

CHANGING ROLE OF STL INSTRUMENT SUITE



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New Tests in Support of STL Waiver

- o Vortex Sensor Intercomparisons
- o Monitor Vortices Farther Out on the Glide Slope
- o Examine Axial (Longitudinal) Coherence of Vortices
- o Vortex Versus Atmospheric Turbulence



Vortex Sensor Intercomparisons

Intercompare measurements of wake vortices made by different sensors to determine the accuracy and errors of the measurements.

Lidars #1 and #3

Windlines 1C and 1A

Vortex Sodar

Look at same vortex at nominally the same time and location.

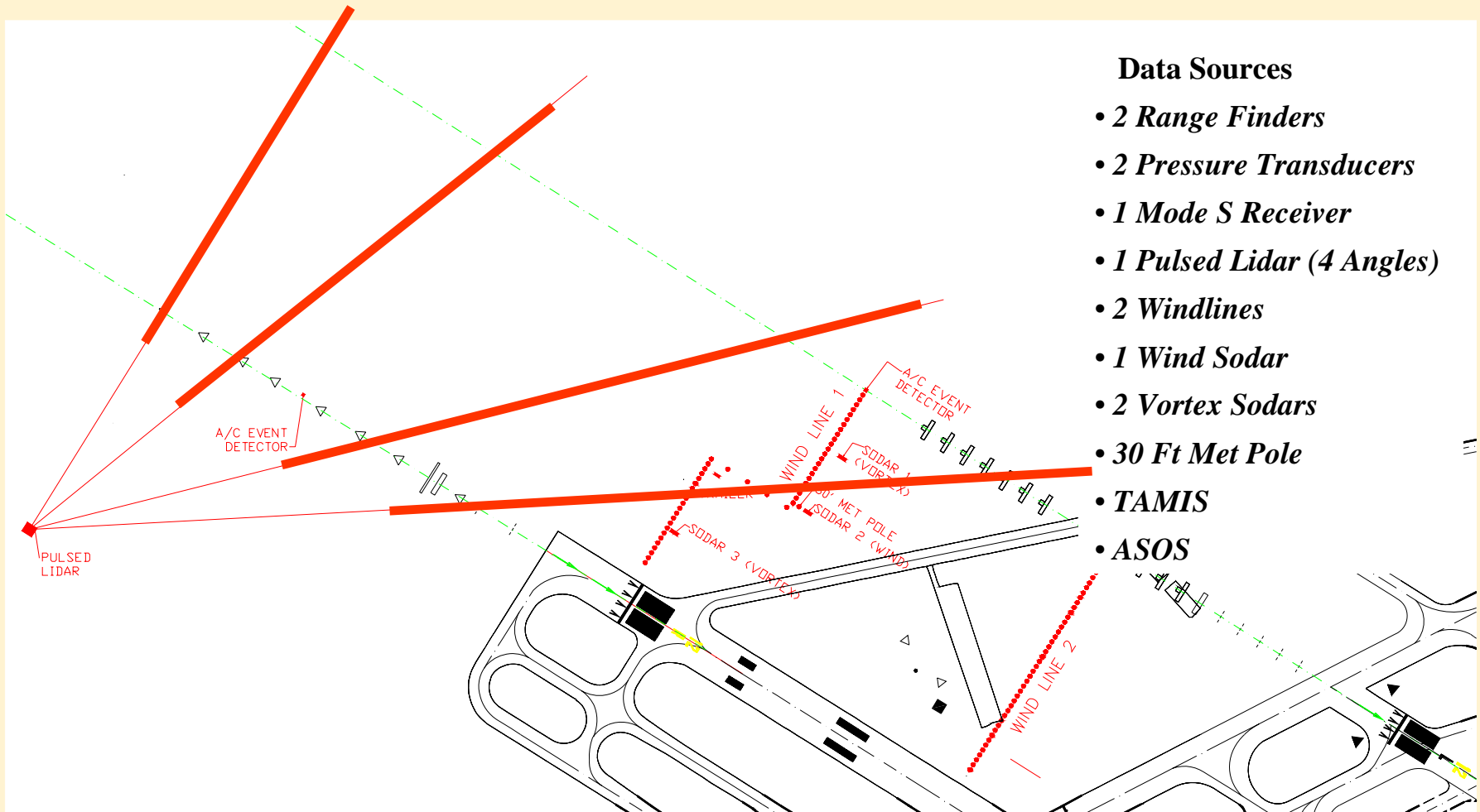
Lateral transport

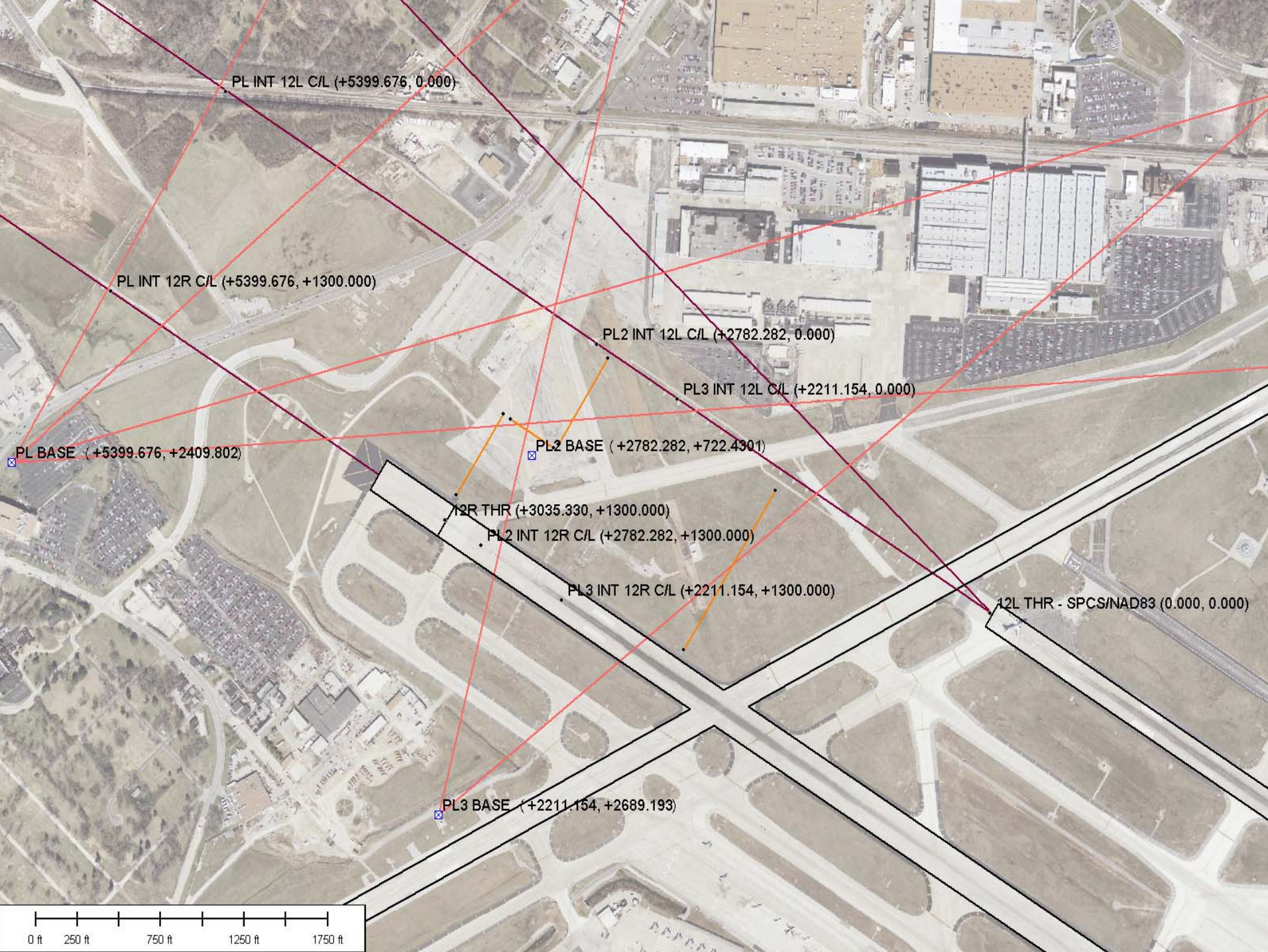
Altitude

Circulation (vortex strength)

Results important to assessment of safety of new procedures and to the prediction of vortex evolution using numerical models.

Current STL Sensor Layout





PL INT 12L C/L (+5399.676, 0.000)

PL INT 12R C/L (+5399.676, +1300.000)

PL2 INT 12L C/L (+2782.282, 0.000)

PL3 INT 12L C/L (+2211.154, 0.000)

PL BASE (+5399.676, +2409.802)

PL2 BASE (+2782.282, +722.4301)

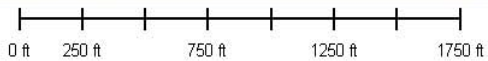
12R THR (+3035.330, +1300.000)

PL2 INT 12R C/L (+2782.282, +1300.000)

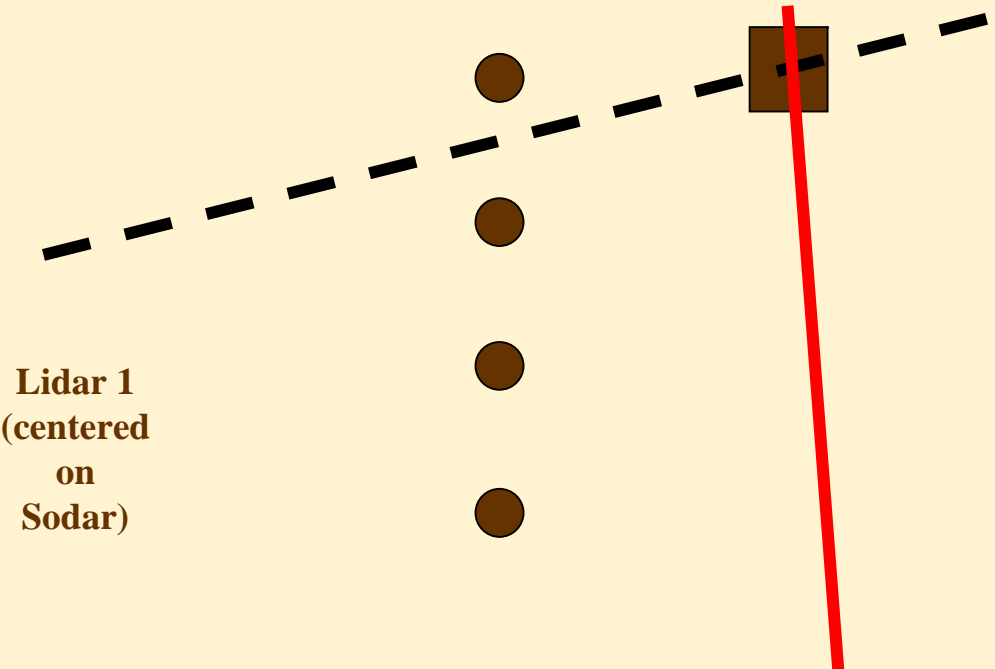
PL3 INT 12R C/L (+2211.154, +1300.000)

12L THR - SPCS/NAD83 (0.000, 0.000)

PL3 BASE (+2211.154, +2689.193)



Measurements in the Base Configuration



Lidar 1
(centered
on
Sodar)

Lidar 3

- Windline 1C
- Vortex Sodar closest to Windline 1A



Monitor Vortices Farther Out on Glide Slope

Lidar #1 VAD Scans – Measuring Winds Aloft

Examine Vortex Behavior at Higher Altitudes

lateral transport

altitude (descent distance)

circulation decay

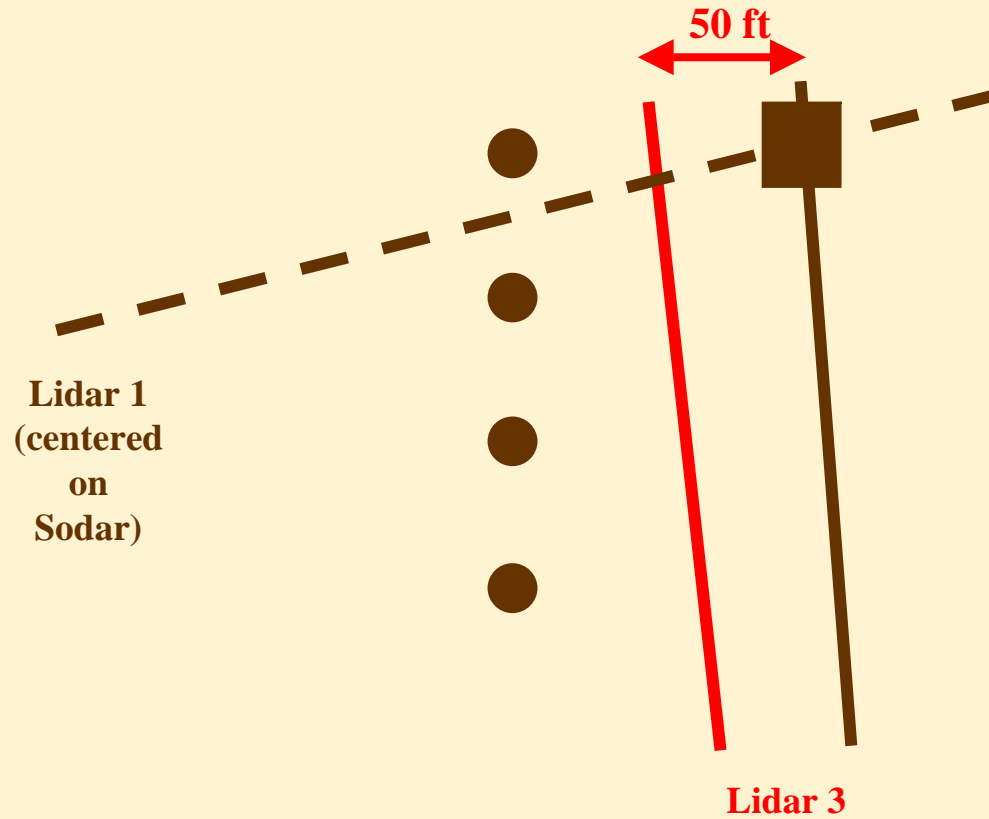




Examine Axial Coherence of Vortices

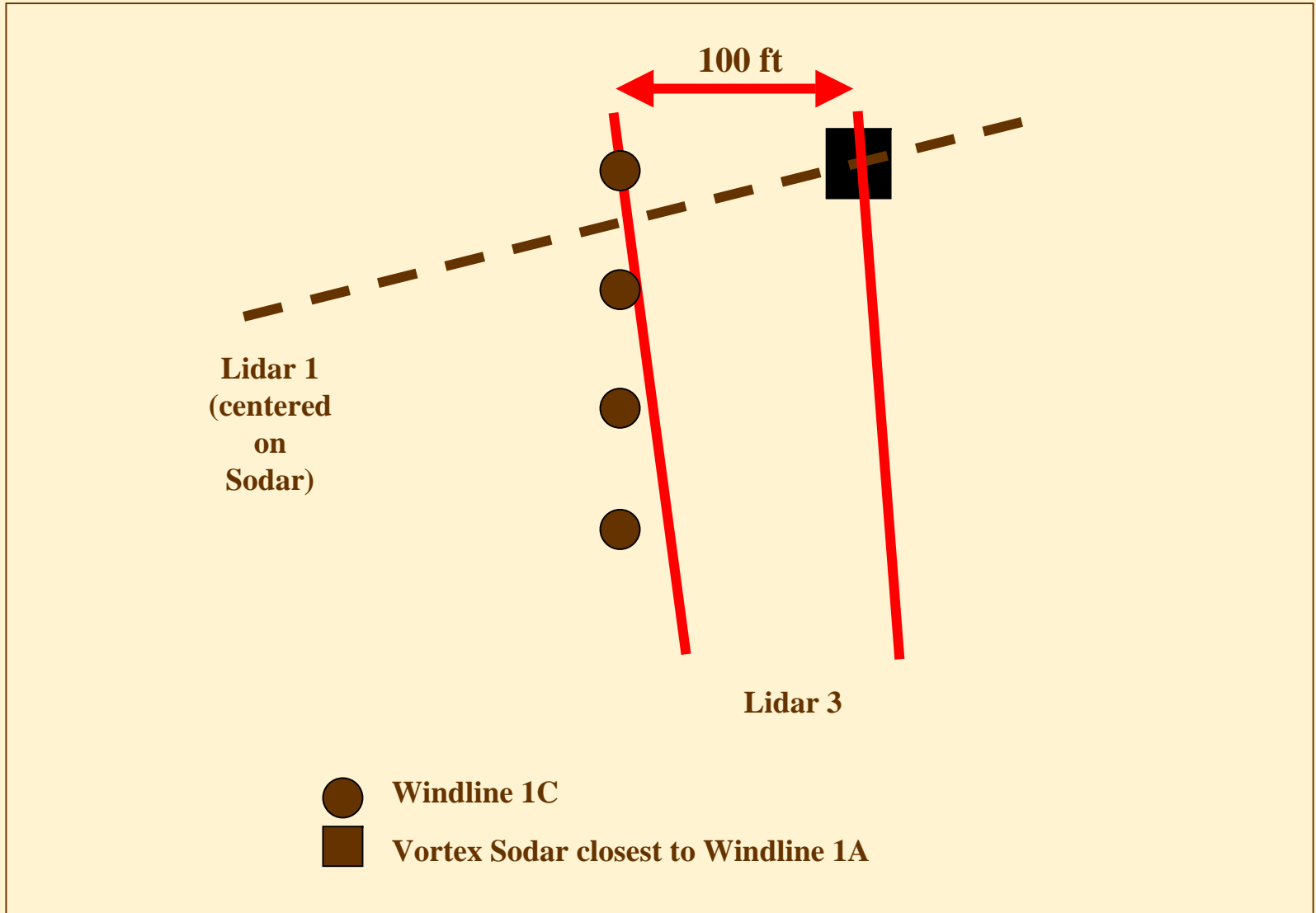
Atmospheric eddies and turbulence cause vortices to change from “straight lines” to meandering lines.

Measurements in the Base +50 Configuration



- Windline 1C
- Vortex Sodar closest to Windline 1A

Measurements in the Base + 100 Configuration





Vortex Versus Atmospheric Turbulence

Wind and Vortex Sodars



Wind and Vortex Sodar - “Acoustic Radar”

Manufacturer: AeroVironment, Monrovia, CA

Transmitting Frequency: 4500 Hz

Sampling Rate: Wind Mode - One Hz Each Beam ;
Vortex Mode - One Hz Vertical Beam

Line-of-Site Velocity Measurements from Acoustic
Backscattering

Distance Resolved by Range Gating

Wind Speed Accuracy: 0.5 m/sec.

Wind Direction Accuracy: ± 5 Deg.

Vertical Turbulence Profile

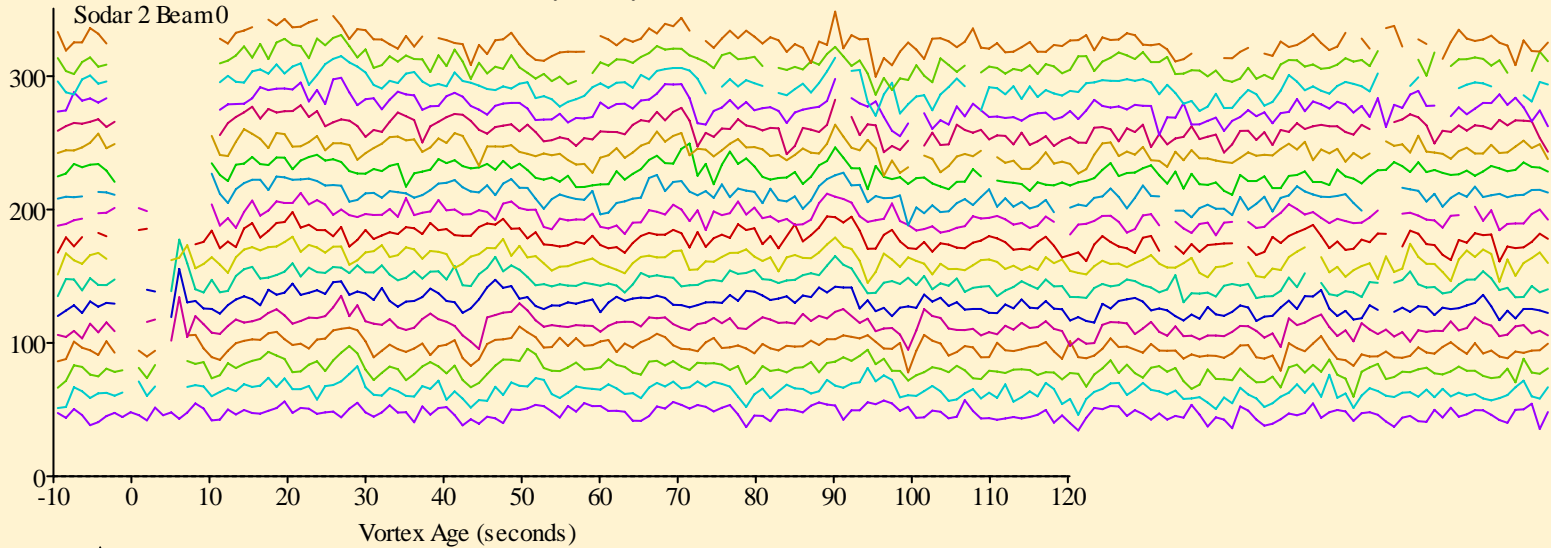
STL Airport Date 20050112 Run 1
NA_-11.88 Arrived on 12R at 175453

Arrival list:12JanA.TXT:Run 1
Time Plot: Wind Line 1

Height (ft) -- Wind Component (knots)

Only Primary Vortices

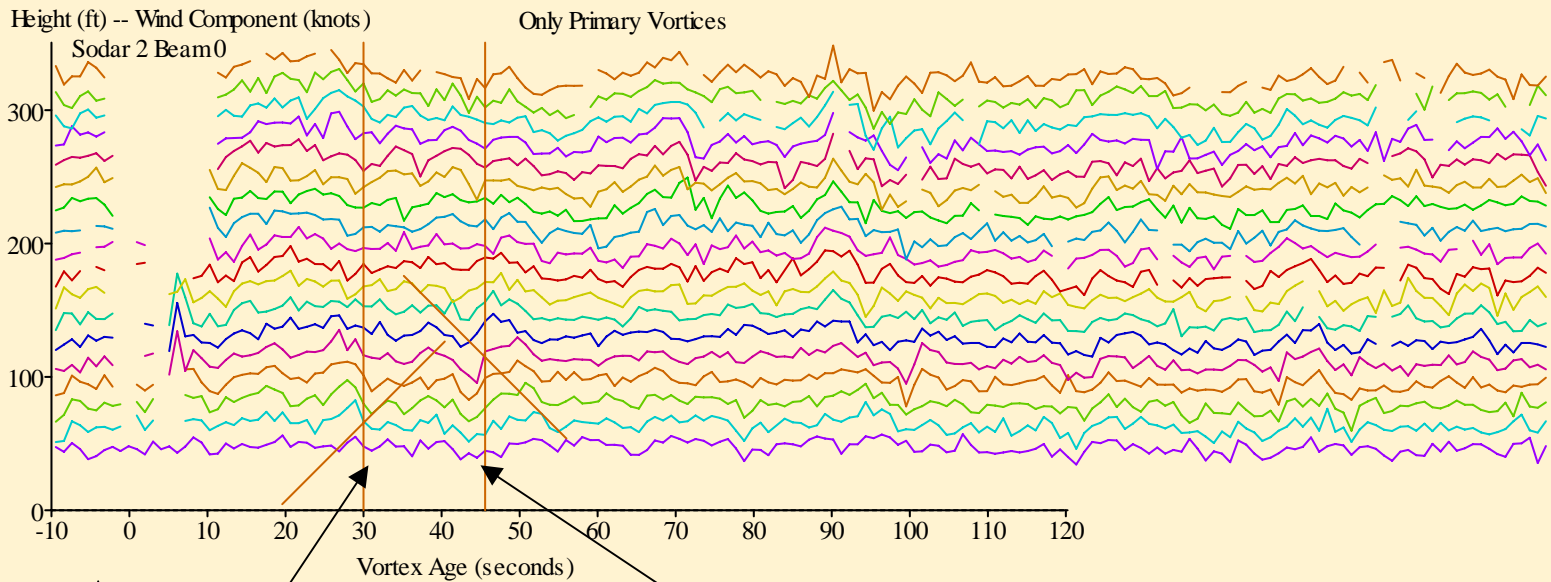
Sodar 2 Beam0



With Vortex Locations Marked

STL Airport Date 20050112 Run 1
NA_-11.88 Arrived on 12R at 175453

Arrival list:12JanA.TXT:Run 1
Time Plot: Wind Line 1



Vortex 1: $G=102 \text{ m}^2/\text{s}$

Vortex 2: $G=63 \text{ m}^2/\text{s}$