International Civil Aviation Organization

EIGHTEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION AND SURVEILLANCE SUB-GROUP (CNS SG/18) OF APANPIRG

Asia and Pacific Regional Sub-Office, Beijing, China
(21 – 25 July 2014)

Agenda Item 5: Aeronautical Mobile Service (AMS)

5.1) Discuss RCP/RSP Implementation Framework (APANPIRG Decision 24/33)

PBCS IN NZZO – CURRENT FANS1/A PERFORMANCE AND ISSUES

(Presented by New Zealand)

SUMMARY

This paper presents an update on current FANS1/A performance observed in NZZO between January and June 2014 and provides information on the analysis of two current issues relating to the performance of Iridium and HF data link. It illustrates post implementation monitoring from an ANSP perspective.

1. INTRODUCTION

1.1 Little change has been observed in FANS1/A performance in the first six months of 2014.

2. DISCUSSION

2.1 We are now seeing more airlines operating on the Inmarsat I4 constellation in our region. Performance of ADS-C reports against the RSP180 parameter is illustrated in Figure 1 which also gives the percentage of messages through each media type. We receive only a small number of reports via HFDL and Iridium.

2.2 The performance of HFDL reports when assessed by themselves meets RSP400 requirements and not RSP180 as evidenced in Figure 1. When HFDL is assessed with SATCOM when operated in "next on busy" mode it causes little degradation on pure SATCOM performance. An assessment of HFDL performance is provided in Attachment 2 of this working paper.

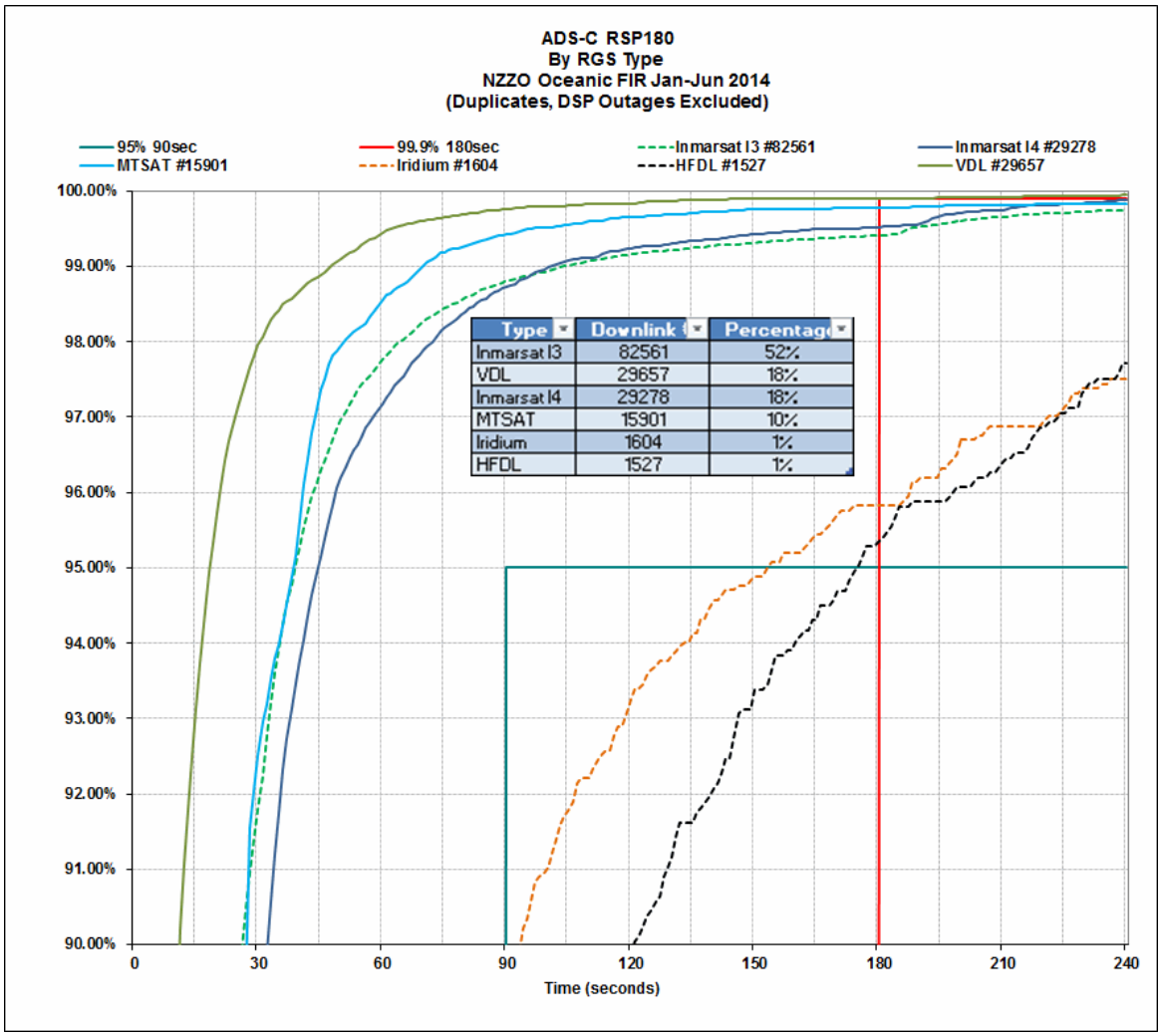


Figure 1: RSP180 in NZZO

2.3 A recent occurrence where an aircraft usually operating HFDL in the Airbus :"next on busy" mode with SATCOM operated in NZZO airspace with SATCOM inoperable. The latency of the downlinks in this mode of operation shows the inability of HFDL to cope in this standalone mode of operation, which questions the suitability of HFDL for ATC communications. Figure 2 illustrates the latency of the downlinks on this flight and also illustrates the need for crews to disable HFDL if SATCOM is inoperable and revert to voice communication. In Figure 2 NLK1 and PPG1 are VDL RGS in the South Pacific, H01, H02, and H05 are messages coming through HFDL RGS.

RGS	LATITUDE	LONGITUDE	TYPE	Aircraft	Ground	Latency in seconds
H05	-31.133709	160.630585	P	01:44:40	01:46:11	91
H05	-30.487404	163.008438	W	01:58:50	01:59:14	24
NLK1	-30.146484	164.246292	P	02:06:01	02:10:06	245
NLK1	-29.072227	167.852203	P	02:27:21	02:27:27	6
NLK1	-29.03738	167.942154	W	02:27:55	02:28:01	6
NLK1	-27.360935	170.872253	P	02:48:41	02:48:47	6
H02	-25.620975	173.712219	P	03:10:01	03:16:44	403
H02	-24.99424	174.693253	W	03:17:37	03:45:49	1692
H02	-23.852348	176.453812	P	03:31:22	03:53:51	1349
H05	-22.030334	179.140152	P	03:52:42	04:13:08	1226
H05	-21.908283	179.315414	P	03:54:07	04:14:05	1198
H05	-21.420422	-179.99004	W	03:59:45	04:20:04	1219
H05	-20.035458	-178.08907	P	04:15:27	04:39:09	1422
H05	-19.514294	-177.38989	W	04:21:18	04:47:21	1563
H05	-17.731419	-174.99178	W	04:41:40	04:56:54	914
H05	-16.183205	-173.01698	P	04:59:24	05:02:37	193
PPG1	-15.906487	-172.67006	W	05:02:35	05:03:32	57
PPG1	-14.415951	-170.68256	L	05:20:27	05:20:32	5
PPG1	-14.401875	-170.64789	W	05:20:43	05:20:49	6
PPG1	-13.146858	-169.48883	W	05:33:08	05:33:15	7
H05	-12.277222	-168.60992	P	05:42:03	05:44:20	137
H05	-10.21677	-166.56046	P	06:03:24	06:04:29	65
H05	-8.611736	-164.9913	W	06:19:54	06:20:29	35
H05	-8.143101	-164.53691	P	06:24:44	06:26:21	97
H01	-6.062565	-162.53706	P	06:46:05	07:04:42	1117
H01	-5.242367	-161.75531	P	06:54:32	07:05:29	657
H01	-4.996376	-161.52152	W	06:57:05	07:06:18	553
H01	-3.99559	-160.56433	P	07:07:24	07:08:26	62

Figure 2 : Operating HFDL with no SATCOM

2.4 We see a small number of flights that do not use HFDL operate FANS1/A without SATCOM and just VDL. While causing some increase in controller workload if the crews do not advise of the issue, it is usually resolved fairly quickly. We note that it requires the VDL downlinks from these flights to be filtered from the performance data to avoid skewing the VDL statistics. Figure 3 illustrates this for a flight operating out of New Zealand in VDL coverage then crosses the Tasman Sea out of VDL coverage. Downlinks are stored by the FMS until in VDL coverage on the other side of the Tasman Sea. AKL2 is the VHF RGS in Auckland, SYD2 is the VHF RGS in Sydney Australia.

RGS	LATITUDE	LONGITUDE		Aircraft	Ground	Latency in seconds
AKL2	-37.192326	173.941895	P	19:03:00	19:03:07	7
AKL2	-36.473579	171.05661	P	19:24:20	19:24:27	7
AKL2	-36.38792	170.735779	W	19:26:42	19:27:00	18
SYD2	-36.194286	168.126694	P	19:45:41	21:12:25	5204
SYD2	-35.90538	165.141327	P	20:07:01	21:12:32	3931
SYD2	-35.650291	162.995911	W	20:22:40	21:12:49	3009

Figure 3: Operating without SATCOM

2.5 Figure 1 indicates poor latency of the data received through the Iridium network. An assessment of Iridum performance is provided in Attachment 1 of this paper. Since this analysis was completed a software problem at the Iridium GES was causing some delays in May and we were still seeing delays in the June data. The observed Iridium latency on a monthly basis for 2014 is illustrated in Figure 4.

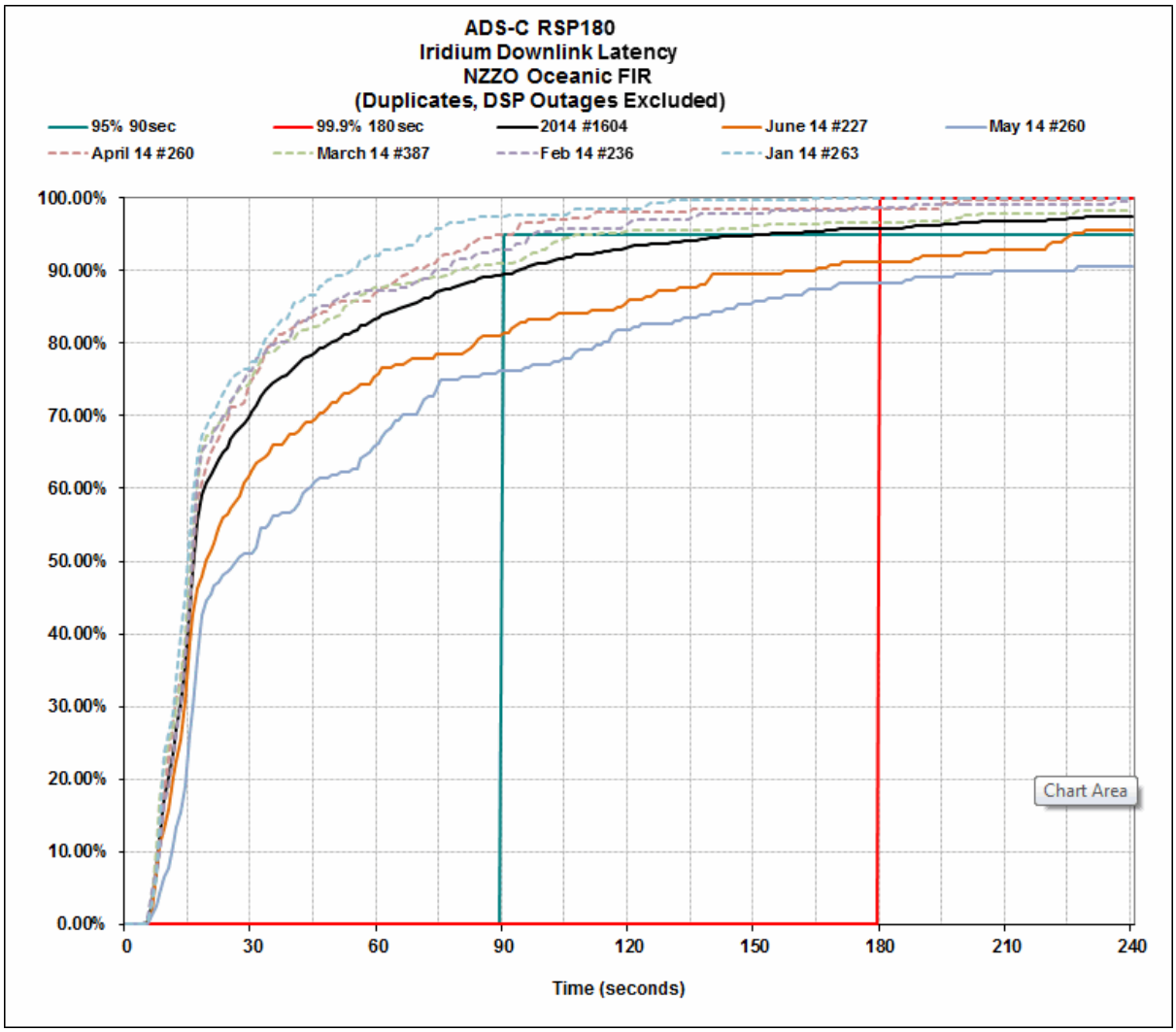


Figure 4: Iridium performance by month in 2014

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matters as appropriate.

– – – – – – – – – – – – –

Attachment 1: Iridium FANS1/A analysis in NZZO

1. INTRODUCTION

1.1 In NZZO we have not seen consistent use of Iridium FANS1/A until 2013. In 2013 HAL B767 aircraft have been operating on the Hawaii – American Samoa route and these flights together with irregular operations by freighters and private aircraft operators have provided enough data points to analyse Iridium ADS-C latency.

2. DISCUSSION

2.1 On the surface the aggregate of the Iridium ADS-C data points for 2013 indicates performance well below the standard expected for RSP180 operations. This aggregate performance uses 2614 data points and is illustrated in Figure 1. The performance falls well below the 95% normal operations requirement which requires 95% of downlinked reports to be received within 90 seconds.

2.2 Hawaiian Airlines B763 operations provided 82% of the 2614 Iridium data points available in 2013. An analysis of individual tail numbers is illustrated in Figure 2 and shows that while three tail numbers were meeting the RSP180 requirements seven were not. However, a check with the FAA indicated that they were observing performance from this fleet that was meeting the RSP180 performance requirements.

2.3 The Hawaiian Airline B763 fleet operates between Hawaii and Pago Pago in American Samoa. This route crosses the Auckland Boundary with Oakland at 5S latitude and spends less than an hour in Auckland Oceanic airspace before descending out of our airspace into the Samoa FIR. With both Auckland and Oakland having established ADS-C contracts with the aircraft as they cross the 5S boundary this is known to cause latency delays. This is not specific to Iridium but occurs with MTSAT and Inmarsat as well.

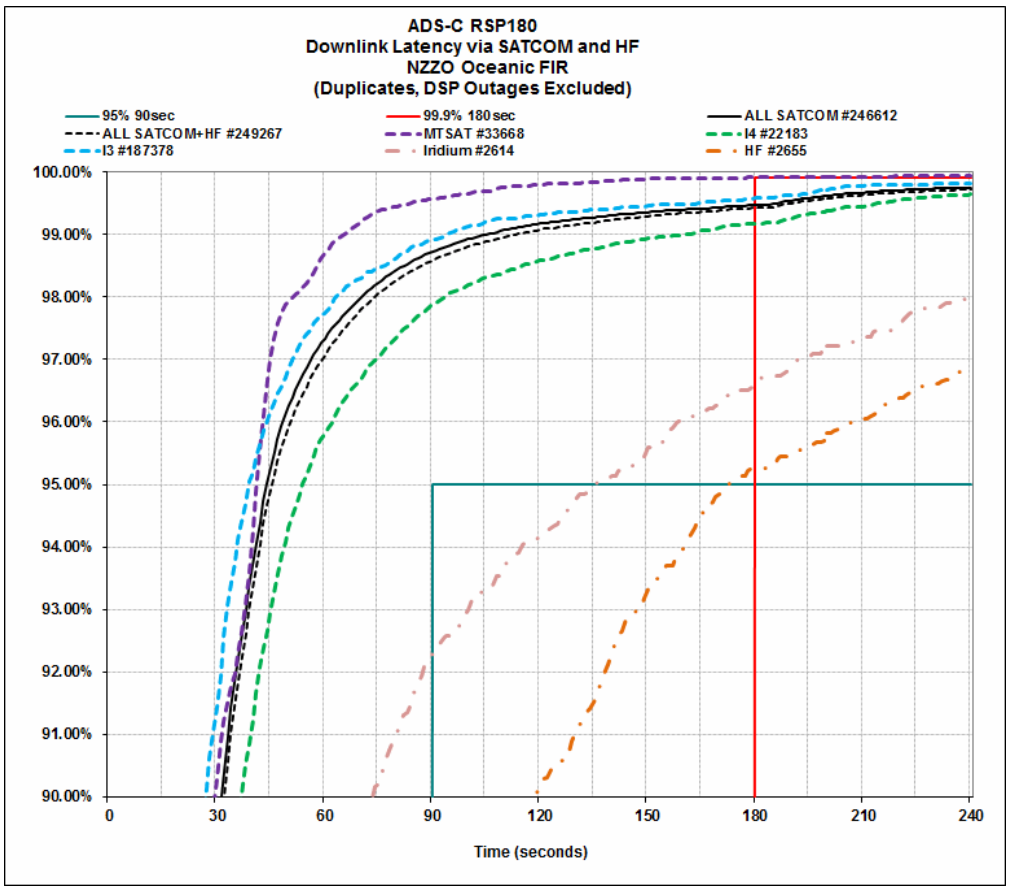


Figure 1: 2013 aggregate of ADS-C latency in NZZO

2.4 A geographical analysis of delays of more than 180 seconds using Google earth illustrates the expected delays around the boundary with Oakland. Also noted on the geographical analysis is a large number of yet unexplained large number of delays inside VHF coverage just North of Samoa. This is illustrated in Figure 3.

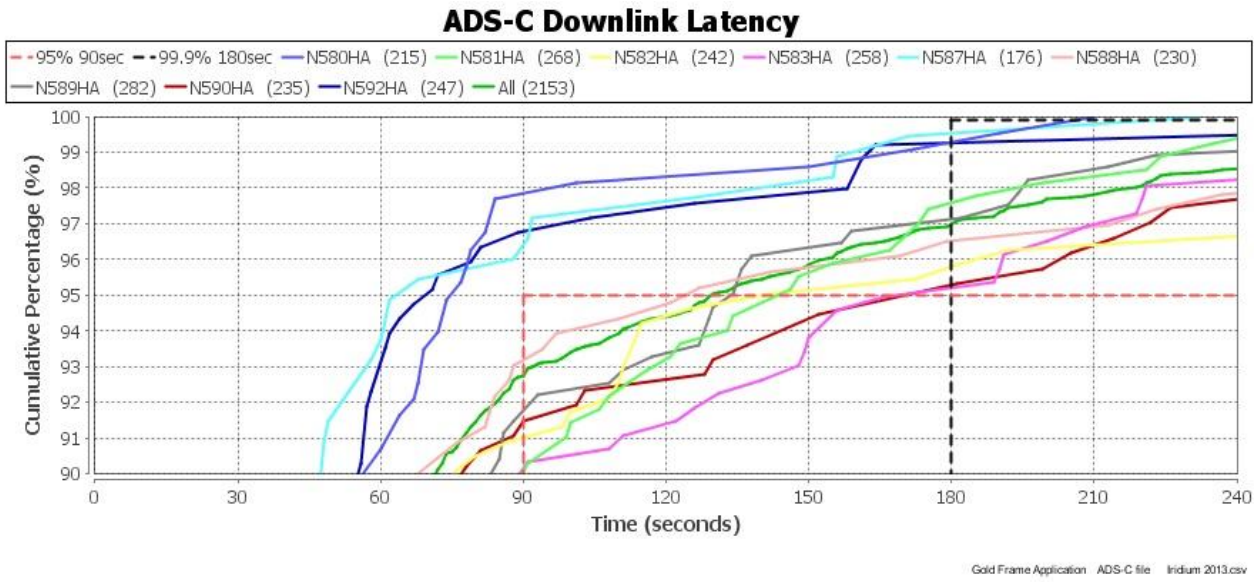


Figure 2: 2013 Analysis of individual HAL tail numbers

(This graph created using FAA supplied GPAT analysis tool)

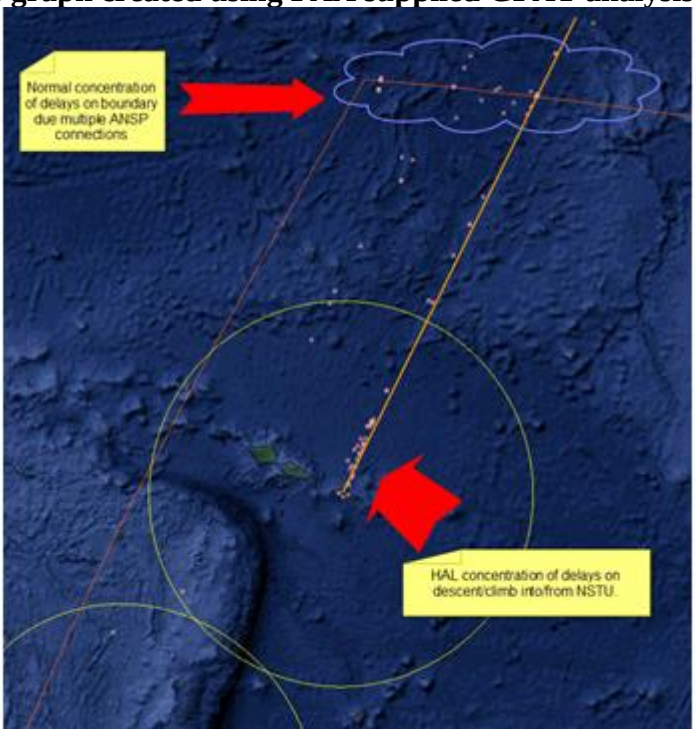
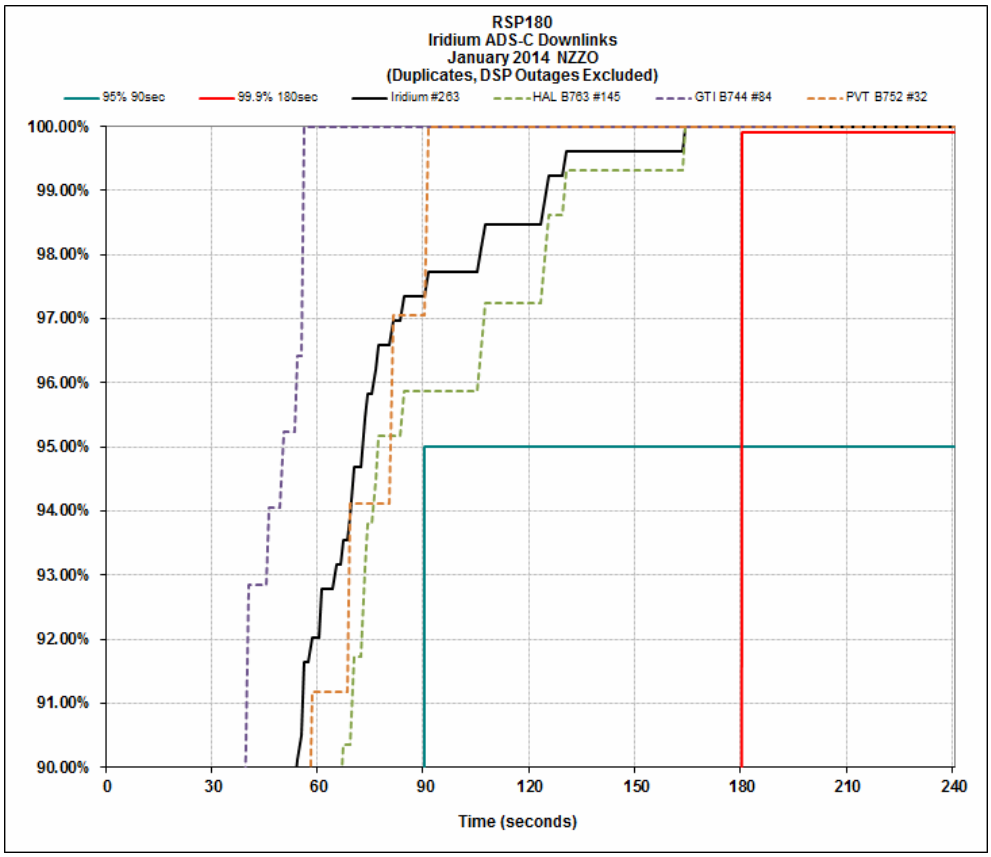


Figure 3: Delays of more than 180 seconds

2.5 The large number of delays on Iridium SATCOM within apparent VHF coverage of Samoa is puzzling. We understand that VHF RGS exist at both Faleolo in Western Samoa and Pago Pago in American Samoa and we see two RGS designator (APW1, and APW2) in use. The delays could be caused by low level shielding causing delays around VHF/SATCOM transitions or an outage in the Pago Pago RGS but this is pure supposition.

2.6 An analysis of Iridium performance observed in January 2014 shows no delays and all aircraft meeting the RSP performance standard. This is depicted in Figure 4 below. The intention is to continue monitoring through 2014 and if further delays occur within expected VHF coverage around Samoa raise a FANS PR to try and arrive at a satisfactory conclusion.

2.7 The positions of the delays around Samoa are in the main located below Auckland airspace where Auckland Oceanic controllers will have ADS-C contracts established but are not in control of the aircraft. This probably explains why we are not receiving controller performance complaints even though overall performance is below the 95% 90 second normal operations threshold.


RSP180
Iridium ADS-C Downlinks
January 2014 NZZO
(Duplicates, DSP Outages Excluded)
95% 90sec
99.9% 180sec
Iridium #263
HAL B763 #145
GTI B744 #84
PVT B752 #32
100.00%
99.00%
98.00%
97.00%
96.00%
95.00%
94.00%
93.00%
92.00%
91.00%
90.00%
0
30
60
90
120
150
180
210
240
Time (seconds)

Attachment 2: HFDL performance in NZZO

INTRODUCTION

1.2 In NZZO we have three Airbus fleets (QFA A388, UAE A388, and CSN A332) as the main users of HF Data Link (HFDL) in NZZO airspace. All these fleets use HFDL as a backup to SATCOM in what has become known as the Airbus "Next on Busy" mode of operation.

2. DISCUSSION

2.1 In 2013 we obtained 2655 ADS-C data points from HFDL. We have seen HFDL ADS-C downlinks from 6 aircraft fleets as illustrated in the table below. Our main users are:

- QANTAS A388, where HFDL is used for 10% of ADS-C downlinks.
- Emirates A388, where HFDL used for 15% of ADS-C downlinks.
- China Southern A332, where HFDL is used for 4% of ADS-C downlinks.

Operator	Type	#HF
QFA	A388	1353
CSN	A332	216
CSN	B788	6
UAE	A388	1072
ACA	B77L	2
GTI	B744	3
HAL	A332	3
	Total	2655

2.2 As noted in previous working papers on this subject the use of HFDL in the "Next on Busy" mode does cause some performance degradation but this is not considered significant in RSP180 operations. The typical degradation of pure SATCOM performance by using HFDL in "next on busy" mode is illustrated in Figure 1 below for the QANTAS A388 fleet. The graph shows pure SATCOM performance compared with that from an aggregate of SATCOM and HFDL (which is the normal operations mode "next on busy") and also shows the performance of pure HFDL.

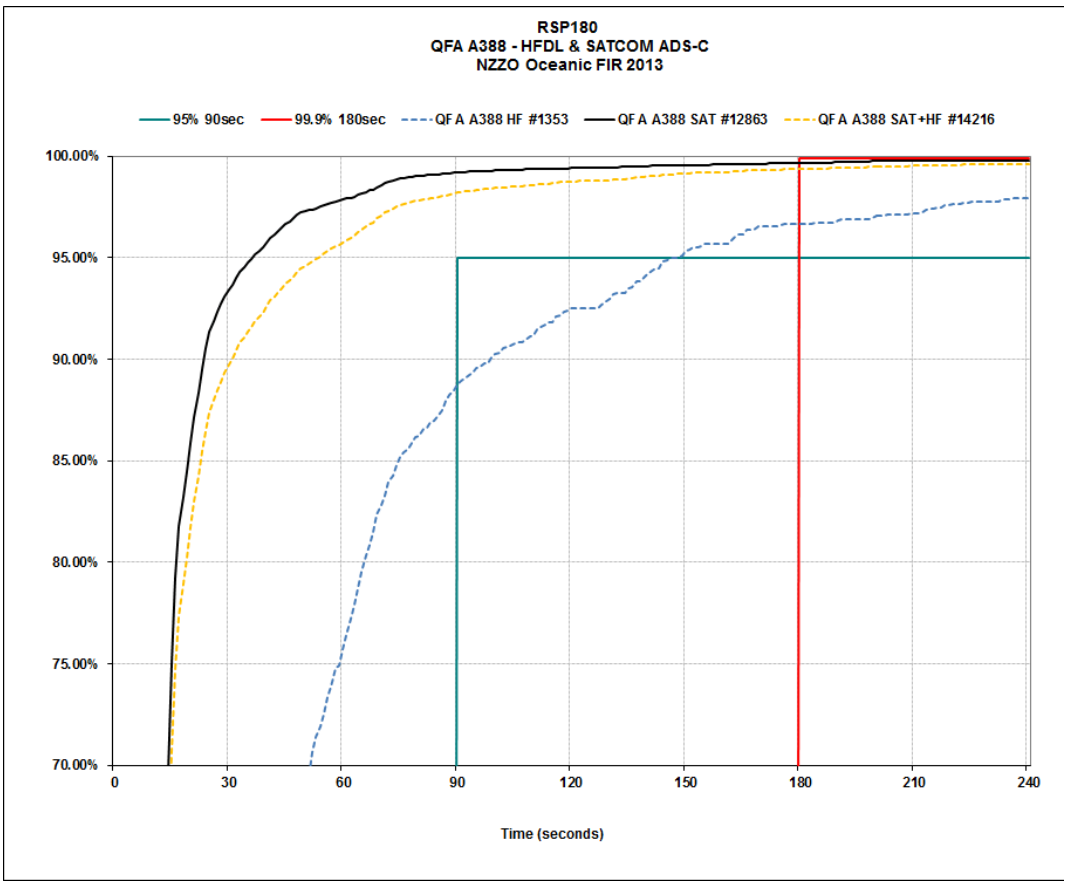


Figure 1: RSP180 QFA A388 – SATCOM, SATCOM+HFDL, HFDL

2.3 As illustrated in Figure 1 this fleet meets the RSP180 requirements when operating with HFDL in the "next on busy" mode and while a slight degradation is seen from pure SATCOM performance this is not significant. Attachment A to this paper contains performance graphs for QANTAS, Emirates, and China Southern HFDL operations and illustrates the consistency between the fleets.

2.4 If operating in pure HFDL mode without SATCOM fleets are expected to meet RSP400. While two of the fleets achieve the RSP400 requirement in 2013 one was well below. This is illustrated in Figure 2 below. Our experience during SATCOM failures is that the performance of HFDL will degrade below RSP400 when used in stand-alone mode and we expect that crews would immediately notify any SATCOM failure.

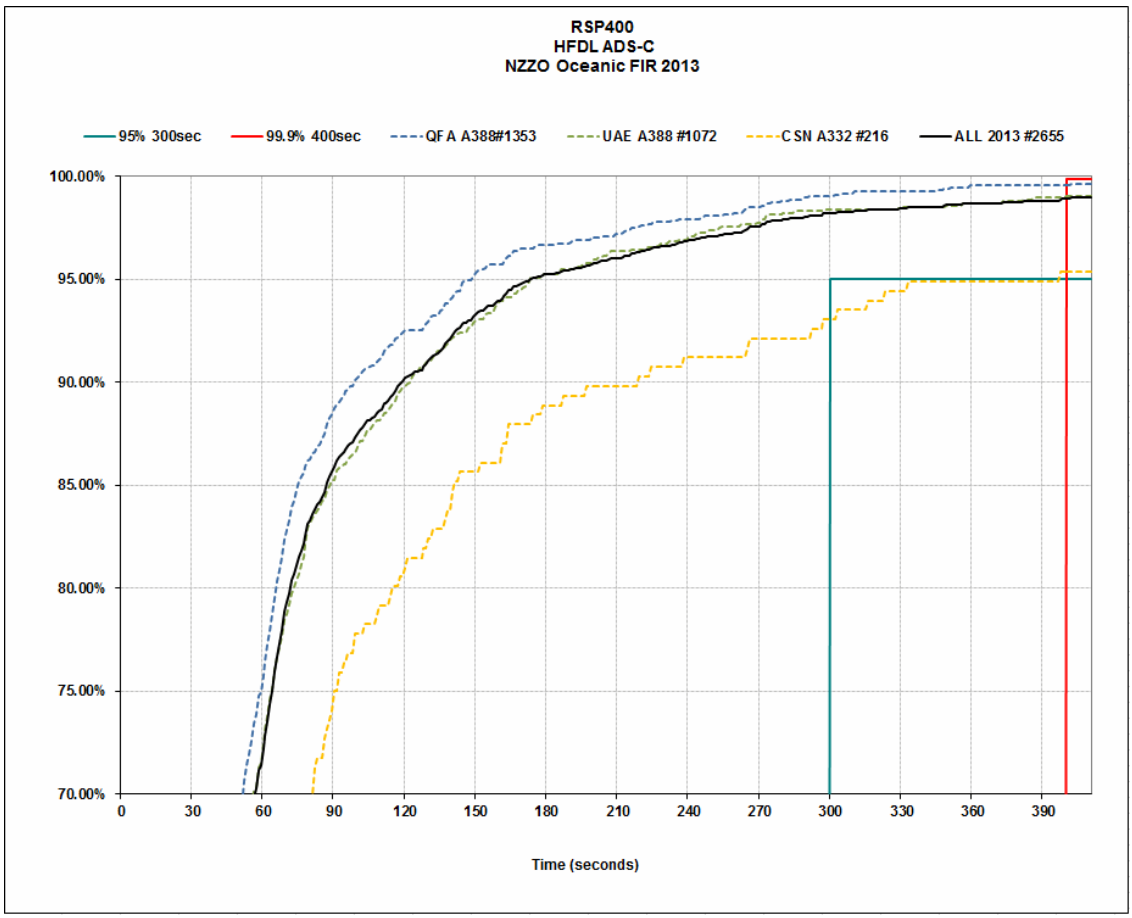


Figure 2: HFDL RSP400 analysis NZZO 2013