Network Manager
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EUROCONTROL

Data link Network Operational Status Report

November 2020

This report is the monthly 'Data link Network Operational Status Report' as identified in the DPMF Report Catalogue available from the DPMF OneSky team web site. It provides a summary of the operational status and technical performance of data link in Europe covering a rolling 12 month period for monthly statistics and a 15 week period for weekly statistics, ending in November 2020.

The report covers three main areas of the datalink operations in Europe:

1. Operational Status
2. Technical Performance
3. VDL Mode Performance

For each of the three areas above different metrics are presented. A detailed definition of the metrics used in this report is available in the DPMF Report Catalogue. In the following report, the identifier for each metric used in the DPMF Report Catalogue is shown in angled brackets e.g. <N-1>.

Notes:

- As soon as new ANSPs are providing LISAT logs to DPMF, the metrics are updated accordingly (sometimes retroactively) and the values presented in this report might evolve from a report to another.
- Between the end of July 2019 and the middle of December 2019 the data for EDYY and EDUU is incomplete with no data at all for some flights and just partial data for some flights. So data for EDUU and EDYY is not representative and any total counts of flights etc. are underestimated in that period.
- As from 1st January 2020 this report now also includes data from EPWW (Warsaw).
- As from August 2020 this report now includes data from LEBC, LEBM and GCCC (Spain) with data since March 2020
- As from September 2020 this report now include data from EVRR (Latvia).

1. Operational Status

Figure 1 on the following page provides a status for each FIR/UIR covered by the DLS IR. The format has changed from previous reports and feedback on the new format is invited. The top map shows the operational status of each centre (<N-4>) as of end of November 2020. The map below shows which centres are providing LISAT data to NM as of end of November. The table on the right shows per centre for the month of November: i) the number of flights operating above FL285, ii) The Provider Abort rate (only for those centres providing LISAT data to NM), iii) what percentage of flights indicate that they are capable of performing CPDLC over the ATN (i.e. file 'J1') and iv) what percentage of the flights operating above FL285 are actually seen using CPDLC over the ATN

ANSPs with service limitations

The table below explains the limitations of service for those centres shown in yellow in 'Implementation Status' map on Figure 1 i.e. those centres that provide data link but not in full compliance with (EC) No 29/2009 as amended.

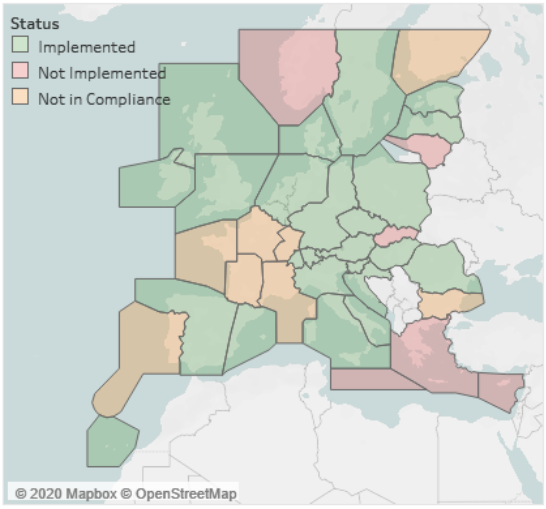
Centre	Limitation of service
LPPC	Only the DLIC service is provided.
LFEE, LFFF, LFMM	DLIC, ACM, AMC services provided (no ACL).
LFRR, LFBB	DLIC, ACM, AMC and ACL service provided, but no downlink messages of ACL are supported.
EFIN	DLIC, ACL, ACM, AMC but only for the SITA network.
LBSR	DLIC, ACL, ACM, AMC but only for the SITA network.

CPDLC / ATN Flights

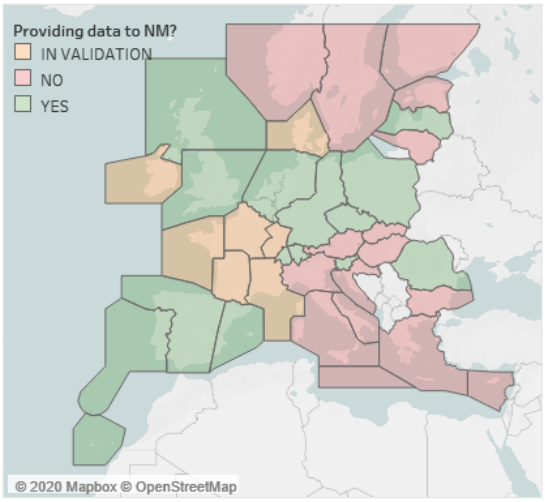
Figure 2 presents data only for flights operating above FL285 in the DLS airspace. It shows what percentage of flights in that airspace[1] file 'J1' in their flight plan <N-1>and what percentage indicate in the flight plan that the aircraft is exempt. For November 2020 62.5% of flights indicated the capability to perform CPDLC over ATN/VDL Mode 2 30.0% indicate they are exempt. The remaining 7.5% filed neither capability, nor exemption. Considering the known exceptions, NM is estimating that about 2.5% of the filed FPLs are likely contravening the DLS IR.

[1] EHAAFIR, LOVVFIR, LECBUIR, LIBBUIR, EBURUIR, GCCCUIRN, GCCCUIRS, LFFFUIR, EDVVUIR, LPPCFIR, EGTTUIR, LECMUIR, LIMMUIR, EDUUUIR, LIRRUIR, EGPXUIR, EISNUIR, LZBBFIR, LRBBFIR, LHCCFIR, EKDKFIR, LJLAFIR, LCCCFIR, LKAAFIR, LBSRFIR, EPWWFIR, EFINFIR, LGGGUIR, LMMMUIR, EVRRUIR, ESAAUIR, EETTUIR, EYVLUIR.

Implementation Status



Providing Data to NM



Statistics

ATSU Code	Total Flights	PA Rate	% J1 Capable	% Us ing..
EDUU	79379	3.6	76%	39%
EDYY	66377	4.0	75%	45%
EETT	5687		56%	
EFIN	2789		69%	
EGPX	18570	7.1	74%	21%
EGTT	55726	3.5	76%	51%
EISN	13663		55%	
EKDK	14057		73%	
ENOR	9180		86%	
EPWW	23043	5.2	74%	40%
EVRR	8261	10.4	62%	14%
EYVL	8011		61%	
GCCC	7085	40.2	86%	10%
LBSR	32864		77%	
LCCC	12543		60%	
LDZO	24648		78%	
LECB	19565	14.7	80%	45%
LECM	35685	9.6	81%	47%
LFBB	26085		75%	
LFEE	33081		74%	
LFFF	22166		69%	
LFMM	27336		73%	
LFRR	31537		78%	
LGGG	28523		72%	
LHCC	31463		81%	
LIBB	10919		74%	
LIMM	22859		78%	
LIRR	25094		79%	
LJLA	13408	6.1	78%	43%
LKAA	23622	9.2	77%	42%
LMMM	3400		55%	
LOVV	35826		79%	
LPPC	16886		84%	
LRBB	24308	6.9	74%	29%
LSAG	15413	6.7	74%	36%
LSAZ	16979	6.2	73%	38%
LZBB	15376		76%	

Figure 1: Current operational status of data link over the ATN

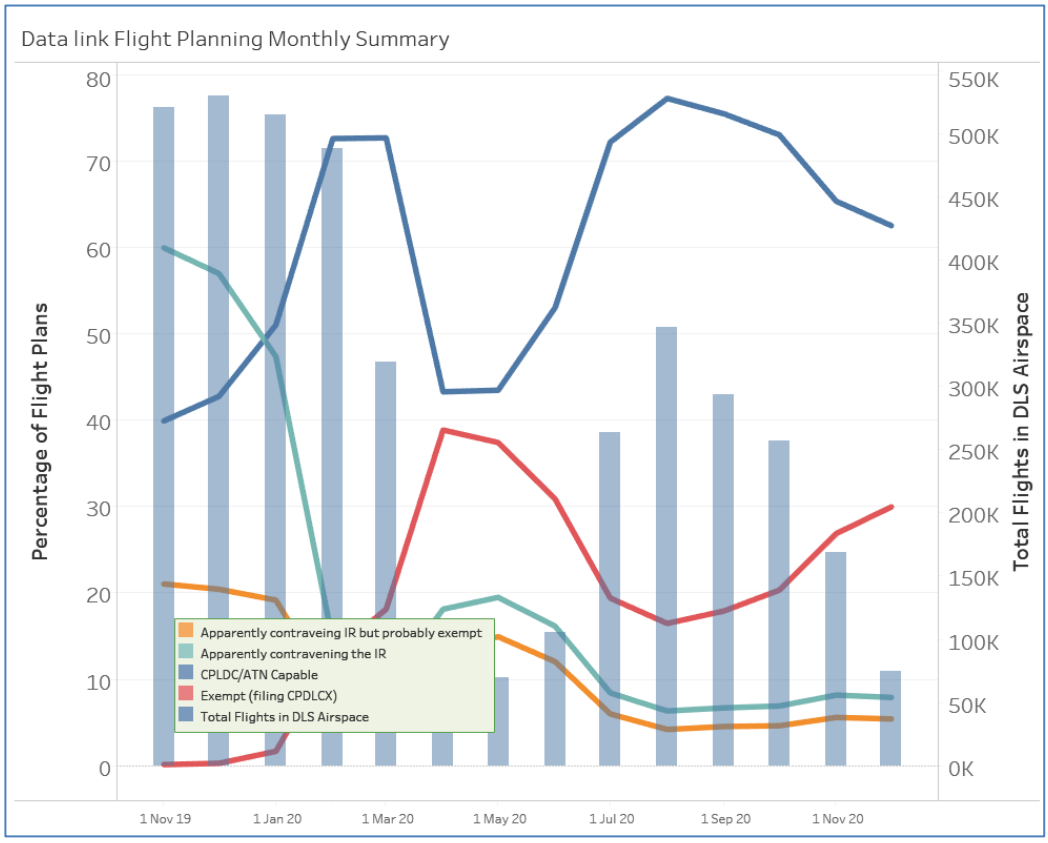


Figure 2: Proportion of flights capable of using CPDLC over ATN/ VDL Mode 2

2. Technical Performance

Overall Provider Abort Rate

Figure 3 below shows the PA rate <O-23> aggregated for all ANSPs providing data to LISAT[2]. The target value is 1 PA per 100 hours CPDLC (shown as a dashed line on the graph below). The overall average rate for November 2020 was 6.6 PAs per 100 hours.

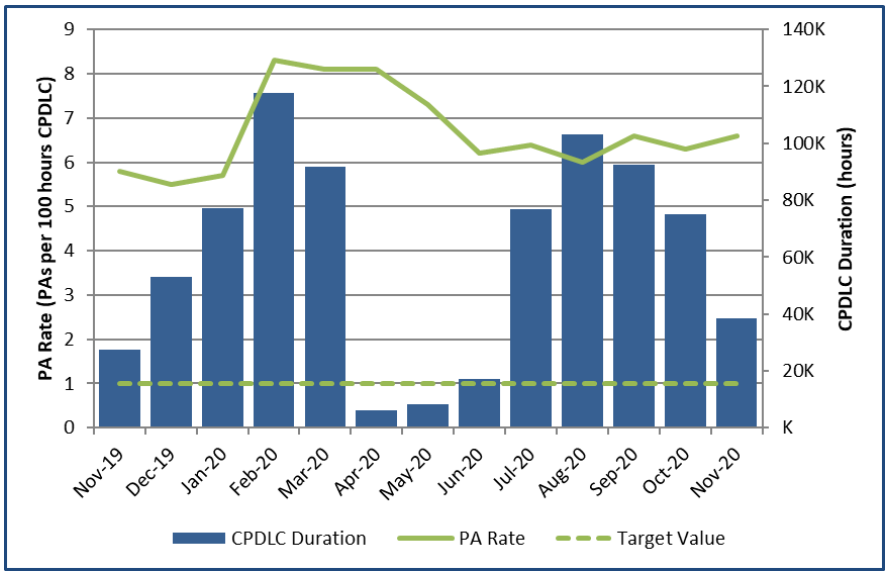


Figure 3: PA rate

Figure 4 below shows the PA rate of aircraft on the Logon List against aircraft not on the Logon List using only data from centers that do not support the Logon List[3].

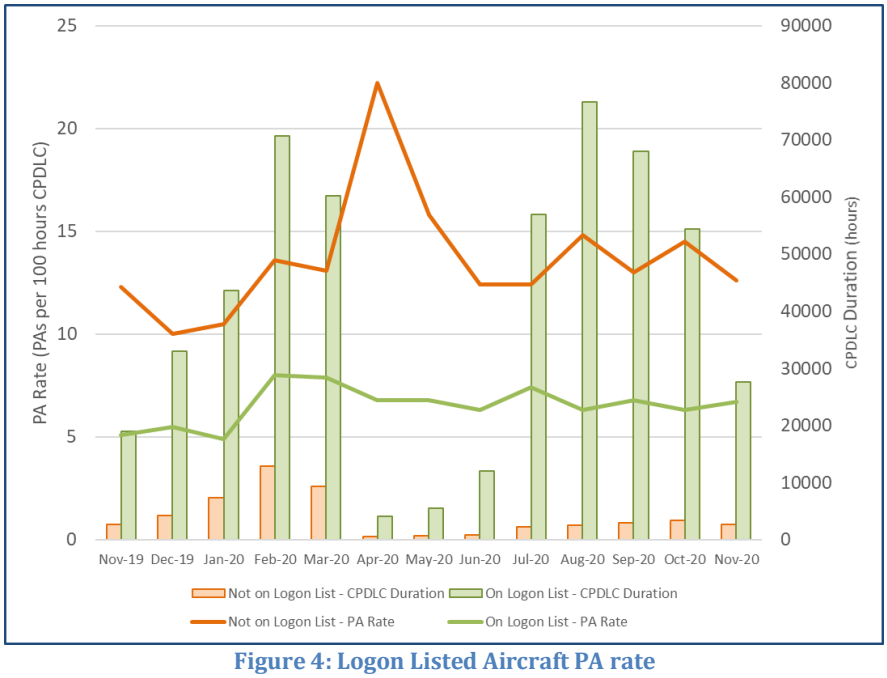


Figure 4: Logon Listed Aircraft PA rate

[2] Currently MUAC, Skyguide, DFS, NATS, ANS CZ, Slovenia Control, PANSA, ENAIRE and Latvia. DSNA and Romatsa have started to provide data but it is still being validated and so is not included in this report.
[3] EDUU,EGTT,EGPX,LKAA,GCCC,LECB,LECM,LJLA,EPWW.

PA rate per ACSP

Figure 5 below shows the PA rate per ACSP for aircraft on the Logon List. The ACSP information is taken from the declarations made by the aircraft operators when adding their aircraft to the Logon List; 'BOTH' implies that the aircraft may use ARINC or SITA.
Note: ENAIRE clarified that the rise of PA rate observed on ARINC's network since February 2020 is due to the use of CPDLC below FL285 in ENAIRE's airspace. ENAIRE is working with ARINC to improve the coverage below the DLS IR required level of FL285.

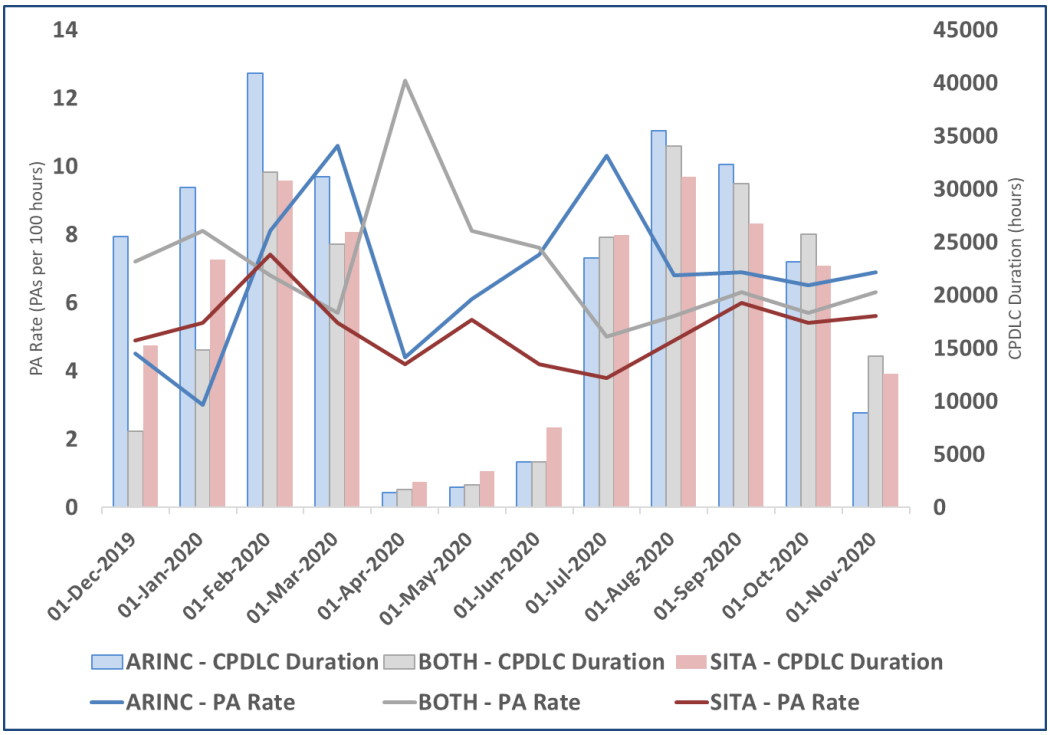


Figure 5: ACSP PA rate

Weekly PA rate per Centre

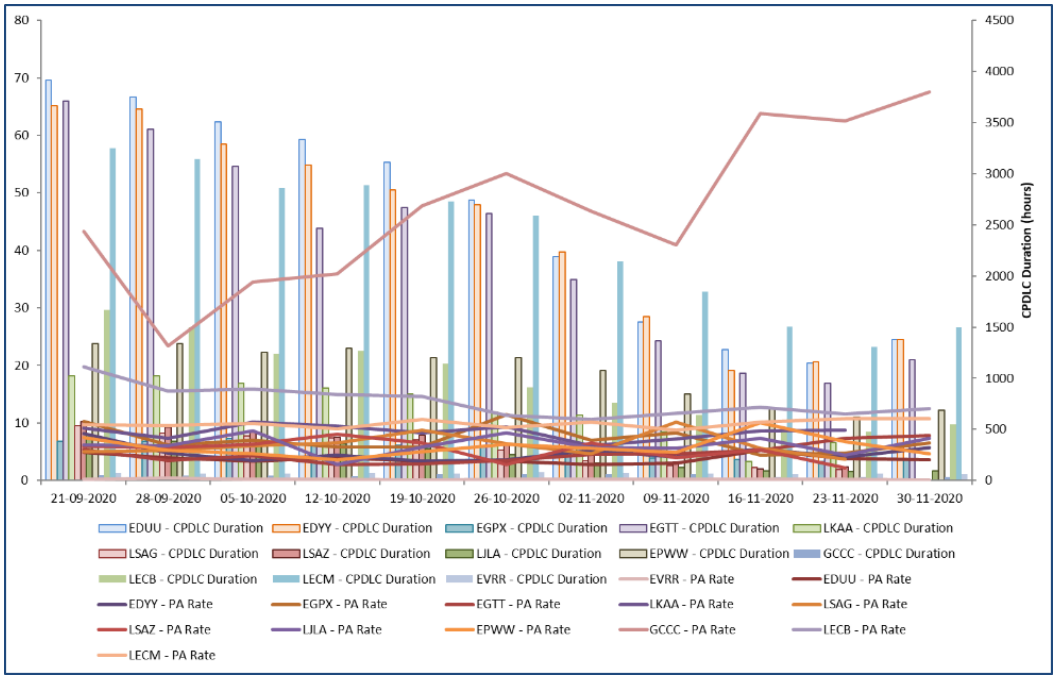


Figure 6: Weekly PA Rate per Centre

Weekly PA Rate for Major Aircraft Operators

Figure 7 below shows the weekly PA rate for the three aircraft operators with the lowest average PA rate and the three aircraft operators with the highest average PA rate from a list of the top 30 aircraft operators in terms of usage of CPDLC/ATN over the past 15 weeks.

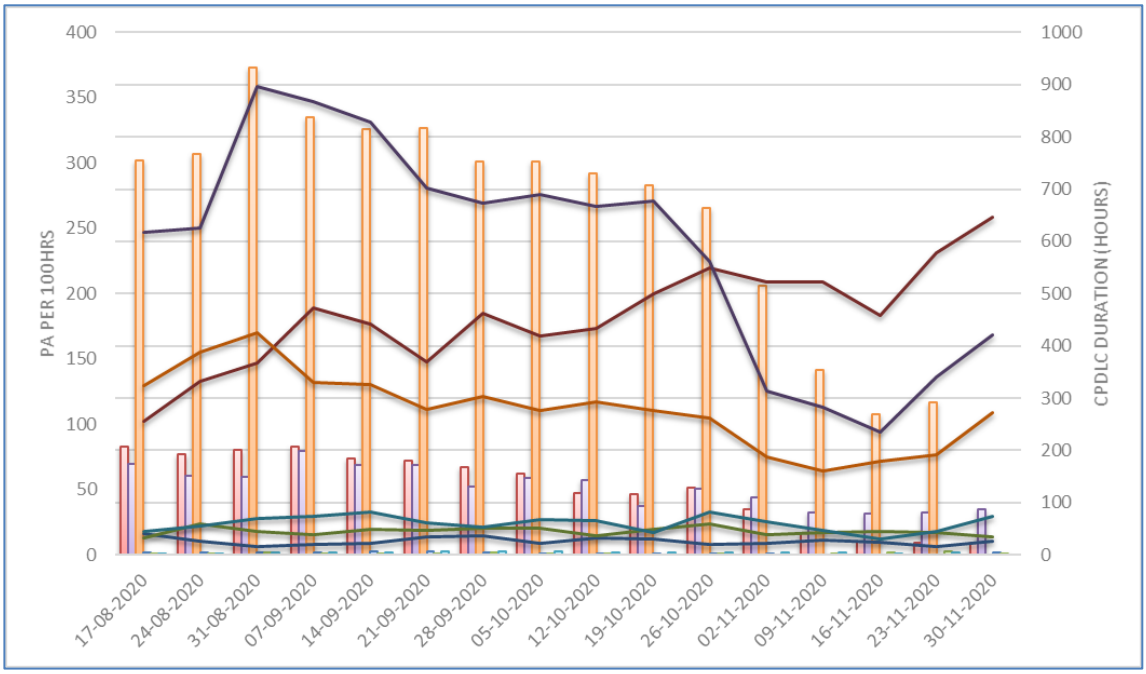


Figure 7: Top 3 and bottom 3 PA Rate for Major Aircraft Operators

Weekly PA Rate for 5 biggest CPDLC users

Figure 8 below shows the weekly PA rate for the five aircraft operators that have used CPDLC most over the past 15 weeks.

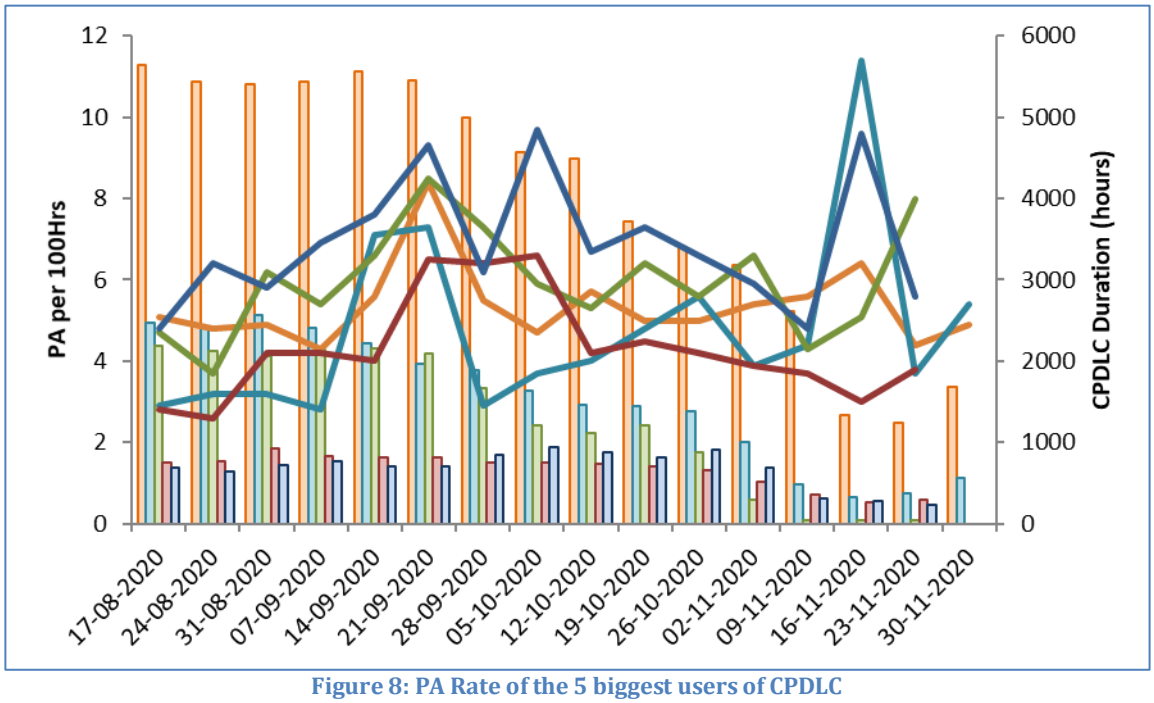


Figure 8: PA Rate of the 5 biggest users of CPDLC

Weekly PA Rate for various aircraft types

The figures below show the weekly PA rate for specific aircraft types for the five aircraft operators using CPDLC the most over the past 15 weeks with the particular aircraft type.

Airbus A320 Family

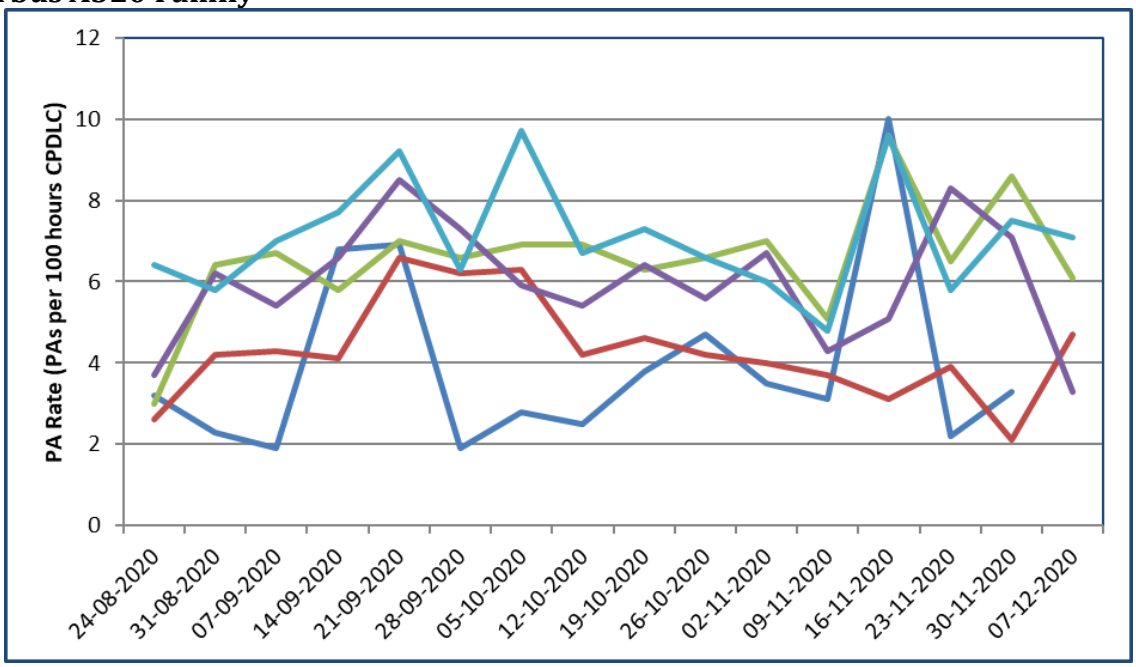


Figure 9: A320 Family (A318/319/320/321/20N/21N) Aircraft Operator PA Rates

Boeing B737 Family

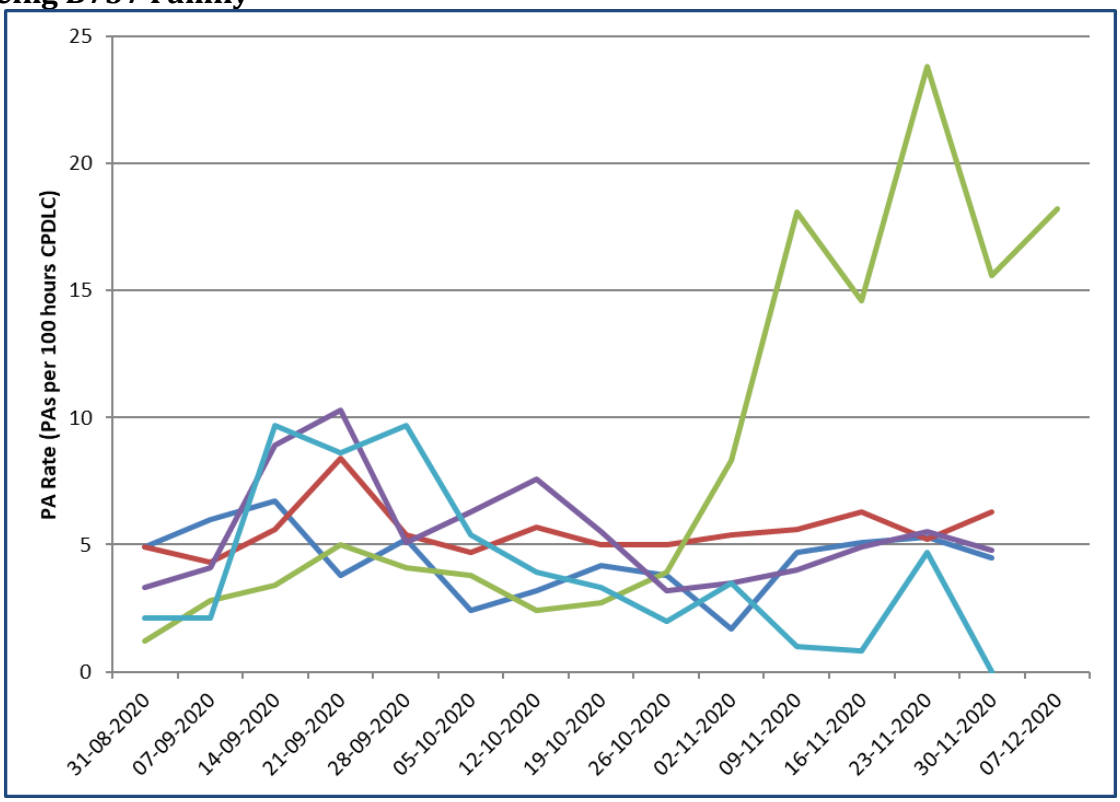


Figure 10: B737 Family Aircraft Operator PA Rates

Technical Round Trip Delay

Figure 11 below shows the 95th and 99th percentile of the technical round trip delay <O-2><O-3>. It represents the delay between when a message is uplinked and the ground system receives the corresponding application level acknowledgement (aggregated for all systems providing data to LISAT). As agreed during DPMG8, the TRTD is now computed taking into account downlinked error messages. This has resulted in an increase of the 99th percentile.

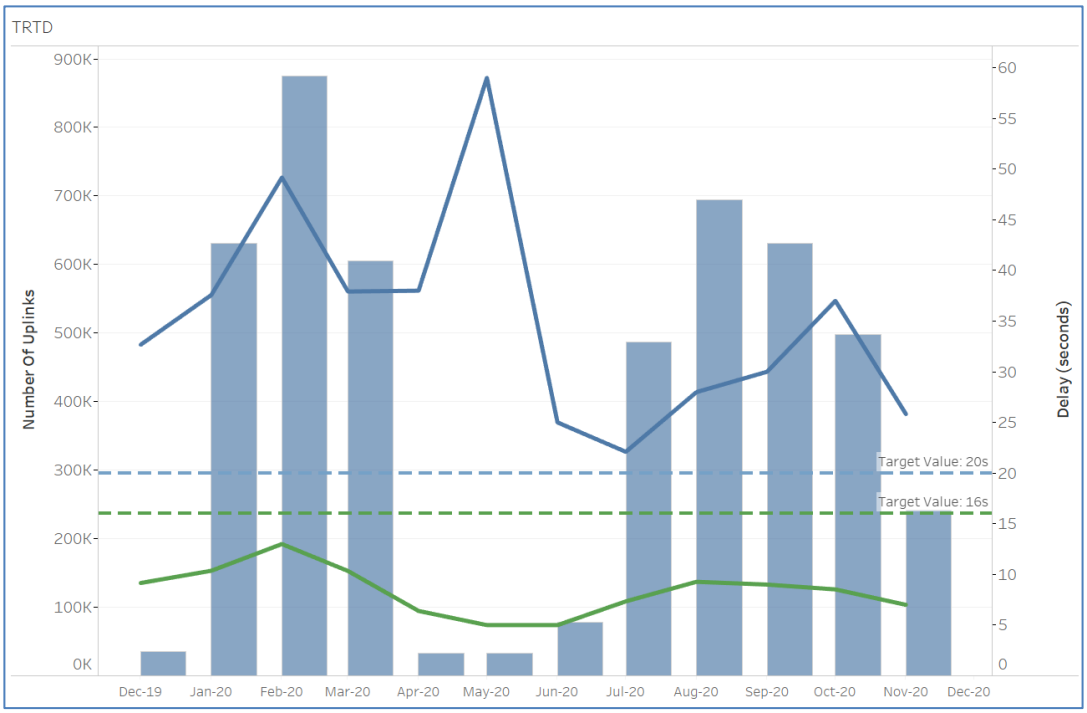


Figure 11: Technical Round Trip Delay

Technical Continuity

The graph below shows a new metric measuring the 'Technical Continuity" (<0-25>). This is the probability that a LACK is received for an uplink message before the technical response timer expires i.e. within 40 seconds.

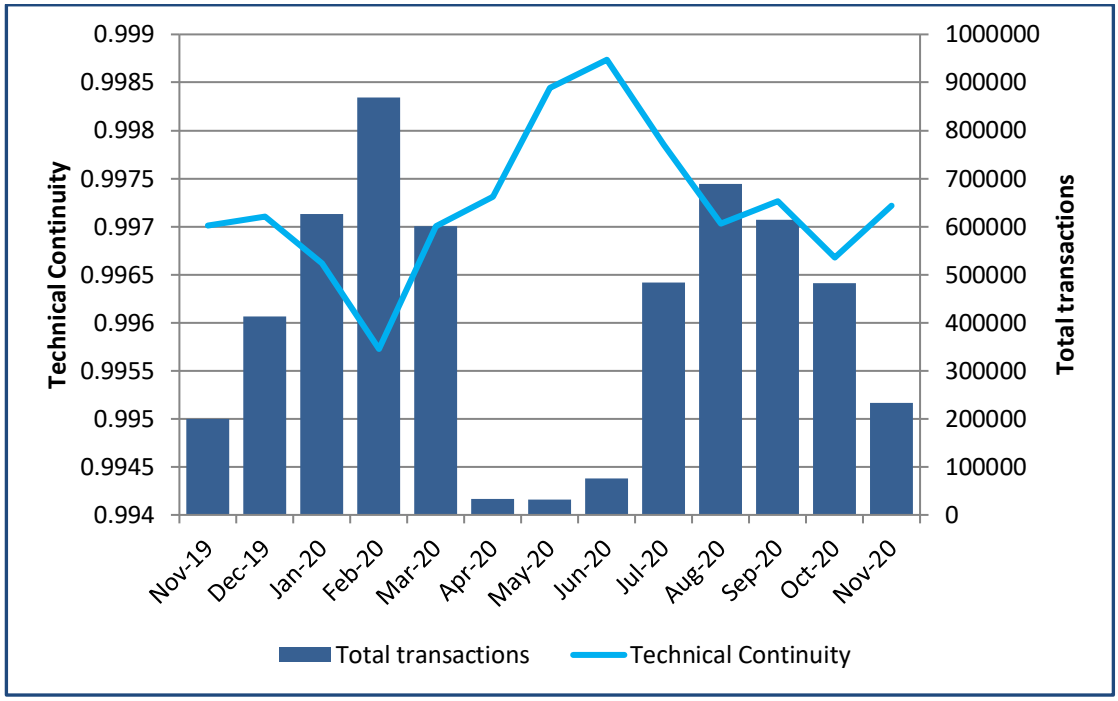


Figure 12: Technical Continuity

N.B The way this metric is currently calculated is not correct; it is presenting the probability of the TRTD being less than 40 seconds, but the TRTD is only calculated for uplink messages which receive a LACK. So the graph below represents an optimistic view of the true performance since some uplink messages do not receive a LACK at all. Work is ongoing to provide a correct graph

3. VDL Mode 2 Performance

The following metrics[4] are computed based on the available data from the VGS logs provided each month to the DPMF by ARINC and SITA. These logs contain the AVLC traffic recorded at each VGS during the 24hrs of the first Friday[5] of each month.

AVLC Round Trip Time for the first Friday of the month.

The graph below shows the cumulative distributions per frequency (and per CSP) for the AVLC Round Trip Time (RTT) of acknowledged AVLC INFO frames conveying ATN packet to Logon-List aircraft and considering all the VGS logs. The 95th and the 99th percentile of ED-120 together with the 95th and the 99.9th percentile of ED-228A are also provided for comparison purposes and tabulated values are reported in the legend. Please note the logarithmic scale of the RTT.

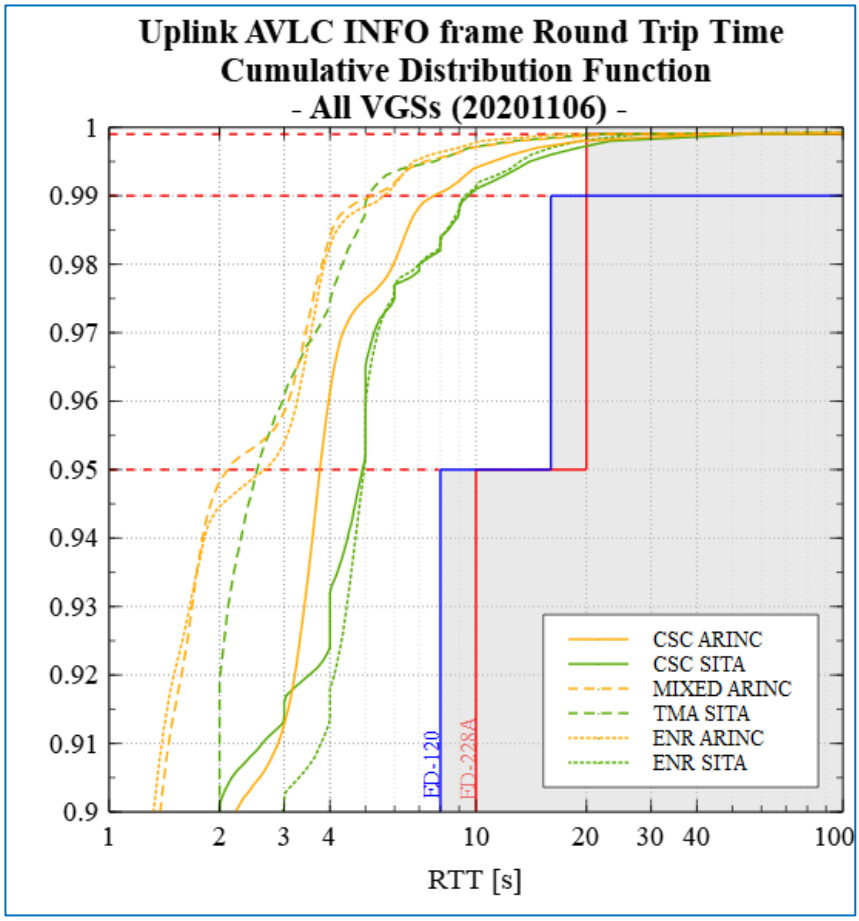


Figure 13: AVLC Round Trip Time

Important note: SITA is providing logs for all their users whereas ARINC is only providing data for their 28 largest ATN users as well as non-AOC users. Moreover, ARINC is providing logs for all their European VGSs whereas SITA is only providing logs of VGSs from which they have access to (mainly: Norway, Sweden, UK, The Netherlands, Germany, Czech Rep., France, Switzerland, Austria and Spain). Therefore the CSPs data does not represent the behaviour of their network as a whole. The trend information for each CSP is valuable and useful but the comparison between the two CSPs is problematic since different data sets are being compared.

[4] The *Channel load*, the *AVLC RTT distribution* and the *number of retransmission distribution* are defined in the DPMF report catalogue.

[5] Friday is observed to have the highest flight traffic of the week.

Number of retransmissions for the first Friday of the month.

The graph below shows the cumulative distributions per frequency (and per CSP for the CSC) for the number of retransmissions needed before acknowledgement of uplink AVLC INFO frames conveying ATN packet to Logon-List aircraft considering all the VGS logs. N=0 represents successes on the first attempt, N=1 to N=5 represent successes on the first to the fifth retransmissions and N>5 represents N2T1 events.

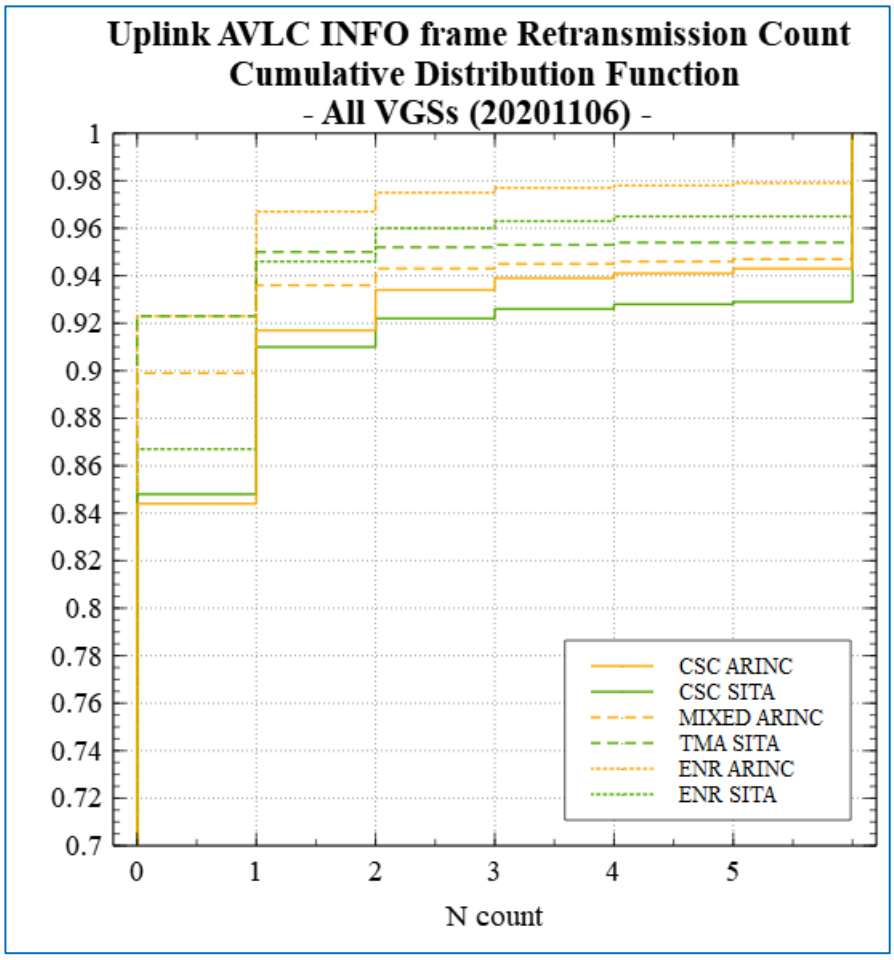


Figure 14: AVLC Uplink INFO frame retransmission count

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AVLC Round Trip Time per frequency trend

The following set of graphs show the 95th and the 99th percentile of the AVLC RTT (in seconds) of acknowledged AVLC INFO frames conveying ATN packet to Logon-List aircraft for the first Friday of each month for each frequency with the CSC split over the two CSPs. The RTT axis has a logarithmic scale with the same range for the different frequencies. The graphs also shows the number of AVLC frames taken into account in the percentiles calculations (Frame count in linear scale) and the 95% confidence interval (gray area).

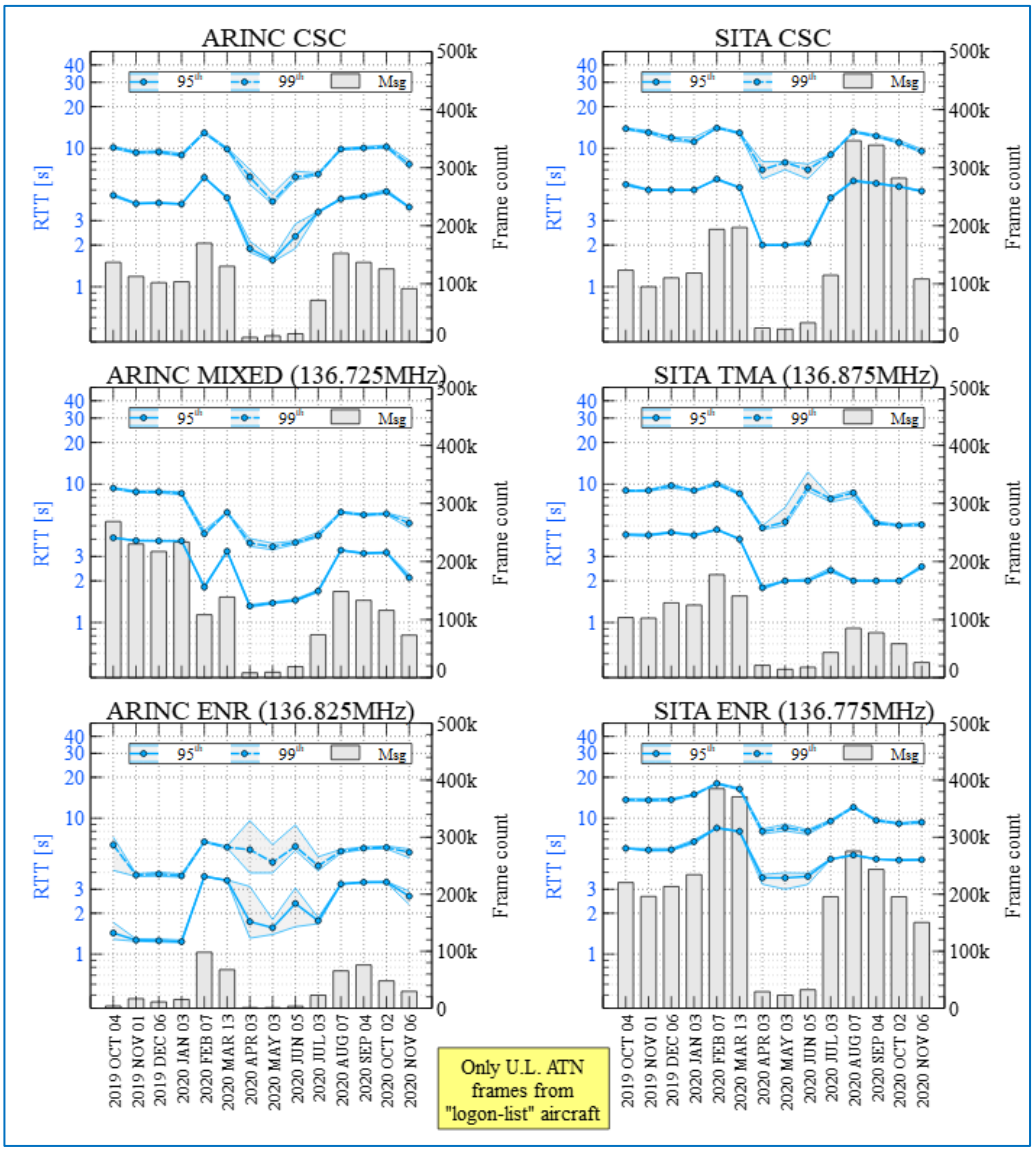

Figure 15: AVLC Uplink INFO Round Trip Time per Frequency

Important note: SITA is providing logs for all their users whereas ARINC is only providing data for their 28 largest ATN users as well as non-AOC users. Moreover, ARINC is providing logs for all their European VGSs whereas SITA is only providing logs of VGSs from which they have access to (mainly: Norway, Sweden, UK, The Netherlands, Germany, Czech Rep., France, Switzerland, Austria and Spain). Therefore the CSPs data does not represent the behavior of their network as a whole. The trend information for each CSP is valuable and useful but the comparison between the two CSPs is problematic since different data sets are being compared.

Uplink delivery success rate

The following set of graphs show the uplink delivery rate of AVLC INFO frames conveying ATN packet to Logon-List aircraft for the first Friday of each month for each frequency with the CSC split over the two CSPs. It is the probability that an AVLC uplink INFO frame is correctly delivered to the aircraft (ACK received). The graphs also shows the number of AVLC frames taken into account in the calculations (Msg count in linear scale = AVLC frame count sent on first attempt) and the 95% confidence interval (gray area).

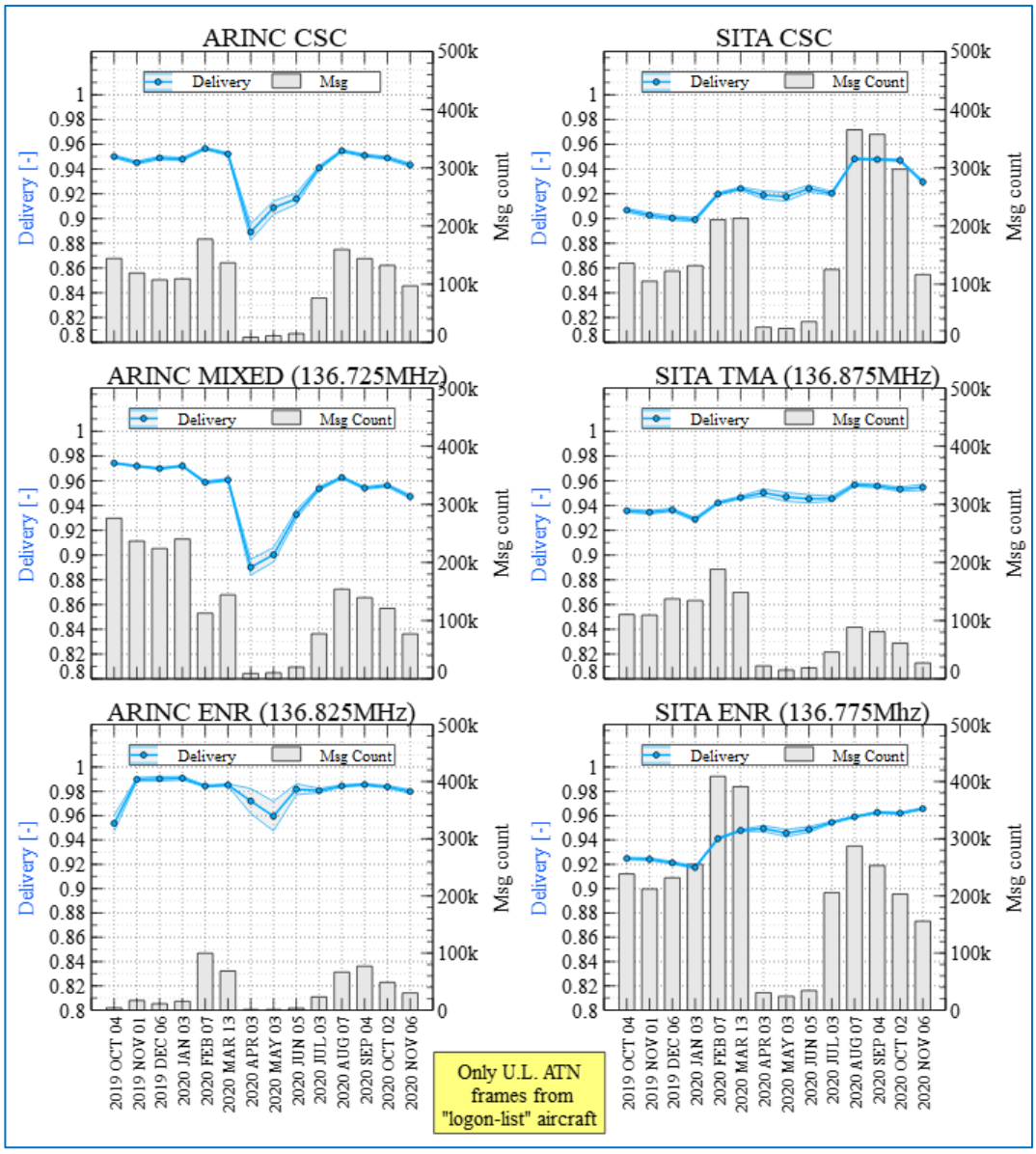

Figure 16: AVLC successful delivery rate per frequency

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Channel load per frequency trend

The following set of graphs show the channel load per AVLC payload type (ATN, AOA and AVLC protocol related frames[6]) for the first Friday of each month for each frequency with the CSC split over the two CSPs. The channel load is expressed in megabytes with the same range for the different frequencies.

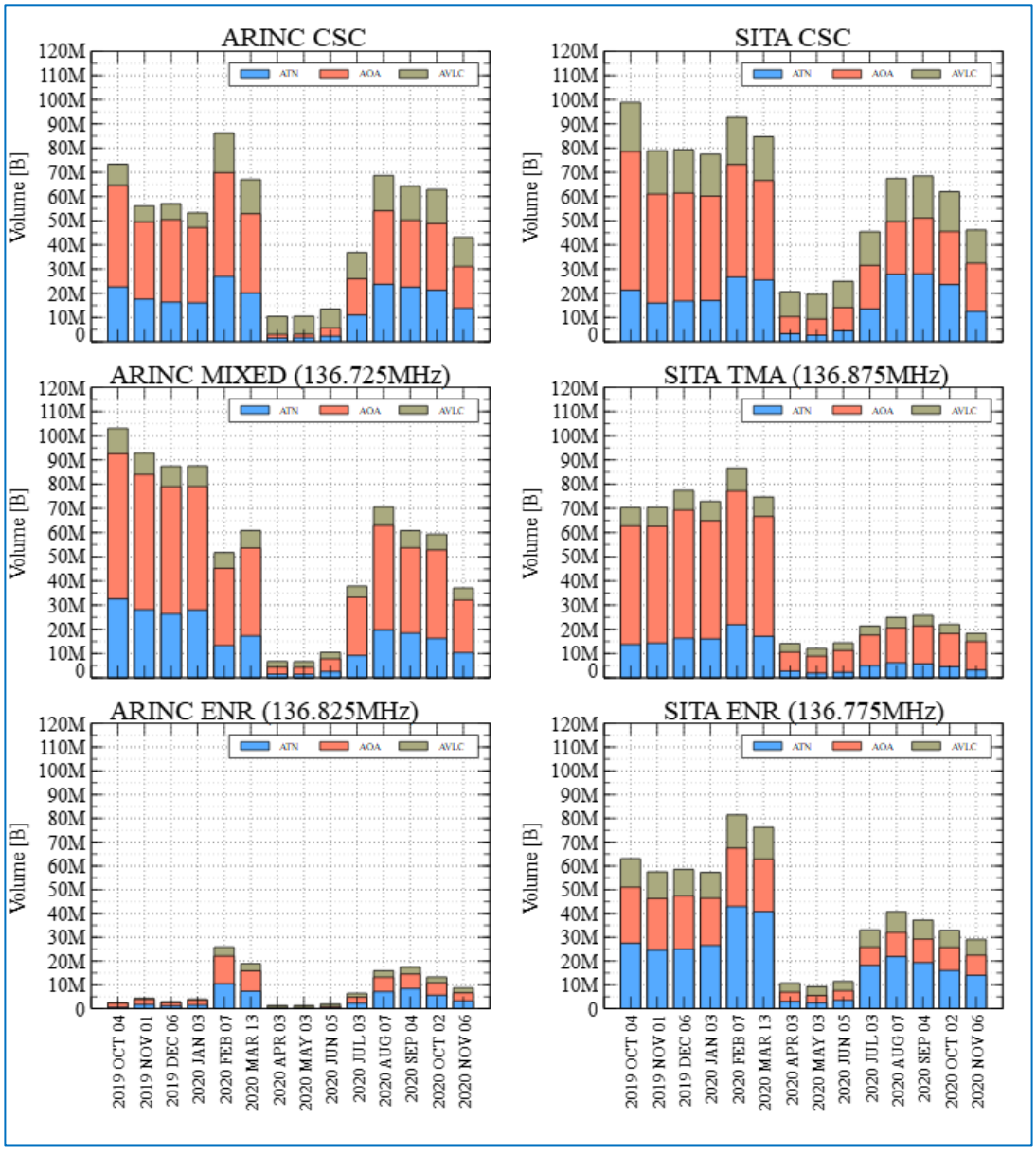

Figure 17: AVLC Channel load per frequency

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[6] i.e. RR, SREJ, XID, …