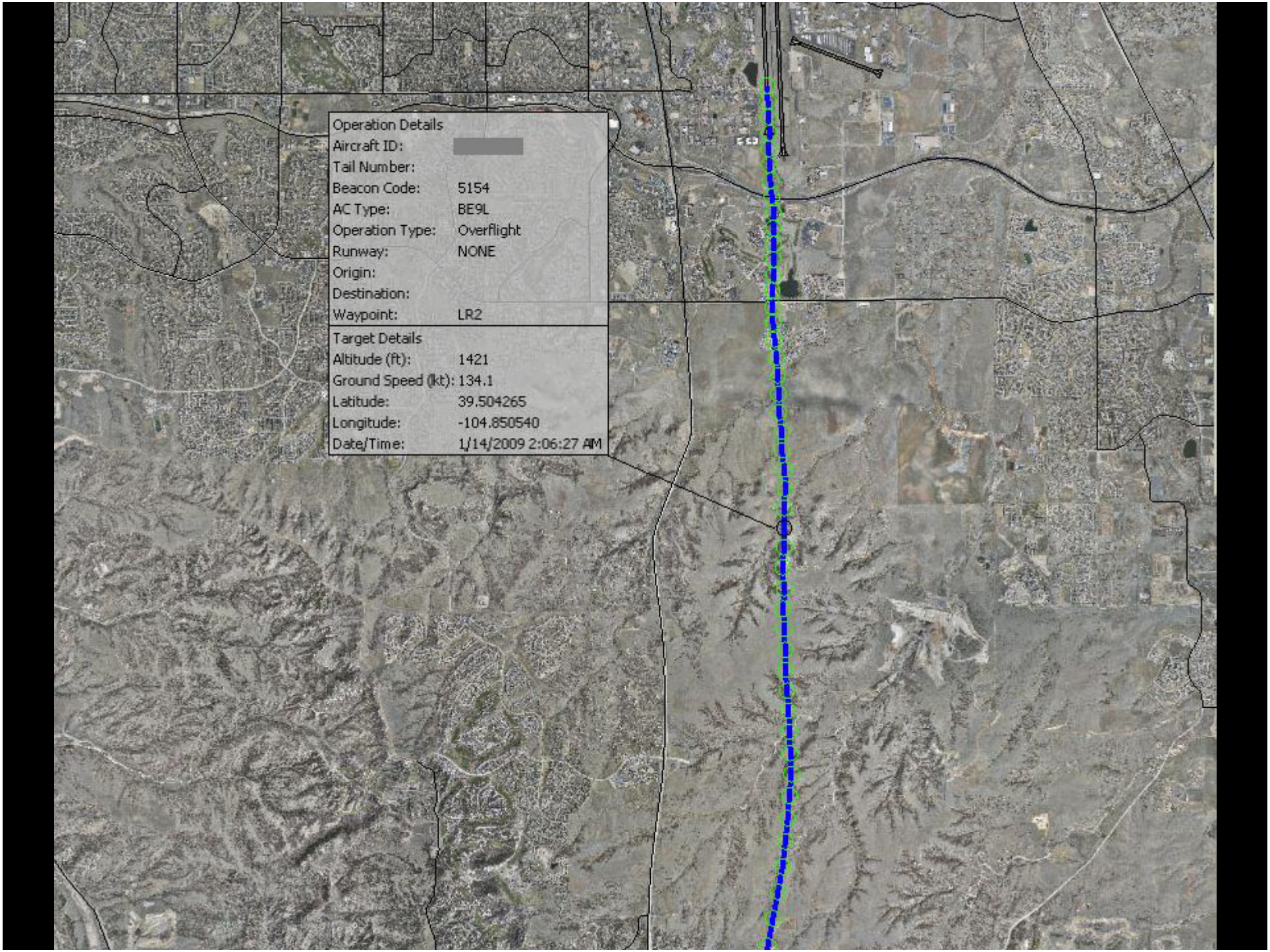
Centennial Airport Part 150 Study

- Part 150 History
  - 1998 Part 150 Study Begins
  - 1999 First Set of Noise Contours completed
  - 2002 Completed Study Submitted to FAA
  - 2002 Lost Federal Funding - Part 150 Shelved
  - 2004 Federal Funding Restored
  - 2006 FAA Provides grant Funding for Noise Contours update
  - 2007 Updated Noise Contours Complete
  - 2008 Part 150 Published in Federal Register, 180 day review period and 60 day comment period begins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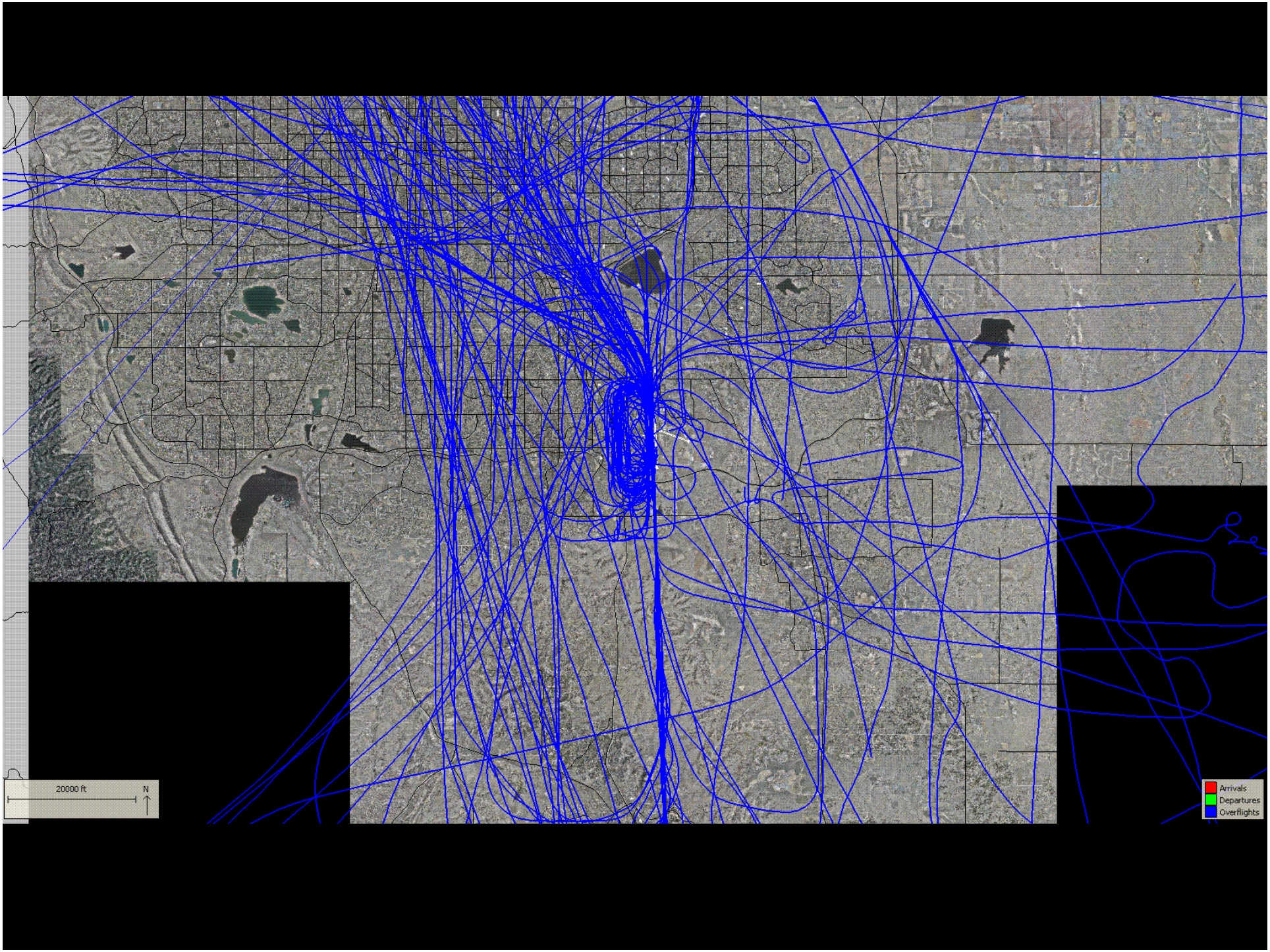
Tail Number:
Beacon Code: 5154
AC Type: BE9L
Operation Type: Overflight
Runway: NONE
Origin:
Destination:
Waypoint: LR2
Target Details
Altitude (ft): 1421
Ground Speed (kt): 134.1
Latitude: 39.504265
Longitude: -104.850540
Date/Time: 1/14/2009 2:06:27 AM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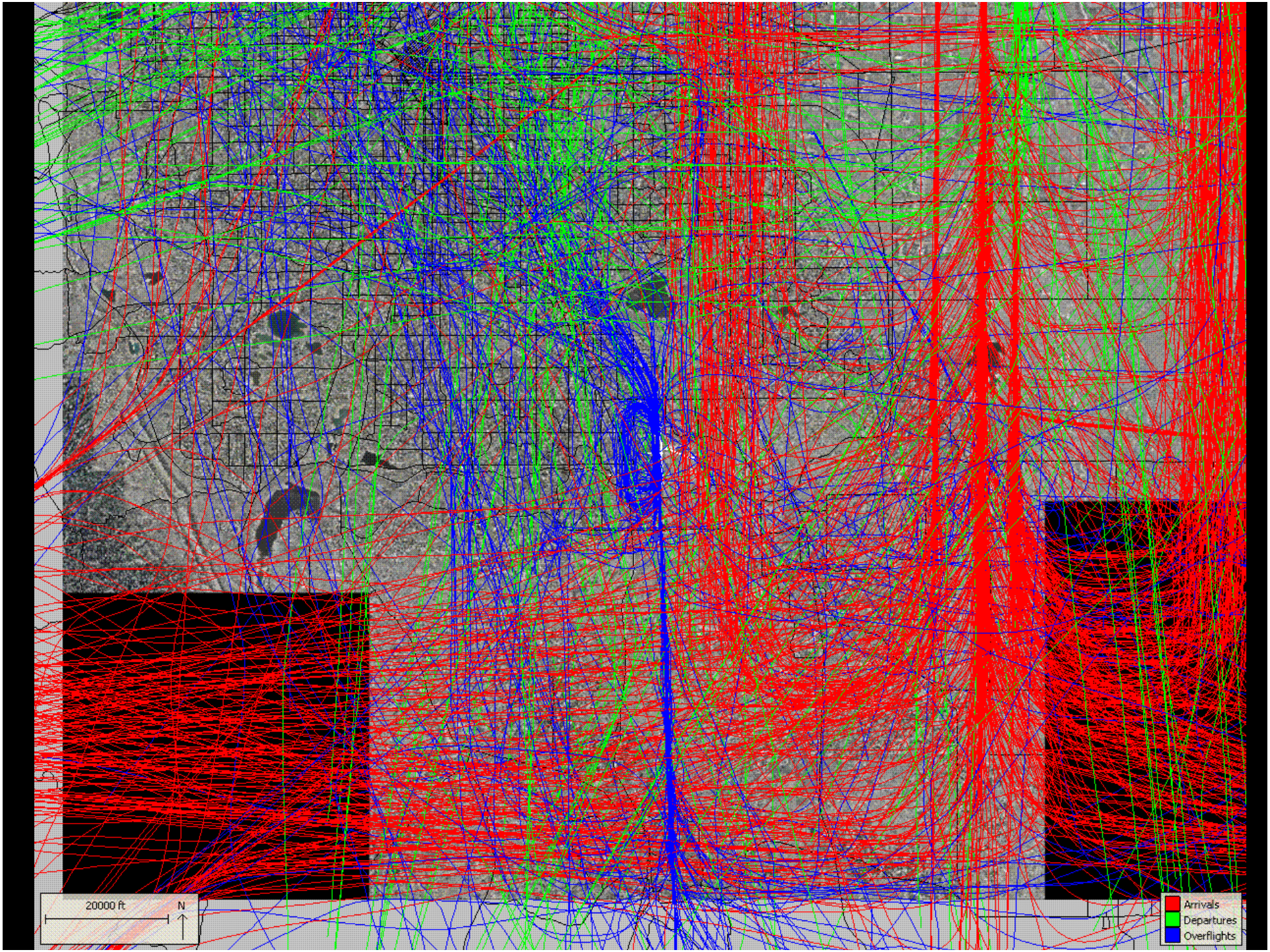
Departures
Overflights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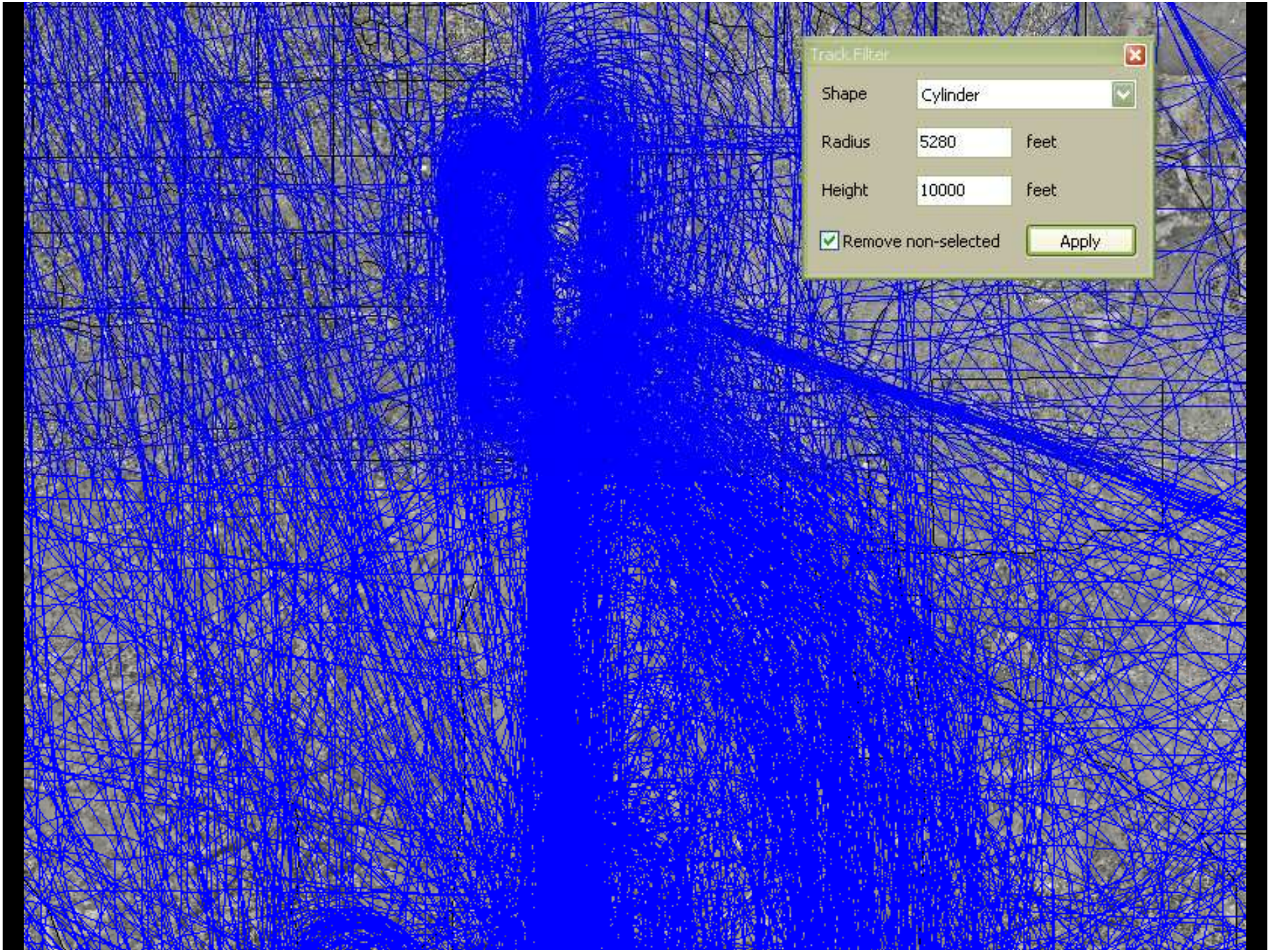
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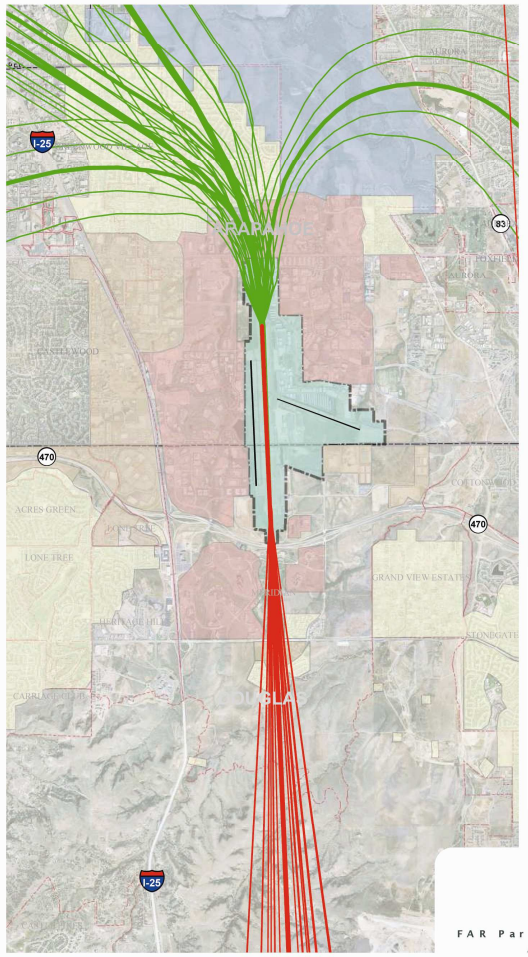
Existing INM Flight Tracks North Flow (Jets)

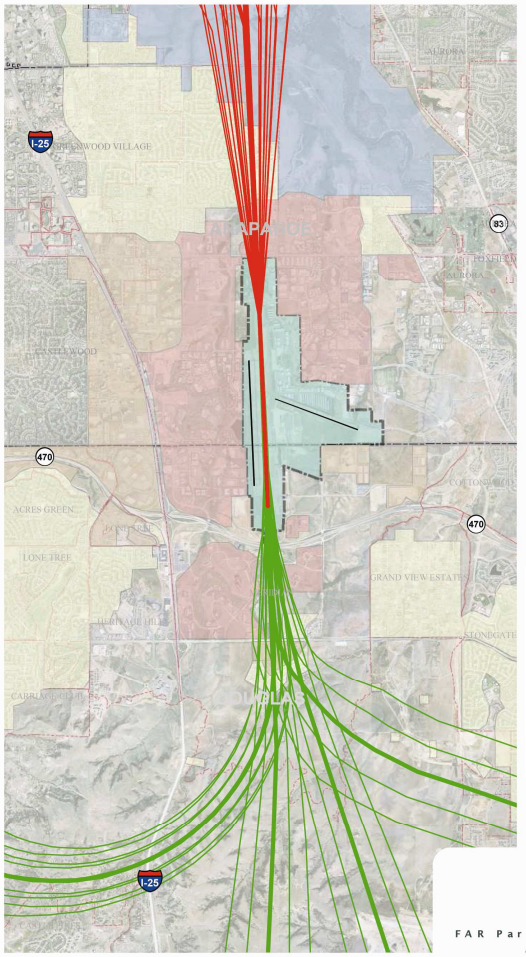


Centennial Airport

FAR Part 150 Noise Exposure & Land Use Compatibility Study Program

Figure D8 **INM FLIGHT TRACKS, NORTH FLOW (JETS)**

Existing INM Flight Tracks South Flow (Jets)



Centennial Airport

FAR Part 150 Noise Exposure & Land Use Compatibility Study Program

Figure D9 **INM FLIGHT TRACKS, SOUTH FLOW (JETS)**

Existing INM Flight Tracks Touch & Go, Crosswind Runway (Fixed Wing)

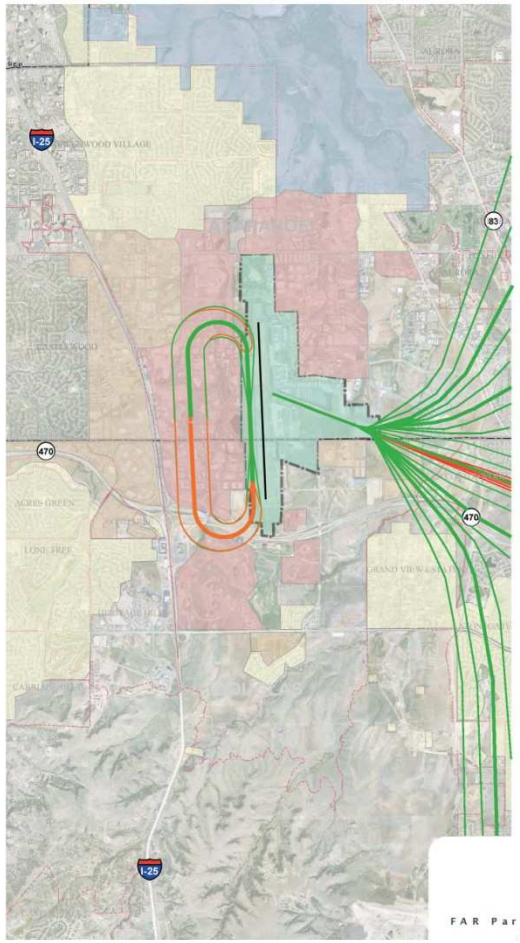


Figure D10 **TOUCH AND GO FLIGHT TRACKS (FIXED WING) & CROSSWIND TRACKS**

- Existing 2006 Noise Contours

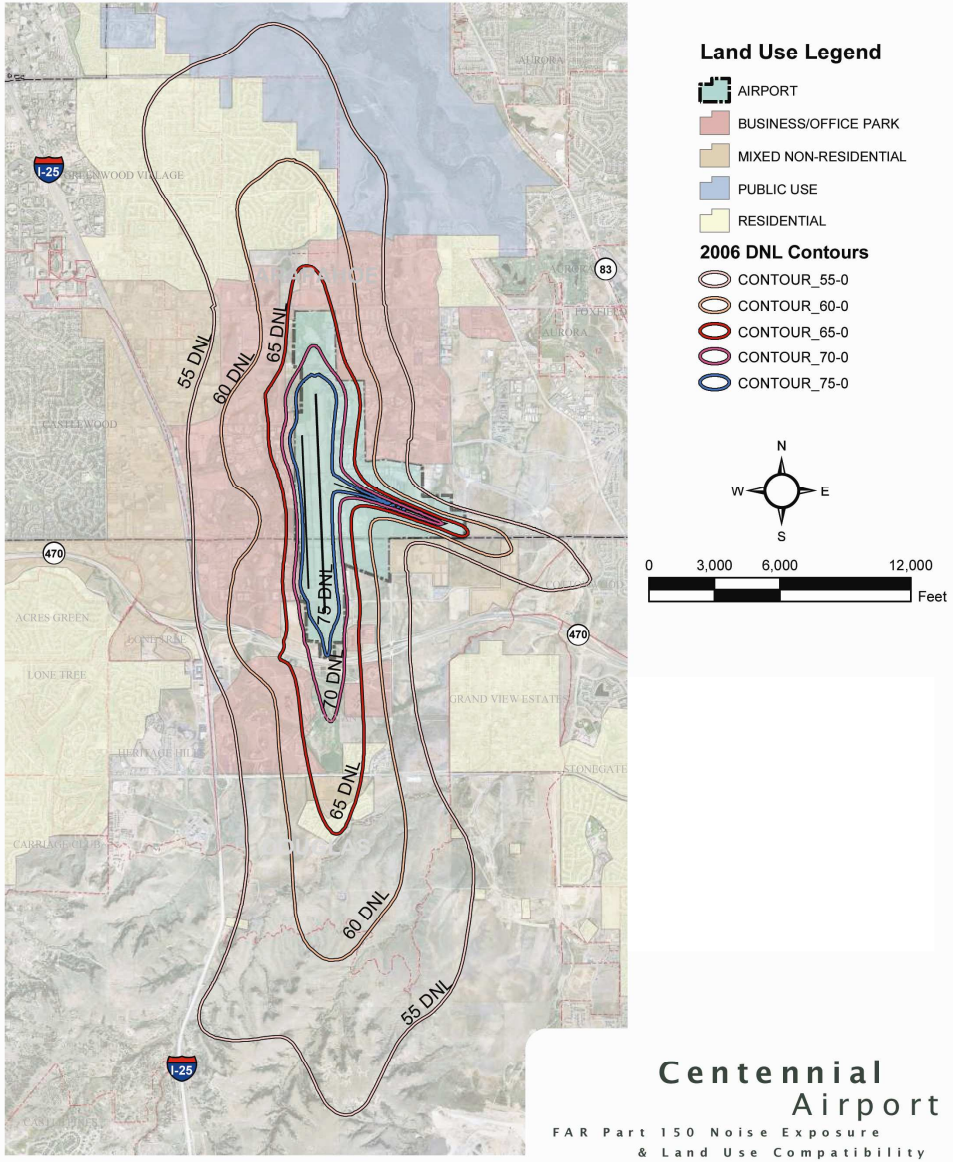


Figure D12 **Existing 2006 Noise Contours**

- Future 2012 Noise Contours

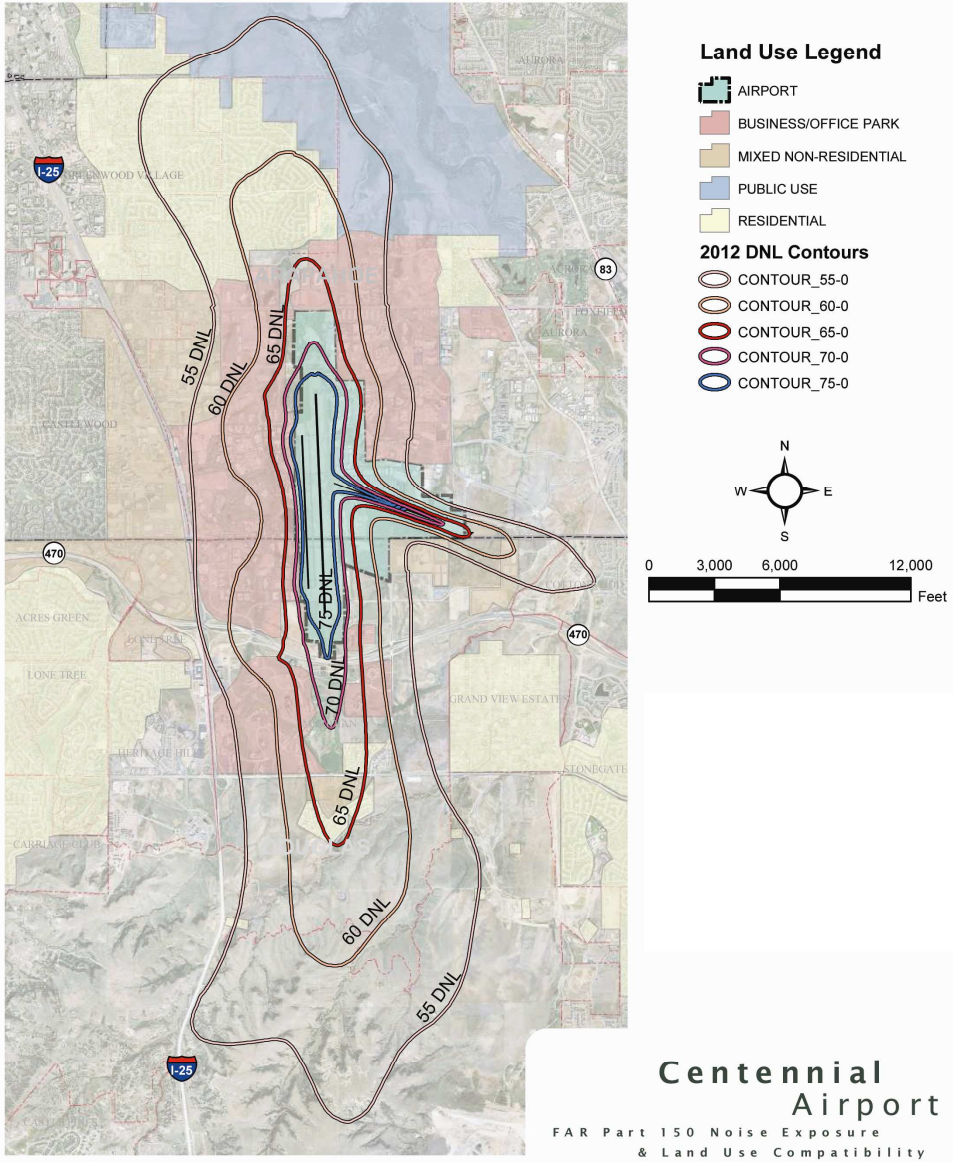


Figure D13 **Future 2012 Noise Contours**

Part 150 Study

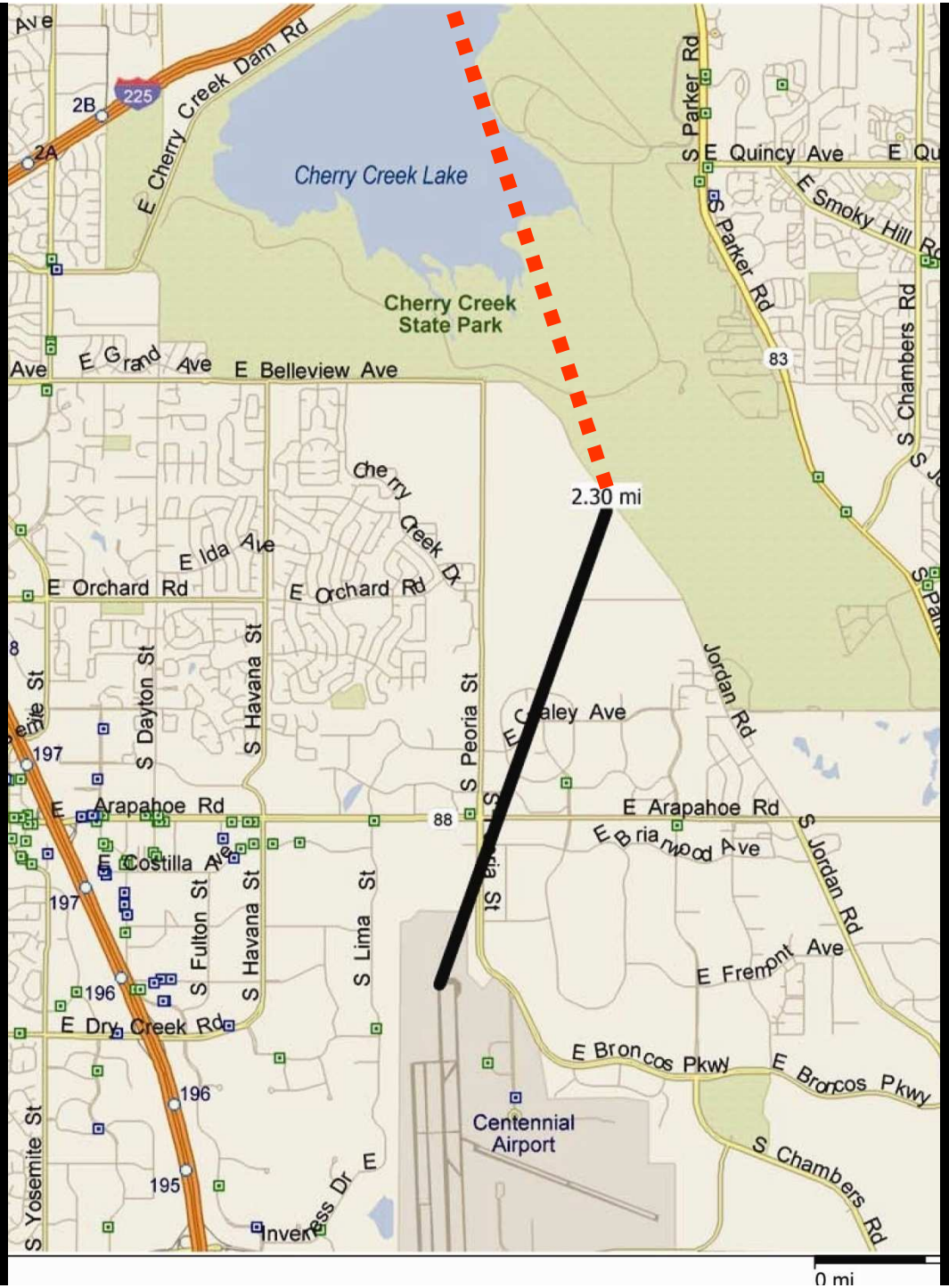
- Ban Stage 1 Aircraft – FAA disapproved this recommendation. The FAA stated that there was not enough evidence provided to prove the proposed ban would significantly reduce noise impact, as required under Part 150. The Airport Authority may submit additional information to FAA for further evaluation and reconsideration of this measure.

- Ban Stage 2 Aircraft at Night – The FAA disapproved of this recommendation. The FAA found the Airport Authority had not complied with all the requirements of Part 150 to demonstrate the noise benefit of this ban. Further, the Airport Authority also must comply with Part 161 requirements, including the analysis of the economic impact of such a ban, before the ban can be implemented. As with the proposed ban of Stage 1 aircraft, the Airport Authority may submit additional information for FAA review

Part 150 Study

- 010 Degree Departure at Night – The FAA approved of this recommendation as a voluntary measure, subject to weather, operational safety, and efficiency. Before implementation of this procedure an Environmental Assessment would need to be completed.

- Test 24-hour Flight Tracks between 350 and 010 degree Headings – The FAA disapproved this recommendation and concluded that there would be significant adverse impacts to the safety and efficiency of FAA Air Traffic Control in the Denver metro area.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Cherry Creek State Park
E Cherry Creek Dam Rd
225
2B
2A
E Grand Ave
E Belleview Ave
S Parker Rd
E Quincy Ave
E Smoky Hill Rd
83
S Chambers Rd
2.30 mi
Cherry Creek Dr
E Orchard Rd
S Dayton St
S Havana St
S Peoria St
Jordan Rd
E Arapahoe Rd
88
S Jordan Rd
E Briarwood Ave
E Costilla Ave
S Fulton St
S Lima St
E Fremont Ave
197
196
E Dry Creek Rd
E Broncos Pkwy
Centennial Airport
S Chambers Rd
S Yosemite St
195
Inverness Dr E
0 mi

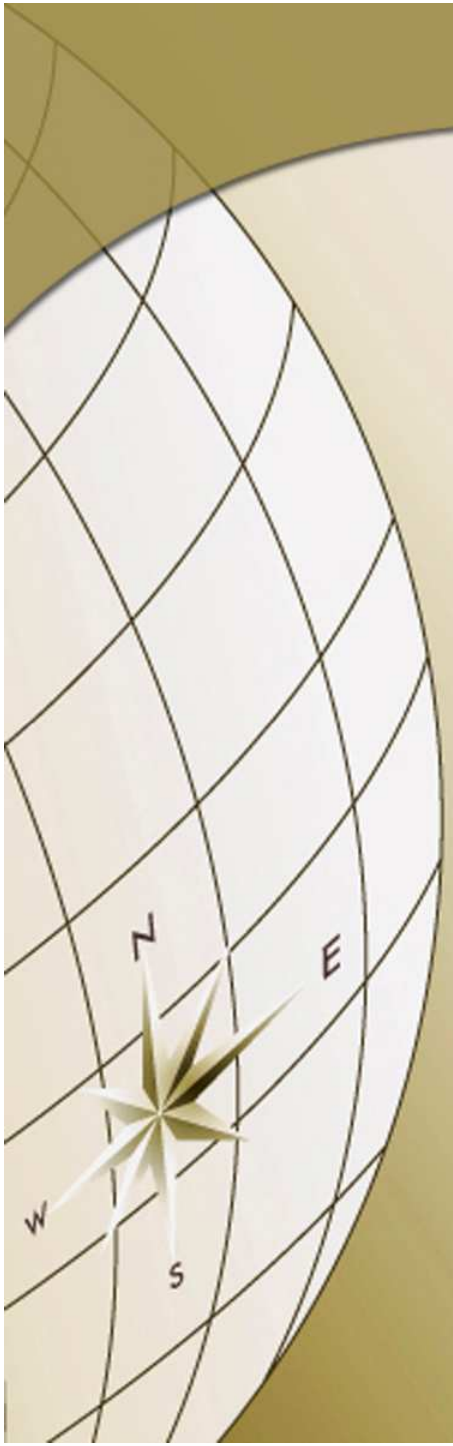
Part 150 Study

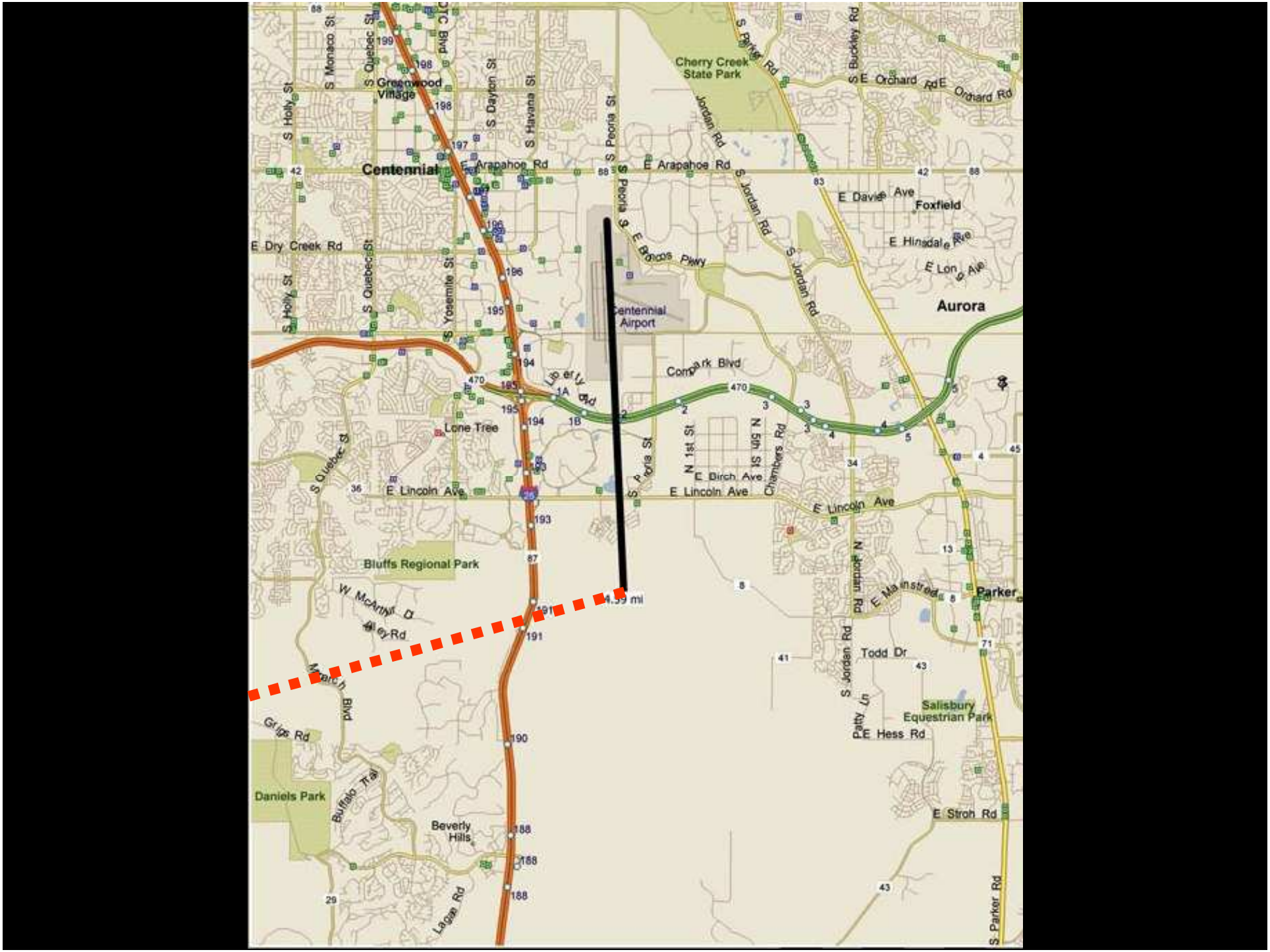
- Amend Community Plans and Zoning Ordinances – The FAA approved-in-part this recommendation. They approved of amendments being made in recognition of the noise impact around the airport but wanted to ensure that any height related issues are handled under 14 CFR Part 77, Objects Affecting Navigable Airspace.

- 170 Degree Departure – The FAA disapproved this recommendation and concluded that there would be significant impacts on safety and efficiency of Air Traffic Control operations.

Part 150 Study

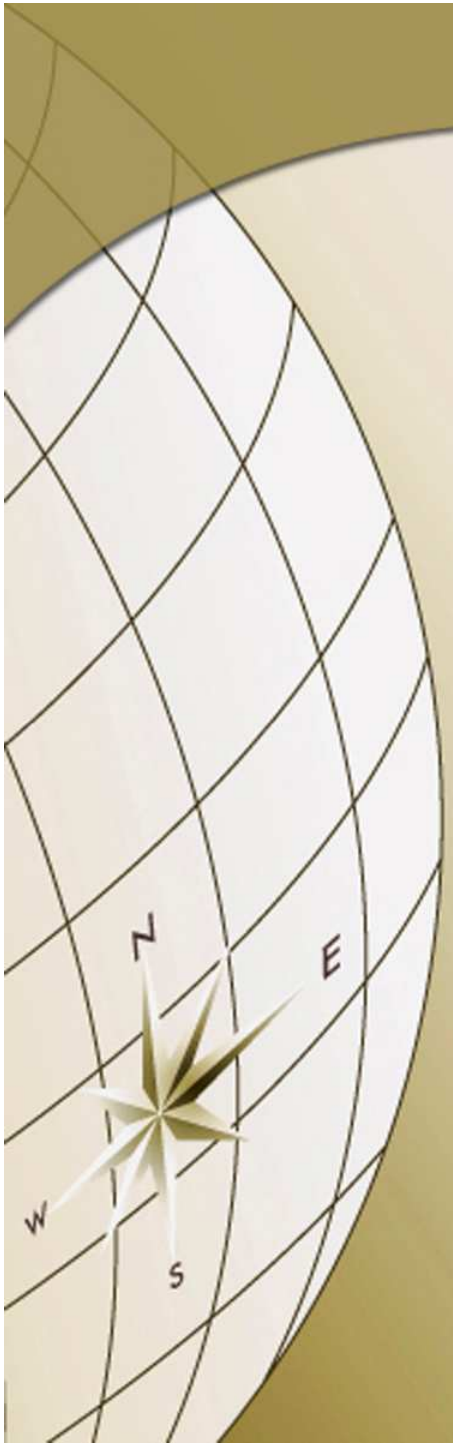
- Establish Noise Abatement Office – The FAA approved this recommendation.
- Noise Monitoring System – The FAA approved of this recommendation provided the system not be used for enforcement purposes. The Airport is planning to request a FAA grant for this project in 2009.
- Develop Fly Quiet Program – For Part 150 purposes, the FAA approved this recommendation as a voluntary measure only for the 010 departure procedure. Other fly quiet procedures could be analyzed and included in future Part 150 Noise Studies.

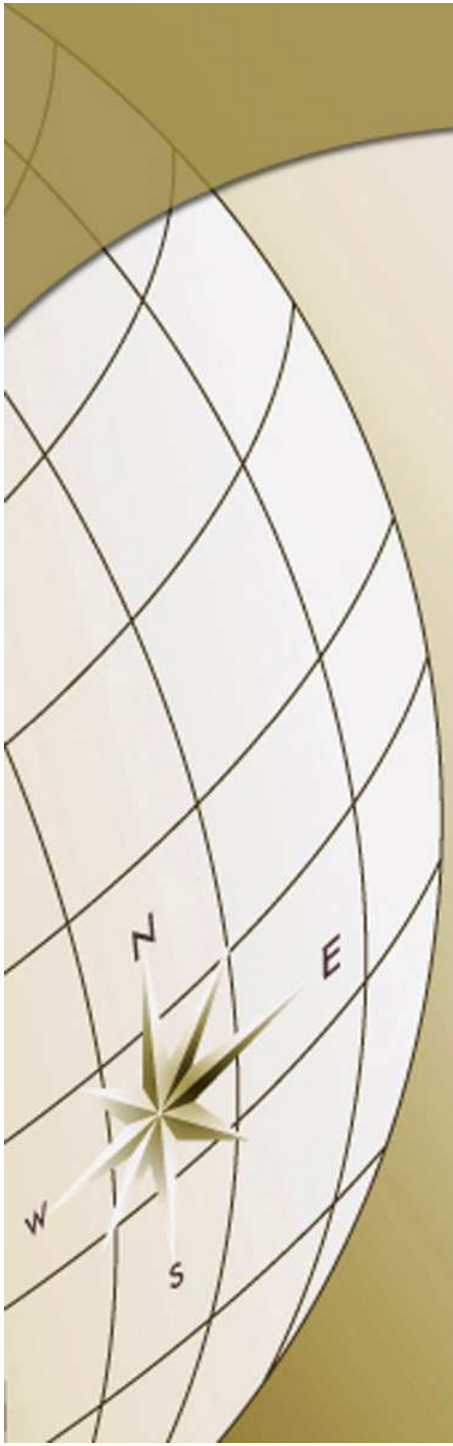



Centennial
Greenwood Village
Cherry Creek State Park
Aurora
Foxfield
Centennial Airport
Lone Tree
Bluffs Regional Park
Parker
Salisbury Equestrian Park
Daniels Park
Beverly Hills
E Arapahoe Rd
E Dry Creek Rd
E Lincoln Ave
E Orchard Rd
E Hampden Ave
E Hinsdale Ave
E Long Ave
E Davies Ave
E Hess Rd
E Stroh Rd
E Mainstreet
Todd Dr
Compark Blvd
Liberty Blvd
W McArthur Ave
Briggs Rd
Lagae Rd
Buffalo Trail
S Parker Rd
S Jordan Rd
S Peoria St
S Yosemite St
S Quebec St
S Dayton St
S Havana St
S Holly St
S Monaco St
S Buckley Rd
S Parker Rd
N Jordan Rd
N 1st St
N 5th St
Chambers Rd
E Birch Ave
E Bronco Pkwy
Jordan Rd
4.59 mi

Part 150 Study

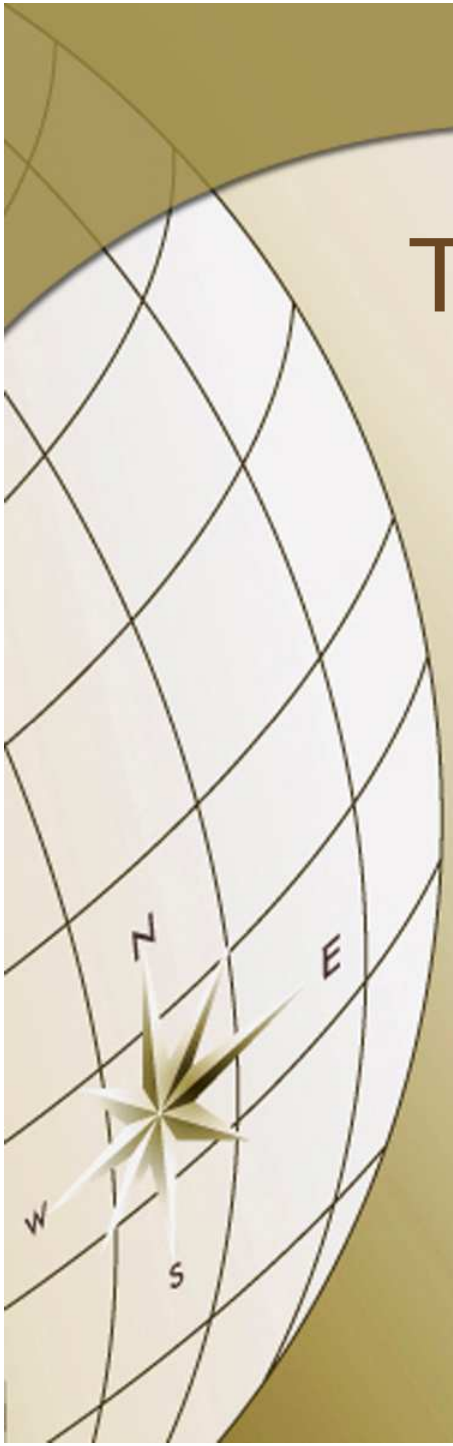
- Operations Review and Part 150 Update – The FAA approved this recommendation.
- Elimination of Preferential Runway Use – The FAA approved this recommendation.
- Establish follow-up Roundtable/Committee – The FAA approved this recommendation.





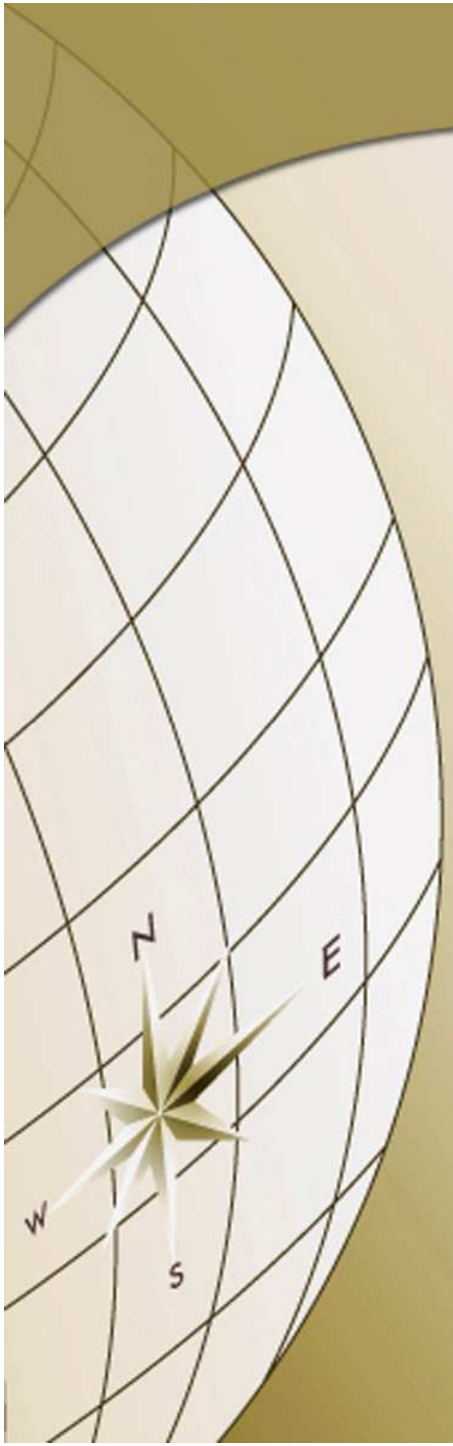
Noise Basics

Terms & Metrics

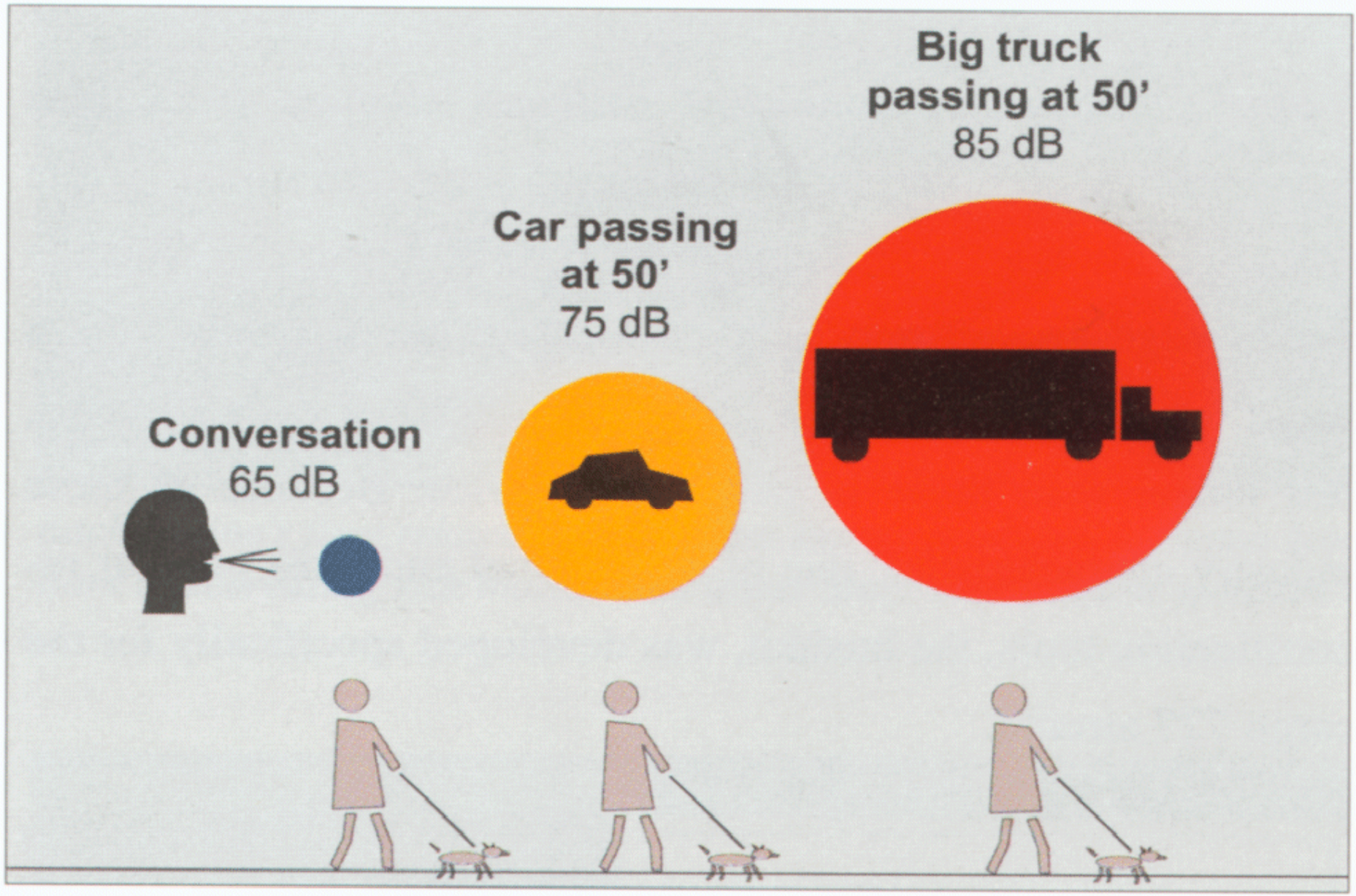


- dB (Decibels)
- dBA (A-Weighted Decibels)
- Lmax (Maximum Noise Level)
- SEL (Sound Exposure Level)
- Leq (Equivalent Sound Level)
- CNEL (Community Noise Equivalent Level)
- DNL (Day-Night Average Sound Level)
- INM (Integrated Noise Model)

Decibels

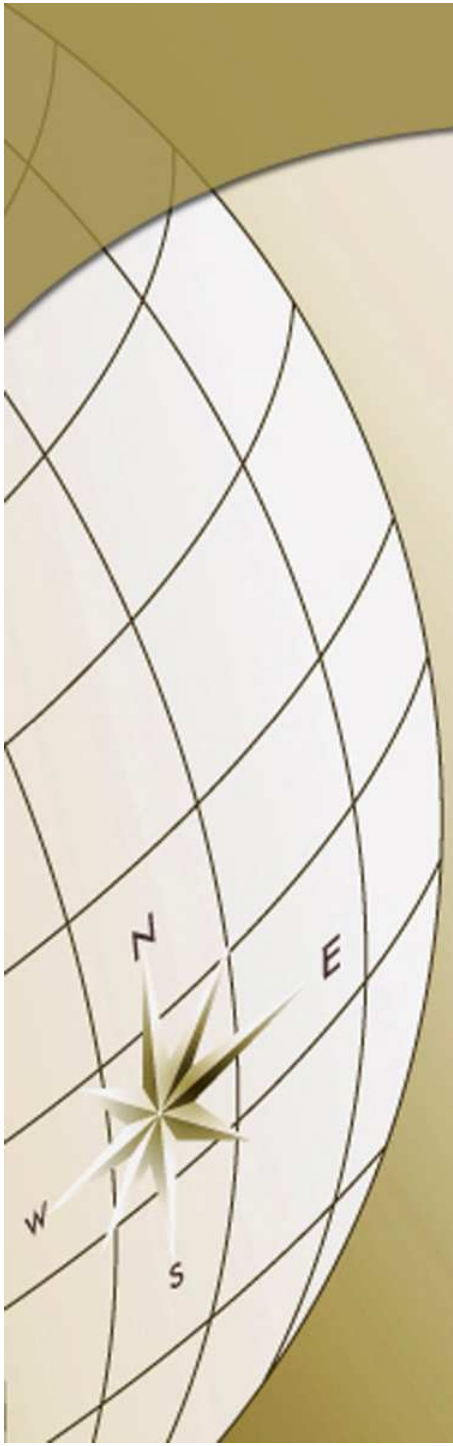


- Decibels (dB) are the unit of measurement on the loudness scale
- The decibel scale is logarithmic, not linear
  - Smallest detectable change = 1 dB
  - 3 dB is readily detectable
  - 10 dB seems twice as loud



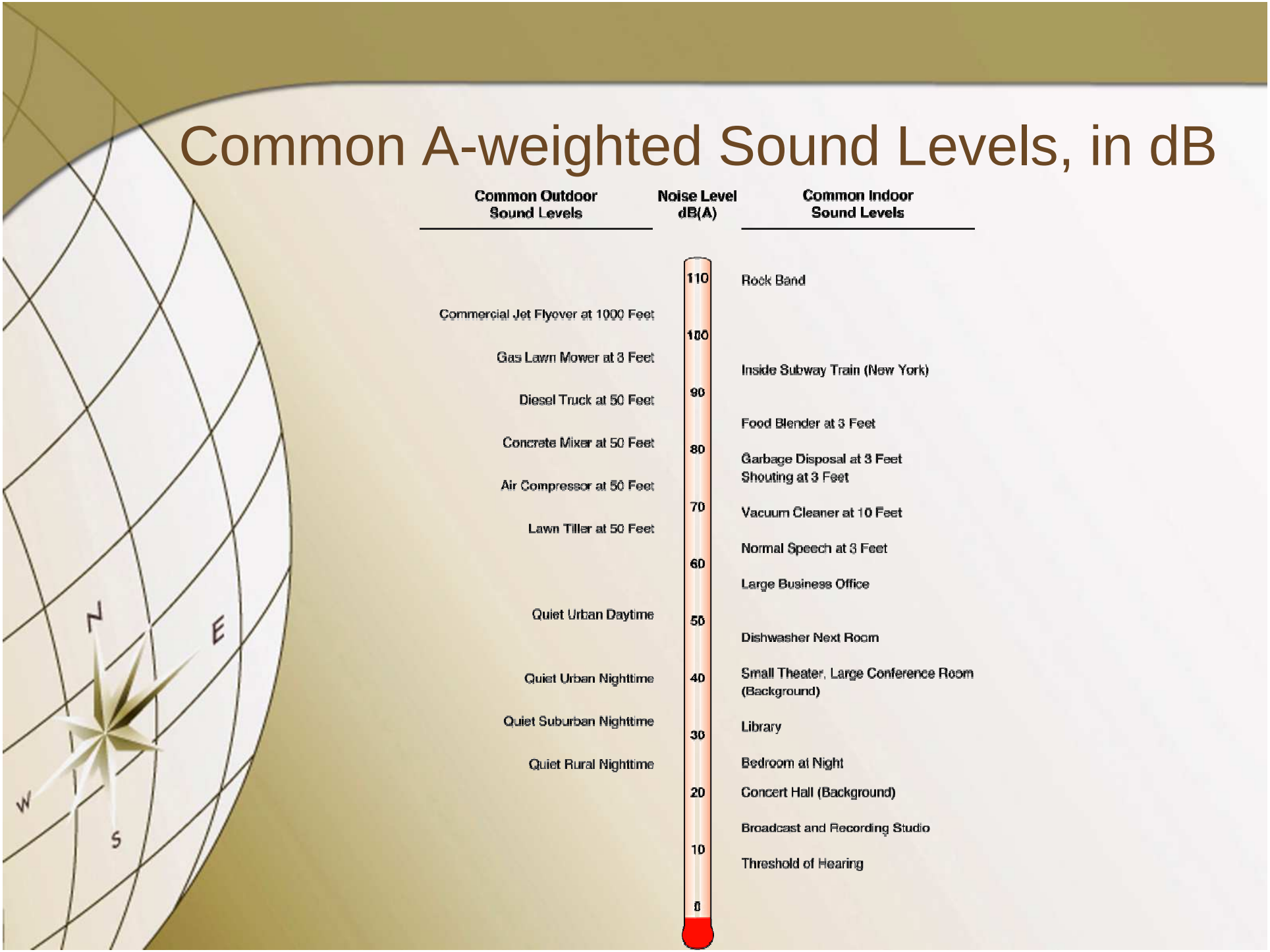
The bubbles represent the relative difference in perceived noise from a reduction of 10 dB and 20 dB.

A-Weighted Decibels



- Accounts for the fact that humans do not hear low frequencies and high frequencies as well as they do middle frequencies.
- The dBA measurement system has a highly reliable relationship between projected noise exposure and the surveyed reactions of people to the noise.

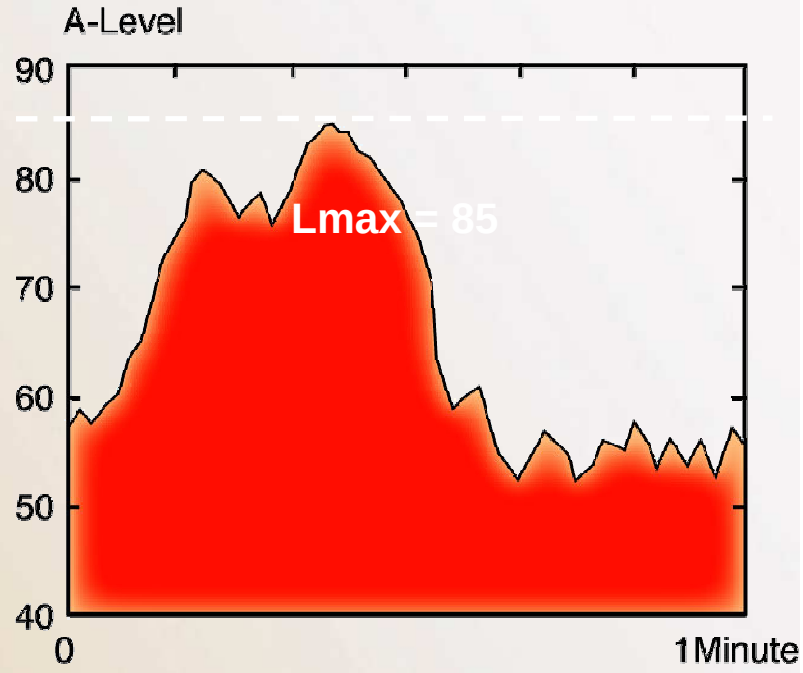
Common A-weighted Sound Levels, in dB



Maximum Sound Level (Lmax)

- Because of the variation in level of a sound event, it is often convenient to describe the event with its maximum sound level, abbreviated as Lmax

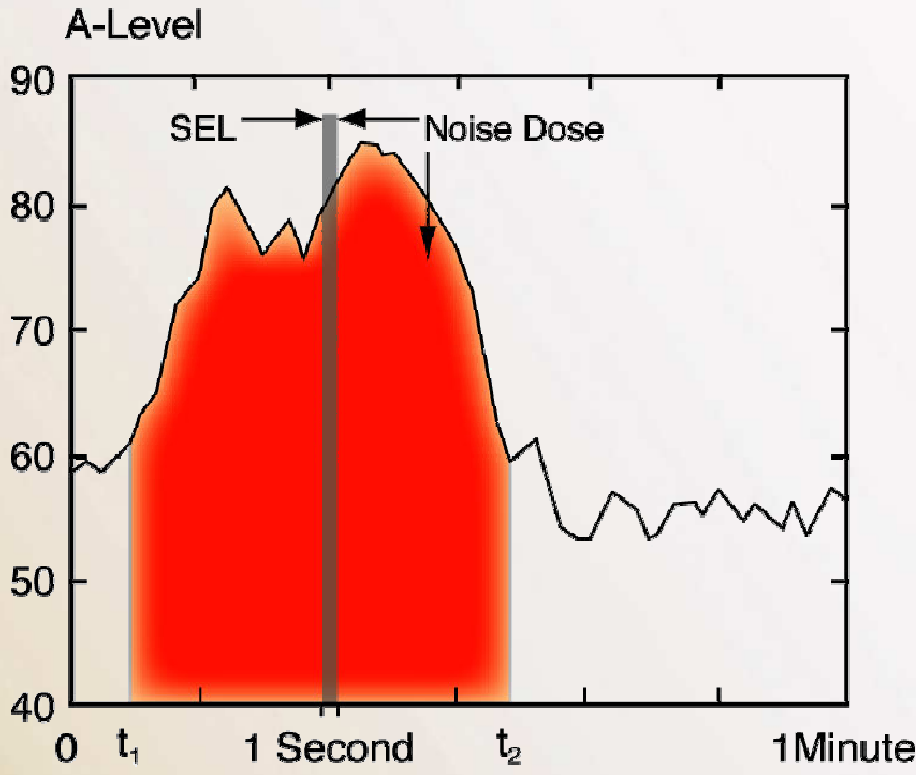
- Accounts only for sound amplitude (A-weighted level)
- Two events may have the same maximum level, but much different exposures



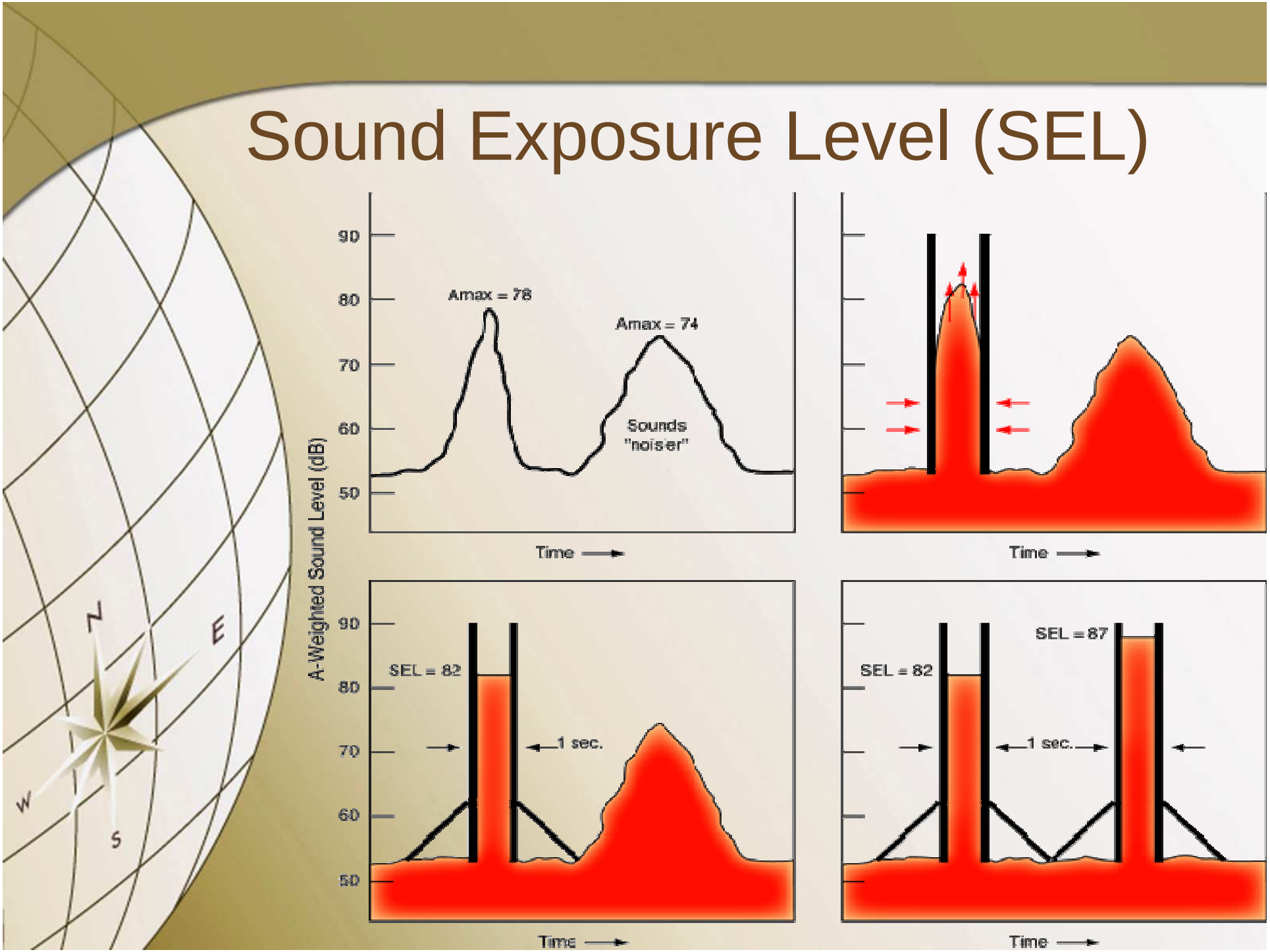
Sound Exposure Level (SEL)

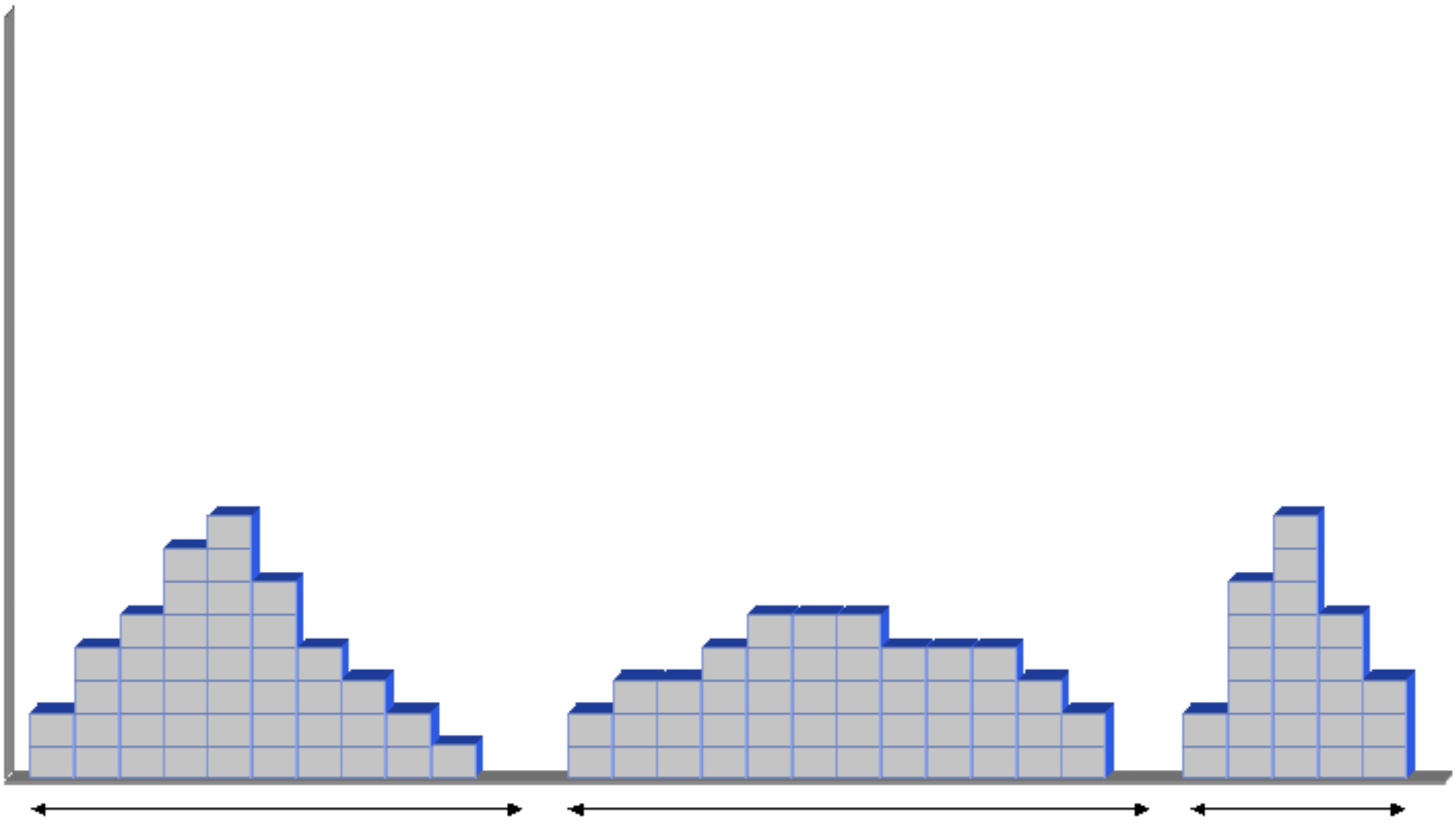
- A way to describe the “noisiness” of a complete noise event or to compare noise events of varying durations and intensities

  - Accounts for sound amplitude (A-weighted level)
  - Accounts for noise event duration



Sound Exposure Level (SEL)

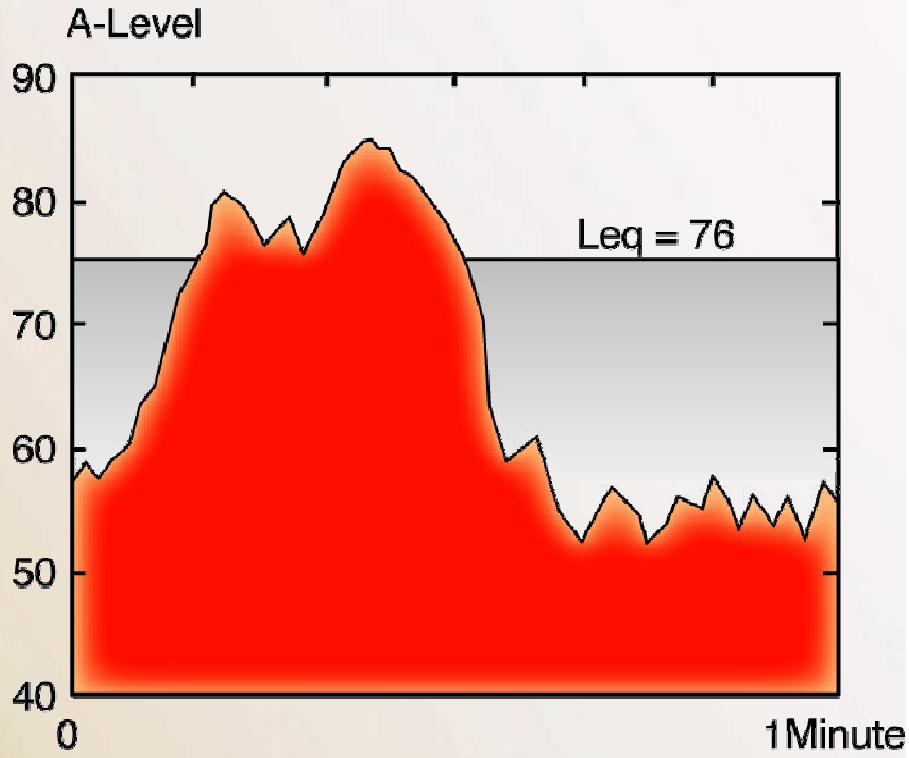




Equivalent Sound Level (Leq)

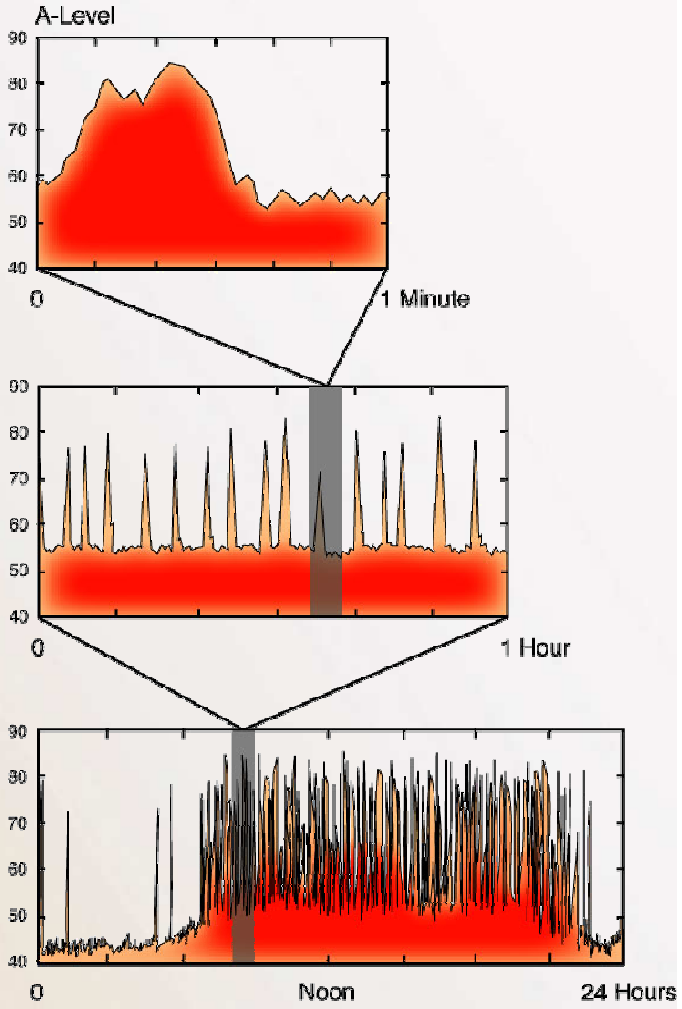
- A constant sound level “equivalent” on an energy basis of a time varying sound level over the same time period

- Leq is time-averaged
- Accounts for sound amplitude and time

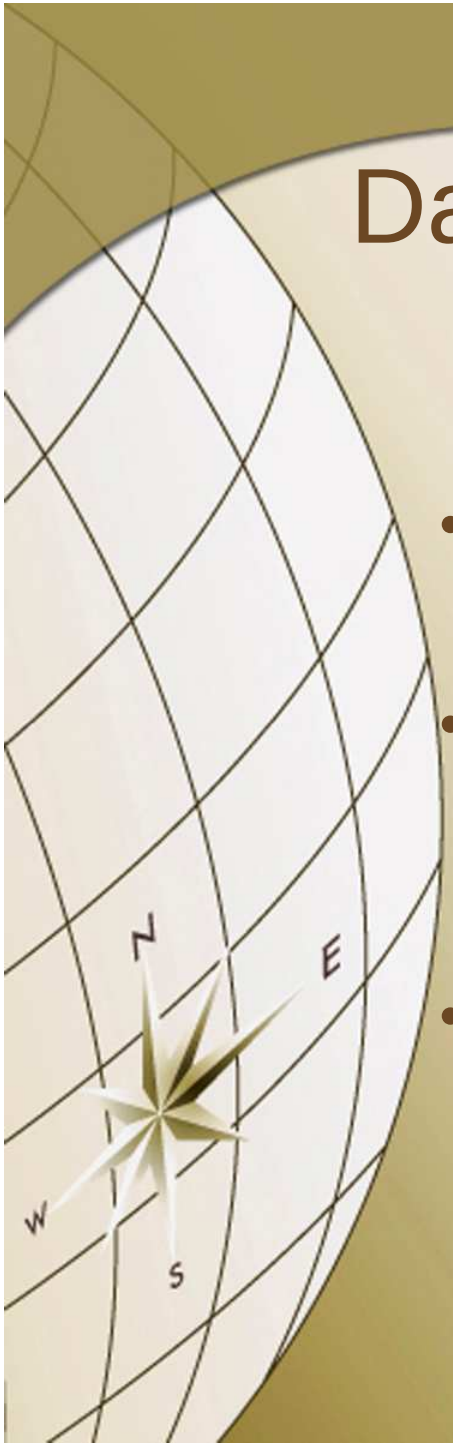


Day-Night Average Sound Level (DNL)

- Averaged 24-hour noise exposure
- Accounts for noise event “noisiness” (SEL)
- Accounts for number of noise events
- Provides an additional weighting factor for nighttime operations
  - CNEL includes another weighting factor for evening operations

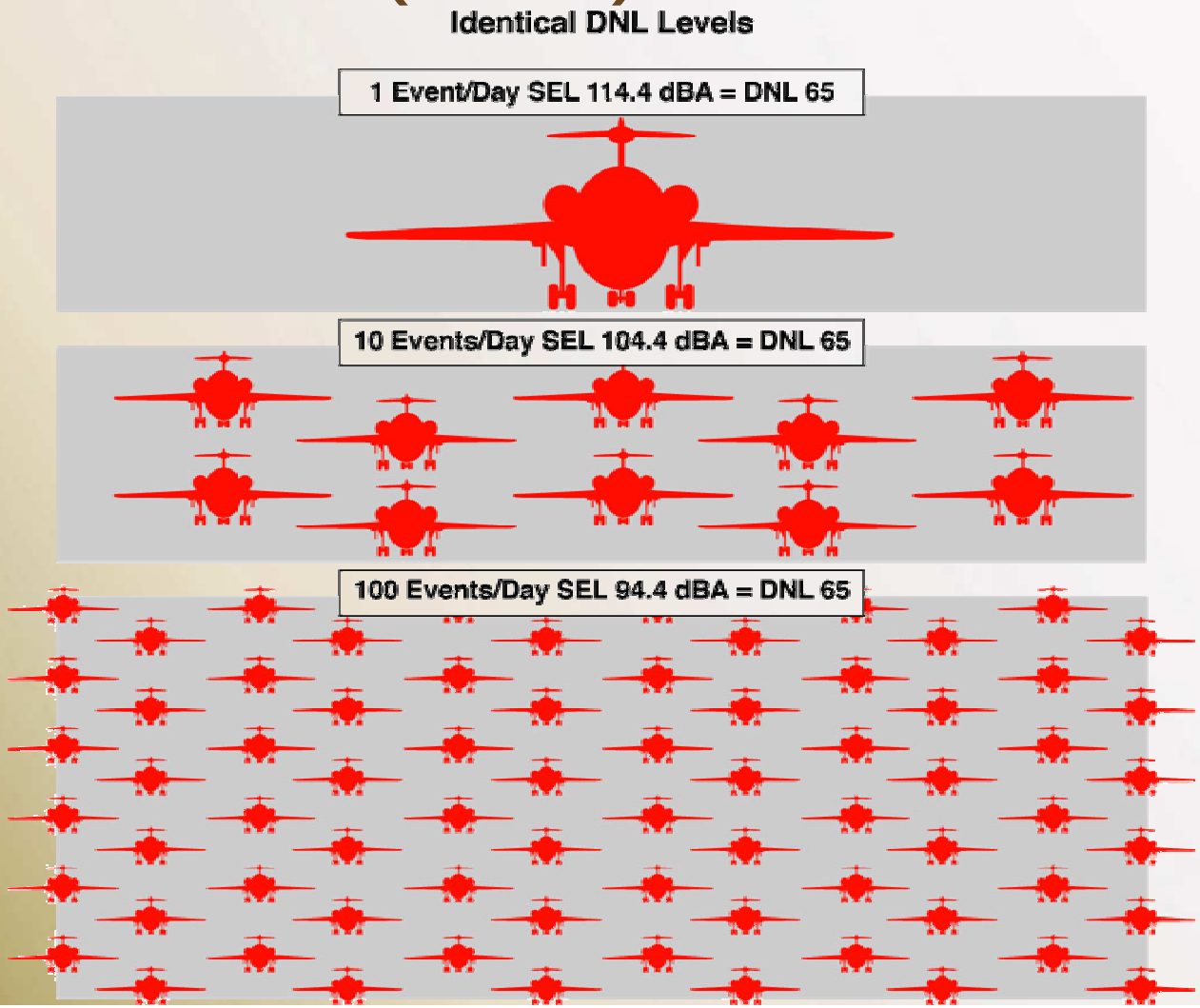


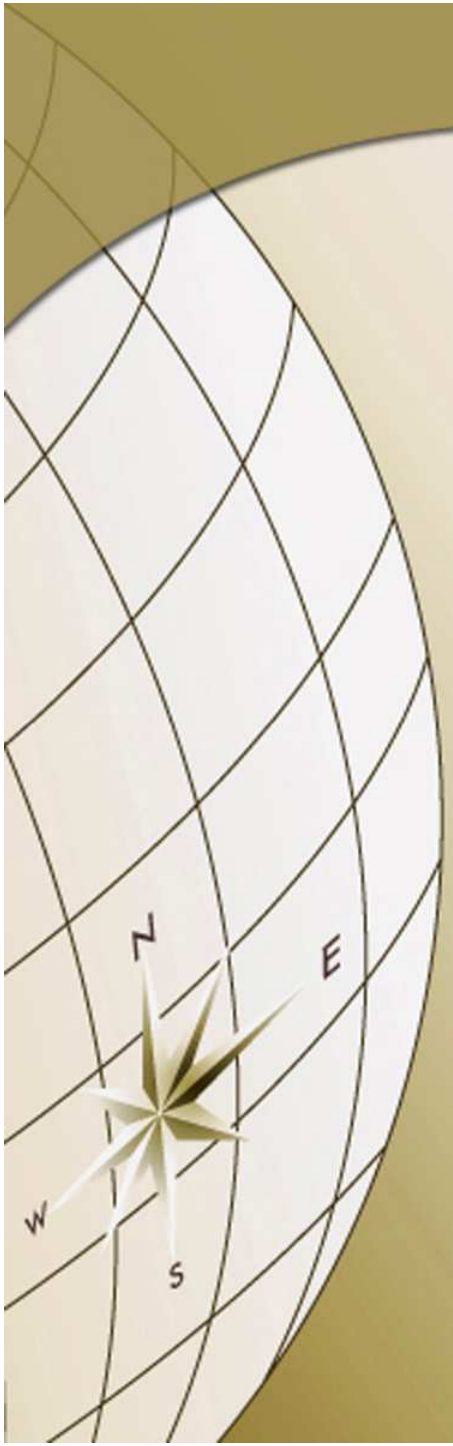
Day-Night Average Sound Level (DNL)



- DNL is a 24-hour time-averaged sound exposure level with a 10 dB nighttime (10p-7a) weighting.
- DNL = Total Daytime Sound Energy + 10 times Total Nighttime Sound Energy divided by Time (in seconds)
- All Federal agencies have adopted DNL as the metric for airport noise analysis.

Day-Night Average Sound Level (DNL)





Integrated Noise Model (INM) and Noise Contours

- The required tool for calculation of aircraft noise contours in studies seeking to make noise mitigation eligible for Airport Improvement Program (AIP) or Passenger Facility Charge (PFC) funding.
- **Ingredients – INM**
  - Airport information - runways, temperature, airport altitude
  - Flight tracks (definitions and usage)
  - Fleet mix data
  - Operations levels – day/night (night=10dB penalty with DNL)
  - What engines are used - hush kit information
  - Where they fly from - runway usage
  - When they fly - time-of-day characteristics
  - How they are flown - climb/descent profiles
  - Where they fly to - performance data
  - Output includes Noise contours connecting points of equal noise exposure (typically 65, 70, 75 DNL), Tabular information, Noise levels at specific locations (grid point analysis)

- Existing 2006 Noise Contours

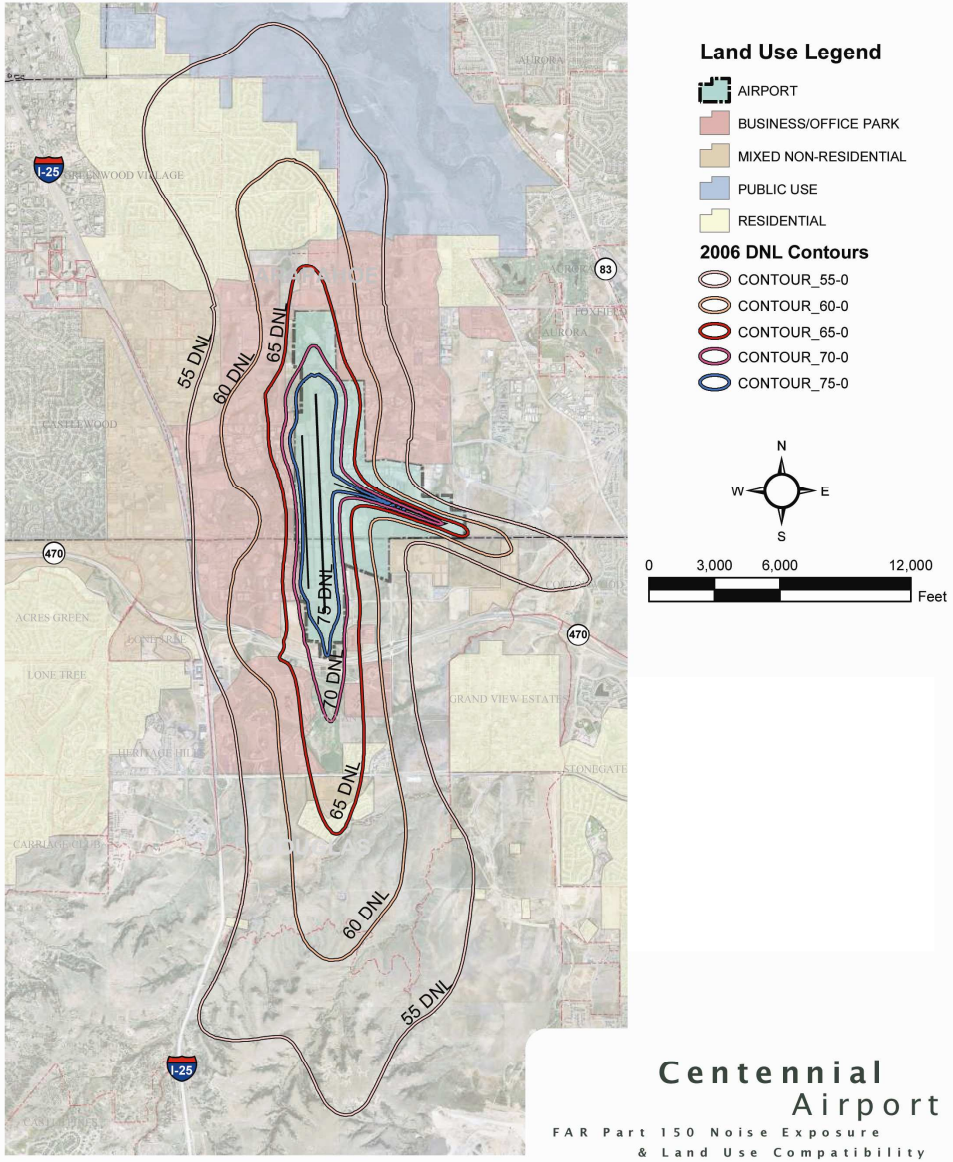


Figure D12 **Existing 2006 Noise Contours**

- Future 2012 Noise Contours

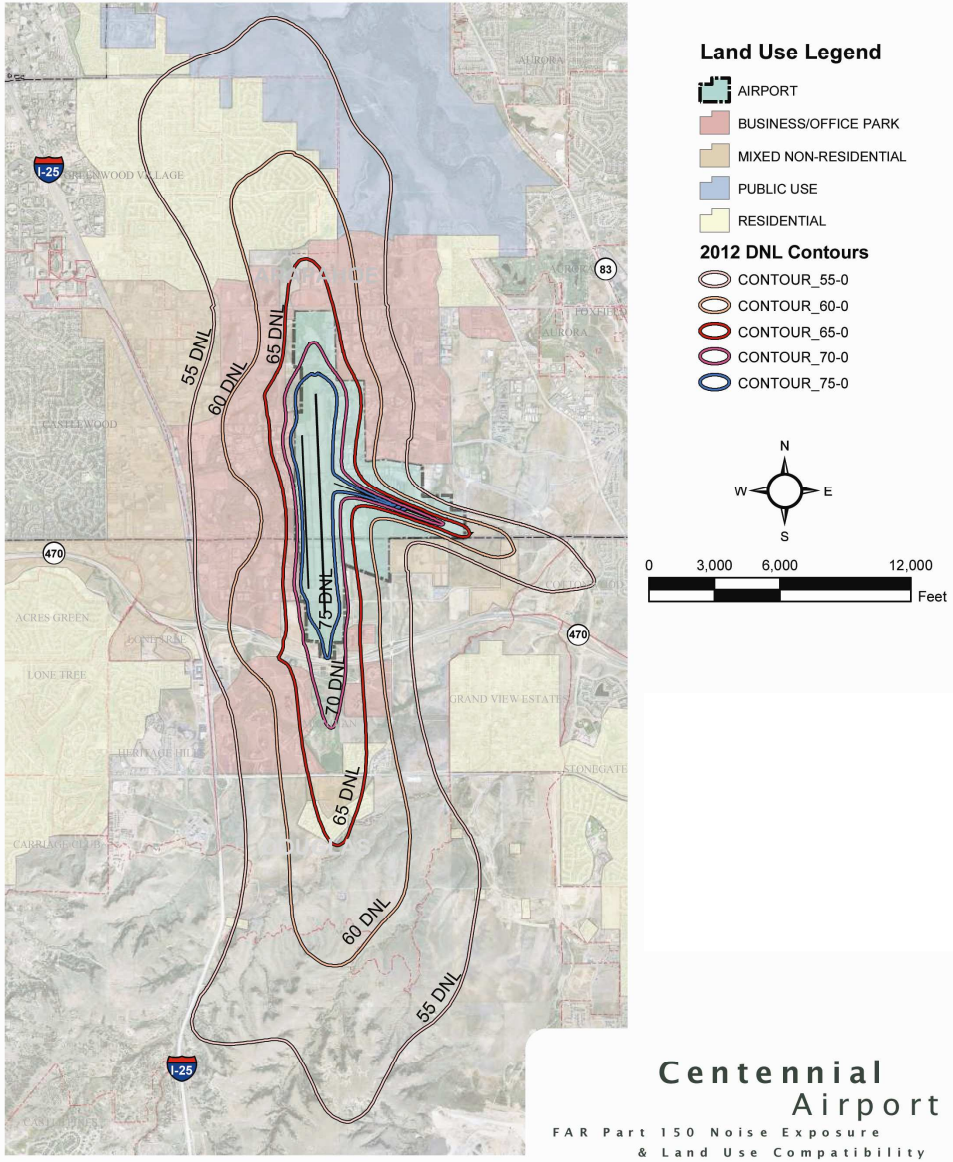
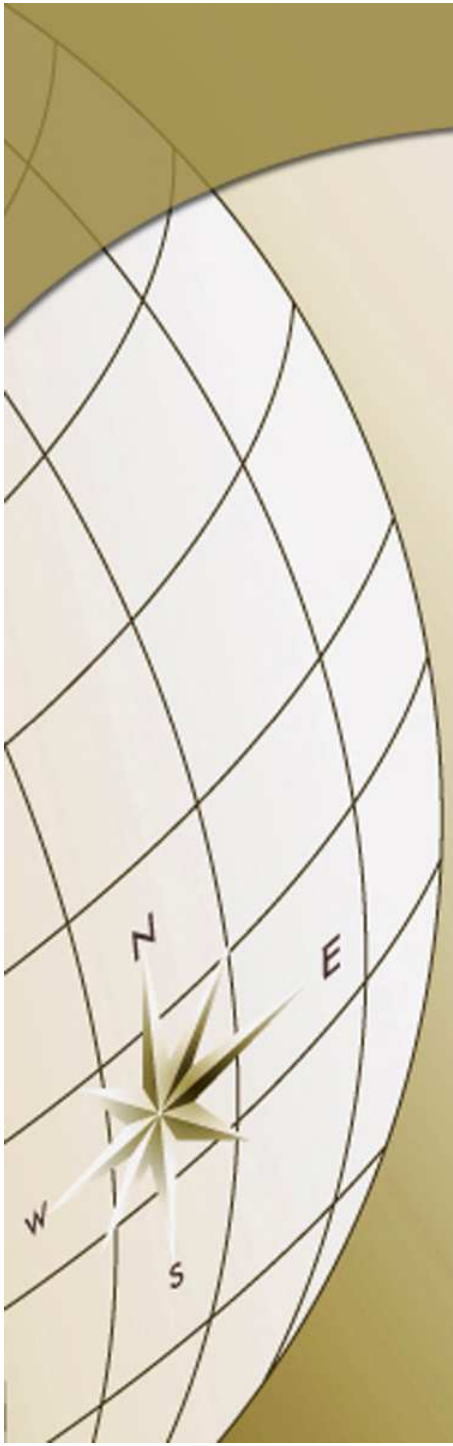


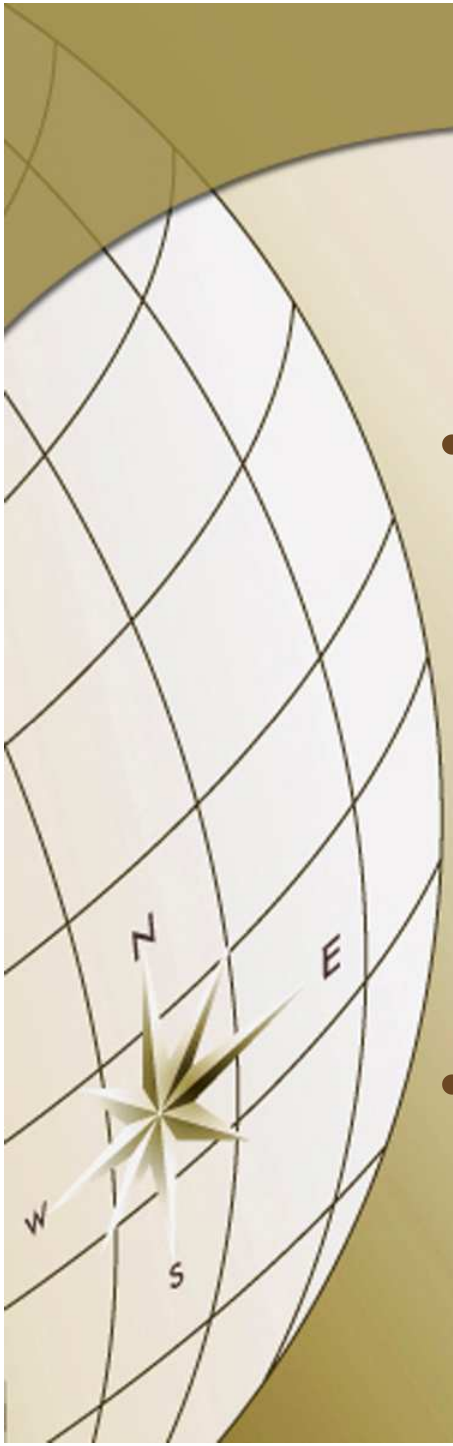
Figure D13 **Future 2012 Noise Contours**



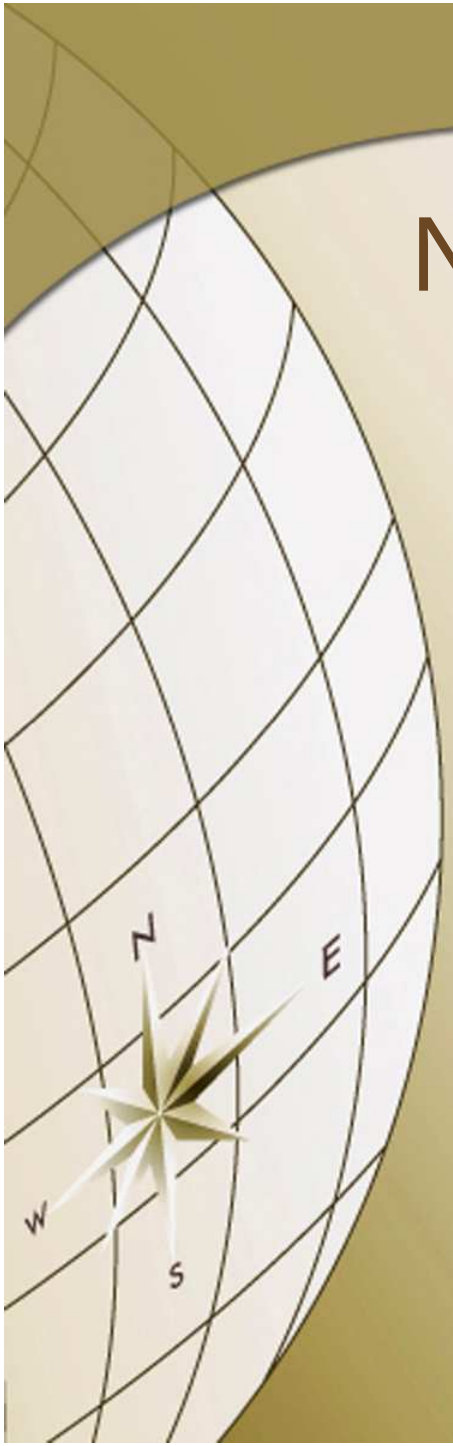
Noise Measurement

- Noise is defined as any unwanted sound. Whether or not a sound is noise is subject to the interpretation of the person who hears the sound.
- Aircraft noise began to become a problem in the early 1960’s with the advent of commercial jet aircraft.
- Today, aircraft noise is probably the single most important environmental constraint for the development and expansion of airports, or the building of new ones.
- Noise is the primary focus of complaints and objections of people living in areas near an airport.

Noise Measurement

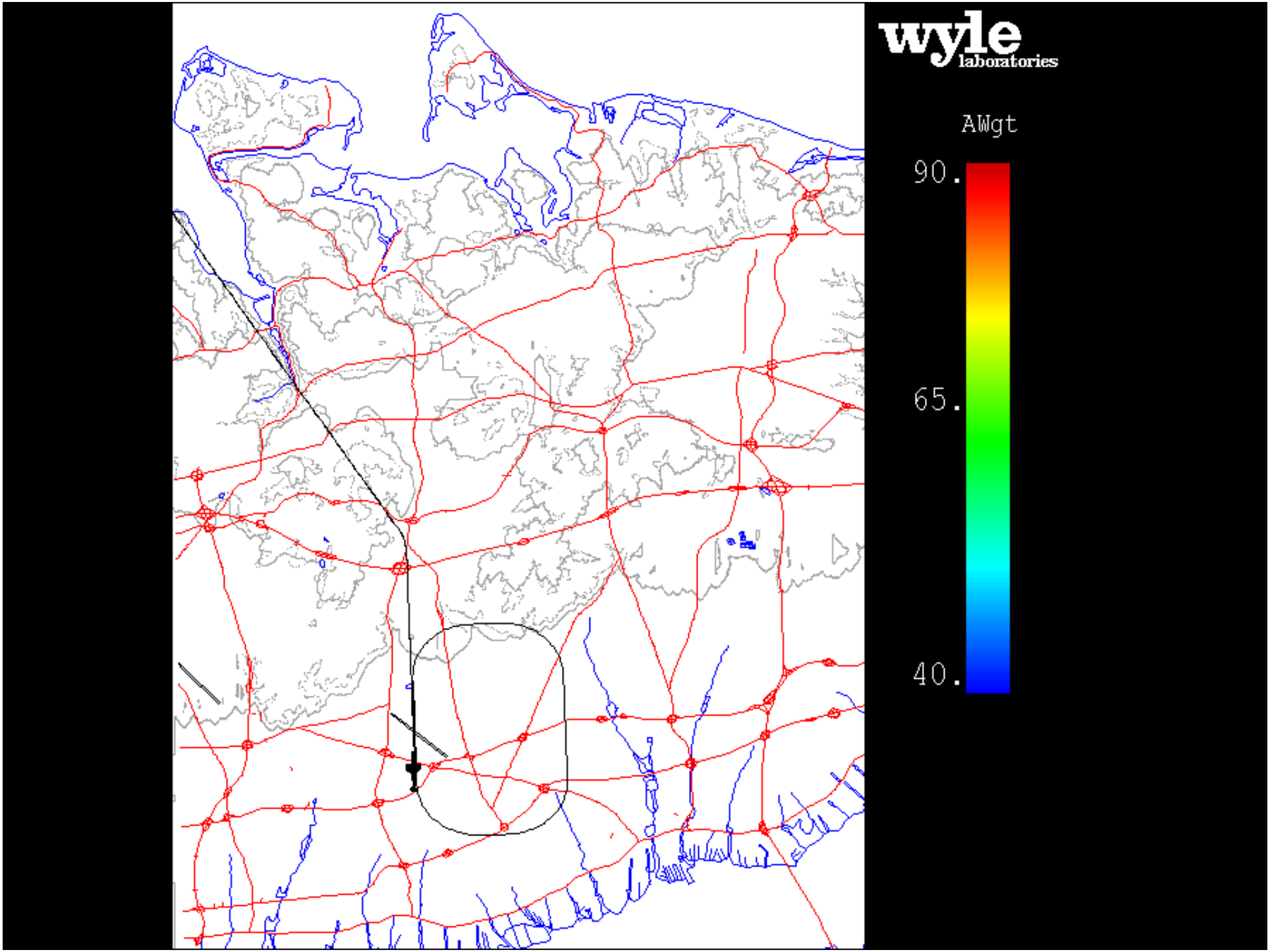


- In order to quantify the measurement of sound, a unit of measurement known as the decibel (dB) is used
  - The decibel scale varies from 0 to 130 dB
  - Threshold of sound is at zero.
  - Threshold of pain for the human ear is at 130 dB
- Decibel rating is a logarithmic scale
  - Perceived loudness doubles with every 10 dB increase



Noise Measurement Basics

- The decibel provides an accurate measure of the sound energy, but does **not** provide a reliable measurement of the human response to the sound energy.
- In order to accurately define the effects of noise on a community, a measure of cumulative noise exposure is needed.
  - Day-Night Average Sound Level (DNL)
  - Noise Exposure Forecast (NEF)
  - Composite Noise Rating (CNR)
  - Community Noise Equivalent Level (CNEL)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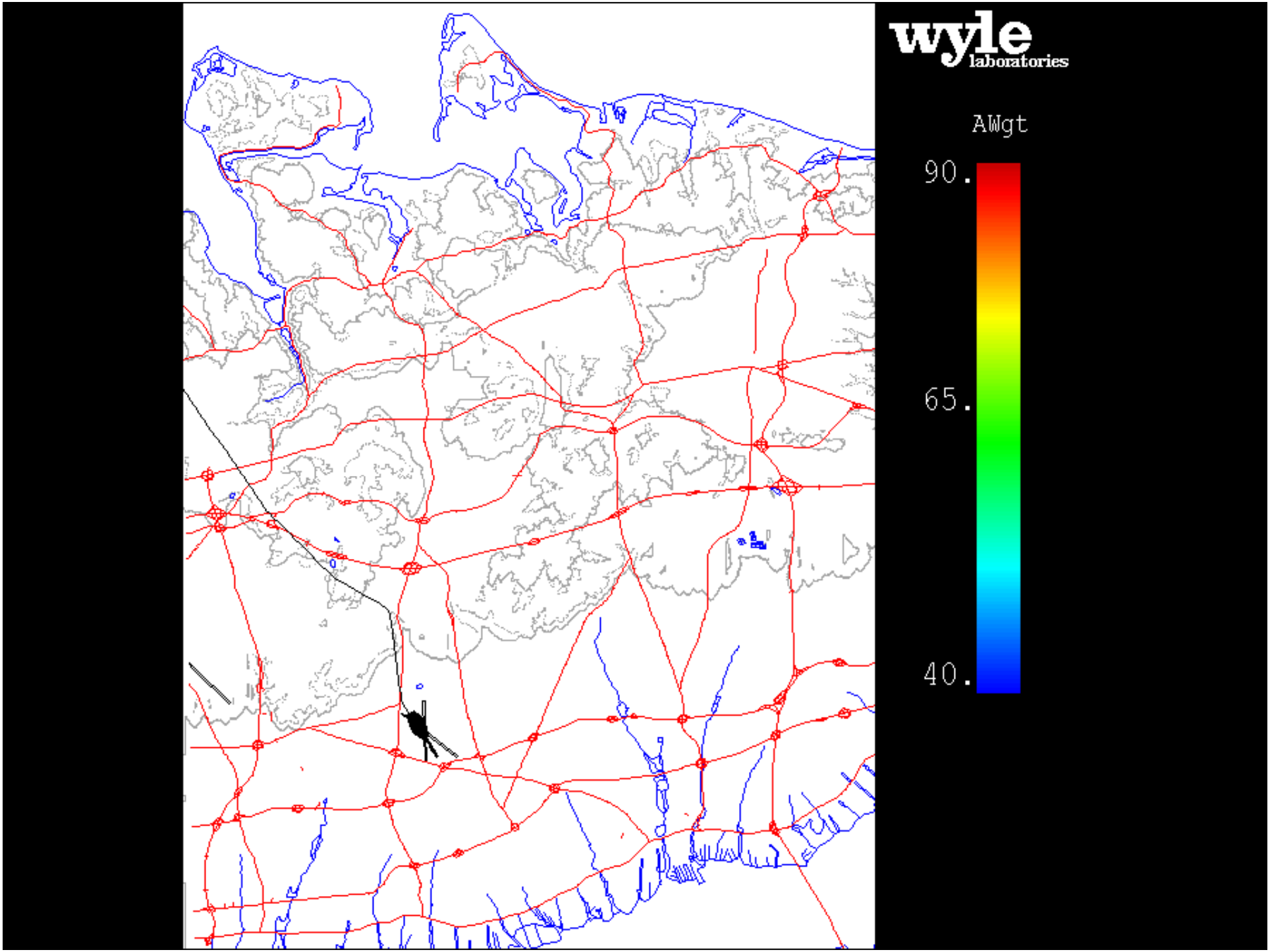
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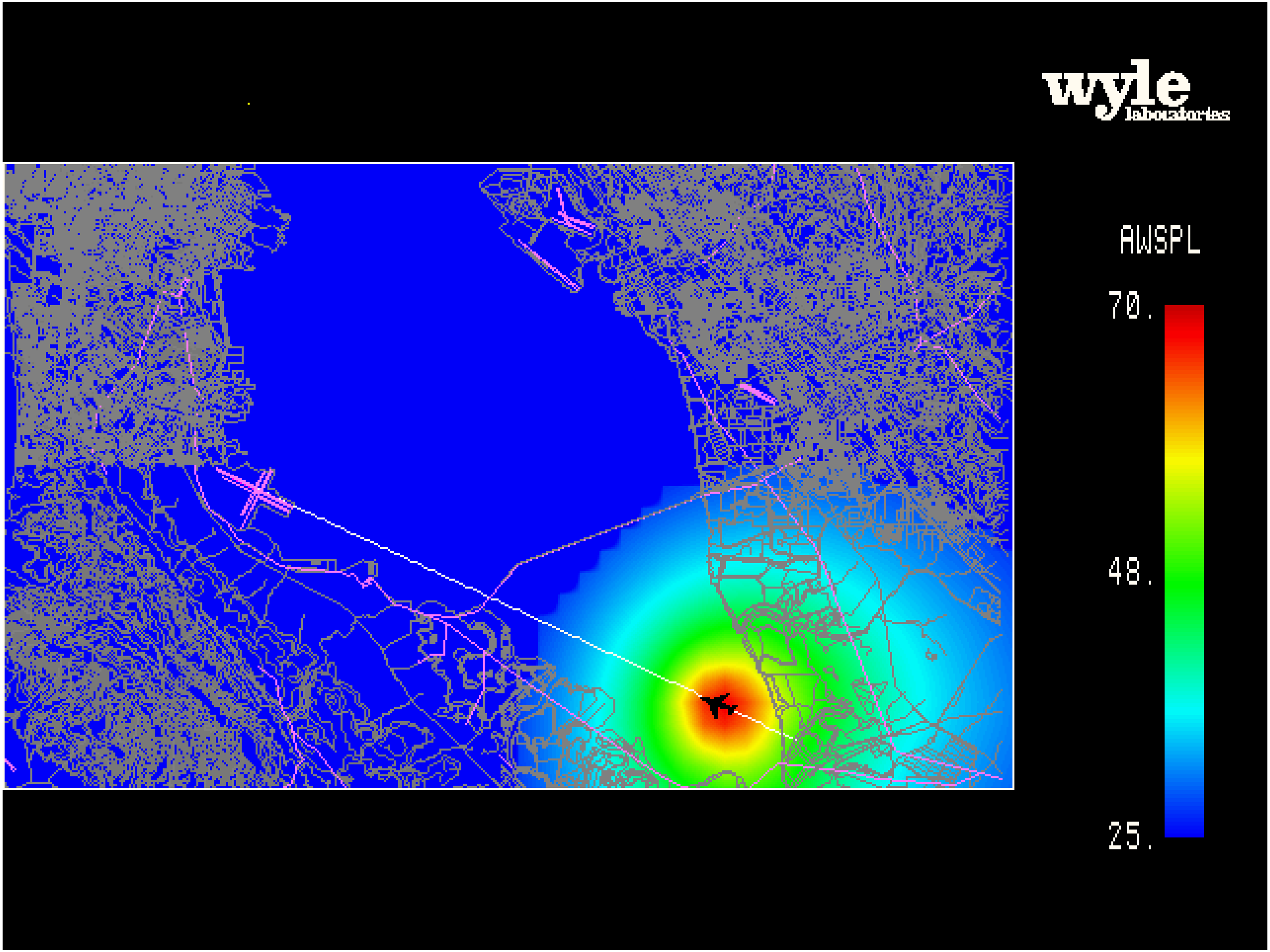
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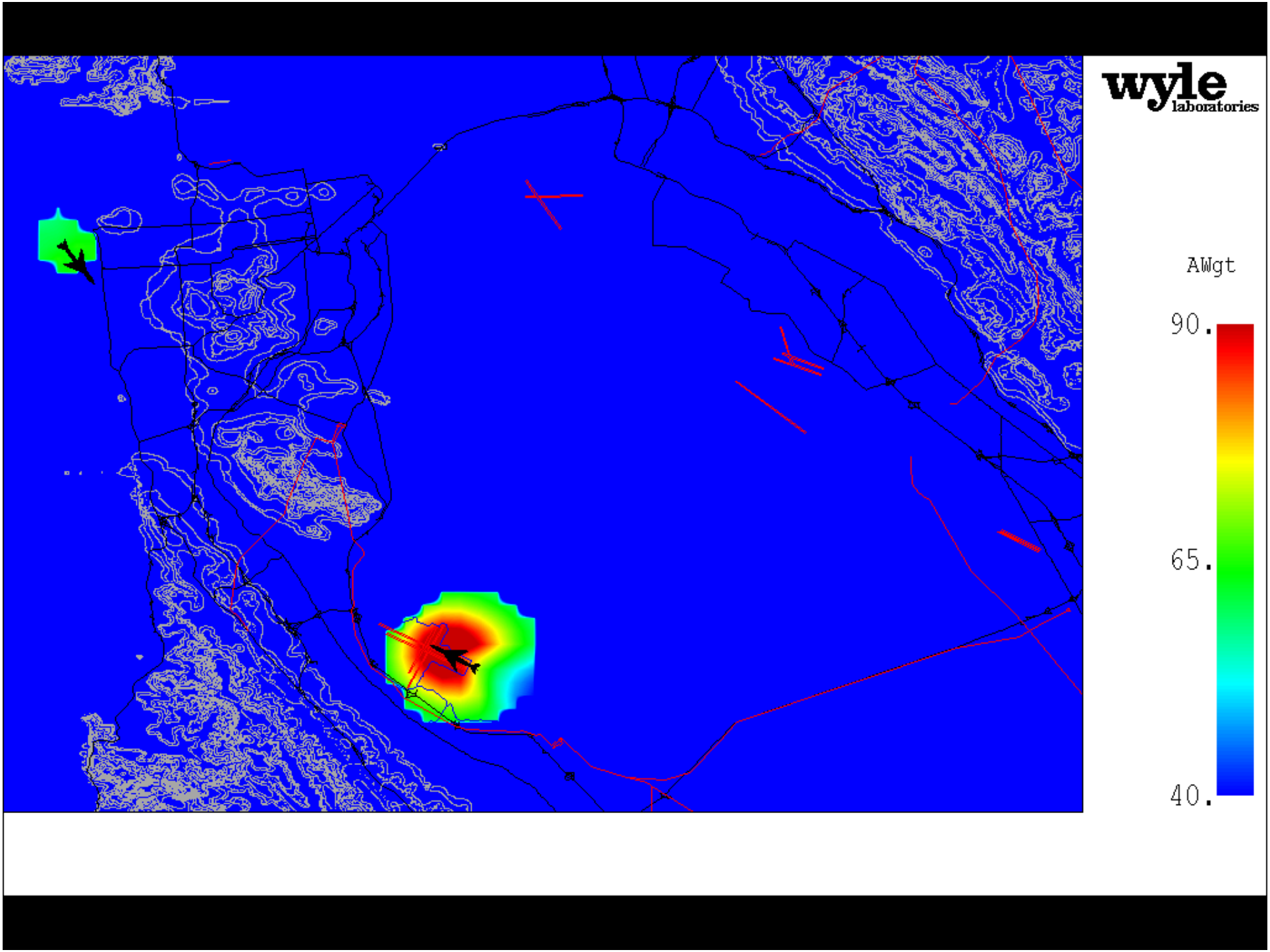
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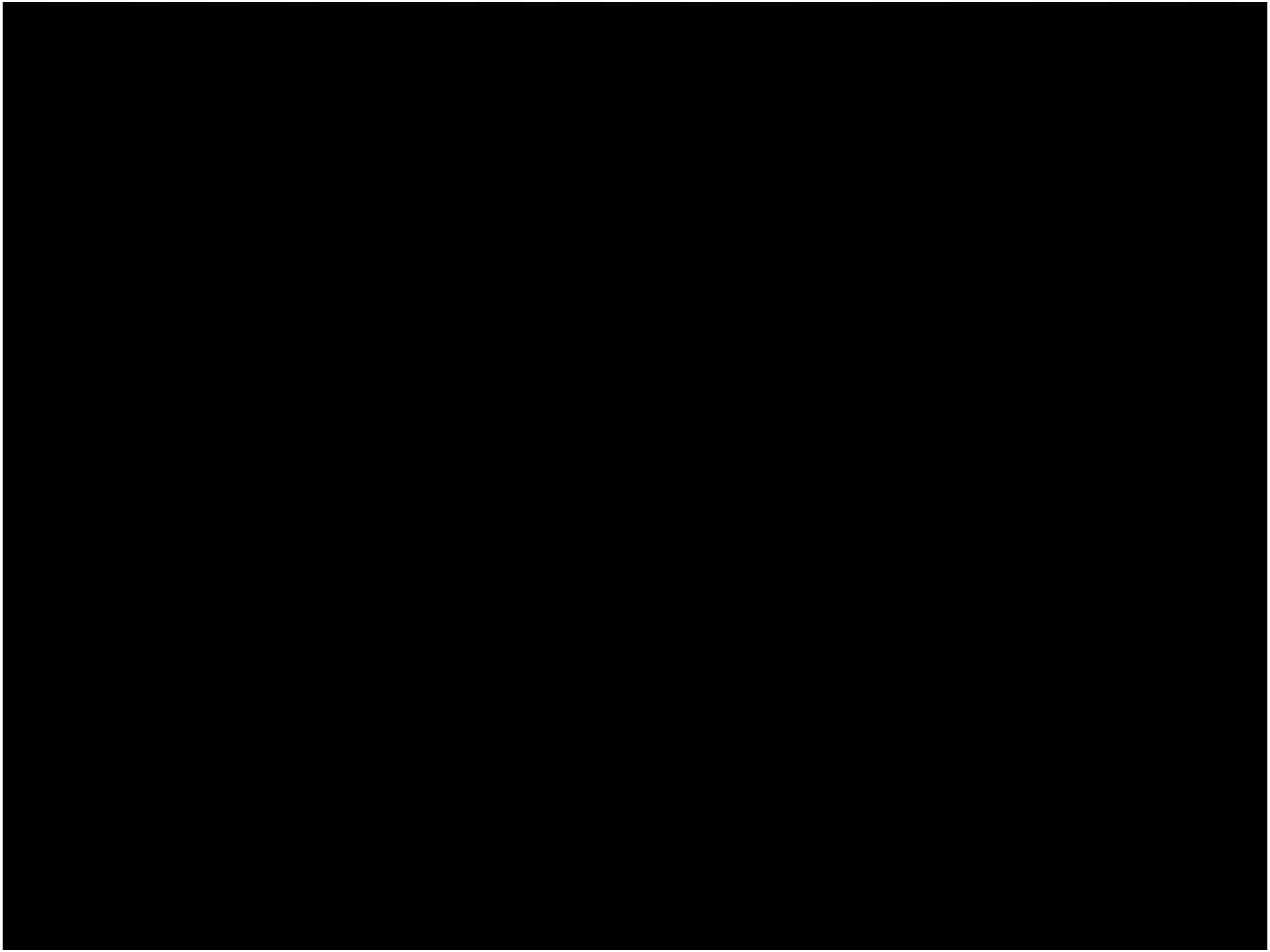
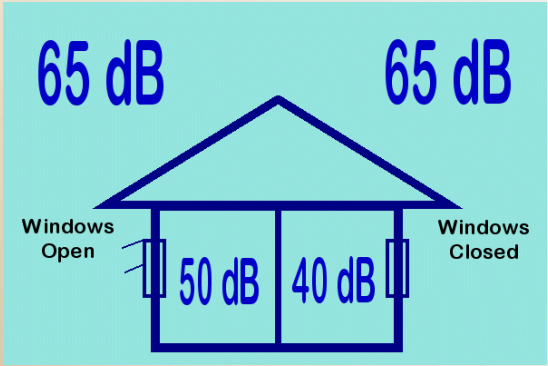
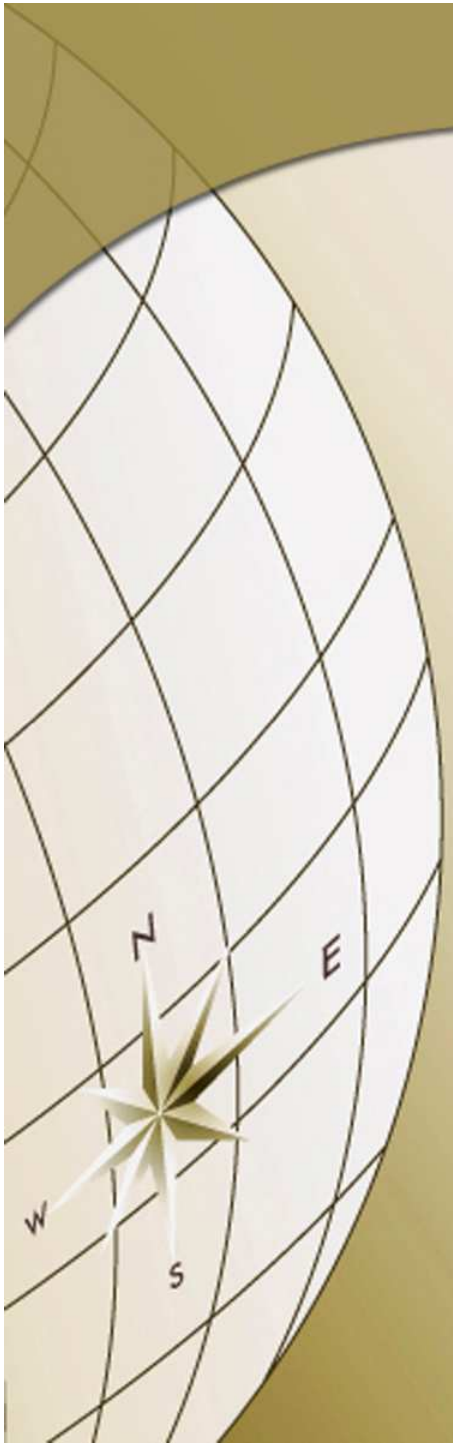


Noise Absorption/Attenuation

- Air absorbs noise at the rate of 6 dB per doubling of distance (point source)
- A typical house attenuates outdoor noise:
  - 15 dB with windows open
  - 25 dB with windows closed



“Rules of Thumb”



- 3 dB is noticeable to most people
- Adding two like sounds adds 3 dB increase
- Double or half the airport operations= +/- 3 dB
- 10 dB sounds twice as loud or twice as quiet
- Double or half the distance equates to 6 dB
- Using DNL, 1 night flight=10 day flights