International Civil Aviation Organization

FIFTH MEETING OF THE FANS 1/A IMPLEMENTATION TEAM (FIT-EURSAM) OVER THE SOUTH ATLANTIC

(Lisbon, Portugal, May 17-18, 2010)

Agenda Item 3: Review of FANS 1/A implementation activities in the South Atlantic

Central FANS 1/A Reporting Agency

(Presented by SATMA)

SUMMARY

The objectives of this working paper are to present the start-up problems of CFRA activities and to introduce an instance of the FANS services monitoring made by AENA.

1. INTRODUCTION

In SAT/FIT/2 Meeting the Central FANS 1/A Reporting Agency (CFRA) was created and, subsequently it was scheduled to be operative by 2010. Along with this, the Terms of Reference, Duties and Responsibilities of this agency were also defined.

Extracting from SAT/FIT/3 Appendix C, the Terms of Reference relating to the CFRA are "*To collect and disseminate operational information supporting ADS/CPDLC applications within the ATM systems, in order to promote, interaction between ATSPs, Stake Holders including Airline operators and FITs in adjacent airspaces*".

2. DISCUSSION

In order to start with the activities of the CFRA, it is necessary that all parties involved collaborate by providing information related to FANS use during 2010. Only partial information has been received so far.

Regarding to this fact, SATMA emphasizes the importance of receiving required information from all States in order to start the development of its functions.

A first attempt to start with CFRA functions can be done by using the reports sent to each States by the communications service providers. By using this information, SATMA would present periodically reports including the performance of the FANS 1/A functionality within the entire EUR/SAM Corridor. These analyses will be restricted to the information included by SITA in its monthly reports; therefore, only technical performance will be analyzed.

It is remarkable that these reports do not provide enough information to monitor the FANS services. Due to this fact, more complete FANS analyses are expected to be done in the future. The development of this kind of studies requires that more detailed and complete information is sent by the States.

Instances of the capabilities which can be developed by the CFRA in the future are presented in the following annex, where the monthly analyses done by AENA to monitor SACCAN FANS 1/A functionality are introduced.

3. ACTION BY THE MEETING

The SAT/FIT/5 Meeting is invited to:

a) Analyze the problems due to the lack of the information needed to develop the CFRA functions.

b) Take note of the information provided in this working paper and its annex.

ANNEX 1. Operational Report on SACCAN FANS 1/A Functionality

1. INTRODUCTION

This annex presents a summary of the results of the "SACCAN FANS 1/A functionality analysis" reports, which are monthly performed by AENA to monitor the use of the FANS services.

2. DISCUSSION

The following sections introduce the main results obtained from the monitoring of FANS 1/A aircraft operating in the oceanic Canary airspace.

To do this report traffic information from the oceanic area of the Canaries UIR has been used, which has been recorded by Palestra (Aena´s flight plan database). As far as the FANS connections are concerned, information is obtained from the recordings done in the SACCAN system.

With the objective to show tendencies, in this report information has been used from September 2009 to January 2010.

This report is based on the flight plans and FANS connections to SACCAN in the oceanic Canary airspace, as it is shown in the following figure:

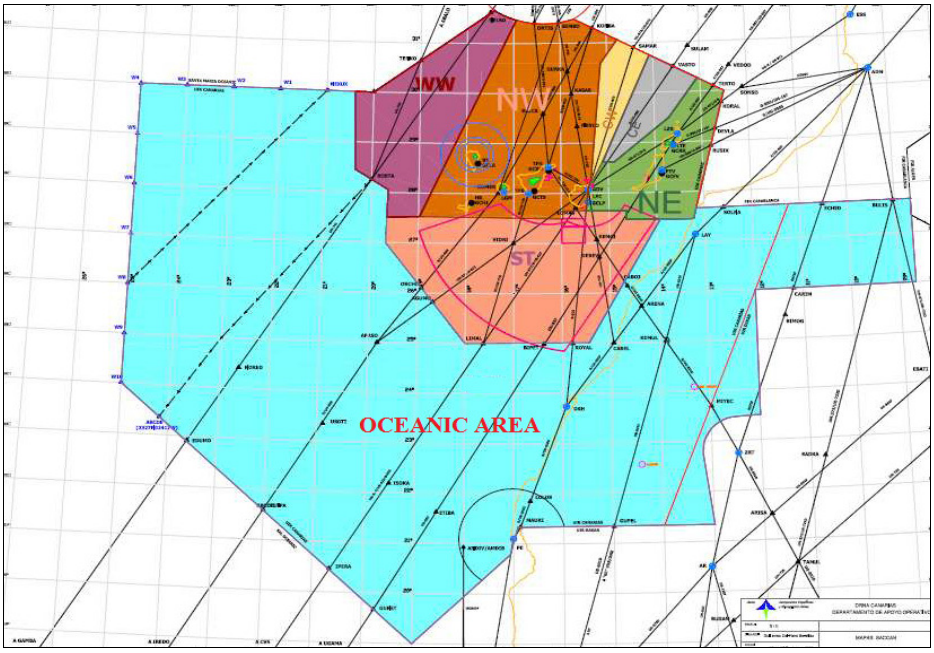

FIGURE 1
Oceanic Canary airspace

2.1 Evolution of the FANS 1/A connections

First of all, the following tables introduce the evolution of the FANS 1/A connections from September 2009 to January 2010 on SACCAN in relation to the number of aircraft flying in the oceanic area and those ones that, in its flight plan, reported ADS and data link capabilities (called in TABLE 1 "FANS 1/A equipped flights").

General information	Jan. 2010	Dec. 2009	Nov. 2009	Oct. 2009	Sep. 2009
Nº connected flights	1233	1210	1165	1049	947
% with respect to total flights (Oceanic area)	32.67%	33.16%	32.70%	28.40%	27.59%
% with respect to FANS 1/A equipped flights (Oceanic area)	73.39%	81.59%	77.31%	66.60%	65.36%
Nº of flights with CPDLC exchange	1127	1065	1001	901	839

TABLE 1
General traffic information in the oceanic Canary airspace

In the second table shown below, a comparison between the principal airlines connected to SACCAN and using FANS 1/A technology has been depicted.

Airline information (Percentage of total connected flights)						
Airline	**Jan. 2010**	**Dec. 2009**	**Nov. 2009**	**Oct. 2009**	**Sep. 2009**	**Type of airplane[1]**
TAM Brazil	22.71%	24.05%	26.35%	24.79%	26.40%	59.83% A330 26.59% B777 13.58% A340
Iberia	19.63%	20.41%	20.17%	20.21%	16.90%	100% A340
TAP Portugal	17.68%	14.96%	14.08%	9.34%	7.18%	100% A330
Air France	17.60%	17.11%	18.03%	21.26%	24.29%	48.90% B777 27.15% A330 21.56% B747 2.39% A340
Lufthansa	6.57%	6.36%	6.35%	7.34%	7.92%	71,44% B747 28.56% A340
Air Europa	5.19%	5.87%	5.24%	4.96%	5.70%	100% A340

TABLE 2
Principal airlines

The following sections summarize those periods of time in which flights connected, in January 2010, to SACCAN. Most of them are carried out at night, from 22:00 pm to 08:00 am next morning, as it is presented in the third and fourth tables below.

[1] Estimated mean in the five studied months.

Day	Contacts between 08:00 a.m. and 22:00 p.m.		Contacts between 22:00 p.m. and 08:00 a.m.	
	Total	Percentage	Total	Percentage
1	9	25,71%	26	74,29%
2	7	20,59%	27	79,41%
3	8	21,05%	30	78,95%
4	12	28,57%	30	71,43%
5	9	32,14%	19	67,86%
6	14	32,56%	29	67,44%
7	17	43,59%	22	56,41%
8	13	31,71%	28	68,29%
9	15	34,88%	28	65,12%
10	17	36,96%	29	63,04%
11	10	33,33%	20	66,67%
12	14	36,84%	24	63,16%
13	10	32,26%	21	67,74%
14	14	38,89%	22	61,11%
15	12	27,91%	31	72,09%
16	12	30,77%	27	69,23%
17	11	27,50%	29	72,50%
18	16	36,36%	28	63,64%
19	12	30,77%	27	69,23%
20	19	48,72%	20	51,28%
21	11	26,83%	30	73,17%
22	10	23,26%	33	76,74%
23	13	29,55%	31	70,45%
24	11	29,73%	26	70,27%
25	10	29,41%	24	70,59%
26	12	30,00%	28	70,00%
27	13	25,49%	38	74,51%
28	12	30,77%	27	69,23%
29	15	27,78%	39	72,22%
30	12	29,27%	29	70,73%
31	12	29,27%	29	70,73%

TABLE 3
Timetable of connections between aircrafts and SACCAN (January 2010)

Regarding the information presented above, the following figure introduces the distribution of connections per hour produced between aircrafts and SACCAN by focusing on the five days with the highest figures of connections in January 2010.

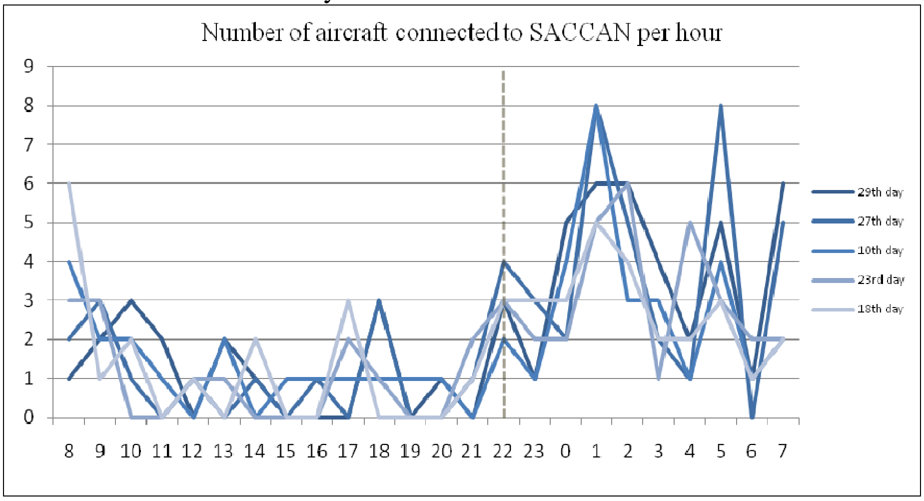

FIGURE 2
Number of connections between aircraft and SACCAN per hour

2.2 Datalink performance analysis.

On the other hand, it is also important to represent the delay in the reception of the message sent by the ADS and CPDLC communications.

To this respect, the following section introduces the downlink message delivery delay at 95% and 99%. These percentages represent the time in which the calculated delay is lower or equal than the value presented.

	Figure of delays ≥ 95% (seconds)	**Figure of delays ≥ 99% (seconds)**
AFN Log On		
VHF	38,503 s.	138,864 s.
Satellite	71,280 s.	112,644 s.
Global	65,447 s.	117,968 s.
ADS Reports		
VHF	27,144 s.	86,944 s.
Satellite	56,555 s.	127,138 s.
Global	45,993 s.	116,326 s.
CPDLC AT		
VHF	21,782 s.	53,201 s.
Satellite	33,682 s.	130,105 s.
Global	32,906 s.	125,740 s.
AFN Log On, ADS Reports and CPDLC AT		
VHF	27,556 s.	89,378 s.
Satellite	55,736 s.	126,132 s.
Global	46,105 s.	116,492 s.

TABLE 4
Delays at 95% and 99% (January 2010)

Additionally, the next three figures relate the table above to its graphical representation, by making a comparison between the ways in which the information is transmitted, namely VHF or satellite.

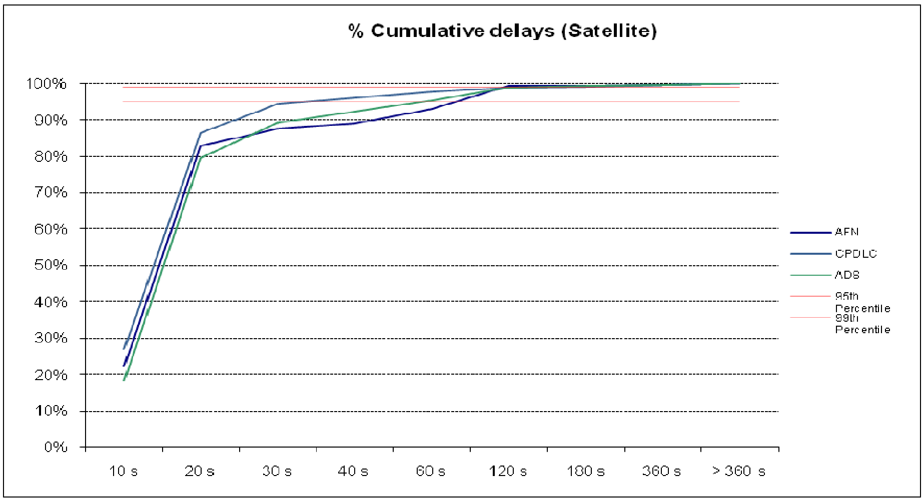

FIGURE 3
Satellite downlink delay – Cumulative diagram (January 2010)

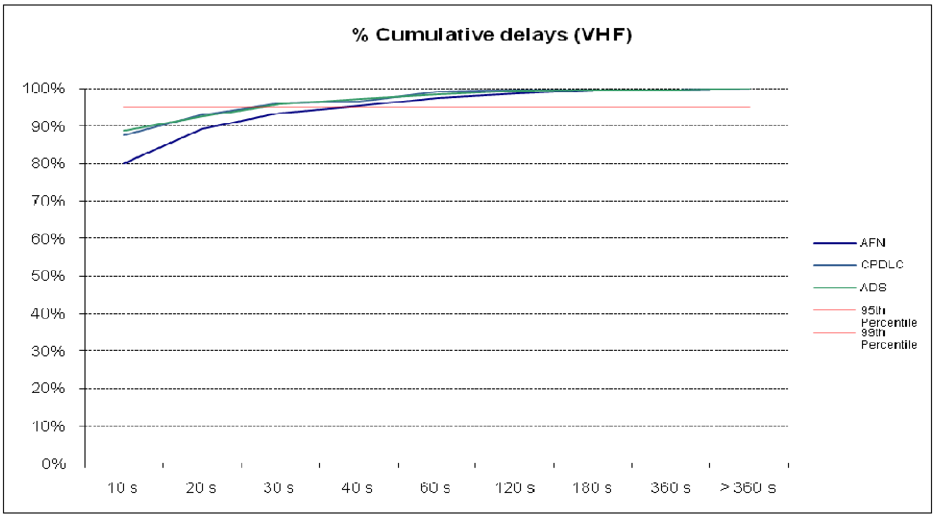

FIGURE 4
VHF downlink delay – Cumulative diagram (January 2010)

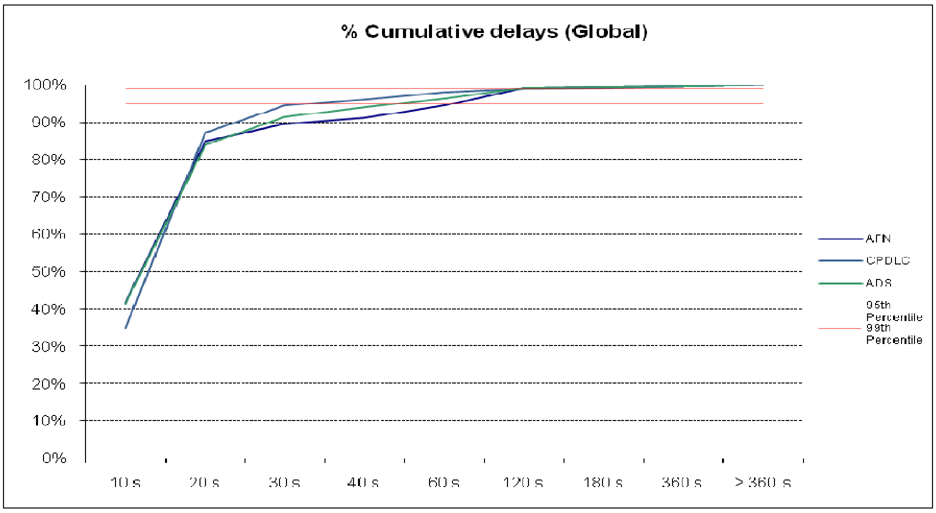

FIGURE 5
Global downlink delay – Cumulative diagram (January 2010)

Regarding to the delays, it is also important to introduce the round trip time. In this study this time is measured by using ADS contracts (from the time these contracts are sent until an answer is provided by the aircraft. Therefore, it also includes time spent by the avionics).

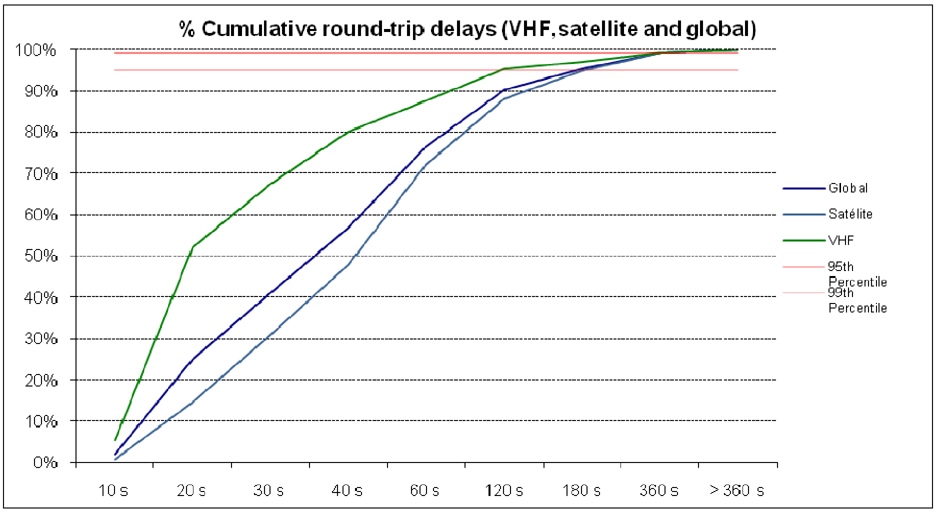

FIGURE 6
Round trip delay – Cumulative diagram (January 2010)

2.3 ADS-C Contracts

ADS-C provides surveillance capability in oceanic and en-route airspace. In non-radar airspace, the effective use of ADS-C in the provision of air traffic services enhances flight safety.

Three types of ADS-C contracts can be established with an aircraft (periodic, event and demand). Each of these contracts operates independently from each other and they are initiated by the ground system and do not require pilot actions.

The following table represents the ADS-C contracts established from September 2009 to January 2010 between aircrafts and SACCAN.

It must be taken into account that SACCAN is configured to automatically establish one periodic and one event contracts (including waypoint change and lateral deviation events). In the following table, these contracts are considered a part from the rest of established contracts.

ADS-C Contracts	Jan. 2010	Dec. 2009	Nov. 2009	Oct. 2009	Sep. 2009
Initials contracts	1332	1311	1347	1193	998
Periodic contracts (No initials)	123	92	114	95	116
Event contracts (No initials)	105	104	113	106	104
Demand contracts	97	77	81	76	82

TABLE 5
Number and type of ADS-C Contracts

Continuing with ADS characteristics, another important issue to remark is the FOM values of ADS message sent by the airplanes. FOM, namely Figure of Merit, defines the accuracy measurement of the navigation information.

The following table introduces the monthly trend of the different FOMs, most part of these values are equal or higher than six, which correspond to an error less than 0.25 NM with a probability of 95%.

FOM	Jan. 2010	Dec. 2009	Nov. 2009	Oct. 2009	Sep. 2009
FOM = 7 (Error < 0.05 NM)	2.31%	1.91%	0.79%	0.75%	1.28%
FOM ≥ 6 (Error < 0.25 NM)	99.13%	99.88%	99.93%	99.95%	99.90%
FOM ≥ 5 (Error < 1 NM)	99.15%	99.88%	99.94%	99.98%	99.91%
FOM ≥ 4 (Error < 4 NM)	99.20%	99.88%	99.94%	99.98%	99.91%
FOM ≥ 3 (Error < 8 NM)	99.34%	99.88%	99.94%	99.98%	99.91%
FOM ≥ 2 (Error < 15 NM)	99.34%	99.88%	99.94%	99.98%	99.91%
FOM ≥ 1 (Error < 30 NM)	99.38%	100%	99.99%	99.98%	99.91%
FOM ≥ 0	100%	100%	100%	100%	100%

TABLE 6
Cumulative percentages of FOM values sent in ADS messages

2.4 Controller-Pilot Datalink Communications

The CPDLC application provides air-ground data communication for the ATC service. This includes a set of clearance/information/request message elements which correspond to voice phraseology employed by Air Traffic Control procedures.

The controller is provided with the capability to issue level assignments, crossing constraints, lateral deviations, route changes and clearances, speed assignments, radio frequency assignments, and various requests for information. A “free text” capability is also provided to exchange information not conforming to defined formats.

To introduce CPDLC functionality, the following tables present the number and type of uplink message elements sent by the air traffic controller to the aircraft.

UL message elements	Nº of times used	Percentage
[freetext] (normal)	660	54,55%
SQUAWK [beaconcode]	124	10,25%
REPORT LEVEL [altitude]	92	7,60%
CONTACT [icaounitname] [frequency]	87	7,19%
CLIMB TO AND MAINTAIN [altitude]	69	5,70%
PROCEED DIRECT TO [position]	63	5,21%
MAINTAIN [altitude]	26	2,15%
ERROR [errorInformation]	22	1,82%
MONITOR [icaounitname] [frequency]	19	1,57%
ROGER	13	1,07%
RADAR CONTACT [position]	11	0,91%
END SERVICE	5	0,41%
DESCEND TO AND MAINTAIN [altitude]	4	0,33%
[freetext] (distress)	4	0,33%
CONFIRM ALTITUDE	3	0,25%
REPORT PASSING [position]	2	0,17%
CONFIRM SPEED	2	0,17%
REQUEST POSITION REPORT	2	0,17%
AT [position] CONTACT [icaounitname] [frequency]	1	0,08%
RADAR SERVICE TERMINATED	1	0,08%

TABLE 7
UL message elements transmitted (January 2010)

Type	Nº of times used	Percentage
Additional messages	664	54,88%
Contact / Monitor / Surveillance requests	231	19,09%
Report / Confirmation requests	101	8,35%
Vertical clearances	99	8,18%
Route modifications	63	5,21%
System management messages	27	2,23%
Responses / Acknowledgements	13	1,07%
Air traffic advisories	12	0,99%
Crossing constraints	0	0,00%
Lateral offsets	0	0,00%
Speed changes	0	0,00%
Negotiation requests	0	0,00%

TABLE 8
Types of UL message elements (January 2010)

On the other hand, the pilot is provided with the capability to respond to messages, to request clearances and information, to report information, and to declare/rescind an emergency. The following two tables introduce the used of CPDLC downlink service in January 2010.

DL message elements	Nº of times used	Percentage
ROGER	525	31,31%
WILCO	360	21,47%
POSITION REPORT [positionreport]	237	14,13%
[freetext]	213	12,70%
LEVEL [altitude]	81	4,83%
DEVIATING [distanceoffset] [direction] OF ROUTE	74	4,41%
REQUEST [altitude]	58	3,46%
REQUEST CLIMB TO [altitude]	36	2,15%
DUE TO AIRCRAFT PERFORMANCE	20	1,19%
STANDBY	16	0,95%
REQUEST CRUISE CLIMB TO [altitude]	10	0,60%
REQUEST DIRECT TO [position]	8	0,48%
ERROR [errorInformation]	6	0,36%
REQUEST VOICE CONTACT	5	0,30%
REQUEST DESCENT TO [altitude]	4	0,24%
PRESENT ALTITUDE [altitude]	4	0,24%
WHEN CAN WE EXPECT HIGHER ALTITUDE	3	0,18%
NOT CURRENT DATA AUTHORITY	3	0,18%
AT [position] REQUEST CLIMB TO [altitude]	2	0,12%
AT PILOTS DISCRETION	2	0,12%
UNABLE	1	0,06%
AT [position] REQUEST DESCENT TO [altitude]	1	0,06%
AT [time] REQUEST CLIMB TO [altitude]	1	0,06%
REQUEST [speed]	1	0,06%
CLIMBING TO [altitude]	1	0,06%
PASSING [position]	1	0,06%
PRESENT SPEED [speed]	1	0,06%
WHEN CAN WE EXPECT [speed]	1	0,06%
WHEN CAN WE EXPECT LOWER ALTITUDE	1	0,06%
DUE TO WEATHER	1	0,06%

TABLE 9
DL message elements transmitted (January 2010)

Type	Nº of times used	Percentage
Responses	902	53,79%
Reports	325	19,38%
Additional messages	236	14,07%
Vertical requests	112	6,68%
Lateral offset requests / reports	74	4,41%
System management messages	9	0,54%
Route modification requests	8	0,48%
Voice contact requests	5	0,30%
Negotiation requests	5	0,30%
Speed requests	1	0,06%
Emergency messages	0	0,00%

TABLE 10
Type of DL message elements (January 2010)