

Data Supporting STL Proposed Change



WakeNet USA: March 16-17, 2005
Boca Raton, FL, USA

<http://www.airliners.net/open.file/588697/L/>
Northwest Airlines DC-10-30/ER
Amsterdam – Schiphol, May 28, 2004



Data Supporting STL Proposed Change

Sponsored by:

Federal Aviation Administration
Air Traffic Organization (ATO-T)

Manager: Steve Lang



Prepared by:

DOT Volpe Center

Surveillance and Assessment Division (DTS-53)

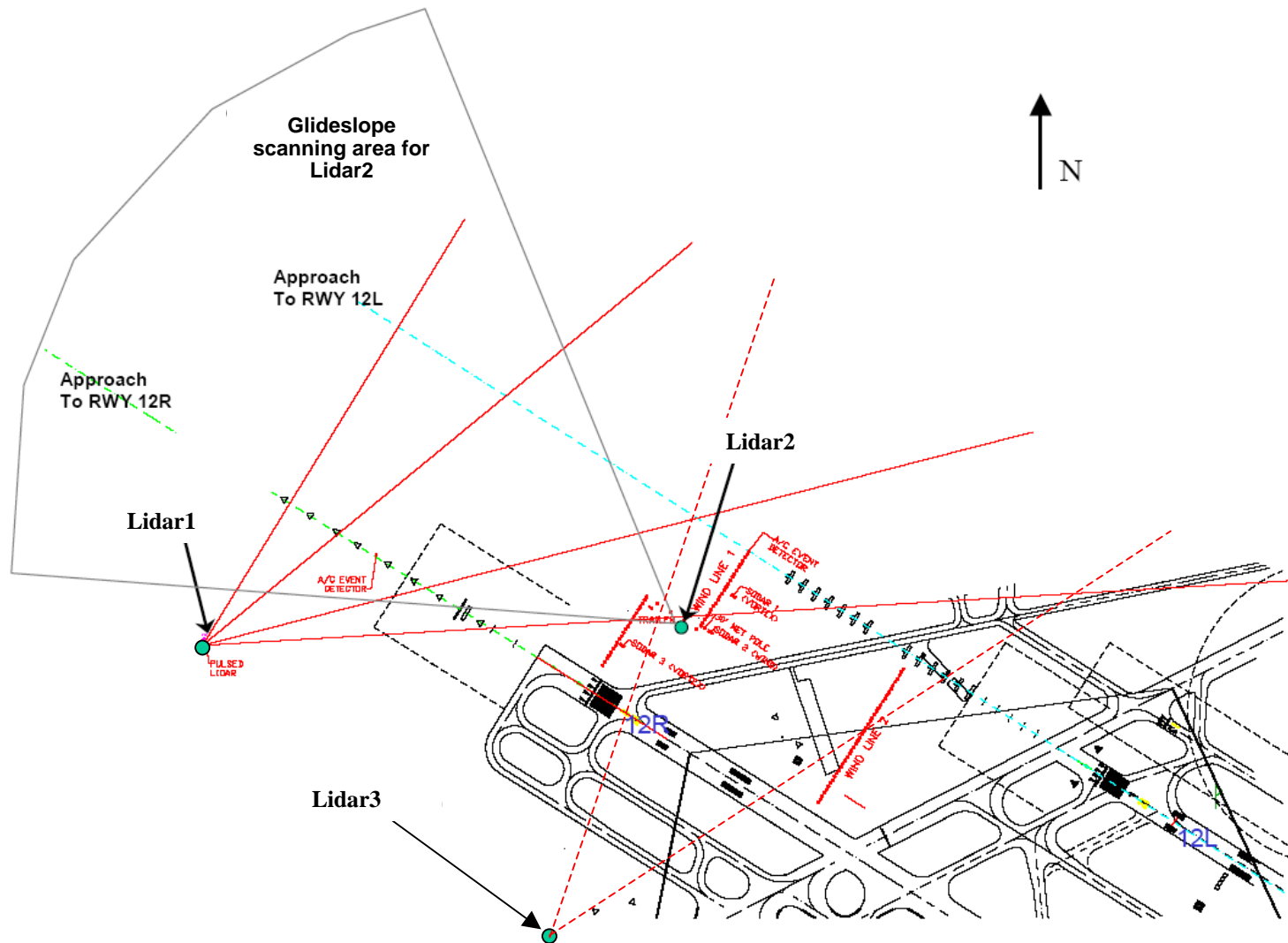


Contributors

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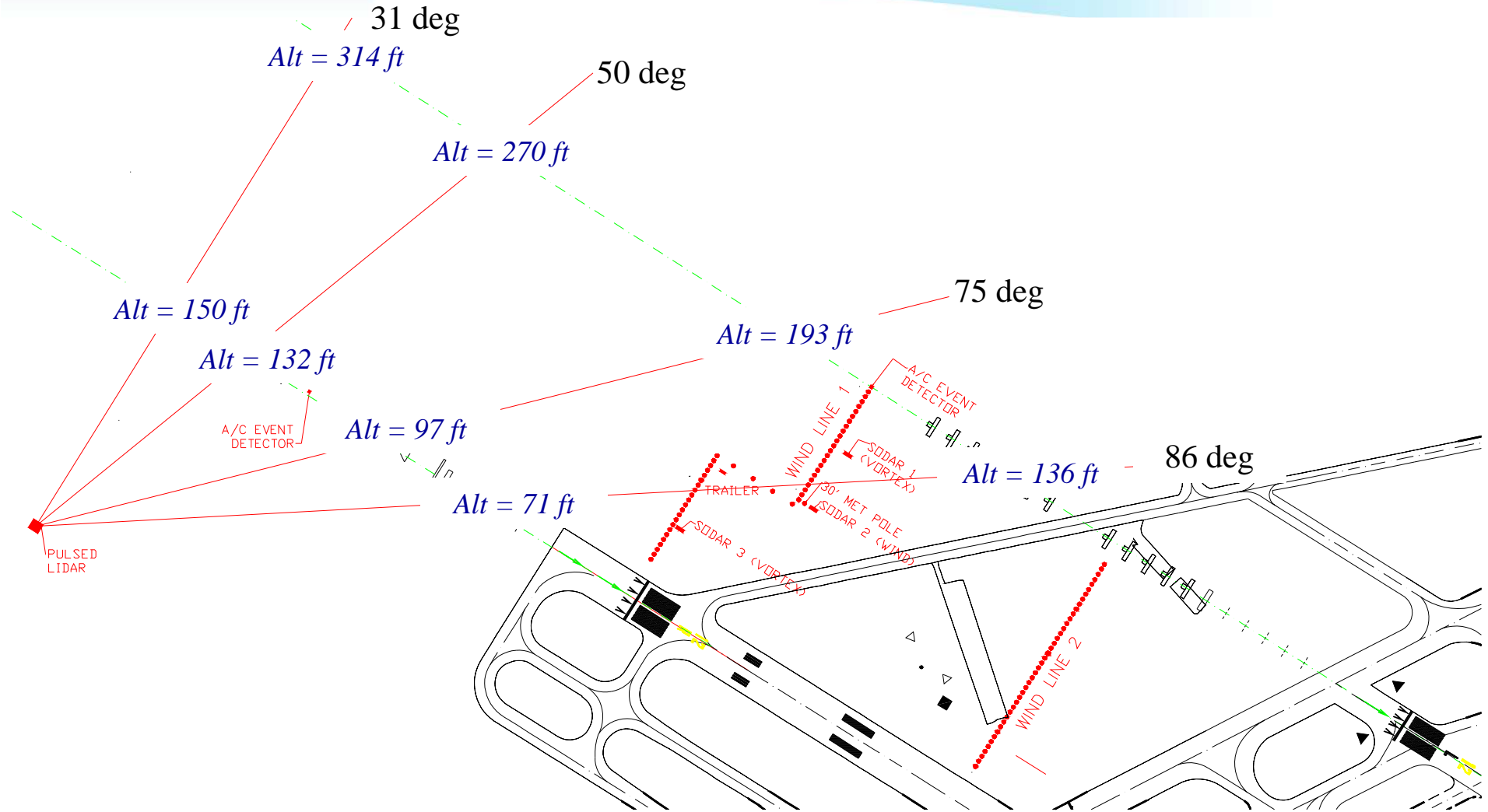
Sensor Layout in the Terminal Area





Definitions of Scan Angles

Glideslope Altitude Relative to Threshold of 12R





Overall Wake Dataset Description

Windline 1 : 19,511 Tracks (02/04 - 11/04)

Total Large Jets: 10,662 (55 Percent of the Database)

Lidar 1 : 24,346 Tracks (07/03 - 10/04)

Total Large Jets: 14,829 (61 Percent of the Database)

Windline 1



Lidar1





Preliminary Remarks – Windline

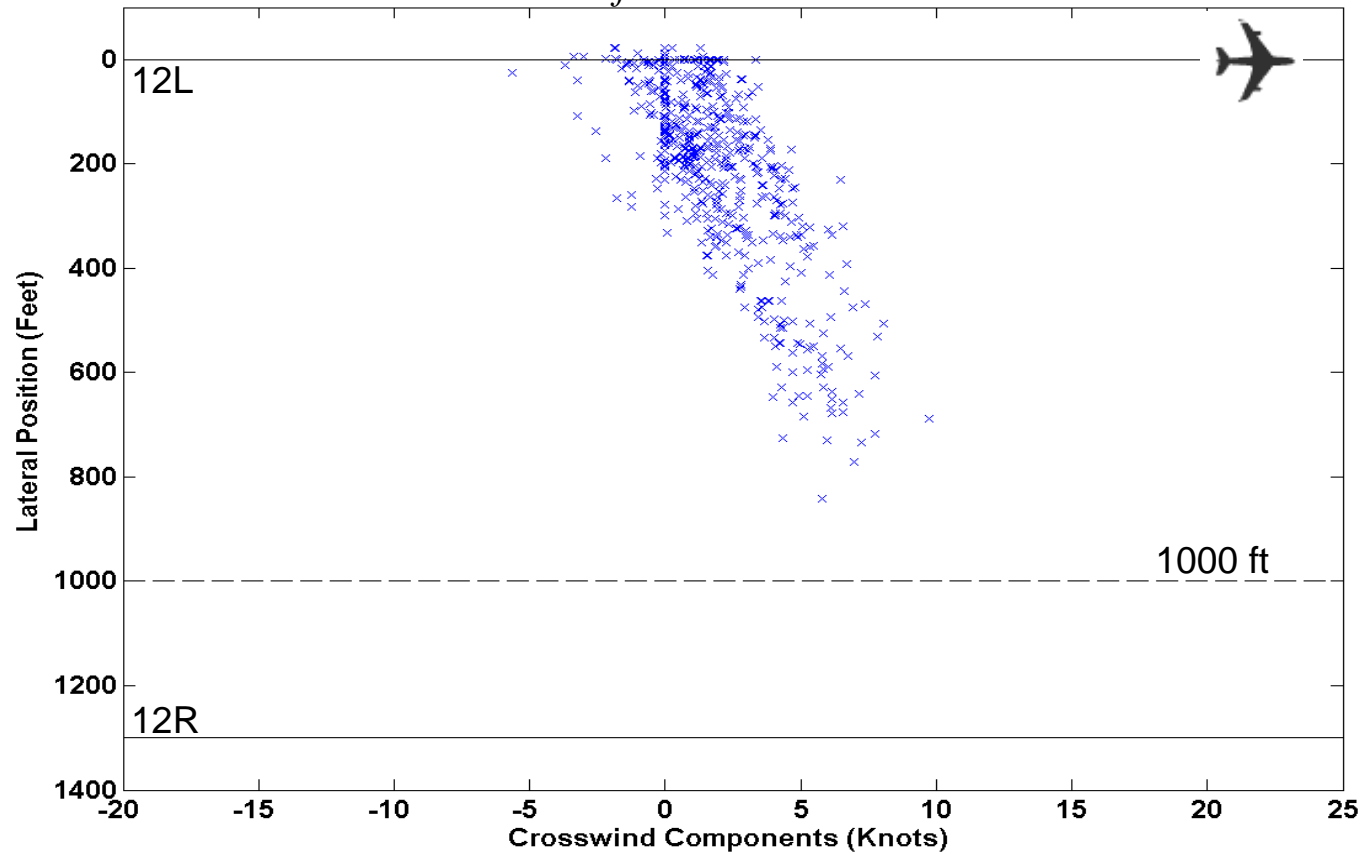
- ⊙ Large Jets (DC9 and Heavier) Only.
- ⊙ Subsequent Graphs Show Wake Locations at 45, 60 and 75 sec (1.5, 2.0 and 2.5 NMI Diagonal Separation) ; Port and Starboard Vortices Not Presented Separately.
- ⊙ A 2 sec Window Used to Represent a Nominal Wake Age.
- ⊙ Viewing from Pilots' Vantage Point.
- ⊙ Origin Set at Threshold of 12L.
- ⊙ CW Component from 12L to 12R : Positive.



WL1 - Large Jets

45 sec Wake Transport

Wakes from 12L
553 Vortices Detected WL1
Data from 02/04 - 11/04

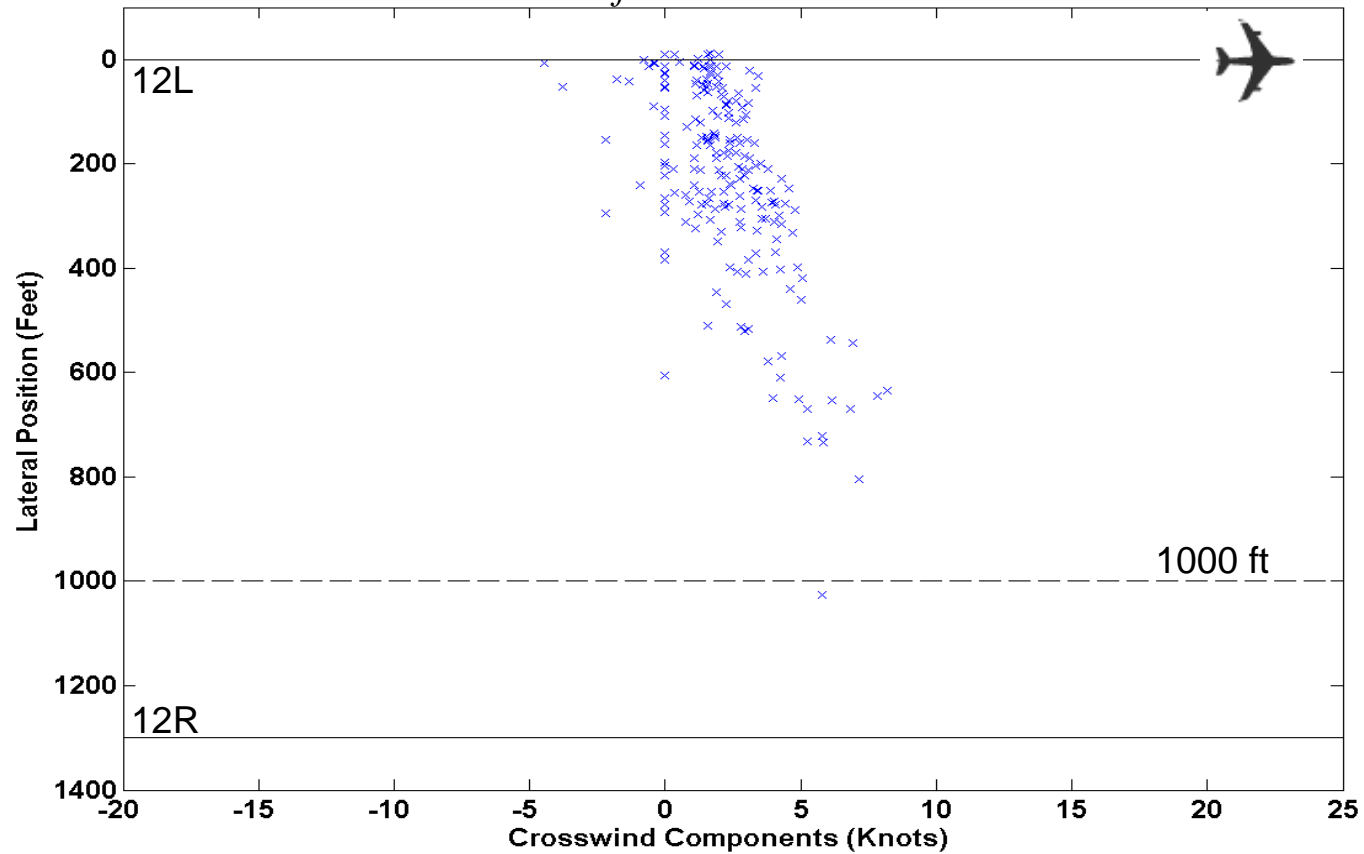




WL1 - Large Jets

60 sec Wake Transport

Wakes from 12L
209 Vortices Detected WL1A
Data from 02/04 - 11/04

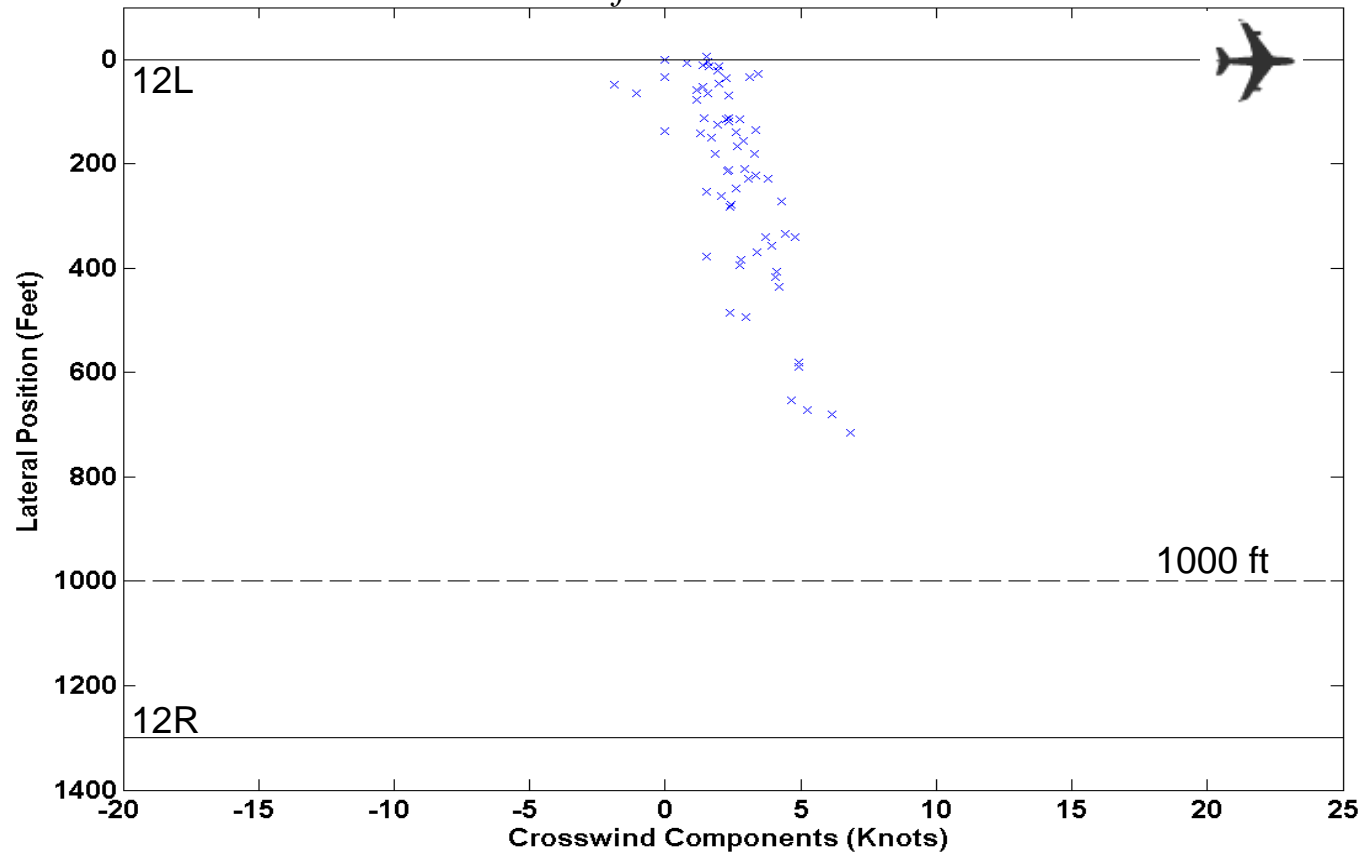




WL1 - Large Jets

75 sec Wake Transport

Wakes from 12L
66 Vortices Detected WL1
Data from 02/04 - 11/04

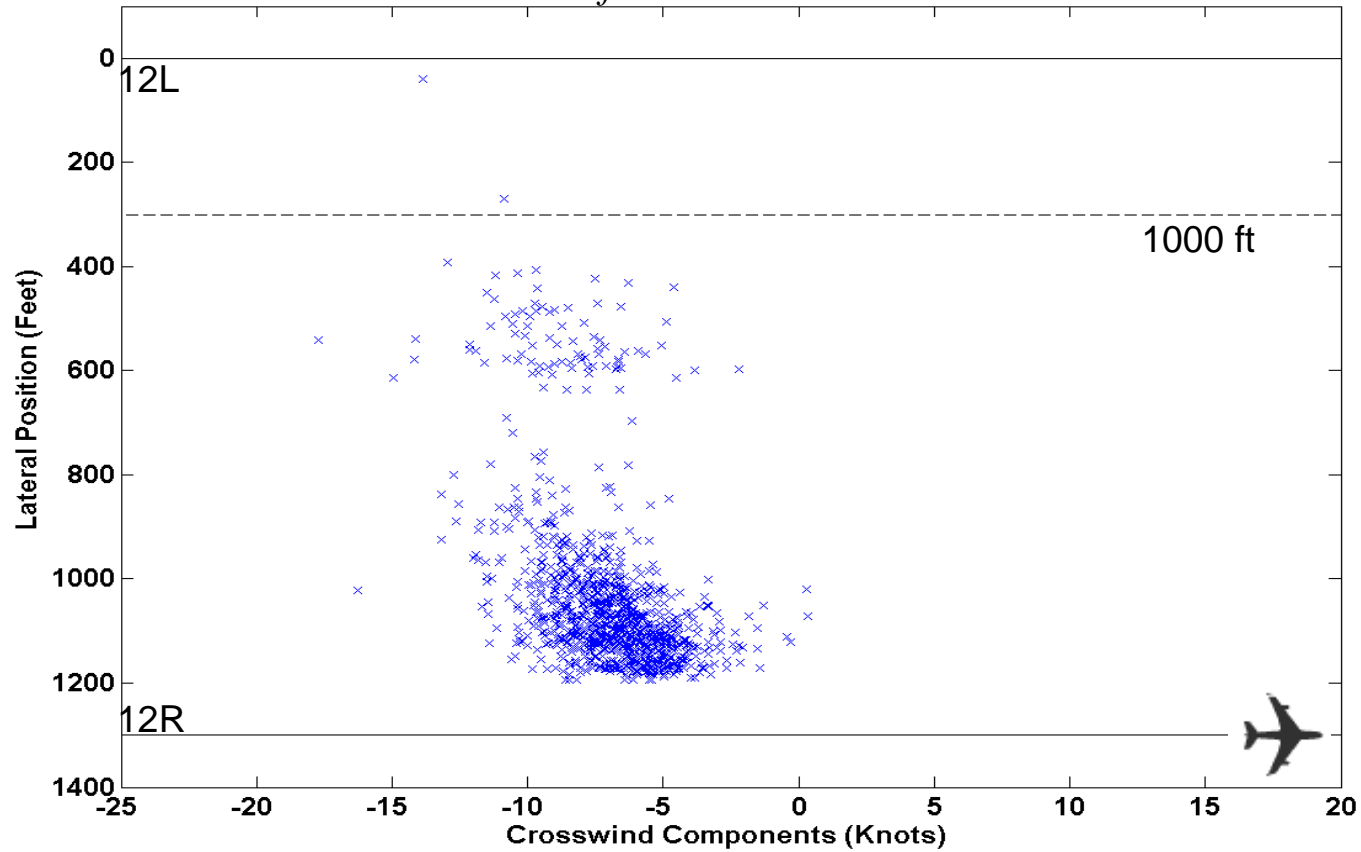




WL1 - Large Jets

45 sec Wake Transport

Wakes from 12R
1657 Vortices Detected WL1
Data from 02/04 - 11/04

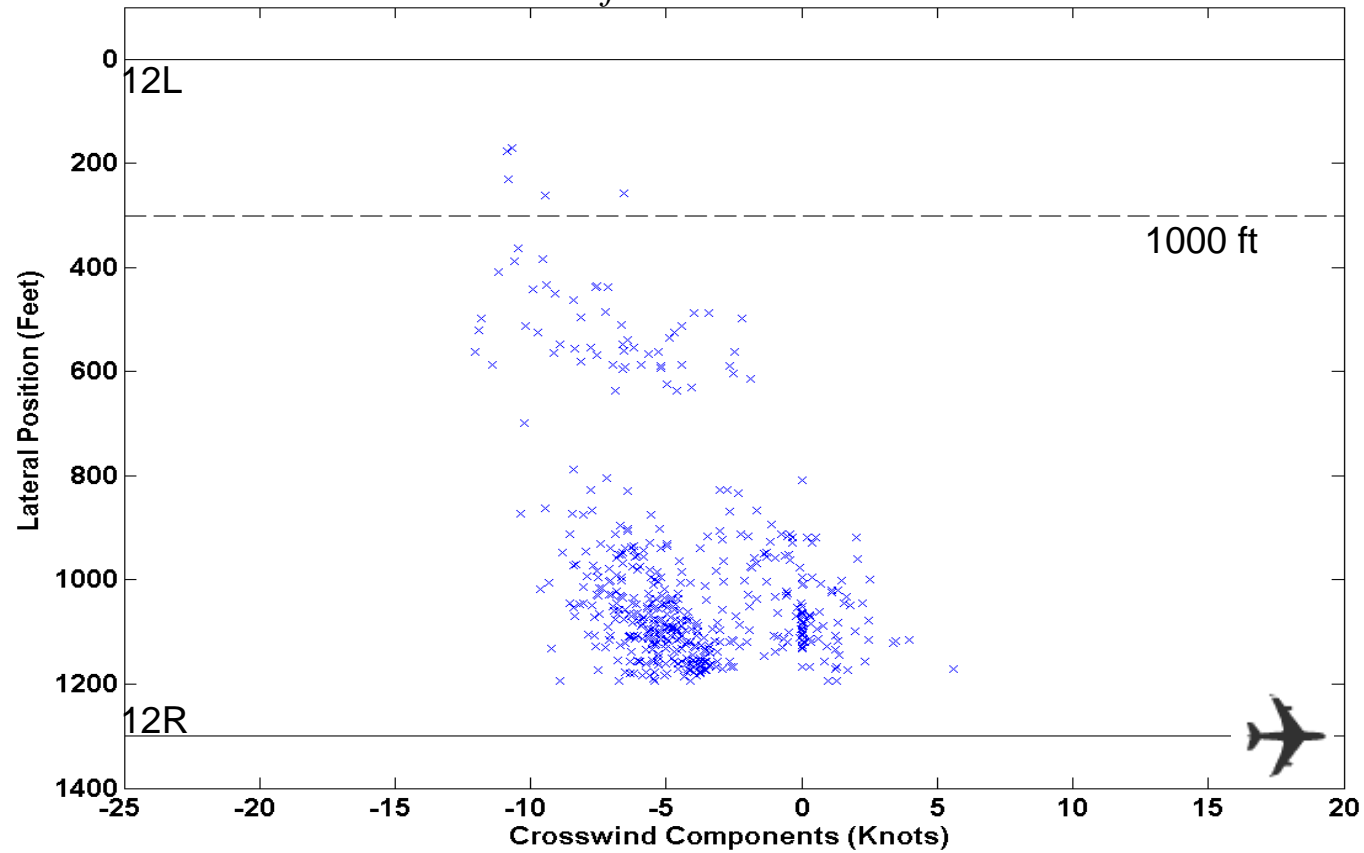




WL1 - Large Jets

60 sec Wake Transport

Wakes from 12R
506 Vortices Detected WL1
Data from 02/04 - 11/04

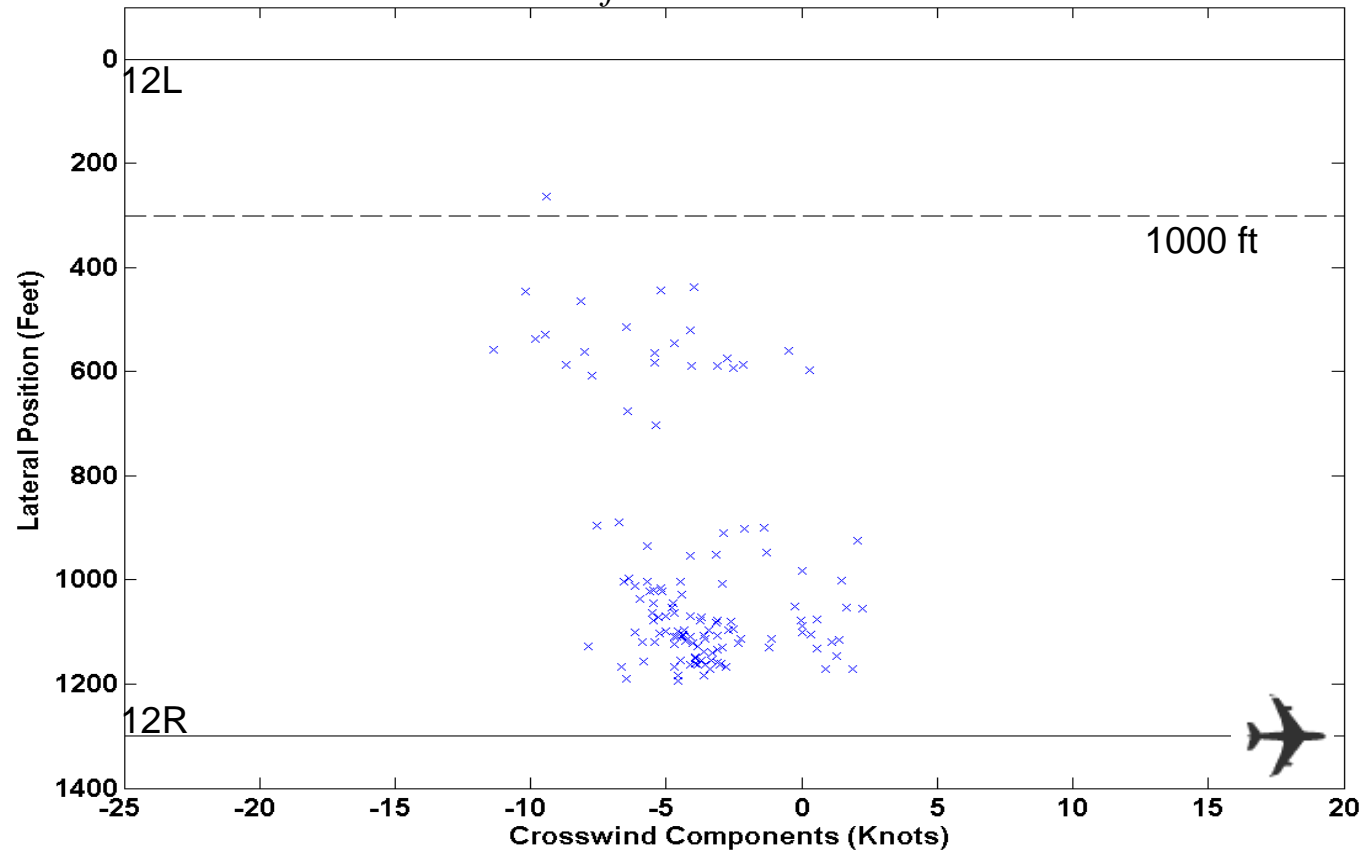




WL1 - Large Jets

75 sec Wake Transport

Wakes from 12R
130 Vortices Detected WL1
Data from 02/04 - 11/04





Preliminary Remarks - Lidar

- ⊙ Large Jets (DC-9 and Heavier) Only.
- ⊙ Subsequent Graphs Show Wake Locations at 45, 60 and 75 sec (1.5, 2.0 and 2.5 NMI Diagonal Separation) ; Port and Starboard Vortices Not Presented Separately.
- ⊙ A 5 sec Window Used to Represent a Nominal Wake Age.
- ⊙ Viewing from Pilots' Vintage Point.
- ⊙ For Non-Orthogonal Scans, Angle Corrections Applied to Project Wake Locations Between Runways.
- ⊙ Ground Clutter Superimposed.
- ⊙ Origin Set at Threshold of 12R.
- ⊙ CW Component from 12L to 12R : Positive.

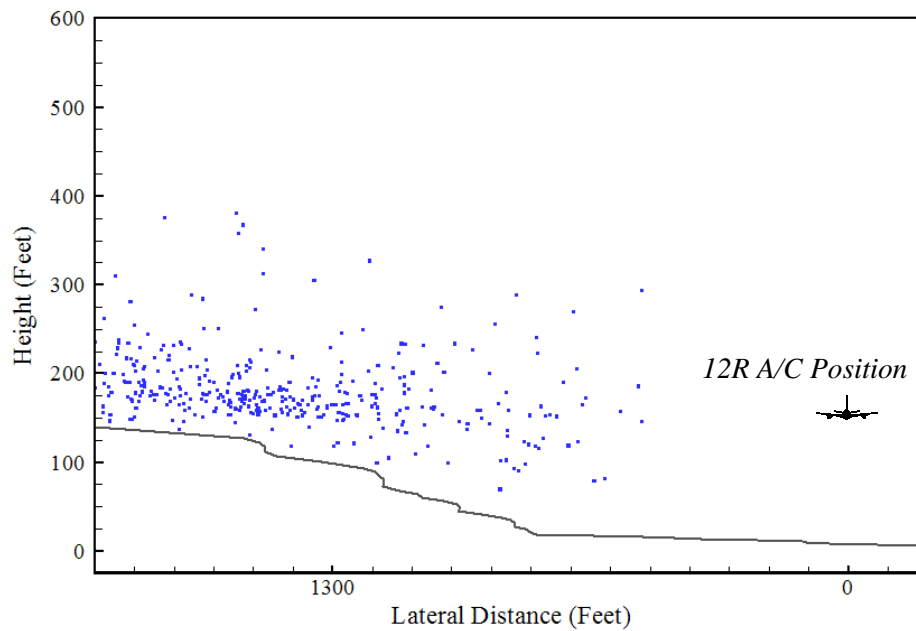


31 deg Lidar Scan - Large Jets

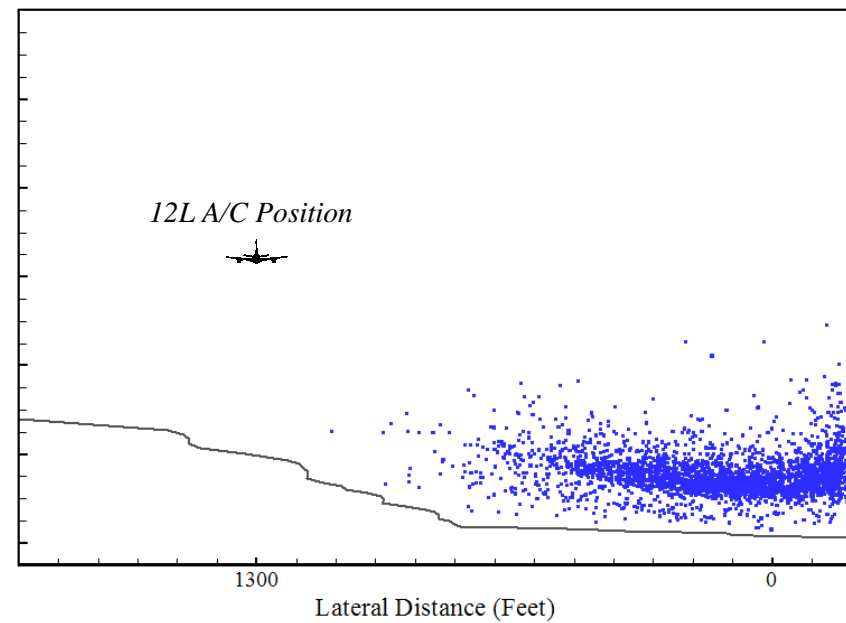
45 sec Wake Transport

Data from 07/03 - 10/04

376 Vortices from 12L



2925 Vortices from 12R



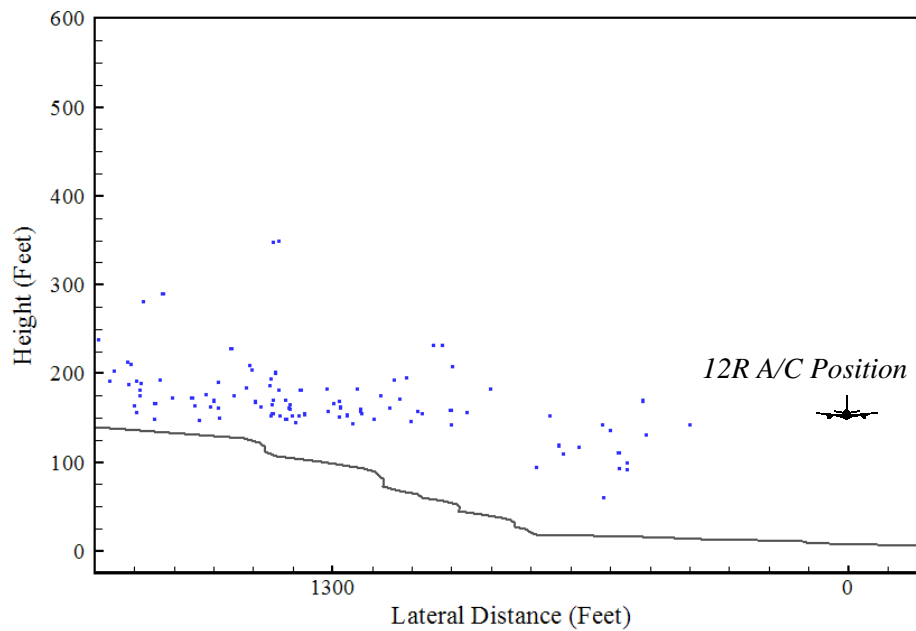


31 deg Lidar Scan - Large Jets

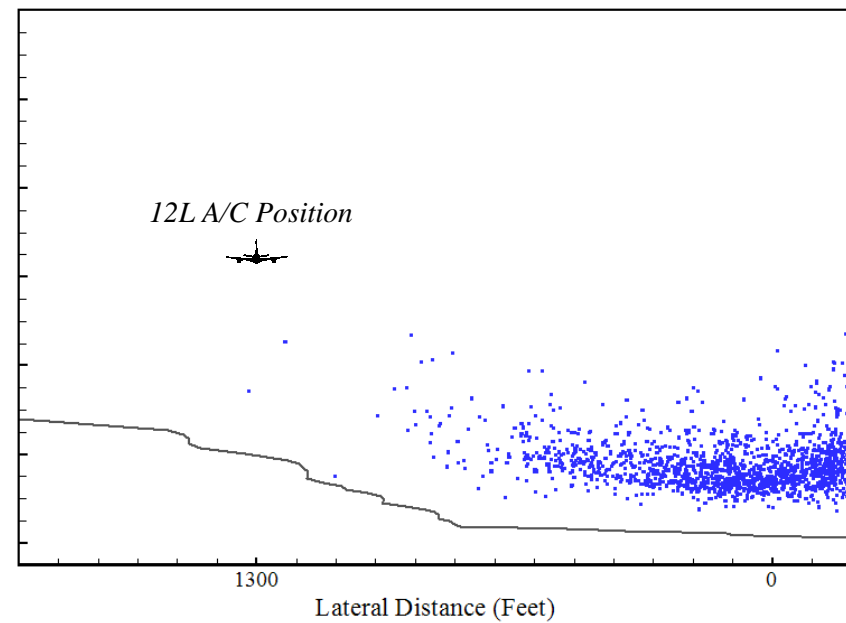
60 sec Wake Transport

Data from 07/03 - 10/04

99 Vortices from 12L



1507 Vortices from 12R

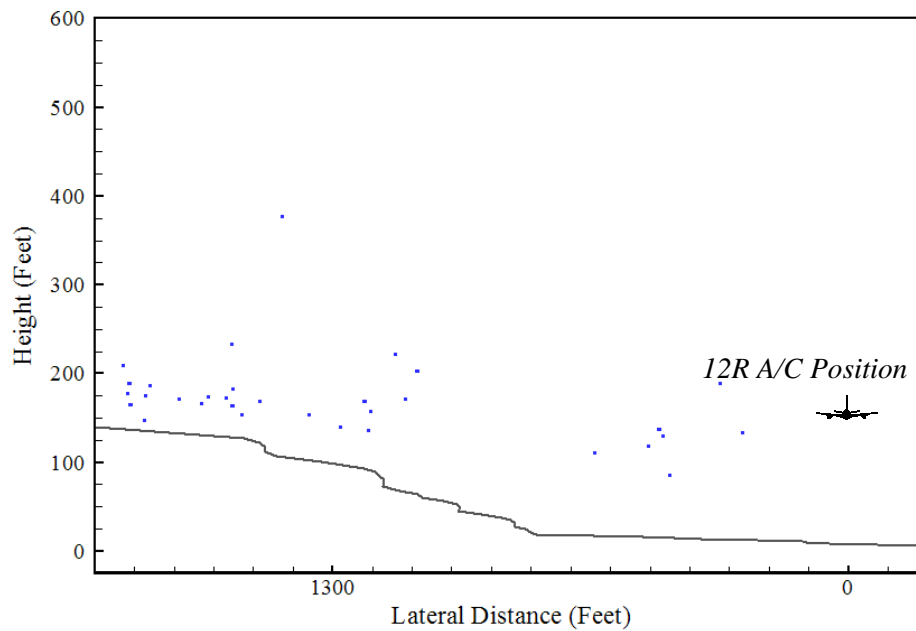




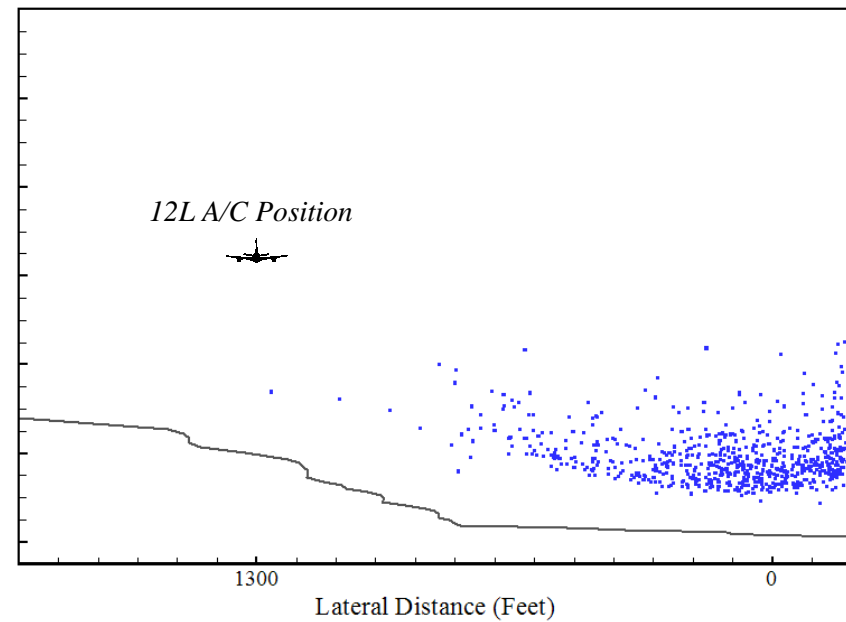
31 deg Lidar Scan - Large Jets

75 sec Wake Transport
Data from 07/03 - 10/04

32 Vortices from 12L



714 Vortices from 12R

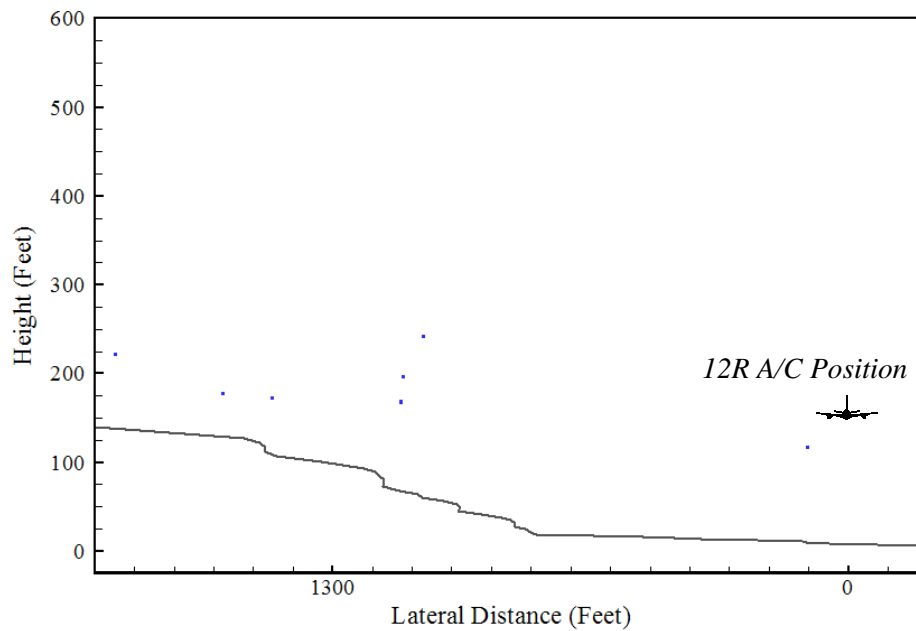




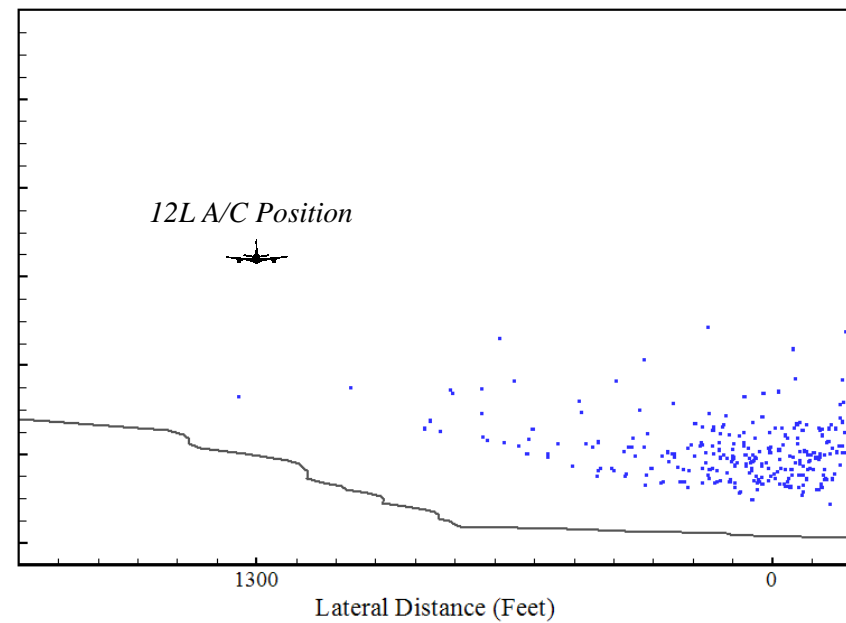
31 deg Lidar Scan - Large Jets

90 sec Wake Transport
Data from 07/03 - 10/04

7 Vortices from 12L



267 Vortices from 12R



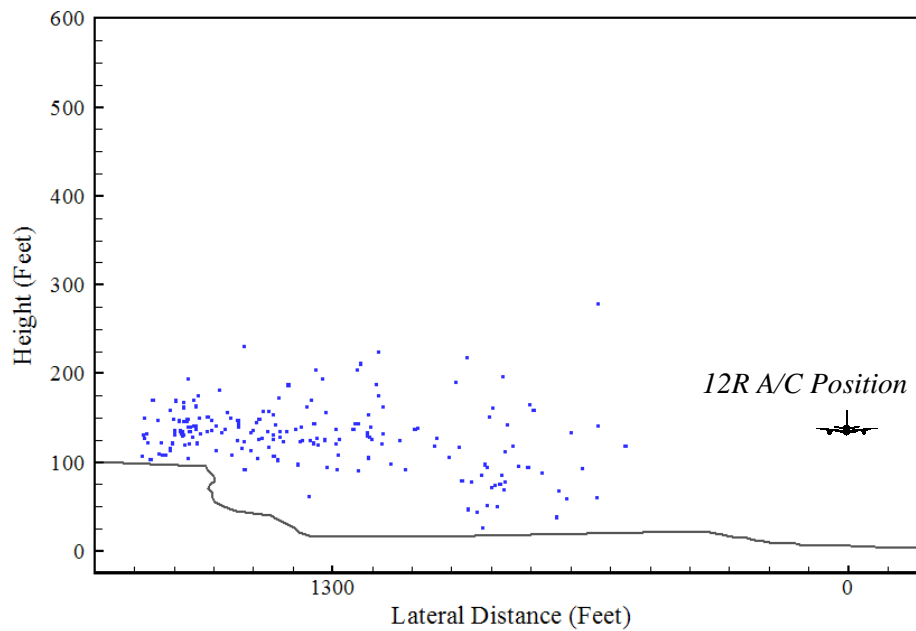


50 deg Lidar Scan - Large Jets

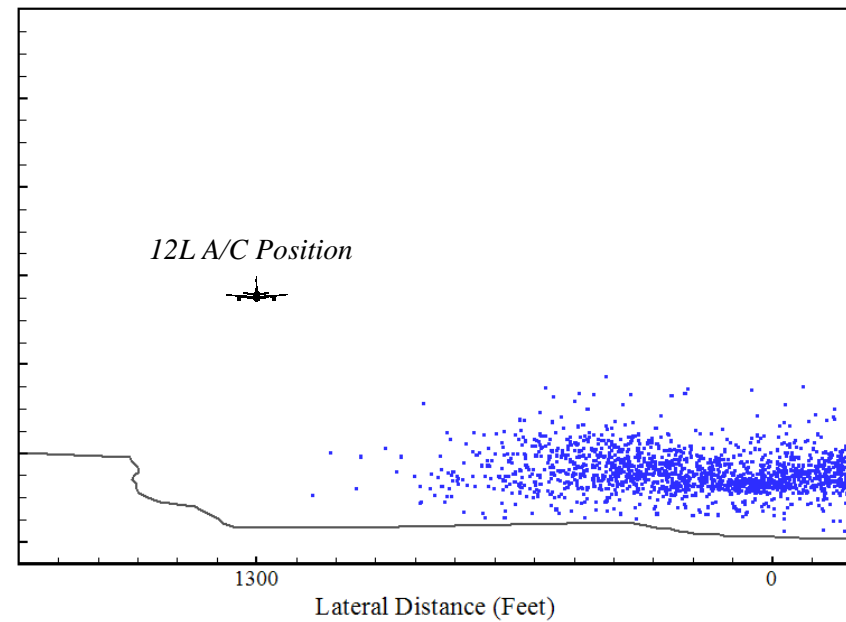
45 sec Wake Transport

Data from 07/03 - 10/04

184 Vortices from 12L



1775 Vortices from 12R



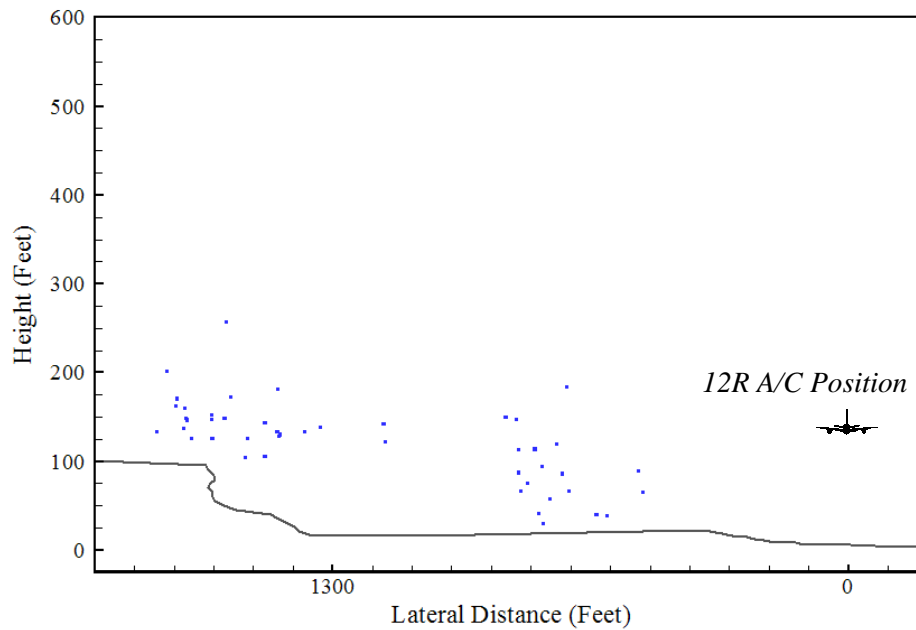


50 deg Lidar Scan - Large Jets

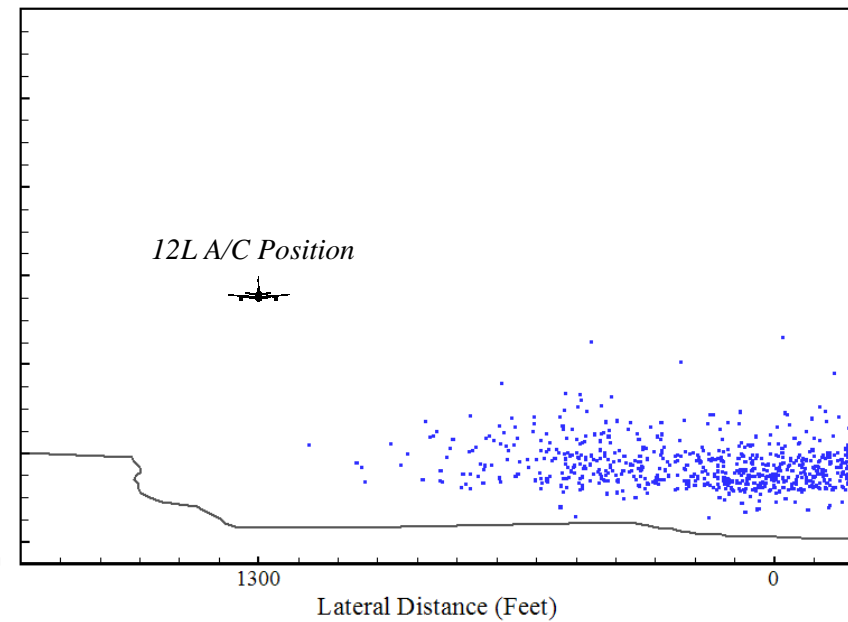
60 sec Wake Transport

Data from 07/03 - 10/04

46 Vortices from 12L



808 Vortices from 12R

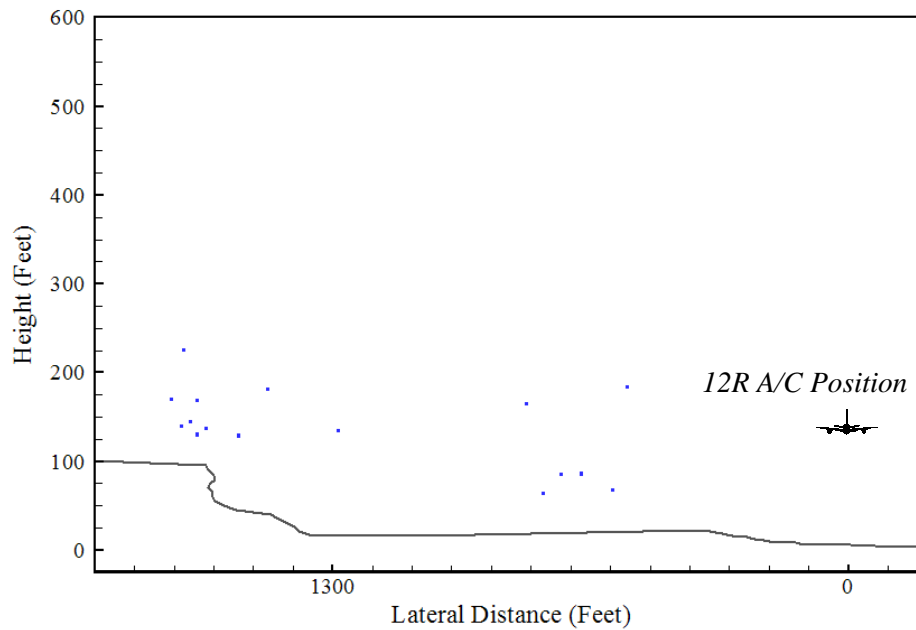




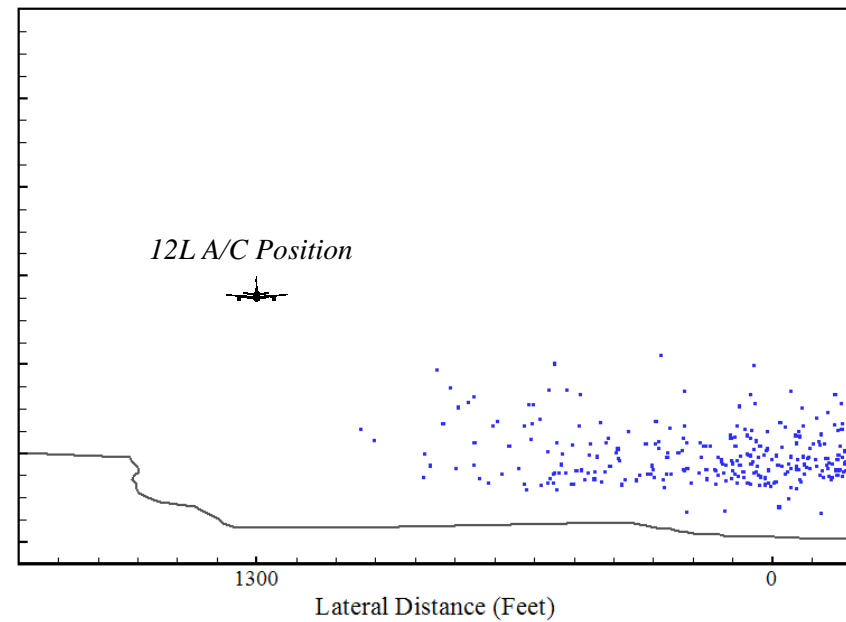
50 deg Lidar Scan - Large Jets

75 sec Wake Transport
Data from 07/03 - 10/04

16 Vortices from 12L



350 Vortices from 12R

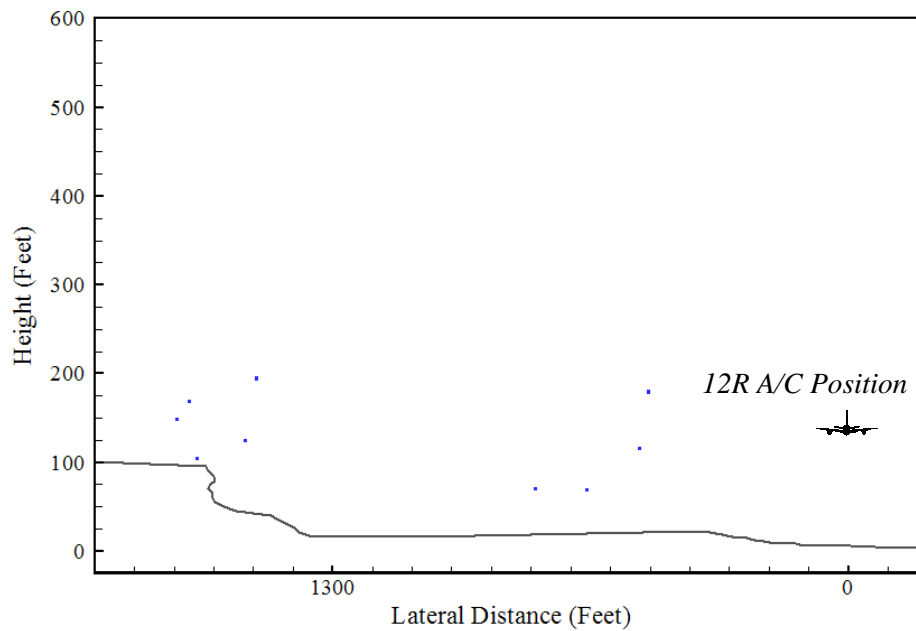




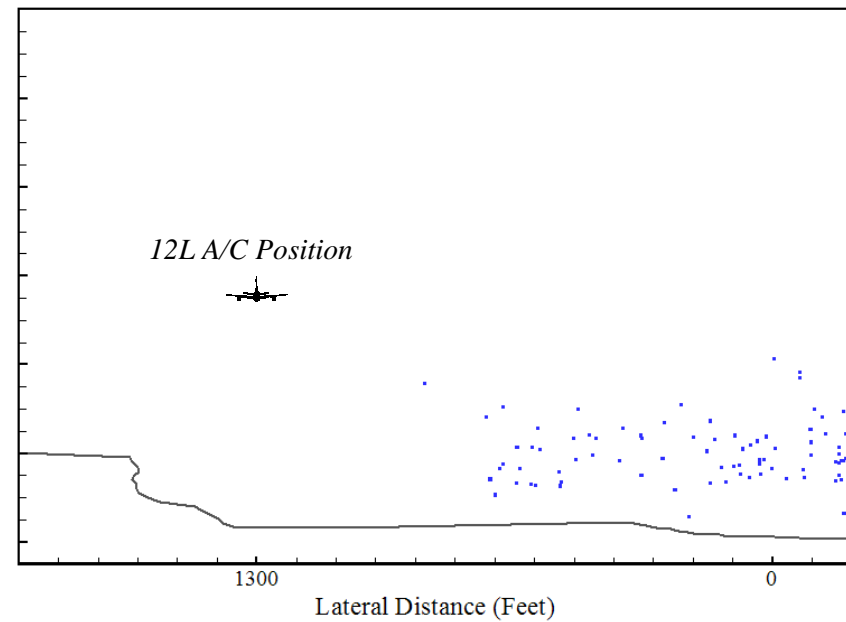
50 deg Lidar Scan - Large Jets

90 sec Wake Transport
Data from 07/03 - 10/04

9 Vortices from 12L



125 Vortices from 12R



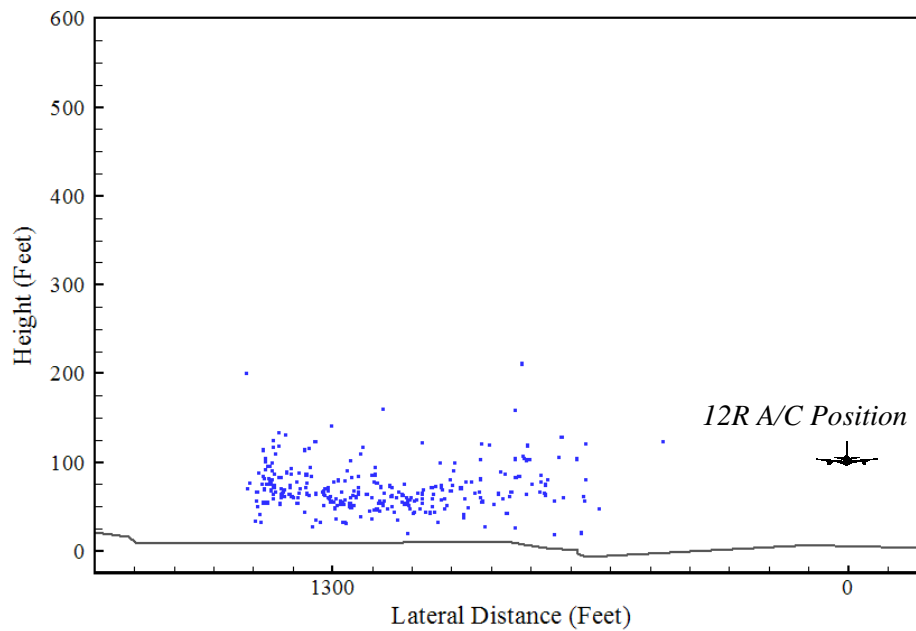


75 deg Lidar Scan - Large Jets

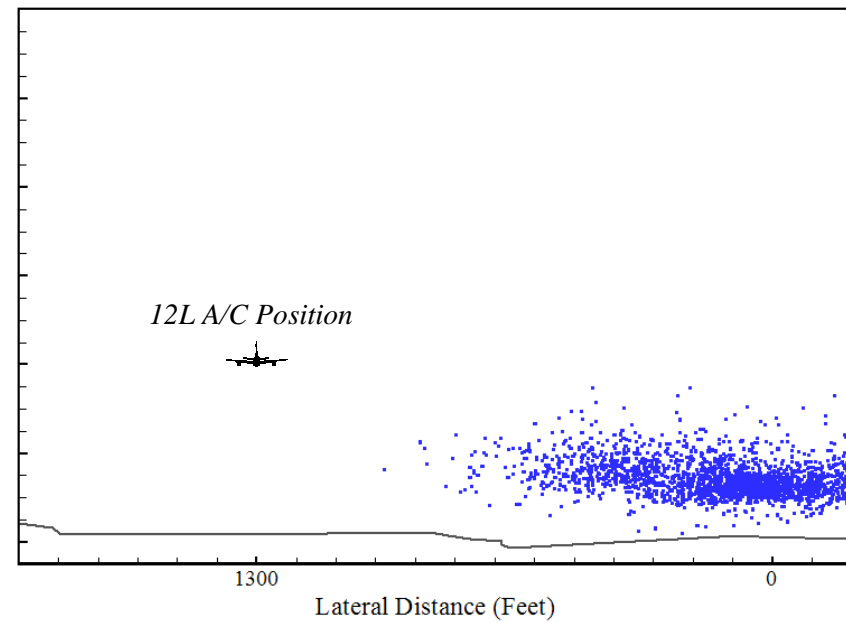
45 sec Wake Transport

Data from 07/03 - 10/04

276 Vortices from 12L



2525 Vortices from 12R



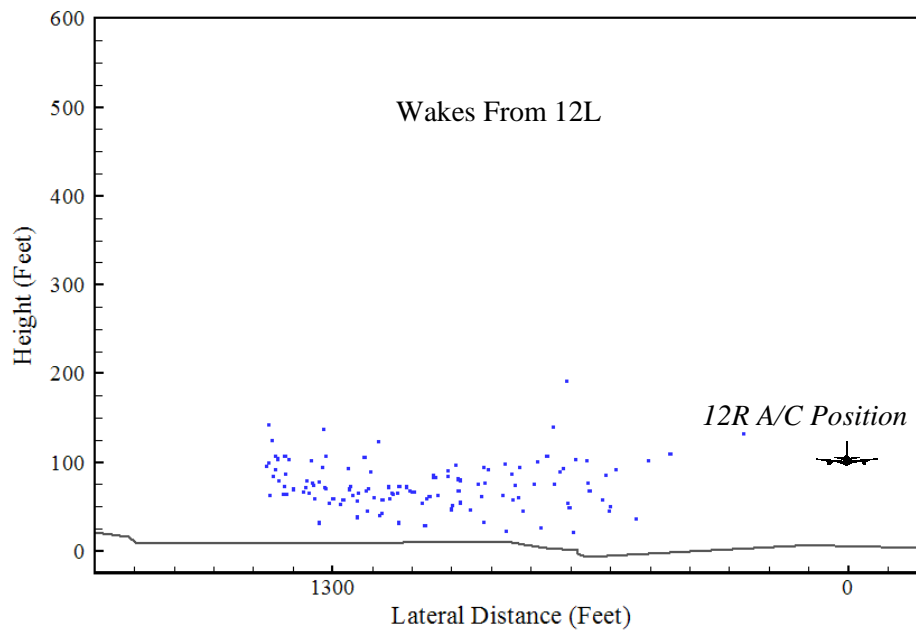


75 deg Lidar Scan - Large Jets

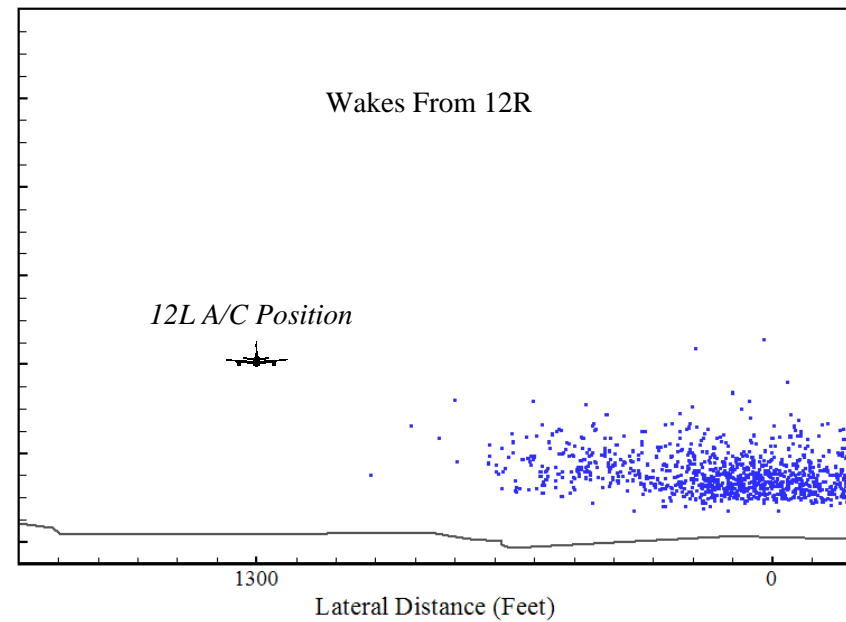
60 sec Wake Transport

Data from 07/03 - 10/04

124 Vortices from 12L



1282 Vortices from 12R

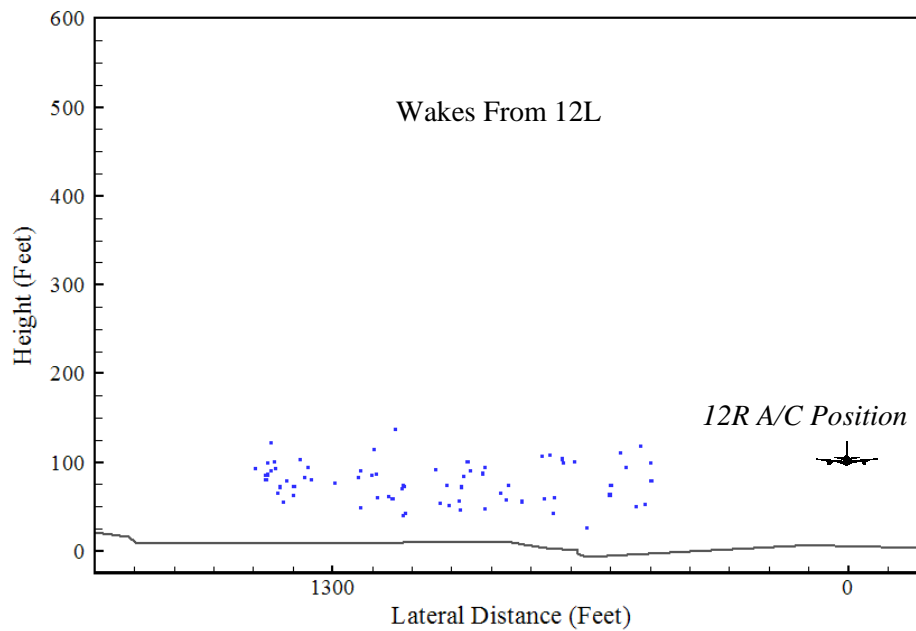




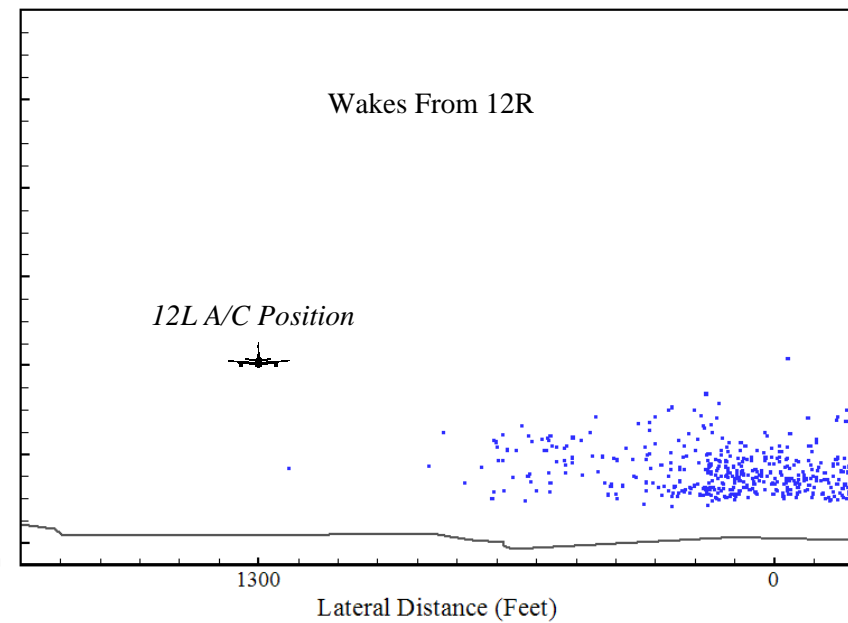
75 deg Lidar Scan - Large Jets

75 sec Wake Transport
Data from 07/03 - 10/04

70 Vortices from 12L



608 Vortices from 12R

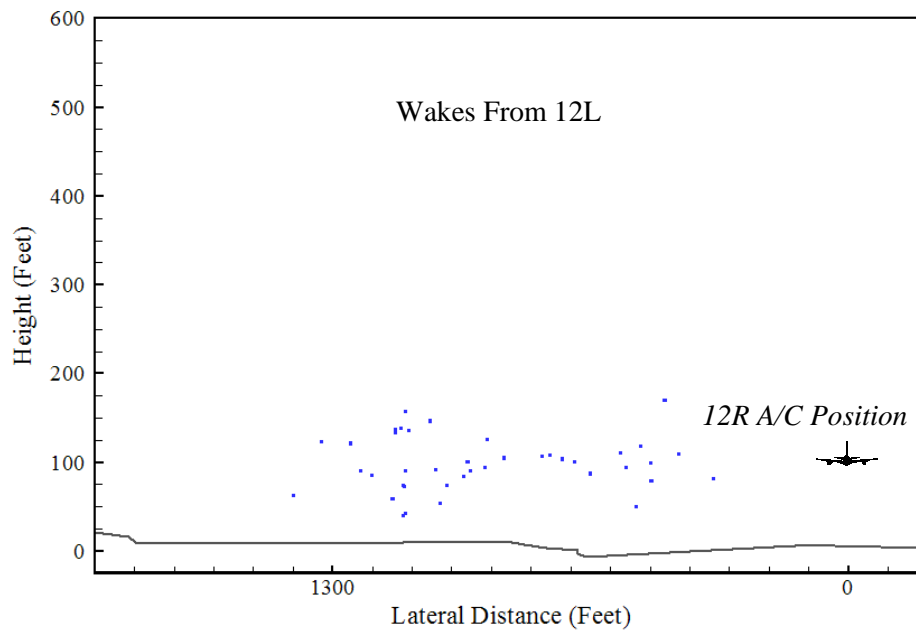




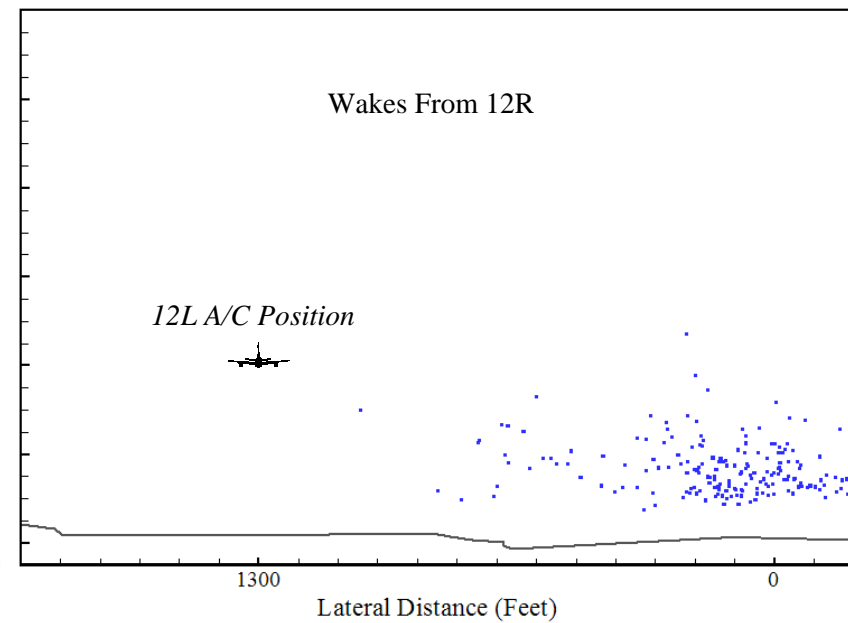
75 deg Lidar Scan - Large Jets

90 sec Wake Transport
Data from 07/03 - 10/04

40 Vortices from 12L



290 Vortices from 12R



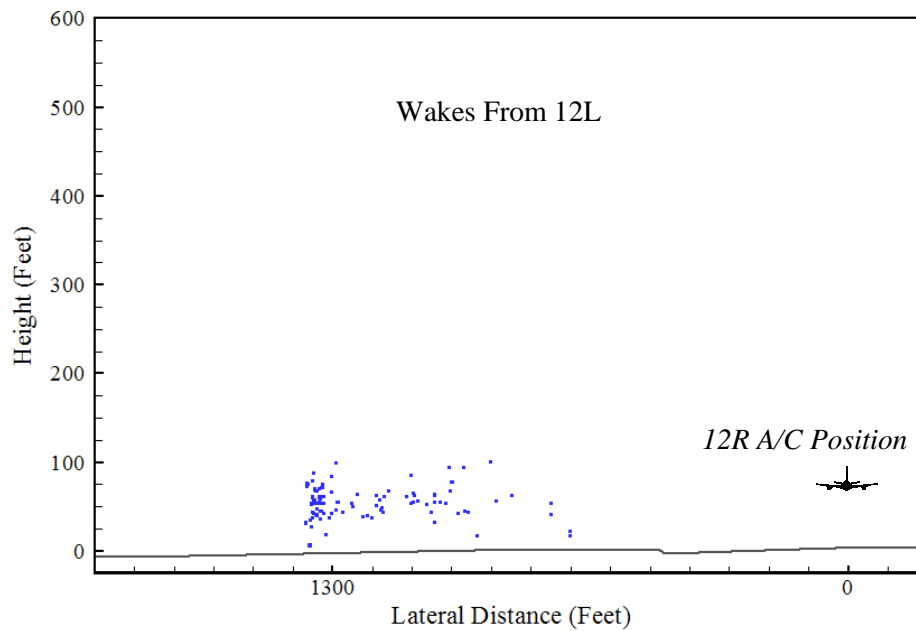


86 deg Lidar Scan - Large Jets

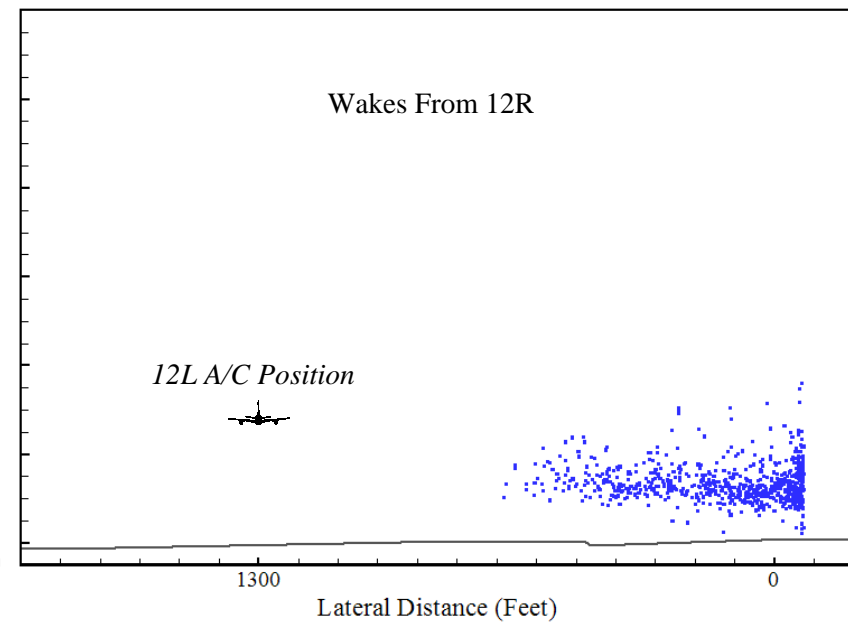
45 sec Wake Transport

Data from 07/03 - 10/04

94 Vortices from 12L



734 Vortices from 12R

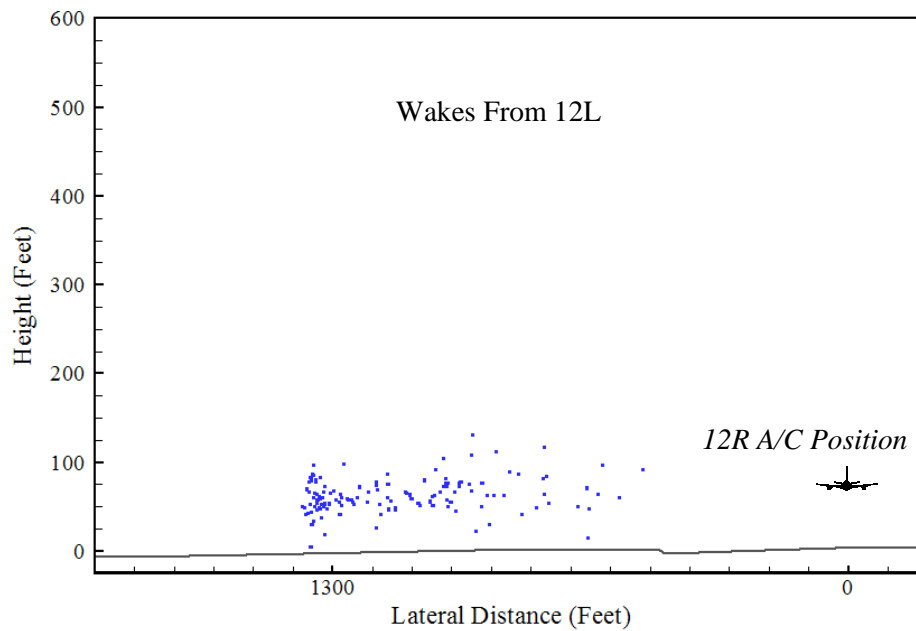




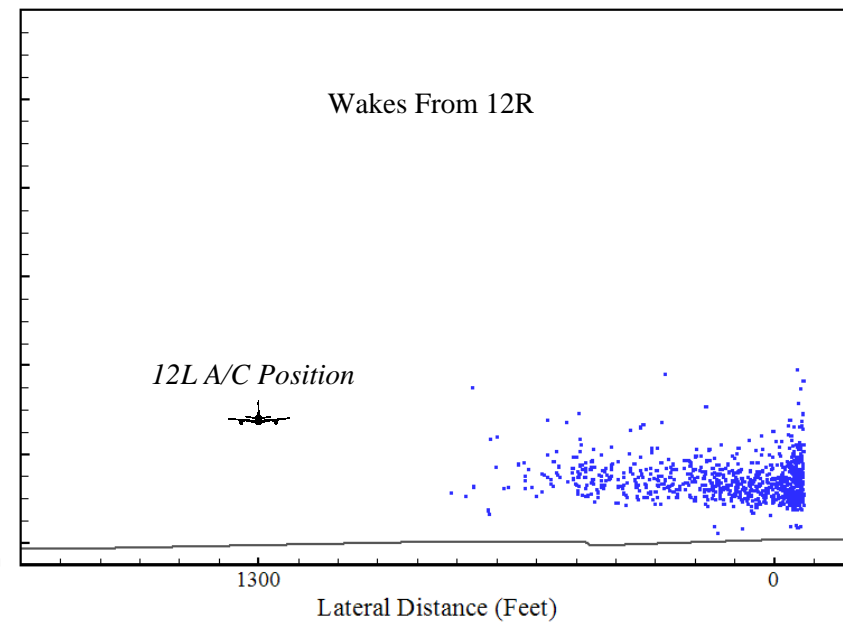
86 deg Lidar Scan - Large Jets

60 sec Wake Transport
Data from 07/03 - 10/04

135 Vortices from 12L



817 Vortices from 12R

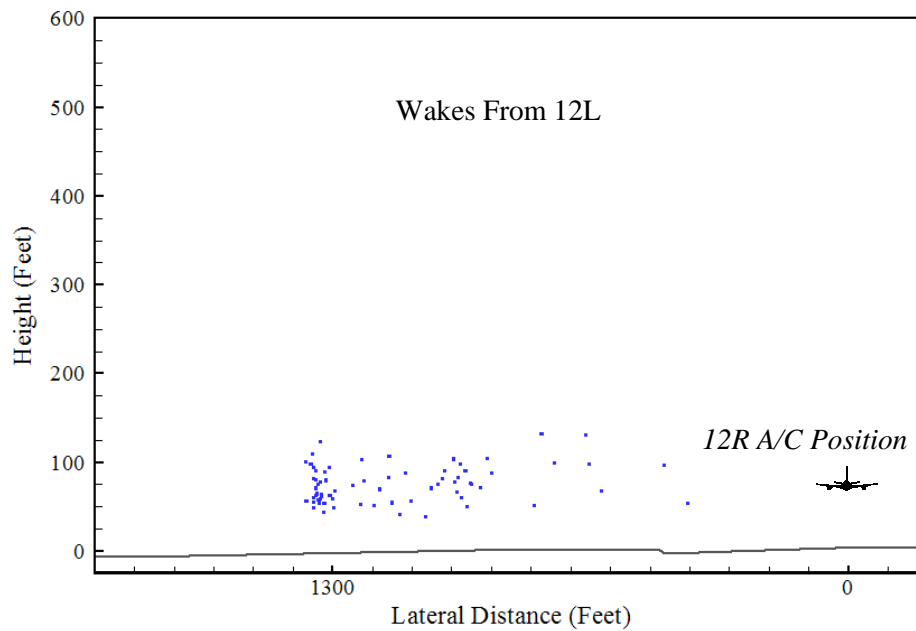




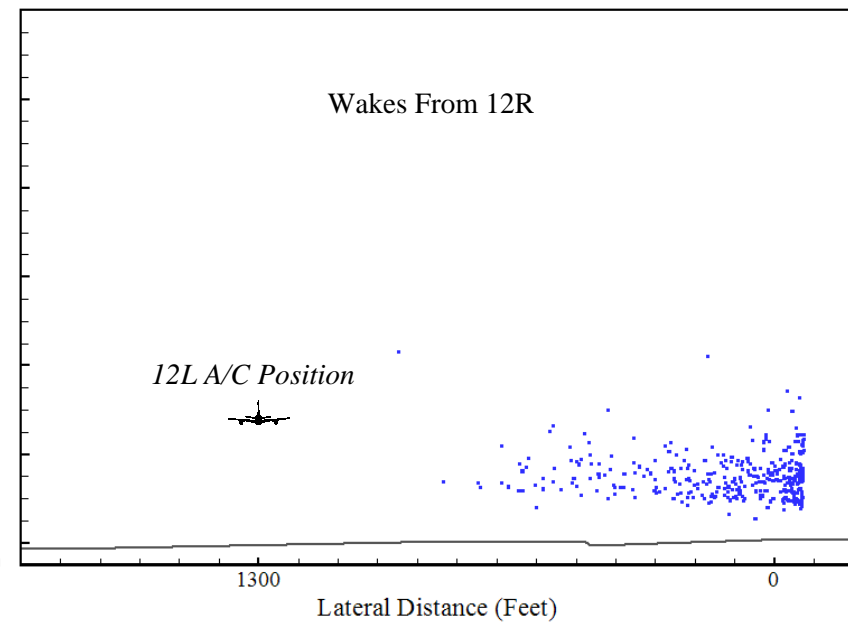
86 deg Lidar Scan - Large Jets

75 sec Wake Transport
Data from 07/03 - 10/04

70 Vortices from 12L



357 Vortices from 12R

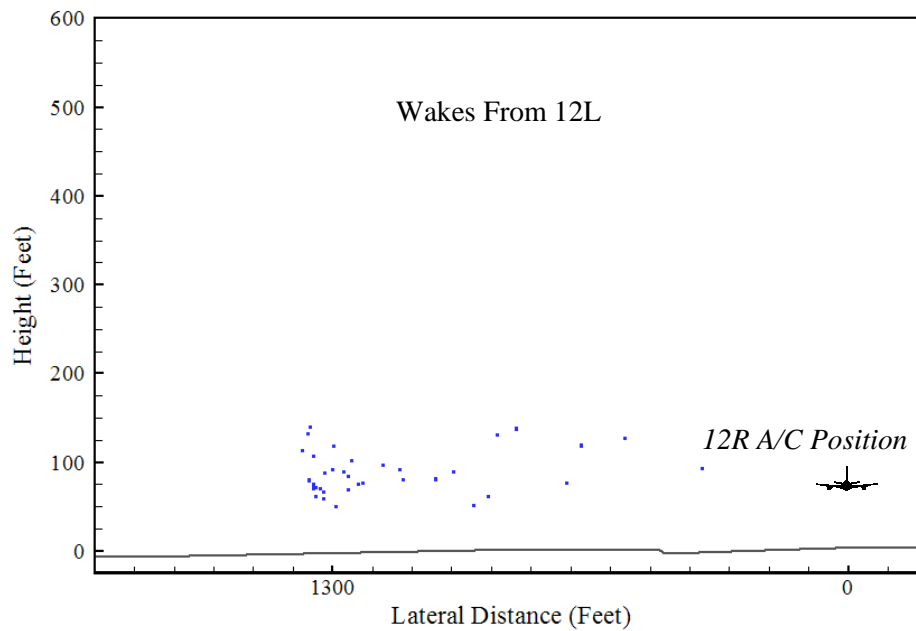




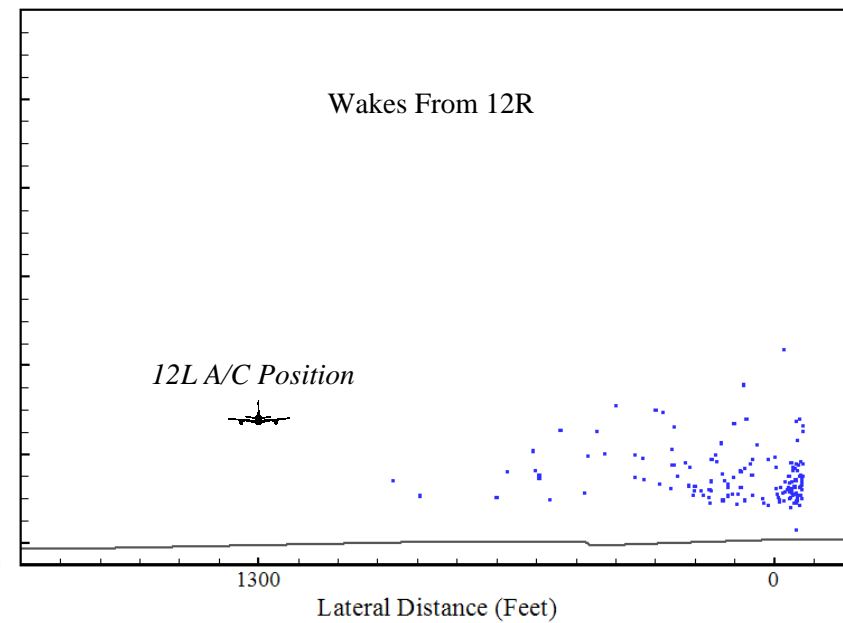
86 deg Lidar Scan - Large Jets

90 sec Wake Transport
Data from 07/03 - 10/04

36 Vortices from 12L



141 Vortices from 12R



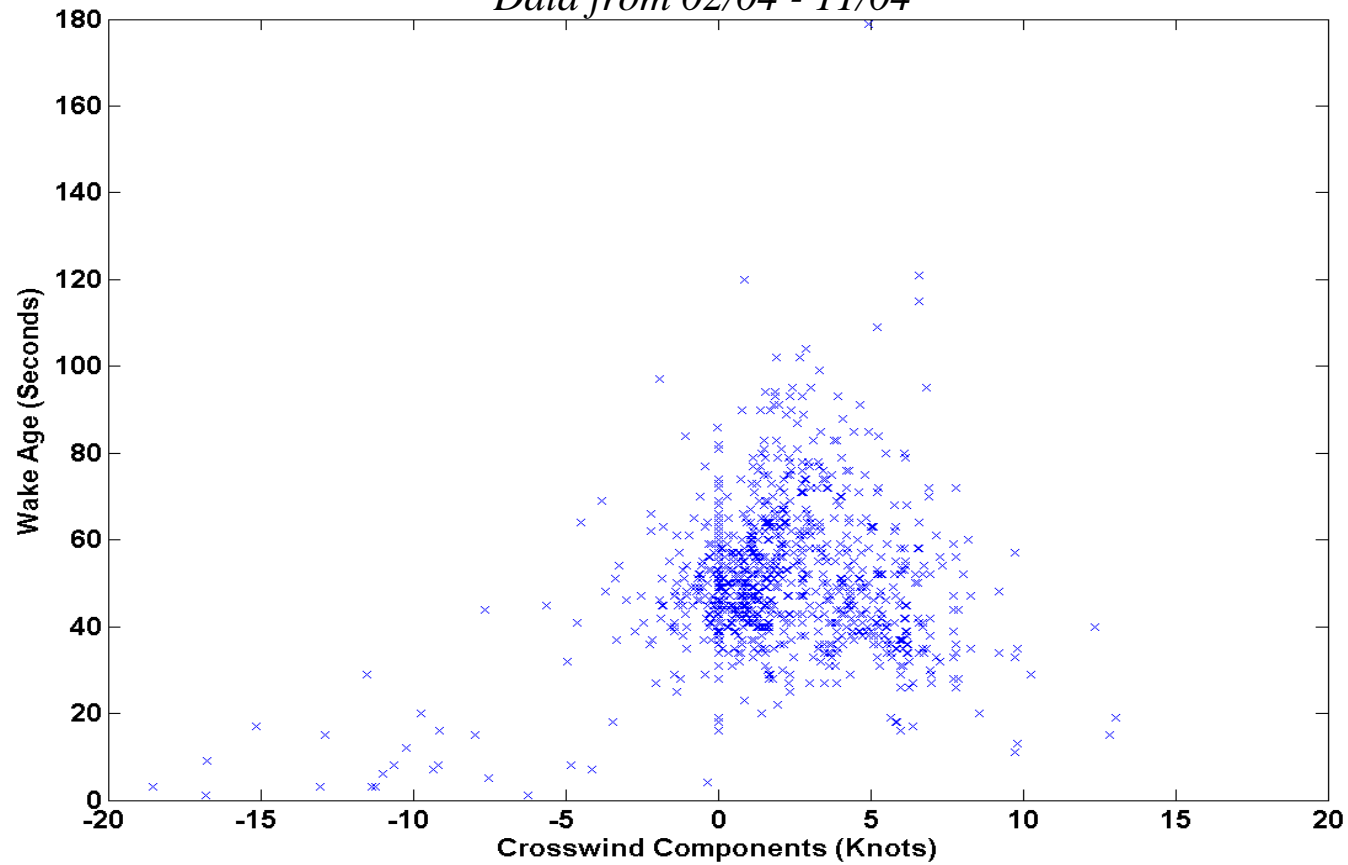


Characterization of Wake Age vs. Crosswind



Wake Age vs. CW - Large Jets

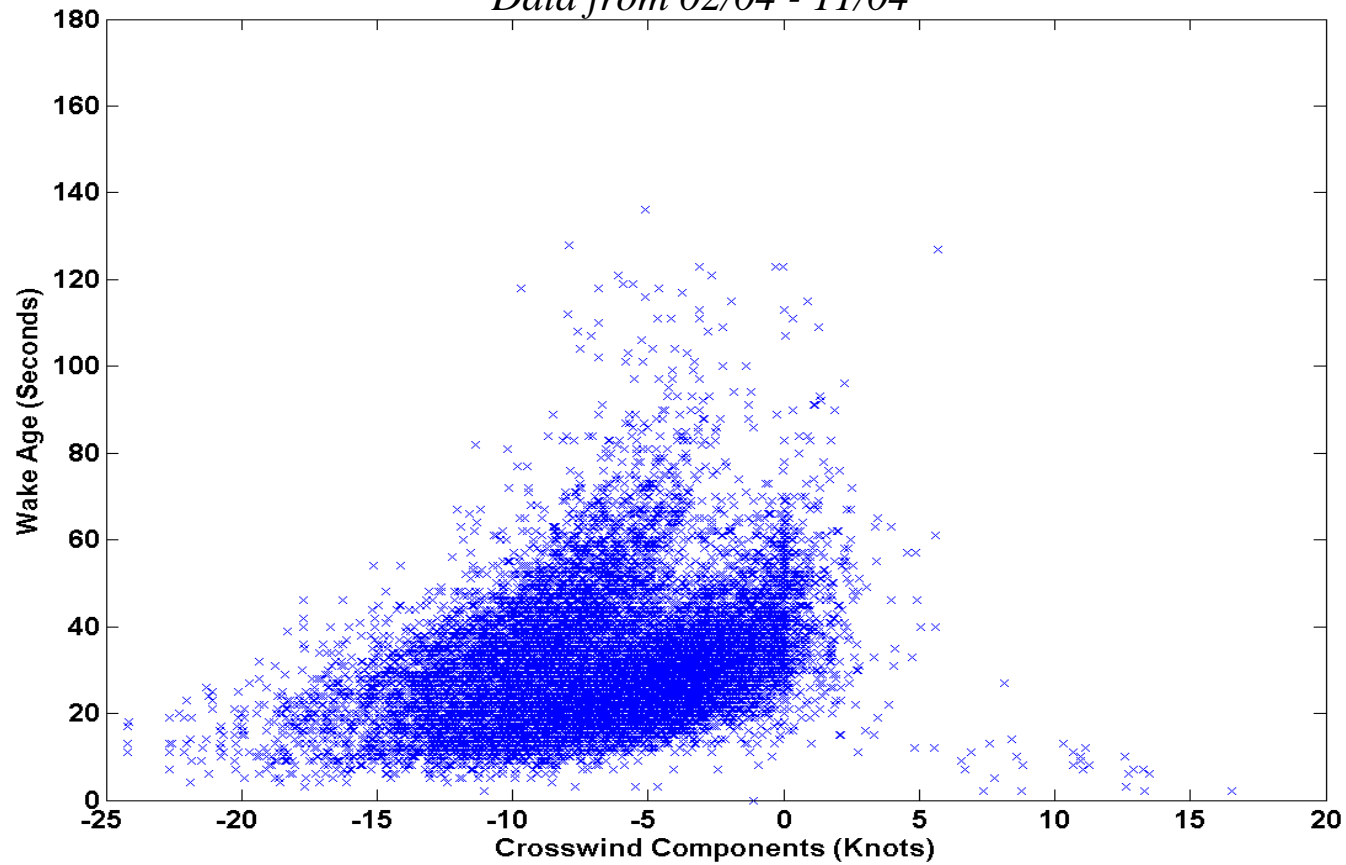
Wakes from 12L
941 Vortices Detected WL1
Data from 02/04 - 11/04





Wake Age vs. CW - Large Jets

Wakes from 12R
13856 Vortices Detected WL1
Data from 02/04 - 11/04

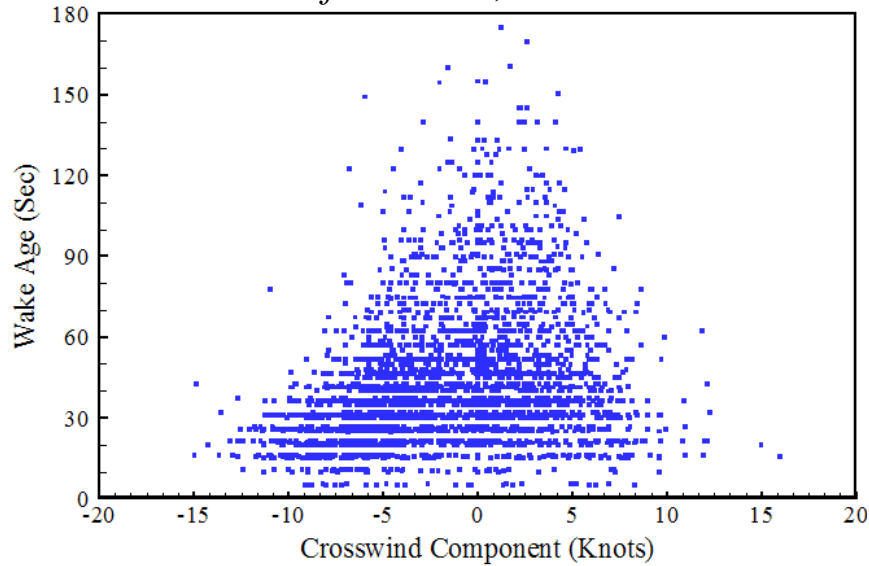




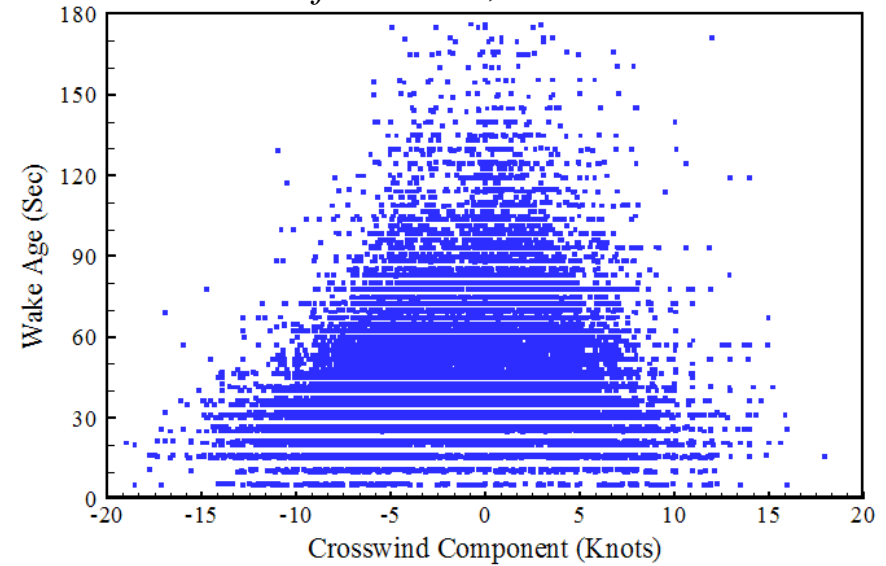
Wake Age vs. CW - Large Jets

All Lidar Angles

Data from 07/03 - 10/04
Wakes from 12L ; 2049 Vortices



Data from 07/03 - 10/04
Wakes from 12R ; 12050 Vortices





Summary

- ❏ Vortices from Large Jets Rarely Transport 1000 ft Toward the Adjacent CSPR within the 1.5-2.5 NMI Diagonal Separation Framework.
- ❏ Likelihood of Wakes in the Flight Path is Far Less in CSPR with 1.5-2.5 NMI Diagonal Separation than 2.5+ NMI In-Trail Separation (STL Geometry/Specific).
- ❏ Runway Stagger Provides Enhanced Protection (Lead A/C on Lower Glideslope).
- ❏ Wake Demise Time and Crosswind Component Have an Inverse Relationship.



Next Steps

- ☞ Continue Data Processing STL1 Data.
- ☞ Continue Outlier Analyses.
- ☞ Start Processing STL3 Data and Comparison with WL1.
- ☞ Further Out Along the Approach OGE Measurements.

Q&A

