Airport Land Use Compatibility

Harry P. Wolfe

Introduction: Objectives

- Explain why noise is a problem
- Identify methods to define the extent of the noise problem at an airport
- Identify measures to address the noise problem
  - Airport
  - Land Use

Why Is Noise a Problem?

- Impacts on humans
  - Health
  - Annoyance
- Impacts on airports
  - Restricts use
  - Inhibits expansion

Background on Noise

Source: Ted Woosley Landrum & Brown, 2001

What is Noise?

- Noise is unwanted sound
- Noise is temporary
- Annoyance is subjective

Perception of Sound

- How people perceive sound depends on several measurable physical characteristics of the sound:
  - **Intensity**
  - **Frequency Content**
  - **Changes in Sound Pressure Level**
  - **Rate of Change in Level**

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

Comparative Noise Levels (dB)

Saturn rocket	200
Walkman ½ volume	94
MD80 takeoff - 1,500 ft. altitude	85
dialtone	80
talking at 3 feet	65
quiet urban daytime	50
quiet urban nighttime	40
quiet rural nighttime	25

"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

Noise Metrics

- Lmax - Maximum noise level
- SEL - Sound exposure Level
- Leq - Equivalent Sound Level
- DNL - Day-night average sound level

DNL
Day-Night Average Sound Level

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

How Do You Define the Noise Problem?

- Establish noise impact area through generation of noise contours
- Identify overflight areas
- Record and plot location of noise complaints

Integrated Noise Model (INM) and Noise Contours

- Required for calculation of aircraft noise contours in studies seeking to make noise mitigation eligible for AIP and PFC funding

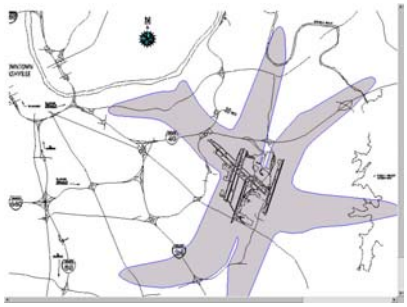
Ingredients – INM

- **Airport information - runways, temperature, airport altitude**
- **Where aircraft fly - flight tracks (definitions and usage)**
- **What aircraft are flown - fleet mix data**
- **How often they fly - 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)**

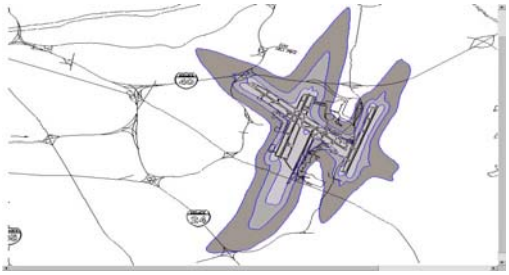
Use of Noise Monitoring

- Identifies more precisely existing noise environment
- Used to validate/calibrate noise contours

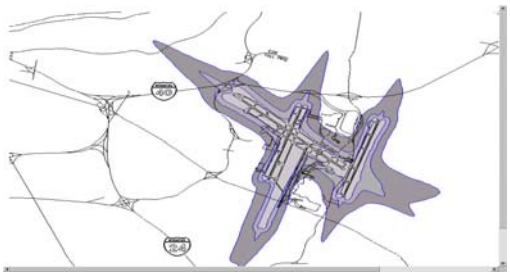
Nashville Noise Contours 1993



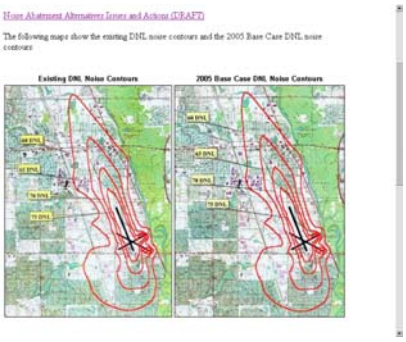
Nashville Noise Contours 1996



Nashville Noise Contours 2001



Palwaukee Noise Contours



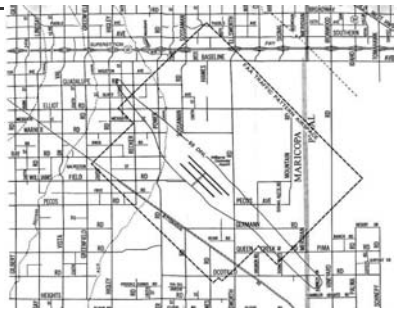
Issues Associated with Noise Contours

- What threshold should be used to define the problem?
  - 65 DNL
  - 60 DNL
  - 55 DNL
- What assumptions should be used to develop them
  - Use an average day over course of year
  - Use average flying day
  - Use peak flying day

Issues Associated with Noise Contours (continued)

- Cumulative Noise Contours do Not Reflect Annoyance associated with single events
- Noise contours do not necessarily reflect areas subjected to overflights

Identify Aircraft Overflight Areas



Identify Noise Complaints

- **2000 2,951 by 354 people**
- **2001 - 22,033 by 672 people**

What Do You Do to Address the Noise Problem

- Control the aircraft noise
- Change the land use
- Some combination of the above

Control the Noise

- Limit use of the airport
- Design airport to minimize noise problems
- Impose aircraft operational changes

Limit Use of Airport

- Noise abatement flight routes for noisier aircraft
- Capacity restrictions
- Aircraft weight restrictions
- Prohibition of intersection departures
- Nightime curfews
- Engine run-up restrictions
- Landing fees tied to noise

Design Airport to Minimize Noise Problems

- Displaced thresholds
- Runway orientation
- Runway extensions
- Noise suppression equipment\
- Navigational aids
- Location of engine run-up areas

Impose Aircraft Operational Procedure Changes

- Reduced thrust departures
- Thrust cutbacks after departure
- Maximum climb departures
- Raised pattern altitudes
- Minimum helicopter altitudes

Control the Land Use

- Regulatory techniques
  - Zoning
  - Building code modifications
  - Subdivision regulations
  - Fair disclosure rules
- Policy Techniques
  - Comprehensive planning
  - Capital improvement programming
  - Planning commission review

Control the Land Use (cont.)

- Expenditure and incentive techniques
  - Public acquisition of land
  - Purchasing easements
  - Soundproofing