NTSB National Transportation Safety Board

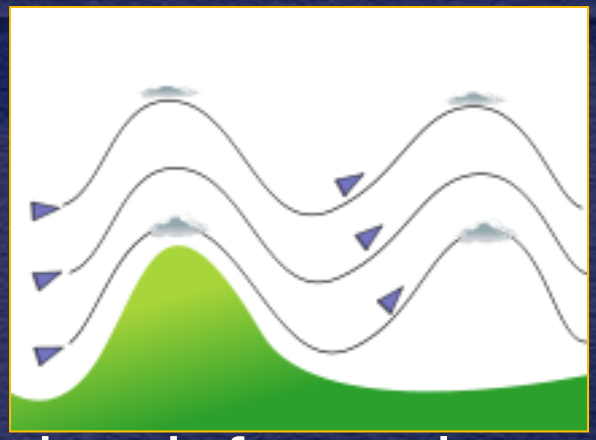
Office of Aviation Safety

Continental Airlines Flight 1404

Meteorology

Donald Eick

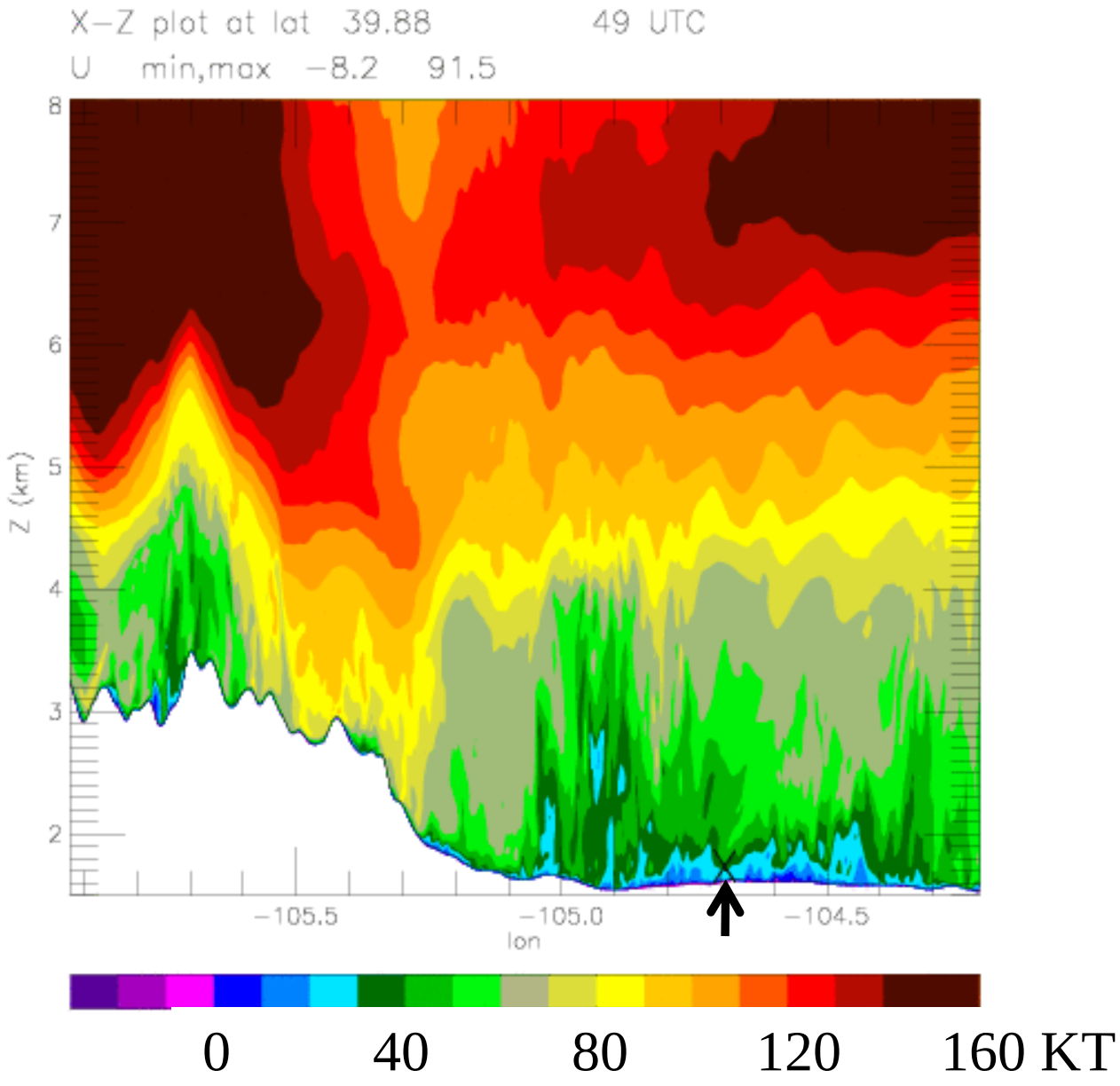
Mountain Wave Conditions



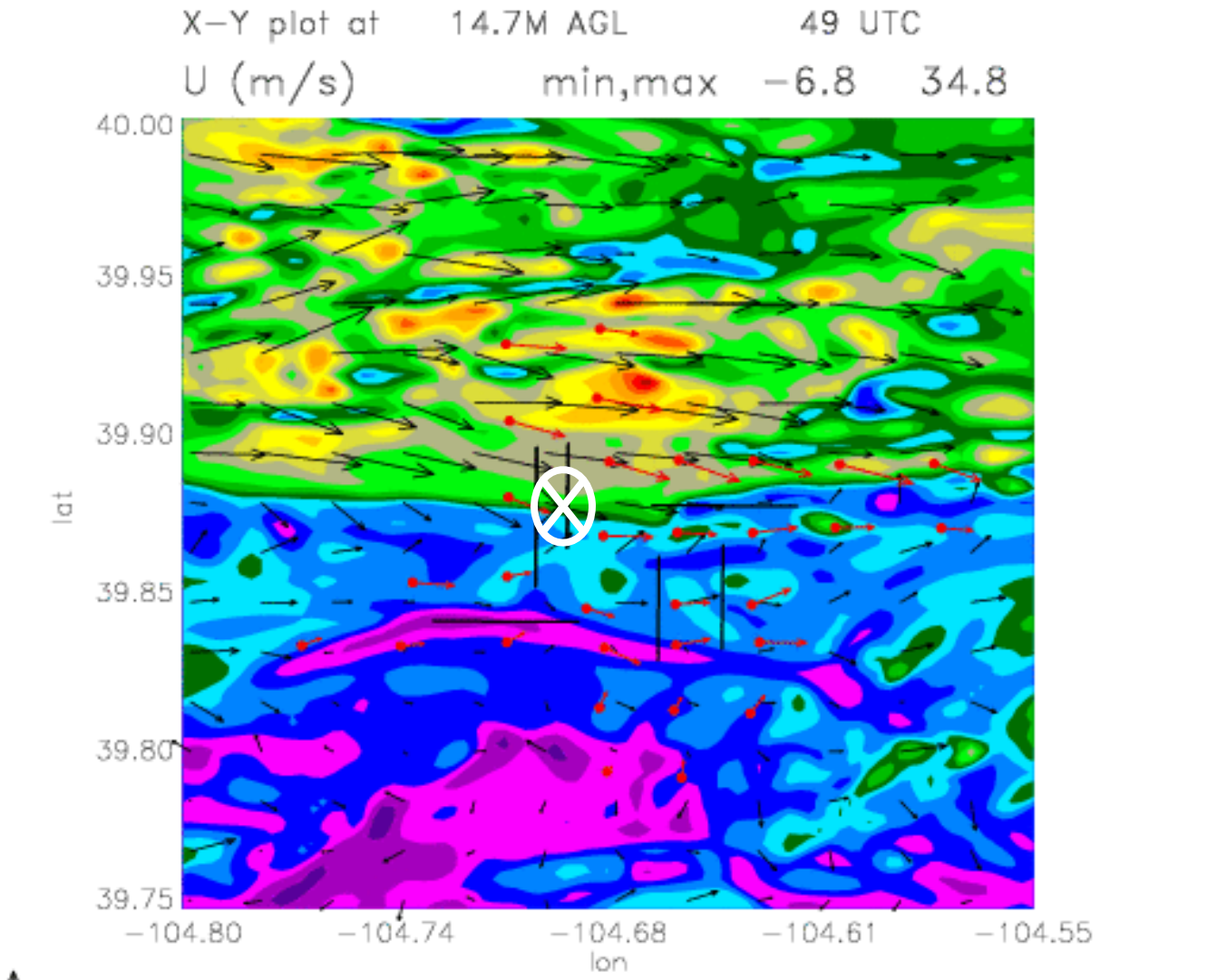
Wave-like flow develops downstream of high terrain

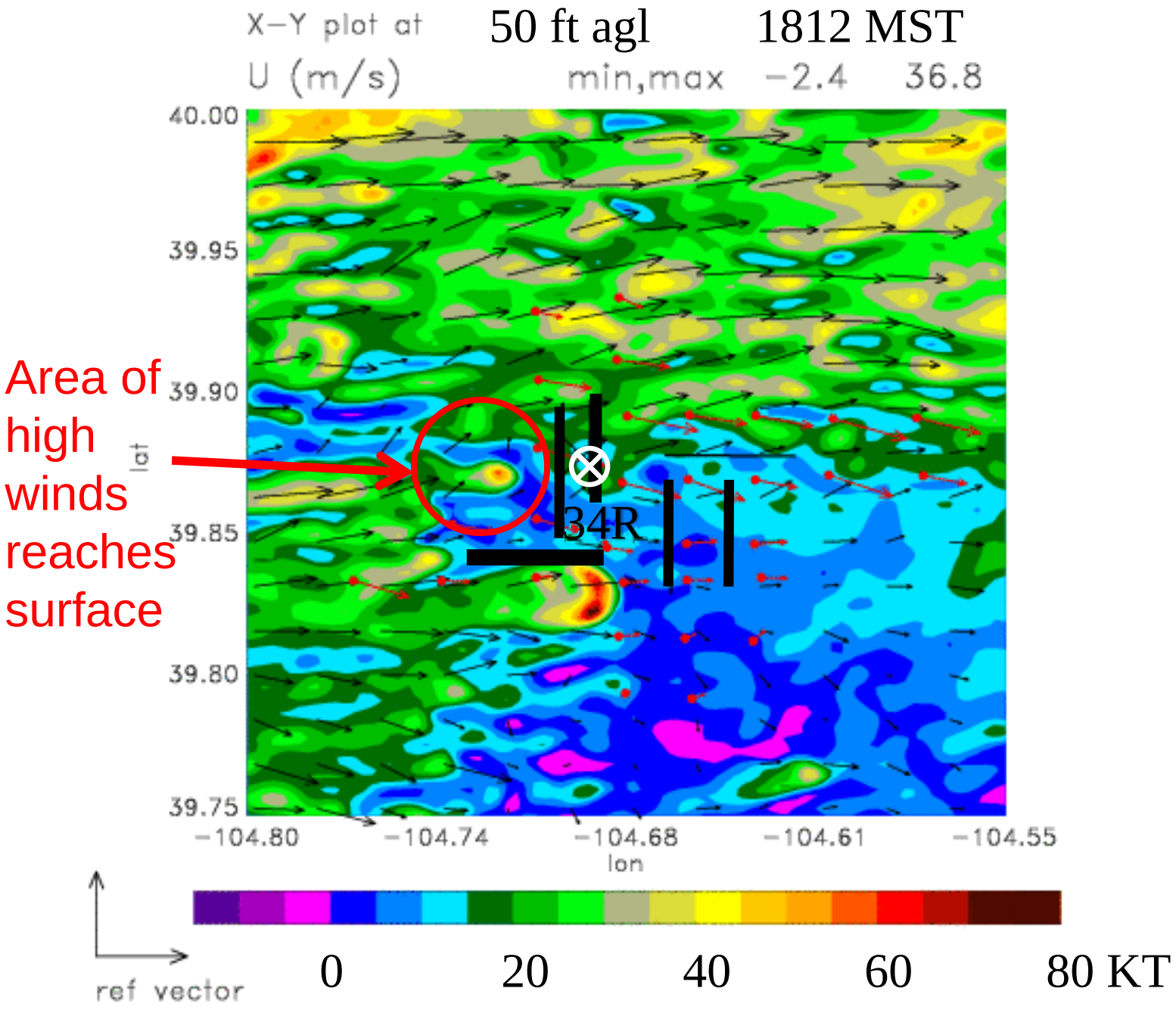
- Weather information available to pilots:
  - Pilot reports of mountain wave, turbulence, low-level wind shear
  - National Weather Service advisory for moderate turbulence to 41,000 feet
  - Weather observations of gusting, westerly winds greater than 20 knots
  - Forecast of westerly wind at 16 knots, gusting to 24 knots

NCAR Clark-Hall Numerical Model



NCAR Clark-Hall Numerical Model

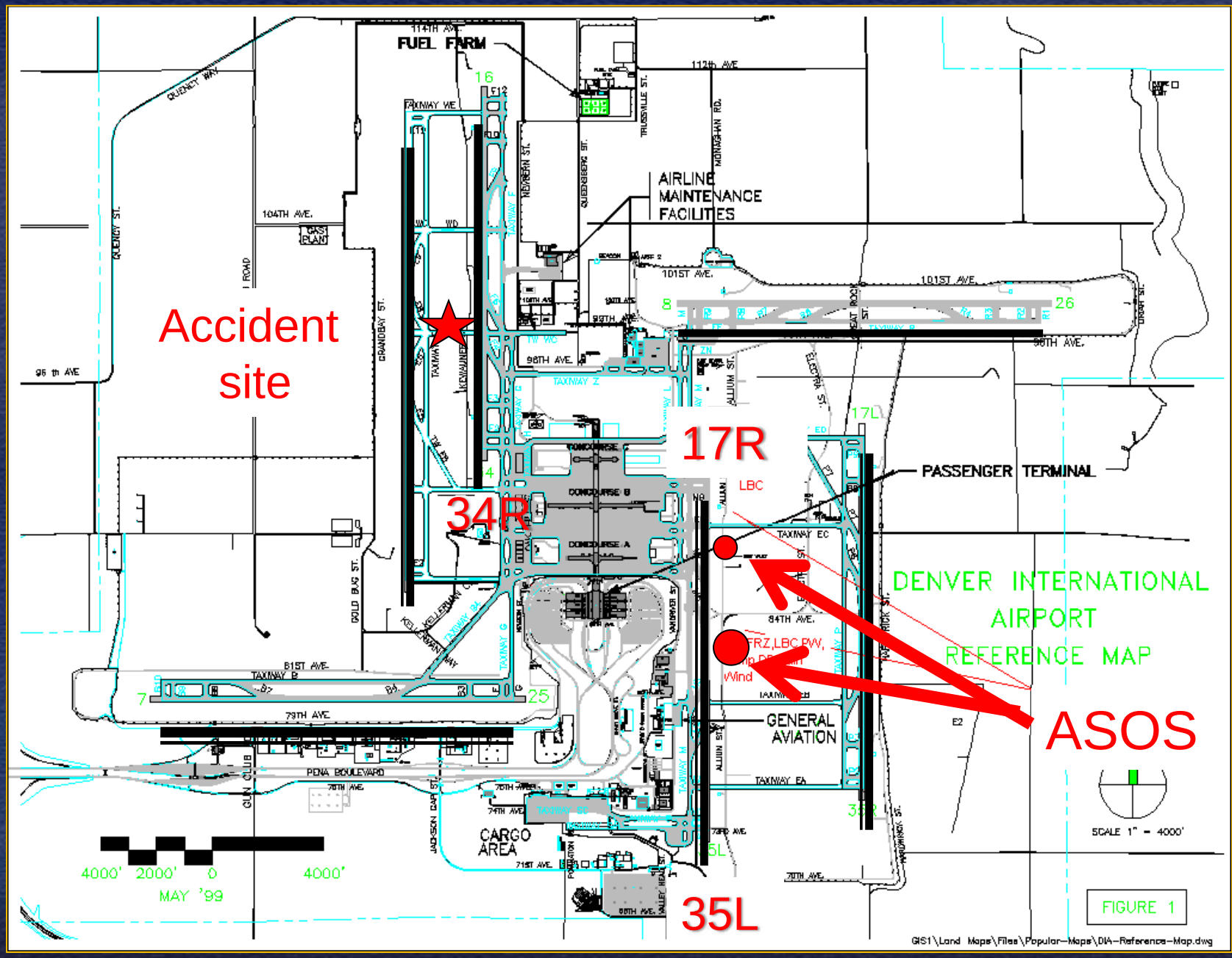



X–Y plot at 50 ft agl 1812 MST
U (m/s) min,max −2.4 36.8
40.00
39.95
39.90
39.85
39.80
39.75
lat
−104.80
−104.74
−104.68
−104.61
−104.55
lon
34R
Area of high winds reaches surface
ref vector
0
20
40
60
80 KT

Detection Systems - Automated Surface Observation System (ASOS)

- Official source of weather
- METAR & SPECI reports
- Sonic anemometer, height 33 feet
- Reports 2-minute average wind and gust
- Peak wind gust greater than 25 knots in remarks

ASOS Sensor Locations



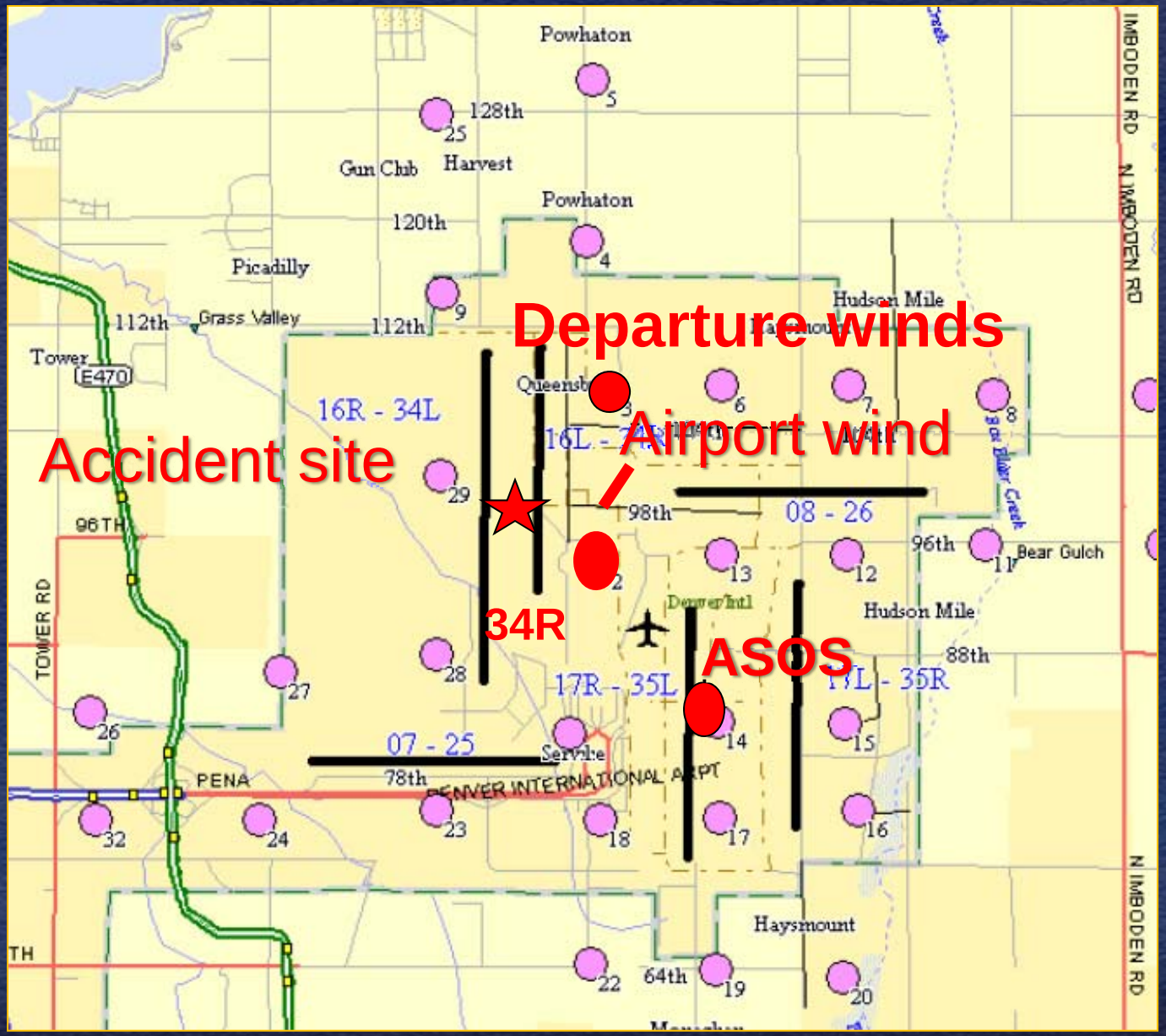
ASOS Weather Observations

- 1653 - 290° 16G19 KT, PK 28 KT
- 1700 - PK wind 290° 27 KT
- 1753 - 280° 11 KT ATIS
- 1818 - Accident
- 1823 - *PK wind 280° 36 KT
- 1834 - 290° 24G32 KT, PK 36 KT

Legend:
- Routine hourly report
- Special report
- Included in remarks
- Accident

NTSB

Detection Systems - LLWAS

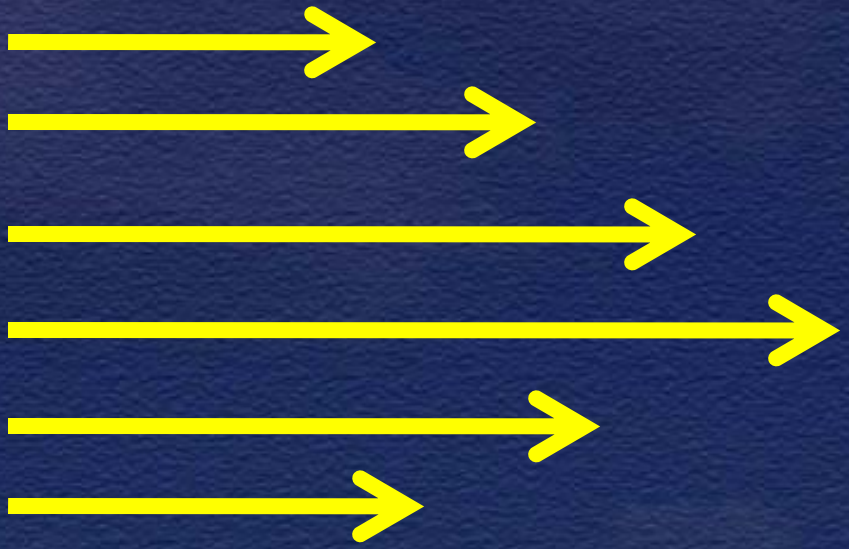


Ribbon Display Terminal (RBDT)

- **Airport wind -** sensor # 2
  - 2-minute average with highest 6-second gust within last 10 minutes from all sensors
  - Update rate 10 seconds
  - Not provided - 280° 35G40 KTS
- **Threshold wind -** sensor # 3
  - 6-second wind sampling
  - Update rate 10 seconds
  - Provided by ATC - 270° 27 KTS

LLWAS Sampling Rate

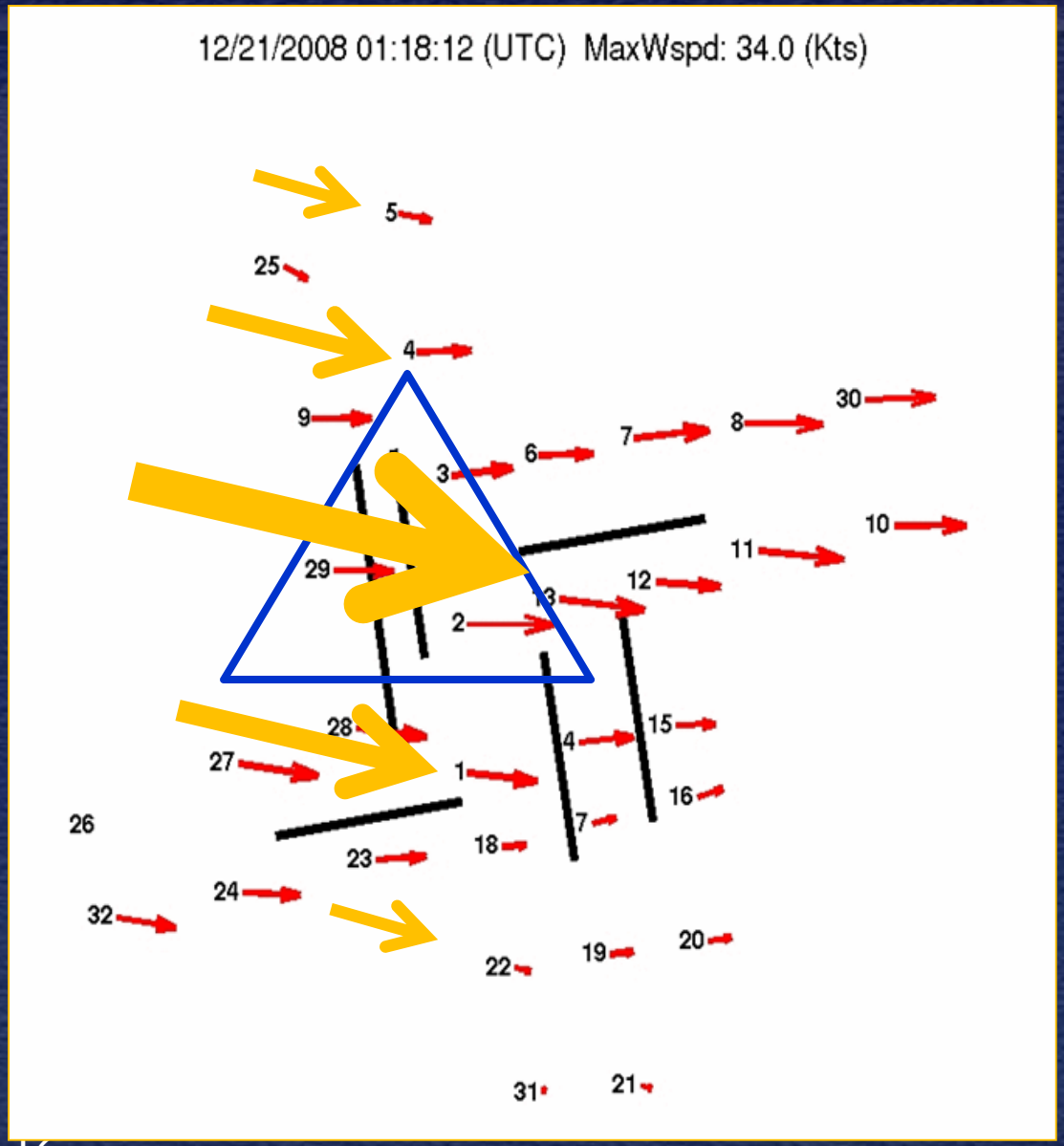
1-second winds



OBSERVED	REPORTED
1-sec	6-sec
26 KT	
35 KT	
46 KT	37 KT
52 KT	
37 KT	
28 KT	

NTSB

LLWAS Wind Vectors



- Band of strong winds centered over airport, with lighter winds north and south
- Potential for use of multiple sensors
- Improved gust, crosswind component information

NTSB