



Monitoring Results: FAA Oceanic Airspace

Global Operational Data Link (GOLD)

Familiarization with Performance Based Communications
and Surveillance (PBCS) Workshop

Dakar, Senegal 11-15 September 2017

Prepared by:
FAA WJH Technical Center
Separation Standards Analysis Branch
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FAA



Federal Aviation
Administration

Overview

- The FAA regularly reports on the performance of CPDLC and ADS-C monitoring results at public meetings
- These results are compiled from the monthly results that are combined into six month data sets
- Results of PBCS monitoring can also be found on the FAA Separation Standards website

https://www.faa.gov/air_traffic/separation_standards/pbcs_monitoring/

Supplementary PBCS Monitoring in FAA Oceanic Airspace

(presented by the United States of America)

Agenda Item 2. Data Link performance monitoring and analysis,
including trials and operations. Reports by States, industry and DLMA
b) NAT data link performance report

NAT TIG/4
11-15 September 2017
Ottawa, Canada

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Federal Aviation
Administration



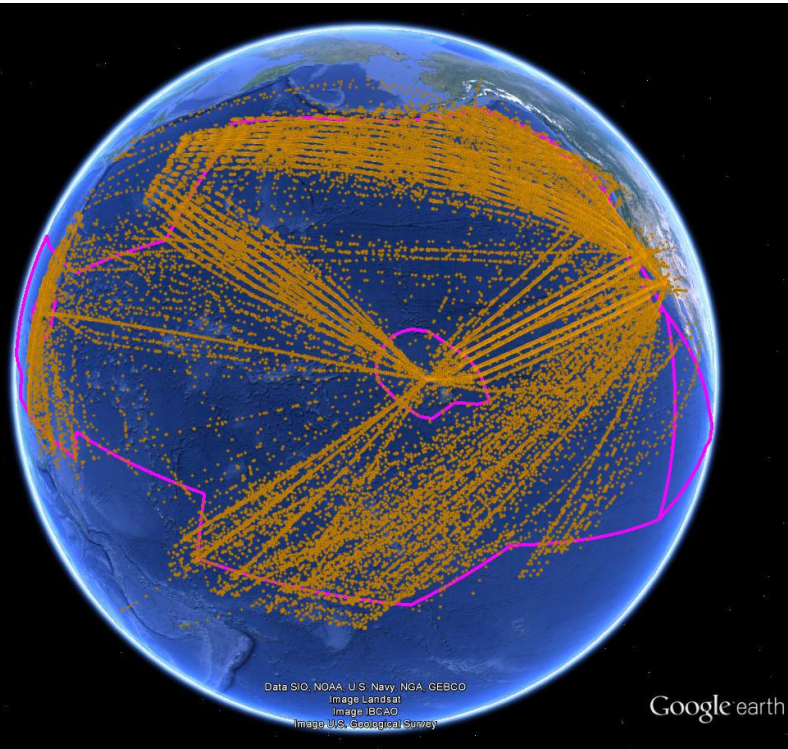
Overview

- Summary of Reported Outages and Measured Availability
- Aggregate FANS Data Link Performance
- ASP for SATCOM Station Identifiers
- Aggregate FANS Data Link Performance by Operator
- Aggregate FANS Data Link Performance for Business Jet Aircraft Types
- FANS over Iridium
- FANS over SwiftBroadband



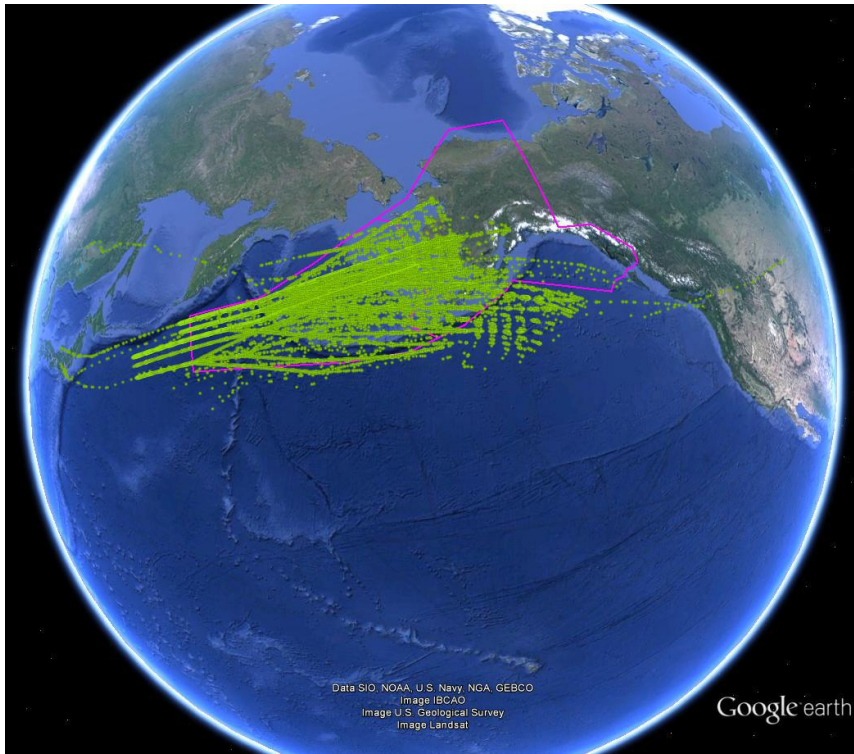
Oakland FIR (KZAK)

FANS Data Link Usage



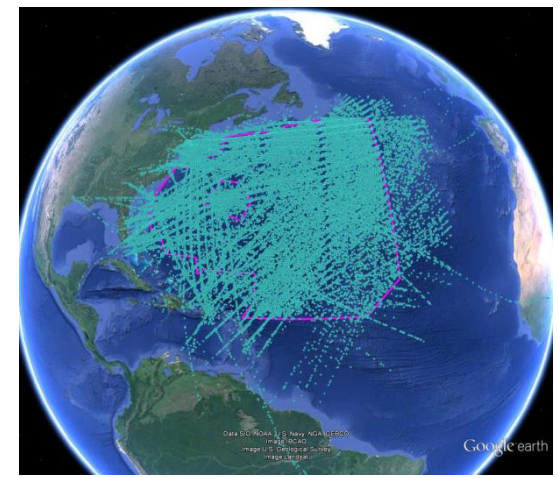
	Jul-Dec 2015	Jan-Jun 2016	Jul-Dec 2016	Jan-Jun 2017
Total flights	132,607	135,880	141,461	144,436
% flights using FANS data link	65%	66%	67%	72%
% RNP4	71%	76%	80%	82%
Individual airframes using FANS data link	2,508	2,677	2,854	3,004

Anchorage FIR (PAZA) FANS Data Link Usage



	Jul-Dec 2015	Jan-Jun 2016	Jul-Dec 2016	Jan-Jun 2017
Total flights	36,371	36,227	36,467	39,253
% flights using FANS data link	94%	96%	96%	95%
% RNP4	82%	88%	88%	89%
Individual airframes using FANS data link	1,650	1,696	1,772	1,865

New York FIR (KZNY) FANS Data Link Usage



	KZNY				KZNY-E (NAT)				KZNY-W (WATRS)			
	Jul-Dec 2015	Jan-Jun 2016	Jul-Dec 2016	Jan-Jun 2017	Jul-Dec 2015	Jan-Jun 2016	Jul-Dec 2016	Jan-Jun 2017	Jul-Dec 2015	Jan-Jun 2016	Jul-Dec 2016	Jan-Jun 2017
Total flights (6 months)	109,374	122,585	113,575	123,361	56,624	60,799	61,043	63,091	92,387	105,452	96,437	106,082
% flights using FANS data link	53%	58%	57%	58%	88%	92%	91%	94%	49%	54%	53%	53%
% RNP4	38%	56%	54%	55%	54%	75%	74%	77%	37%	55%	53%	54%
Individual airframes using FANS data link	2,966	3,335	3,271	3,747								

Note: Some flights are included in both ZNY-E and ZNY-W



CSP Outage Reporting

- CSPs provide reports of planned and unexpected outages/degradations
- Reports are essential operationally by ATC and Operators
 - Should have processes in place to receive reports in most efficient manner for specific operation
 - For unexpected outages reports:
 - First report upon detection by CSP
 - Intermediate report as needed depending on length and magnitude
 - Final report upon full restoral of service
 - Post-incident reports inform on results on investigation and provide updates on resolutions/mitigations
- Reports also used to estimate network availability for PBCS monitoring to assess against requirements for RCP240/RSP180



START DATE	START TIME (UTC)	DURATION (min)	SERVICE IMPACTED	SATELLITE REGION IMPACTED	NOTIFICATION SOURCE	NOTES
25-Jan-17	11:59	175.00			ARINC,SITA	The SITA-ARINC traffic is now flowing normally via the redundant link via Singapore while the Annapolis link is under investigation
8-Feb-17	18:04	30.00	SITA Iridium	Global	SITA	Issue with the Iridium Datalink ACARS Service
8-Feb-17	18:06	126.00	ARINC Iridium	Global	ARINC	Issue with the Iridium Datalink ACARS Service
9-Feb-17	17:12	68.00	SITA Iridium	Global	SITA	AOC advised IRIDIUM we were not seeing traffic from their LAN on the AISSR3TMP / AISSR4TMP routers
9-Feb-17	17:15	0.77	ARINC Iridium	Global	ARINC	AOC advised IRIDIUM we were not seeing traffic from their LAN on the AISSR3TMP / AISSR4TMP routers
16-Feb-17	03:06	34.00	Inmarsat I-3	IOR	ARINC,SITA	Inmarsat unscheduled loss of Network service in I-3 Indian Ocean Region for Classic Aero over I3
16-Feb-17	12:41	38.00	Inmarsat I-3	IOR	SITA	Inmarsat degradation for Classic Aero over I3
16-Feb-17	13:01	19.00	Inmarsat I-3	IOR	ARINC	Inmarsat degradation for Classic Aero over I3
16-Feb-17	15:11	49.00	Inmarsat I-4	APAC/AMER	SITA	Paumalu earth station had a power outage, backup power did not come up as expected.
16-Feb-17	15:13	115.00	Inmarsat I-4	APAC/AMER	ARINC	Paumalu earth station had a power outage, backup power did not come up as expected. This created a stale session on our router which had to be cleared.
22-Feb-17	08:05	647.00	Iridium	Global	SITA	Intermittent Iridium Datalink ACARS Service delays
1-Mar-17	16:02	35.00	Inmarsat I-3	POR	SITA	
3-Mar-17	13:05	15.00	Inmarsat I-3	IOR	SITA	
3-Mar-17	13:11	9.00	Inmarsat I-3	IOR	ARINC	
23-Mar-17	09:49	41.00	ARINC Iridium	Global	ARINC	
25-Apr-17	08:36	46.00	SITA Iridium	Global	SITA	Satellite Aircom Iridium Datalink ACARS service is not not available due problem at Iridium
1-May-17	03:14	127.00	Inmarsat I-4	Global	ARINC	
1-May-17	03:15	125.00	Inmarsat I-3, I-4	AOR, APAC, AMER	SITA	Inmarsat I3 and I4 services are unavailable over Atlantic, Asia Pacific and the Americas regions. EUA1,IOR2 and POR1 regions are not affected.
3-May-17	12:30	95.00	SITA	Global	SITA	SITA-ARINC Internetworking to Annapolis. The cause was identified as a looping message issued by ARINC and later removed by ARINC from their queue to resolve the issue.
3-May-17	12:30	137.00	ARINC	Global	ARINC	Numerous agencies are reporting delay in delivery of CDPLC and ATC messages, including FAA, IAA, ATC Gander, and UKNATS. No issues within our network have been found, and our Support Teams are investigating with our partners. A filter was put in place to trap the message, and delays have cleared.
18-May-17	23:34	22.00	Inmarsat I-4	EMEA	ARINC	BGAN/FB/SB/ Classic Aero over I4
8-Jun-17	01:10	30.00	Inmarsat I-3	POR	SITA	Inmarsat I3 data services over Pacific Ocean region is not available
11-Jun-17	12:51	50.00	Inmarsat I-4	EMEA, APAC	SITA	Inmarsat network service degradation in I4 EMEA and Asia-Pacific regions has now been restored
22-Jun-17	22:32	43.00	Inmarsat I-4	EMEA	ARINC	
30-Jun-17	08:40	???	Inmarsat ??	???	ARINC	???

GES Location(s)	Satellite/ Region	SITA	ARINC
Borum, Netherlands	Inmarsat I-3 AOR-E	AOE2	XXN
	Inmarsat I-3 AOR-W	AOW2	XXW
Perth, Australia	Inmarsat I-3 IOR	IOR2	XXI
	Inmarsat I-3 POR	POR1	XXP
Fucino, Italy	Inmarsat I-4 EMEA	EUA1	XXF
	Inmarsat I-4 EMEA SBB	EME9	XXB
Paumalu, Hawaii, US	Inmarsat I-4 Americas	AME1	XXH
	Inmarsat I-4 Asia-Pacific	APK1	XXA
	Inmarsat I-4 Americas SBB	AMR9	XXU
	Inmarsat I-4 Asia-Pacific SBB	PAC9	XXS
Kobe and Hitachiota, Japan	MTSAT Japan	MTS1	--
Phoenix, Arizona, US	Iridium Global	IGW1	IG1

Measured Availability by Path – RSP180/RCP240

Based on Reported Outages/Degradations from Jul-16 to Jun-17

PBCS criteria - max values			
Safety - 99.9%	48	520	99.90%
Reliability - 99.99%	4	52	99.99%

Satellite Region	CSP	Path Identifier	# unplanned outages affecting path > 10 min	Sum of unplanned outages affecting path > 10 min (min)	Estimated availability for path
AOR-E	SITA	AOE2	5	852	99.84%
	ARINC	XXN	3	615	99.88%
AOR-W	SITA	AOW2	5	852	99.84%
	ARINC	XXW	3	615	99.88%
IOR	SITA	IOR2	8	929	99.82%
	ARINC	XXI	4	321	99.94%
POR	SITA	POR1	5	365	99.93%
	ARINC	XXP	0	-	100.00%
EMEA	SBB SITA	EME9	7	912	99.83%
	SBB ARINC	XXB	7	958	99.82%
	SITA	EUA1	8	1,062	99.80%
	ARINC	XXF	8	1,047	99.80%
Americas	SBB SITA	AMR9	5	562	99.89%
	SBB ARINC	XXU	5	554	99.89%
	SITA	AME1	6	901	99.83%
	ARINC	XXH	5	857	99.84%
Asia-Pac	SBB SITA	PAC9	4	418	99.92%
	SBB ARINC	XXS	4	393	99.93%
	SITA	APK1	6	534	99.90%
	ARINC	XXA	4	440	99.92%
Global	SITA	IGW1	9	1,897	99.64%
	ARINC	IG1	10	1,385	99.74%
	SITA	MTS1	0	-	100.00%

	Meets safety and reliability criteria
	Meets safety criteria only
	Does not meet safety or reliability criteria



January to June 2017

DATA LINK PERFORMANCE BY MEDIA TYPE



Performance by Media Type

101,575
data link flights

January – June 2017

Oakland

Media Type	ADS-C			CPDLC					
	Count of ADS-C Downlink Messages	ADS-C 95%	ADS-C 99.9%	Count of CPDLC Transactions	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%	PORT 95%
Performance Criteria		RSP 180			RCP 240				
Aggregate	3,968,142	98.38%	99.31%	125,524	99.56%	99.67%	99.33%	99.55%	98.32%
SAT	3,552,648	98.48%	99.36%	123,072	99.62%	99.70%	99.38%	99.58%	98.39%
VHF	392,557	99.08%	99.66%	1,578	99.75%	99.87%	99.62%	99.68%	97.72%
HF	22,907	71.21%	84.76%	11					
SAT-VHF				124	96.77%	96.77%	93.55%	93.55%	84.68%
VHF-SAT				184	89.67%	94.02%	94.02%	96.20%	92.93%
SAT-HF				437	87.41%	91.76%	88.79%	92.45%	91.76%
HF-SAT				114	98.25%	98.25%	95.61%	98.25%	83.33%
VHF-HF				4					
HF-VHF				2					



Performance by Media Type

January – June 2017

Anchorage

38,180
data link flights

Media Type	ADS-C			CPDLC					
	Count of ADS-C Downlink Messages	ADS-C 95%	ADS-C 99.9%	Count of CPDLC Transactions	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%	PORT 95%
Performance Criteria		RSP 180			RCP 240				
Aggregate	1,141,248	97.73%	99.00%	25,694	99.53%	99.67%	99.39%	99.57%	98.23%
SAT	781,859	97.22%	98.87%	16,646	99.41%	99.56%	99.26%	99.48%	98.02%
VHF	352,168	99.68%	99.80%	8,372	99.95%	100.00%	99.89%	99.92%	98.93%
HF	7,207	59.04%	72.83%	5					
SAT-VHF				365	99.73%	99.73%	99.18%	99.45%	96.16%
VHF-SAT				215	96.28%	97.21%	93.95%	95.35%	94.42%
SAT-HF				43					
HF-SAT				35					
VHF-HF				11					
HF-VHF				2					



Performance by Media Type

72,113
data link flights

January – June 2017

New York

Media Type	ADS-C			CPDLC					
	Count of ADS-C Downlink Messages	ASP 95%	ASP 99.9%	Count of CPDLC Transactions	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%	PORT 95%
Performance Criteria		RSP 180			RCP 240				
Aggregate	2,100,907	98.38%	99.38%	61,768	99.51%	99.65%	99.26%	99.55%	97.52%
SAT	1,615,235	98.13%	99.31%	56,908	99.52%	99.66%	99.25%	99.56%	97.53%
VHF	483,156	99.41%	99.71%	4,186	99.93%	99.93%	99.71%	99.74%	97.87%
HF	2,506	67.36%	82.48%	2					
SAT-VHF				313	99.68%	99.68%	97.44%	98.08%	93.61%
VHF-SAT				288	95.14%	97.22%	96.87%	96.87%	95.83%
SAT-HF				46					
HF-SAT									
VHF-HF									



2010 - 2017

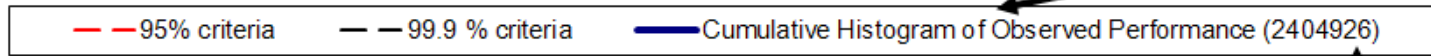
ANNUAL AGGREGATE FIR PERFORMANCE



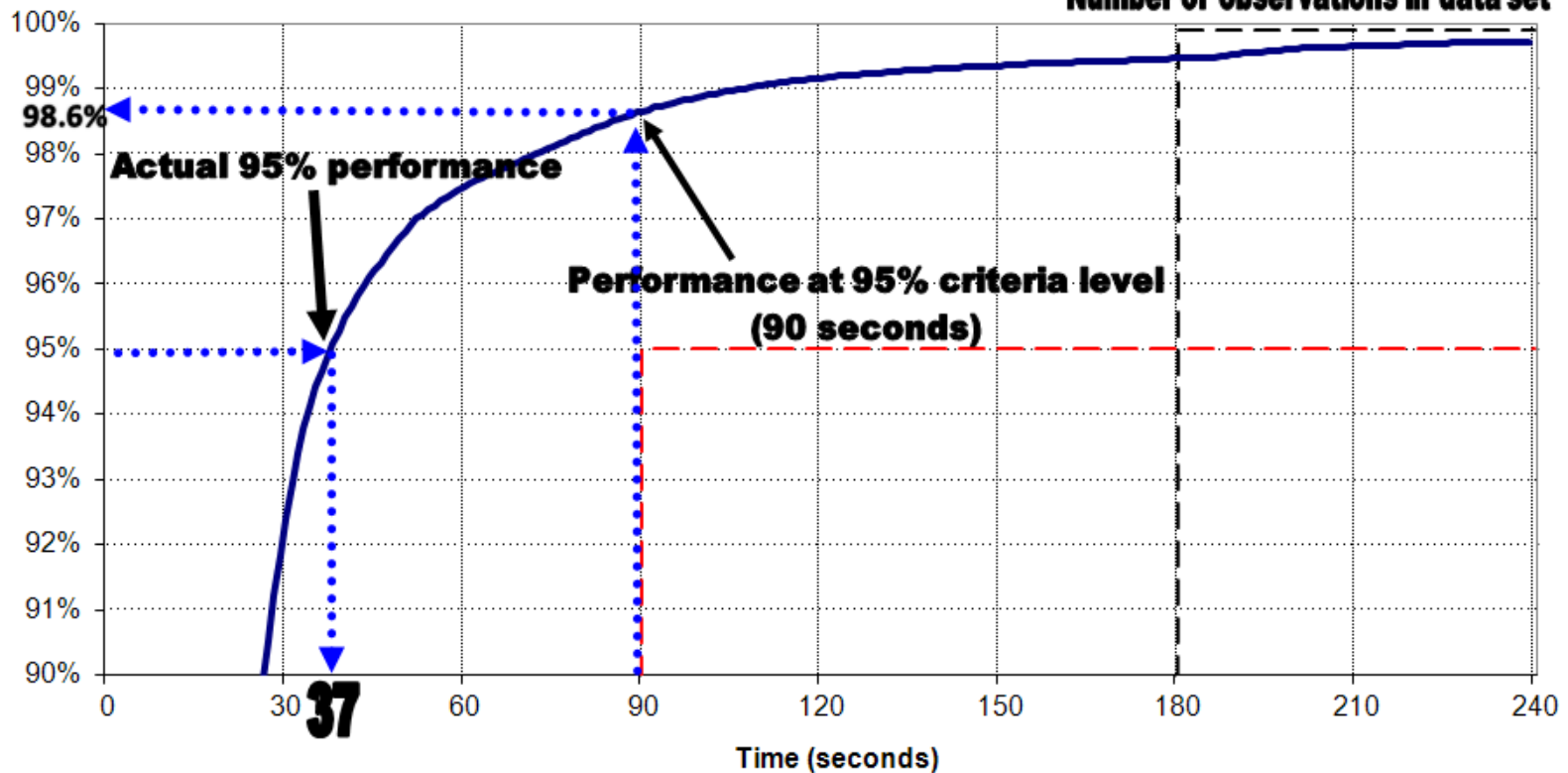
How to Read PBCS Monitoring Charts

ADS-C Downlink Latency

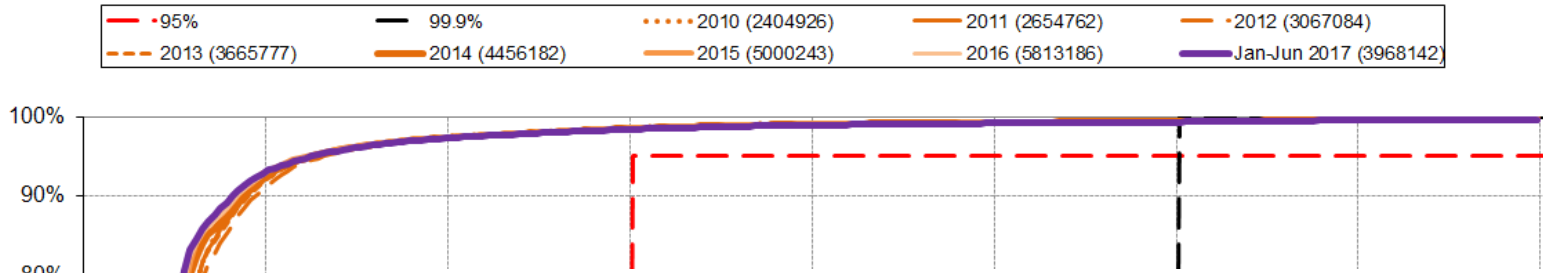
Description of data set



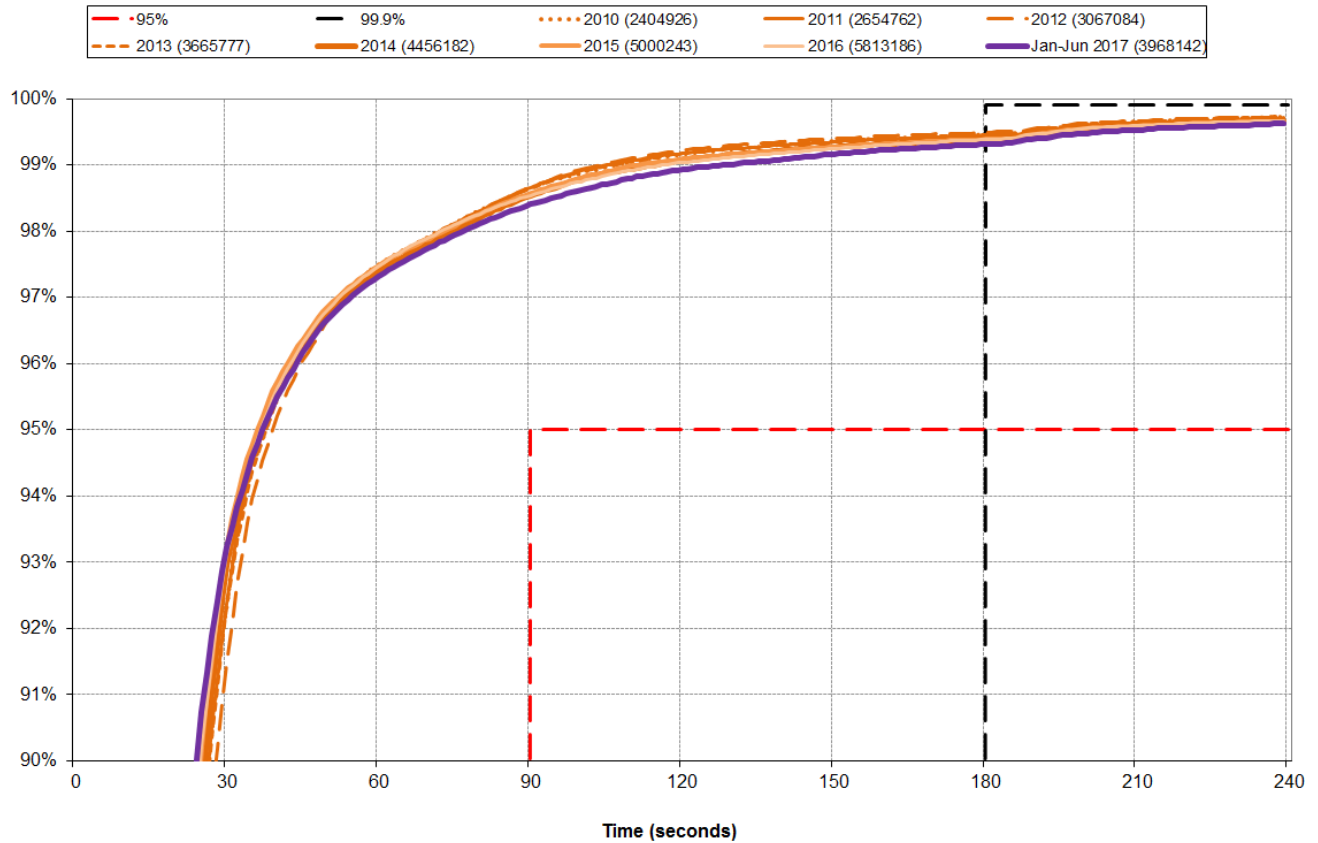
Number of observations in data set



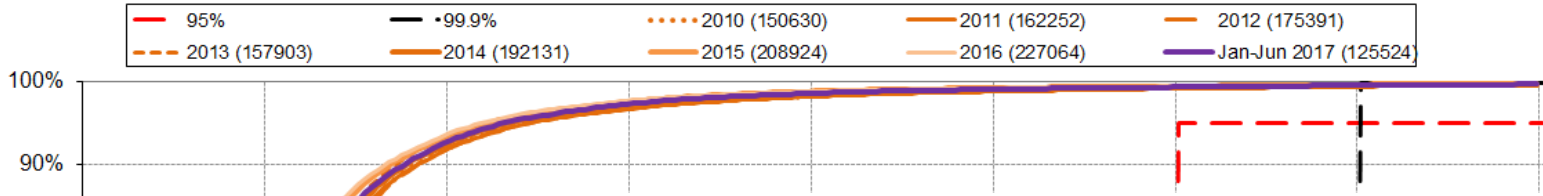
Actual Surveillance Performance (ASP) Oakland FIR Aggregate



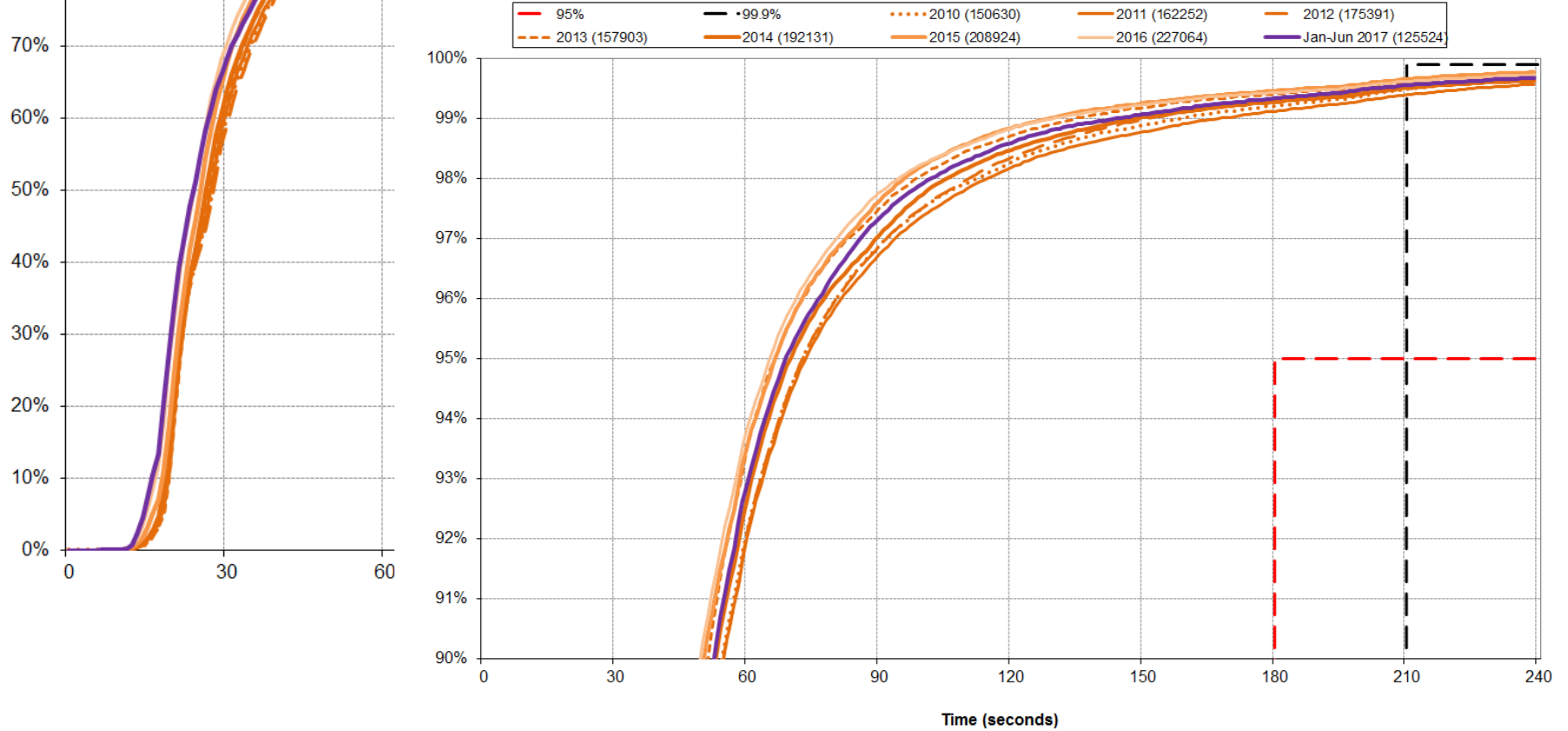
Actual Surveillance Performance (ASP) Oakland FIR Aggregate



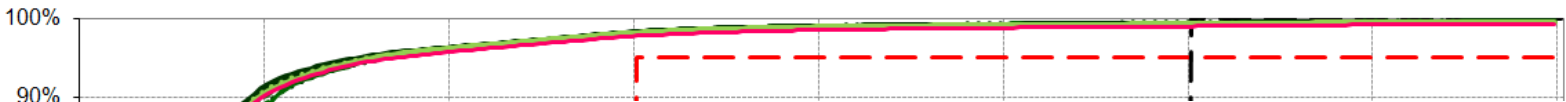
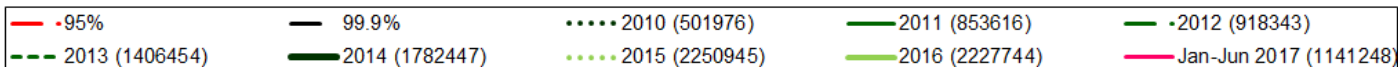
Actual Communication Performance (ACP) Oakland FIR Aggregate



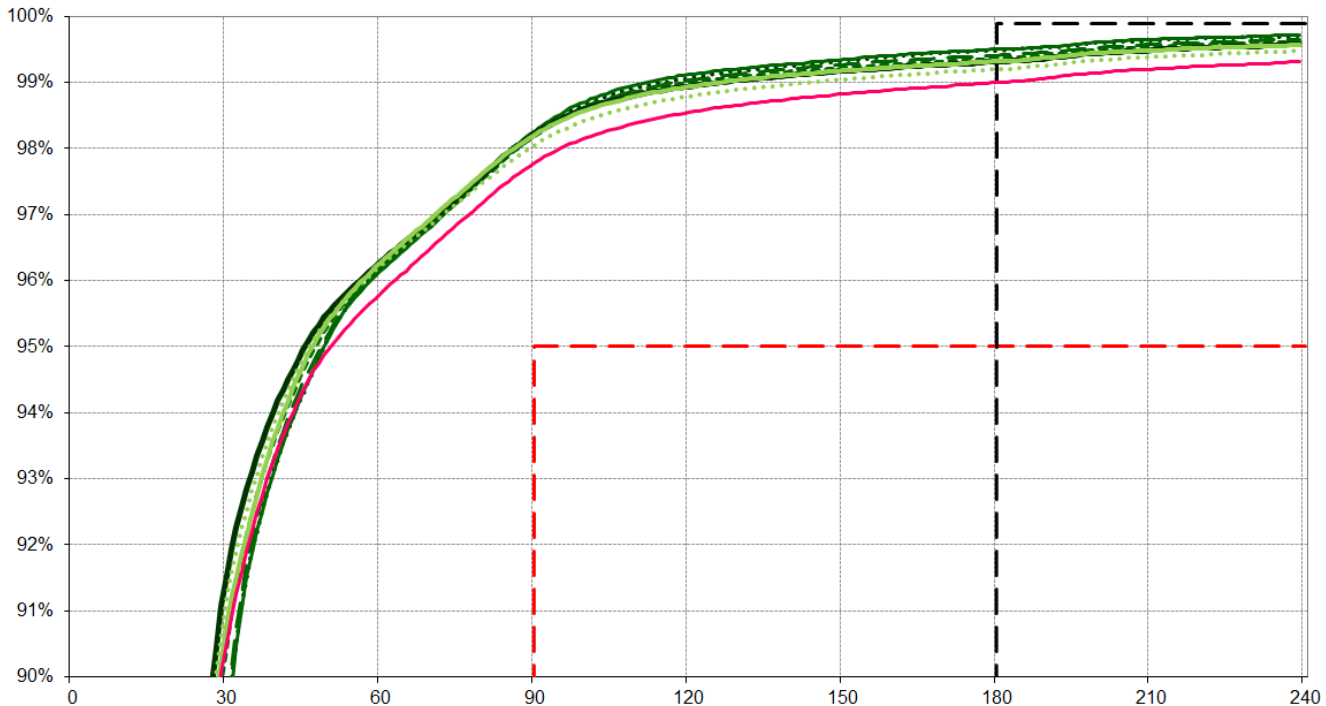
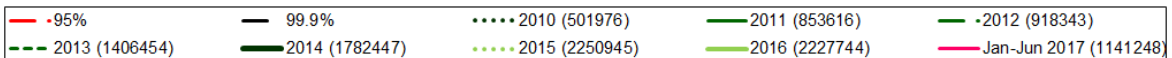
Actual Communication Performance (ACP) Oakland FIR Aggregate



Actual Surveillance Performance (ASP) Anchorage FIR Aggregate



Actual Surveillance Performance (ASP) Anchorage FIR Aggregate

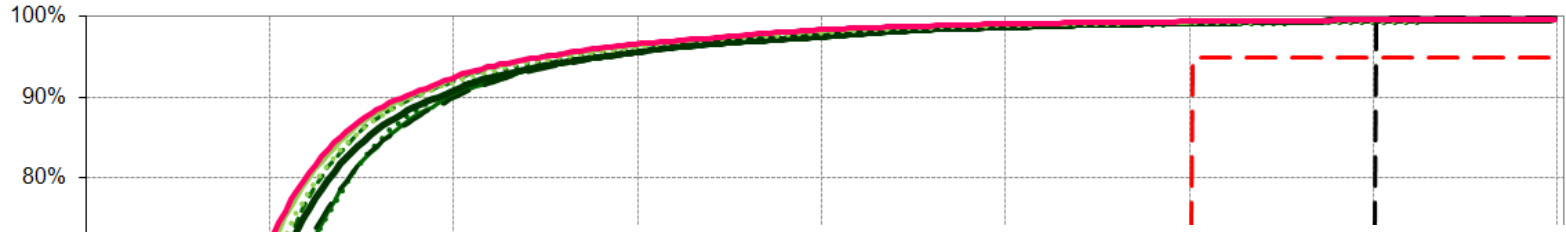
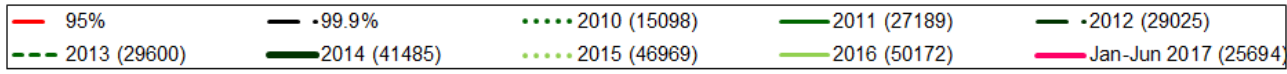


Time (seconds)

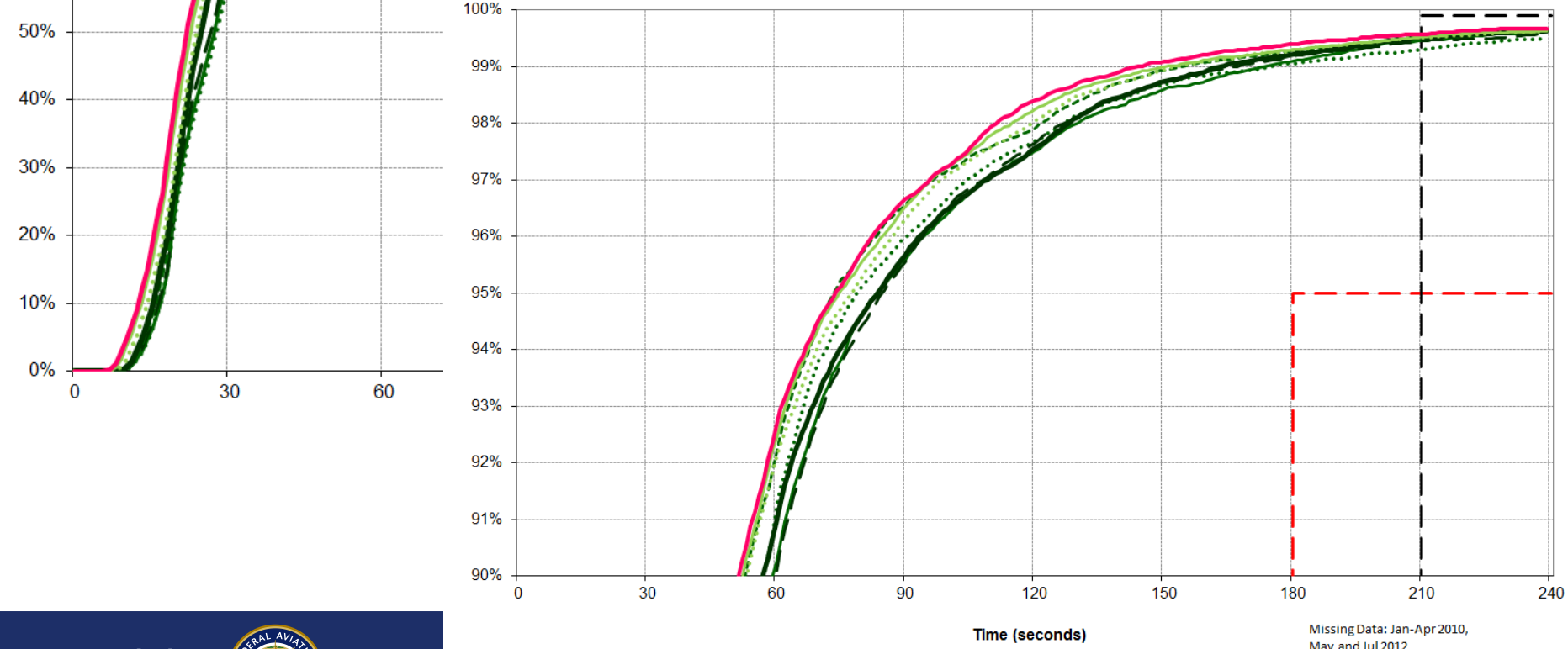
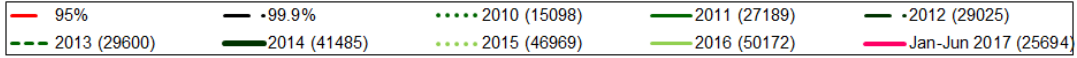
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May and Jul 2012



Actual Communication Performance (ACP) Anchorage FIR Aggregate



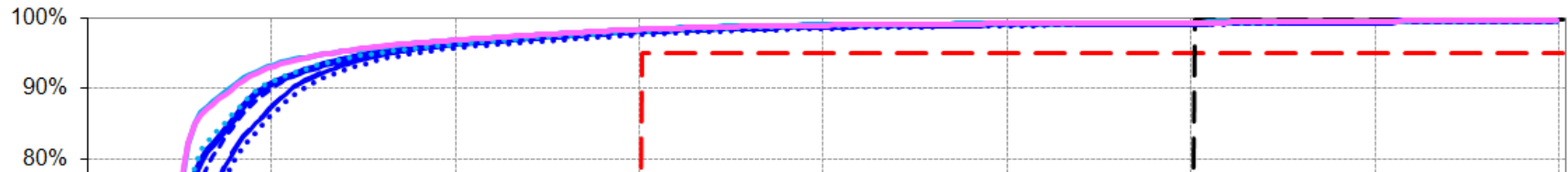
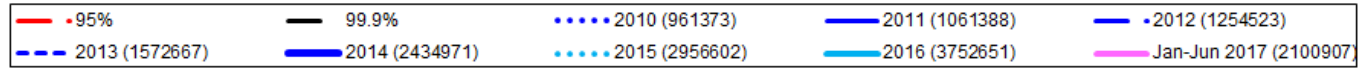
Actual Communication Performance (ACP) Anchorage FIR Aggregate



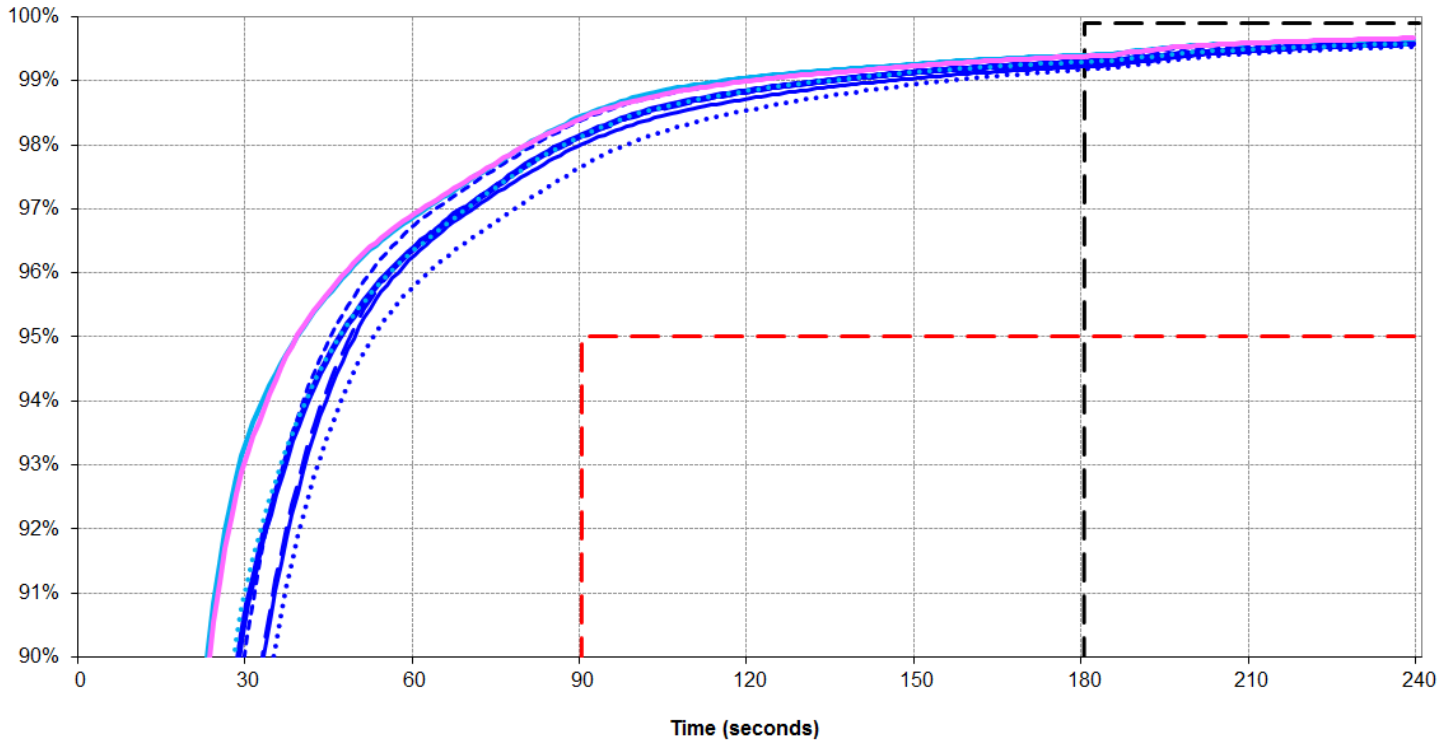
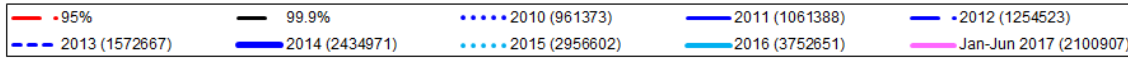
Missing Data: Jan-Apr 2010,
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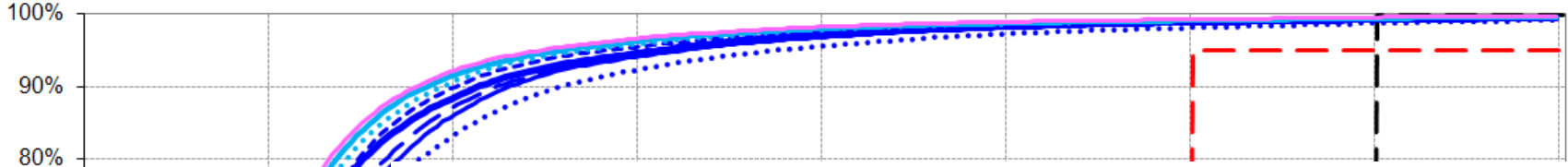
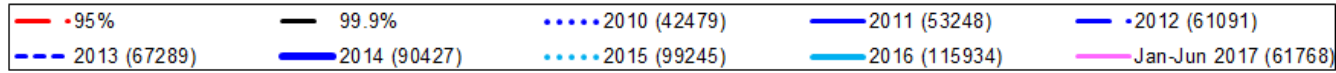
Actual Surveillance Performance (ASP) New York FIR Aggregate



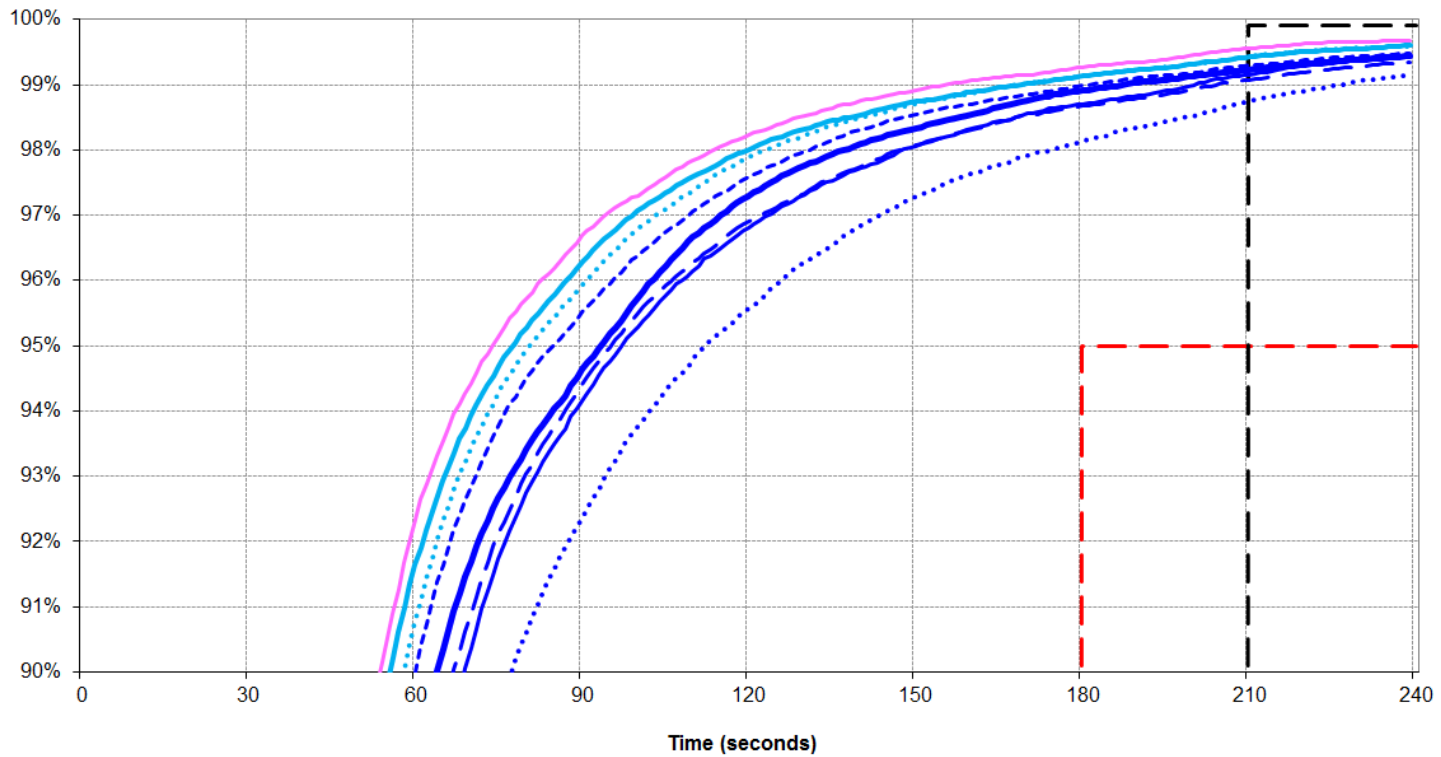
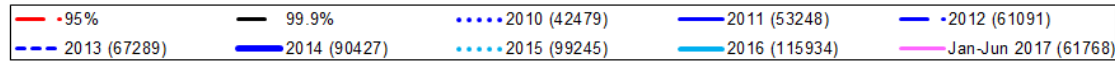
Actual Surveillance Performance (ASP) New York FIR Aggregate



Actual Communication Performance (ACP) New York FIR Aggregate



Actual Communication Performance (ACP) New York FIR Aggregate

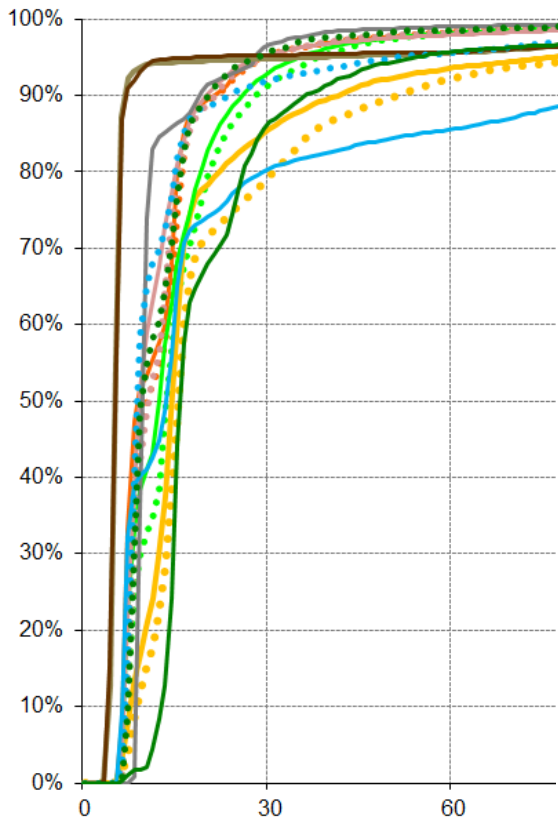
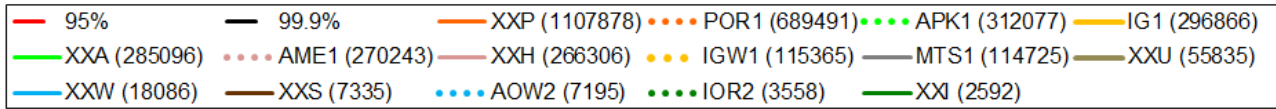


- Station identifiers designate “path” taken by data link messages between aircraft and ATC
- “Paths” vary between the four constellations of satellites and between the two data link service providers

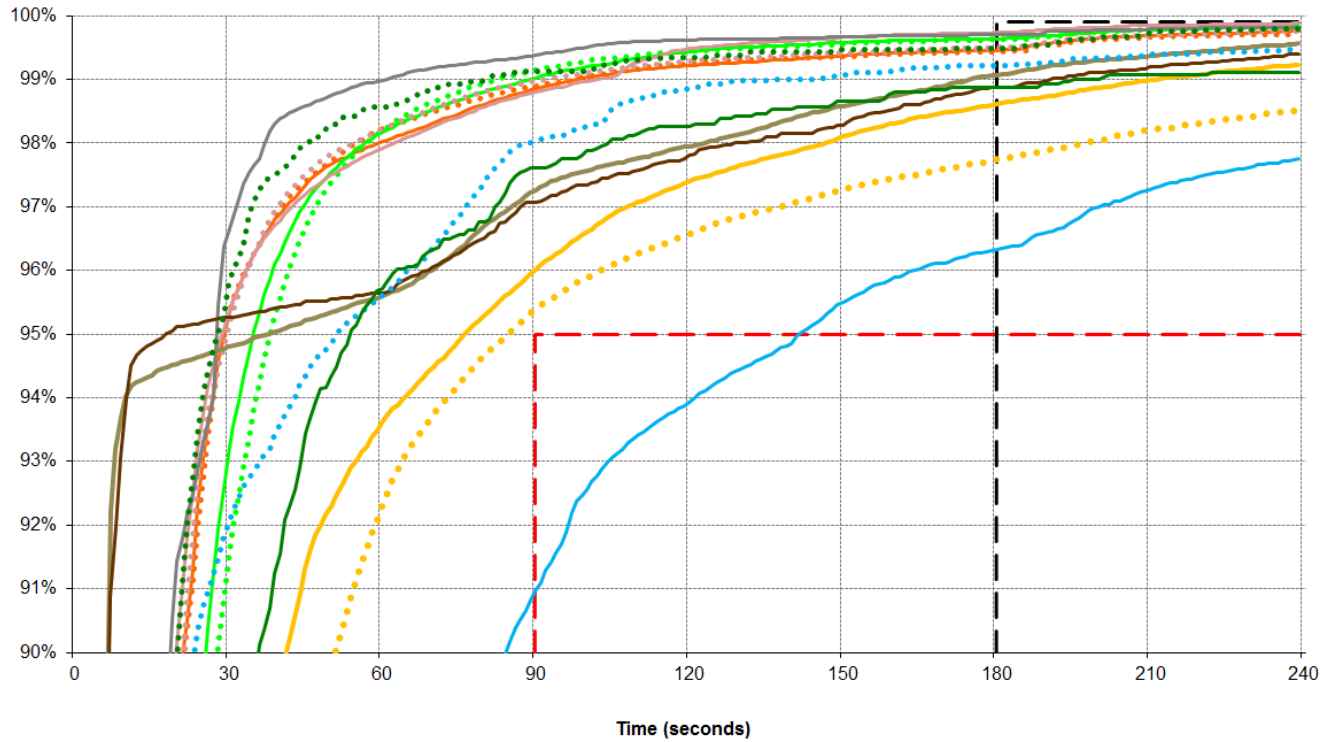
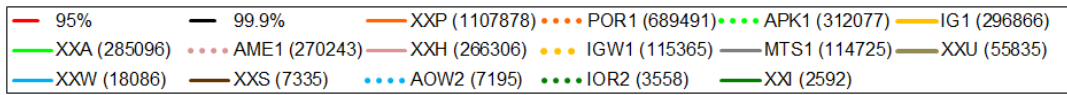
January – June 2017

ASP BY STATION IDENTIFIER

Oakland FIR - January to June 2017 Actual Surveillance Performance (ASP)

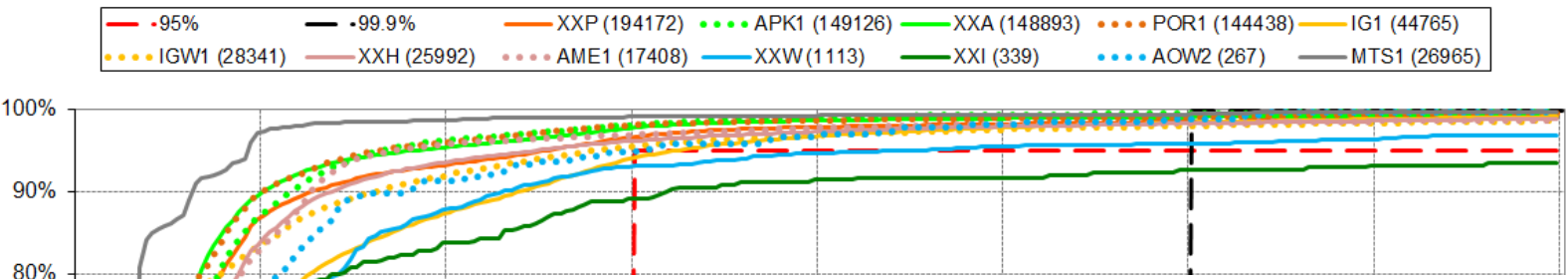


Oakland FIR - January to June 2017 Actual Surveillance Performance (ASP)

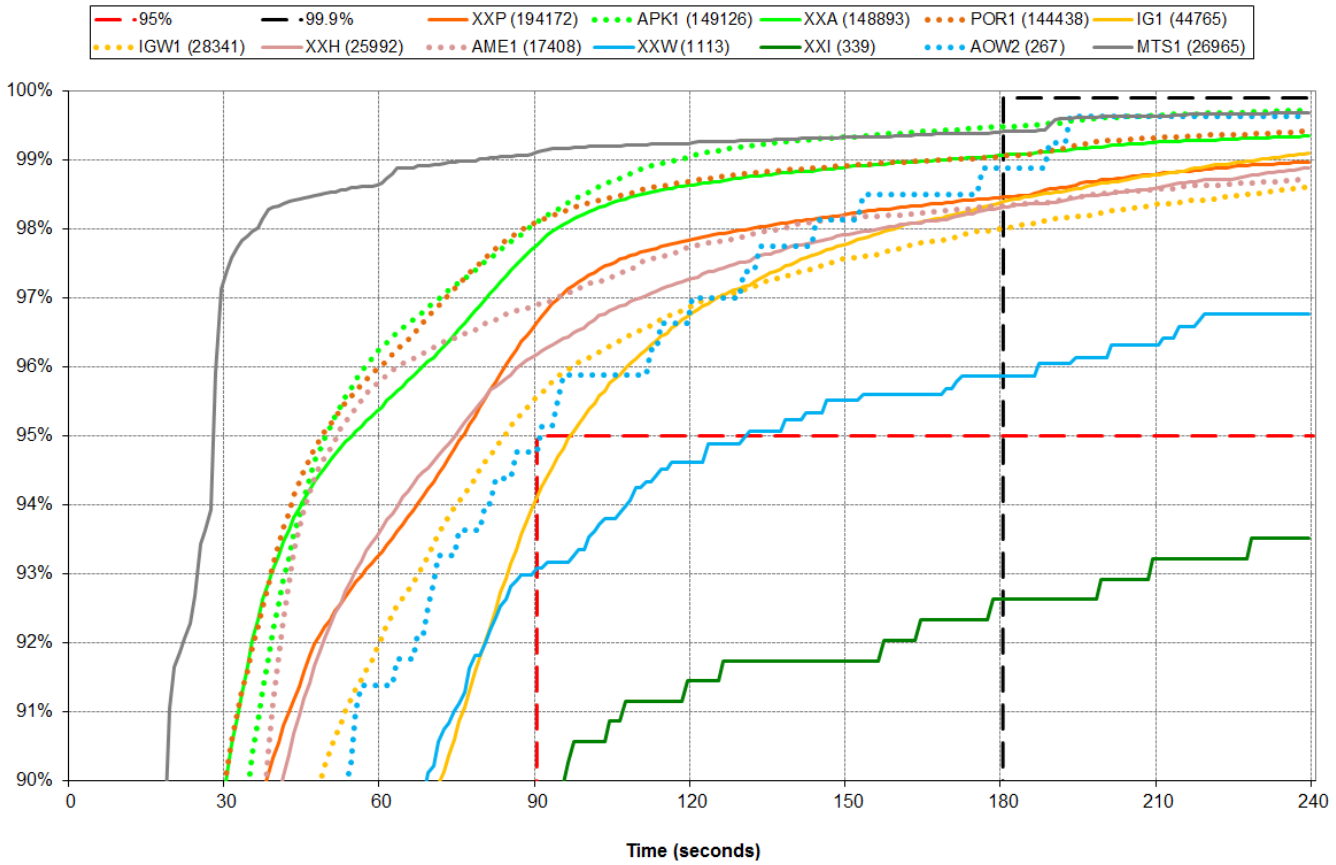


Time (seconds)

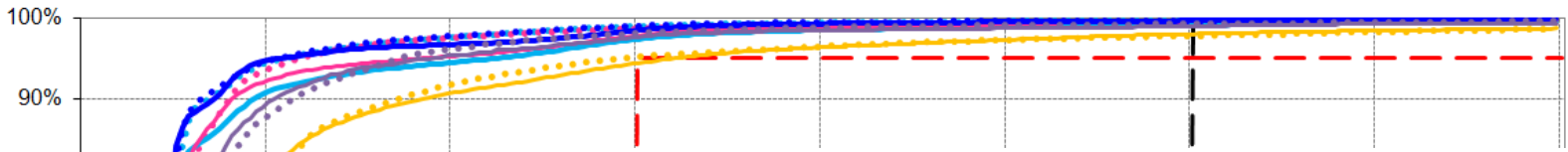
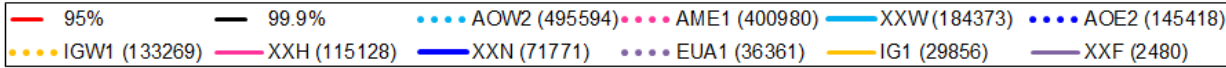
Anchorage FIR - January to June 2017 Actual Surveillance Performance (ASP)



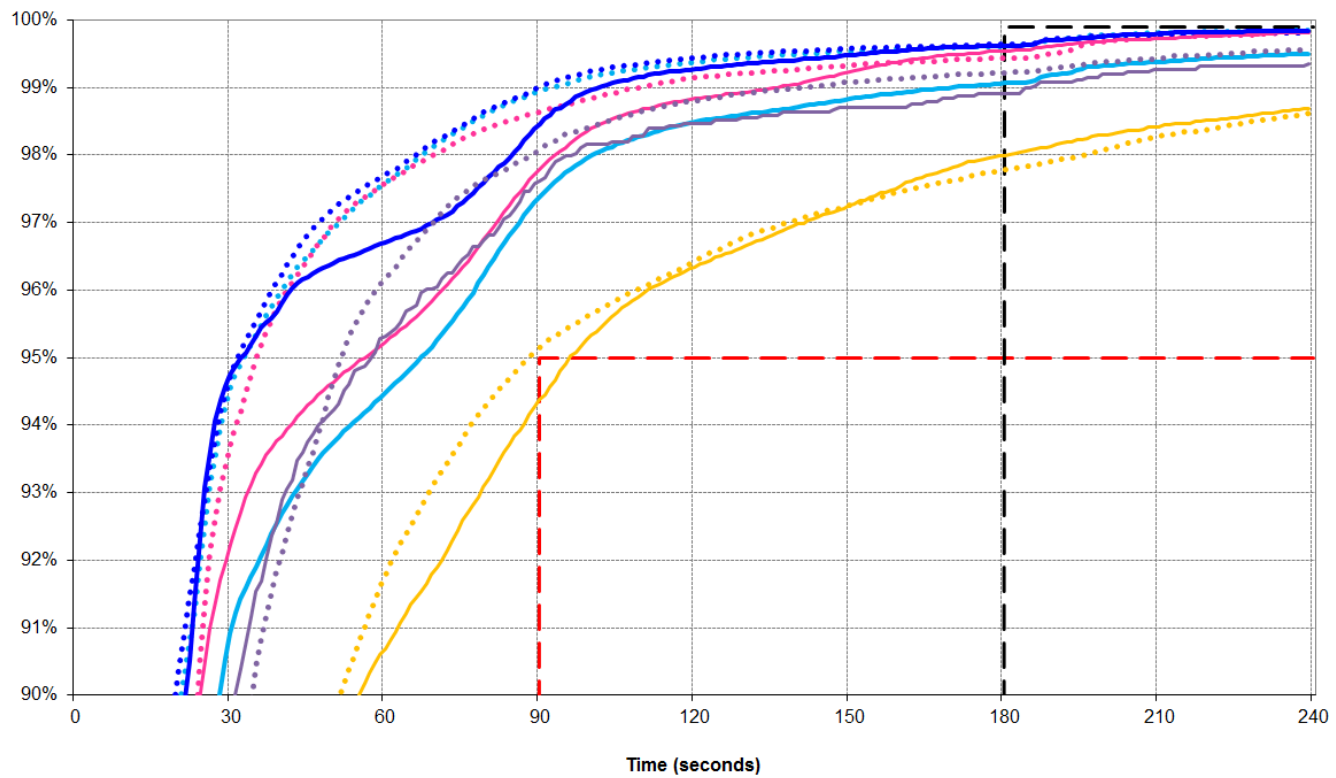
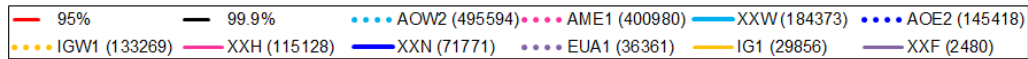
Anchorage FIR - January to June 2017 Actual Surveillance Performance (ASP)



New York FIR - January to June 2017 Actual Surveillance Performance (ASP)



New York FIR - January to June 2017 Actual Surveillance Performance (ASP)



January – June 2017

DATA LINK PERFORMANCE BY OPERATOR/AIRCRAFT TYPE



Operator/Aircraft Types Not Meeting RSP180/RCP240

Operator/ Aircraft Type	ADS-C			CPDLC			Operator/ Aircraft Type	ADS-C			CPDLC		
	Count of ADS-C	ADS-C 95%	ADS-C 99.9%	Count of CPDLC	ACP 95%	ACP 99.9%		Count of ADS-C	ADS-C 95%	ADS-C 99.9%	Count of CPDLC	ACP 95%	ACP 99.9%
JBU/A321	50,733	95.5%	97.5%	335	96.1%	97.9%	AFL/A332	566	96.1%	97.0%	NONE or COUNT <100		
CFG/B763	44,018	96.6%	98.6%	1,280	97.8%	98.8%	AUA/B772	443	97.3%	97.3%	NONE or COUNT <100		
VIR/B744	35,597	96.4%	99.4%	1,187	97.7%	98.2%	UPS/B76N	409	96.1%	98.0%	NONE or COUNT <100		
UAL/B772	25,367	96.8%	98.4%	465	99.4%	99.8%	DAL/B739	356	91.3%	94.9%	NONE or COUNT <100		
UAL/B764	17,803	95.4%	98.1%	337	99.1%	99.7%	ACA/B77W	346	93.4%	97.1%	NONE or COUNT <100		
UAL/B752	9,271	95.5%	98.3%	133	98.5%	98.5%	UPS/B763	345	92.8%	94.2%	NONE or COUNT <100		
UAE/B77W	7,309	97.7%	99.8%	197	98.5%	98.5%	ACA/B763	260	93.5%	98.5%	NONE or COUNT <100		
CRL/B744	6,309	97.9%	98.6%	361	99.5%	99.5%	TGM/GLF6	253	94.9%	98.0%	NONE or COUNT <100		
DAL/B75F	6,101	95.2%	98.0%	122	97.5%	97.5%	DJT/B752	229	86.0%	90.0%	NONE or COUNT <100		
LPE/B763	5,618	98.3%	99.4%	144	97.2%	97.2%	TCX/A333	223	95.1%	97.8%	NONE or COUNT <100		
SAA/A333	5,582	95.8%	97.9%	134	99.3%	99.3%	SLM/B763	202	98.5%	98.5%	NONE or COUNT <100		
ETH/B788	5,540	96.3%	98.1%	98	100.0%	100.0%	NOS/B744	188	95.2%	96.3%	NONE or COUNT <100		
NWS/B772	4,034	96.6%	99.8%	138	98.6%	98.6%	AAL/B738	187	88.2%	91.4%	NONE or COUNT <100		
CLX/B744	3,637	96.0%	98.5%	102	97.1%	99.0%	EXU/GLF5	178	93.3%	95.5%	NONE or COUNT <100		
TFL/B763	3,500	95.6%	98.0%	92	97.8%	98.9%	UAL/B753	163	76.1%	81.6%	NONE or COUNT <100		
TOM/B763	3,301	96.0%	98.2%	107	100.0%	100.0%	SIO/GLF5	161	96.3%	98.1%	NONE or COUNT <100		
PLM/B744	3,151	94.7%	96.0%	140	99.3%	99.3%	SVA/B744	157	93.6%	98.7%	NONE or COUNT <100		
UPS/MD11	3,066	97.1%	98.4%	NONE or COUNT <100			BAW/A318	151	90.7%	92.7%	NONE or COUNT <100		
UAL/B52N	2,621	94.9%	98.1%	NONE or COUNT <100			EVE/B744	148	95.3%	96.0%	NONE or COUNT <100		
BLX/B763	2,377	93.6%	97.6%	NONE or COUNT <100			EJM/CL60	138	95.7%	97.8%	NONE or COUNT <100		
DAL/B752	2,371	89.8%	92.0%	NONE or COUNT <100			GMA/GLF6	126	97.6%	98.4%	NONE or COUNT <100		
RCH/C5	2,273	97.2%	97.9%	NONE or COUNT <100			TCX/B744	123	97.6%	98.4%	NONE or COUNT <100		
VKG/A333	1,565	96.9%	98.3%	NONE or COUNT <100			SIO/CL60	122	95.1%	95.1%	NONE or COUNT <100		
CKS/B744	870	96.0%	97.9%	NONE or COUNT <100			GMA/GLF5	114	96.5%	98.3%	NONE or COUNT <100		
NJE/GLEX	852	96.6%	98.1%	NONE or COUNT <100			SOO/B77L	111	97.3%	98.2%	NONE or COUNT <100		
ABW/B748	771	96.4%	98.2%	NONE or COUNT <100			SAM/B737	110	98.2%	98.2%	NONE or COUNT <100		
GEC/B77L	603	96.9%	97.7%	NONE or COUNT <100									

IGA Types – New York FIR

Operator/ Aircraft Type	ADS-C			CPDLC		
	Count of ADS-C	ADS-C 95%	ADS-C 99.9%	Count of CPDLC	ACP 95%	ACP 99.9%
IGA/GLF5	11,071	96.8%	98.9%	232	96.1%	96.1%
IGA/GLEX	9,336	97.4%	99.5%	177	98.9%	100.0%
IGA/FA7X	6,248	98.7%	99.5%	156	98.1%	100.0%
IGA/GL5T	5,526	97.4%	99.4%	103	99.0%	99.0%
IGA/GLF4	4,880	97.1%	99.0%	NONE or COUNT <100		
IGA/CL35	4,826	95.2%	98.1%	NONE or COUNT <100		
IGA/GLF6	3,961	97.8%	99.3%	NONE or COUNT <100		
IGA/F900	3,863	98.4%	99.4%	NONE or COUNT <100		
IGA/F2TH	2,632	96.9%	99.0%	NONE or COUNT <100		
IGA/CL60	2,091	94.6%	97.5%	NONE or COUNT <100		
IGA/G280	689	96.1%	98.7%	NONE or COUNT <100		
IGA/B737	612	98.7%	100.0%	NONE or COUNT <100		
IGA/FA8X	220	98.2%	100.0%	NONE or COUNT <100		
IGA/A319	212	99.1%	99.5%	NONE or COUNT <100		
IGA/E35L	131	100.0%	100.0%	NONE or COUNT <100		
IGA/CL30	116	95.7%	98.3%	NONE or COUNT <100		



FANS OVER IRIDIUM

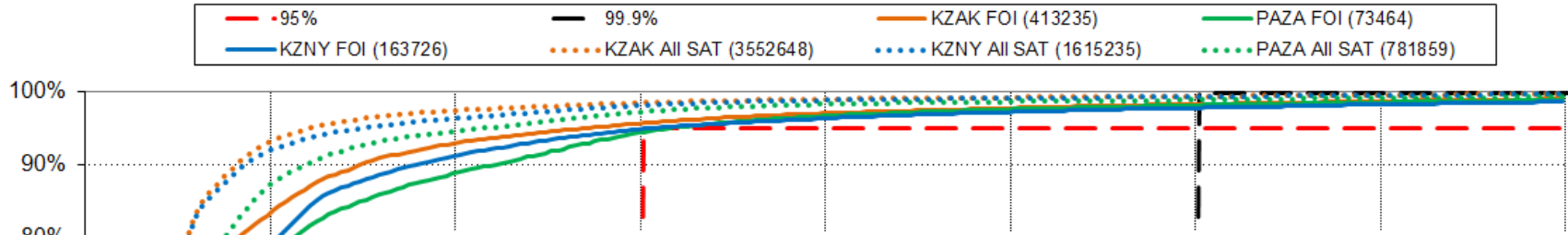


FANS over Iridium Data Link Usage

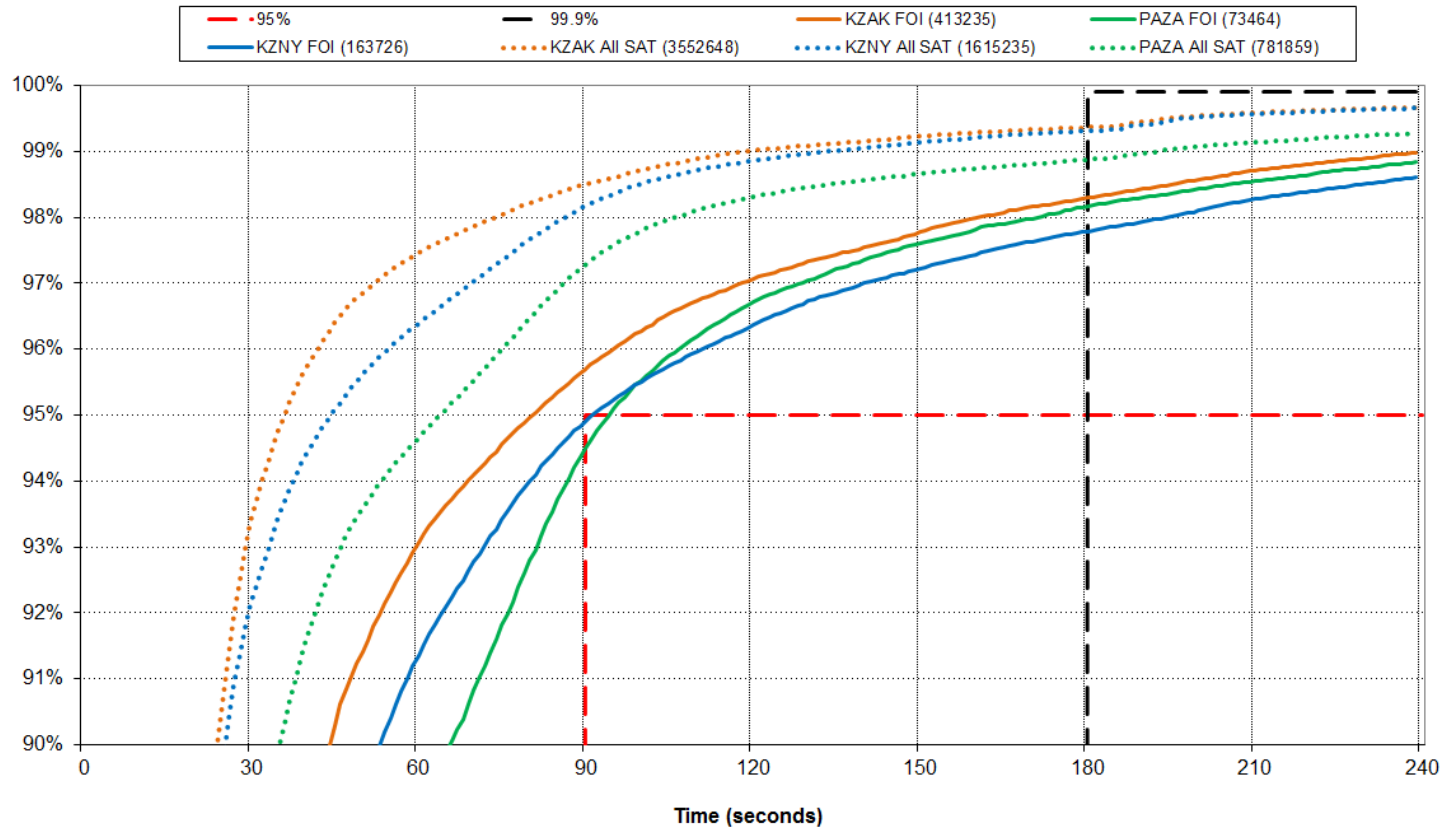
	KZNY				KZAK				PAZA			
	Jul-Dec 2015	Jan-Jun 2016	Jul-Dec 2016	Jan-Jun 2017	Jul-Dec 2015	Jan-Jun 2016	Jul-Dec 2016	Jan-Jun 2017	Jul-Dec 2015	Jan-Jun 2016	Jul-Dec 2016	Jan-Jun 2017
% FANS data link flights using Iridium	7%	8%	7%	11%	6%	7%	10%	14%	9%	9%	10%	11%
Average flights/day using Iridium	24	29	26	45	30	36	53	77	17	17	19	22
% FANS data link airframes using Iridium	9%	9%	10%	12%	10%	11%	12%	14%	10%	11%	12%	14%
Total airframes using Iridium	270	305	343	443	248	295	343	434	165	180	220	270



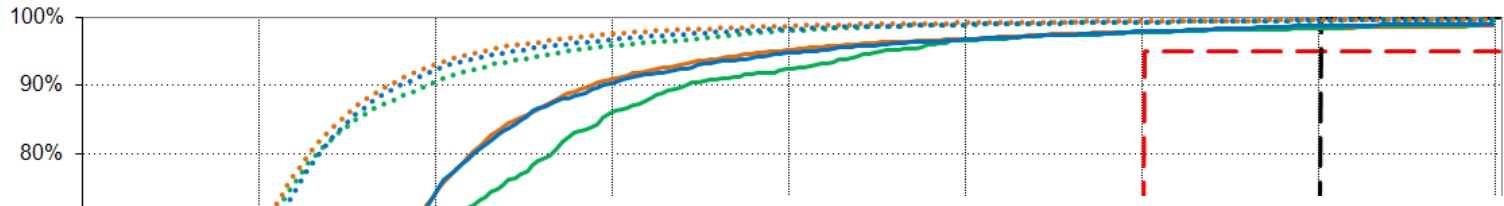
Actual Surveillance Performance (ASP) Iridium - January to June 2017



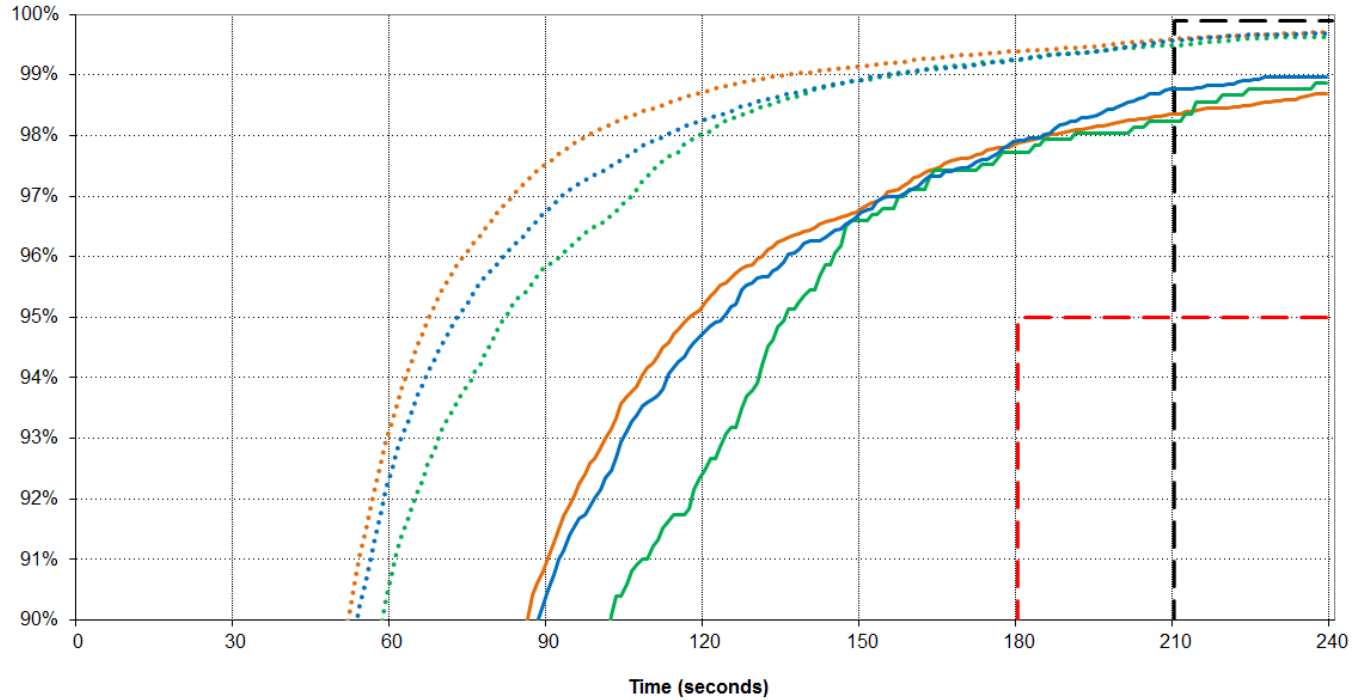
Actual Surveillance Performance (ASP) Iridium - January to June 2017



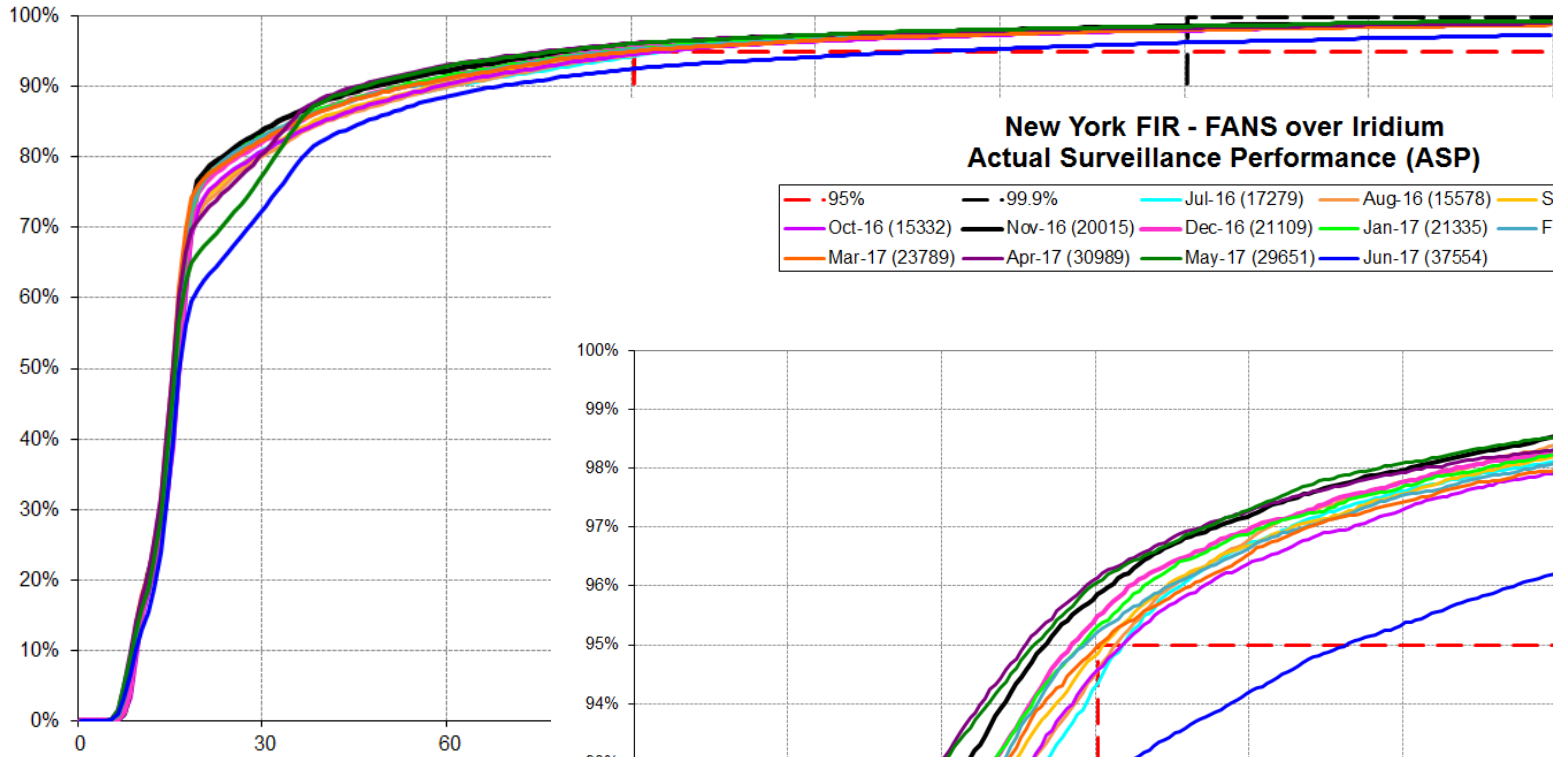
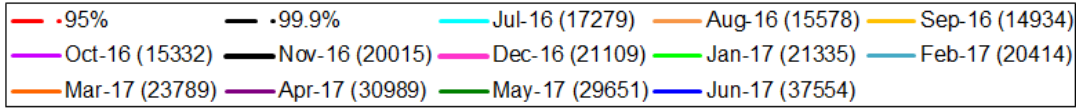
Actual Communication Performance (ACP) Iridium - January to June 2017



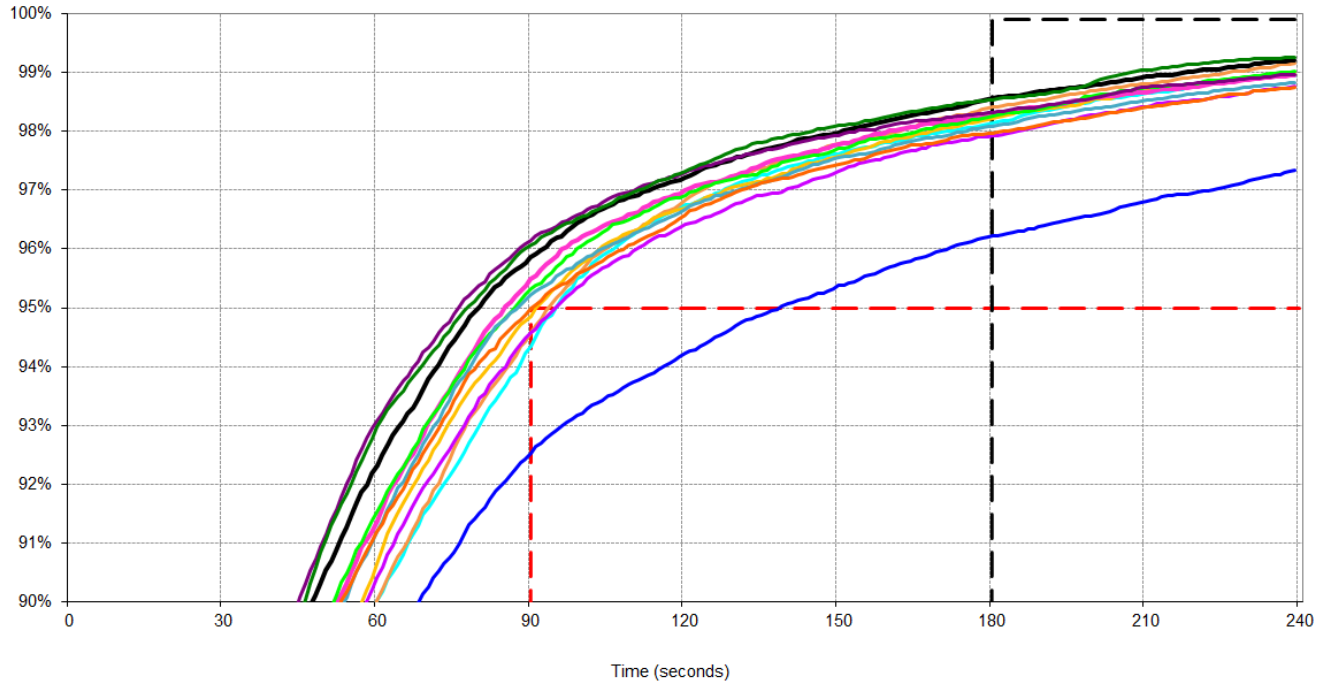
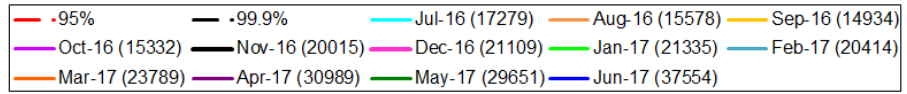
Actual Communication Performance (ACP) Iridium - January to June 2017



New York FIR - FANS over Iridium Actual Surveillance Performance (ASP)

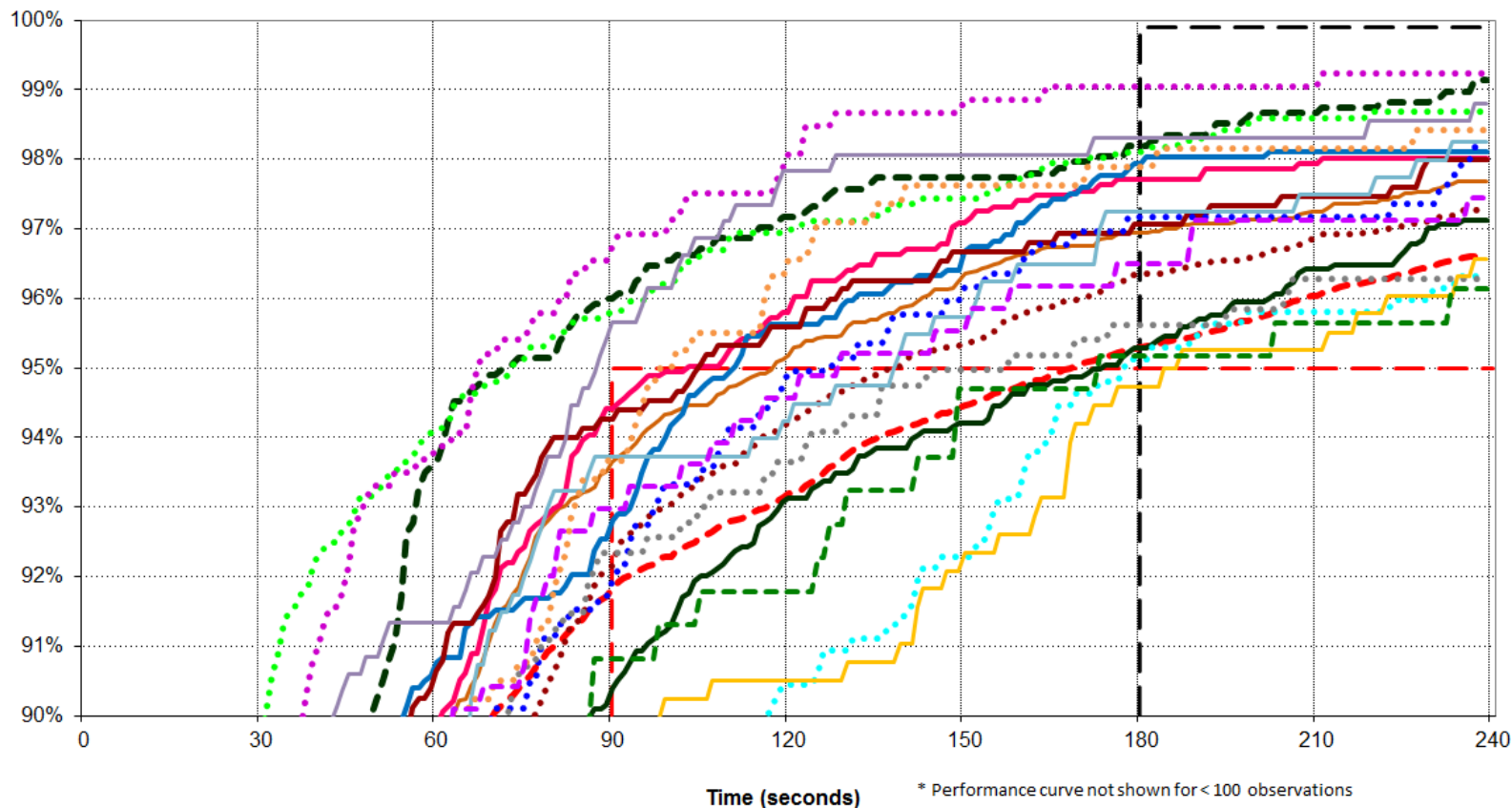
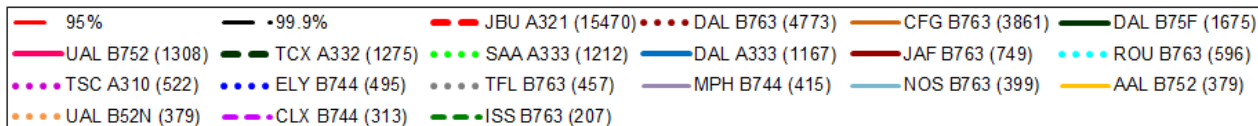


New York FIR - FANS over Iridium Actual Surveillance Performance (ASP)



Time (seconds)

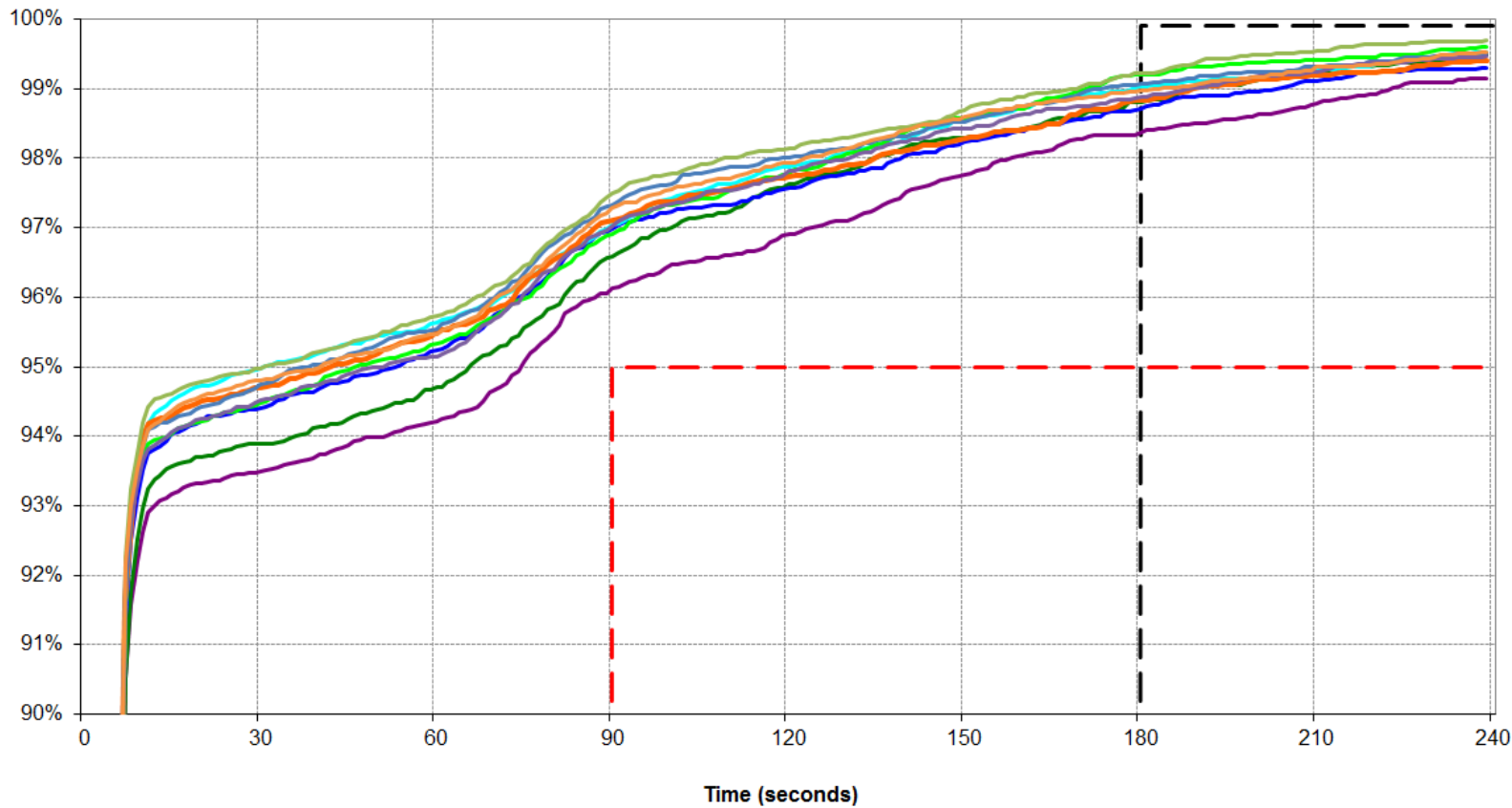
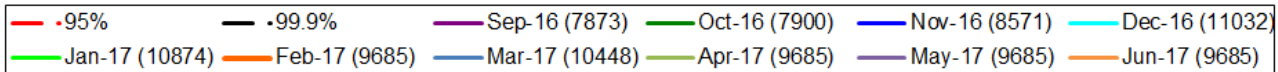
New York FIR - Iridium - June 2017 Actual Surveillance Performance (ASP)



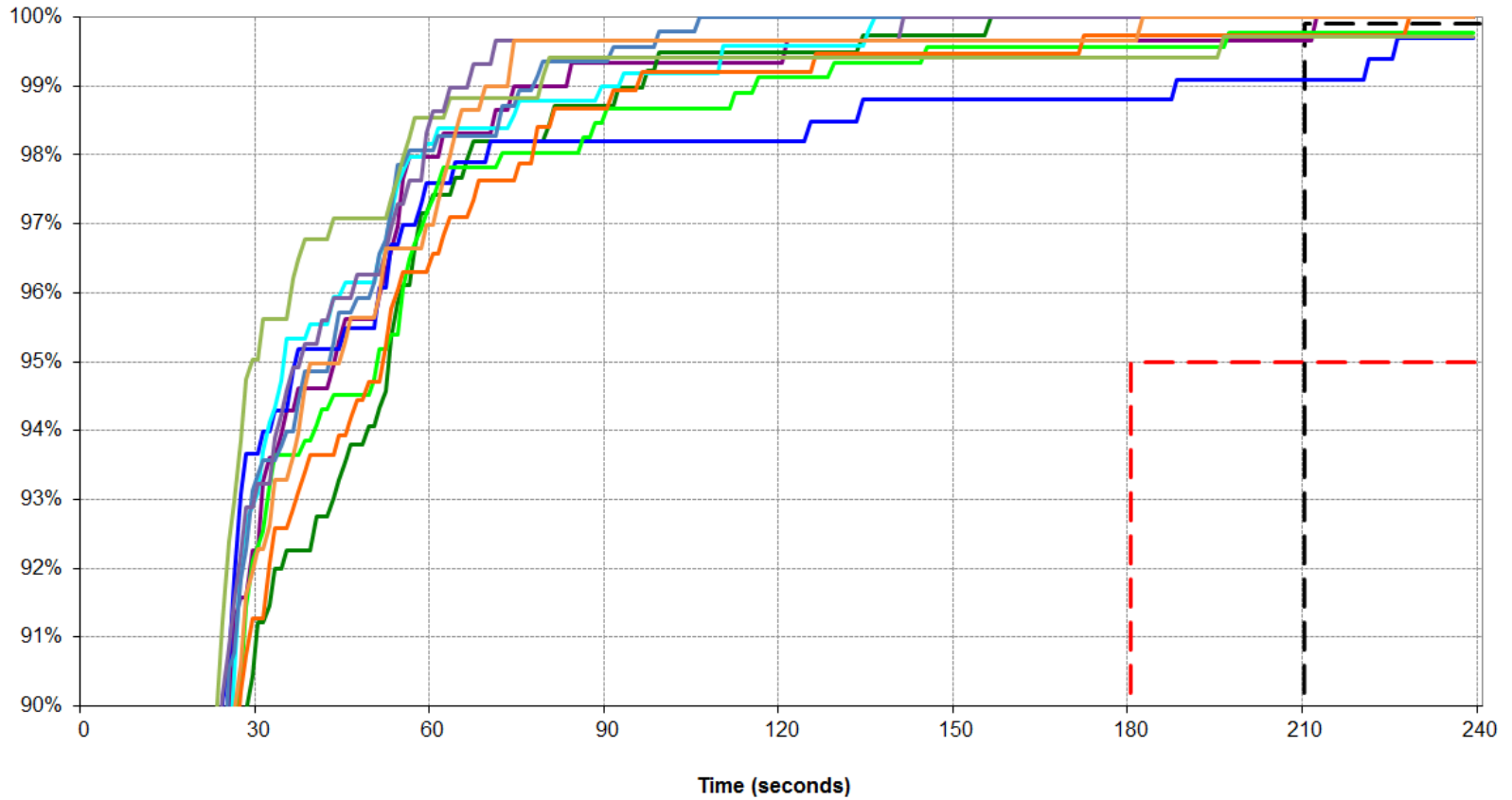
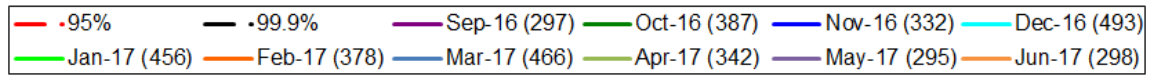
FANS OVER SWIFT BROADBAND



Oakland FIR - All SBB Actual Surveillance Performance (ASP)



Oakland FIR - All SBB Actual Communication Performance (ACP)



KZAK - SwiftBroadband - June 2017 Actual Surveillance Performance (ASP)

