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Future Monitoring Systems

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Part 1: Future Monitoring Options

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Contents

- ADS-B Service Volume and Stations
- USA Coverage Map
- Raw Data
- ASE Processing Interface
  - ADS-B Extract
  - ASE Processing
- Quality Control
- Data Processed

Service Volume and Stations

Service Volume	Station
0	Boston Washington New York
1	Memphis Atlanta
2	Jacksonville Miami San Juan
5	Indianapolis Cleveland
6	Chicago Kansas City Minneapolis
7	Albuquerque Fort Worth Huston Golf of Mexico
10	Denver Salt Lake City Seattle
11	Los Angeles Oakland
15	Alaska Juneau
16	Honolulu
17	Guam

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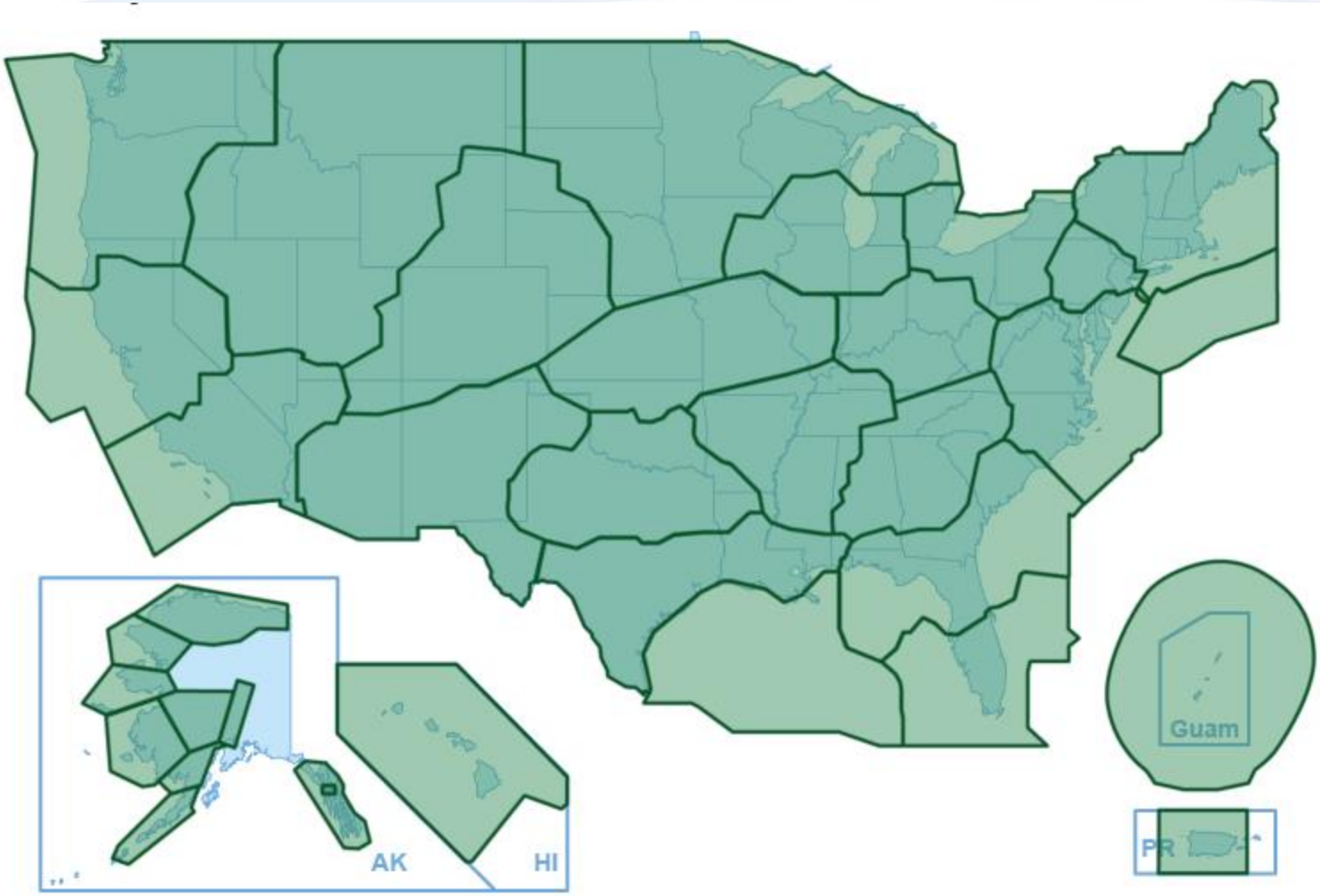
USA Coverage Map



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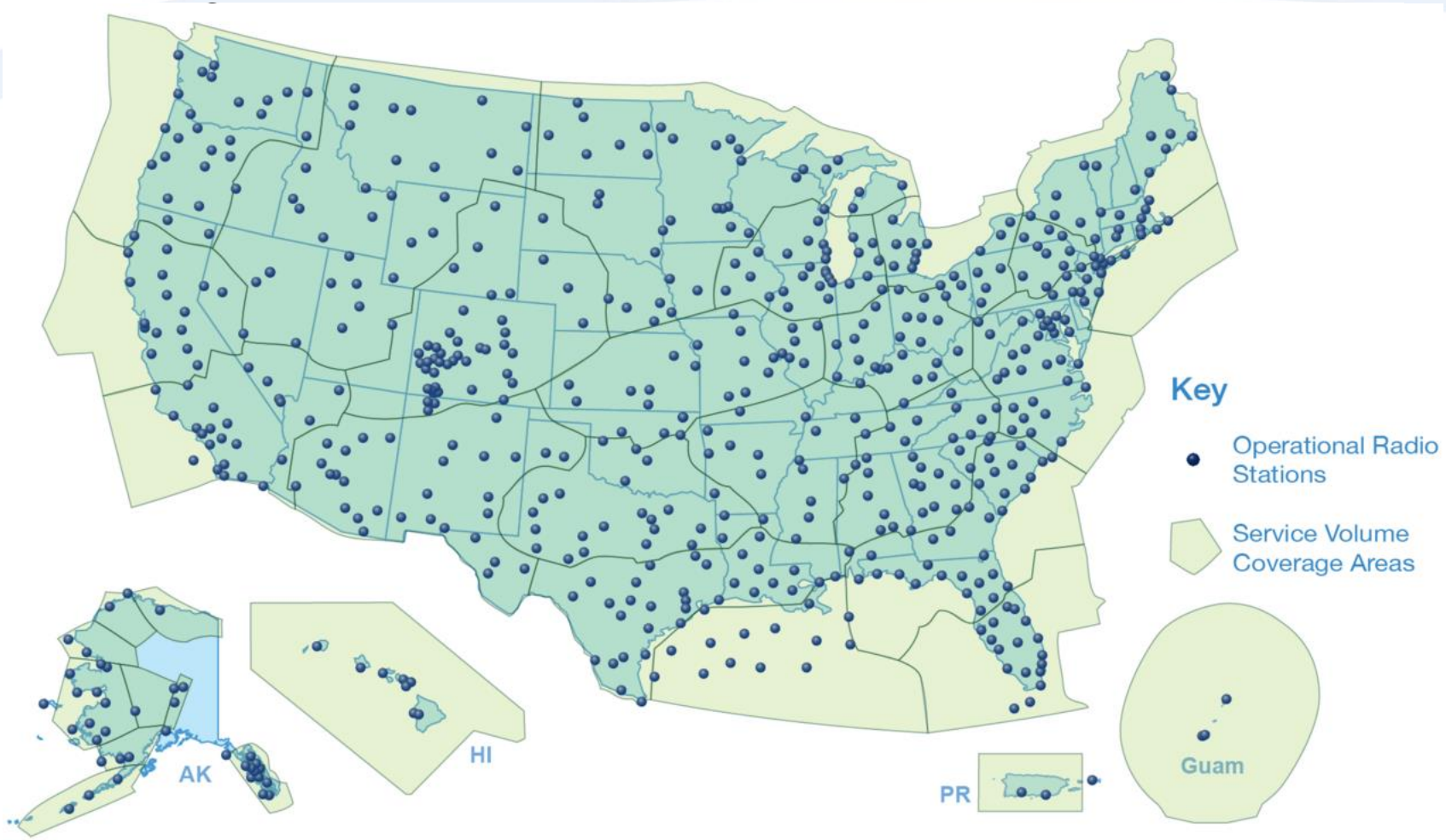
USA Operational Radio Stations



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Raw Data

- Currently getting more than 1,000 individual Aircraft daily
- Around 1 GB of data
- Example of the Raw data

```
AA,6,3,N/A,82804335,82803935,A8F00E,1,2,7,0,invalid,n/a,0,40.74522257, -73.69804859,33000,GNSS,342.0,387.0,0,,
AA,6,3,N/A,82804335,82803935,A8F00E,1,2,7,0,invalid,n/a,0,40.74522257, -73.69804859,33000,GNSS,342.0,387.0,0,,
```

- How the data look like after the first step of the ADS-B Processing

latitude	longitude	gps	modes	date	time	modes	sta	reg	NAC	link
(dec deg)	(dec deg)	hgt	alt		(Z)	addr	ATC			version
	(ft)	(ft)								
39.51264954,	-87.13537598,	28025,	28500,	2014-12-16,	17:59:53.578,	AD3353,	ZID,	N95LL,	10,	1090ES_260B
39.51237106,	-87.13707733,	28050,	28525,	2014-12-16,	17:59:54.460,	AD3353,	ZID,	N95LL,	10,	1090ES_260B
39.51173019,	-87.14044189,	28125,	28625,	2014-12-16,	17:59:56.390,	AD3353,	ZID,	N95LL,	10,	1090ES_260B
39.51173019,	-87.14044189,	28150,	28625,	2014-12-16,	17:59:56.390,	AD3353,	ZID,	N95LL,	10,	1090ES_260B
39.51140594,	-87.14235687,	28175,	28650,	2014-12-16,	17:59:57.367,	AD3353,	ZID,	N95LL,	10,	1090ES_260B

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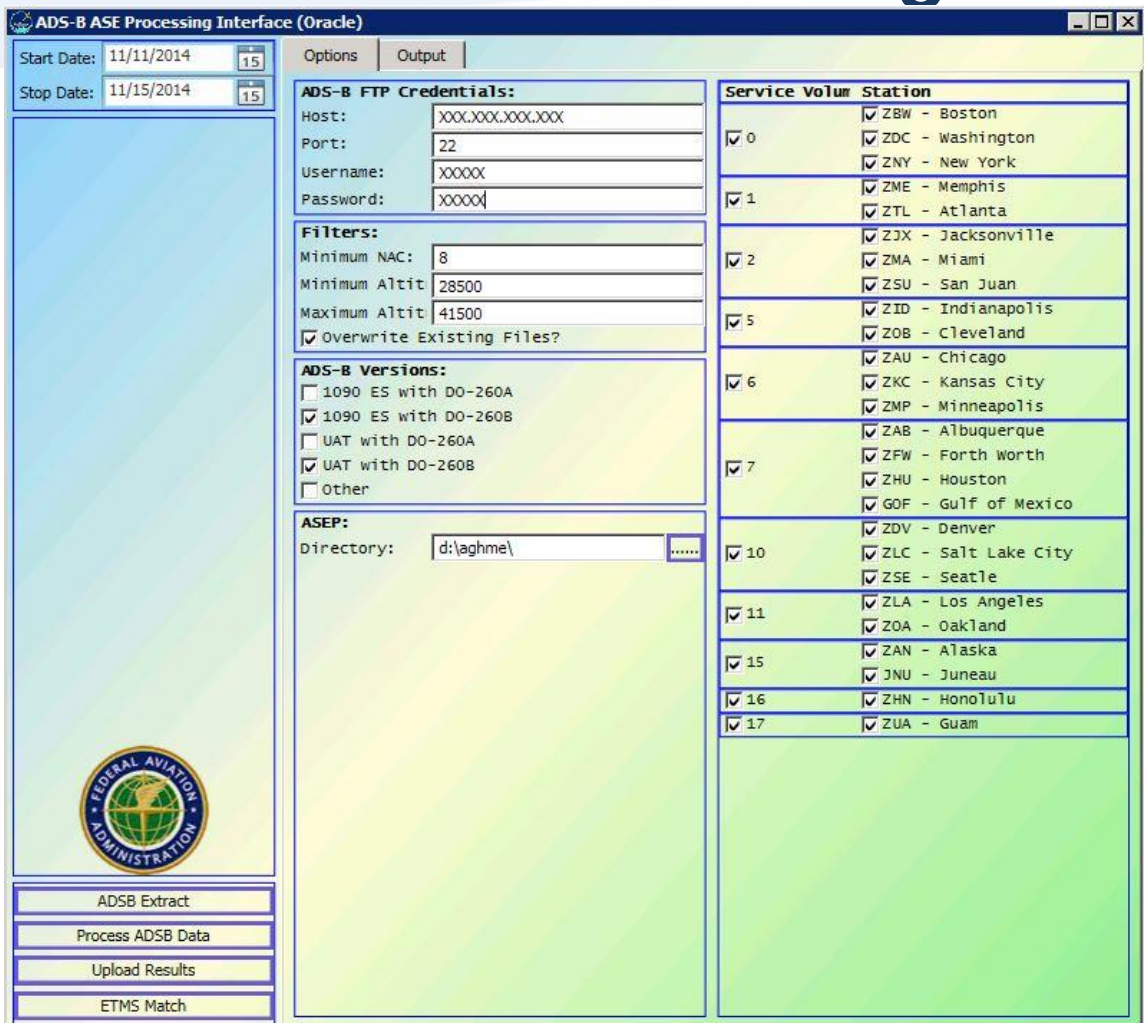
ADS-B ASE Processing Interface



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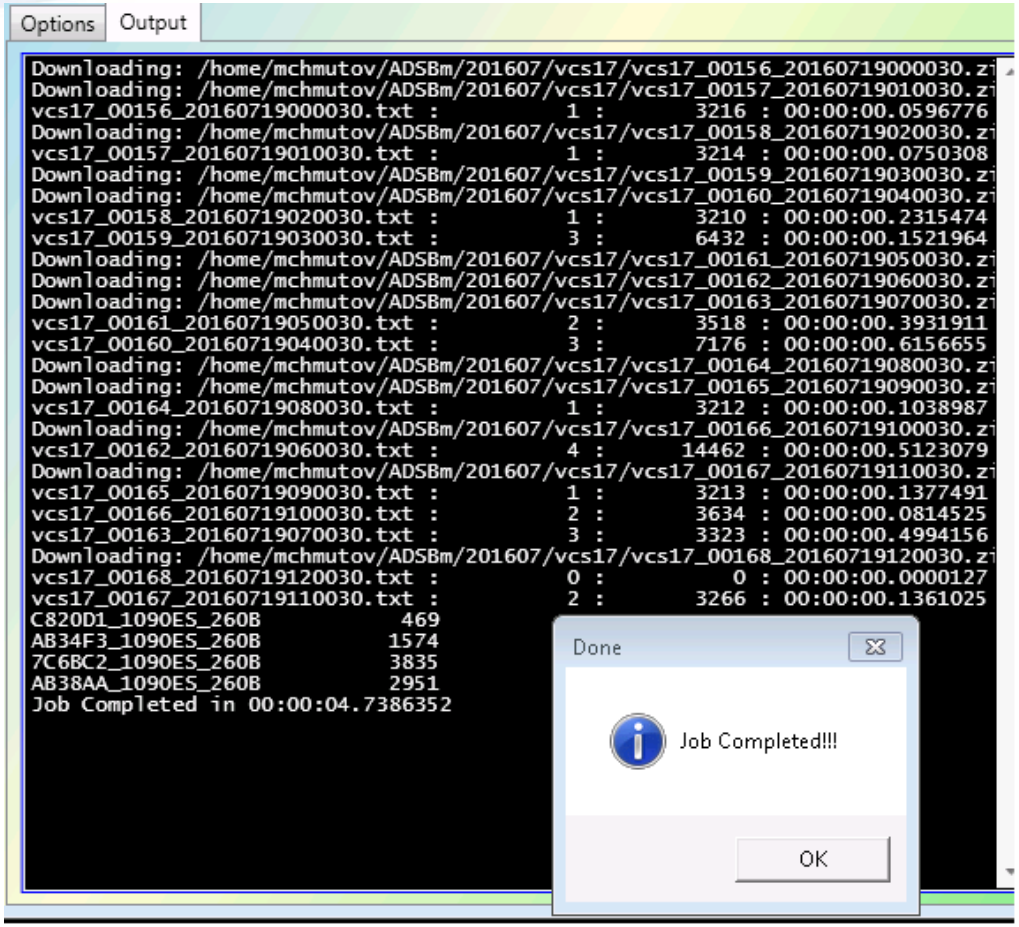
ADS-B Extract



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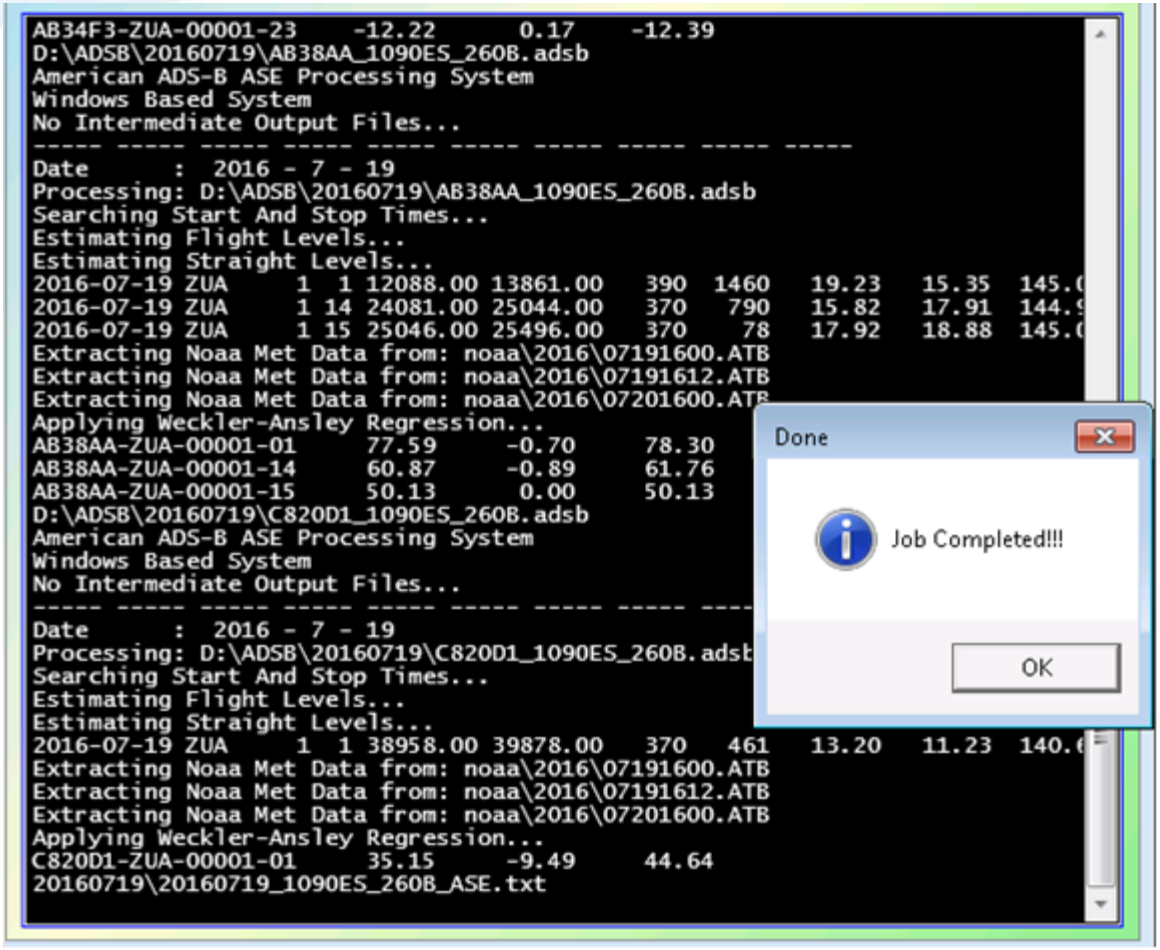
ASE Processing



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Quality Control

- Altimetry System Error less than 200
- Standard Deviation less or equal to 45
- Straight Flight Levels between 290 and 410
- NAC value 8 or higher
- Developing quality control for ADS-B/MET alignment.
  - Localized areas of high MET gradients can cause incorrect high ASE values
- ADS-B Version B (1090 & UAT DO-260B)

Data Processed

- Quarterly Report for 2016

- 1st Quarter (Jan, Feb, Mar)

  - 2,601 Individual Segment with an ASE
  - 82 Non-Compliant Due to High ASE
  - 404 Not Successful Monitoring Due to High SD

- 2nd Quarter (Apr, May, Jun)

  - 3,431 Individual Segment with an ASE
  - 61 Non-Compliant Due to High ASE
  - 323 Not Successful Monitoring Due to High SD

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Part 2: ADS-B Independent Sampling

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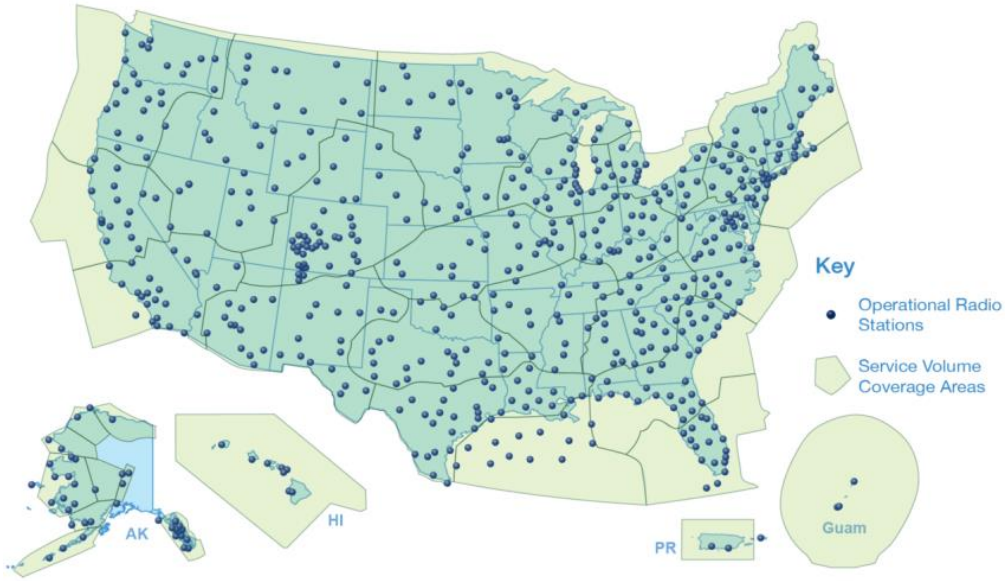
ADS-B Independent Sampling

- Calculating and monitoring ASE utilizing AGHMEs is restricted by geometry.
- Calculating ASE utilizing ADS-B is much less restrictive.



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ADS-B ASE

- Plotted ADS-B ASE position tracks for randomly selected GLF6 and GLF4 aircraft.

  - GREEN LINE Compliant average ASE values. Average ASE track value that is <=160
  - YELLOW LINE Aberrant average ASE values. Average ASE track value that is >160 but <=199
  - RED LINE Non-Compliant average ASE values. Average ASE track value >=200

Methodology

- Aircraft is selected and all ASE tracks are plotted
- The day with the largest number of observations is plotted over ALL ADS-B aircraft that flew on that day.
- Averaged ASE Position tracks use ADS-B filtered data
  - Version 2 (DO-260B)
  - Between FL290-FL410
  - 180 consecutive observations
    - Assuming 3 or more minutes of data

Map Key	
	All compliant ADS-B aircraft tracks
	All aberrant ADS-B aircraft tracks
	All non-compliant ADS-B aircraft
	New aircraft

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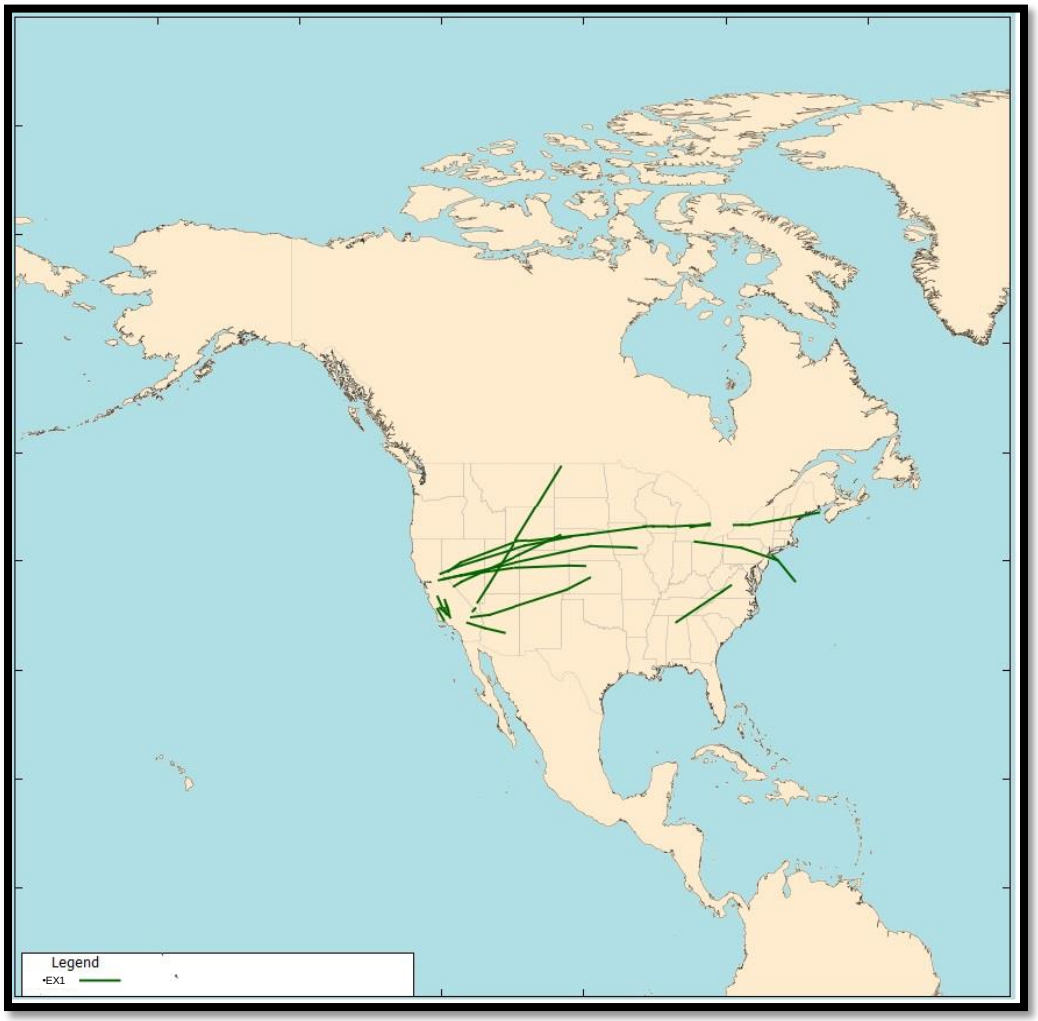
Example 1: GLF6

- LOA on 31-Mar-15

Date	Count of ASE Segments
21-Jul-15	1
27-Jul-15	3
4-Aug-15	12
17-Aug-15	2
12-Sep-15	1
13-Sep-15	2
16-Sep-15	2
24-Sep-15	2
25-Sep-15	2
26-Sep-15	4
29-Sep-15	2
1-Oct-15	3
2-Oct-15	3
Total	39



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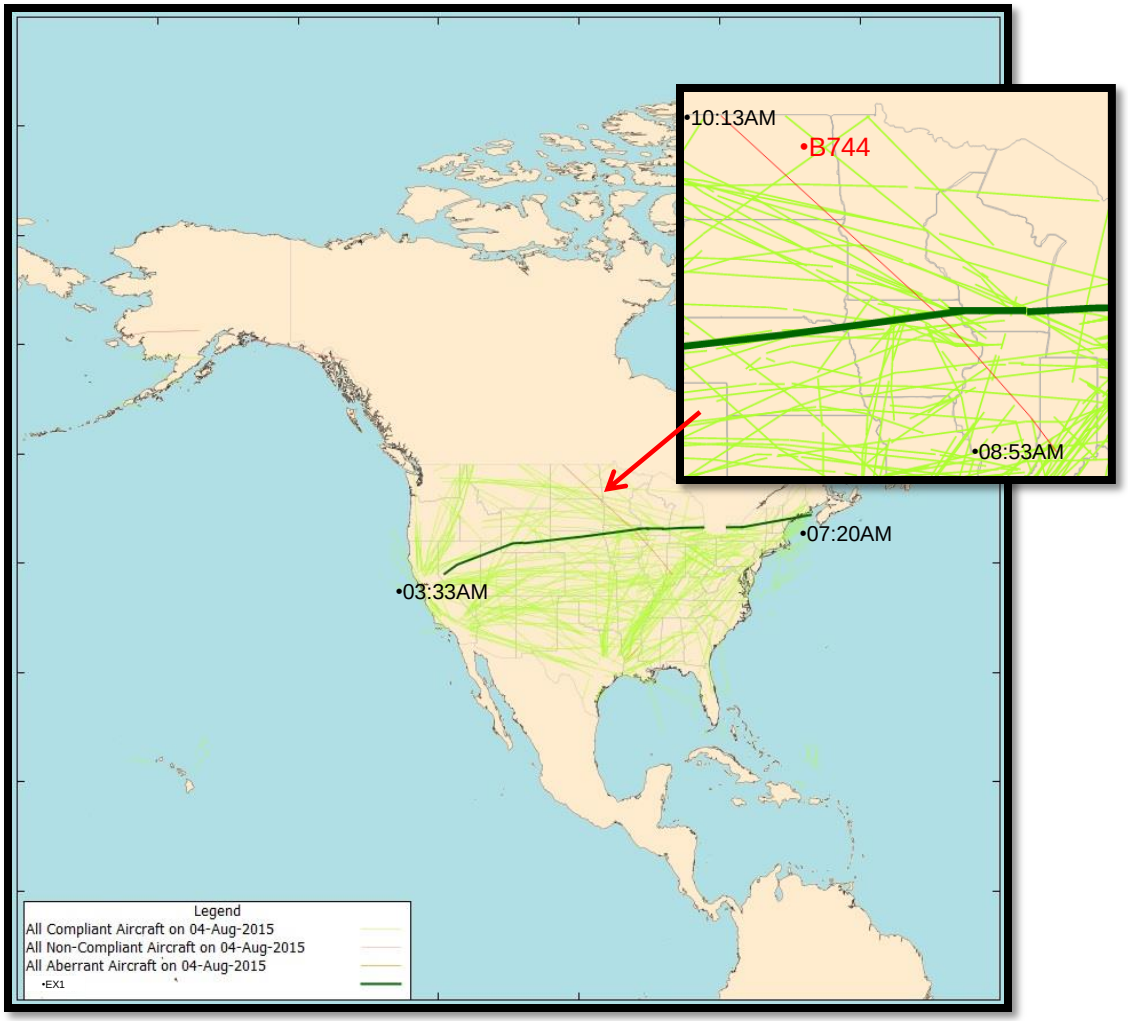
Ex1 with all Aircraft on 4-Aug-15

- LOA on 31-Mar-15

Date	Count of ASE Segments
21-Jul-15	1
27-Jul-15	3
4-Aug-15	12
17-Aug-15	2
12-Sep-15	1
13-Sep-15	2
16-Sep-15	2
24-Sep-15	2
25-Sep-15	2
26-Sep-15	4
29-Sep-15	2
1-Oct-15	3
2-Oct-15	3
Total	39

- 469 ADS-B Aircraft ON 04-AUG-15



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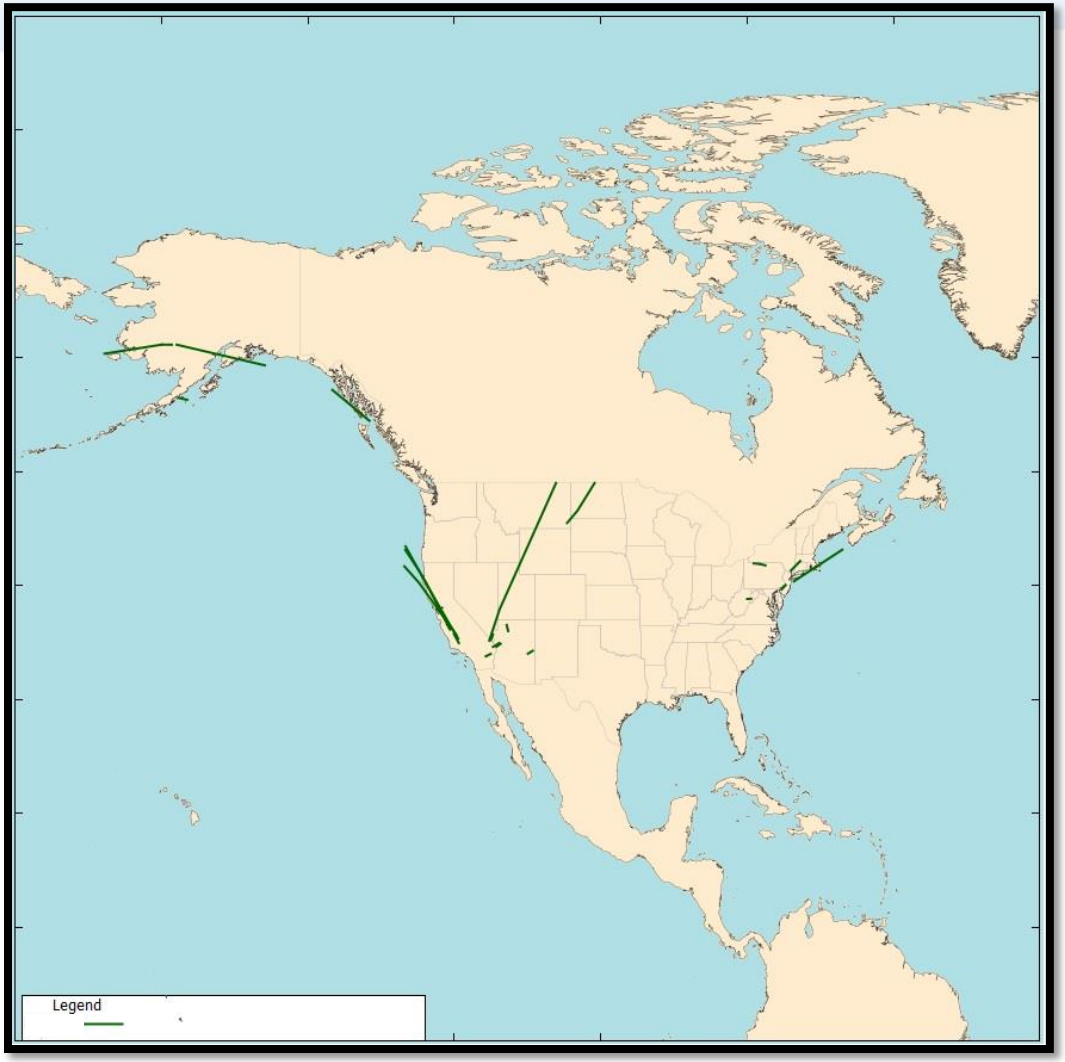
Ex2: GLF6

- LOA on 16-Jun-15

Date	Count of Segments
23-Jun-15	3
24-Jun-15	1
25-Jun-15	1
26-Jun-15	2
29-Jun-15	2
16-Jul-15	1
2-Aug-15	3
11-Aug-15	4
15-Aug-15	1
28-Aug-15	2
2-Sep-15	3
4-Sep-15	2
11-Sep-15	4
21-Sep-15	1
22-Sep-15	1
Total	31

- 481 ADS-B ACT ON 11-AUG-15



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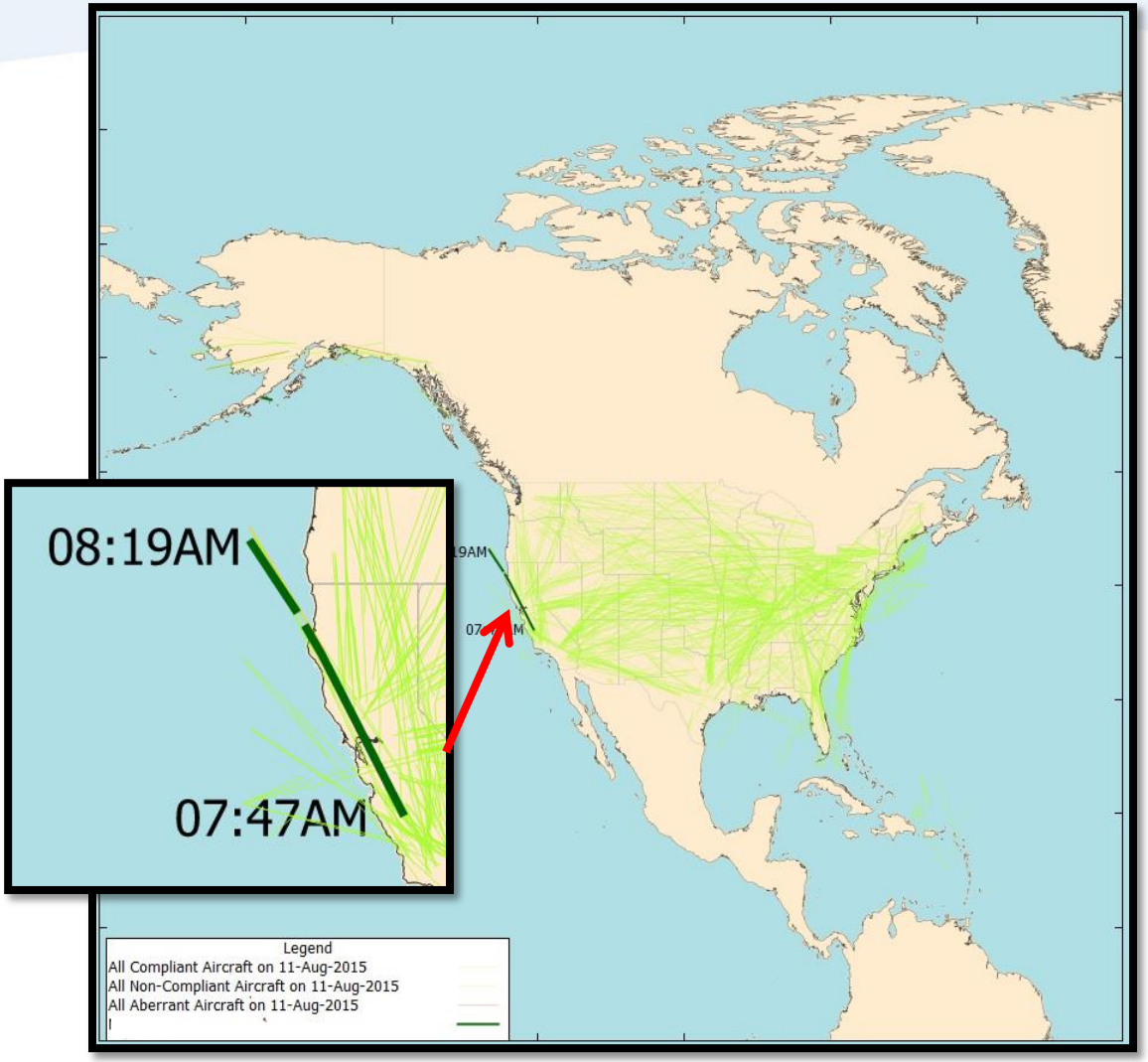
Ex2: GLF6

- LOA on 16-Jun-15

Date	Count of Segments
23-Jun-15	3
24-Jun-15	1
25-Jun-15	1
26-Jun-15	2
29-Jun-15	2
16-Jul-15	1
2-Aug-15	3
11-Aug-15	4
15-Aug-15	1
28-Aug-15	2
2-Sep-15	3
4-Sep-15	2
11-Sep-15	4
21-Sep-15	1
22-Sep-15	1
Total	31

- 481 ADS-B ACT ON 11-AUG-15



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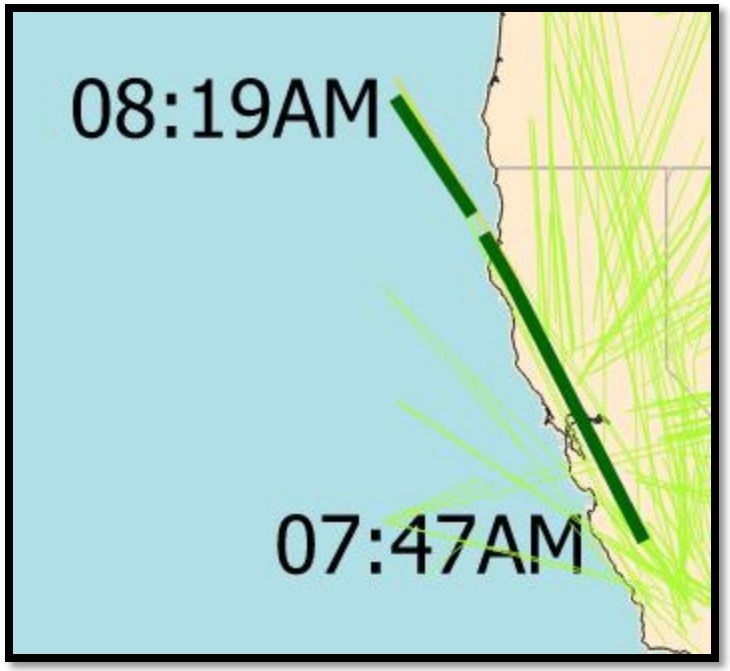
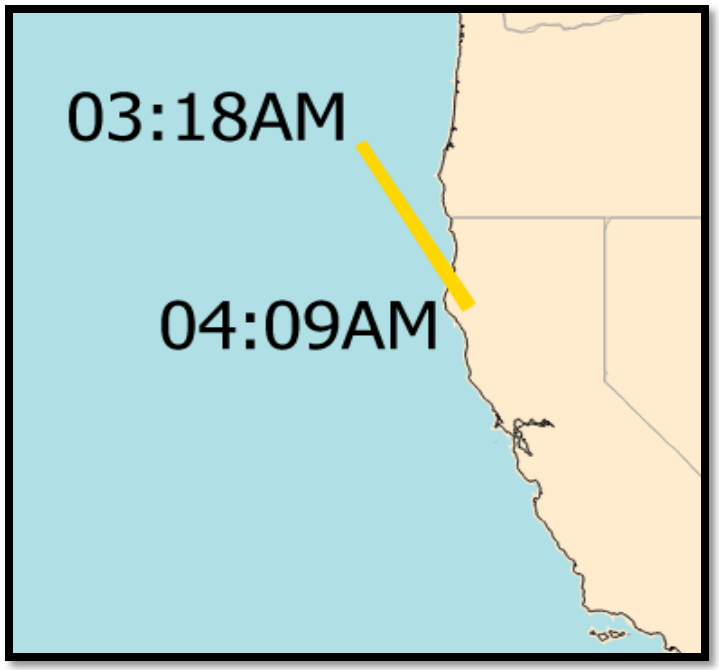
Ex2 GLF6 on 11-Aug-15

LOA on 16-Jun-15

•Ex3 GLF6 8/11/2015



•B744 8/11/2015



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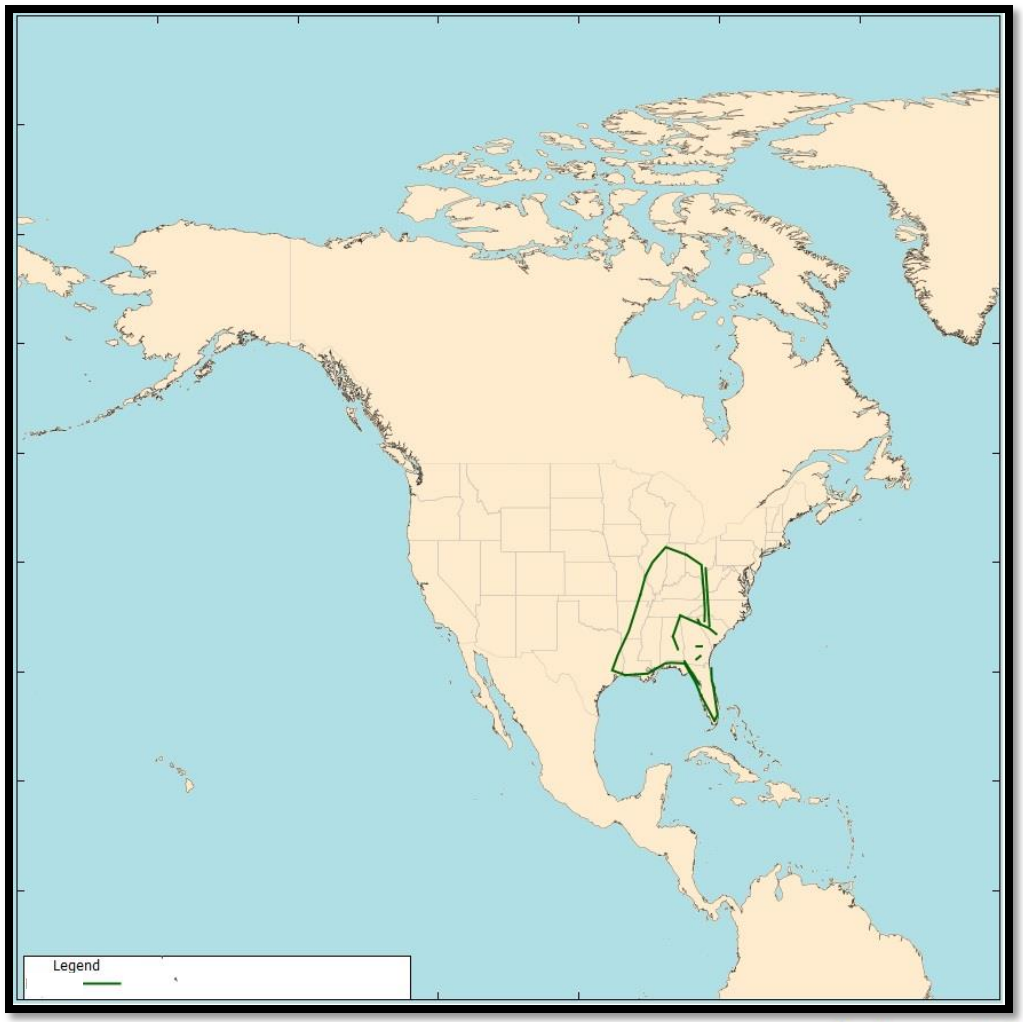
Ex4:GLF6

- LOA on 16-Jan-15

Date	Count of ASE segments
3-Sep-15	2
9-Sep-15	1
14-Sep-15	5
17-Sep-15	1
22-Sep-15	23
24-Sep-15	1
Total	33



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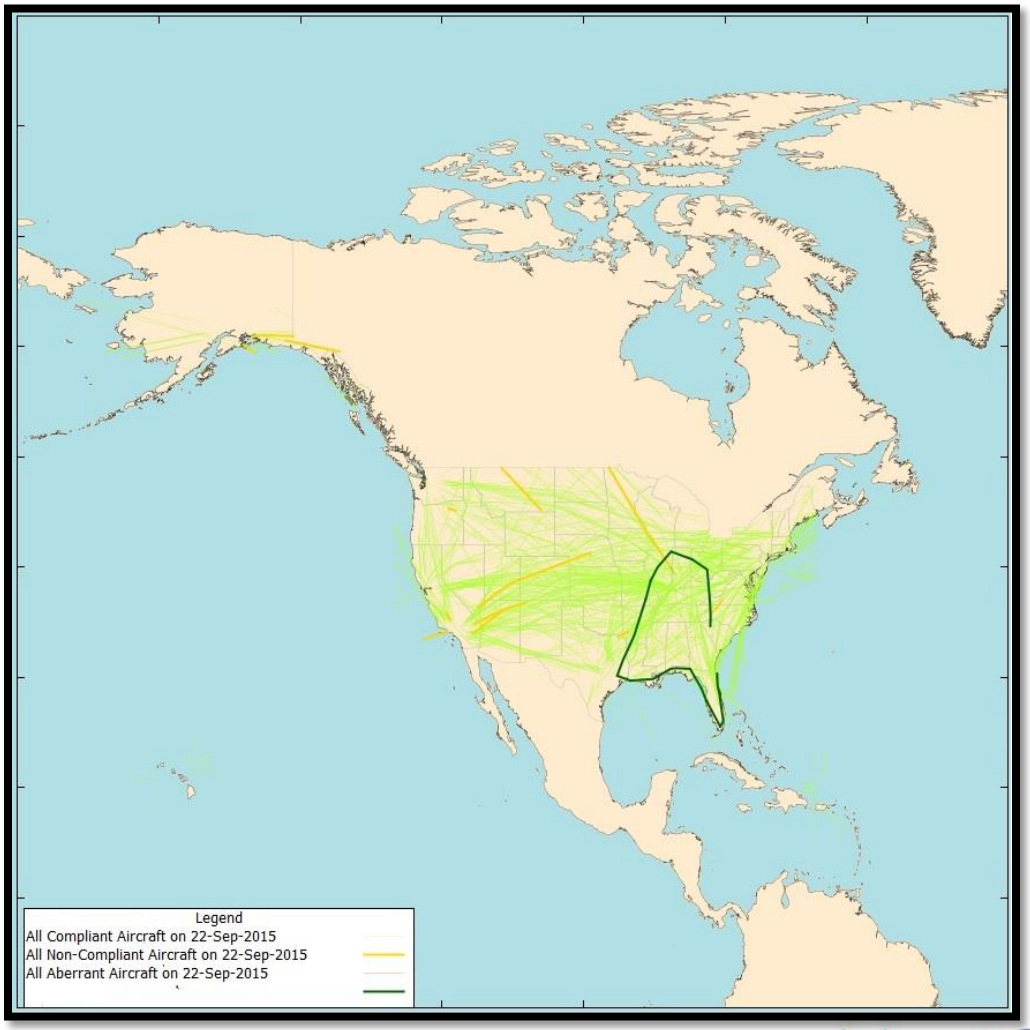
Ex3: GLF6 with all ADS-B On 22-Sep-15

- Gulfstream Aerospace Corporation (GXFJ)
- LOA on 16-Jan-15

Date	Count of ASE segments
3-Sep-15	2
9-Sep-15	1
14-Sep-15	5
17-Sep-15	1
22-Sep-15	23
24-Sep-15	1
Total	33

- 518 ADS-B ACT ON 22-SEP-15



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Conclusions

- With ADS-B we have a greater ability to observe ASE
- Still in the process of developing a procedure for ADS-B independent sampling
- By using ADS-B, we will be able to build an ASE profile as a function of speed and altitude and perhaps develop an error calibration curve into ASE calculation.