,54%	0,63%	0,04%
REQUEST DIRECT TO [position]	0,19%	0,29%	0,35%	0,22%	0,41%	0,13%	0,23%	0,63%	0,34%	0,54%	0,24%	0,20%
ERROR [errorInformation]	0,15%	0,12%	0,15%	0,04%	0,26%	1,06%	0,09%	0,19%	0,06%	0,27%	0,10%	0,35%

[11] Both DM67 and DM68 downlink message elements are included.

Downlink message element	Percentage referred to total downlink message elements in the month											
	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012	Nov 2012	Dec 2012
STANDBY	0,30%	0,08%	0,23%	0,33%	0,07%	0,17%	0,14%	0,29%	0,06%	0,11%	0,24%	0,20%
REQUEST VOICE CONTACT	0,22%	0,04%	0,15%	0,15%	0,07%	0,17%	0,09%	0,14%	0,39%	0,05%	0,19%	0,32%
PRESENT SPEED [speed]	0,11%	-	0,08%	0,15%	0,04%	0,30%	0,23%	0,19%	0,17%	0,11%	0,05%	0,55%
REQUEST [speed]	0,11%	0,08%	0,27%	0,04%	0,04%	0,09%	-	-	0,23%	0,54%	0,10%	0,16%
UNABLE	0,04%	0,12%	-	0,22%	0,07%	0,09%	0,19%	0,19%	0,23%	0,16%	0,10%	0,20%
DUE TO WEATHER	0,30%	0,17%	0,08%	0,26%	-	-	-	-	-	0,11%	0,24%	0,28%
REQUEST WEATHER DEVIATION UP TO [distanceoffset] [direction] OF ROUTE	0,15%	0,17%	0,04%	0,44%	0,04%	-	-	0,10%	-	0,11%	0,63%	0,08%
NOT CURRENT DATA AUTHORITY	0,19%	0,37%	0,08%	0,18%	0,11%	0,21%	-	-	0,34%	-	-	-
AT [position] REQUEST CLIMB TO [altitude]	0,04%	0,08%	0,15%	-	0,15%	0,09%	0,14%	0,05%	0,06%	0,11%	0,10%	0,08%
WHEN CAN WE EXPECT HIGHER ALTITUDE	-	-	0,12%	-	0,11%	0,09%	0,05%	0,14%	0,17%	0,11%	0,10%	-
CLIMBING TO [altitude]	0,07%	0,08%	0,12%	-	0,04%	0,09%	0,05%	0,10%	0,06%	-	0,10%	0,04%
AT PILOTS DISCRETION	-	0,08%	0,12%	0,04%	-	0,04%	0,05%	-	0,17%	-	0,05%	0,08%
REQUEST VOICE CONTACT [frequency]	0,04%	0,08%	-	0,07%	0,04%	-	-	-	0,06%	-	-	-
REQUEST [routeclearance]	0,04%	-	-	-	-	-	-	-	0,06%	0,05%	-	-
WHEN CAN WE EXPECT CRUISE CLIMB TO [altitude]	0,04%	-	0,08%	0,04%	0,04%	-	0,05%	-	-	-	-	-
REQUEST CLEARANCE	-	-	0,04%	-	-	0,09%	0,09%	-	0,06%	-	0,05%	-

Downlink message element	Percentage referred to total downlink message elements in the month											
	Jan 2012	Feb 2012	Mar 2012	Apr 2012	May 2012	Jun 2012	Jul 2012	Aug 2012	Sept 2012	Oct 2012	Nov 2012	Dec 2012
ASSIGNED ROUTE [routeclearance]	-	-	-	-	-	-	-	-	-	-	0,05%	0,12%
REACHING [altitude]	-	-	-	-	-	-	0,09%	-	-	-	-	0,04%
WHEN CAN WE EXPECT [speed]	-	-	-	-	-	0,09%	-	-	-	-	-	-
AT [time] [distance] [tofrom] [position]	0,07%	-	-	-	-	-	-	-	-	-	-	-

Table 14
Percentage of downlink message elements transmitted for each month in the phase of study