PBCS Monitoring in FAA Oceanic Airspace

ISPACG31 & FIT/24

6-7 March 2017

Prepared by:
Theresa Brewer
theresa.brewer@faa.gov
FAA WJH Technical Center
Separation Standards Analysis Branch
ANG-E61

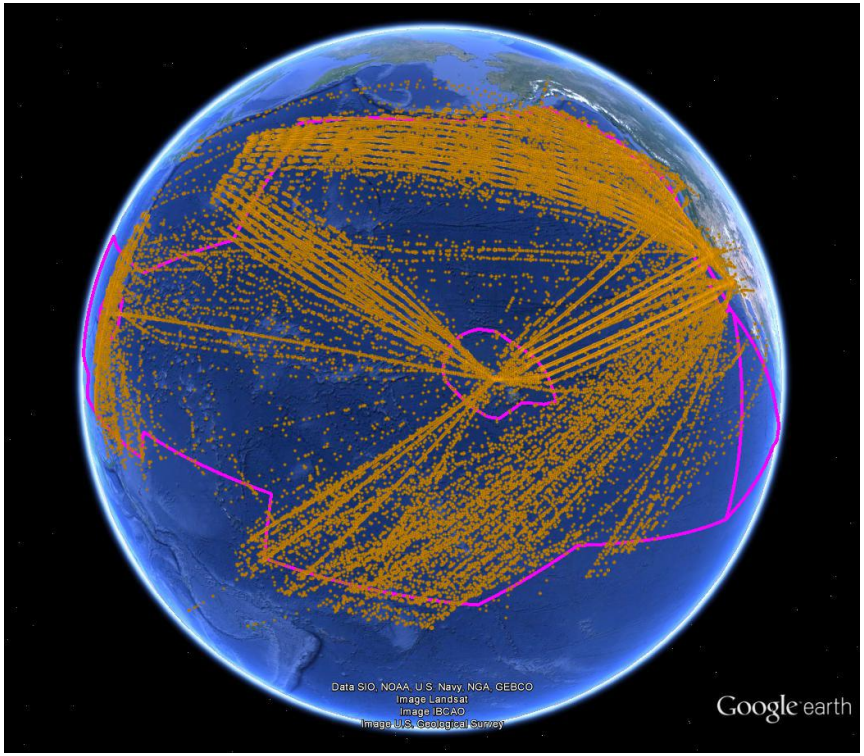
FAA

Federal Aviation Administration

Overview

- Overview of FANS Data Link Usage in US Oceanic FIRs
- Summary of Reported Outages and Measured Availability
- PBCS Performance Criteria and Relevant Separation Minima
- Aggregate FANS Data Link Performance
- ASP for SATCOM Station Identifiers by FIR
- Aggregate FANS Data Link Performance by Operator
- Aggregate FANS Data Link Performance for Business Jet Aircraft Types
- FANS over Iridium usage and ASP by Operator/Aircraft Type
- ADS-C ASP by message type

Oakland FIR (KZAK)
FANS Data Link Usage

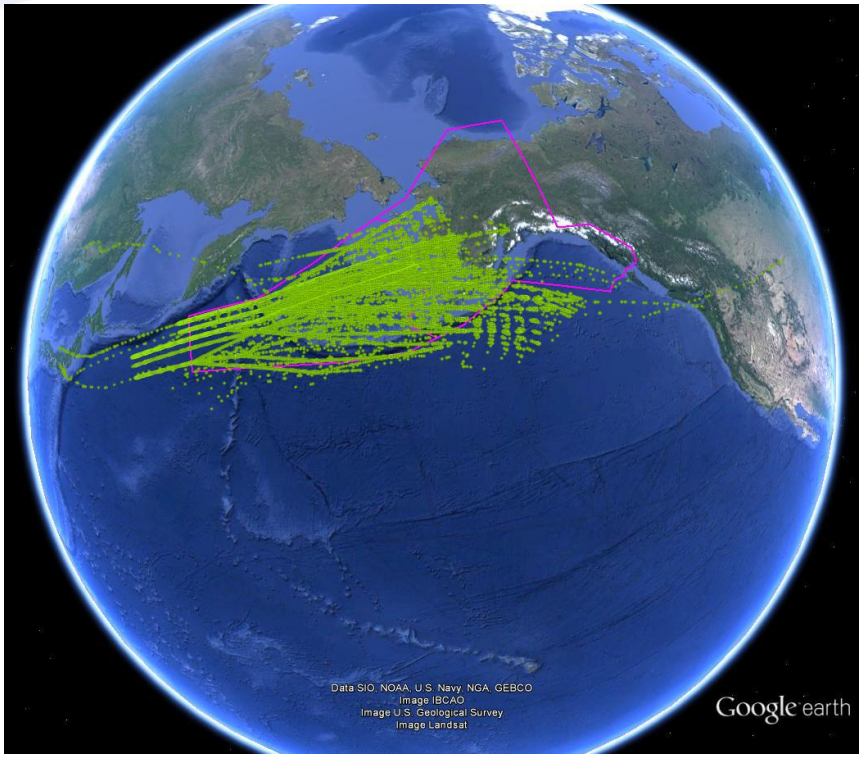


	Jul-Dec 2015	Jan-Jun 2016	Jul-Dec 2016
Total flights	132,607	135,880	**141,461**
% flights using FANS data link	65%	66%	**67%**
% RNP4	71%	76%	**80%**
Individual airframes using FANS data link	2,508	2,677	**2,854**

FAA

NextGEN

Anchorage FIR (PAZA)
FANS Data Link Usage

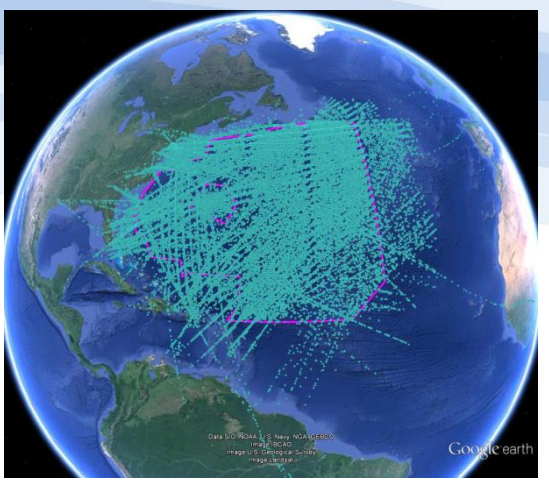


	Jul-Dec 2015	Jan-Jun 2016	Jul-Dec 2016
Total flights	36,371	36,227	**36,467**
% flights using FANS data link	94%	96%	**96%**
% RNP4	82%	88%	**88%**
Individual airframes using FANS data link	1,650	1,696	**1,772**

FAA

NextGEN

New York FIR (KZNY)
FANS Data Link Usage



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

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

FAA

NextGEN

Unexpected SAT Outages Reported [Aug 2016 – Jan 2017]

START DATE	START TIME (UTC)	DURATION (min)	SERVICE IMPACTED	SATELLITE REGION IMPACTED	NOTIFICATION SOURCE	NOTES
16-Aug-16	18:30	1,215.00	Inmarsat I-4	APAC/MEAS	ARINC	Terminals in the MEAS coverage area were unable to register to the network or if registered were unable to establish data or voice connections. Non-optimal management of the shared resources between MEAS and APAC, triggered by the APAC planned switch
27-Aug-16	14:58	230.00	Inmarsat I-4	EMEA	ARINC	Inmarsat network service degradation
31-Aug-16	12:47	12.00	Inmarsat I-4	EMEA	ARINC	Inmarsat network service degradation
30-Sep-16	21:53	165.00	Inmarsat I-4 SBB	MEAS	ARINC	
30-Sep-16	21:24	194.00	Inmarsat I-4 SBB	AMER	ARINC	
30-Sep-16	21:24	194.00	Inmarsat I-4 SBB	EMEA	ARINC	
14-Oct-16	10:37	68.00	Inmarsat I-4 SBB	APAC/AMER	ARINC	INMARSAT has restored the service after identifying and bypassing a failed link in New York.
18-Oct-16	20:47	204.00	ARINC Iridium	Global	ARINC	Iridium has determined that during the above time frame, an issue with IWS Provisioning & SPNet Pro did occur. Iridium was able to correct this problem by restoring IWS Provisioning and SPNet Pro.
20-Oct-16	22:11	305.00	ARINC Iridium	Global	ARINC	Outage was caused by a loss of commercial power at the Iridium Gateway
20-Oct-16	22:09	481.00	SITA Iridium	Global	SITA	
18-Nov-16	18:27	115.00	Inmarsat I-3	IOR	SITA	Inmarsat experienced issues at the IOR2 Ground Earth Station.Voice and Data services were not available during the above window.Inmarsat has resolved the issue and we are monitoring closely.
18-Nov-16	18:39	103.00	Inmarsat I-3	IOR	ARINC	Inmarsat advises that the unscheduled loss of Network service in I-3 Indian Ocean Region for Classic Aero over I3 has been resolved.
1-Dec-16	20:27	33.00	Inmarsat I-4	APAC	ARINC	
11-Dec-16	13:39	102.00	SITA Inmarsat	Inmarsat Global	SITA	Inmarsat link redundancy has been lost following a degradation of our link to the New York meet-me point.Our New York meet-me point router was flapping earlier and may have caused uplinks and downlinks delays. We have now forced this link down until the link flapping issue is resolved. Services are currently operating normally on a single link.
6-Jan-17	23:17	41.00	Inmarsat I-4	EMEA	ARINC	
10-Jan-17	23:22	23.00	Inmarsat I-3	POR	ARINC	

Measured Availability by Path – RSP180/RCP240

Based on Reported Outages/Degradations from Jan to Dec 2016

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

Satellite	Region	DSP	Path ID	# unplanned outages affecting path > 10 min	Sum of unplanned outages affecting path > 10 min (min)	Estimated availability for path
Inmarsat I-3	AOR-E	SITA	AOE2	5	644	99.88%
		ARINC	XXN	2	450	99.91%
	AOR-W	SITA	AOW2	5	644	99.88%
		ARINC	XXW	2	450	99.91%
	IOR	SITA	IOR2	6	759	99.86%
		ARINC	XXI	2	207	99.96%
	POR	SITA	POR1	3	194	99.96%
		ARINC	XXP	0		100.00%
Inmarsat I-4	EMEA	SBB SITA	EME9	6	736	99.86%
		SBB ARINC	XXB	6	733	99.86%
		SITA	EUA1	9	1,111	99.79%
		ARINC	XXF	7	964	99.82%
	Americas	SBB SITA	AMR9	5	354	99.93%
		SBB ARINC	XXU	6	480	99.91%
		SITA	AME1	5	644	99.88%
		ARINC	XXH	2	450	99.91%
	Asia-Pac	SBB SITA	PAC9	3	160	99.97%
		SBB ARINC	XXS	5	248	99.95%
		SITA	APK1	4	227	99.96%
		ARINC	XXA	2	57	99.99%
Iridium	Global	SITA	IGW1	7	1,211	99.77%
		ARINC	IG1	7	1,159	99.78%
MTSAT		SITA	MTS1	2	92	99.98%

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

FAA

NextGEN

PBCS approval required to be eligible to participate in the following horizontal separation minima in accordance with ICAO PANS-ATM (Doc 4444):

Dimension of separation	Separation Minima	RSP requirement	RCP requirement	Associated navigation requirement
Lateral	**42.6 km (23 NM)**	180	240	RNP4
Performance-based Longitudinal	**5 minutes**	180	240	RNP2 or RNP4 or RNP10
Performance-based Longitudinal	**55.5 km (30 NM)**	180	240	RNP2 or RNP4
Performance-based Longitudinal	**93 km (50 NM)**	180	240	RNP4 or RNP10

FAA

NextGEN

July to December 2016

DATA LINK PERFORMANCE BY MEDIA TYPE

Performance by Media Type

96,183 flights

July – December 2016

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	3,187,141	98.4%	99.4%	119,894	99.6%	99.7%	99.4%	99.6%	98.4%
SAT	2,848,433	98.5%	99.4%	117,603	99.7%	99.7%	99.4%	99.6%	98.5%
VHF	323,622	99.1%	99.7%	1,549	99.7%	99.9%	99.7%	99.7%	98.0%
HF	15,072	70.3%	83.9%	25	--	--	--	--	--
VHF-SAT				215	92.6%	96.7%	95.4%	97.2%	96.7%
SAT-HF				212	84.9%	89.6%	88.7%	90.6%	94.8%
HF-SAT				146	99.3%	100.0%	97.3%	100.0%	82.9%
SAT-VHF				141	97.2%	98.6%	95.0%	96.5%	89.4%
VHF-HF				2	--	--	--	--	--
HF-VHF				1	--	--	--	--	--

FAA

NextGEN

Performance by Media Type

35,111 flights

July – December 2016

Anchorage

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	1,106,893	98.2%	99.4%	25,505	99.6%	99.6%	99.3%	99.5%	98.1%
SAT	749,322	97.8%	99.3%	16,913	99.5%	99.6%	99.2%	99.4%	97.9%
VHF	351,124	99.6%	99.8%	7,918	99.9%	99.9%	99.8%	99.8%	98.9%
HF	6,444	67.2%	81.6%	6	--	--	--	--	--
SAT-VHF				397	99.0%	99.2%	98.2%	99.0%	95.2%
VHF-SAT				188	94.2%	96.3%	95.7%	96.8%	97.3%
SAT-HF				41	--	--	--	--	--
HF-SAT				32	--	--	--	--	--
VHF-HF				9	--	--	--	--	--
HF-VHF				1	--	--	--	--	--

FAA

NextGEN

Performance by Media Type

64,436 flights

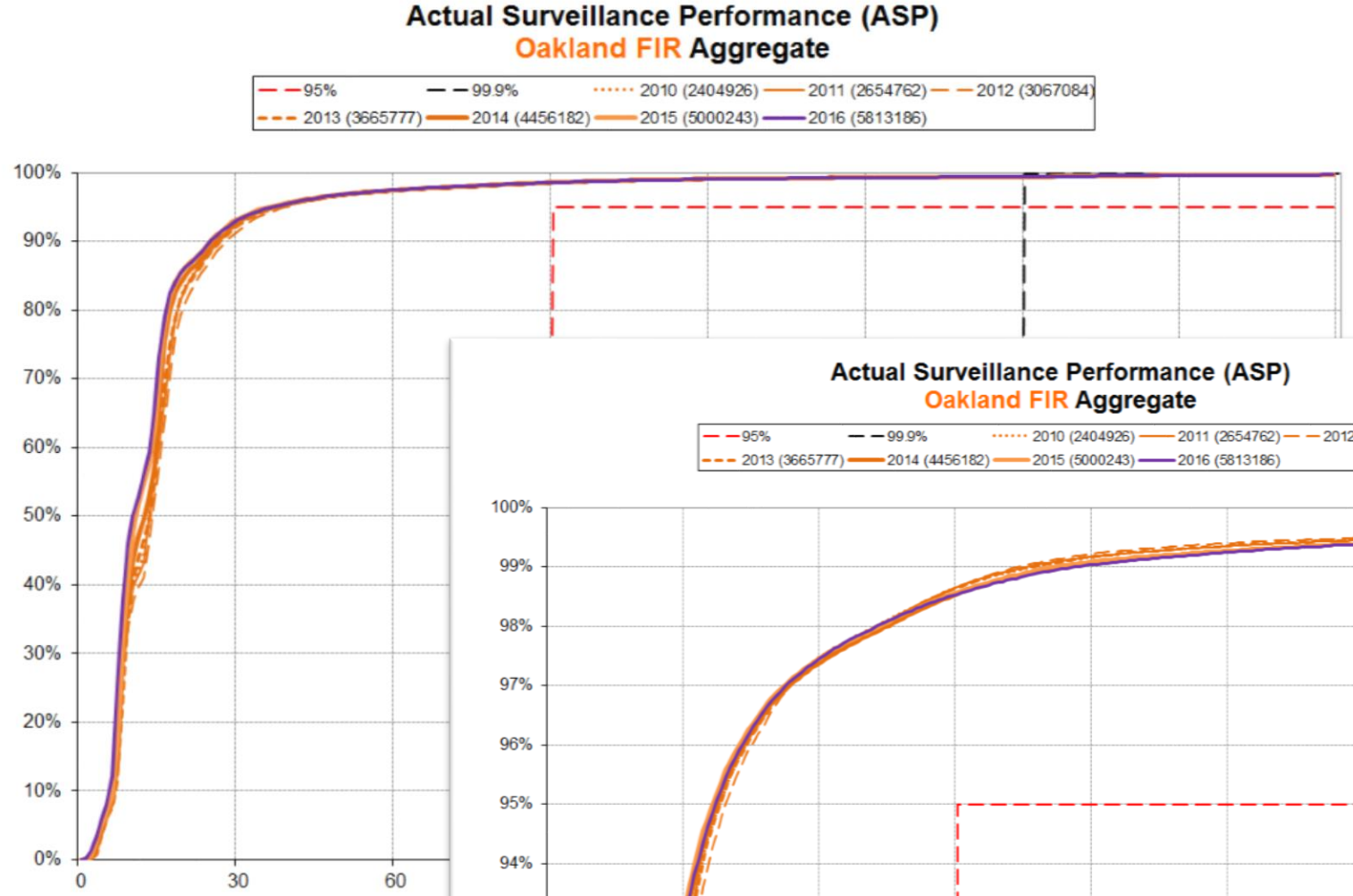
July – December 2016

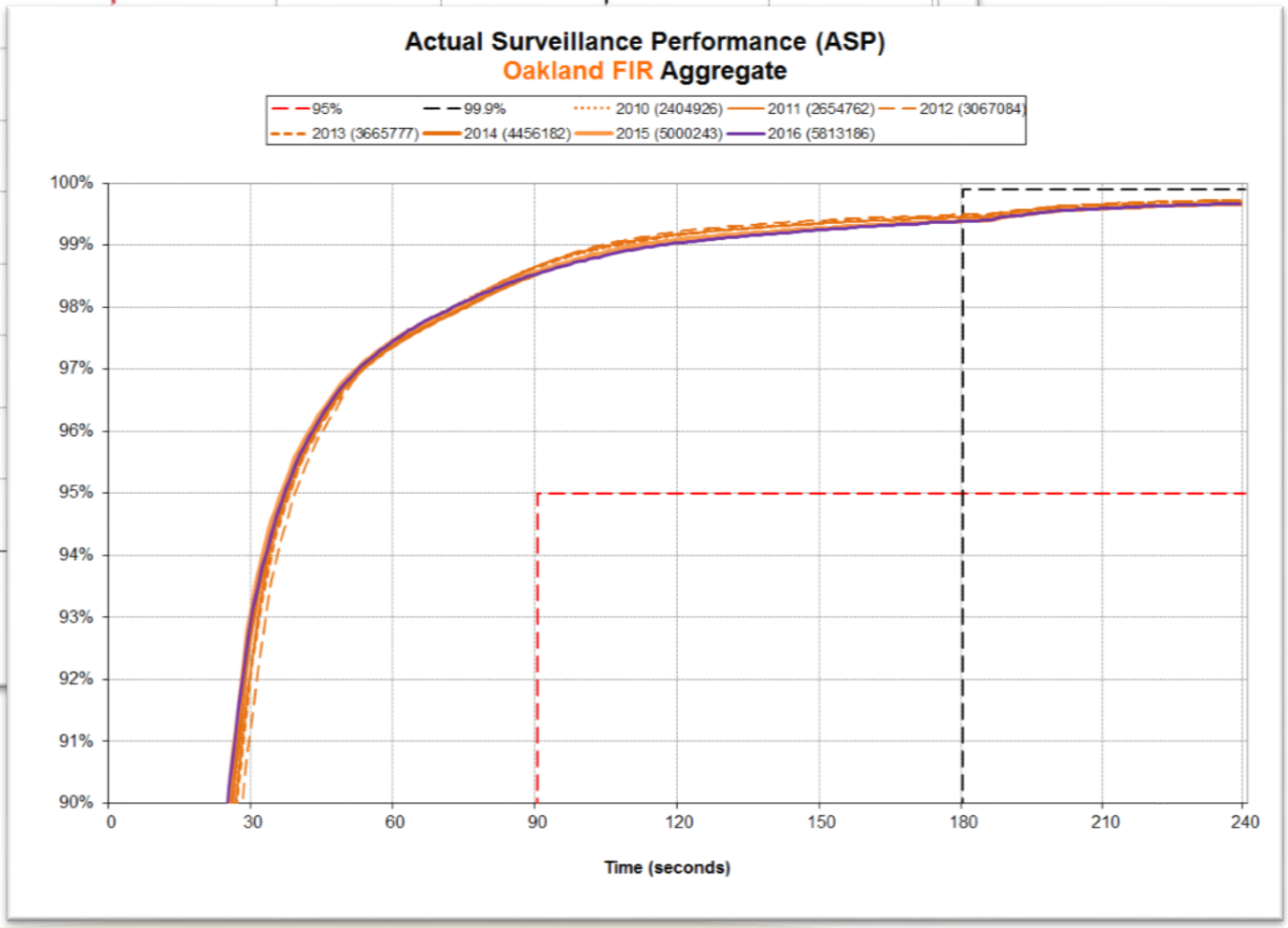
New York

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	1,922,031	98.4%	99.4%	59,355	99.5%	99.6%	99.1%	99.4%	97.3%
SAT	1,477,422	98.2%	99.4%	54,317	99.5%	99.6%	99.2%	99.5%	97.4%
VHF	442,175	99.3%	99.6%	4,289	99.9%	99.9%	99.7%	99.7%	97.5%
HF	2,430	62.4%	75.8%	2	--	--	--	--	--
SAT-VHF				362	99.2%	99.5%	96.4%	97.5%	90.9%
VHF-SAT				331	94.3%	97.3%	91.5%	94.6%	90.3%
SAT-HF				34	--	--	--	--	--
HF-SAT				20	--	--	--	--	--
VHF-HF				--	--	--	--	--	--

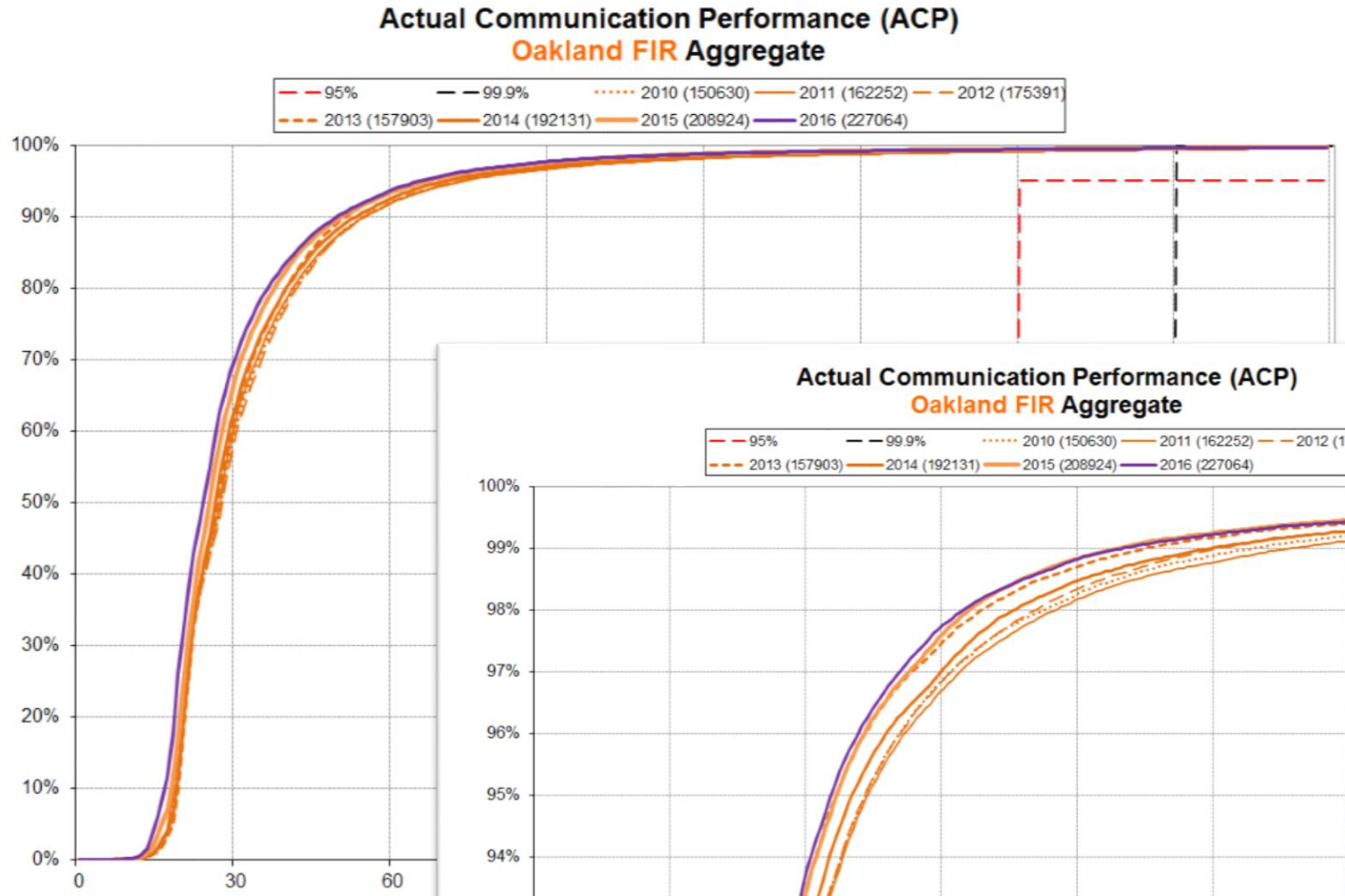
2010 - 2016

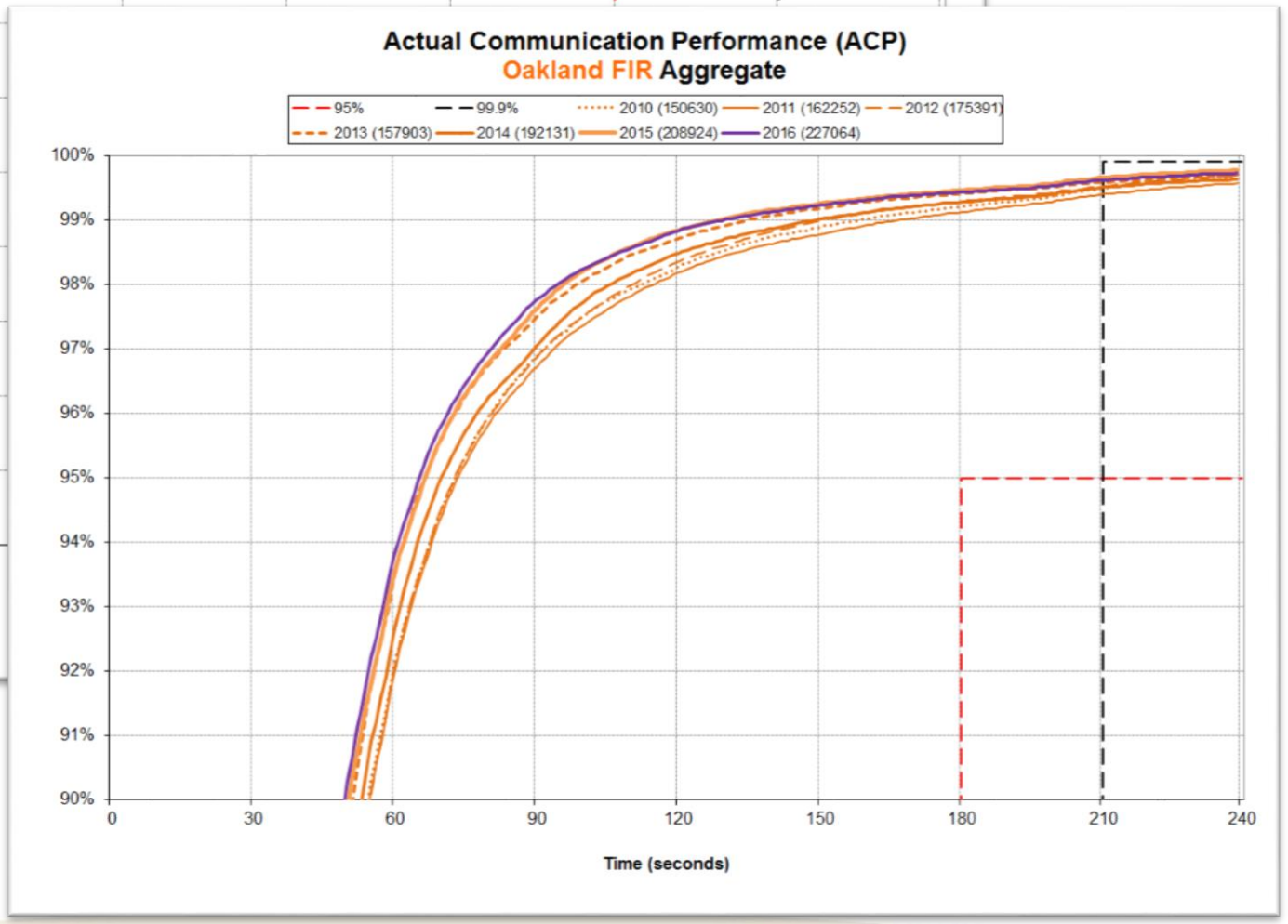
ANNUAL AGGREGATE FIR PERFORMANCE


Actual Surveillance Performance (ASP)
Oakland FIR Aggregate
95%
99.9%
2010 (2404926)
2011 (2654762)
2012 (3067084)
2013 (3665777)
2014 (4456182)
2015 (5000243)
2016 (5813186)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30
60

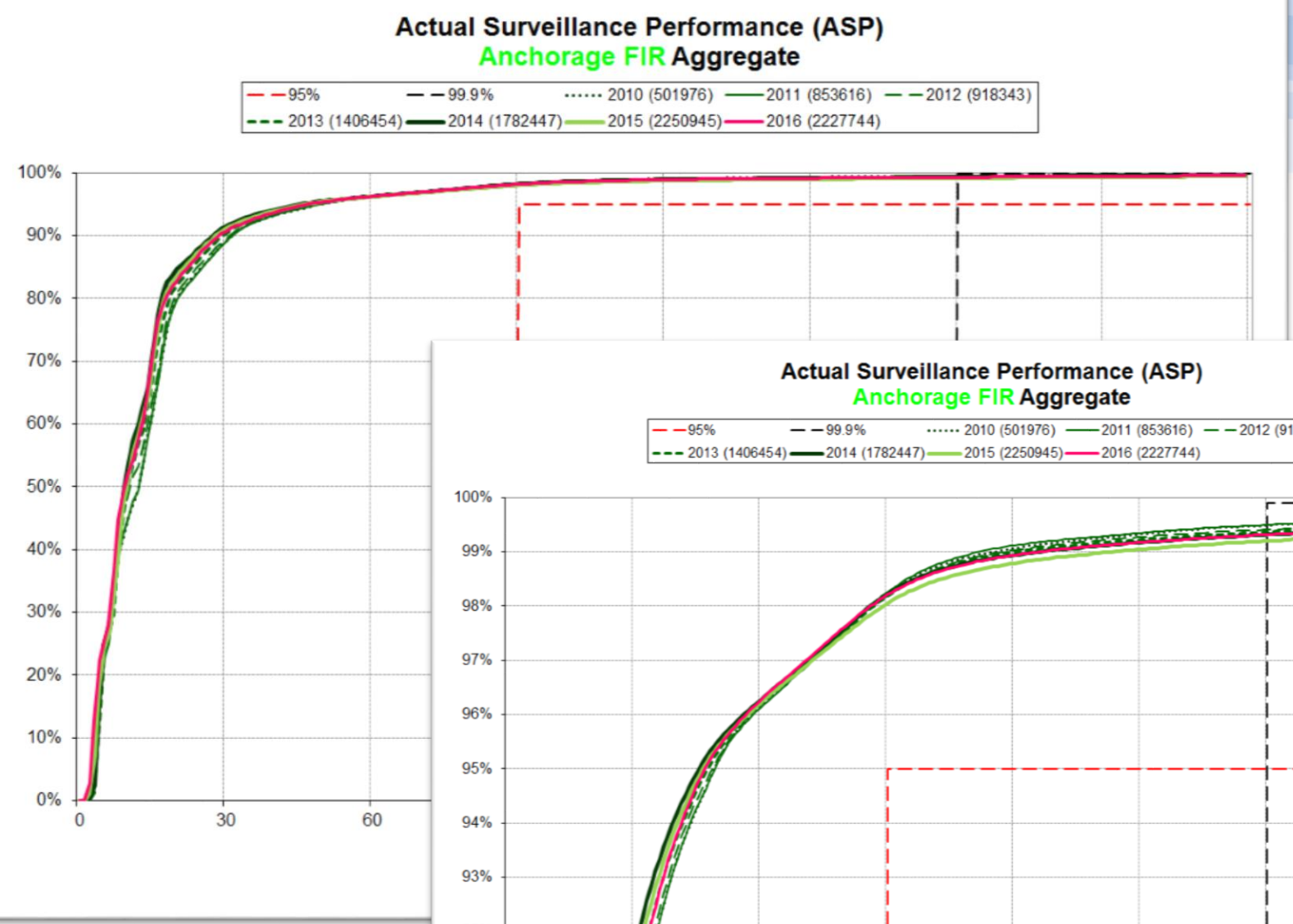

Actual Surveillance Performance (ASP)
Oakland FIR Aggregate
95%
99.9%
2010 (2404926)
2011 (2654762)
2012 (3067084)
2013 (3665777)
2014 (4456182)
2015 (5000243)
2016 (5813186)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

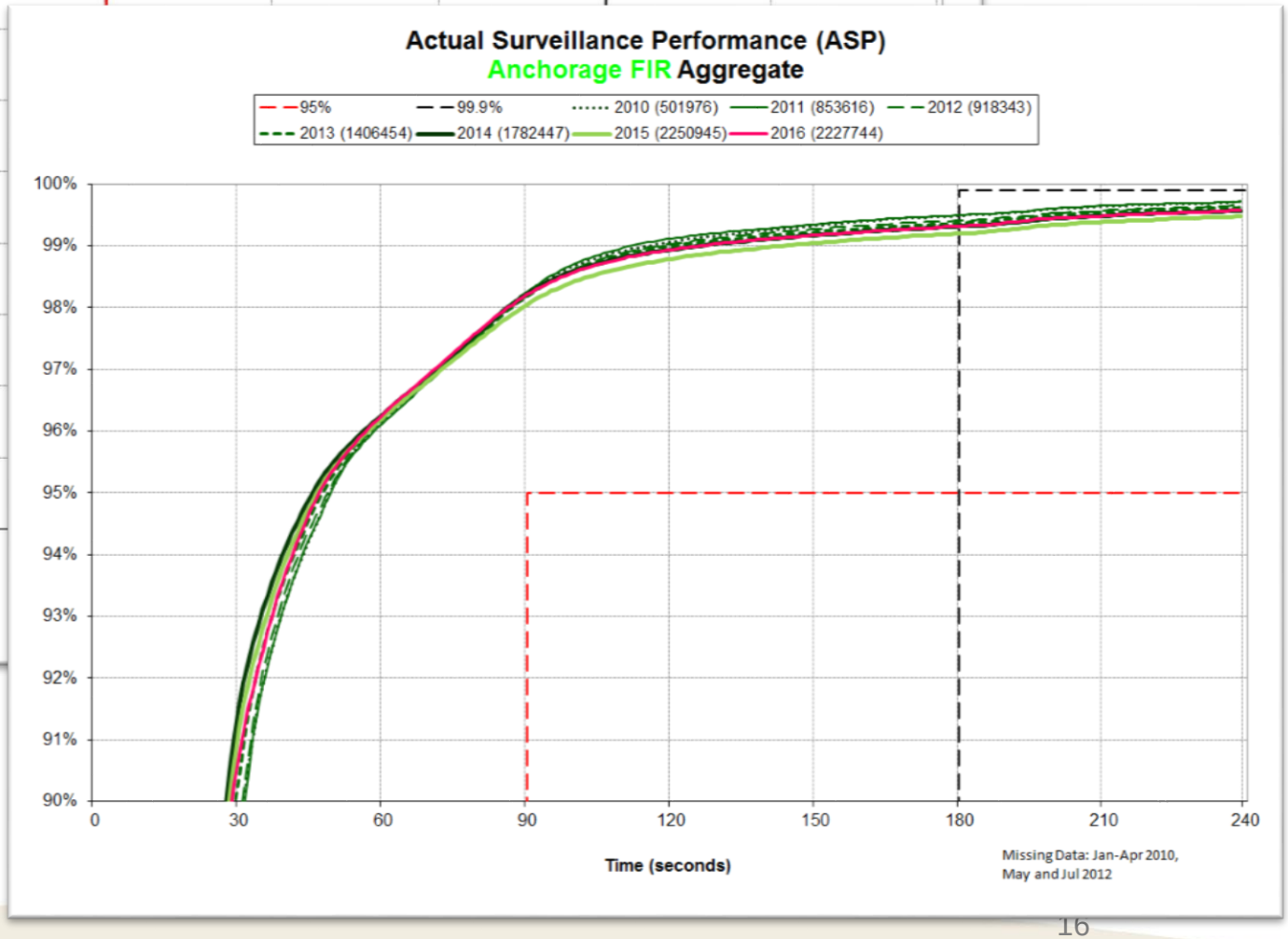
FAA


Actual Communication Performance (ACP)
Oakland FIR Aggregate
95%
99.9%
2010 (150630)
2011 (162252)
2012 (175391)
2013 (157903)
2014 (192131)
2015 (208924)
2016 (227064)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30
60

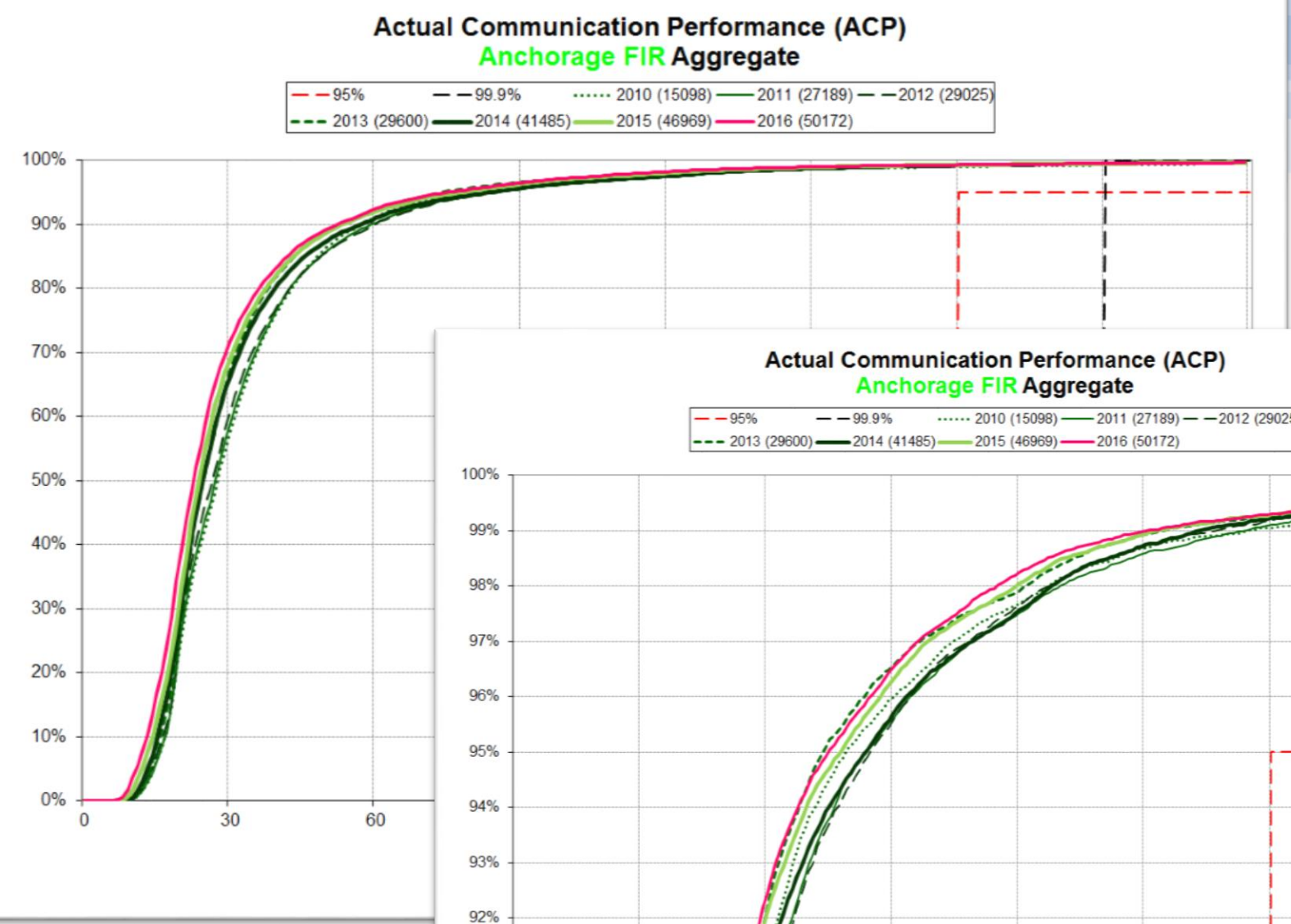

Actual Communication Performance (ACP)
Oakland FIR Aggregate
95%
99.9%
2010 (150630)
2011 (162252)
2012 (175391)
2013 (157903)
2014 (192131)
2015 (208924)
2016 (227064)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

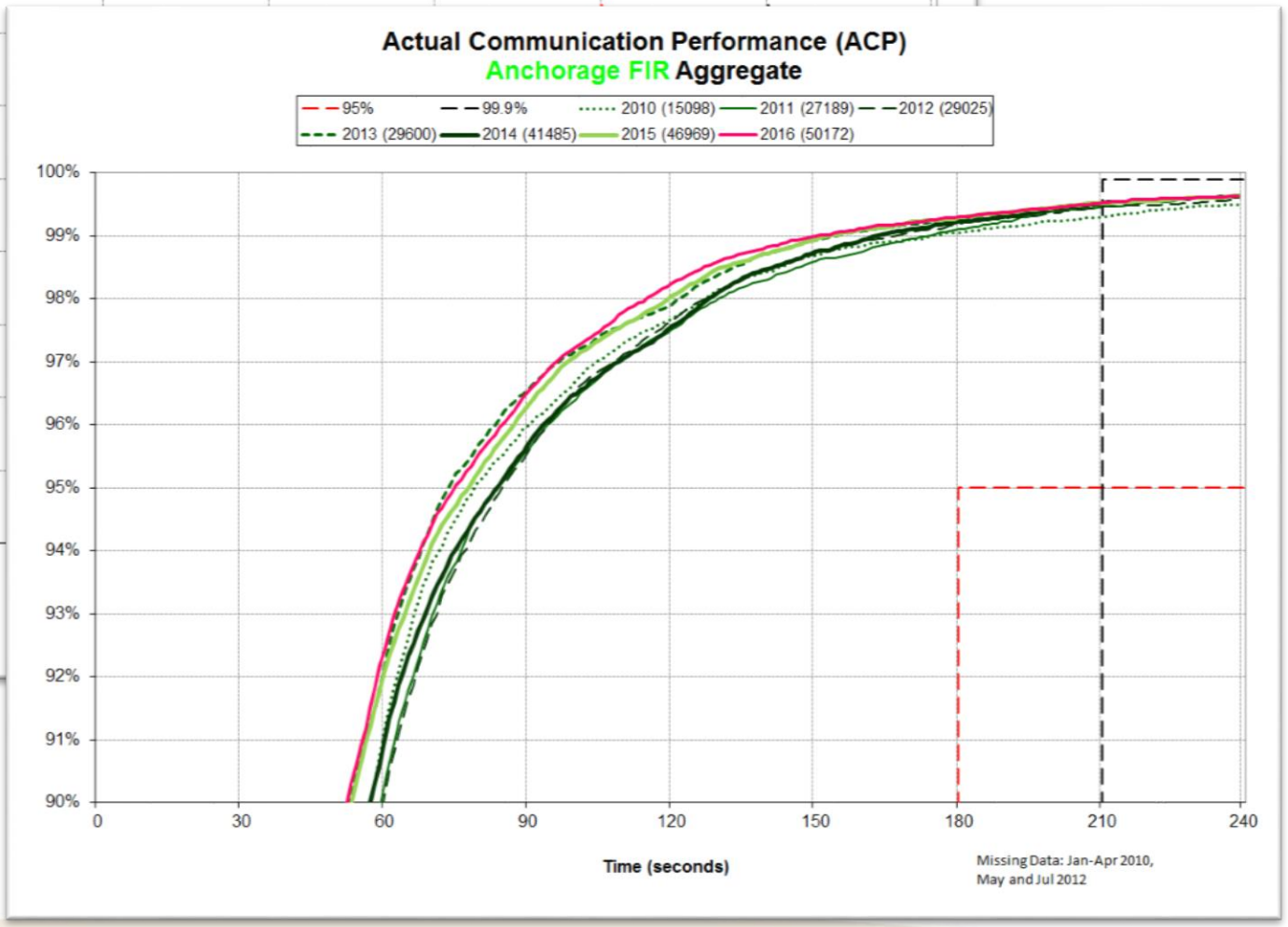
FAA


Actual Surveillance Performance (ASP)
Anchorage FIR Aggregate
95%
99.9%
2010 (501976)
2011 (853616)
2012 (918343)
2013 (1406454)
2014 (1782447)
2015 (2250945)
2016 (2227744)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30
60

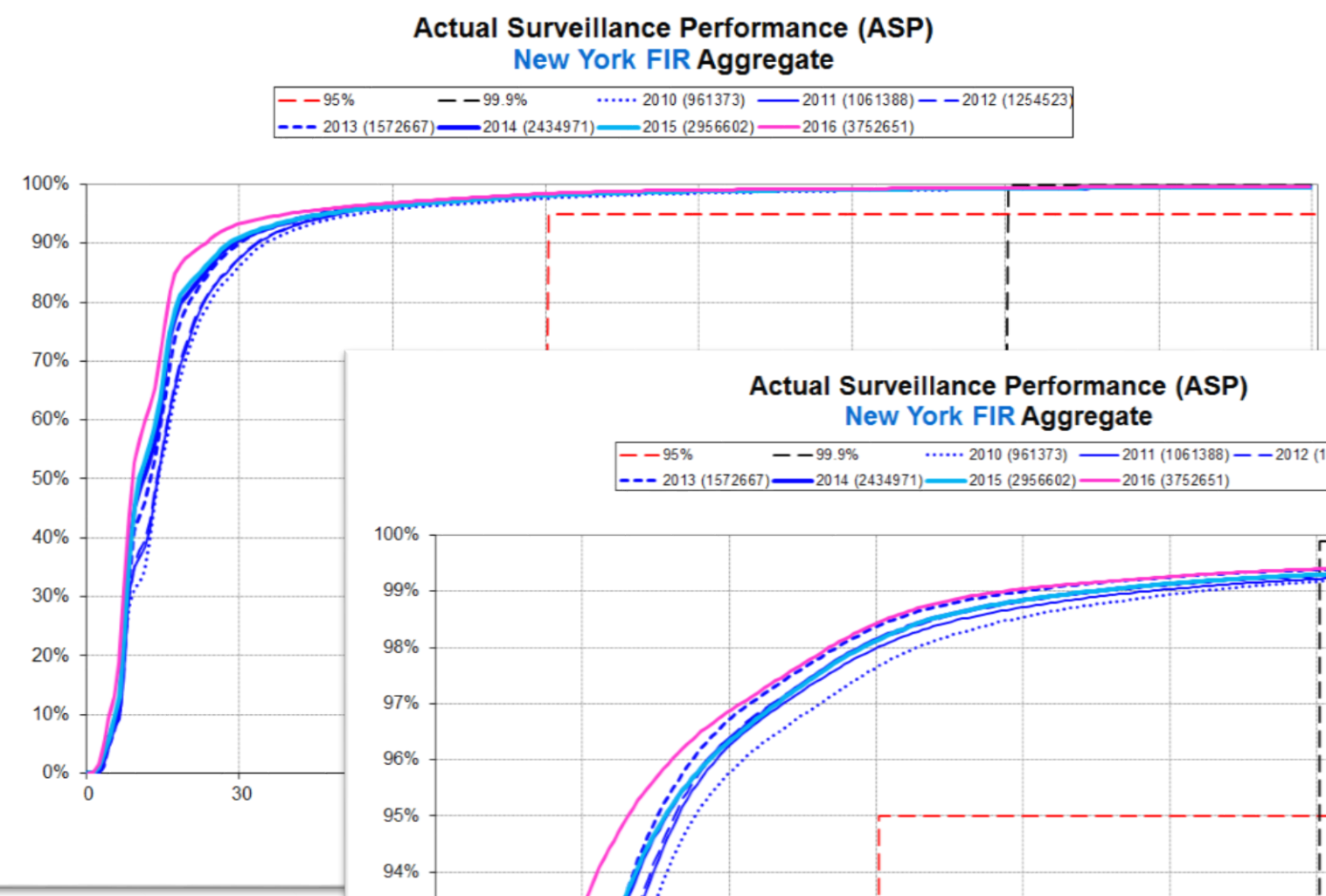

Actual Surveillance Performance (ASP)
Anchorage FIR Aggregate
95%
99.9%
2010 (501976)
2011 (853616)
2012 (918343)
2013 (1406454)
2014 (1782447)
2015 (2250945)
2016 (2227744)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)
Missing Data: Jan-Apr 2010, May and Jul 2012

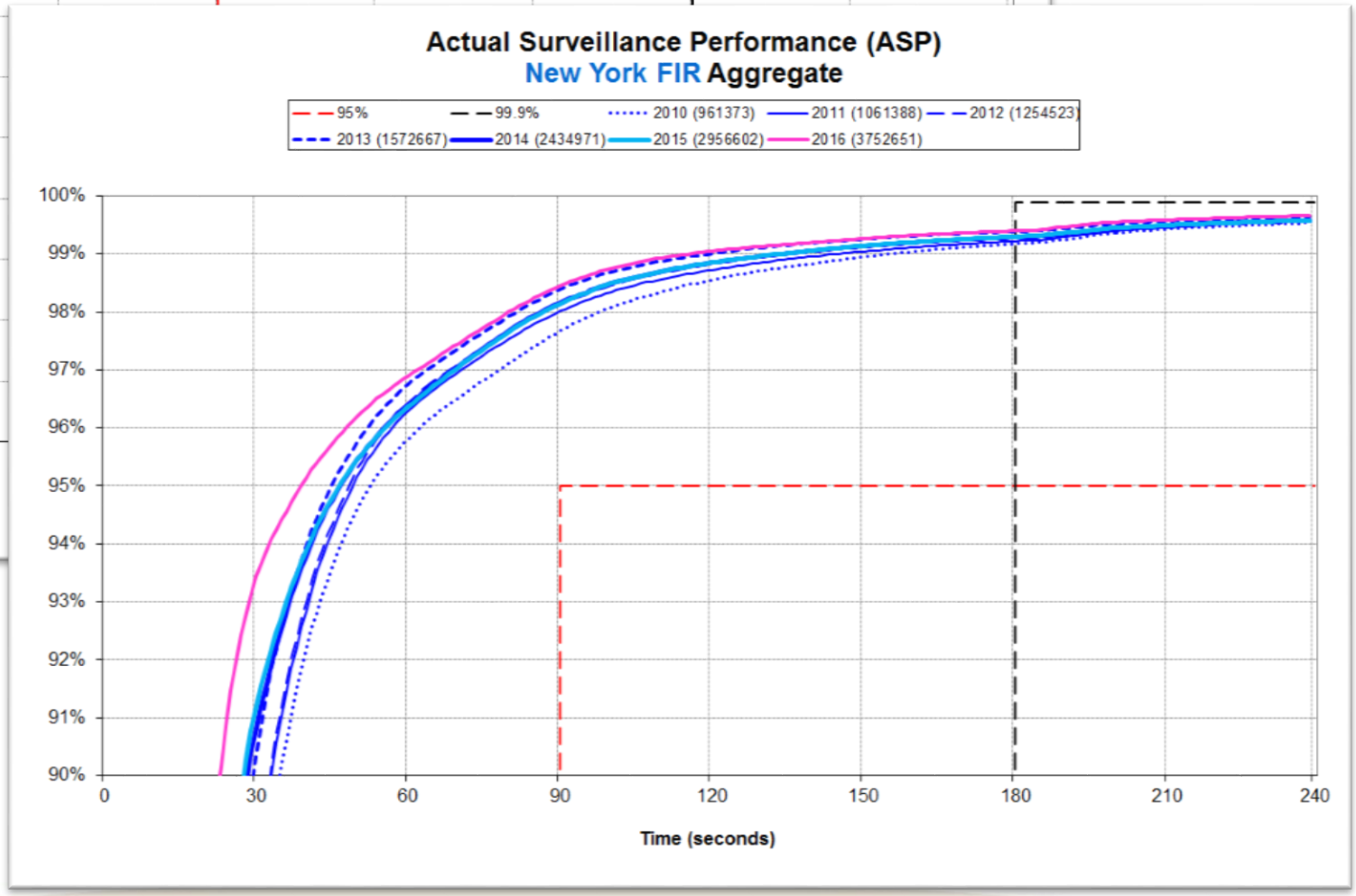
FAA


Actual Communication Performance (ACP)
Anchorage FIR Aggregate
95%
99.9%
2010 (15098)
2011 (27189)
2012 (29025)
2013 (29600)
2014 (41485)
2015 (46969)
2016 (50172)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30
60

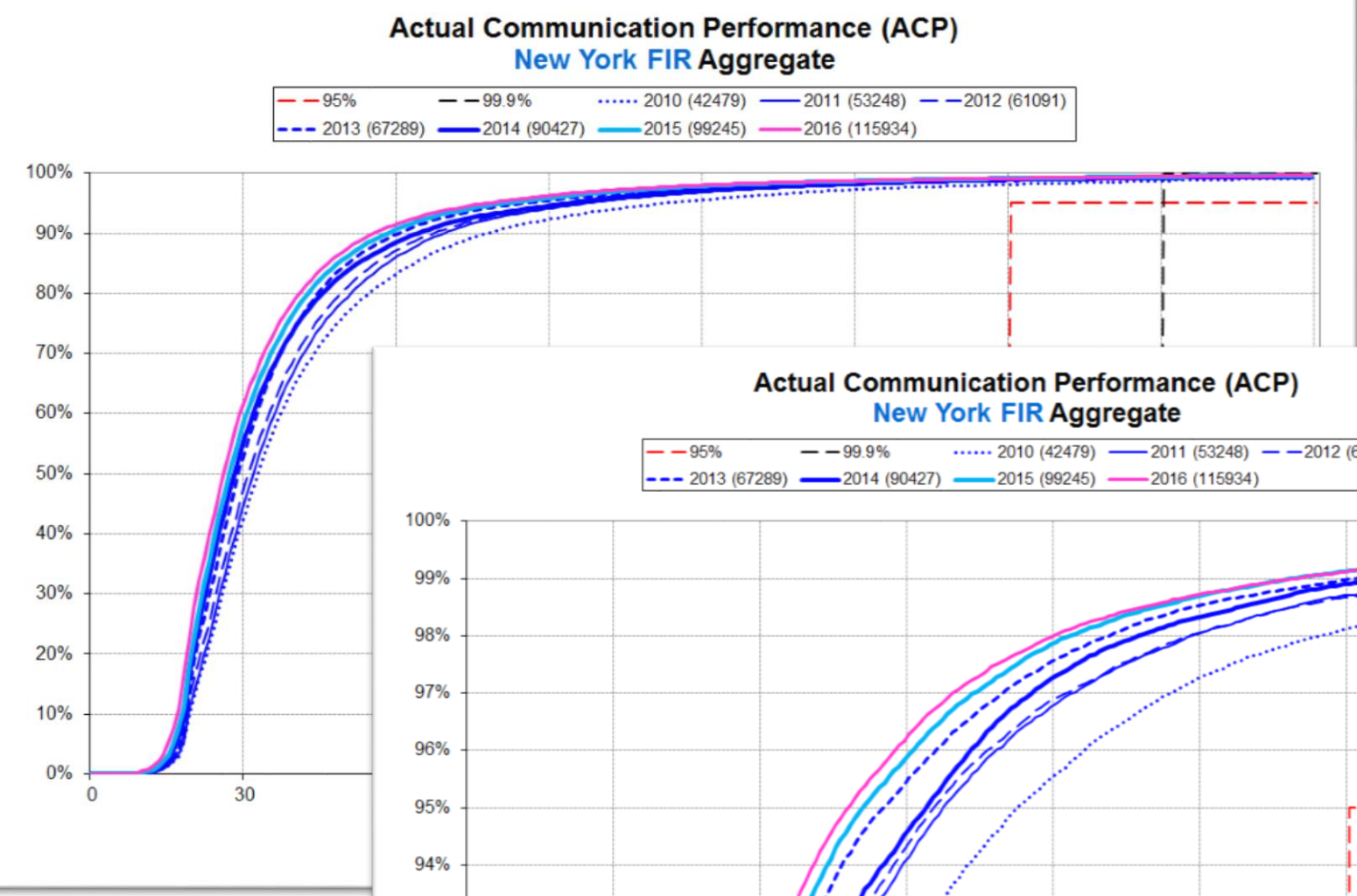

Actual Communication Performance (ACP)
Anchorage FIR Aggregate
95%
99.9%
2010 (15098)
2011 (27189)
2012 (29025)
2013 (29600)
2014 (41485)
2015 (46969)
2016 (50172)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)
Missing Data: Jan-Apr 2010,
May and Jul 2012

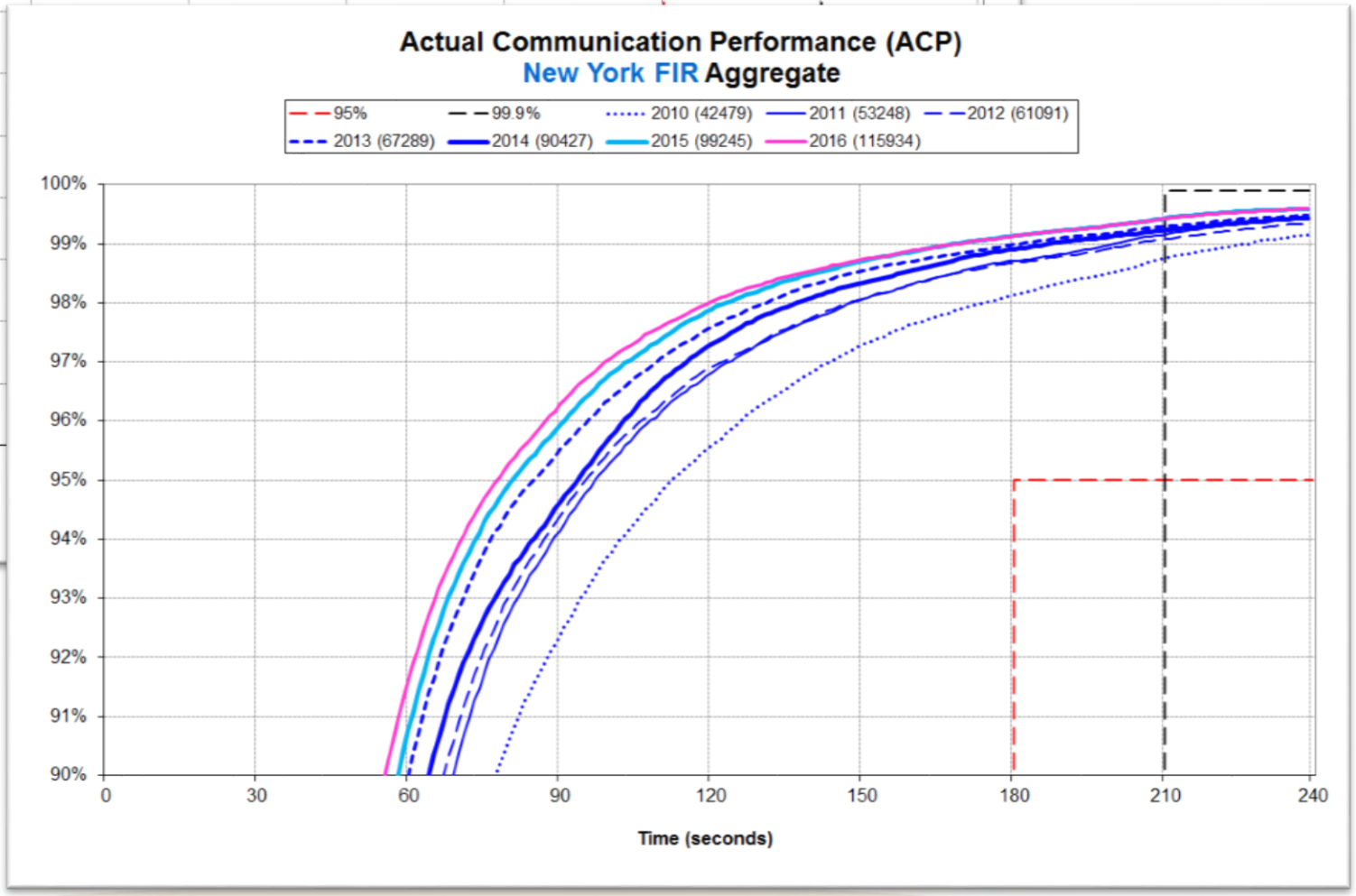
FAA


Actual Surveillance Performance (ASP)
New York FIR Aggregate
95%
99.9%
2010 (961373)
2011 (1061388)
2012 (1254523)
2013 (1572667)
2014 (2434971)
2015 (2956602)
2016 (3752651)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30


Actual Surveillance Performance (ASP)
New York FIR Aggregate
95%
99.9%
2010 (961373)
2011 (1061388)
2012 (1254523)
2013 (1572667)
2014 (2434971)
2015 (2956602)
2016 (3752651)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

FAA


Actual Communication Performance (ACP)
New York FIR Aggregate
95%
99.9%
2010 (42479)
2011 (53248)
2012 (61091)
2013 (67289)
2014 (90427)
2015 (99245)
2016 (115934)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30


Actual Communication Performance (ACP)
New York FIR Aggregate
95%
99.9%
2010 (42479)
2011 (53248)
2012 (61091)
2013 (67289)
2014 (90427)
2015 (99245)
2016 (115934)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

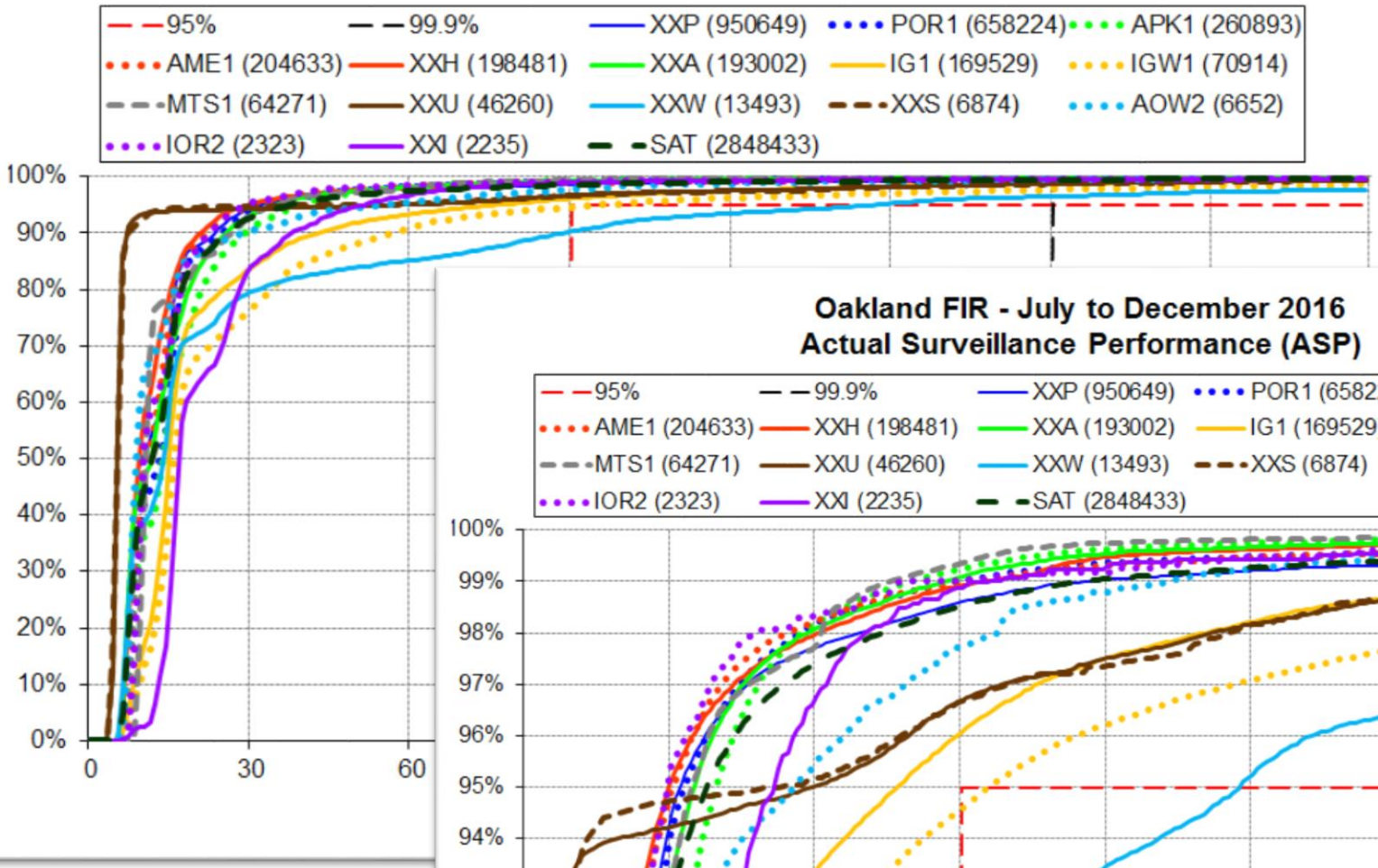
FAA

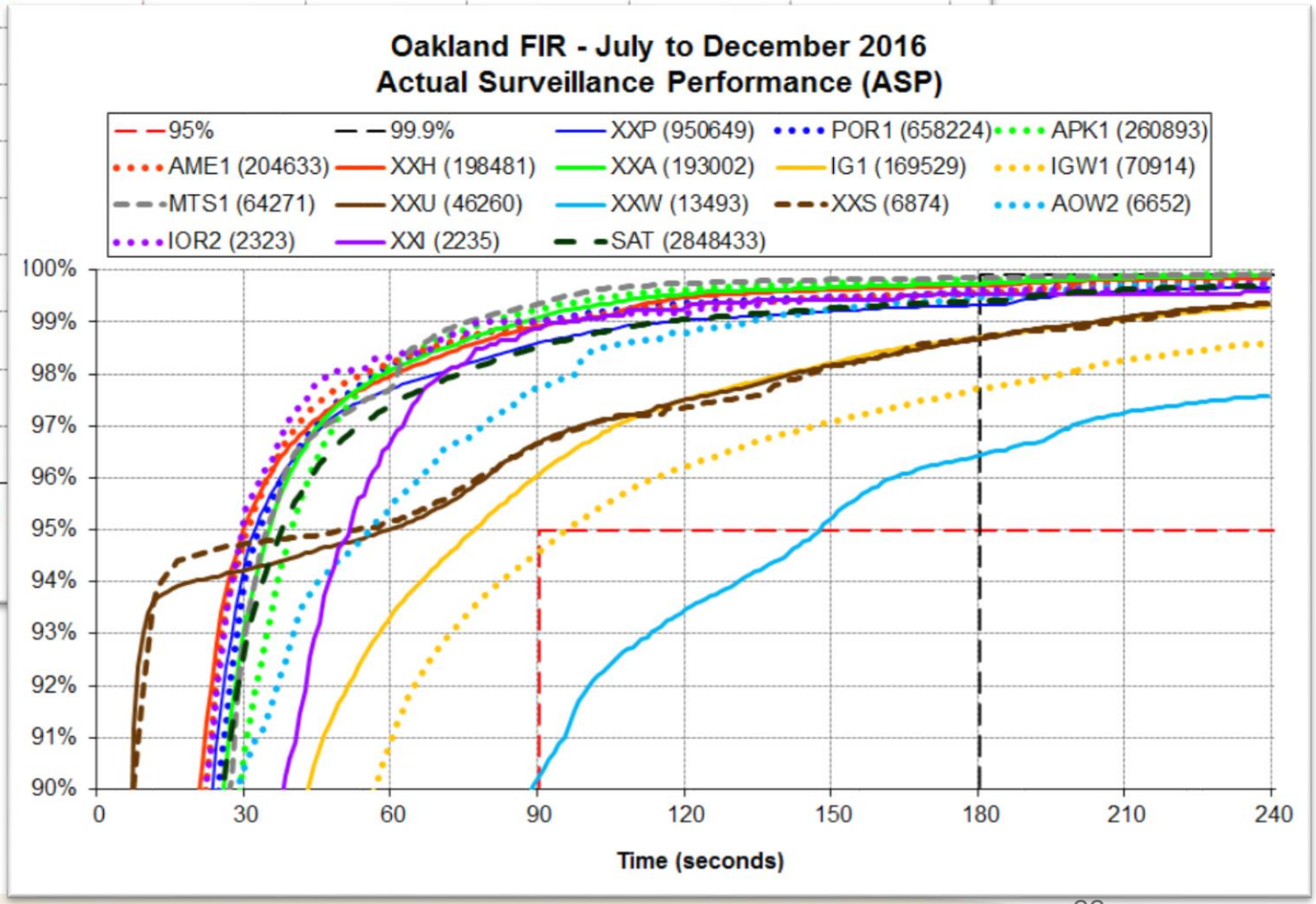
- Station identifiers designate "path" taken by data link messages between aircraft and ATC
- "Paths" vary between the four constellations of satellites and between the two data link service providers

June – December 2016

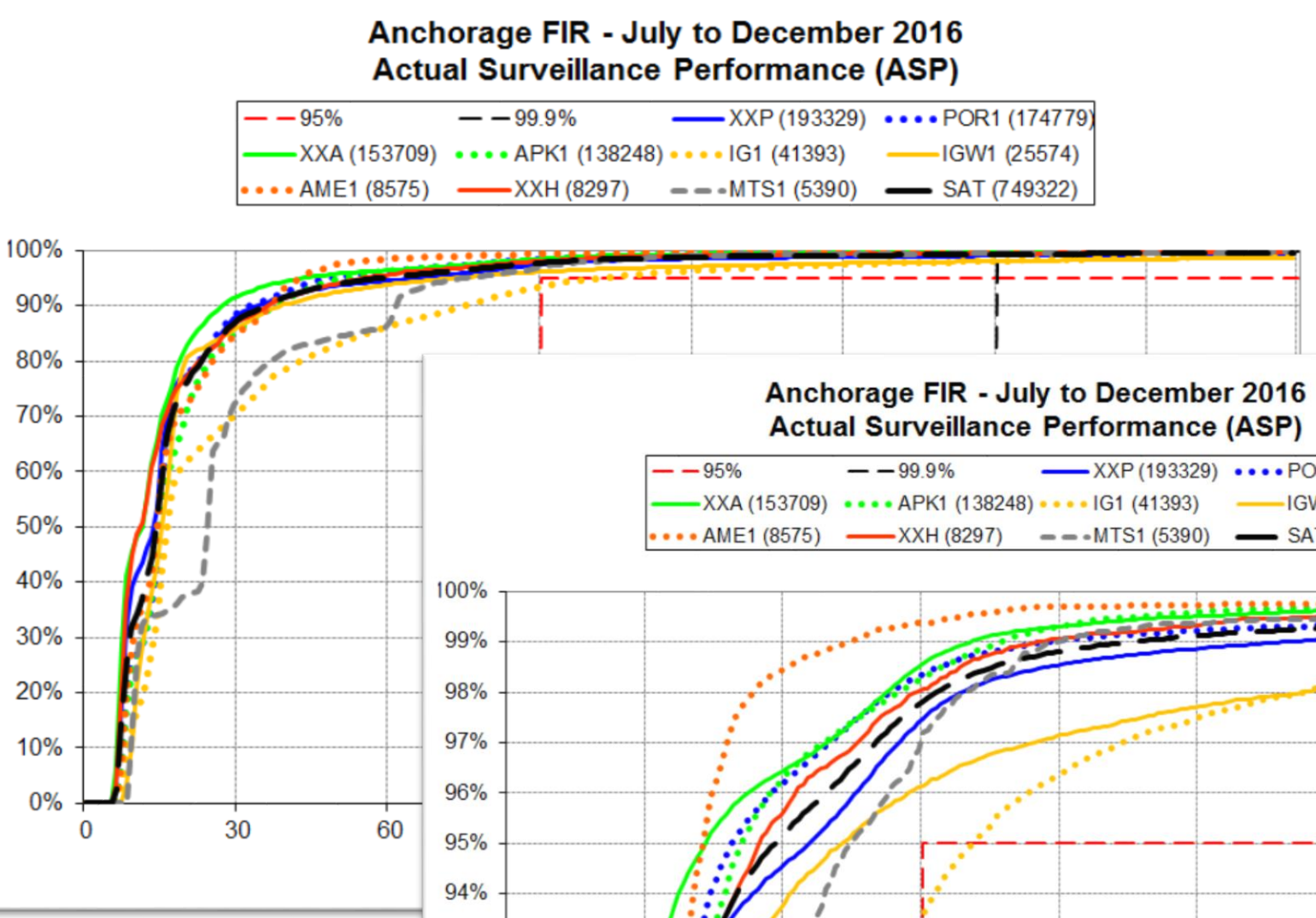
ASP BY STATION IDENTIFIER

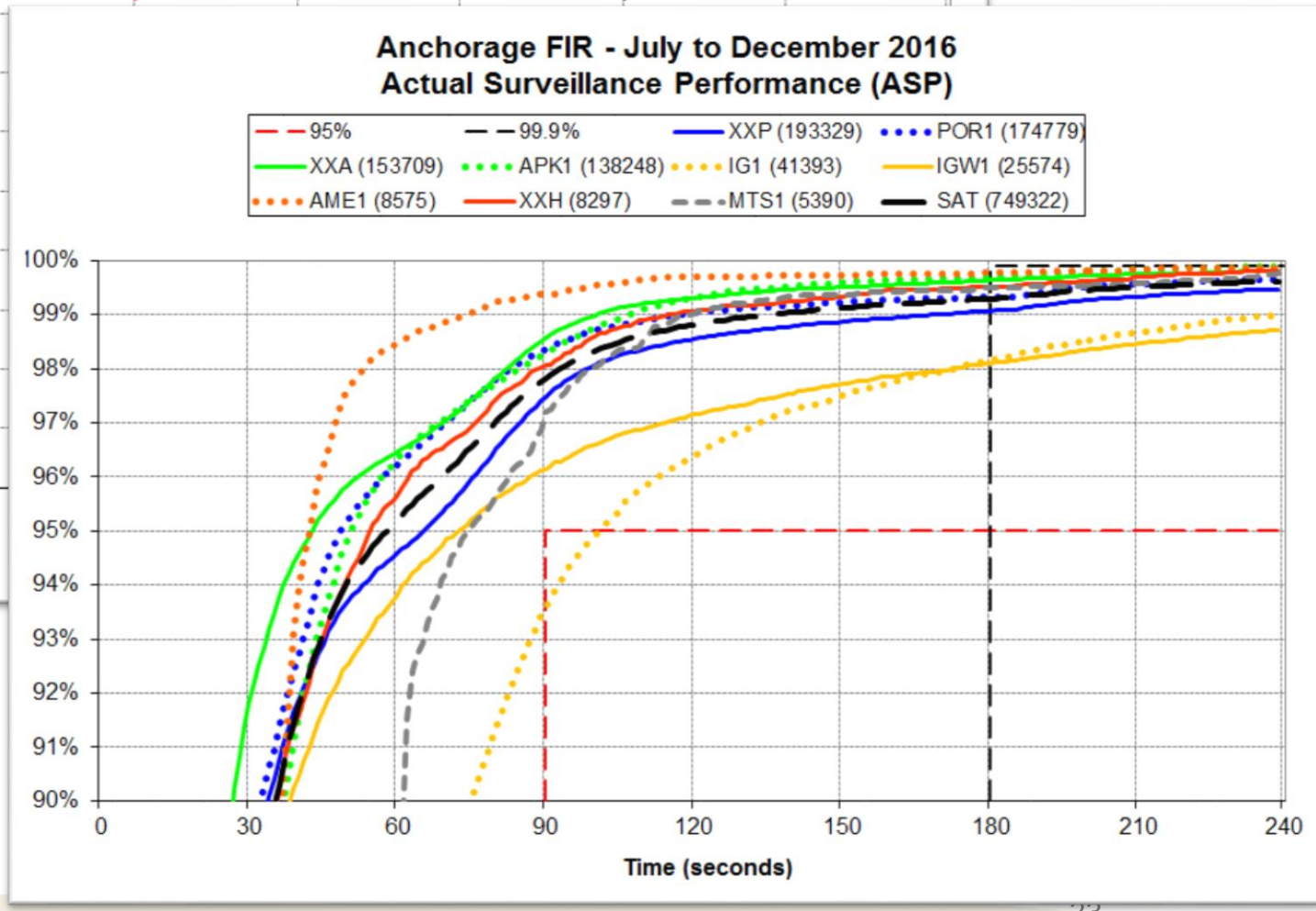
GES Location(s)	Satellite/ Region	SITA	ARINC
Burum, Netherlands	Inmarsat I-3 AOR-E	AOE2	XXN
	Inmarsat I-3 AOR-W	AOW2	XXW
Perth, Australia	Inmarsat I-3 IOR	IOR2	XXI
	Inmarsat I-3 POR	POR1	XXP
Fucino, Italy	Inmarsat I-4 EMEA	EUA1	XXF
	Inmarsat I-4 EMEA SBB	EME9	XXB
Paumalu, Hawaii, US	Inmarsat I-4 Americas	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


Oakland FIR - July to December 2016
Actual Surveillance Performance (ASP)
95%
99.9%
XXP (950649)
POR1 (658224)
APK1 (260893)
AME1 (204633)
XXH (198481)
XXA (193002)
IG1 (169529)
IGW1 (70914)
MTS1 (64271)
XXU (46260)
XXW (13493)
XXS (6874)
AOW2 (6652)
IOR2 (2323)
XXI (2235)
SAT (2848433)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30
60

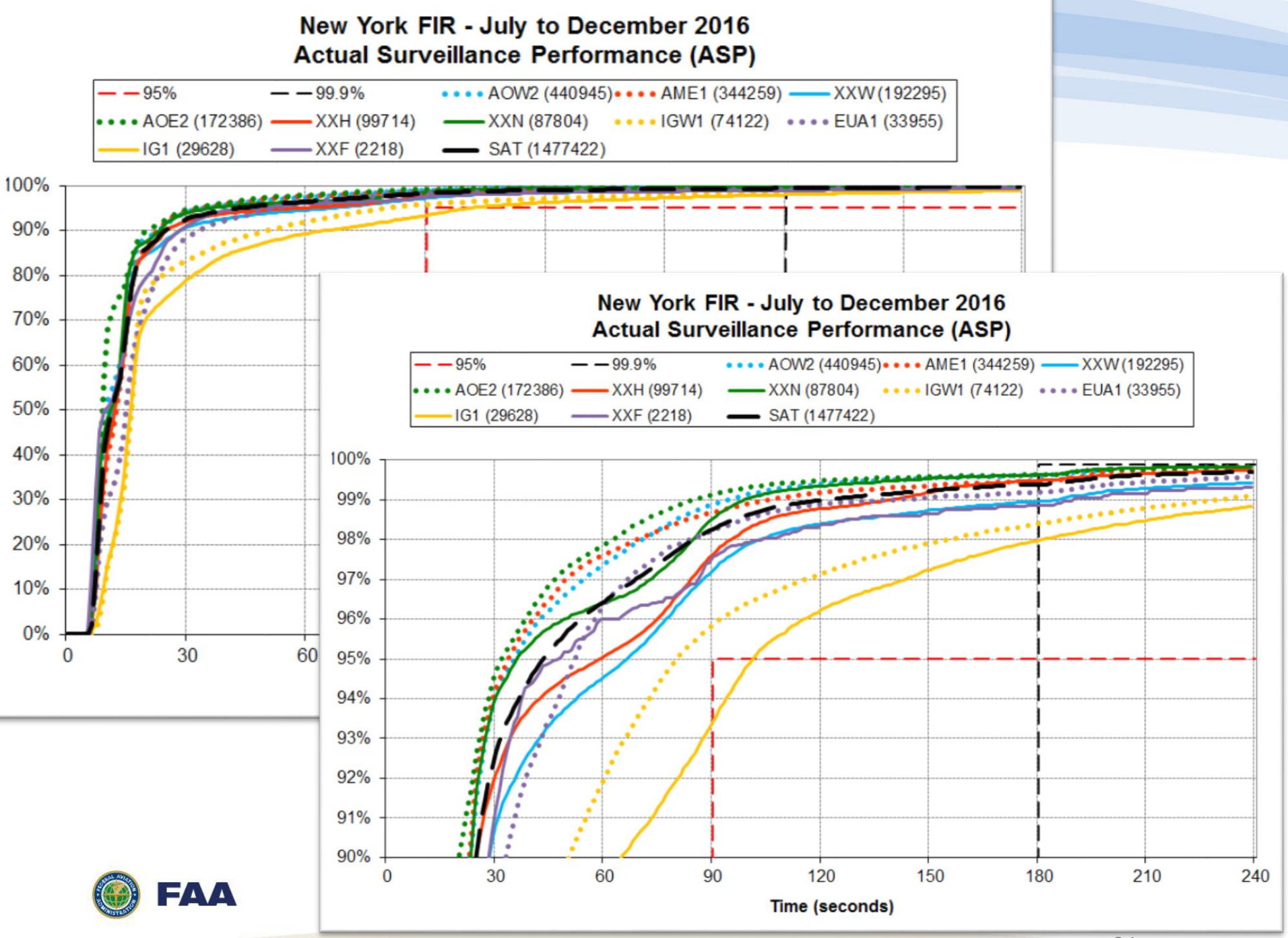

Oakland FIR - July to December 2016
Actual Surveillance Performance (ASP)
95%
99.9%
XXP (950649)
POR1 (658224)
APK1 (260893)
AME1 (204633)
XXH (198481)
XXA (193002)
IG1 (169529)
IGW1 (70914)
MTS1 (64271)
XXU (46260)
XXW (13493)
XXS (6874)
AOW2 (6652)
IOR2 (2323)
XXI (2235)
SAT (2848433)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

FAA


Anchorage FIR - July to December 2016
Actual Surveillance Performance (ASP)
95%
99.9%
XXP (193329)
POR1 (174779)
XXA (153709)
APK1 (138248)
IG1 (41393)
IGW1 (25574)
AME1 (8575)
XXH (8297)
MTS1 (5390)
SAT (749322)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30
60


Anchorage FIR - July to December 2016
Actual Surveillance Performance (ASP)
95%
99.9%
XXP (193329)
POR1 (174779)
XXA (153709)
APK1 (138248)
IG1 (41393)
IGW1 (25574)
AME1 (8575)
XXH (8297)
MTS1 (5390)
SAT (749322)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

FAA


New York FIR - July to December 2016
Actual Surveillance Performance (ASP)
95%
99.9%
AOW2 (440945)
AME1 (344259)
XXW (192295)
AOE2 (172386)
XXH (99714)
XXN (87804)
IGW1 (74122)
EUA1 (33955)
IG1 (29628)
XXF (2218)
SAT (1477422)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30
60
New York FIR - July to December 2016
Actual Surveillance Performance (ASP)
95%
99.9%
AOW2 (440945)
AME1 (344259)
XXW (192295)
AOE2 (172386)
XXH (99714)
XXN (87804)
IGW1 (74122)
EUA1 (33955)
IG1 (29628)
XXF (2218)
SAT (1477422)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

FAA

July – December 2016

DATA LINK PERFORMANCE BY OPERATOR/AIRCRAFT TYPE

Summary of Performance by Operator/Aircraft Type
July – December 2016

- **OAKLAND FIR**
  - **151** operator/aircraft type pairs with at least 100 ADS-C messages
  - **95** operator/aircraft type pairs with at least 100 RCP transactions during this 6-month period
- **ANCHORAGE FIR**
  - **99** operator/aircraft type pairs with at least 100 ADS-C messages
  - **55** operator/aircraft type pairs with at least 100 RCP transactions during this 6-month period
- **NEW YORK FIR**
  - **221** operator/aircraft type pairs with at least 100 ADS-C messages
  - **94** operator/aircraft type pairs with at least 100 RCP transactions during this 6-month period

Operator/Aircraft Types Not Meeting RSP180/RCP240

Operator/ Aircraft Type	ADS-C				CPDLC						
	Count of ADS-C	% of Total ADS-C	ADS-C 95%	ADS-C 99.9%	Count of CPDLC	% of Total CPDLC	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%	PORT 95%
EVA/B77W	96,930	3.0%	97.7%	98.5%	4,493	3.7%	99.6%	99.6%	99.6%	99.8%	99.6%
UAL/B744	61,831	1.9%	98.7%	99.2%	3,559	3.0%	98.9%	99.0%	97.7%	98.2%	91.4%
VRD/A320	43,174	1.4%	96.8%	98.4%	940	0.8%	99.4%	99.6%	97.1%	97.9%	92.1%
ASA/B738	31,308	1.0%	94.3%	97.9%	1,583	1.3%	98.1%	98.7%	96.8%	97.0%	92.7%
UAL/B752*	21,944	0.7%	95.1%	98.4%	570	0.5%	99.7%	99.7%	98.4%	98.8%	94.9%
DAL/B752	16,201	0.5%	89.3%	96.2%	203	0.2%	96.1%	97.0%	94.6%	95.1%	91.1%
CKS/B744	10,752	0.3%	95.9%	98.4%	185	0.2%	99.5%	99.5%	98.9%	99.5%	94.6%
ASA/B739	10,625	0.3%	94.1%	97.8%	599	0.5%	97.0%	97.8%	95.7%	96.5%	90.7%
UPS/B744	9,338	0.3%	97.2%	98.8%	196	0.2%	98.0%	99.0%	97.5%	98.5%	94.9%
UPS/B763	6,161	0.2%	95.6%	97.7%	98	0.1%	95.9%	96.9%	95.9%	96.9%	94.9%
CSC/A333	4,828	0.2%	97.0%	98.6%	66	0.1%	95.5%	97.0%	97.0%	97.0%	98.5%
ASY/C17	2,796	0.1%	99.2%	99.5%	139	0.1%	99.3%	99.3%	95.7%	96.4%	92.1%
CES/A333	2,209	0.1%	96.8%	98.0%							
ABW/B744	460	0.0%	96.5%	97.4%							
CAL/A343	273	0.0%	98.2%	98.5%							
GTI/BLCF	225	0.0%	91.6%	95.6%							
UAL/B753	102	0.0%	82.4%	85.3%							

Operator/Aircraft Types Not Meeting RSP180/RCP240

Operator/ Aircraft Type	ADS-C				CPDLC						
	Count of ADS-C	% of Total ADS-C	ADS-C 95%	ADS-C 99.9%	Count of CPDLC	% of Total CPDLC	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%	PORT 95%
UPS/MD11	20,867	1.9%	96.1%	97.8%	234	0.9%	97.9%	97.9%	97.0%	97.4%	97.4%
UPS/B744	20,485	1.9%	96.7%	98.3%	356	1.4%	97.8%	97.8%	94.4%	96.4%	93.5%
UAL/B789	18,101	1.6%	97.9%	98.5%	486	1.9%	97.1%	97.1%	97.1%	97.1%	98.8%
UAL/B788	10,820	1.0%	97.2%	98.1%	200	0.8%	98.0%	98.0%	98.0%	98.0%	99.5%
UPS/B763	9,421	0.9%	95.4%	97.6%	121	0.5%	95.9%	95.9%	92.6%	93.4%	94.2%
UPS/B763-New	8,856	0.8%	95.5%	97.6%							
UPS/B744 (FOI)	8,469	0.8%	94.1%	97.1%							
ACA/B763	1,144	0.1%	95.8%	98.9%							
ASA/B738	228	0.0%	91.7%	99.1%							
FDX/B763	196	0.0%	95.4%	98.5%							

Operator/Aircraft Types Not Meeting RSP180/RCP240

Operator/ Aircraft Type	ADS-C				CPDLC						
	Count of ADS-C	% of Total ADS-C	ADS-C 95%	ADS-C 99.9%	Count of CPDLC	% of Total CPDLC	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%	PORT 95%
VIR/B744	40,012	2.1%	95.7%	99.1%	1,340	2.3%	99.3%	99.9%	97.2%	97.9%	91.9%
AVA/B788	27,242	1.4%	97.4%	98.5%	1,454	2.4%	98.6%	99.0%	98.7%	99.2%	98.5%
UAL/B763	27,070	1.4%	97.2%	98.5%	592	1.0%	99.3%	99.3%	98.7%	99.3%	97.0%
SAA/A346	20,354	1.1%	98.9%	99.4%	622	1.0%	98.4%	98.6%	98.2%	98.6%	96.6%
UAL/B764	16,406	0.9%	95.6%	98.2%	321	0.5%	97.8%	98.1%	97.8%	98.1%	98.1%
DAL/B752	12,038	0.6%	94.0%	96.8%	189	0.3%	98.4%	98.4%	97.4%	97.9%	97.9%
UAL/B772	9,730	0.5%	97.8%	99.2%	165	0.3%	98.8%	98.8%	97.6%	97.6%	98.2%
ACA/B763	9,681	0.5%	94.0%	97.9%	111	0.2%	98.2%	98.2%	95.5%	95.5%	90.1%
ARG/A332	9,556	0.5%	98.8%	99.9%	122	0.2%	100.0%	100.0%	98.4%	98.4%	91.0%
ROU/B763	8,451	0.4%	94.9%	98.7%	91	0.2%	97.8%	98.9%	96.7%	97.8%	94.5%
UAL/B752	7,535	0.4%	95.4%	97.9%	219	0.4%	99.5%	99.5%	99.1%	99.1%	97.7%
DLH/B744	7,298	0.4%	97.3%	98.5%	265	0.4%	98.9%	99.3%	97.7%	98.5%	95.1%
ETH/B788	5,628	0.3%	97.0%	98.0%	89	0.1%	100.0%	100.0%	100.0%	100.0%	97.8%
ARA/A332	4,757	0.2%	94.9%	98.5%	198	0.3%	100.0%	100.0%	99.0%	100.0%	97.0%
PLM/B744	4,312	0.2%	94.5%	95.8%	197	0.3%	99.0%	99.0%	98.5%	98.5%	98.5%
TFL/B763	4,164	0.2%	96.4%	98.5%	118	0.2%	99.2%	100.0%	94.9%	95.8%	93.2%
LPE/B763	3,784	0.2%	96.8%	98.1%	91	0.2%	100.0%	100.0%	98.9%	98.9%	90.1%
UPS/MD11	3,249	0.2%	96.9%	98.2%							
DLH/B748	3,193	0.2%	98.0%	99.6%	106	0.2%	96.2%	97.2%	95.3%	95.3%	96.2%
LNE/B763	2,339	0.1%	97.8%	98.5%	105	0.2%	99.1%	99.1%	96.2%	97.1%	97.1%

FAA

NextGEN

Operator/Aircraft Types Not Meeting RSP180/RCP240

Operator/ Aircraft Type	ADS-C				CPDLC						
	Count of ADS-C	% of Total ADS-C	ADS-C 95%	ADS-C 99.9%	Count of CPDLC	% of Total CPDLC	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%	PORT 95%
VKG/A333	1,299	0.1%	95.8%	98.0%							
TOM/B763	1,174	0.1%	95.4%	98.0%							
RJA/B788	1,040	0.1%	94.5%	96.0%							
GTI/B748	987	0.1%	94.5%	96.0%							
CMB/MD11	922	0.0%	96.6%	98.1%							
UAL/B788	715	0.0%	97.8%	98.5%							
SIA/A388	574	0.0%	98.1%	98.4%							
AFL/A332	549	0.0%	96.4%	97.8%							
VKG/A332	532	0.0%	97.2%	98.5%							
UPS/B763-New	530	0.0%	94.7%	97.7%							
BLX/B763	458	0.0%	91.7%	96.9%							
UPS/B763	389	0.0%	94.6%	97.9%							
ACA/A319	376	0.0%	93.1%	97.3%							
DJT/B752	185	0.0%	86.5%	91.9%							
AAL/B738	181	0.0%	92.8%	93.9%							
BAW/A318	147	0.0%	91.2%	95.9%							
ACA/B77W	147	0.0%	94.6%	98.0%							
DUB/B744	119	0.0%	98.3%	98.3%							
ICV/B744	117	0.0%	94.0%	98.3%							
ETD/B744	115	0.0%	92.2%	96.5%							
GLF/G280	109	0.0%	90.8%	96.3%							
HVN/B789	105	0.0%	90.5%	91.4%							

IGA Types – Oakland FIR

Operator/ Aircraft Type	ADS-C				CPDLC						
	Count of ADS-C	% of Total ADS-C	ADS-C 95%	ADS-C 99.9%	Count of CPDLC	% of Total CPDLC	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%	PORT 95%
BOM/CL60	692	0.0%	97.3%	98.7%							
BOM/GL5T	5,725	0.2%	97.9%	99.4%	94	0.1%	100.0%	100.0%	98.9%	100.0%	92.6%
BOM/GLEX	13,679	0.4%	98.3%	99.5%	340	0.3%	99.7%	99.7%	97.7%	97.7%	94.7%
DAS/F2TH	418	0.0%	95.9%	98.8%							
DAS/F900	1,279	0.0%	97.5%	98.8%							
DAS/FA7X	3,272	0.1%	97.3%	98.9%	81	0.1%	98.8%	98.8%	98.8%	100.0%	90.1%
GLF/G280	241	0.0%	96.7%	98.8%							
GLF/GLF4	8,336	0.3%	96.8%	98.6%	173	0.1%	97.7%	97.7%	94.8%	95.4%	82.7%
GLF/GLF5	15,246	0.5%	97.8%	99.1%	418	0.3%	99.3%	99.5%	97.6%	97.6%	93.5%
GLF/GLF6	9,665	0.3%	97.9%	99.3%	275	0.2%	97.8%	98.6%	98.2%	99.3%	96.4%
IGA/B737	703	0.0%	96.4%	98.4%							
IGA/B762	185	0.0%	100.0%	100.0%							
IGA/CL35	3,723	0.1%	94.6%	97.6%							
IGA/E135	423	0.0%	98.8%	100.0%							

IGA Types – Anchorage FIR

Operator/ Aircraft Type	ADS-C				CPDLC						
	Count of ADS-C	% of Total ADS-C	ADS-C 95%	ADS-C 99.9%	Count of CPDLC	% of Total CPDLC	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%	PORT 95%
BOM/GL5T	573	0.1%	98.6%	99.7%							
BOM/GLEX	2,884	0.3%	98.2%	99.7%							
DAS/F900	358	0.0%	98.9%	99.4%							
DAS/FA7X	859	0.1%	98.7%	99.1%							
GLF/G280	178	0.0%	98.9%	99.4%							
GLF/GLF4	1,205	0.1%	97.3%	97.9%							
GLF/GLF5	5,144	0.5%	97.9%	99.0%							
GLF/GLF6	2,347	0.2%	97.4%	98.6%							
IGA/B737	513	0.0%	99.6%	99.8%							

IGA Types – New York FIR

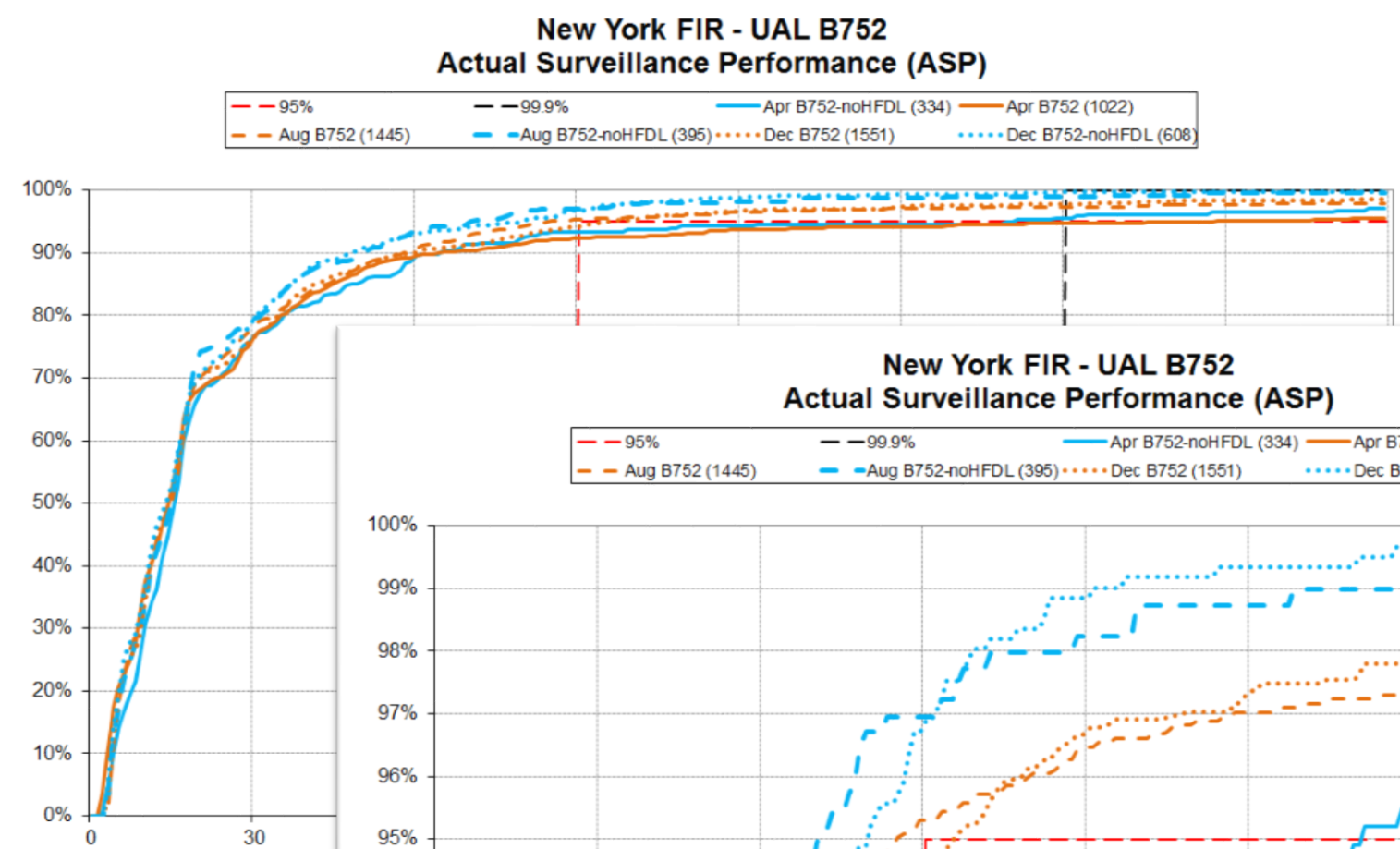
Operator/ Aircraft Type	ADS-C				CPDLC						
	Count of ADS-C	% of Total ADS-C	ADS-C 95%	ADS-C 99.9%	Count of CPDLC	% of Total CPDLC	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%	PORT 95%
BOM/CL30	167	0.0%	98.2%	100.0%							
BOM/CL60	866	0.0%	96.2%	98.2%							
BOM/GL5T	4,465	0.2%	97.3%	99.6%	102	0.2%	100.0%	100.0%	97.1%	98.0%	94.1%
BOM/GLEX	13,978	0.7%	97.8%	99.6%	298	0.5%	99.3%	100.0%	98.3%	99.3%	91.6%
DAS/F2TH	1,886	0.1%	96.6%	98.5%							
DAS/F900	3,060	0.2%	98.5%	99.3%	81	0.1%	100.0%	100.0%	96.3%	97.5%	86.4%
DAS/FA7X	6,352	0.3%	98.1%	99.2%	164	0.3%	100.0%	100.0%	96.3%	97.0%	89.0%
GLF/G280	109	0.0%	90.8%	96.3%							
GLF/GLF4	4,598	0.2%	97.1%	99.0%							
GLF/GLF5	13,012	0.7%	97.1%	98.9%	307	0.5%	99.4%	99.7%	95.1%	96.1%	92.2%
GLF/GLF6	4,352	0.2%	97.8%	99.4%	119	0.2%	99.2%	99.2%	99.2%	100.0%	96.6%
IGA/A319	153	0.0%	100.0%	100.0%							
IGA/B737	427	0.0%	99.8%	100.0%							
IGA/B748	100	0.0%	92.0%	99.0%							
IGA/CL35	2,796	0.1%	94.5%	97.9%							
IGA/E35L	131	0.0%	100.0%	100.0%							

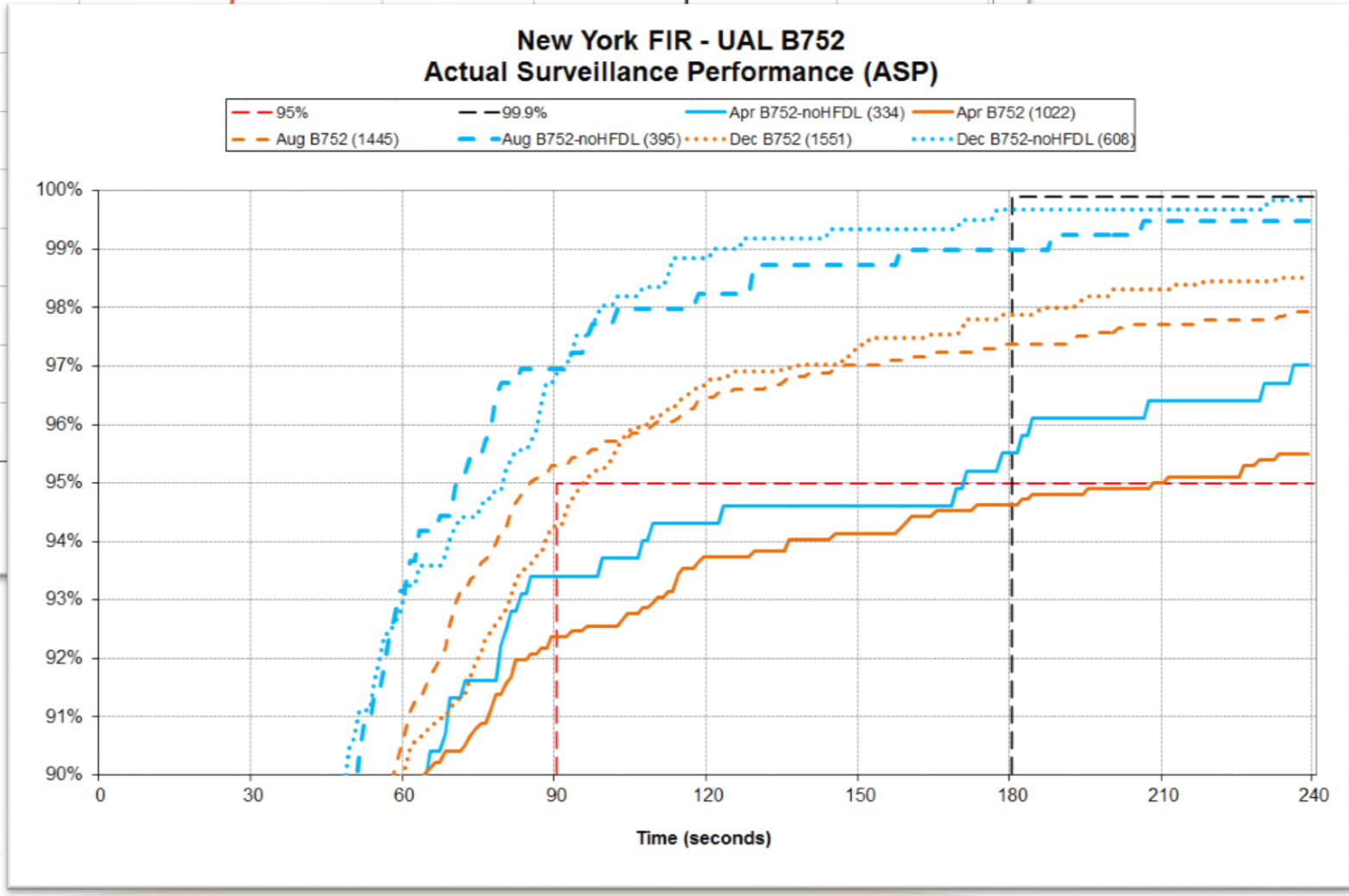
FAA

NextGEN

UAL B752 – HFDL Test

- UAL deactivated HFDL on ten of their forty-one B752 aircraft in May/June/July 2016
- Improved performance observed after deactivation


New York FIR - UAL B752
Actual Surveillance Performance (ASP)
95%
99.9%
Apr B752-noHFDL (334)
Apr B752 (1022)
Aug B752 (1445)
Aug B752-noHFDL (395)
Dec B752 (1551)
Dec B752-noHFDL (608)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30


New York FIR - UAL B752
Actual Surveillance Performance (ASP)
95%
99.9%
Apr B752-noHFDL (334)
Apr B752 (1022)
Aug B752 (1445)
Aug B752-noHFDL (395)
Dec B752 (1551)
Dec B752-noHFDL (608)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

FAA

FANS OVER IRIDIUM

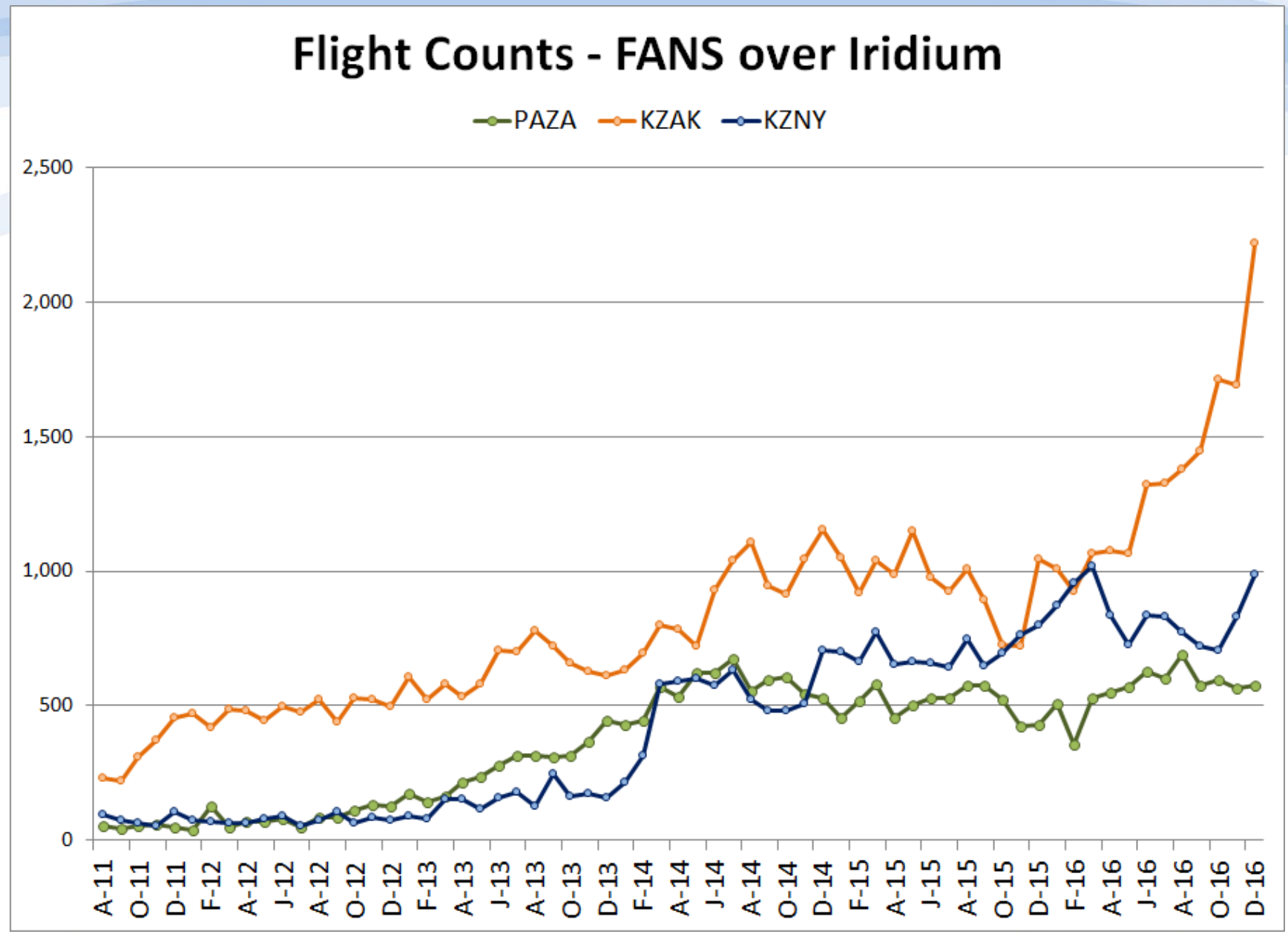
FANS over Iridium Data Link Usage

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

FAA

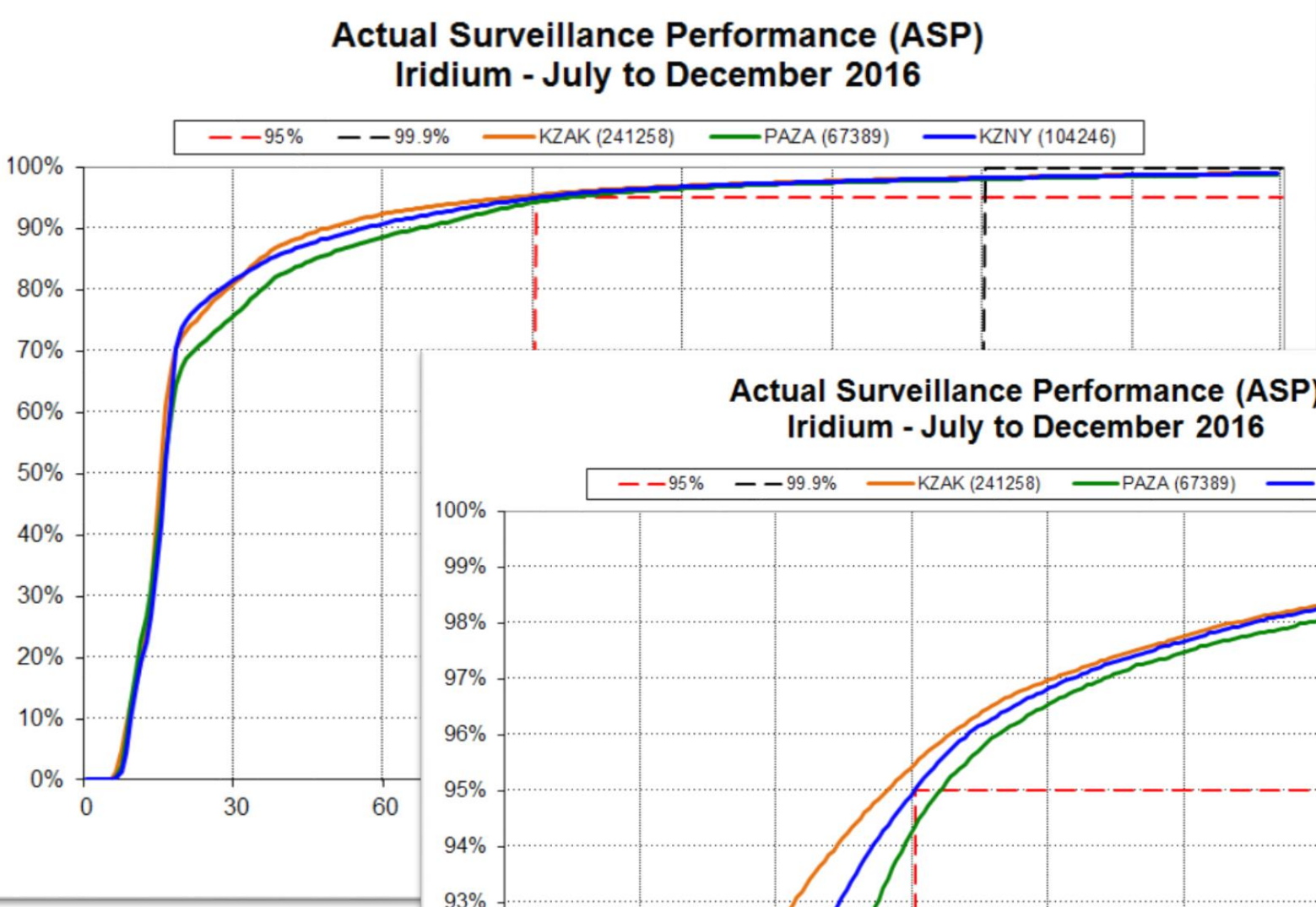
NextGEN

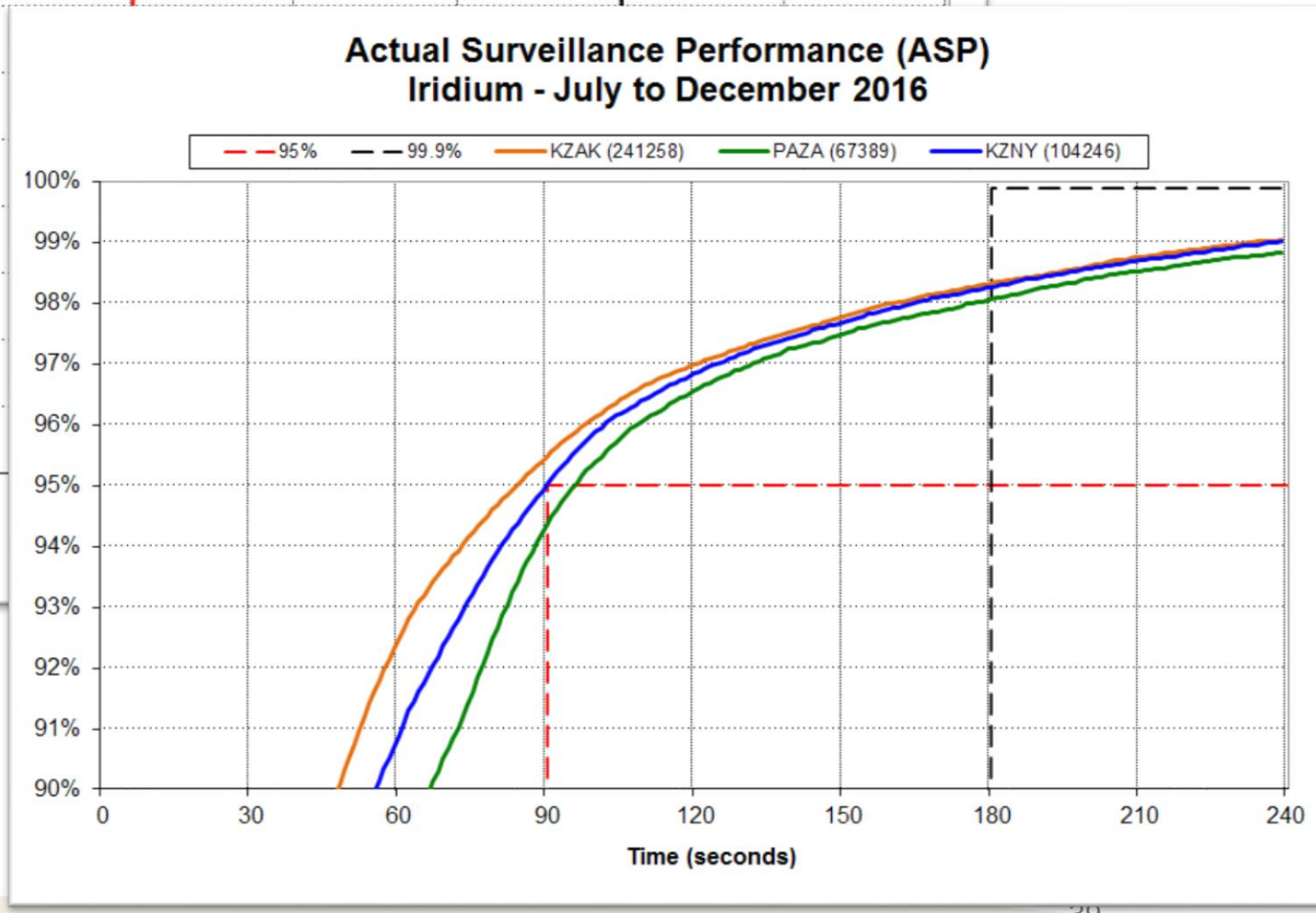
Flight Counts - FANS over Iridium



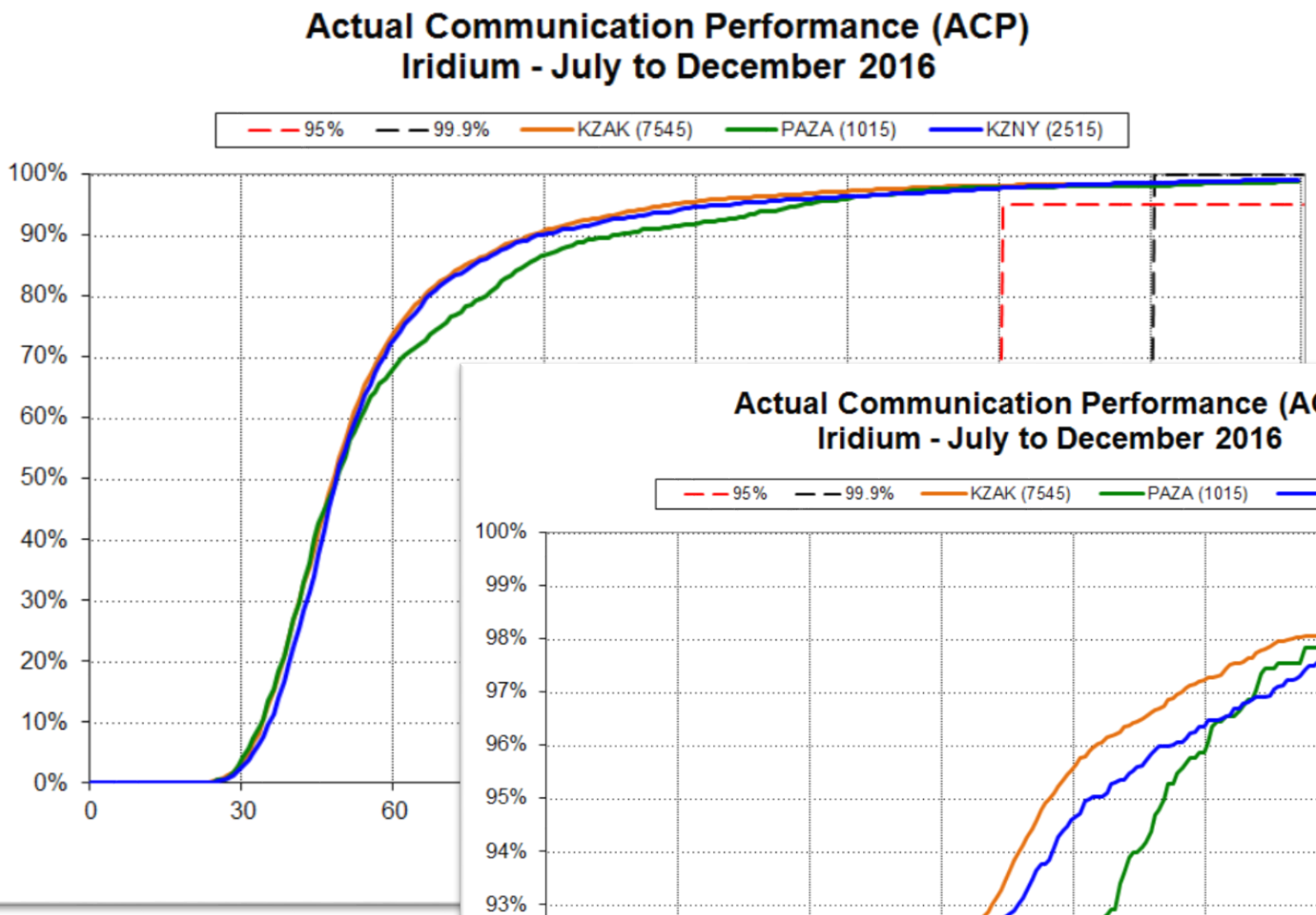
FAA

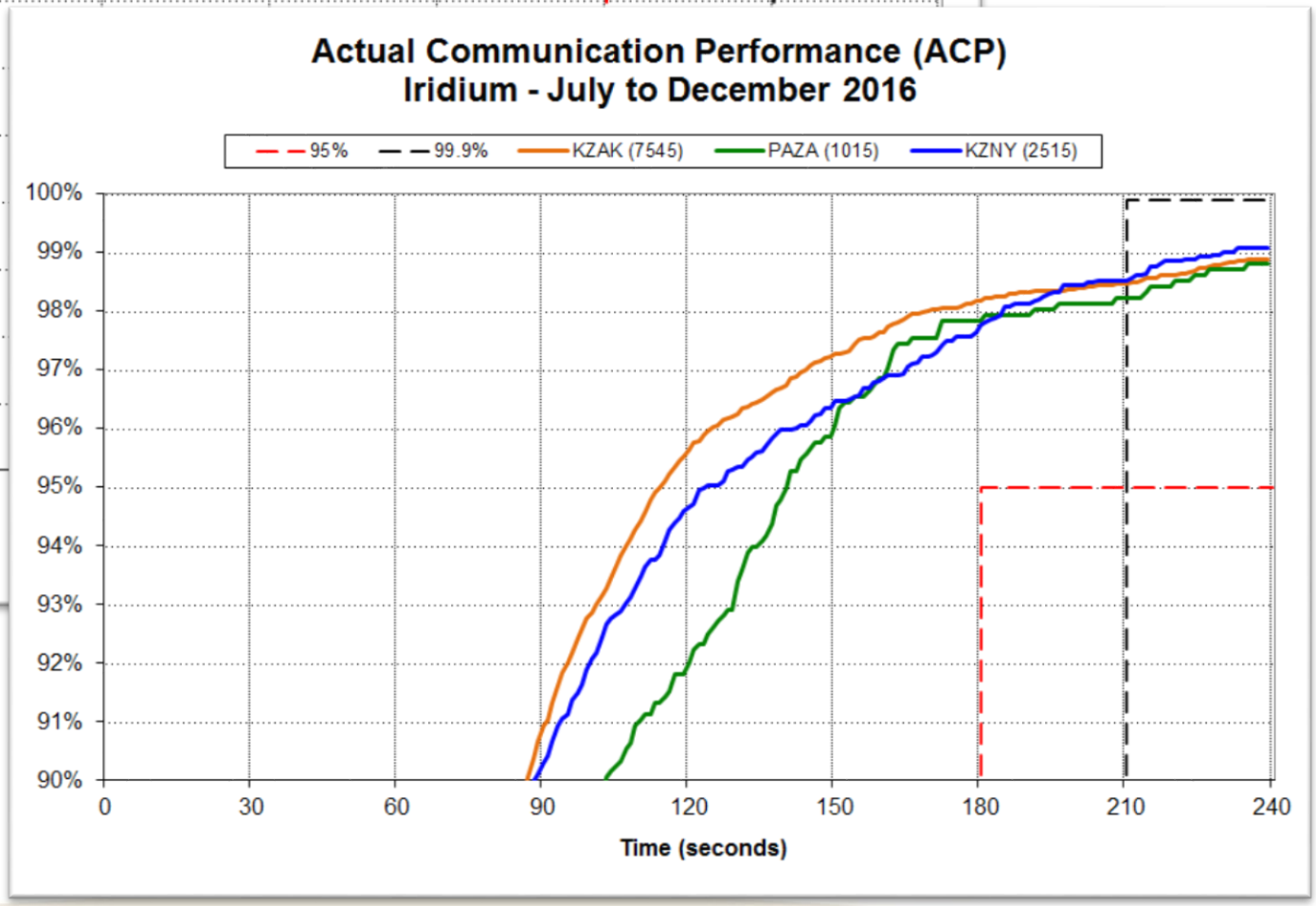
NextGEN


Actual Surveillance Performance (ASP)
Iridium - July to December 2016
95%
99.9%
KZAK (241258)
PAZA (67389)
KZNY (104246)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30
60


Actual Surveillance Performance (ASP)
Iridium - July to December 2016
95%
99.9%
KZAK (241258)
PAZA (67389)
KZNY (104246)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

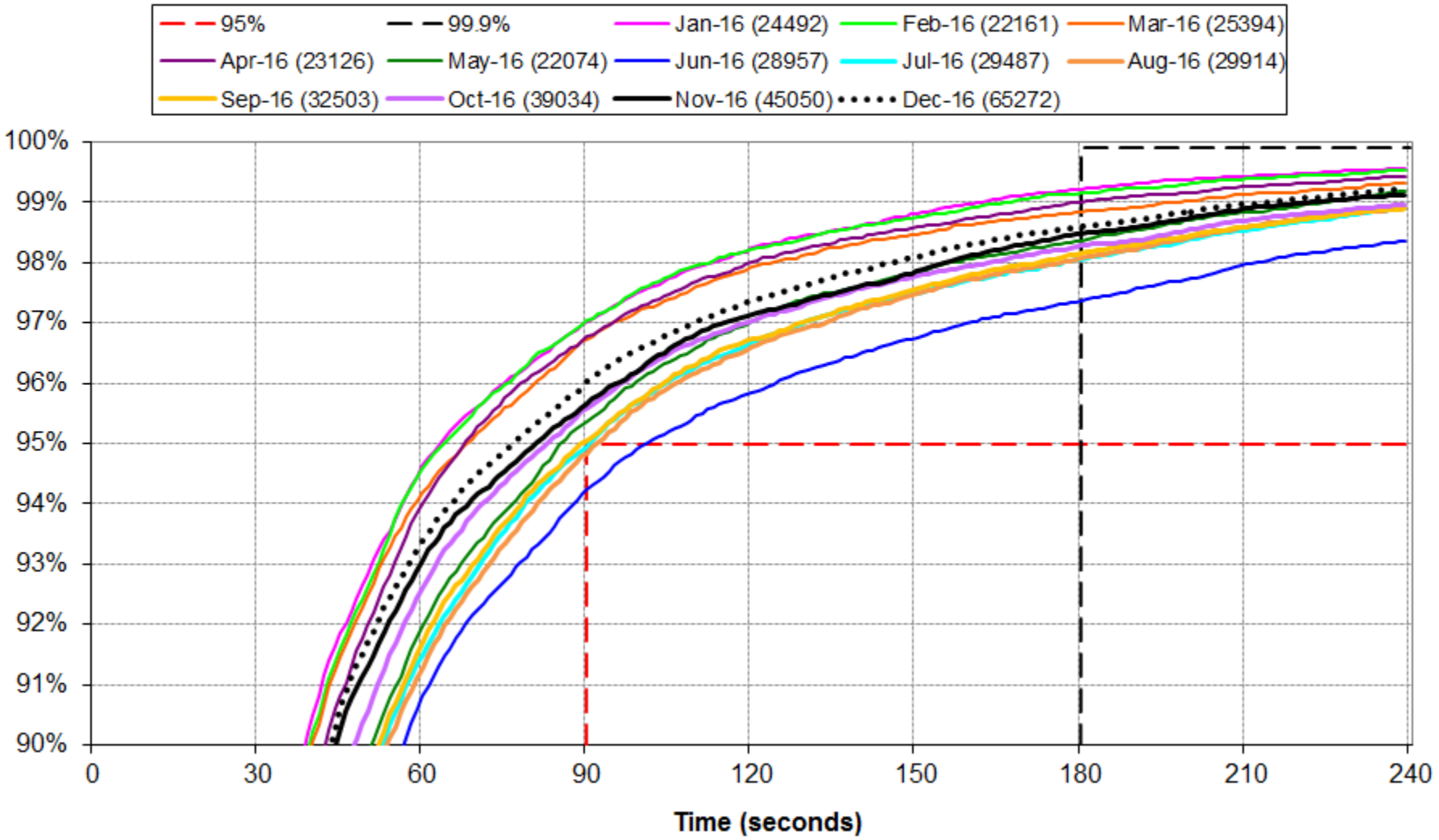
FAA


Actual Communication Performance (ACP)
Iridium - July to December 2016
95%
99.9%
KZAK (7545)
PAZA (1015)
KZNY (2515)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30
60


Actual Communication Performance (ACP)
Iridium - July to December 2016
95%
99.9%
KZAK (7545)
PAZA (1015)
KZNY (2515)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

FAA

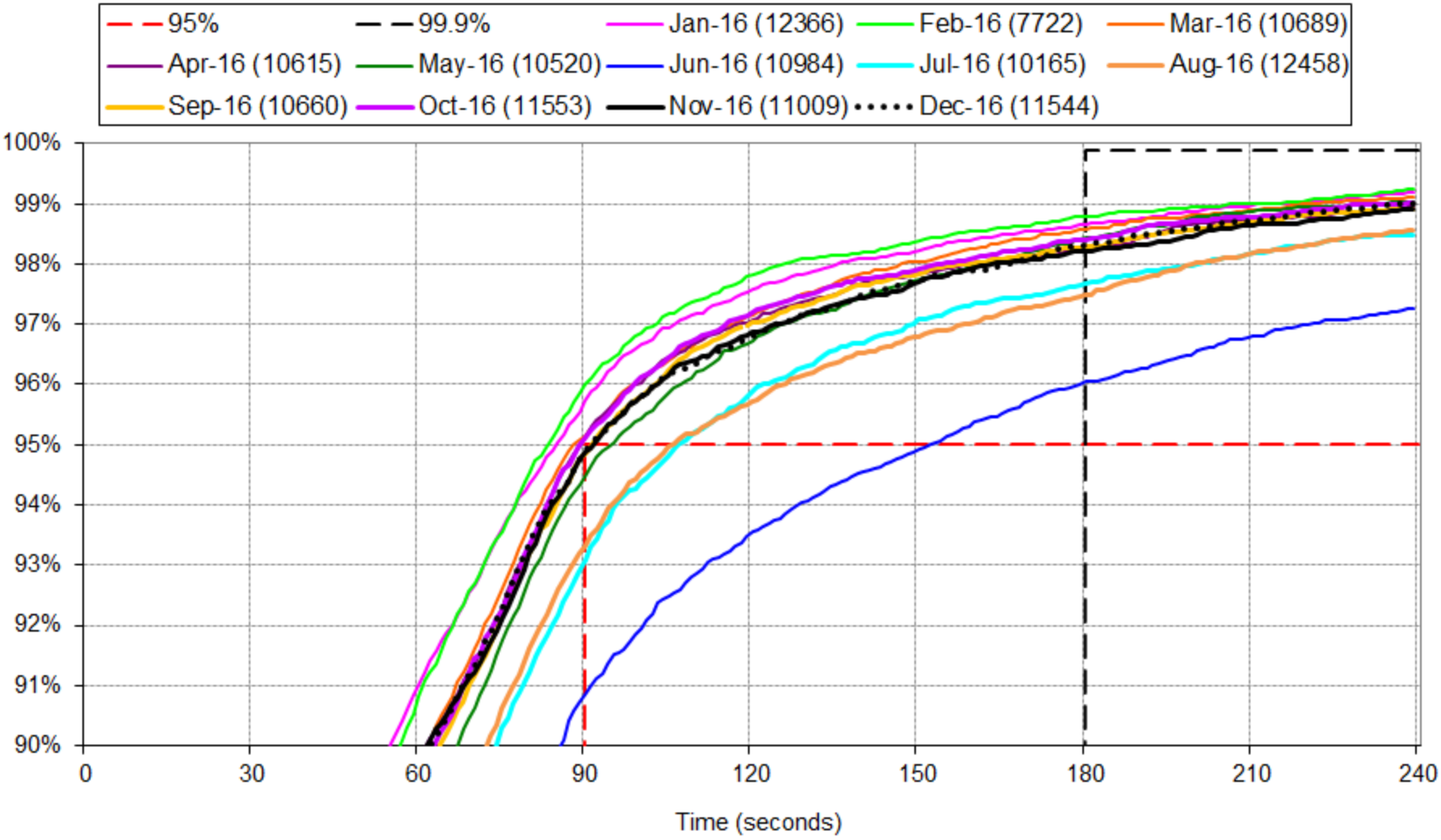
Oakland FIR - FANS over Iridium
Actual Surveillance Performance (ASP)



FAA

NextGEN

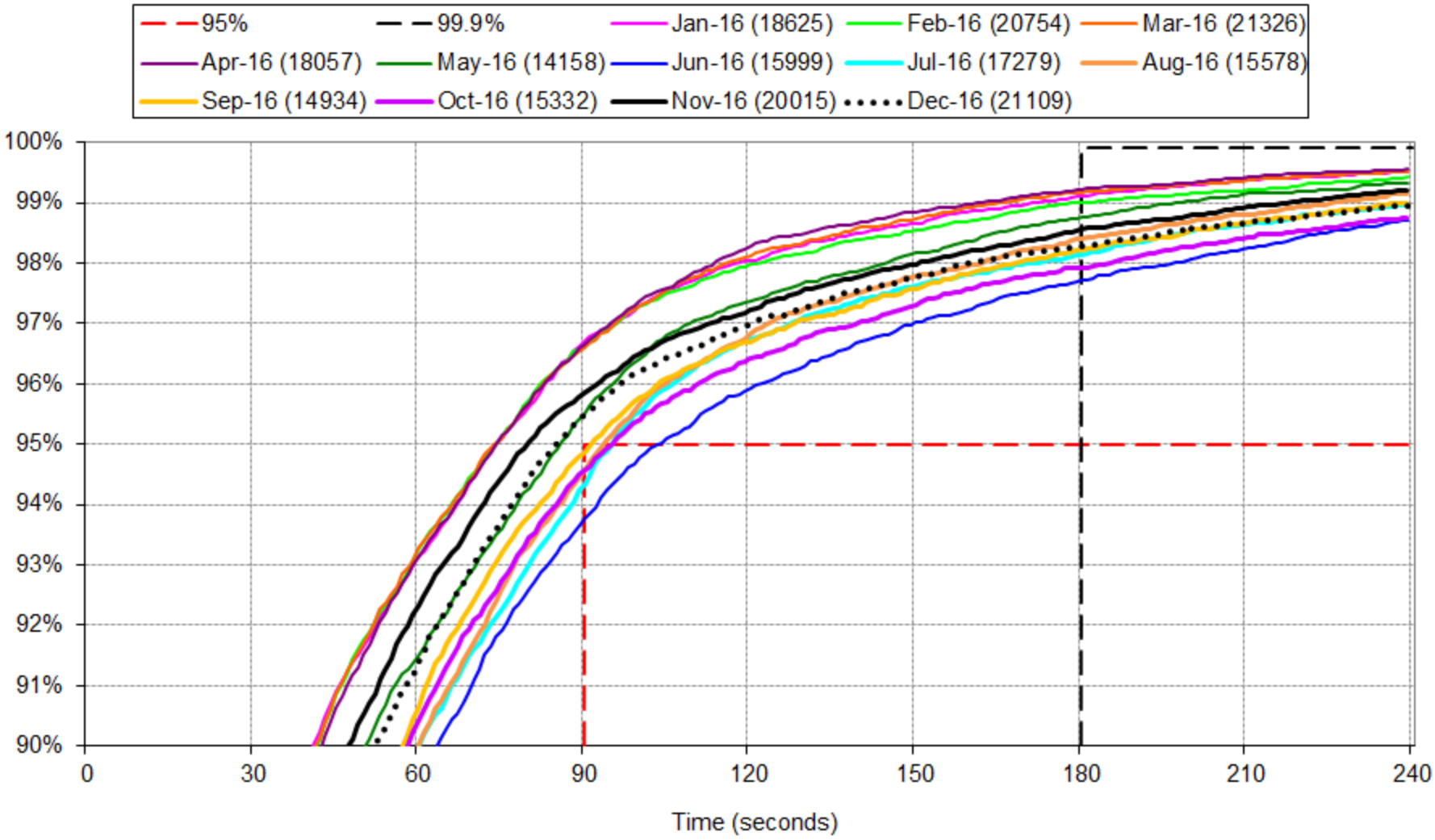
Anchorage FIR - FANS over Iridium
Actual Surveillance Performance (ASP)



FAA

NextGEN

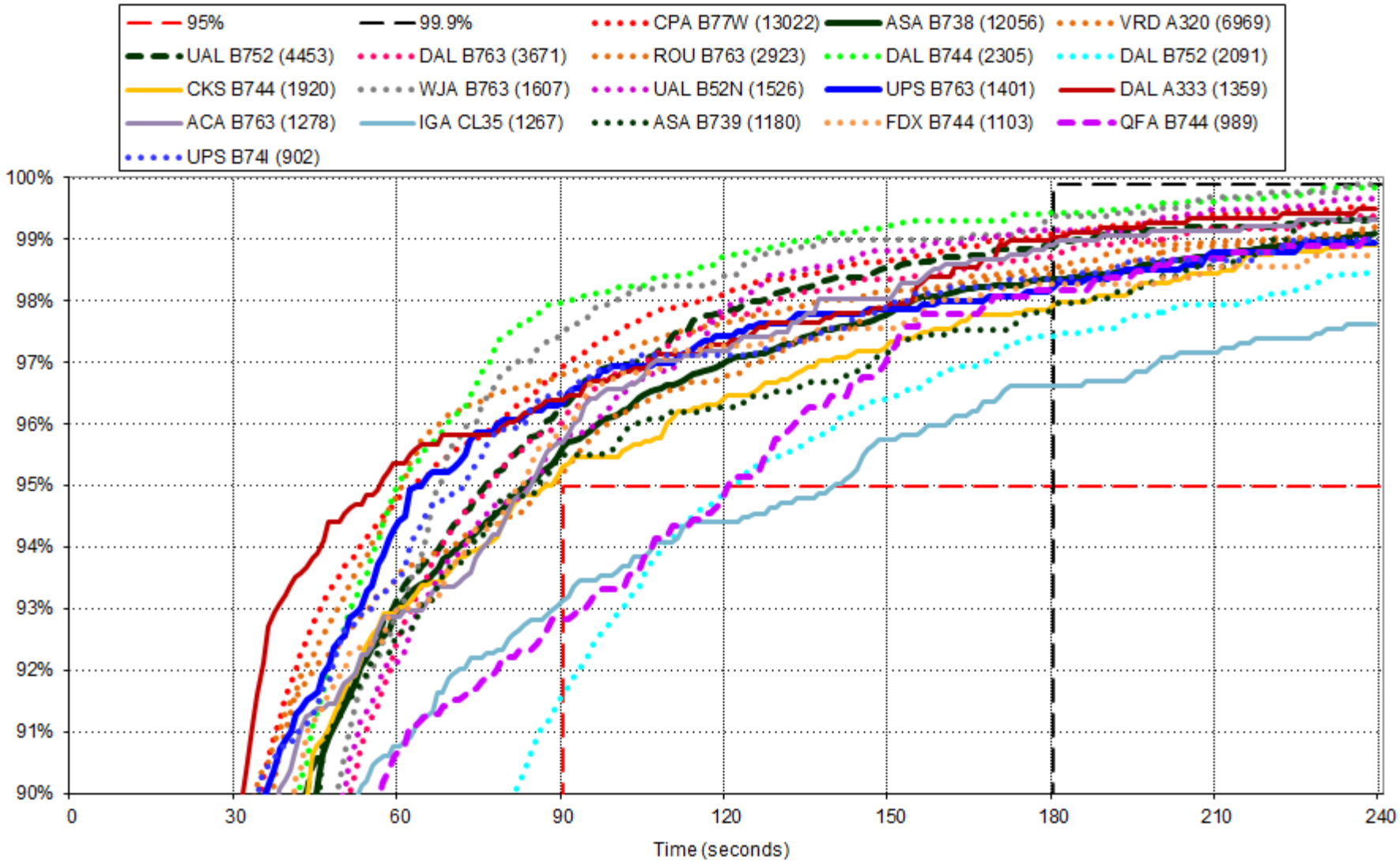
New York FIR - FANS over Iridium
Actual Surveillance Performance (ASP)



FAA

NextGEN

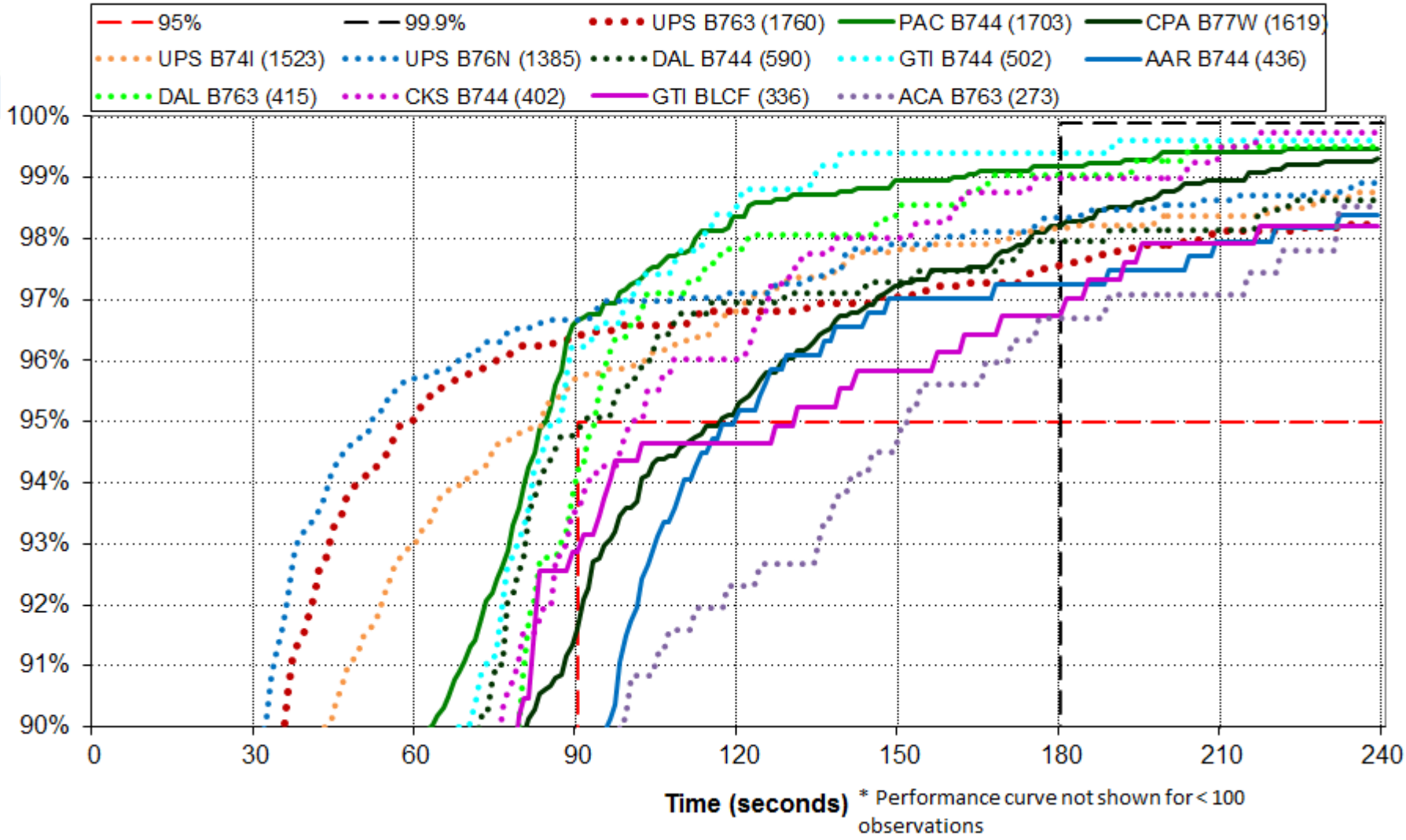
Oakland FIR - Iridium - December 2016
Actual Surveillance Performance (ASP)



FAA

NextGEN

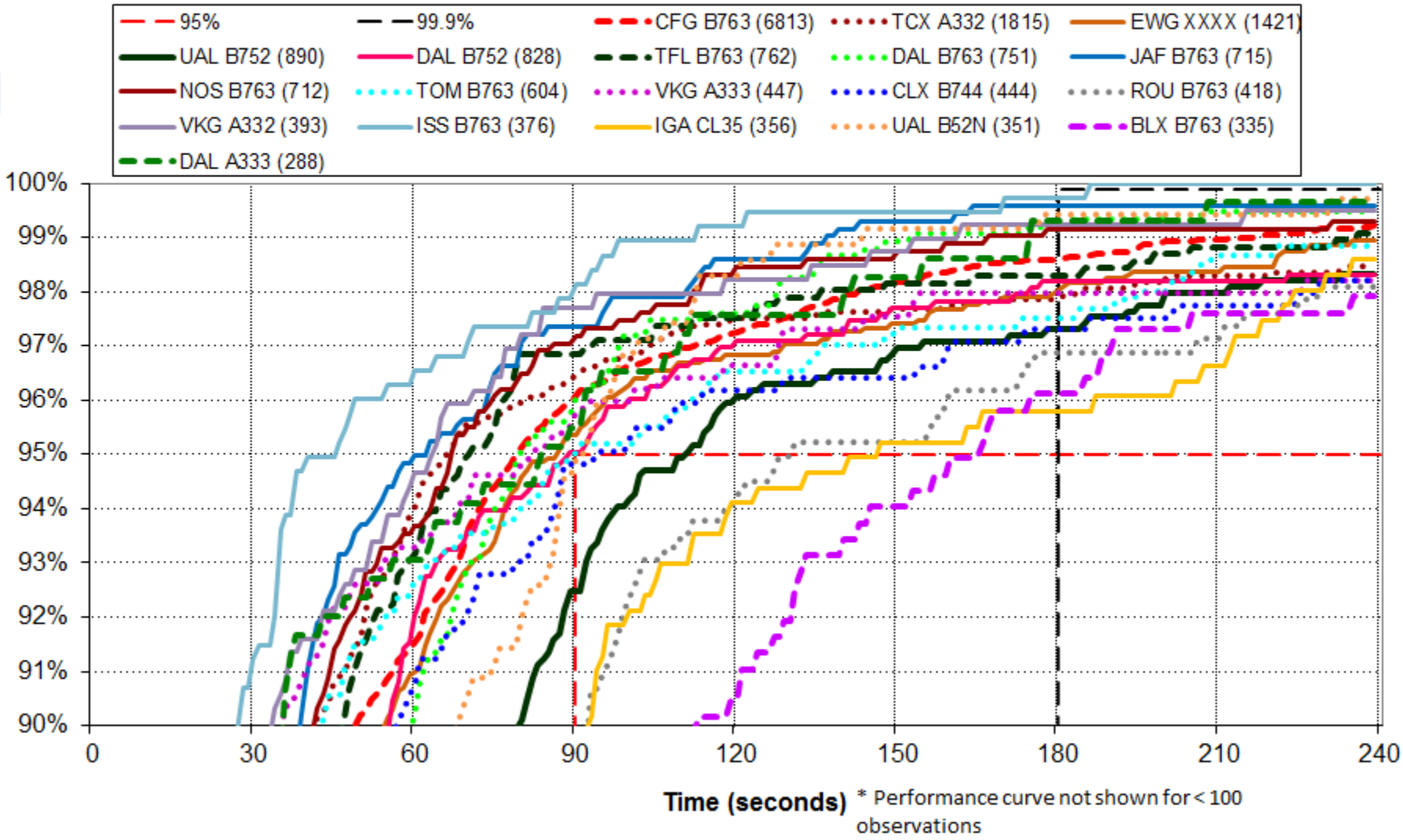
Anchorage FIR - Iridium - December 2016
Actual Surveillance Performance (ASP)



FAA

NextGEN

New York FIR - Iridium - December 2016
Actual Surveillance Performance (ASP)

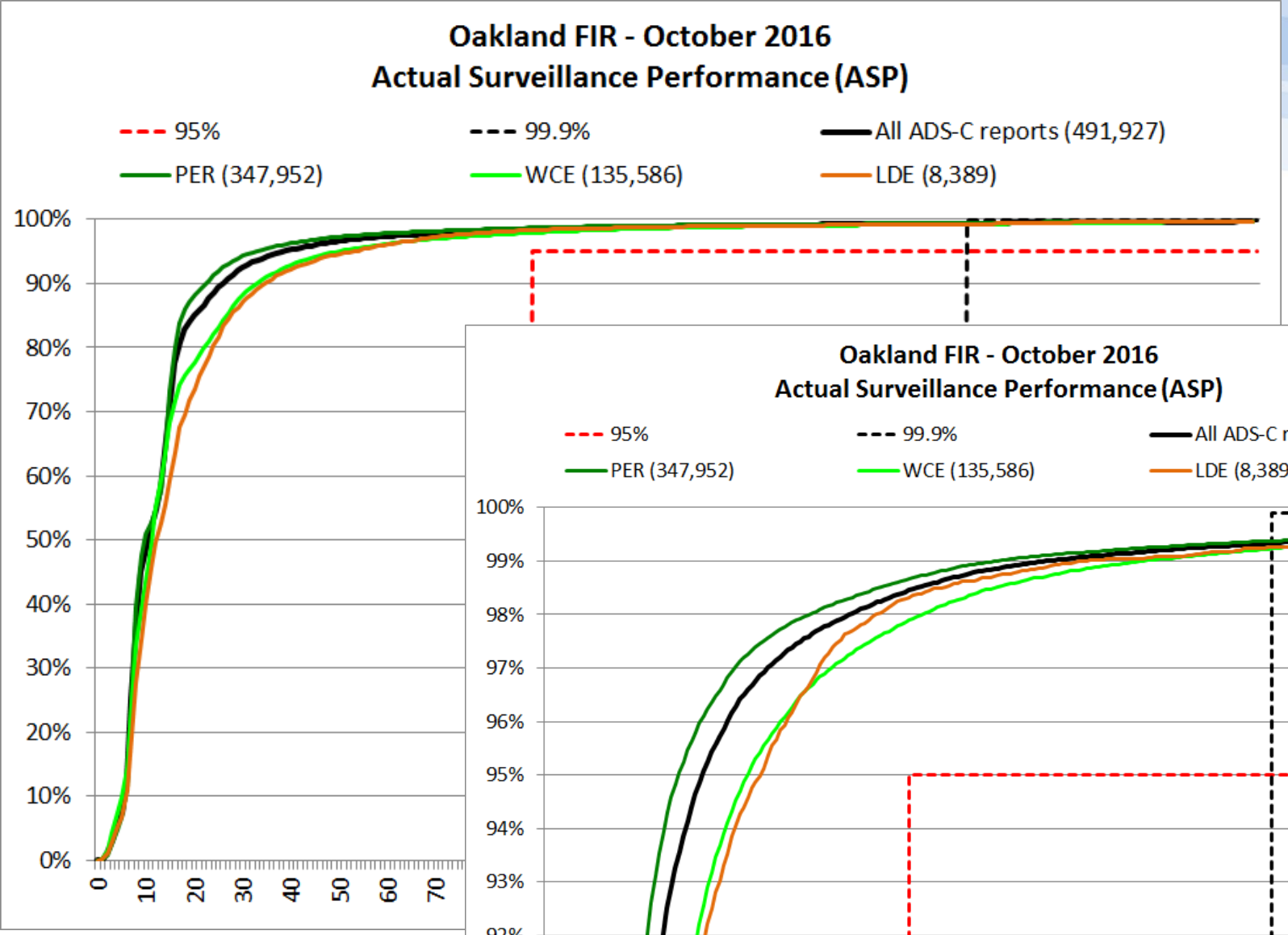


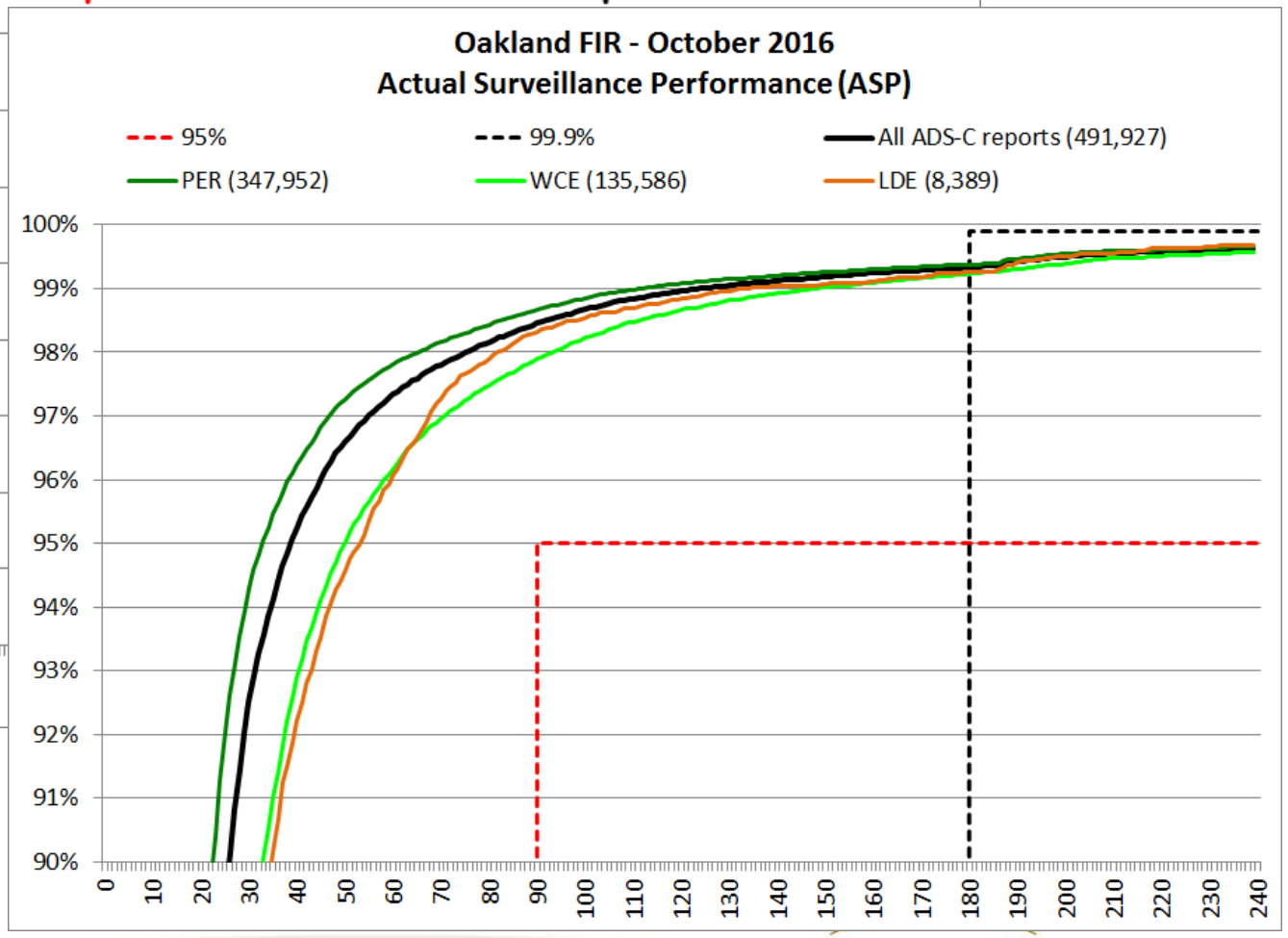
* Performance curve not shown for < 100 observations

FAA

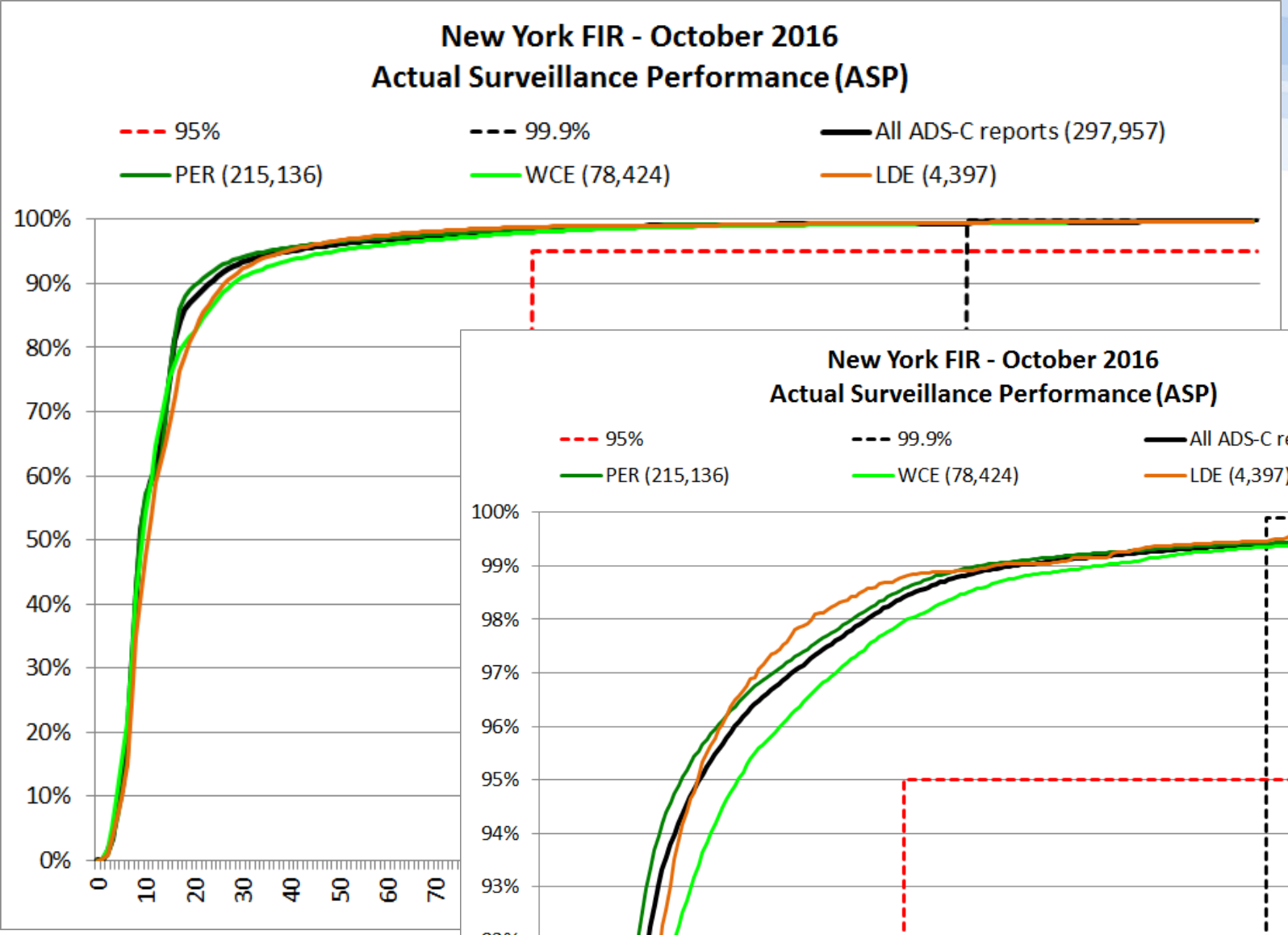
NextGEN

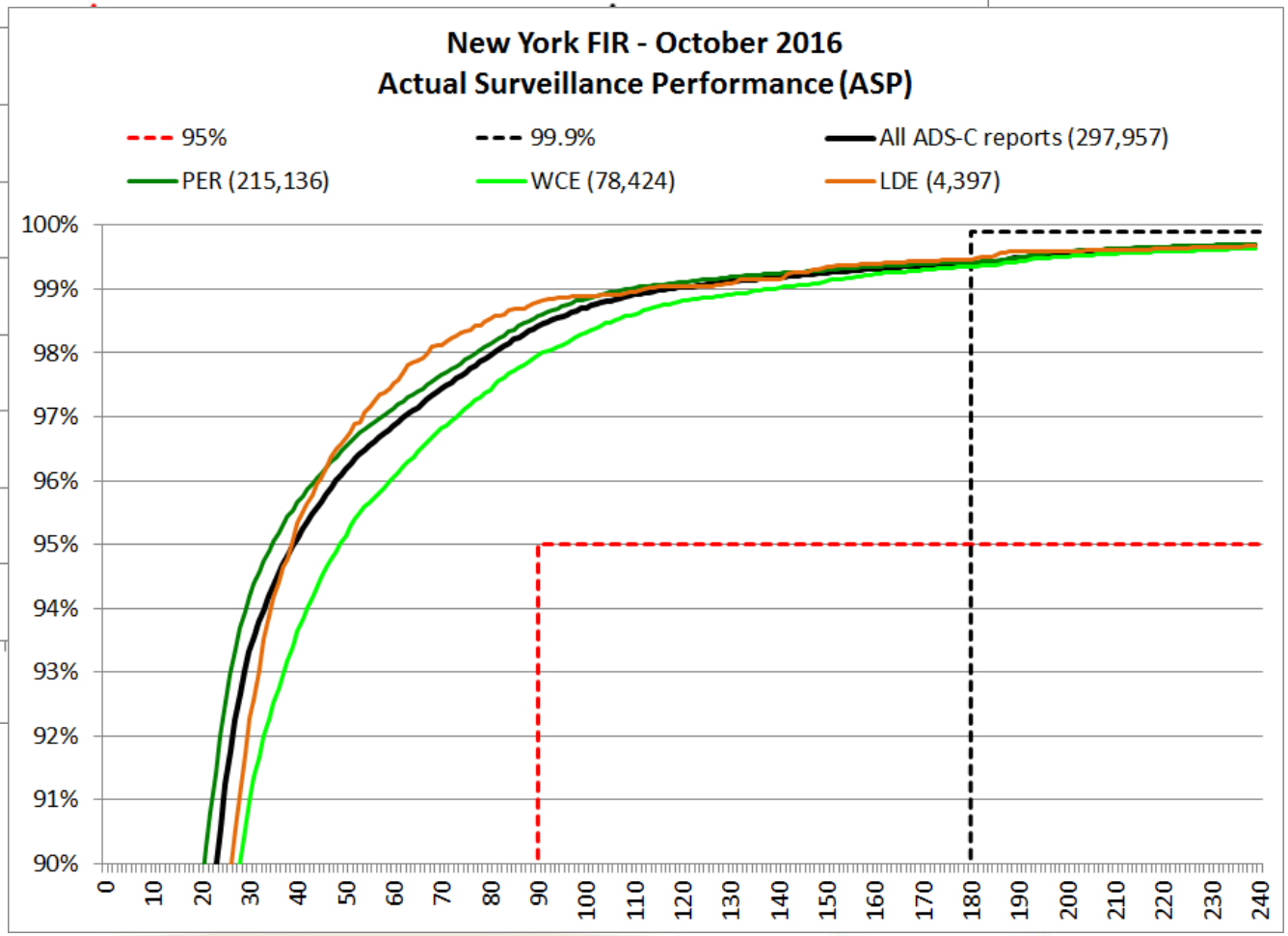
ASP BY MESSAGE TYPE


Oakland FIR - October 2016
Actual Surveillance Performance (ASP)
95%
99.9%
All ADS-C reports (491,927)
PER (347,952)
WCE (135,586)
LDE (8,389)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
10
20
30
40
50
60
70

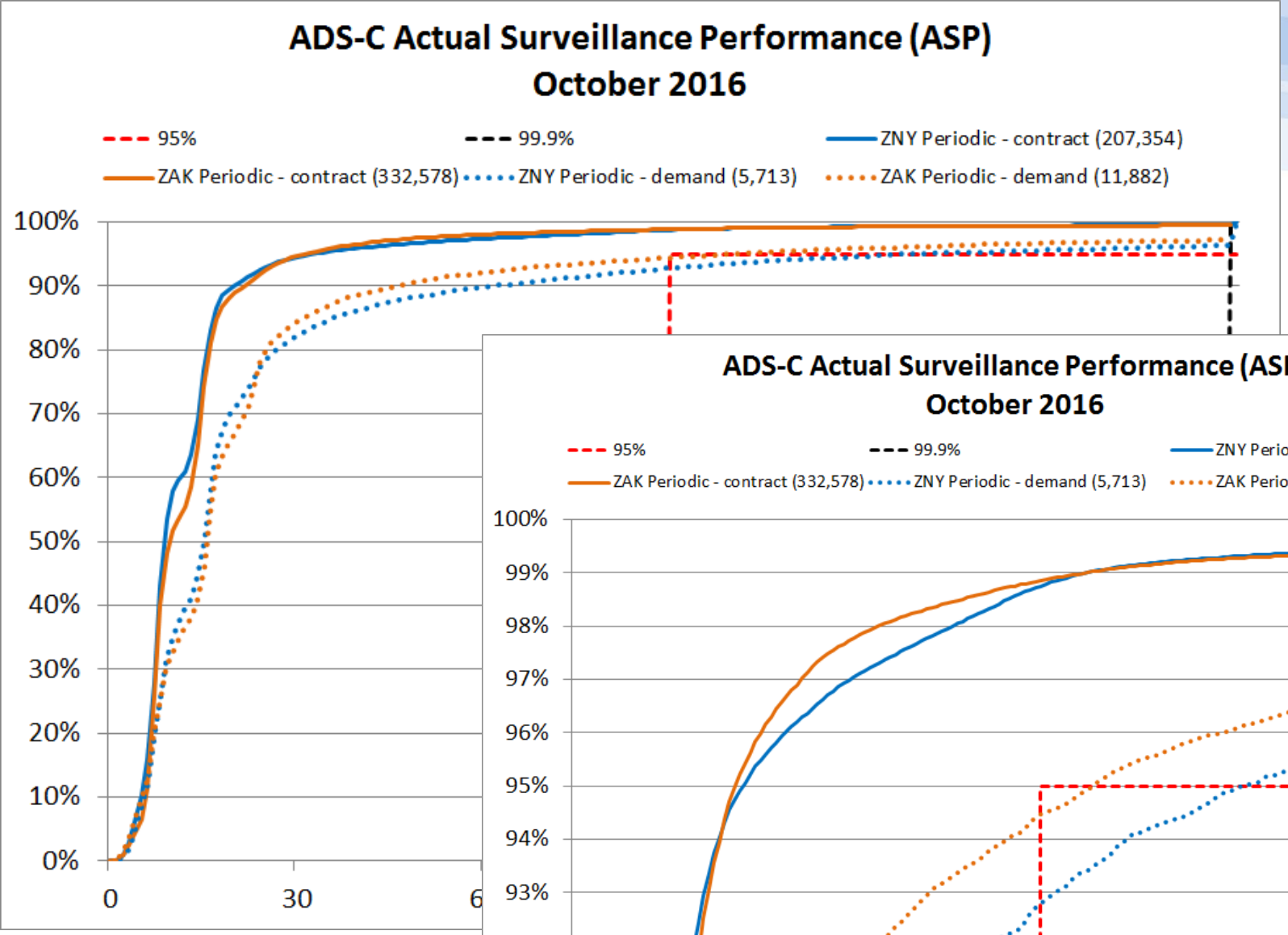

Oakland FIR - October 2016
Actual Surveillance Performance (ASP)
95%
99.9%
All ADS-C reports (491,927)
PER (347,952)
WCE (135,586)
LDE (8,389)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240

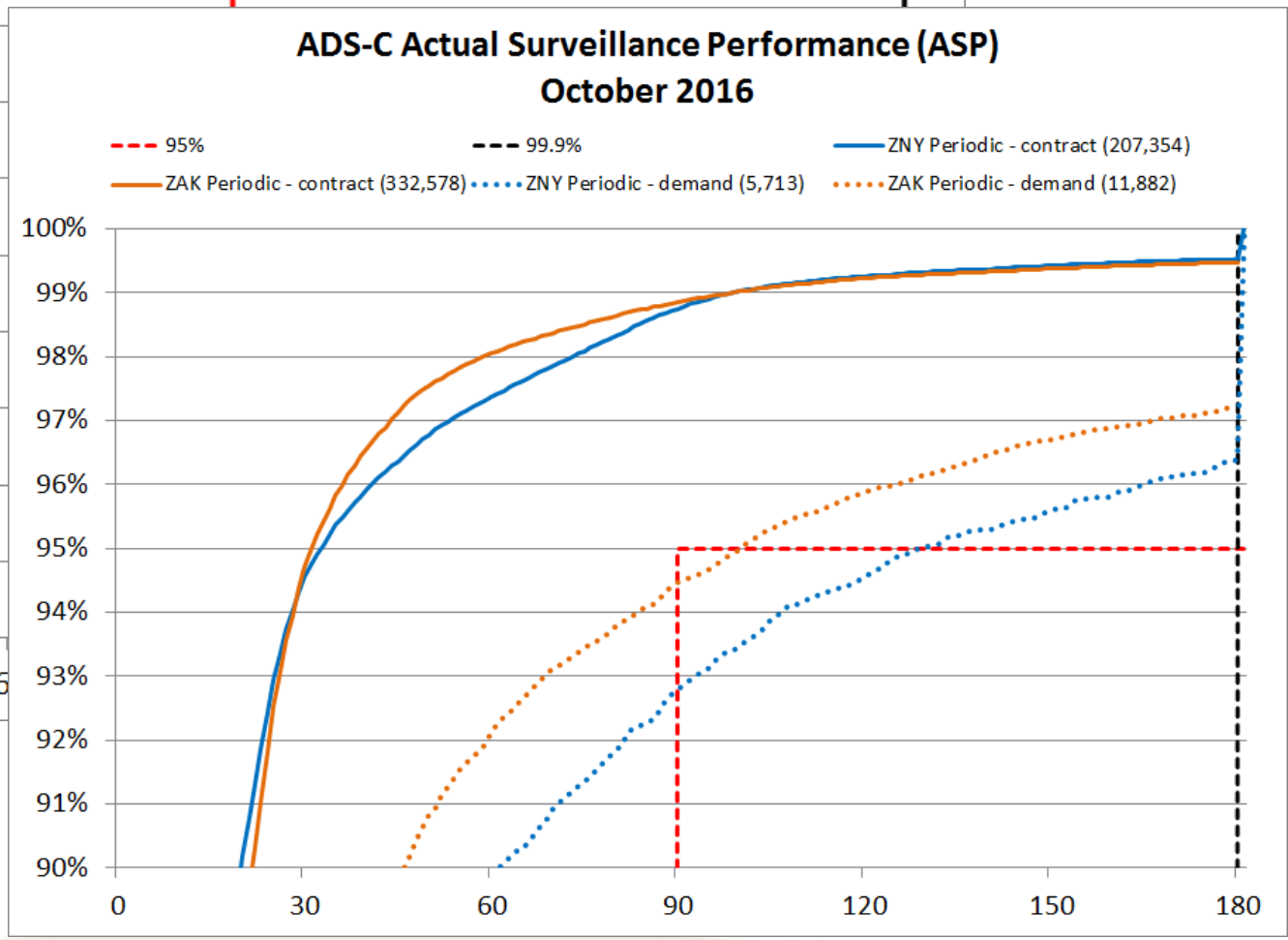
FAA


New York FIR - October 2016
Actual Surveillance Performance (ASP)
95%
99.9%
All ADS-C reports (297,957)
PER (215,136)
WCE (78,424)
LDE (4,397)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
10
20
30
40
50
60
70


New York FIR - October 2016
Actual Surveillance Performance (ASP)
95%
99.9%
All ADS-C reports (297,957)
PER (215,136)
WCE (78,424)
LDE (4,397)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240

FAA


ADS-C Actual Surveillance Performance (ASP)
October 2016
95%
99.9%
ZNY Periodic - contract (207,354)
ZAK Periodic - contract (332,578)
ZNY Periodic - demand (5,713)
ZAK Periodic - demand (11,882)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30


ADS-C Actual Surveillance Performance (ASP)
October 2016
95%
99.9%
ZNY Periodic - contract (207,354)
ZAK Periodic - contract (332,578)
ZNY Periodic - demand (5,713)
ZAK Periodic - demand (11,882)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180

FAA

Observations

- ADS-C periodic reports are observed with lower latency than event reports
  - Event reports contain more information and may be sent to multiple ATS Units at once
- ADS-C periodic demand reports are observed with lower latency than periodic reports associated with active contract
  - Expected since demand reports are typically sent during periods of connectivity issues
- Oakland and New York have similar ASP associated with periodic-contract reports, with slight differences around 10-15 seconds and 30-90 seconds
- New York has notably lower ASP associated with periodic-demand reports
  - **2.7%** of New York ADS-C periodic reports are demands
  - **3.4%** of Oakland ADS-C periodic reports are demands

FAA

NextGEN