International Civil Aviation Organization

The Twentieth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/20)

Bangkok, Thailand, 26-29 May 2015

Agenda Item 3: Reports from Asia/Pacific RMAs and EMAs

PARMO HORIZONTAL SAFETY MONITORING REPORT

(Presented by Pacific Approvals Registry and Monitoring Organization (PARMO)/United States)

SUMMARY

This paper presents the horizontal safety monitoring report from the Pacific Approvals Registry and Monitoring Organization (PARMO) for the time period 1 January to 31 December 2014. This report contains a summary of large longitudinal errors and large lateral deviations received by the PARMO for that time period and the related performance monitoring activities for the Anchorage and Oakland Flight Information Regions (FIRs).

1. INTRODUCTION

1.1 The Pacific Approvals Registry and Monitoring Organization (PARMO), serves as the En-route Monitoring Agency (EMA) for the Anchorage and Oakland Oceanic Flight Information Regions (FIRs). The report presented in this paper fulfills the ICAO emphasis on safety management systems; such reporting for international airspace is a component of safety management systems.

1.2 This report covers the current reporting period 1 January to 31 December 2014 in the PARMO's ongoing process of providing periodic updates of information relevant to the continued safe use of the reduced lateral and longitudinal separation standards in the Anchorage and Oakland FIRs. This report follows the standardized reporting period and format guidelines set forth by the ICAO's Asia and Pacific Region Regional Airspace Safety Monitoring Advisory Group (RASMAG). These guidelines are stated in reference 1, paragraph 5.34.

1.3 Within the report, the reader will find the large lateral deviation and large longitudinal error reports received by the PARMO during the reporting period, as well as relevant data link performance. There were a total of eleven (11) such reports submitted to the PARMO during the reporting period.

2. DISCUSSION

2.1 **Attachment A** contains the PARMO Horizontal Safety Monitoring Report for January to December 2014.

<u>Executive Summary</u>

2.2 **Table 1** provides the Anchorage and Oakland oceanic airspace horizontal risk estimates. **Figure 1** presents the lateral and longitudinal collision risk estimate trends for the Anchorage and Oakland oceanic airspace during the period 1 January 2014 to 31 December 2014.

Anchorage and Oakland Oceanic Airspace **Estimated annual flying hours = 948,309 hours** ***(note: estimated hours based on Dec 2014 traffic sample data)***			
Risk	**Risk Estimation**	**TLS**	**Remarks**
RASMAG 19 30NM Lateral Risk	*0.26 x* 10^{-9}	*5.0 x* 10^{-9}	*Below TLS*
RASMAG 19 50NM Lateral Risk	*0.97 x* 10^{-9}	*5.0 x* 10^{-9}	*Below TLS*
RASMAG 19 30NM Longitudinal Risk	*3.74 x* 10^{-9}	*5.0 x* 10^{-9}	*Below TLS*
RASMAG 19 50NM Longitudinal Risk	*2.32 x* 10^{-9}	*5.0 x 10-9*	*Below TLS*
30NM Lateral Risk	**0.53 x** $\mathbf{10^{-9}}$	5.0 x 10^{-9}	**Below TLS**
50NM Lateral Risk	**1.35 x** $\mathbf{10^{-9}}$	5.0 x 10^{-9}	**Below TLS**
30NM Longitudinal Risk	**3.74 x** $\mathbf{10^{-9}}$	5.0 x 10^{-9}	**Below TLS**
50NM Longitudinal Risk	**2.32 x** $\mathbf{10^{-9}}$	5.0 x 10^{-9}	**Below TLS**

Table 1: Anchorage and Oakland Oceanic Airspace Horizontal Risk Estimates

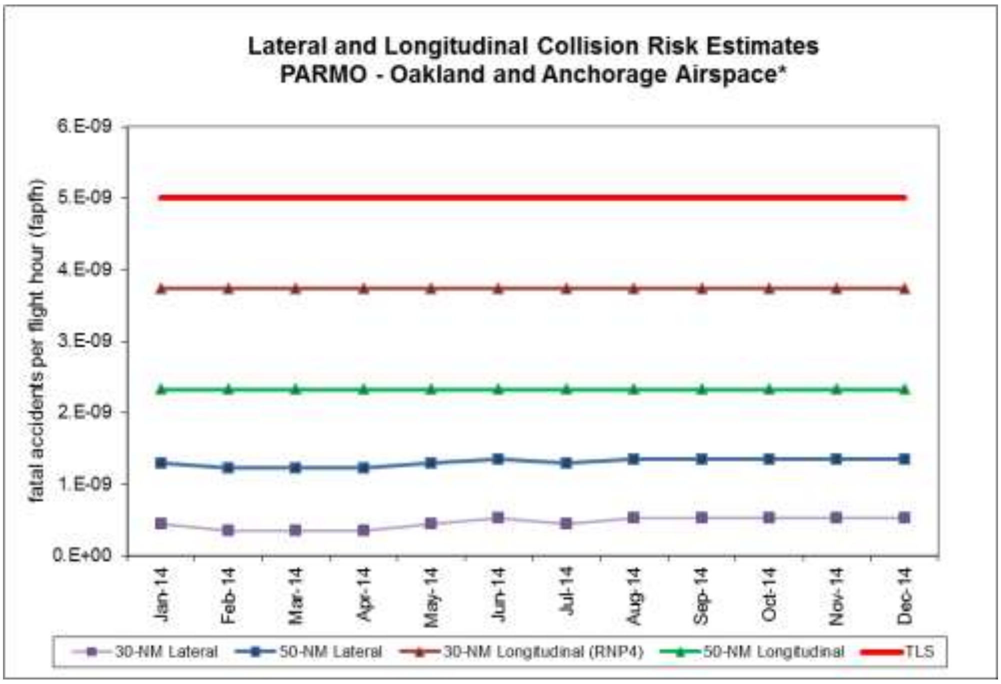

Figure 1: Anchorage and Oakland Oceanic Airspace Horizontal Risk Estimates

2.3 **Table 2** contains a summary of Large Lateral Deviations (LLD) and Large Longitudinal Errors (LLE) received by PARMO for Anchorage and Oakland Oceanic airspace.

Deviation Code	**Cause of Deviation**	**Number of Occurrences**
Operational Errors		
A	Flight crew deviate without ATC Clearance;	2
B	Flight crew incorrect operation or interpretation of airborne equipment (e.g. incorrect operation of fully functional FMS, incorrect transcription of ATC clearance or re-clearance, flight plan followed rather than ATC clearance, original clearance followed instead of re-clearance etc.);	2

Deviation Code	Cause of Deviation	Number of Occurrences
C	Flight crew waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position;	2
D	ATC system loop error (e.g. ATC issues incorrect clearance, Flight crew misunderstands clearance message etc);	3
E	Coordination errors in the ATC-unit-to-ATC-unit transfer of control responsibility;	0
Deviation due to navigational errors		
F	Navigation errors, including incorrect position estimate or equipment failure of which notification was not received by ATC or notified too late for action;	1
Deviation due to Meteorological Conditions		
G	Turbulence or other weather related causes (other than approved);	0
Others		
H	An aircraft without PBN approval;	0
I	Other	1

Table 2: Summary of Anchorage and Oakland Oceanic Airspace LLD and LLE Reports

2.4 In November 2013, Oakland ARTCC initiated a pro-active safety management process to identify aircraft operations that had not provided ATC with an updated forward position estimate. The goal of this activity is to reduce time errors which will help to improve airspace safety. To accomplish this, the Oakland ARTCC has automated time error tracking and reporting. During the first month of the automated tracking, 109 time error events were identified and reported as having not provided an updated forward estimate of position. Most, if not all, of these events involved operations using HF radio for communication and are not eligible for the reduced longitudinal separation minima. Therefore, these reports are included to inform the RASMAG of this activity, and are not incorporated into the PARMO collision risk estimates for reduced longitudinal separation.

2.5 As a result of this activity, improvement has been observed with a few operators. In April 2014, the FAA and ARINC initiated new procedures which include HF radio read-backs. This paper contains a summary of the observed results from the implementation of the new procedures. A 50% decrease in the number of time events identified by the Oakland ARTCC is observed from January 2014 to December 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.

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Horizontal Safety Monitoring report for Anchorage and Oakland Flight Information Regions (FIRs) January to December 2014

Prepared by:
Pacific Approvals Registry and Monitoring Organization (PARMO)

Summary

This paper presents the horizontal safety monitoring report from the Pacific Approvals Registry and Monitoring Organization (PARMO) for the time period 1 January to 31 December 2014. This report contains a summary of large longitudinal errors and large lateral deviations received by the PARMO for that time period and the related performance monitoring activities for the Anchorage and Oakland Flight Information Regions (FIRs).

1. Introduction

1.1. The Pacific Approvals Registry and Monitoring Organization (PARMO), a service provided by the U.S. Federal Aviation Administration's Technical Center, serves as the en-route monitoring agency (EMA) for Anchorage and Oakland oceanic airspace.

1.2. This report covers the current reporting period 1 January to 31 December 2014 in the PARMO's ongoing process of providing periodic updates of information relevant to the continued safe use of the reduced horizontal separation minima in the Anchorage and Oakland FIRs. This report follows the standardized reporting period and format guidelines set forth by the ICAO's Asia and Pacific Region Regional Airspace Safety Monitoring Advisory Group (RASMAG). These guidelines are stated in reference 1, paragraph 5.34.

2. Discussion

2.1. *Lateral Separation Standards*

2.1.1. The lateral separation minima applied in the Anchorage and Oakland FIR varies. The 50-NM lateral separation minimum applied to RNP10 aircraft. However, the airspace is not exclusionary and non-RNP10 aircraft are permitted to operate within the airspace as ATC will apply another form of aircraft separation (either longitudinal or vertical) for non-RNP10 aircraft.

2.1.2. The 30-NM lateral separation minimum can be applied to suitably equipped RNP4 operations. The application of the 30-NM lateral separation is accomplished ad hoc between pairs of suitably equipped aircraft; this means that the application of the separation minima is not planned prior to oceanic entry. On 27 November 2012, the FAA implemented the 30-NM lateral separation minimum in the Anchorage FIR.

2.2. *Longitudinal Separation Standards*

2.2.1. The longitudinal separation minima applied in the Anchorage and Oakland FIR varies. The 10-minute longitudinal separation can be applied with or without mandatory assignment of Mach number. The 50-NM longitudinal separation minimum can be applied to RNP10 aircraft using ADS-C for position reporting and Controller Pilot Data Link Communication (CPDLC) for ATC communications. A 27 minute interval for ADS-C periodic reports is assigned to aircraft eligible for the 50-NM longitudinal separation. The application of the 50-NM longitudinal separation in the Anchorage and Oakland FIRs is accomplished ad hoc between pairs of suitably equipped aircraft; this means that the application of the separation minima is not planned prior to oceanic entry.

2.2.2. On 27 November 2012, the FAA implemented the 30-NM longitudinal separation minimum in the Anchorage FIR. The 30-NM longitudinal separation minimum can be applied to suitably equipped RNP4 operations. The ADS-C periodic report interval is 10 minutes in the Anchorage FIR and 14 minutes in the Oakland FIR for operations eligible for the 30-NM longitudinal separation minimum. The application of the 30-NM longitudinal separation minimum is also done ad hoc between pairs of suitably equipped aircraft.

2.3. *Data Sources*

2.3.1. Monthly large lateral deviation (LLDs) and large longitudinal errors (LLEs) are forwarded to the PARMO from the Anchorage and Oakland oceanic FIRs. Traffic movement data are archived through the FAA's ATOP system. These data encompass position reports, filed flight plans, and communication messages between the pilots and air traffic controllers.

2.3.2. Data link transmission data obtained from operations conducted within the Anchorage and Oakland oceanic FIRs are obtained at the FAA Technical Center. These data include the required time stamps from data link messages to measure performance as described in the ICAO GOLD (reference 3). Specific pilot-controller CPDLC message sets are used to estimate the actual communication performance (ACP), actual communication technical performance (ACTP), and pilot operational response time (PORT). In addition, ADS-C surveillance performance is measured. Appendix D to the GOLD (reference 3) provides the post implementation modeling and corrective action details for use of ADS-C and CPDLC data link in airspace.

2.4. *Data Submission*

2.4.1. The most recent annual one-month traffic movement samples for December 2014 were received from both the Oakland and Anchorage FIRs. These traffic movement samples are used to update the horizontal risk estimates and related monitoring activities described in this report.

2.4.2. Monthly reports of LLDs and LLEs were also received from both the Anchorage and Oakland FIRs for the time period January through December 2014.

2.5. Large Lateral Deviation and Large Longitudinal Error Report Summary

2.5.1. Table 1 contains a summary of the number of risk-bearing LLD and LLE occurrences during the time period 1 January to 31 December 2014 in the Anchorage and Oakland oceanic FIRs. There were a total of eleven (11) reports received during the time period.

Table 1. Summary of LLD and LLE Occurrences in Anchorage and Oakland Oceanic Airspace

Month-Year	**No. of LLDs and LLEs Occurrences**
Jan-14	3
Feb-14	0
Mar-14	0
Apr-14	0
May-14	2
Jun-14	1
Jul-14	1
Aug-14	2
Sep-14	0
Oct-14	0
Nov-14	0
Dec-14	2
Total	**11**

2.5.2. The LLD and LLE reports are separated by categories based on the details provided for each event. These categories are defined in the ICAO Asia Pacific Region EMA Handbook (reference 2). Table 2 lists the categories for LLDs and LLEs for use in the Asia Pacific region.

Table 2. LLD and LLE Deviation Codes and Category Descriptions for the Asia Pacific Region

Deviation Code	Cause of Deviation	Number of Occurrences
Operational Errors		
A	Flight crew deviate without ATC Clearance;	2
B	Flight crew incorrect operation or interpretation of airborne equipment (e.g. incorrect operation of fully functional FMS, incorrect transcription of ATC clearance or re-clearance, flight plan followed rather than ATC clearance, original clearance followed instead of re-clearance etc.);	2
C	Flight crew waypoint insertion error, due to correct entry of incorrect position or incorrect entry of correct position;	2
D	ATC system loop error (e.g. ATC issues incorrect clearance, Flight crew misunderstands clearance message etc);	3
E	Coordination errors in the ATC-unit-to-ATC-unit transfer of control responsibility;	0
Deviation due to navigational errors		
F	Navigation errors, including incorrect position estimate or equipment failure of which notification was not received by ATC or notified too late for action;	1
Deviation due to Meteorological Conditions		
G	Turbulence or other weather related causes (other than approved);	0
Others		
H	An aircraft without PBN approval;	0
I	Other	1

2.5.3. Eight (8) of the reports listed in Table 2 are LLD events, three are LLE events.

2.5.4. In addition to the eleven reported LLE and LLD events, the PARMO is in receipt of many incorrect position estimate events from Oakland ARTCC. In November 2013, Oakland ARTCC initiated a pro-active safety management process to identify aircraft operations that had not provided ATC with an updated forward position estimate. The goal of this activity is to reduce time errors and improve airspace safety. To accomplish this, the Oakland ARTCC automated time error tracking and reporting. During the first month of the automated tracking, 109 time error events were identified and reported as having not provided an updated forward estimate of position. Most, if not all, of these events involved operations using HF radio for communication and are not eligible for the reduced longitudinal separation minima. Therefore, these reports are included to inform the RASMAG of this activity, and are not incorporated into the PARMO collision risk estimates for reduced longitudinal separation.

2.5.5. After several months of data collection and analyses, it was determined that a significant number of these errors were the result of a lack read-backs performed by the third party communication agent, ARINC. In April 2014, the FAA and ARINC initiated new procedures which include HF radio read-backs. There were a total of 892 time events identified by Oakland ARTCC in calendar year 2014. The data contained in Figure 1 show the number of time events by month and demonstrate the results from the implementation of the new procedures. A decrease in the number of time events identified by the Oakland ARTCC is observed. The number of time events identified in January 2014 was 131, and the number identified in December 2014 was 62, roughly a 50 percent decrease.

2.5.6. Figure 2 shows the approximate locations of the eleven LLD and LLE reports received by the PARMO.

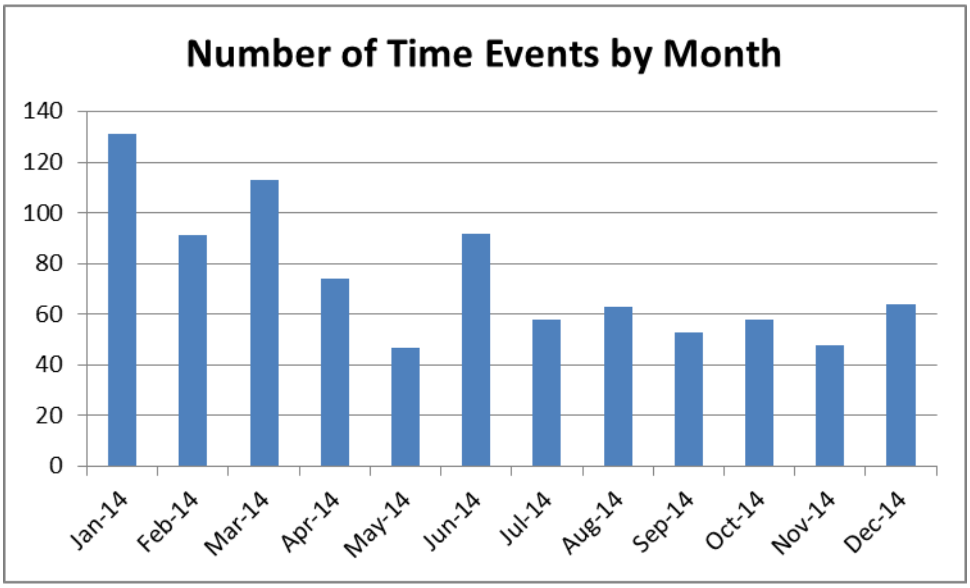

Figure 1. Number of Time Events Identified by Month by Oakland ARTCC

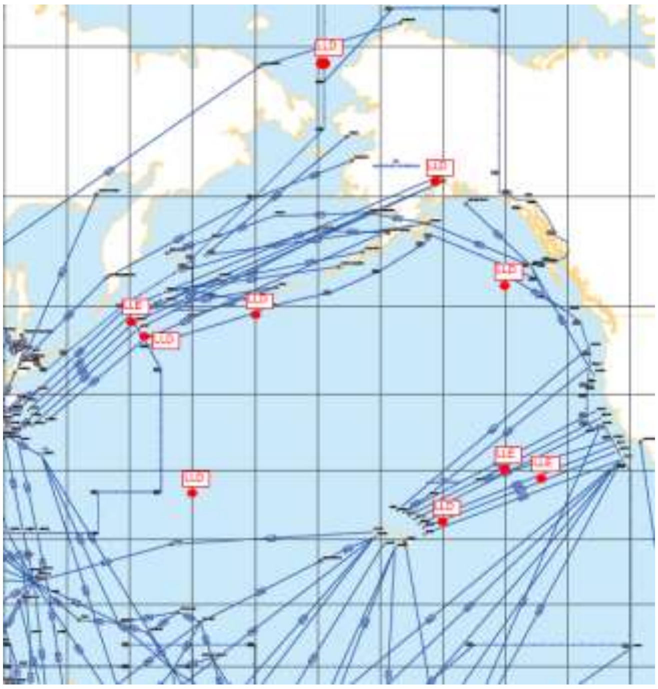

Figure 2. Approximate locations of the eleven (11) LLD and LLE event reports

2.6. *Performance Monitoring Related to the Application of the Reduced Horizontal Separation Standards*

2.6.1. The PARMO monitoring activities include an examination of the filed RNP4 status from operations conducted within the airspace and comparisons of the RNP4 status to the RNP4 approval records. The PARMO has formally established RNP4 and RNP10 approval records for operators/aircraft types contained within the PARMO RVSM approvals database. Figures 3 and 4 provide the numbers of flights, data link operations, proportions of RNP4 and RNP10 observed by month for Anchorage and Oakland oceanic airspace, respectively.

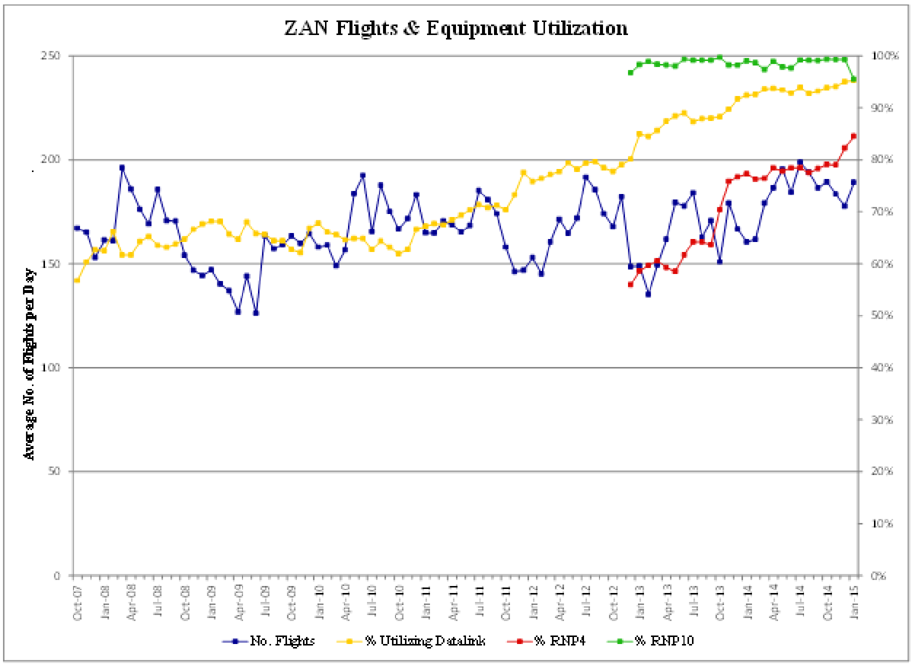

Figure 3. Number of data link flights and proportion of RNP observed in Anchorage oceanic airspace

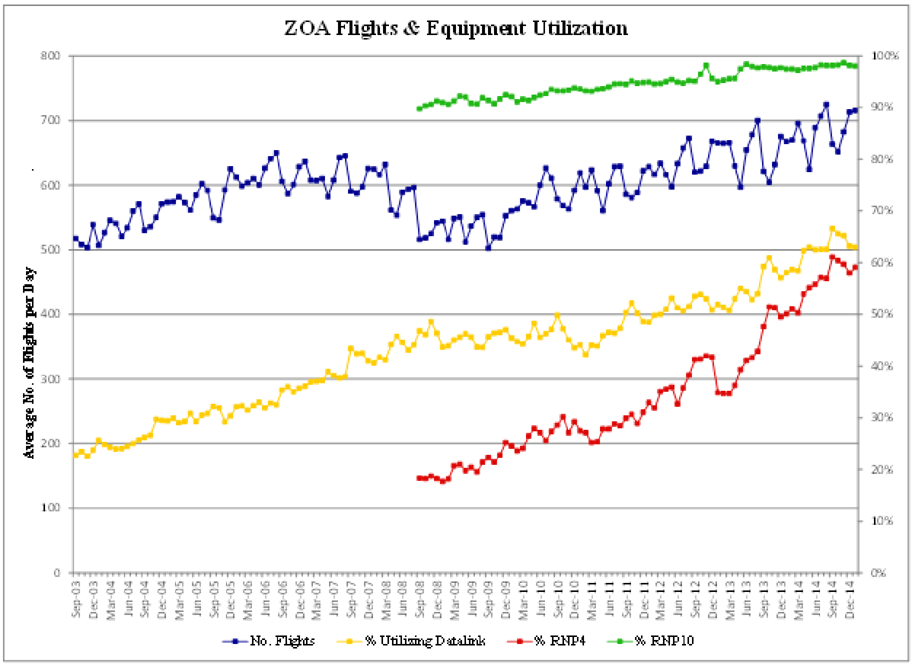

Figure 4. Number of data link flights and proportion of RNP observed in Oakland oceanic airspace

2.7. *Longitudinal Monitoring*

2.7.1. The observed speed data were obtained from ADS-C operations in the Anchorage and Oakland FIRs from traffic data collected for the period of January – September 2014. The data used in this paper were available in the ATOP data archives that contain amongst other items, filed flight plans and ADS-C reports.

2.7.2. A data analyses was conducted to observe the application of the various longitudinal separation standards available in the airspace for ADS-C aircraft. Specifically, aircraft pairs operating on the same track, flight level and within 20 minutes of each other were identified in the archives. In order to identify aircraft pairs, the following rules were applied:

- o Both aircraft travel on the same date;
- o Both aircraft are on the same local route (previous and next waypoints);
- o Both aircraft maintain the same Flight Level for the duration of the waypoint to waypoint transit;
- o The actual time separation between the aircraft pair at the first waypoint is less than or equal to 20 minutes;
- o The reporting periods of the aircraft pair overlap in time;
- o The Leader's first periodic report is earlier than the Follower's first periodic report.

2.7.3. In the Anchorage FIR a total of 12,517 unique aircraft pairs were identified. Figure 5 shows the position locations of the aircraft pairs in the Anchorage FIR data set.

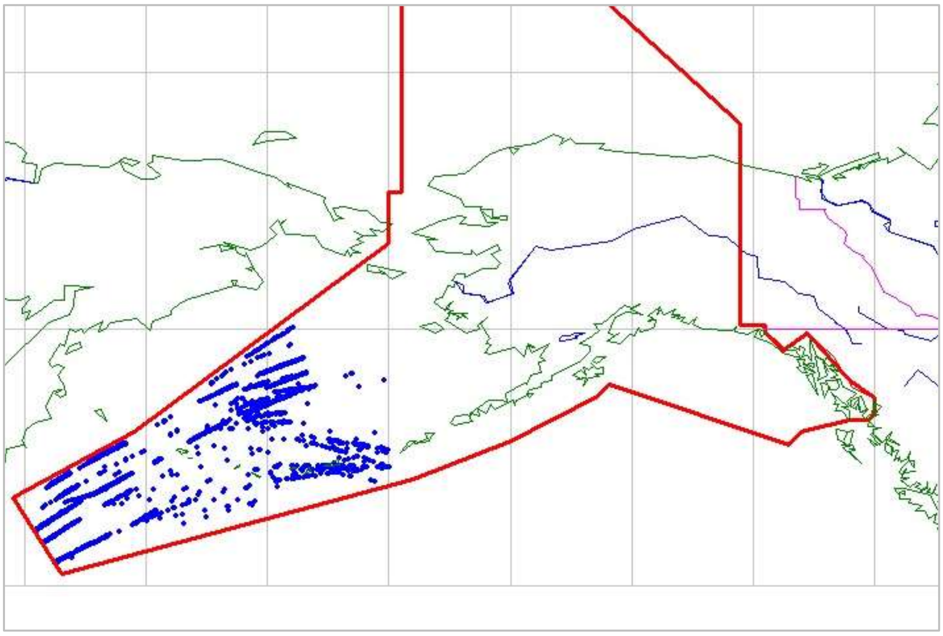

Figure 5. Position Locations for Aircraft Pairs in the Anchorage FIR

2.7.4. One critical component which represents the distribution of separations is based on the planned separations at the next waypoint based on the forecast provided in the ADS-C periodic position reports. Another critical component which represents the probability of losing longitudinal separation between position reports is based on the change in the forecast separation calculated from the Leader and Follower waypoint reports. Figure 6 presents these data observed in the Anchorage FIR.

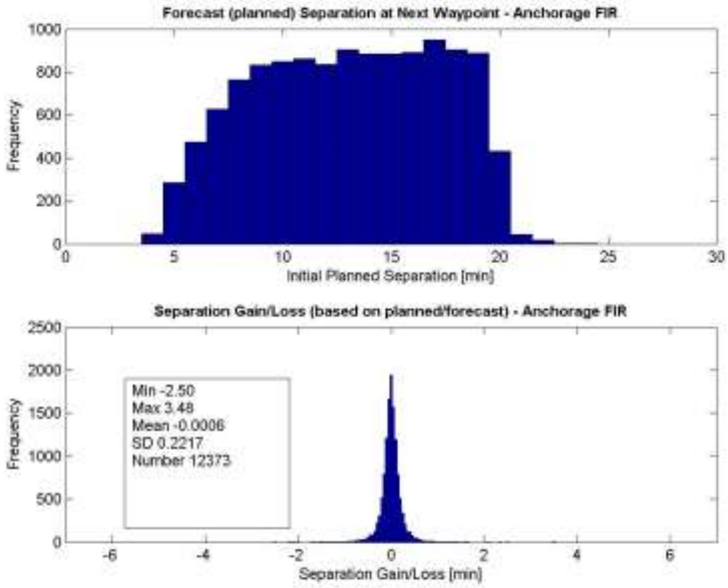

Figure 6. Initial and Change in Separation Distributions for Aircraft Pairs Observed in the Anchorage FIR

2.7.5. The same analysis was conducted with data from the Oakland FIR for the time period of January – September 2014. There were 20,665 unique aircraft pairs observed in this data set. Figure 7 shows the position locations for the aircraft pairs identified in the Oakland FIR data sample. The initial separation distribution and change in separation distribution are shown in Figure 8.

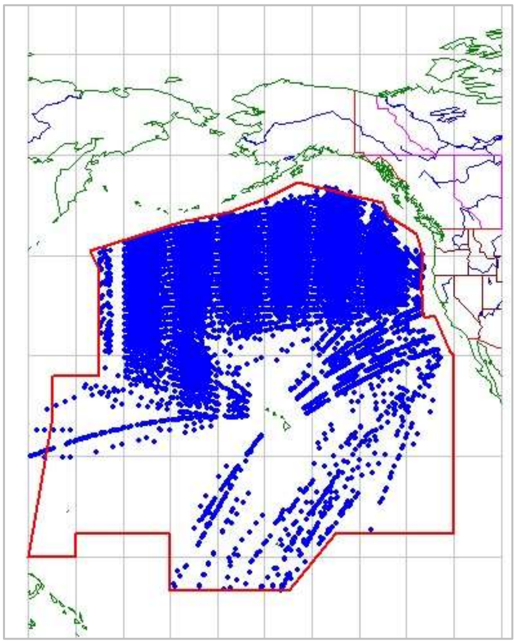

Figure 7. Position Locations for aircraft pairs in the Oakland FIR

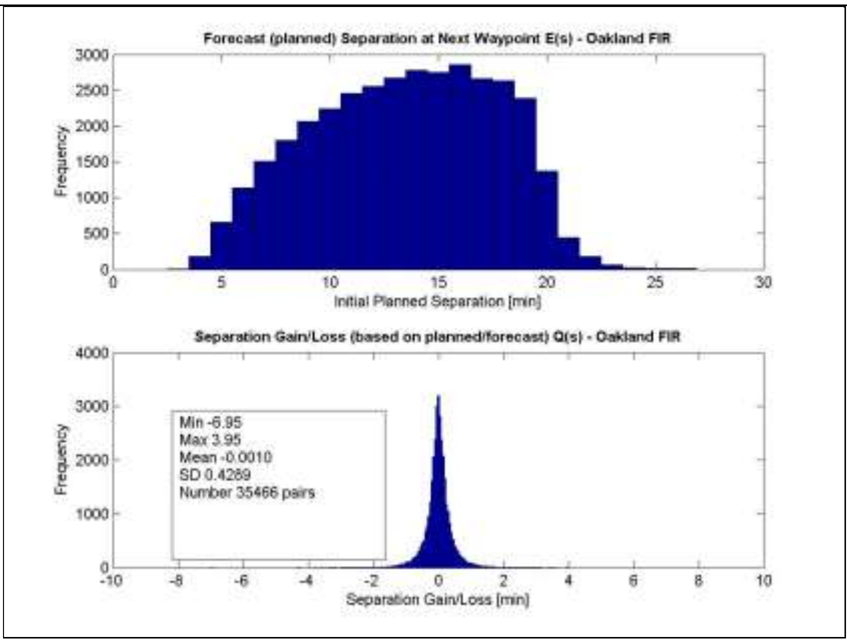

Figure 8. Initial and Change in Separation Distributions for Aircraft Pairs Observed in the Oakland FIR

2.7.6. One observation from these data is a difference in the separation gain/loss for aircraft pairs that are initially closely spaced apart compared to aircraft pairs that are spaced farther apart.

2.7.7. One of the work items for the Mathematicians Sub Group (MSG) within the ICAO Separation and Airspace Safety Panel (SASP) is to develop a process to monitor the speed performance associated with longitudinally separated aircraft pairs. Once developed, this process will be made available to all EMAs for inclusion in the monitoring activities for performance-based longitudinal separation minima.

2.8. Observed Data Link Performance

2.8.1. Attachment B provides a summary of the observed performance of the operational data link system at Anchorage and Oakland Oceanic Centers. The purpose is to compare the measured performance obtained from analysis of the operational data to the criteria specified in the Global Operational Data Link Document (GOLD) (reference 3). The data link performance analysis for the Anchorage and Oakland FIRs uses data collected for the time period January 2014 through June 2014.

2.8.2. The data link performance data are relevant to the monitoring of the reduced horizontal separation standards in oceanic airspace because the communication and surveillance systems necessary to support the reduced separation minima rely on data link.

2.8.3. The data in Attachment B show that the observed data link performance in both Anchorage and Oakland for the top 90 percent of operators meets the 95 percent criteria for the ACP, ACTP, and ADS-C latency established in the GOLD.

2.9. *Estimate of Horizontal Collision Risk for Pacific Airspace*

2.9.1. Estimation of lateral collision risk

2.9.2. The form of the lateral collision risk model applicable to assessing the risk, for the 30-NM and 50-NM lateral separation standards from Appendix 15 of reference 4 is:

$$N_{ay} = P_y(S_y)P_z(0)\frac{\lambda_x}{S_x}\left\{E_y(same)\left[\frac{\overline{|\dot{x}|}}{2\lambda_x}+\frac{\overline{|\dot{y}(S_y)|}}{2\lambda_y}+\frac{\overline{|\dot{z}|}}{2\lambda_z}\right]+E_y(opp)\left[\frac{\overline{|V|}}{\lambda_x}+\frac{\overline{|\dot{y}(S_y)|}}{2\lambda_y}+\frac{\overline{|\dot{z}|}}{2\lambda_z}\right]\right\} \quad (1)$$

2.9.3. Table 3 provides the lateral collision risk model parameter definitions and values used in the estimation of lateral risk.

Table 3. Parameter Values for the Lateral Collision Risk Estimates

Parameter Symbol	Parameter Definition	Parameter Value	Source for Value
$\overline{\lvert\dot{x}\rvert}$	Average absolute relative along track speed between aircraft on same direction routes	17 knots	Estimated from ADS-C reports in traffic sample, (reference 5, section 14.1)
$\overline{\lvert V\rvert}$	Average absolute aircraft air speed	480 knots	Value used in vertical safety assessment
$\overline{\lvert\dot{y}(30)\rvert}$	Average absolute relative cross track speed	59.5 knots for 50-NM lateral separation minimum, 35.9 knots for 30-NM lateral separation minimum	Conservative value based on speed required to commit waypoint insertion error
$\overline{\lvert\dot{z}\rvert}$	Average absolute relative vertical speed of an aircraft pair that have lost all vertical separation	1.5 knots	Value used in vertical safety assessment
S_x	Length of longitudinal window used to calculate occupancy	120-NM	Value used in vertical safety assessment
λ_x	Average aircraft length	0.0363-NM	Weighted average
λ_y	Average aircraft wing-span	0.0333-NM	Weighted average
λ_z	Average aircraft height with undercarriage retracted.	0.0100-NM	Weighted average
$P_z(0)$	Probability that two aircraft which are nominally at the same level are in vertical overlap.	0.538	Value used in vertical risk estimates
N_{ay}	Number of fatal accidents per flight hour due to loss of lateral separation.	*Calculated*	-
S_y	Lateral separation minimum	30-NM / 50-NM	-
$P_y(S_y)$	Probability that two aircraft which are nominally separated by the lateral separation minimum are in lateral overlap.	1.48 X 10^{-8} for 30NM lateral separation / 3.38 x 10^{-8} for 50NM lateral separation	Determined from the RNP requirement and the observed frequency of lateral errors modeled with a DDE density
$E_y(same)$	Same direction lateral occupancy	0.06052	Average value estimated from December 2014 traffic sample

Parameter Symbol	Parameter Definition	Parameter Value	Source for Value
$E_y(opp)$	Opposite direction lateral occupancy	0.01212	Average value estimated from December 2014 traffic sample

2.9.4. The lateral navigation performance is modeled as a Double Double Exponential (DDE) distribution. The core portion of the DDE represents the typical lateral deviations from the route center line. The mathematical modeling uses the RNP type value to determine the shape of the core density. The reported LLDs are used to determine the shape of the tail portion of the distribution.

2.10. *Estimation of longitudinal collision risk*

2.10.1. The generalized form of the longitudinal collision risk model applicable to assessing the risk, the number of accidents per flight hour, N_{ax}, associated with a distance-based longitudinal separation standard is given in references 6 and 7. Assuming that the aircraft pair are on the same ground track, the collision risk during a time interval $[t_0,t_1]$ is given by:

$$CR(t_0,t_1) = 2NP\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{t_0}^{t_1} HOP(t \mid V_1,V_2)P_z(h_z)\left(\frac{2V_{rel}}{\pi\lambda_{xy}} + \frac{|\dot{z}|}{2\lambda_z}\right) f_1(V_1)\, f_2(V_2)\, dt\, dV_1\, dV_2 \qquad (2)$$

2.10.2. In equation (2) the speeds, V_1 and V_2, of the two aircraft are assumed to follow the same double exponential distribution with known means and the same scale parameter, λ_v. The integral over V_1 and V_2 with their respective probability distributions $f_1(V_1)$ and $f_2(V_2)$ accounts for the variation in aircraft speed around the nominal speed.

2.10.3. The term for the horizontal overlap probability (HOP) considers the along-track and cross-track position errors of two longitudinally separated aircraft. An equation for HOP for operations on the same ground track (e.g. angle of zero degrees) is given in reference 6 as:

$$HOP(t \mid V_1 V_2) = \frac{\pi\lambda_{xy}^2}{16\lambda^2} e^{-|D_x(t)|/\lambda}\left(\frac{|D_x(t)|}{\lambda} + 1\right) \qquad (3)$$

2.10.4. Similar to the estimate of lateral collision risk, the required navigation performance is used in estimating the longitudinal risk. The mathematical modeling uses the RNP type value (either RNP 10 or RNP 4) to determine the shape of the navigational performance distribution.

2.10.5. The time integral is evaluated over $t \in [0, T+\tau]$ where T is the ADS reporting period and τ is the controller intervention buffer. Reference 6 considers three cases under an ADS environment and provides the components for τ for each case. The components for each of the three cases are replicated here for clarity.

2.10.6. Under normal ADS operation, an allowance of 4 minutes is assumed for the value of τ.

2.10.7. In the case where the periodic ADS reports are received and a response to the CPDLC uplink is not received in 3 minutes, an allowance of 10 ½ minutes is assumed for the value of τ.

2.10.8. When the ADS periodic report is lost or takes longer than 3 minutes, and allowance of 13 ½ minutes is assumed for the value of τ.

2.10.9. All of the components for τ used in this collision risk estimation conform to those provided in reference 6 except for the CPDLC uplink time. Reference 6 assigns a static value of 90 seconds to the CPDLC uplink transit time. This document uses an empirical distribution for the CPDLC uplink transit time based on observed performance in Anchorage and Oakland oceanic airspace.

2.10.10.Table 4 provides the longitudinal collision risk parameters used in the safety assessment for the ongoing use of the 30NM and 50NM longitudinal separation minima.

Table 4. Parameter Values for the Longitudinal Collision Risk Estimates

Parameter Symbol	Parameter Definition	Parameter Value	Source for Value
V_1	Assumed average ground speed of aircraft 1	480 knots	Value used in vertical risk estimates
V_1	Assumed average ground speed of aircraft 2	480 knots	Value used in vertical risk estimates
λ_{xy}	Average aircraft wingspan or length	0.0363-NM	Larger value of λ_y and λ_x
λ	Scale parameter for speed error distribution	5.82 knots	Reference 6
T	ADS-C periodic report rate	10, 14, and 27 minutes	Reference 5 and 6
τ	Controller intervention buffer.	3 cases with empirical CPDLC Uplink Data	Reference 6 and archived CPDLC data – reference 5
NP	Number of aircraft pairs per hour	1	Conservative estimate (see Figures 2 and 3)

2.11. *Collision risk estimates*

2.11.1. Figure 8 presents the collision risk estimates by month for Oakland and Anchorage oceanic airspace. In all cases, the estimates are made using the RNP Type required for the application of the separation. The SASP is undertaking a re-evaluation of the risk model under observed navigation performance and the RNP type for GNSS aircraft. The SASP is also examining the speed error distribution used in the collision risk model. Recent data support the effect of application of tactical ATC procedures that limit the speed variation between closely spaced aircraft pairs.

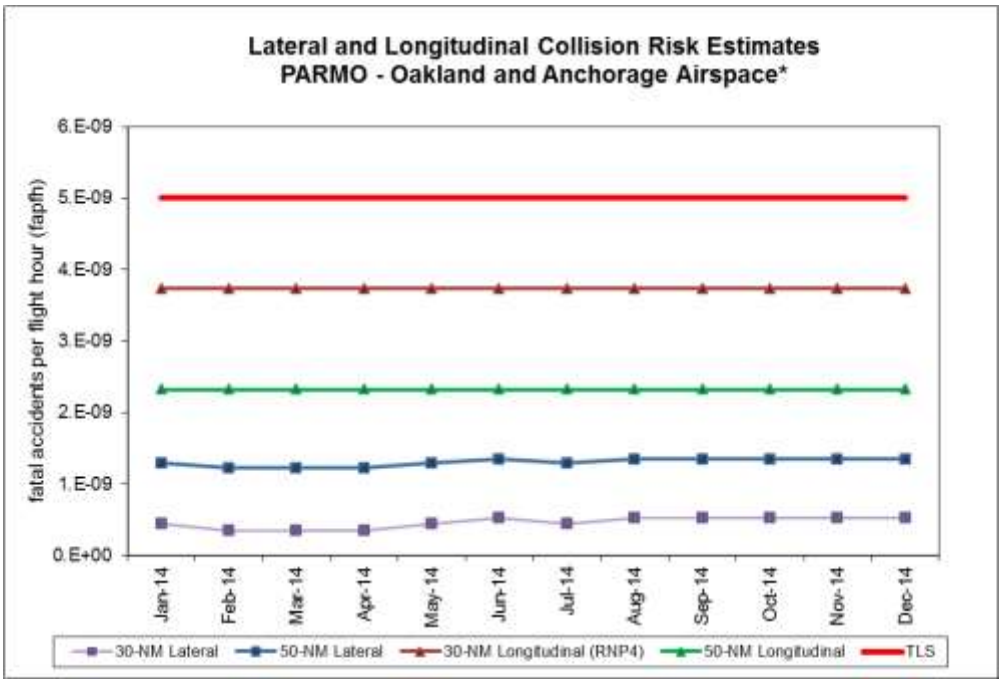

Figure 8. Horizontal Collision Risk Estimates for Anchorage and Oakland Oceanic Airspace

* The estimate of collision risk uses the Required Navigation Performance (RNP) for each separation minima.

2.11.2. The data in Figure 8 show that the estimated lateral and longitudinal collision risk values satisfies the TLS applicable to judging the safety of the appropriate separation standards, 5.0×10^{-9} fatal accidents per flight hour due to the loss of planned separation.

2.11.3. Table 5 provides a summary of the data. (see * note above) As noted earlier, one of the work items for the SASP MSG is to develop a process to monitor the speed performance associated with longitudinally separated aircraft pairs. Once developed, this process would be made available to all EMAs for inclusion in the monitoring activities for performance-based longitudinal separation minima. The results from the speed error monitoring and the pertinent data link communication monitoring could provide more meaningful measures for the safety oversight of performance-based longitudinal separation in the region.

Table 5. Horizontal Collision Risk Estimates for Pacific Airspace

Anchorage and Oakland Oceanic Airspace Estimated annual flying hours = 948,309 hours *(note: estimated hours based on Dec 2014 traffic sample data)*			
Source of Risk	**Lower Bound Risk Estimation**	**TLS**	**Remarks**
30-NM Lateral Risk	0.53×10^{-9}	5.0×10^{-9}	Below Overall TLS
50-NM Lateral Risk	1.35×10^{-9}	5.0×10^{-9}	Below Overall TLS
30-NM Longitudinal Risk	3.74×10^{-9}	5.0×10^{-9}	Below Overall TLS
50-NM Longitudinal Risk	2.32×10^{-9}	5.0×10^{-9}	Below Overall TLS

REFERENCES

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2. *ICAO Asia Pacific Region En-Route Monitoring Agency (EMA)*, ICAO Asia Pacific Office, Version 2, August 2010 Edition, Bangkok, Thailand.
3. *Global Operational Data Link Document (GOLD)*, ICAO, 1st Edition, 14 June 2010.
4. *Manual on Airspace Planning Methodology For the Determination of Separation Minima*, First Edition, Doc 9689-AN/953, International Civil Aviation Organization, Montreal, 1998.
5. PARMO, "Safety Assessment to Support the Use of the 30-NM Lateral and 30-NM Longitudinal Separation Standards in Anchorage Oceanic and Offshore Airspace", WP/24, RASMAG/16, Bangkok, Thailand, February 2012.
6. Anderson, D., "A Collision Risk Model Based On Reliability Theory That Allows For Unequal RNP Navigational Accuracy" ICAO SASP WG/WHL/7, WP/20, Montreal, Canada, May 2005.
7. *A Unified Framework for Collision Risk Modelling in Support of the Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689)*, ICAO Circular 319 AN/181, 2009.

PBCS Monitoring in US Pacific Oceanic Airspace

RASMAG/20 - WP/XX Attachment B

Prepared by:
PARMO
parmo@faa.gov

FAA

Overview

- Summary of Reported Outages
- PBCS Performance Criteria
- Summary of Flight Counts and Data Link Usage by FIR
- Aggregate Data Link Performance Tables
- ASP by Station Identifier by FIR
- Aggregate Data Link Performance by Operator

Specification: RSP 180/D and RCP 240/D,
Application: CPDLC, ADS-C, FMC WPR; **Component:** CSP

Availability parameter	Efficiency	Safety	Compliance means
Service availability (A_{CSP})	0.9999	0.999	Contract/service agreement terms
Unplanned outage duration limit (min)	10	10	Contract/service agreement terms
Maximum number of unplanned outages	4	48	Contract/service agreement terms
Maximum accumulated unplanned outage time (min/yr)	52	520	Contract/service agreement terms
Unplanned outage notification delay (min)	5	5	Contract/service agreement terms

Outages Reported in 2014 (slide 1 of 3)

START DATE	START TIME (UTC)	DURATION (HH:MM:SS)	SERVICE IMPACTED	SATELLITE REGION IMPACTED	NOTIFICATION SOURCE	NOTES
20-Jan-14	02:14	00:11:00	ARINC Iridium	Global	ARINC	IRIDIUM outage of Telephony, Paging, SMS messaging, Short Burst Data, and Circuit Switch Data
23-Jan-14	22:26	00:17:00	SITA Iridium	Global	SITA	Intermittent Short Burst Data service delays
31-Jan-14	05:40	00:24:00	ARINC Inmarsat	POR	ARINC	Defective link between Perth and Hong Kong
1-Feb-14	06:02	00:24:00	ARINC	Global	ARINC	GMP on-call was unable to get GMP1 to recover. Power recycled GMP1 to allow auto switchover to GMP2.
5-Feb-14	16:03	00:43:00	SITA	IOR	SITA	
26-Mar-14	13:49	03:36:00	Iridium	Global	SITA	The Iridium Short Burst Data service is currently degraded and customers may experience a high uplink reject rate and delayed downlinks. SITA AIRCOM connectivity to Iridium is not affected and Iridium is investigating the satellite radio link side.
30-Mar-14	02:00	01:30:00	SITA VHF and Satellite Data Services	Global	SITA	The clock on the Datalink server was shifted ahead by an hour causing some uplink messages to be rejected as too old.
25-Apr-14	04:05	02:55:00	ARINC Inmarsat	XXI, XXP	ARINC	Inmarsat NOC reports they had to fall back on previously made config changes to restore service
14-May-14	04:20	00:27:00	Iridium	Global	SITA, ARINC	All SBD Services were delayed during the above timeframe due to an unexpected issue. SBD DirectIP MT connections were declined during this timeframe. All SBD services are currently verified operational and messages have been delivered.

Outages Reported in 2014 (slide 2 of 3)

START DATE	START TIME (UTC)	DURATION (HH:MM:SS)	SERVICE IMPACTED	SATELLITE REGION IMPACTED	NOTIFICATION SOURCE	NOTES
15-May-14	21:56	00:13:00	Iridium	Global	SITA	Iridium customers may have experienced intermittent Short Burst Data service delays
2-Jun-14	12:34	03:16:00	Iridium	Global	SITA, ARINC	A fiber cut was repaired.
21-Jul-14	22:02	02:08:00	SITA Iridium	Global	SITA	Due to an unexpected Service Interruption at Iridium, SATELLITE AIRCOM-Iridium Voice Services were not available
28-Jul-14	06:32	00:12:00	Iridium	Global	SITA, ARINC	SBD services were temporarily unavailable for customers
7-Aug-14	22:33	01:27:00	SITA Satellite Data Services	POR	SITA	Satellite Data services over Pacific Ocean region was affected due to problem at the Ground Earth Station
8-Sep-14	20:35	01:38:00	SITA Iridium	Global	SITA	The flooding in the Tempe area is the suspected cause of the terrestrial link outage
11-Sep-14	08:55	00:23:00	SITA Iridium	Global	SITA	SITA Links to the Iridium Gateway were intermittently down
11-Sep-14	10:07	04:08:00	SITA Iridium	Global	SITA	SATELLITE AIRCOM-Iridium Datalink ACARS Service was down due to an interruption of the main lease lines which were affected by flooding
12-Sep-14	21:03	00:35:00	SITA Iridium	Global	SITA	Iridium has advised that Mobile terminated messages were degraded. Mobile originated messages were not affected.
13-Sep-14	09:14	00:41:00	SITA Satellite Voice and Data Services	AOE, AOW	SITA	Aircom Satellite Voice and Data services via Atlantic Ocean region were affected due to problem at the Inmarsat Ground Earth Station
23-Sep-14	19:12	03:40:00	Inmarsat Voice and Data Svcs	POR	SITA, ARINC	Inmarsat experienced an unscheduled loss of Network service over the Pacific Ocean Region

Outages Reported in 2014 (slide 3 of 3)

START DATE	START TIME (UTC)	DURATION (HH:MM:SS)	SERVICE IMPACTED	SATELLITE REGION IMPACTED	NOTIFICATION SOURCE	NOTES
23-Oct-14	22:51	00:23:00	ARINC Iridium	Global	ARINC	
25-Oct-14	02:07	02:03:00	Inmarsat Data Services	POR	SITA	Satelite Data Services over Pacific Ocean Region were affected due to problem at the Ground Earth Station
25-Oct-14	02:11	02:01:00	Inmarsat Data Services	POR	ARINC	* same outage as above but different start/stop times reported
2-Nov-14	11:40	00:28:00	Inmarsat I-4	EMEA	ARINC	BGAN/FB/SB users connected to the network at the time of the incident were not affected. The problem only affected users on dark beams and those requiring extra capacity on illuminated beams. Traffic recovered after the master PCS switched to Burum.
17-Nov-14	15:45	01:29:00	SITA Iridium	Global	SITA	Iridium customers may have experienced intermittent Short Burst Data service delays during the above timeframe
18-Nov-14	17:16	00:17:00	I-4	EMEA	ARINC	

Summary of Reported Outages/Degradations

January to November 2014

Satellite System	DSP	% Messages in Pacific	% Messages in Atlantic	# Unplanned outages > 10 min	Sum of unplanned outages > 10 min (min)
All	ARINC	45%	25%	1	24
POR	ARINC	37%		2	199
Iridium	ARINC	4%	1%	2	34
I-4	ARINC		<1%	2	45
I-3	All	68%		2	343
Iridium	All	5%	4%	4	248
IOR	SITA	<1%		1	43
Iridium	SITA	1%	3%	8	854
All	SITA	36%	53%	1	90
POR	SITA	25%		1	87
AOE, AOW	SITA		21%	1	41
Total				***25***	***2008***

Availability Criteria	Max # unplanned outages > 10 min	Max sum of unplanned outages > 10 min (min)
Safety - 99.9%	**48**	**520**
Reliability - 99.99%	**4**	**52**

PBCS Performance Criteria
Time/Continuity

Performance Measure	Percentage of Messages Required to Meet Criteria	ADS-C		CPDLC	
		RSP180 Criteria (sec)	RSP400 Criteria (sec)	RCP240 Criteria (sec)	RCP400 Criteria (sec)
ASP	95%	90	300		
	99.9%	180	400		
ACTP	95%			120	260
	99.9%			150	310
ACP	95%			180	320
	99.9%			210	370
PORT	95%			60	60

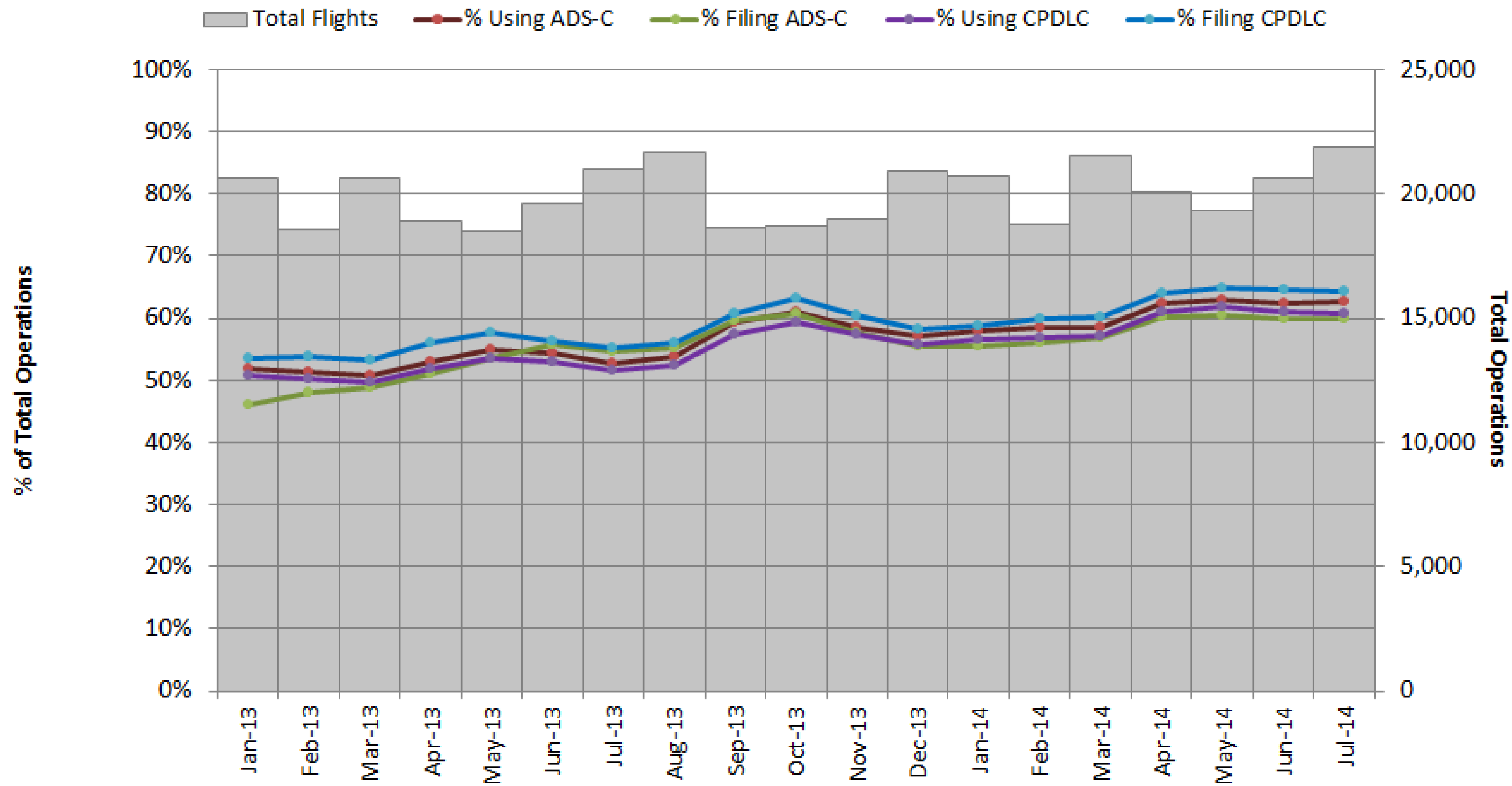
January 2013 – June 2014

FLIGHT COUNTS AND DATA LINK USAGE BY FIR

ADS/CPDLC Equipage and Usage

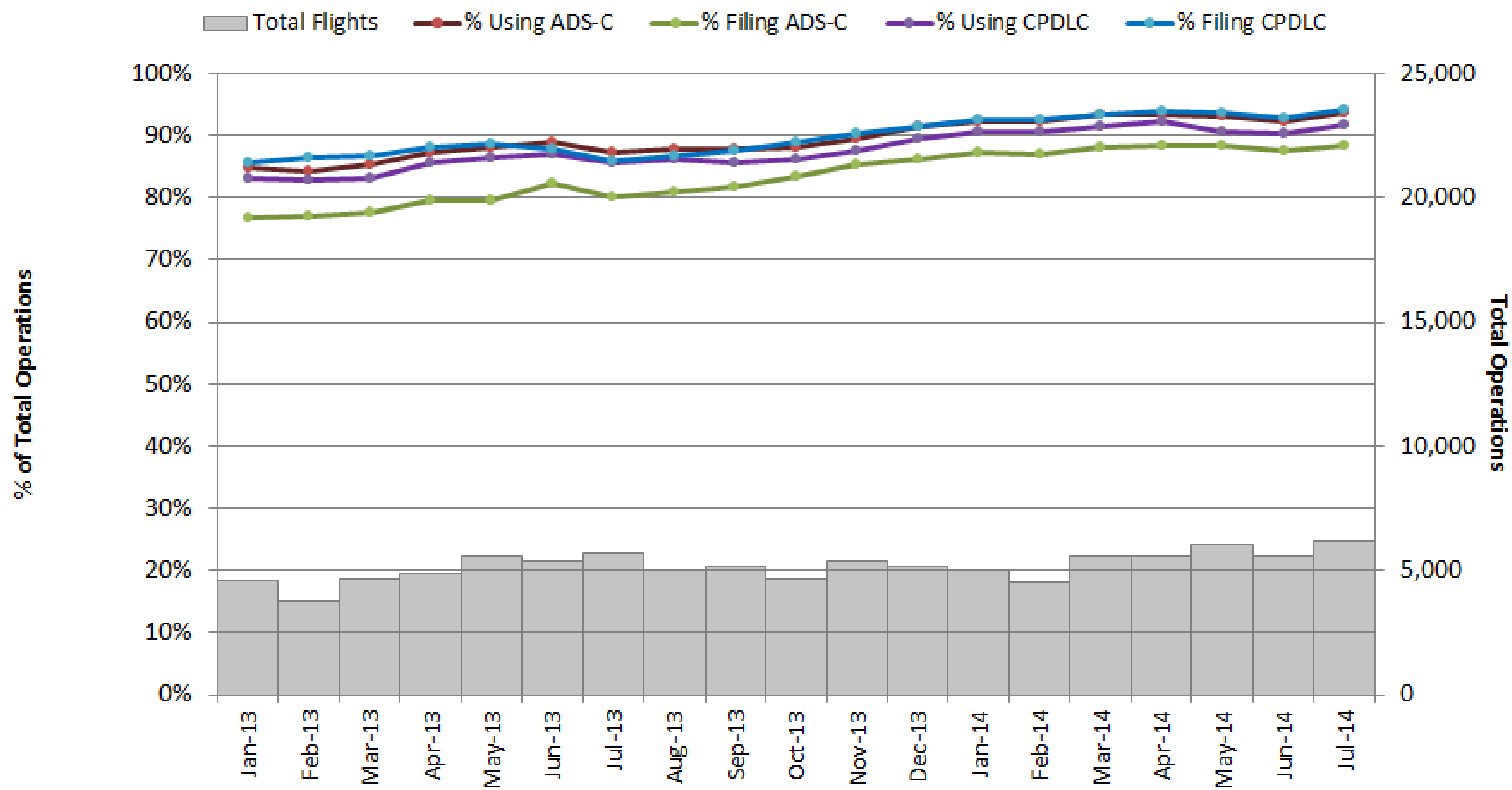
- A flight is determined to be "**using ADS-C**" if there is one ADS-C report observed
- A flight is determined to be "**filing ADS-C**" if a "D1" is observed in field 10b of the ICAO flight plan
- A flight is determined to be "**using CPDLC**" if there is one CPDLC message observed
- A flight is determined to be "**filing CPDLC**" if a "J2," "J3," "J4," "J5," "J6" or "J7" is observed in field 10a of the ICAO flight plan

Data Link Equipage in ZAK Oceanic FIR



	J-13	F-13	M-13	A-13	M-13	J-13	J-13	A-13	S-13	O-13	N-13	D-13	J-14	F-14	M-14	A-14	M-14	J-14	J-14
Total Flights	20,626	18,600	20,629	18,883	18,497	19,633	21,016	21,706	18,639	18,734	18,951	20,925	20,688	18,744	21,556	20,056	19,351	20,662	21,903
% Using ADS-C	51.9%	51.3%	50.7%	53.0%	55.0%	54.3%	52.8%	53.9%	59.2%	60.9%	58.6%	57.0%	58.0%	58.6%	58.4%	62.3%	63.0%	62.5%	62.5%
% Filing ADS-C	46.1%	48.0%	48.9%	51.1%	53.5%	55.8%	54.8%	55.2%	59.7%	60.7%	57.7%	55.5%	55.5%	56.1%	56.7%	60.3%	60.4%	60.0%	59.9%
% Using CPDLC	50.7%	50.1%	49.5%	51.9%	53.6%	52.9%	51.5%	52.5%	57.4%	59.4%	57.4%	55.8%	56.6%	56.8%	57.2%	61.0%	61.7%	60.9%	60.7%
% Filing CPDLC	53.5%	53.8%	53.3%	55.9%	57.7%	56.4%	55.2%	55.9%	60.8%	63.2%	60.5%	58.3%	58.7%	59.9%	60.3%	64.0%	64.8%	64.5%	64.3%

Data Link Equipage in ZAN Oceanic FIR



	J-13	F-13	M-13	A-13	M-13	J-13	J-13	A-13	S-13	O-13	N-13	D-13	J-14	F-14	M-14	A-14	M-14	J-14	J-14
Total Flights	4,621	3,792	4,636	4,859	5,567	5,339	5,709	5,047	5,126	4,681	5,377	5,171	4,982	4,534	5,558	5,600	6,064	5,536	6,169
% Using ADS-C	84.9%	84.3%	85.4%	87.3%	88.2%	88.8%	87.2%	87.7%	87.7%	88.1%	89.5%	91.3%	92.2%	92.2%	93.3%	93.4%	93.2%	92.3%	93.7%
% Filing ADS-C	76.8%	77.1%	77.5%	79.6%	79.6%	82.3%	80.1%	80.8%	81.7%	83.5%	85.4%	86.1%	87.2%	87.1%	88.1%	88.5%	88.3%	87.5%	88.4%
% Using CPDLC	83.0%	82.7%	83.2%	85.5%	86.4%	86.9%	85.6%	86.1%	85.6%	86.2%	87.6%	89.4%	90.7%	90.5%	91.5%	92.2%	90.6%	90.2%	91.6%
% Filing CPDLC	85.6%	86.3%	86.8%	88.1%	88.7%	87.9%	86.0%	86.8%	87.6%	88.8%	90.3%	91.3%	92.5%	92.6%	93.5%	93.9%	93.5%	92.8%	94.2%

January – June 2014

DATA LINK PERFORMANCE BY MEDIA TYPE

Performance by Media Type | Oakland

January – June 2014

72,194 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	2,098,467	98.6%	99.4%	83,633	99.6%	99.7%	99.3%	99.6%	98.1%
SAT	1,847,590	98.6%	99.4%	81,639	99.7%	99.7%	99.4%	99.6%	98.1%
VHF	242,890	99.3%	99.6%	1,686	100.0%	100.0%	99.6%	99.7%	98.0%
Performance Criteria		**RSP 400**			**RCP 400**				
HF	7,981	92.4%	94.6%	51	--	--	--	--	--

Performance by Media Type

January – June 2014

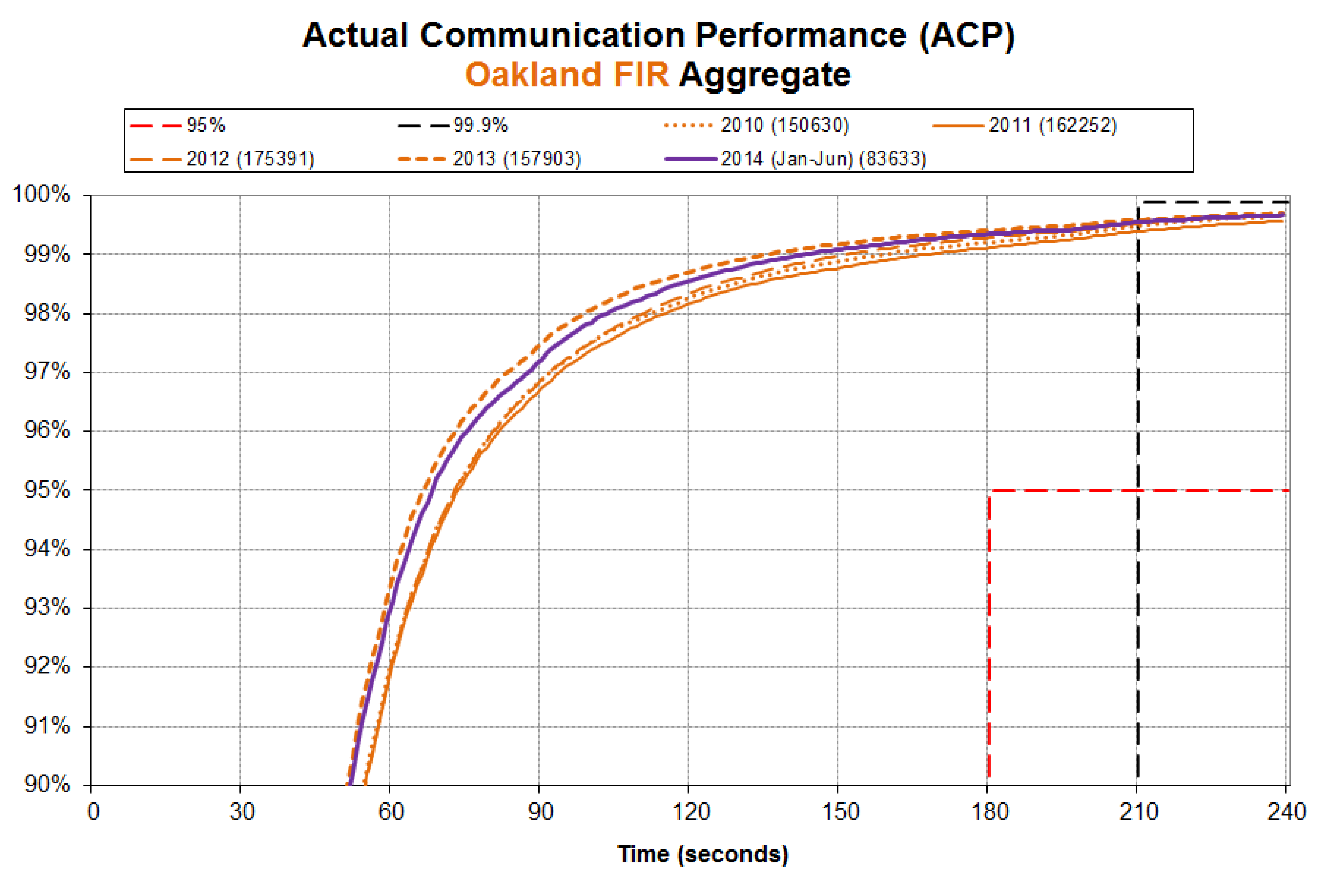
Anchorage

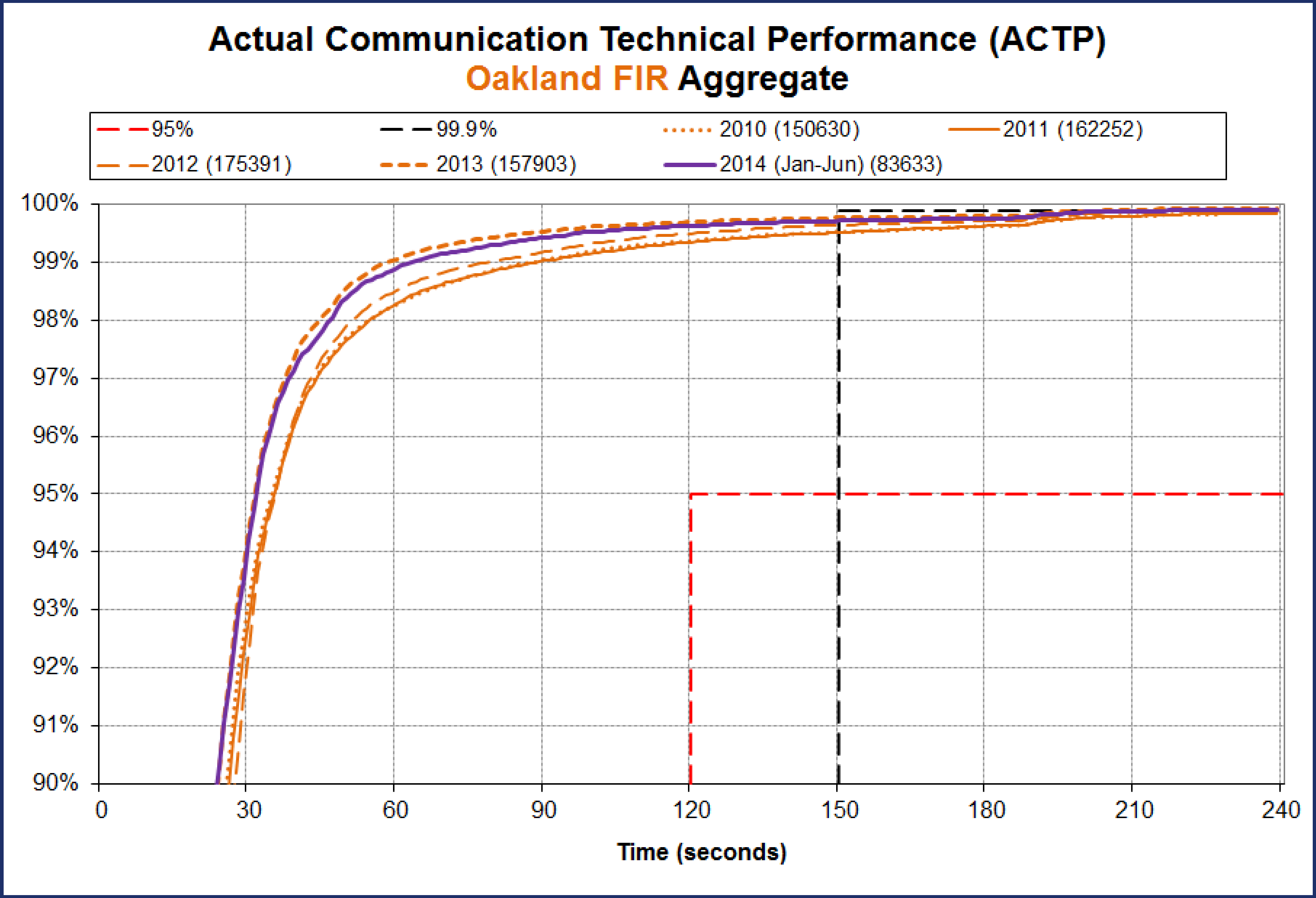
30,066 flights

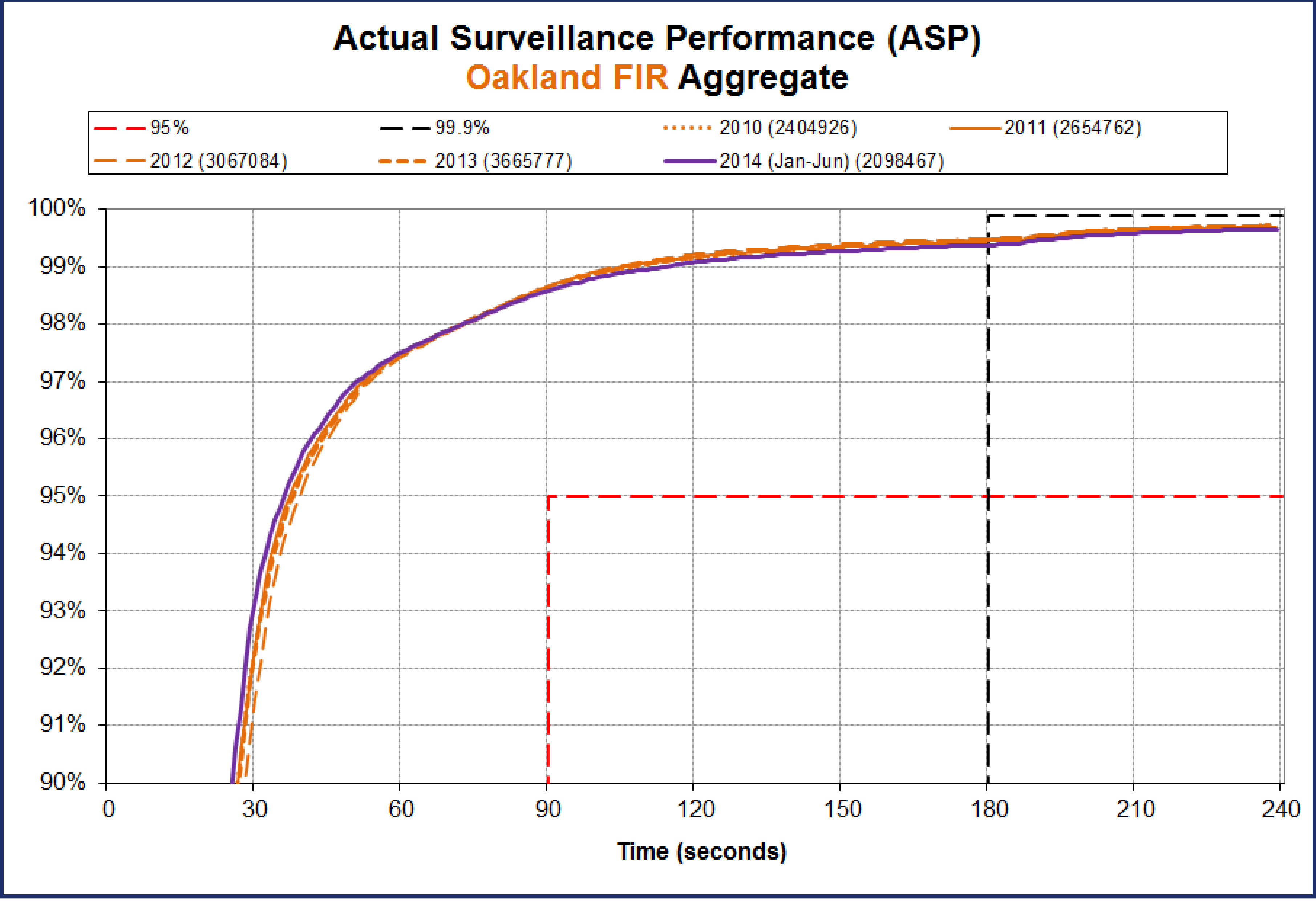
Media Type	ADS-C			CPDLC					
	Count of ADS-C Downlink Messages	ADS-C 95%	ADS-C 99.9%	Count of CPDLC Transactions	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%	PORT 95%
Performance Criteria		**RSP 180**			**RCP 240**				
Aggregate	855,689	98.1%	99.3%	19,120	99.6%	99.7%	99.3%	99.6%	97.1%
SAT	549,918	97.6%	99.2%	12,353	99.5%	99.7%	99.1%	99.5%	96.6%
VHF	300,081	99.6%	99.7%	6,512	100.0%	100.0%	99.8%	99.8%	98.3%
Performance Criteria		**RSP 400**			**RCP 400**				
HF	5,687	90.7%	94.1%	14	--	--	--	--	--

2010 - 2014

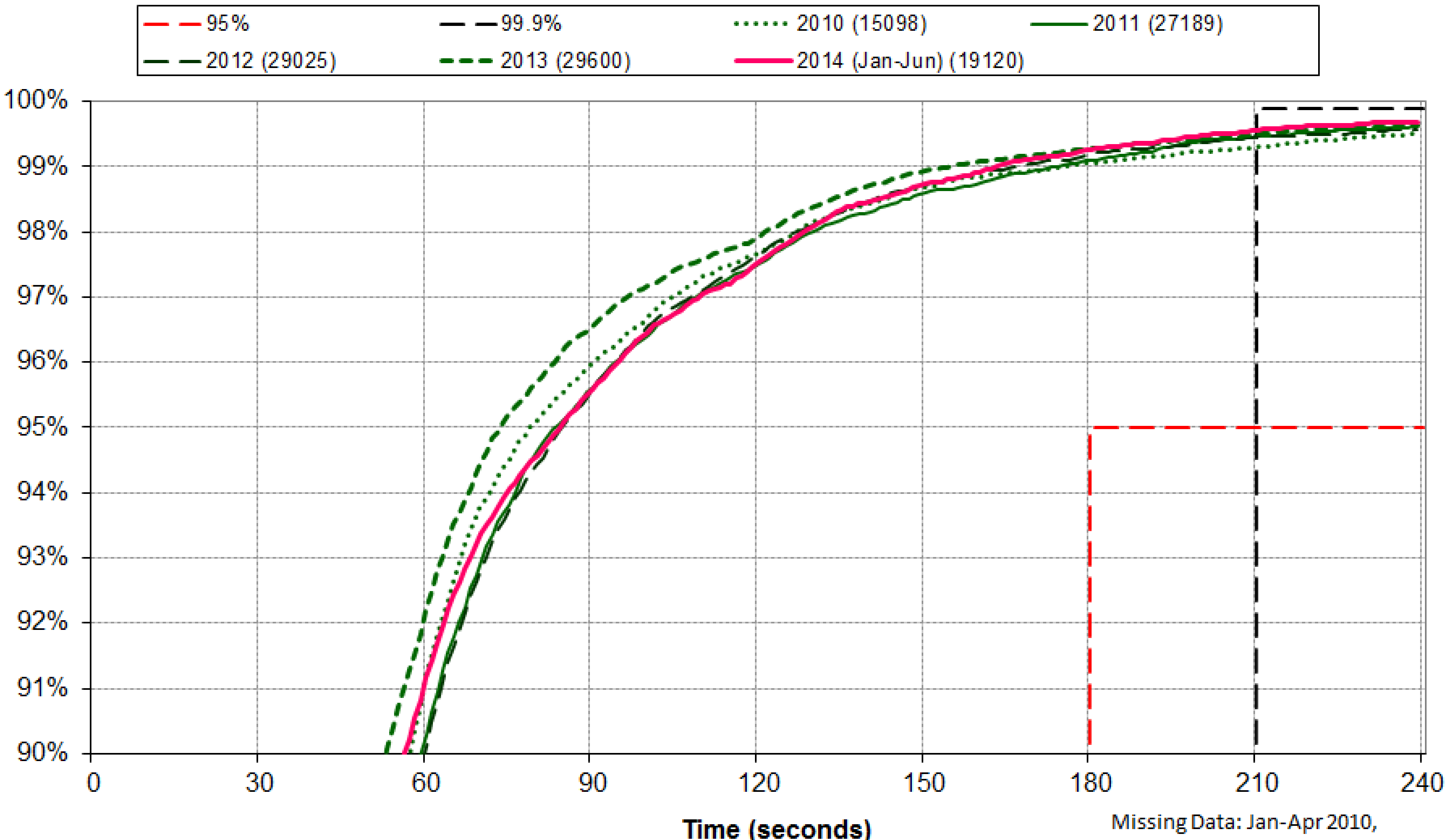
ANNUAL AGGREGATE FIR PERFORMANCE


Actual Communication Performance (ACP)
Oakland FIR Aggregate
95%
99.9%
2010 (150630)
2011 (162252)
2012 (175391)
2013 (157903)
2014 (Jan-Jun) (83633)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)


Actual Communication Technical Performance (ACTP)
Oakland FIR Aggregate
95%
99.9%
2010 (150630)
2011 (162252)
2012 (175391)
2013 (157903)
2014 (Jan-Jun) (83633)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

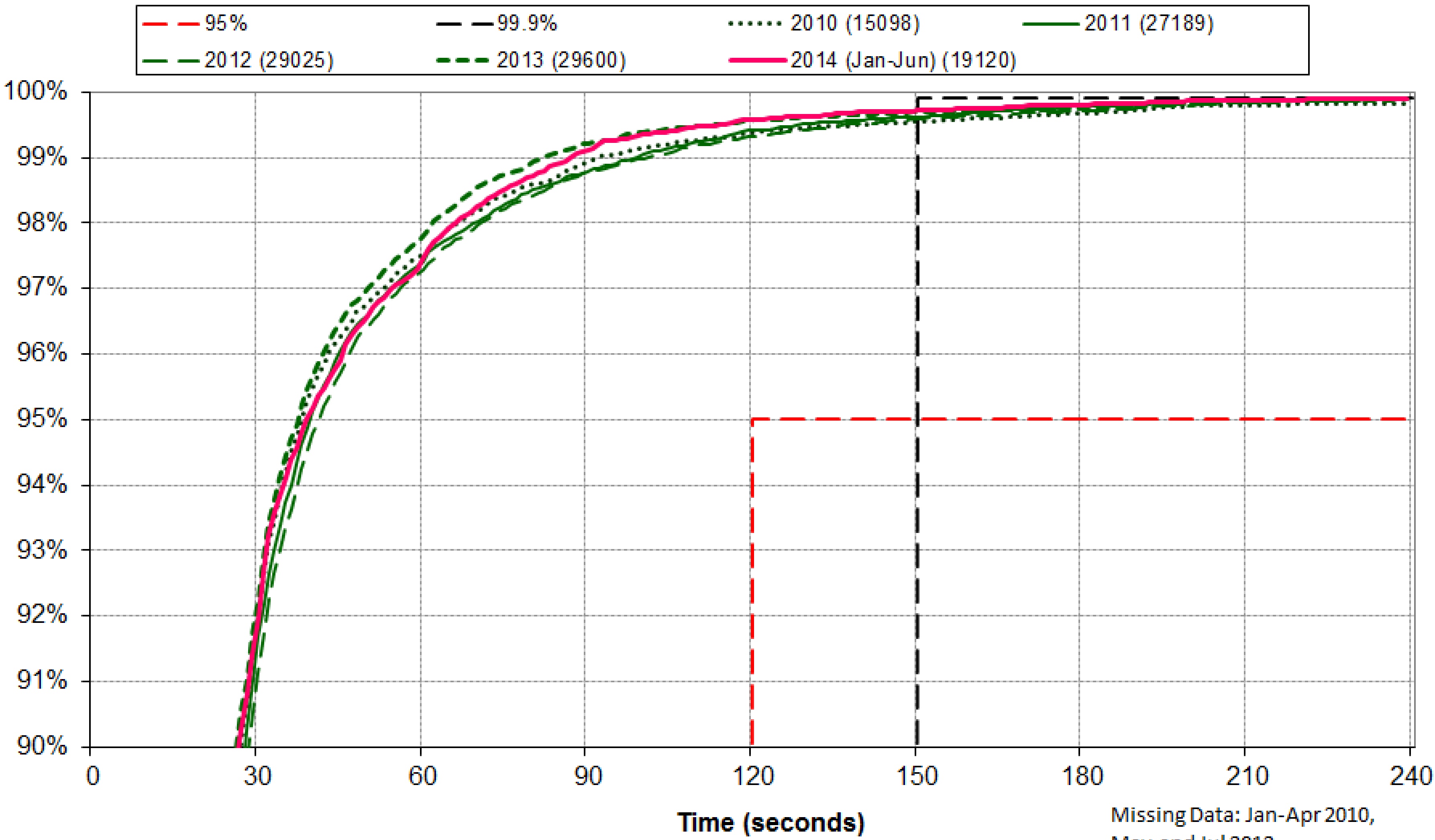

Actual Surveillance Performance (ASP)
Oakland FIR Aggregate
95%
99.9%
2010 (2404926)
2011 (2654762)
2012 (3067084)
2013 (3665777)
2014 (Jan-Jun) (2098467)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

Actual Communication Performance (ACP)
Anchorage FIR Aggregate

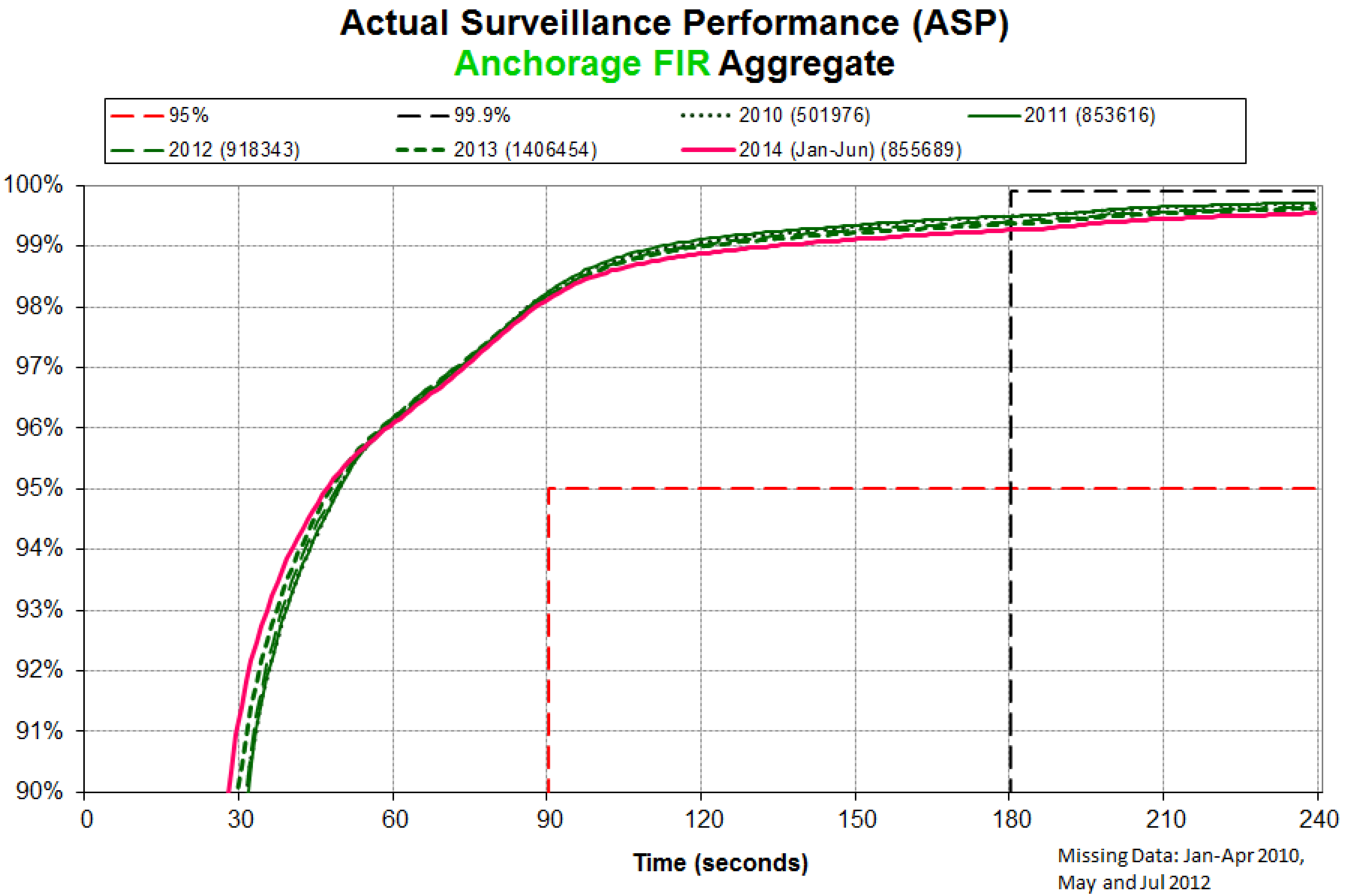


Missing Data: Jan-Apr 2010, May and Jul 2012

Actual Communication Technical Performance (ACTP)
Anchorage FIR Aggregate



Missing Data: Jan-Apr 2010, May and Jul 2012



Federal Aviation Administration

Overview

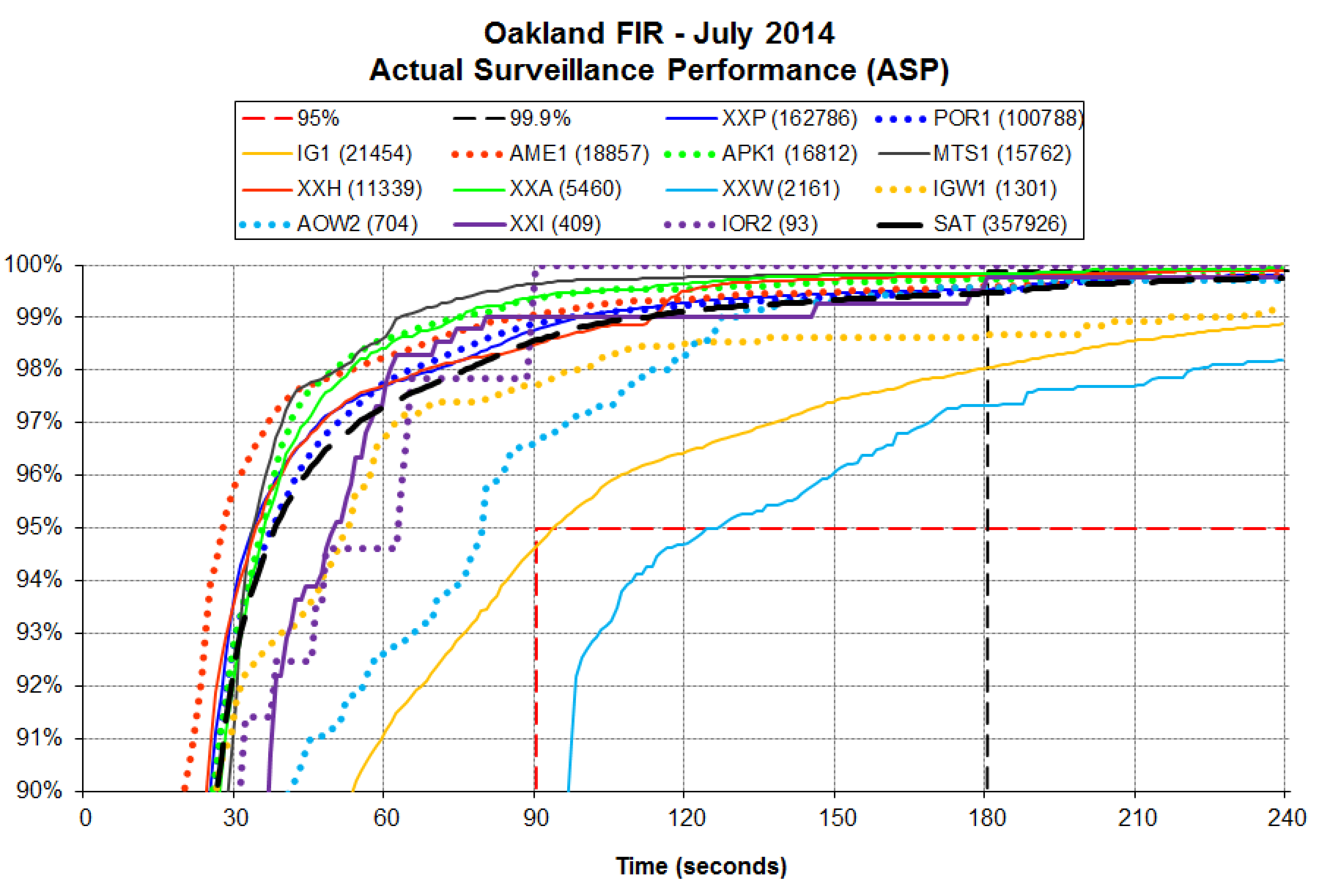
- Analysis period: July 2014
- Analysis by FIR: Oakland, Anchorage
- ASP → RSP180 criteria
- Station identifiers designate “path” taken by data link messages between aircraft and ATC
- “Paths” vary between the four constellations of satellites and between the two data link service providers

July 2014

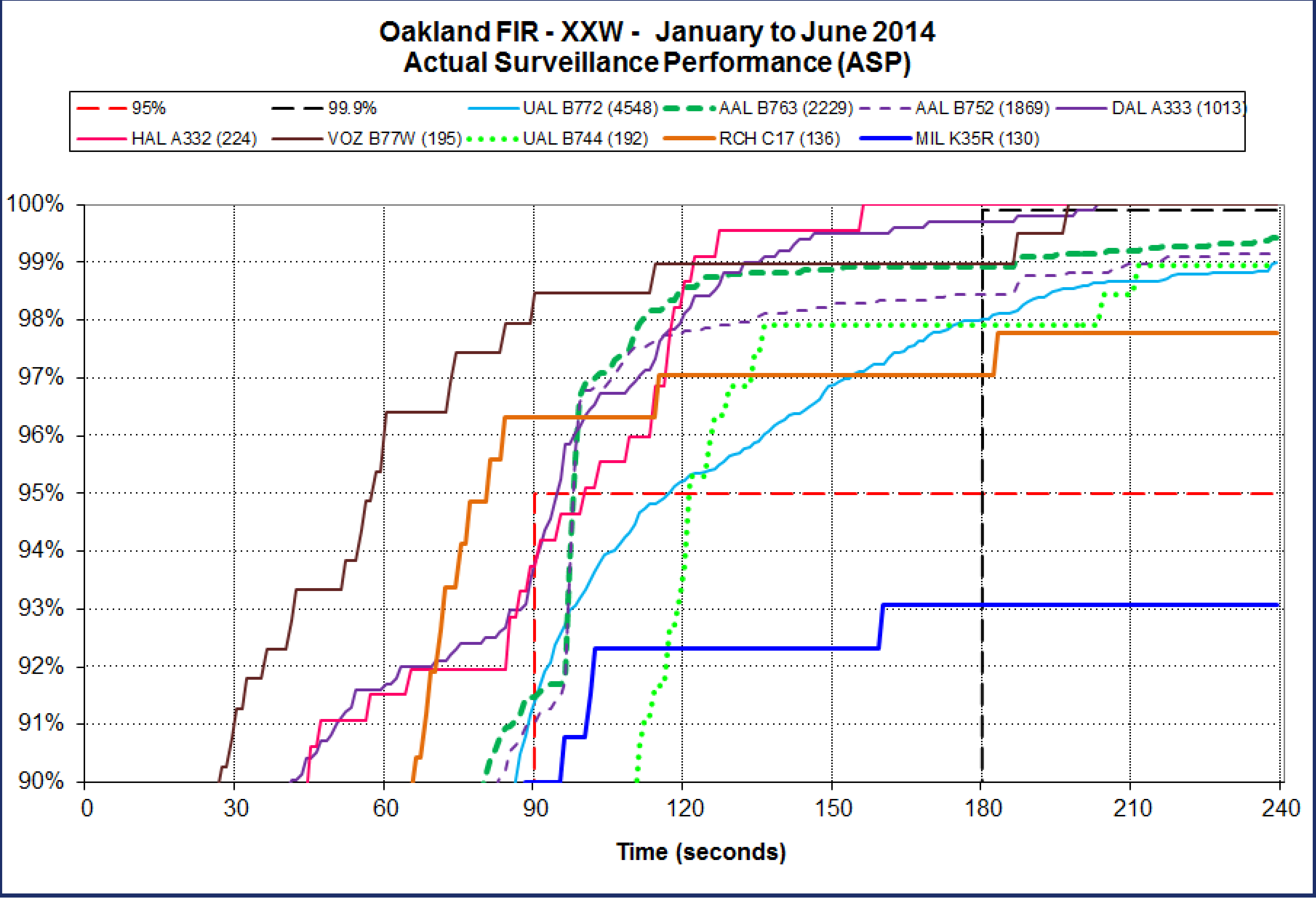
ADS-C PERFORMANCE BY STATION IDENTIFIER

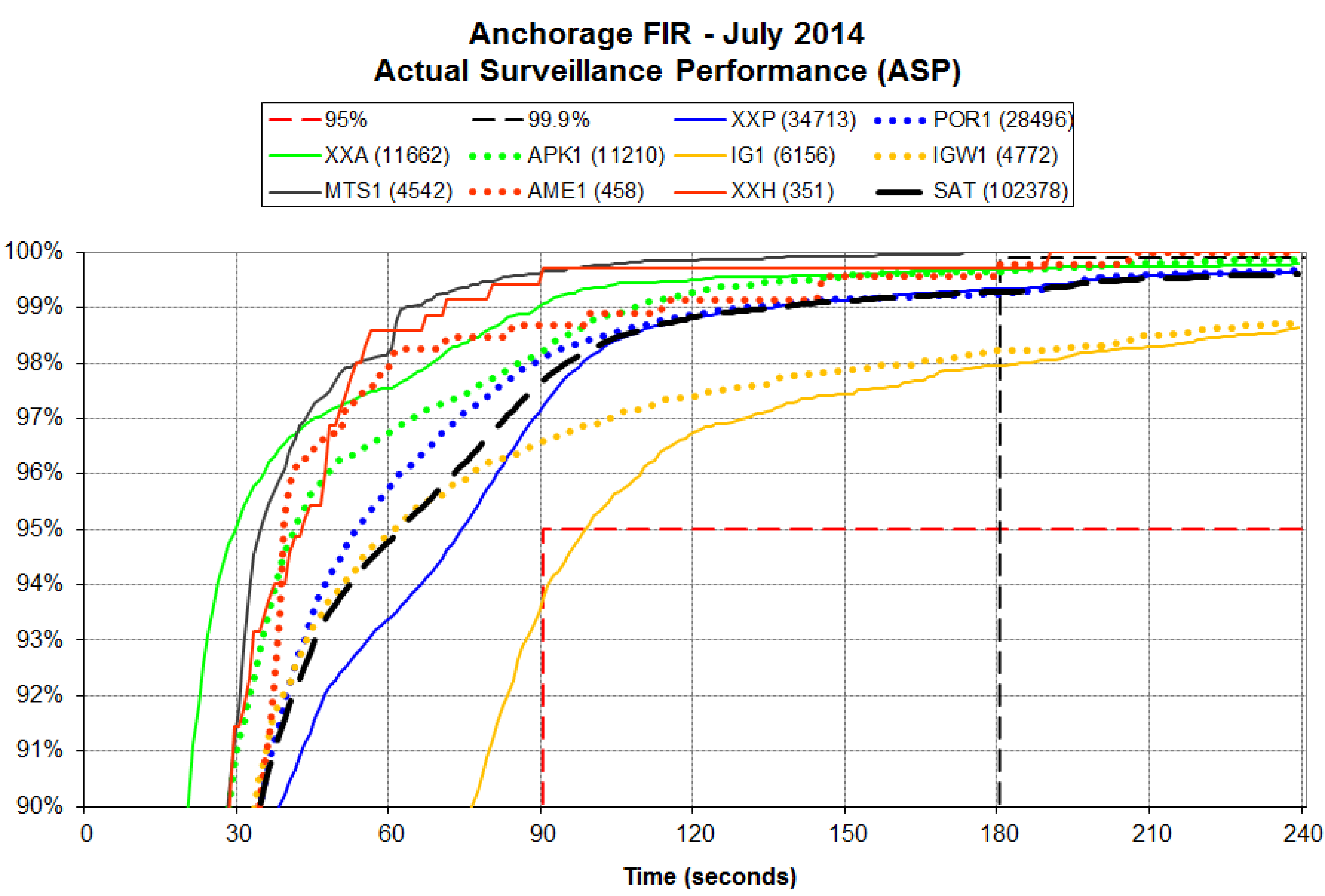
Station/Gateway Identifiers

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**
Paumalu, Hawaii, US	Inmarsat I-4 Americas	**AME1**	**XXH**
	Inmarsat I-4 Asia-Pac	**APK1**	**XXA**
Kobe and Hitachiota, Japan	MTSAT Japan	**MTS1**	**--**
Phoenix, Arizona, US	Iridium Global	**IGW1**	**IG1**



Federal Aviation Administration


Oakland FIR - XXW - January to June 2014
Actual Surveillance Performance (ASP)
95%
99.9%
UAL B772 (4548)
AAL B763 (2229)
AAL B752 (1869)
DAL A333 (1013)
HAL A332 (224)
VOZ B77W (195)
UAL B744 (192)
RCH C17 (136)
MIL K35R (130)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

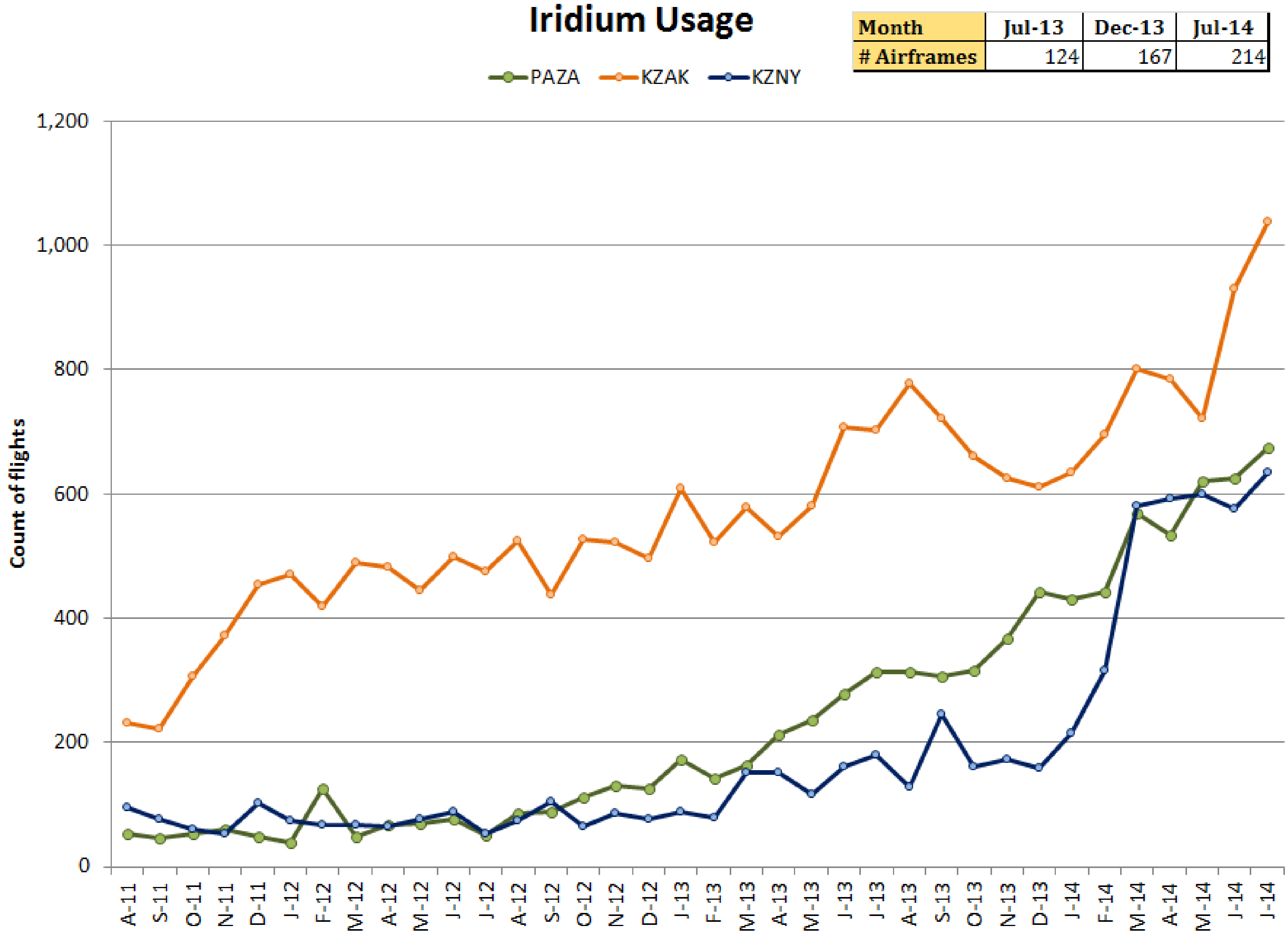

Anchorage FIR - July 2014
Actual Surveillance Performance (ASP)
95%
99.9%
XXP (34713)
POR1 (28496)
XXA (11662)
APK1 (11210)
IG1 (6156)
IGW1 (4772)
MTS1 (4542)
AME1 (458)
XXH (351)
SAT (102378)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

PR 1411-BC: Poor performance for AOR-E over I-3

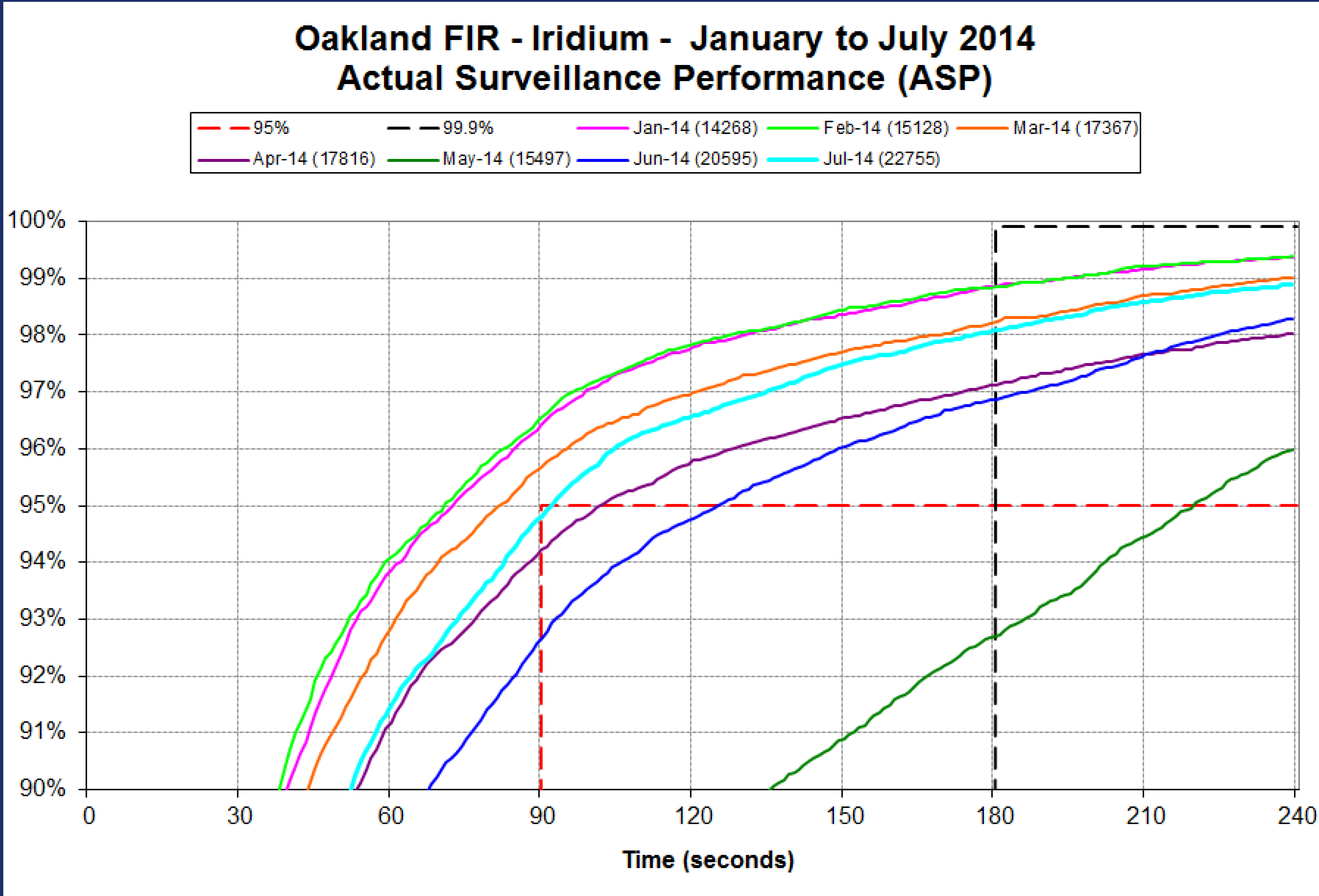
- Submitted PR to DLMA for performance over XXW – 11/8/2013
- Inmarsat investigation revealed it is not an Inmarsat issue
- Suggested the issue could be investigated as an issue with operator/aircraft (see chart on next slide)
- Still under investigation

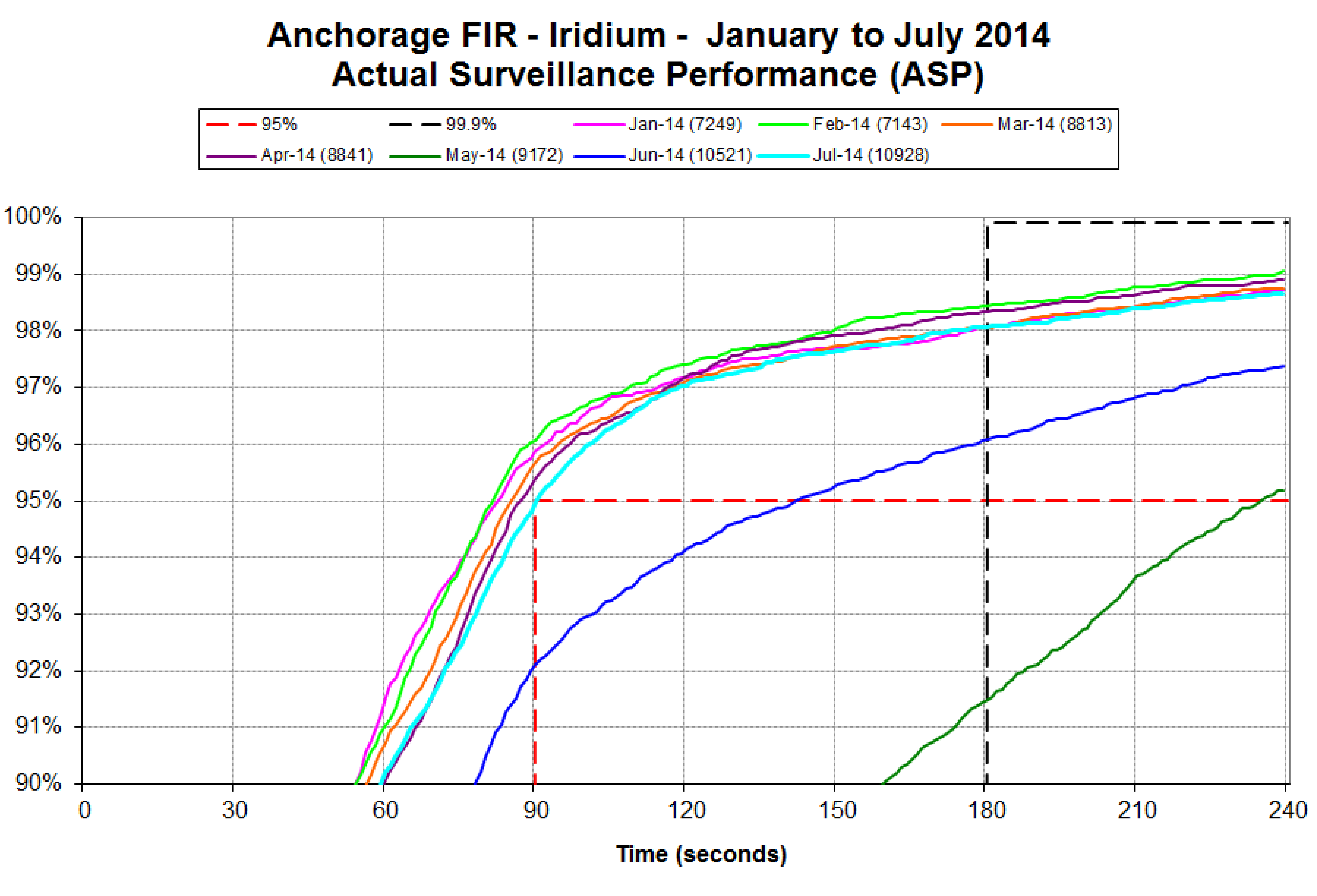
Usage Trends and
ADS-C Performance by Operator/Aircraft Type

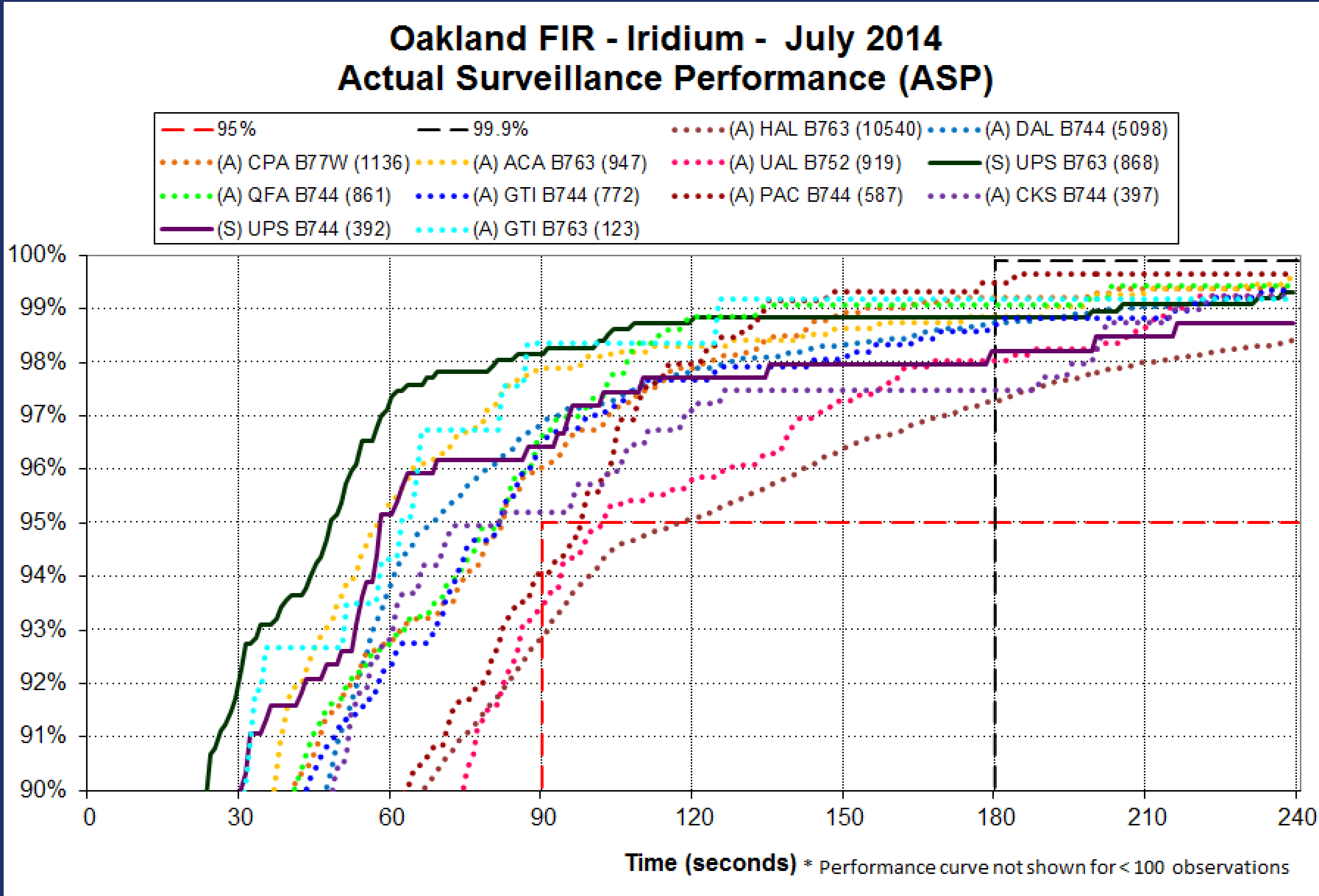
FANS OVER IRIDIUM (FOI)



Month	Jul-13	Dec-13	Jul-14
# Airframes	124	167	214

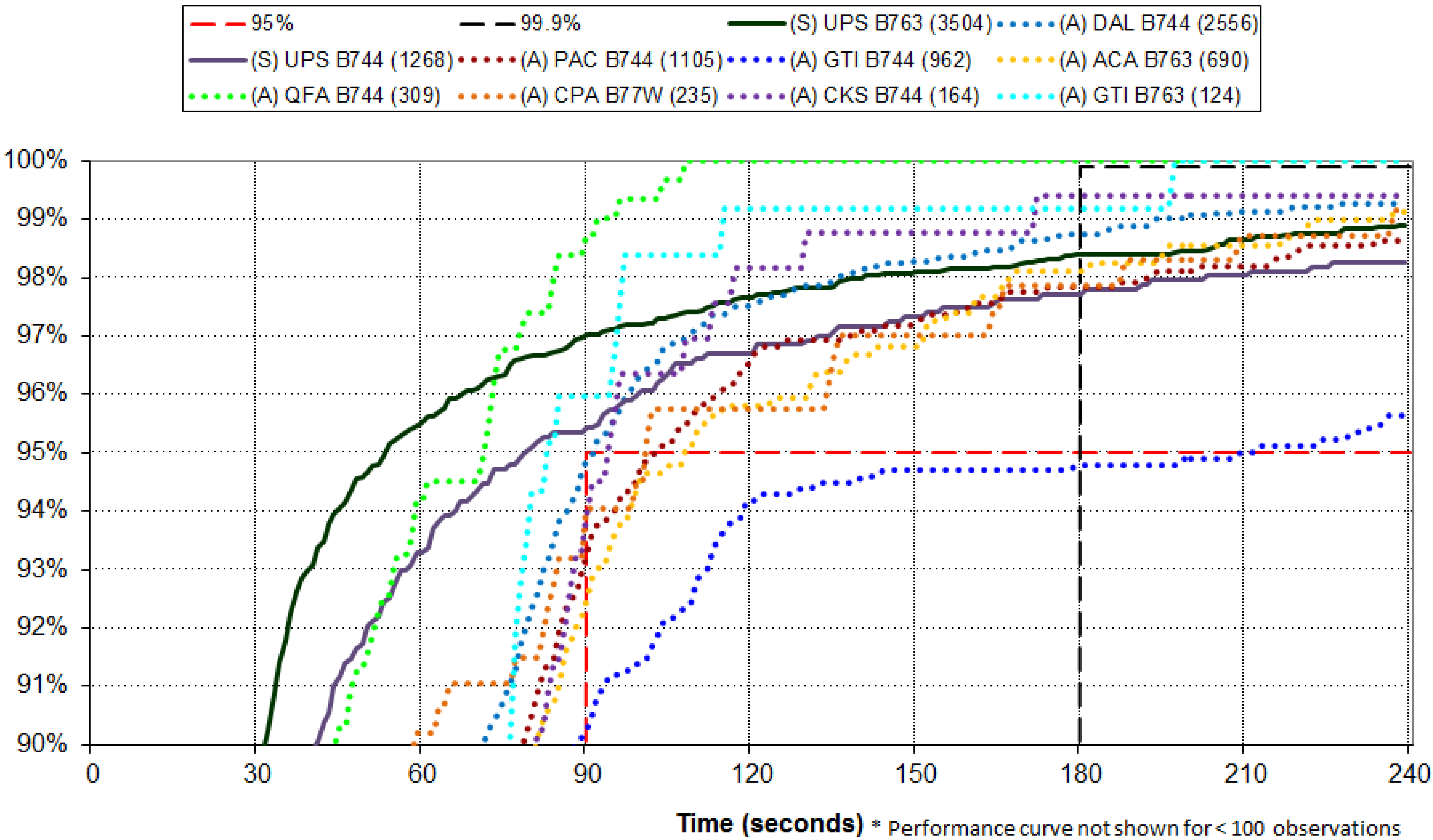

Oakland FIR - Iridium - January to July 2014
Actual Surveillance Performance (ASP)
95%
99.9%
Jan-14 (14268)
Feb-14 (15128)
Mar-14 (17367)
Apr-14 (17816)
May-14 (15497)
Jun-14 (20595)
Jul-14 (22755)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)


Anchorage FIR - Iridium - January to July 2014
Actual Surveillance Performance (ASP)
95%
99.9%
Jan-14 (7249)
Feb-14 (7143)
Mar-14 (8813)
Apr-14 (8841)
May-14 (9172)
Jun-14 (10521)
Jul-14 (10928)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)



Oakland FIR - Iridium - July 2014
Actual Surveillance Performance (ASP)
95%
99.9%
(A) HAL B763 (10540)
(A) DAL B744 (5098)
(A) CPA B77W (1136)
(A) ACA B763 (947)
(A) UAL B752 (919)
(S) UPS B763 (868)
(A) QFA B744 (861)
(A) GTI B744 (772)
(A) PAC B744 (587)
(A) CKS B744 (397)
(S) UPS B744 (392)
(A) GTI B763 (123)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)
* Performance curve not shown for < 100 observations

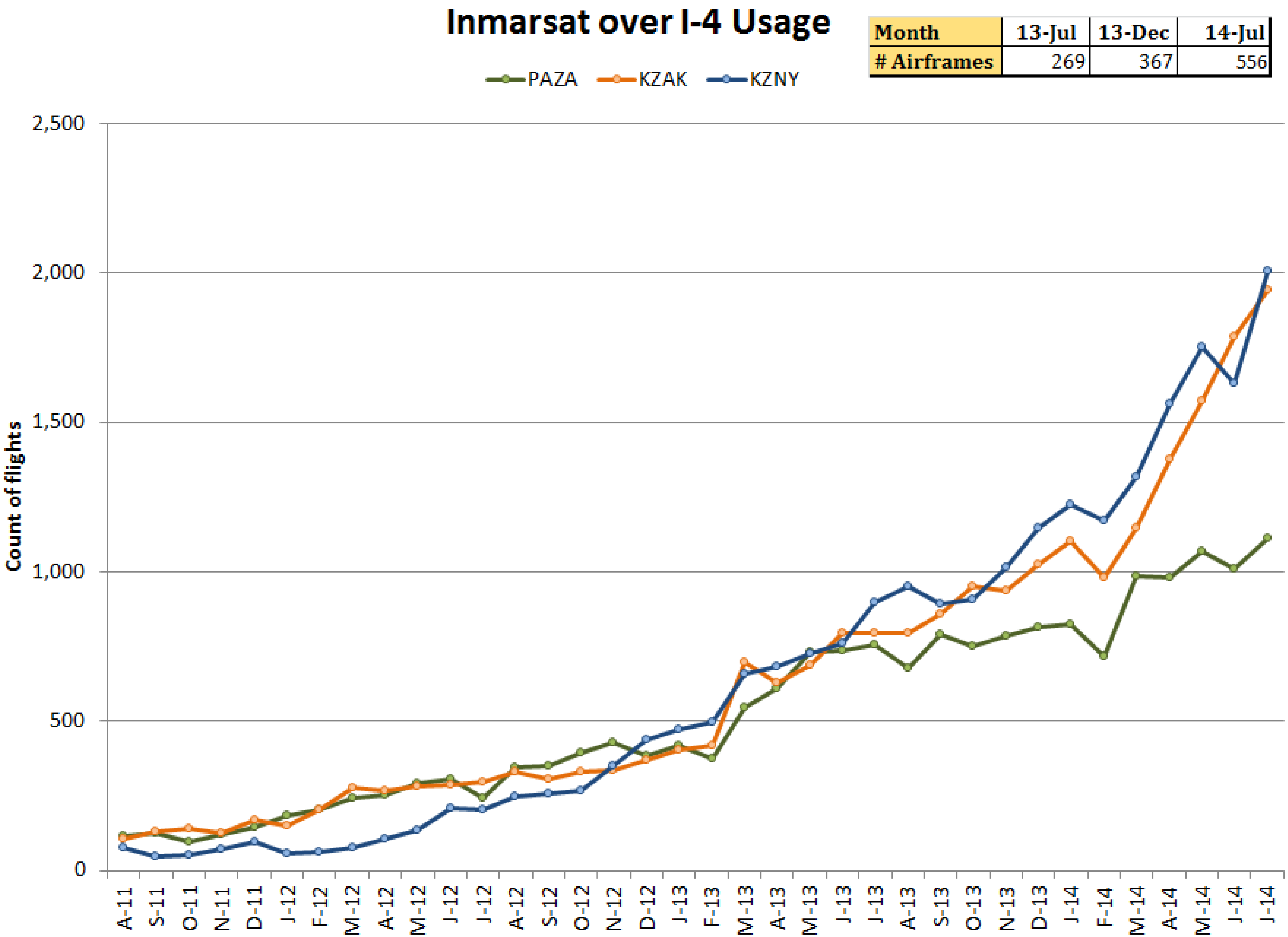
Anchorage FIR - Iridium - July 2014
Actual Surveillance Performance (ASP)



Usage Trends and

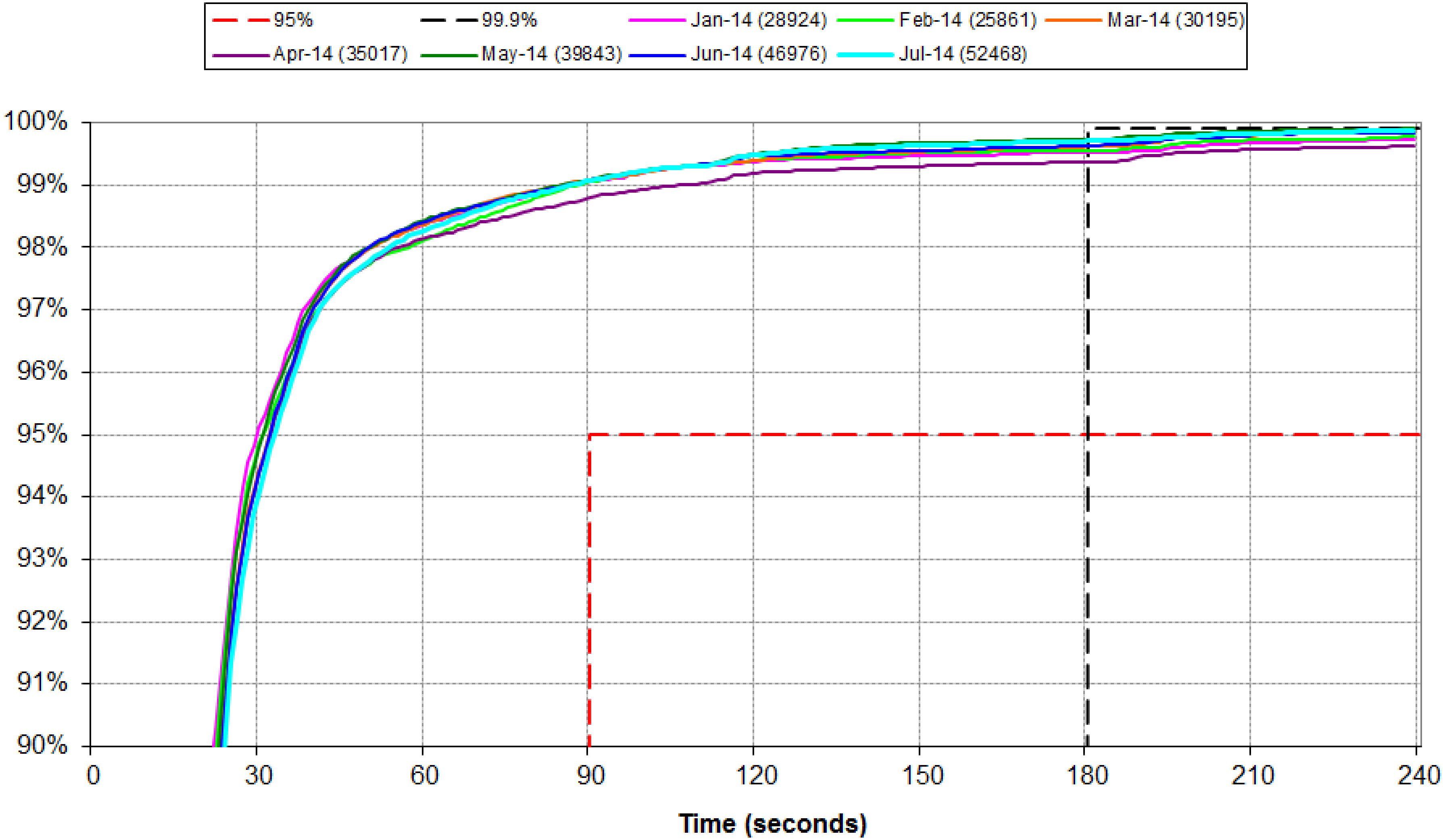
ADS-C Performance by Operator/Aircraft Type

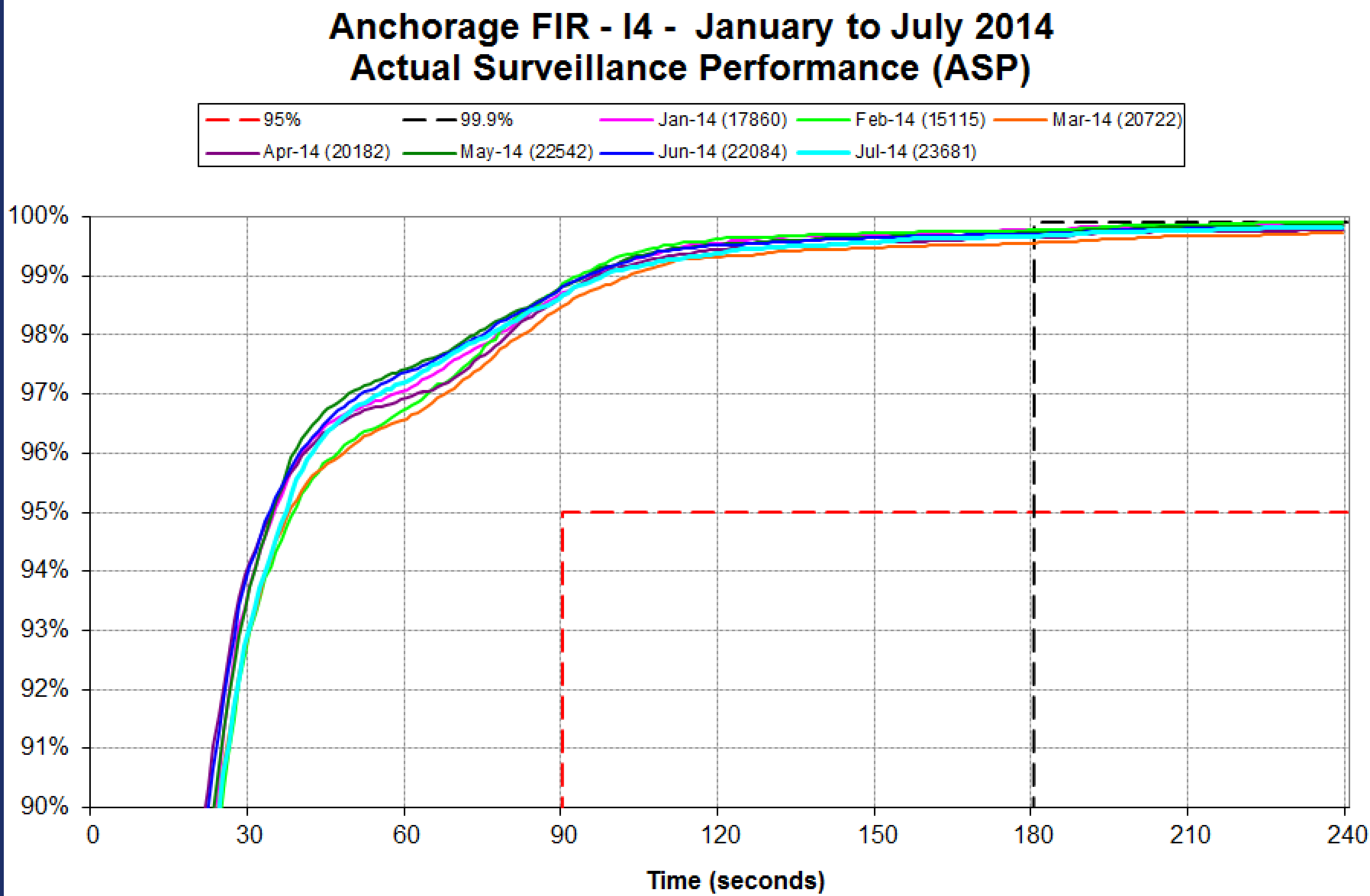
FANS OVER INMARSAT I-4



Month	13-Jul	13-Dec	14-Jul
# Airframes	269	367	556

Oakland FIR - I4 - January to July 2014
Actual Surveillance Performance (ASP)





Anchorage FIR - I4 - January to July 2014
Actual Surveillance Performance (ASP)
95%
99.9%
Jan-14 (17860)
Feb-14 (15115)
Mar-14 (20722)
Apr-14 (20182)
May-14 (22542)
Jun-14 (22084)
Jul-14 (23681)
100%
99%
98%
97%
96%
95%
94%
93%
92%
91%
90%
0
30
60
90
120
150
180
210
240
Time (seconds)

Oakland FIR I-4 – ASP

January – June 2014

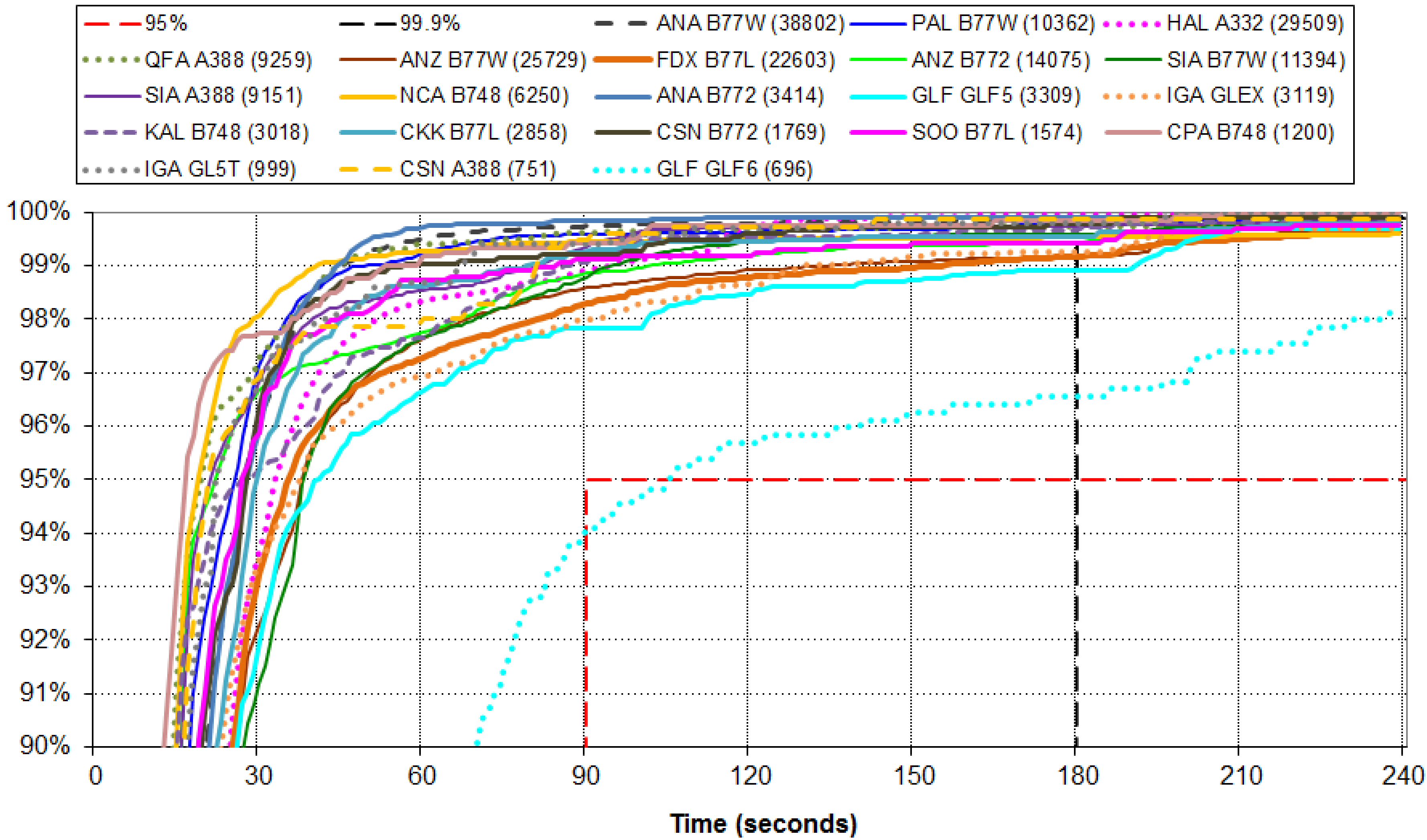
- **33** operator/aircraft types observed with 100 or more ADS-C downlink reports during the 6-month period
- **1** does not meet the 95% criteria for RSP180 ASP

GLF/GLF6	696	**93.8%**	96.6%

- **8** meet the 99.9% criteria for RSP180 ASP
- **4** do not meet the 99.9% criteria for RSP180 ASP at the rule-of-thumb 99.0%

GLF/GLF6	696	93.8%	**96.6%**
GLF/GLF4	403	97.0%	**98.0%**
BOE/B789	209	95.7%	**98.1%**
KAL/B77L	171	96.5%	**97.7%**

Oakland FIR - I4 - January to June 2014
Actual Surveillance Performance (ASP)



Anchorage I-4 – ASP

January – June 2014

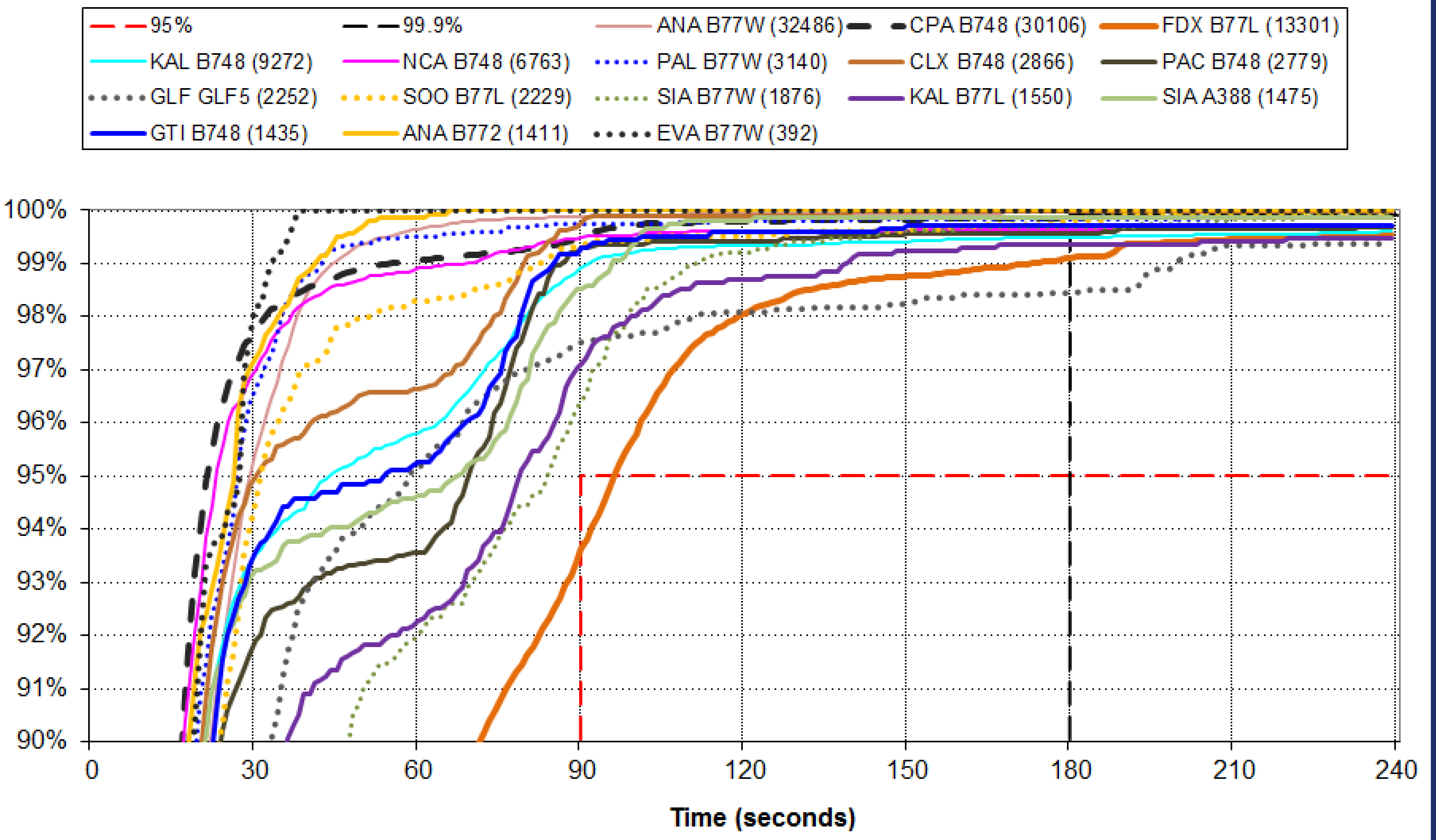
- **24** operator/aircraft types observed with 100 or more ADS-C downlink reports during the 6-month period
- **3** do not meet the 95% criteria for RSP180 ASP

FDX/B77L	13,301	**93.4%**	99.1%
GLF/GLF6	239	**94.6%**	98.3%
IGA/GL5T	100	**92.0%**	94.0%

- **7** meet the 99.9% criteria for RSP180 ASP
- **5** do not meet the 99.9% criteria for RSP180 ASP at the rule-of-thumb 99.0%

GLF/GLF5	2,252	97.5%	**98.5%**
GLF/GLF4	262	97.3%	**98.5%**
GLF/GLF6	239	94.6%	**98.3%**
IGA/FA7X	107	98.1%	**98.1%**
IGA/GL5T	100	92.0%	**94.0%**

Anchorage FIR - I4 - January to June 2014
Actual Surveillance Performance (ASP)



Overview

- Analysis period: January to June 2014
- Analysis by FIR: Oakland, Anchorage,
- All media types combined
- RCP240 and RSP180 criteria
- Operators ordered in summary tables by descending count of ADS-C downlink messages
- Green highlights where criteria is met
- Red highlights where criteria is not met
- Yellow highlights where 99.9% performance is 99.0% - 99.9%

January – June 2014

DATA LINK PERFORMANCE BY OPERATOR

Summary of Performance by Operator Oakland FIR

- There were 53 operators with at least 100 ADS-C messages during this 6-month period
- Summary of how many operators meet criteria:

Criteria	ASP	ACTP	ACP	PORT
95% within 90 sec (60 sec for PORT)	**53**	**53**	**53**	**45**
99.9% within 180 sec	**6**	**30**	**23**	
99.0% - 99.9% within 180 sec	**43**	**22**	**23**	
Less than 99.0% within 180 sec	**4**	**1**	**7**	

Observed Performance by Operator Oakland FIR

January – June 2014

Oper	ADS-C				CPDLC						
Code	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%
A	273,991	13.1%	98.4%	99.3%	12,708	15.2%	99.5%	99.5%	99.1%	99.3%	96.6%
NNN	210,062	10.0%	96.8%	98.9%	4,938	5.9%	99.5%	99.6%	98.7%	99.0%	96.5%
R	143,448	6.8%	98.7%	99.4%	4,454	5.3%	99.4%	99.5%	99.0%	99.3%	98.3%
L	142,208	6.8%	98.3%	99.1%	7,229	8.6%	99.6%	99.7%	99.0%	99.3%	96.7%
G	126,531	6.0%	99.5%	99.8%	5,669	6.8%	99.9%	99.9%	99.8%	99.9%	99.7%
D	117,676	5.6%	99.1%	99.7%	3,643	4.4%	99.8%	99.9%	99.7%	99.8%	98.7%
B	106,012	5.1%	98.7%	99.3%	4,246	5.1%	99.5%	99.6%	99.4%	99.7%	98.5%
Q	92,822	4.4%	98.8%	99.6%	4,685	5.6%	99.8%	99.9%	99.8%	99.8%	99.0%
J	86,749	4.1%	99.5%	99.7%	4,678	5.6%	99.9%	99.9%	99.9%	99.9%	99.4%
H	67,685	3.2%	99.6%	99.8%	2,654	3.2%	99.9%	99.9%	99.7%	99.8%	99.4%
E	66,137	3.2%	99.0%	99.5%	2,927	3.5%	99.6%	99.6%	99.3%	99.5%	99.3%
S	59,382	2.8%	98.4%	99.3%	1,746	2.1%	99.4%	99.7%	99.5%	99.8%	98.9%
T	57,321	2.7%	99.3%	99.6%	2,416	2.9%	99.7%	99.7%	99.6%	99.8%	99.5%
F	49,473	2.4%	99.0%	99.6%	4,121	4.9%	99.7%	99.7%	99.6%	99.7%	99.2%
N	43,985	2.1%	99.0%	99.2%	879	1.1%	99.7%	99.7%	98.8%	99.1%	96.9%
P	39,597	1.9%	98.2%	99.4%	2,091	2.5%	99.6%	99.8%	99.4%	99.6%	97.9%
Y	37,601	1.8%	96.6%	98.2%	646	0.8%	97.4%	97.7%	97.7%	98.1%	97.1%
NNNN	37,216	1.8%	98.2%	99.2%	729	0.9%	99.5%	99.9%	99.6%	99.9%	97.1%
O	34,508	1.6%	98.9%	99.6%	1,419	1.7%	99.9%	100.0%	99.9%	99.9%	99.6%
PPPP	32,972	1.6%	99.1%	99.6%	2,035	2.4%	99.8%	99.9%	99.7%	99.9%	99.7%
ZZZZ	30,856	1.5%	99.1%	99.4%	1,017	1.2%	99.8%	99.8%	99.1%	99.3%	94.6%
US MIL	28,739	1.4%	98.7%	99.4%	501	0.6%	99.8%	99.8%	97.6%	98.0%	92.2%

Observed Performance by Operator Oakland FIR

January – June 2014 (Continued)

Oper	ADS-C				CPDLC						
Code	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%
V	21,452	1.0%	99.5%	99.6%	885	1.1%	99.8%	99.9%	99.9%	100.0%	99.9%
QQQQ	20,517	1.0%	99.3%	99.5%	1,123	1.3%	99.6%	99.6%	99.2%	99.5%	97.9%
X	19,796	0.9%	98.8%	99.5%	919	1.1%	99.9%	100.0%	99.6%	99.8%	98.0%
JJJ	14,408	0.7%	98.3%	99.2%	347	0.4%	99.4%	99.7%	100.0%	100.0%	98.0%
MMM	13,738	0.7%	99.1%	99.5%	606	0.7%	100.0%	100.0%	99.8%	99.8%	98.7%
LLL	12,733	0.6%	99.1%	99.6%	599	0.7%	99.2%	99.2%	99.2%	99.5%	99.2%
W	12,722	0.6%	98.0%	99.9%	376	0.4%	99.7%	100.0%	99.7%	99.7%	98.1%
MMMM	11,109	0.5%	97.8%	98.9%	301	0.4%	99.0%	99.7%	97.3%	98.0%	90.0%
IGA	11,040	0.5%	98.4%	99.4%	246	0.3%	100.0%	100.0%	97.6%	98.0%	90.2%
AB	9,804	0.5%	98.9%	99.5%	426	0.5%	99.5%	100.0%	100.0%	100.0%	100.0%
RRR	9,496	0.5%	97.1%	99.0%	191	0.2%	99.0%	99.5%	98.4%	99.5%	92.7%
WW	9,416	0.4%	99.1%	99.6%	336	0.4%	100.0%	100.0%	100.0%	100.0%	97.9%
QQQ	8,391	0.4%	99.2%	99.4%	637	0.8%	99.7%	99.7%	99.8%	99.8%	99.2%
OOOO	6,362	0.3%	97.8%	98.8%	197	0.2%	100.0%	100.0%	100.0%	100.0%	100.0%
Z	5,403	0.3%	99.0%	99.5%	266	0.3%	100.0%	100.0%	100.0%	100.0%	99.6%
AA	4,521	0.2%	99.5%	99.7%	210	0.3%	99.5%	99.5%	99.5%	100.0%	98.6%
AC	4,051	0.2%	97.9%	98.9%	29	0.0%	100.0%	100.0%	100.0%	100.0%	89.7%
OOO	4,000	0.2%	99.2%	99.9%	60	0.1%	100.0%	100.0%	100.0%	100.0%	100.0%
LLLL	3,450	0.2%	99.2%	99.7%	108	0.1%	100.0%	100.0%	100.0%	100.0%	97.2%
AE	3,409	0.2%	99.3%	99.6%	119	0.1%	100.0%	100.0%	95.8%	96.6%	93.3%
CCCC	3,363	0.2%	95.5%	97.6%	66	0.1%	98.5%	100.0%	98.5%	98.5%	98.5%
HHH	935	0.0%	98.2%	99.3%	23	0.0%	100.0%	100.0%	95.7%	100.0%	87.0%

Summary of Performance by Operator Anchorage FIR

- There were 38 operators with at least 100 ADS-C messages during this 6-month period
- Summary of how many operators meet criteria:

Criteria	ASP	ACTP	ACP	PORT
95% within 90 sec (60 sec for PORT)	**38**	**37**	**37**	**30**
99.9% within 180 sec	**4**	**22**	**16**	
99.0% - 99.9% within 180 sec	**30**	**13**	**18**	
Less than 99.0% within 180 sec	**4**	**2**	**3**	

Observed Performance by Operator Anchorage FIR

January – June 2014

Oper	ADS-C				CPDLC						
Code	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%
A	92,618	10.8%	98.5%	99.5%	2,155	11.3%	99.8%	99.9%	99.2%	99.7%	94.8%
D	86,185	10.1%	98.4%	99.6%	1,439	7.5%	99.6%	99.9%	99.6%	99.8%	98.1%
Q	79,801	9.3%	97.5%	99.2%	1,784	9.3%	99.7%	99.8%	99.6%	99.8%	97.9%
L	70,665	8.3%	97.7%	99.2%	1,808	9.5%	99.4%	99.6%	98.6%	99.4%	93.9%
J	60,926	7.1%	99.6%	99.8%	1,596	8.3%	99.9%	99.9%	99.7%	99.7%	99.4%
Y	57,629	6.7%	94.8%	97.1%	577	3.0%	97.8%	98.6%	98.3%	98.6%	96.0%
H	55,525	6.5%	99.1%	99.6%	1,457	7.6%	99.5%	99.7%	99.5%	99.8%	97.3%
G	48,717	5.7%	99.1%	99.7%	978	5.1%	100.0%	100.0%	99.6%	99.7%	99.0%
S	48,239	5.6%	97.5%	99.5%	855	4.5%	99.8%	99.8%	99.5%	99.9%	98.3%
F	35,920	4.2%	98.8%	99.7%	1,666	8.7%	99.9%	100.0%	99.6%	99.8%	98.9%
R	29,741	3.5%	98.1%	99.5%	487	2.5%	99.2%	99.4%	99.4%	99.4%	98.2%
RRR	26,375	3.1%	97.1%	98.8%	410	2.1%	98.5%	99.0%	97.1%	98.1%	92.0%
T	25,106	2.9%	99.1%	99.7%	692	3.6%	99.7%	99.7%	99.3%	99.4%	98.0%
NNNN	22,936	2.7%	98.6%	99.4%	309	1.6%	100.0%	100.0%	99.7%	99.7%	97.4%
P	19,406	2.3%	97.4%	99.2%	645	3.4%	98.8%	99.2%	98.8%	99.4%	96.3%
CCCC	14,296	1.7%	95.2%	97.2%	281	1.5%	98.2%	98.6%	97.2%	97.5%	92.9%
QQQ	11,841	1.4%	99.4%	99.5%	511	2.7%	100.0%	100.0%	99.6%	99.6%	99.0%
O	11,269	1.3%	98.2%	99.8%	310	1.6%	99.4%	99.4%	99.4%	99.4%	99.4%

Observed Performance by Operator Anchorage FIR

January – June 2014 (Continued)

Oper	ADS-C				CPDLC							
Code	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%
LLL	7,678	0.9%	98.6%	99.7%	149	0.8%	99.3%	99.3%	98.7%	98.7%	98.0%
OOOO	6,613	0.8%	98.9%	99.5%	96	0.5%	99.0%	99.0%	100.0%	100.0%	94.8%
FFF	5,609	0.7%	99.8%	99.9%	129	0.7%	100.0%	100.0%	100.0%	100.0%	99.2%
MMMM	5,045	0.6%	97.9%	98.9%	59	0.3%	98.3%	98.3%	100.0%	100.0%	89.8%
ZZZZ	4,723	0.6%	98.8%	98.9%	111	0.6%	100.0%	100.0%	97.3%	98.2%	91.9%
QQQQ	4,504	0.5%	99.2%	99.3%	184	1.0%	100.0%	100.0%	99.5%	99.5%	98.4%
GGG	3,348	0.4%	98.5%	99.6%	76	0.4%	98.7%	98.7%	98.7%	98.7%	98.7%
US MIL	3,211	0.4%	99.4%	99.6%	29	0.2%	100.0%	100.0%	100.0%	100.0%	86.2%
WW	3,103	0.4%	99.4%	100.0%	43	0.2%	100.0%	100.0%	100.0%	100.0%	100.0%
B	3,060	0.4%	97.6%	98.7%	50	0.3%	100.0%	100.0%	100.0%	100.0%	96.0%
MMM	2,702	0.3%	98.4%	99.4%	52	0.3%	100.0%	100.0%	100.0%	100.0%	98.1%
OOO	2,198	0.3%	98.2%	99.8%	39	0.2%	100.0%	100.0%	100.0%	100.0%	100.0%
AM	1,884	0.2%	95.3%	98.0%	38	0.2%	100.0%	100.0%	97.4%	100.0%	89.5%
IGA	1,788	0.2%	97.9%	99.1%	26	0.1%	100.0%	100.0%	100.0%	100.0%	96.2%
Z	949	0.1%	98.3%	99.7%	21	0.1%	100.0%	100.0%	100.0%	100.0%	100.0%
III	912	0.1%	100.0%	100.0%	31	0.2%	100.0%	100.0%	100.0%	100.0%	100.0%
LLLL	280	0.0%	98.9%	99.6%	13	0.1%	100.0%	100.0%	100.0%	100.0%	100.0%