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Monday, July 25 through Friday, July 29, 2011  
**Sustaining Military Readiness Conference**  
Connecting Missions, Resources, and Communities



# Enhancing Airport Land Use Compatibility – ACRP Report 27

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Nick Miller – HMMH



# Presentation Outline

- Project Team
- Project Volumes
- Study Highlights
- Importance of Land Use Compatibility
- Common Concerns
- Roles & Responsibilities
- Federal Guidance
- Economic Costs
- Noise
- Aircraft Accidents
- Tools & Techniques
- Templates
- Case Studies
- Questions

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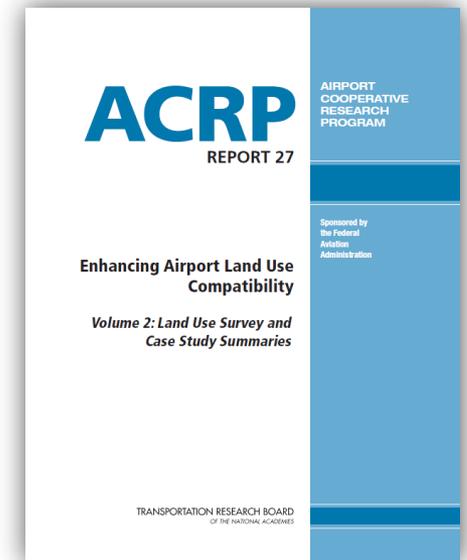
# Project Team

- Mead & Hunt, Inc. – Principal Investigator
  - Stephanie Ward, AICP
  - Regan Massey
- Clarion Associates, Inc.
  - Christopher Duerksen
  - Erica Heller, AICP
- Harris Miller Miller Hanson, Inc.
  - Nicholas Miller
  - Robin Gardner
- Aviation System Consulting, LLC
  - Dr. Geoffrey Gosling, Ph.D.
- Unison Consulting, Inc.
  - Sharon Sarmiento
- Dr. Richard Lee, Ph.D.



# Study Highlights

- Literature Review
  - Over 300 documents/sources
- Over 120 Airport Surveys
- 19 Case Studies
  - General Aviation
  - Commercial Service
  - Military



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# Case Studies

- Buckley AFB
- Baltimore/Washington Int'l Airport
- Centennial Public Airport
- Collin County Regional Airport
- Denver International Airport
- Fort Bragg AFB
- Ft. Lauderdale Executive Airport
- Independence State Airport
- Indianapolis International Airport
- Naples Municipal Airport
- NAS Pensacola
- O'Hare International Airport
- Randall Airport
- Sacramento County Airport System
- Willmar Municipal Airport





# Importance of Land Use Compatibility

## ■ History

- 1952 – *The Doolittle Report*

## ■ Value

- Civilian airports create \$507 billion annually in economic activities nationwide
- 6.7 million airport-related jobs
- \$33.5 billion generated in local, state, and federal taxes
  - *The Economic Impact of U.S. Airports, Airports Council Int'l (ACI)*

## ■ Consequences

- Economic Costs
- Safety
- Limited Airport Development
- Hindered Airport Services
- Impact to National Aviation System

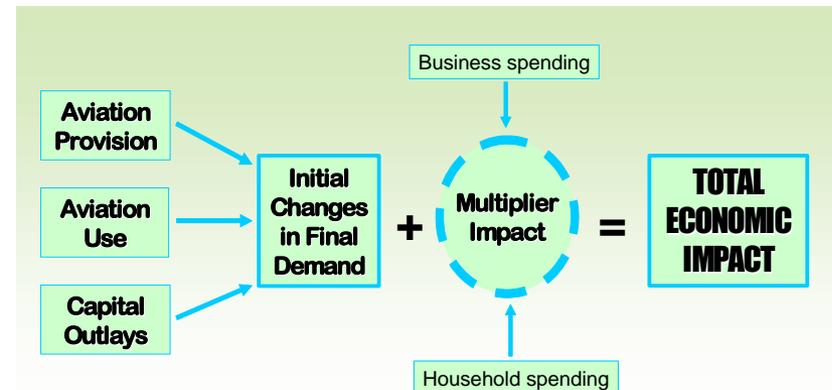


US Airways Airbus A320 (flight 1549) struck a flock of migrating Canada geese at 3,100 feet



# Economic Costs

- Various Methods to Determine Economic Cost
- Numerous Variables such as:
  - Cost of travel delays
  - Value of travel time
  - Value of statistical life
  - Aircraft replacement & restoration costs
  - And more...



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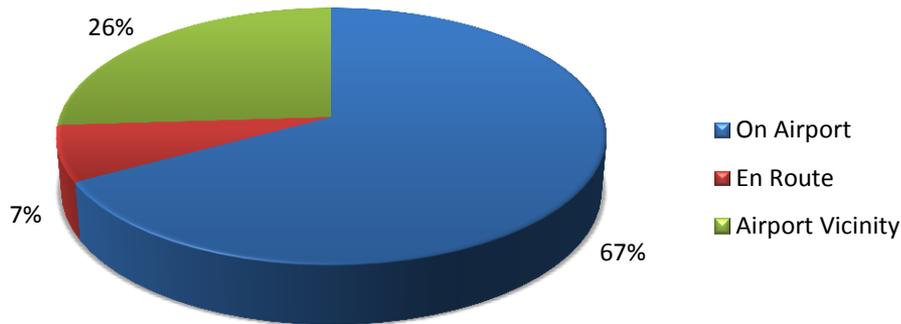
# Economic Costs

- Sample Litigation Costs from Case Studies
  - Six airports ( 3 General Aviation, 3 Commercial Service)
    - Attorney fees ranging from \$2,500- \$4 million
    - Staff time ranging from \$2, 734 - \$500,000
    - Settlements ranging from \$8,500 - \$130 million
    - Duration ranging from 30 months to over 9 years

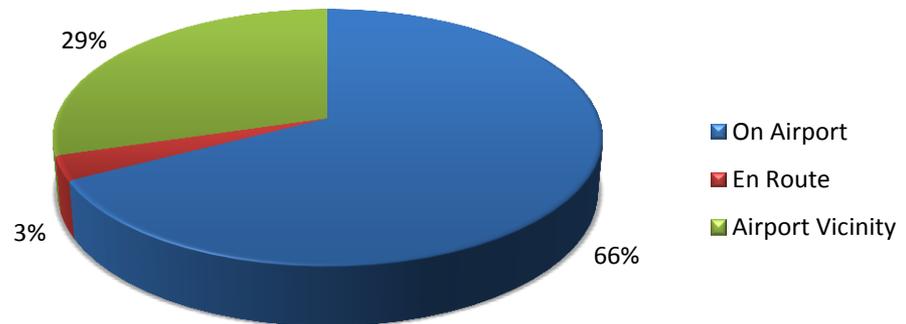


# Aircraft Accidents

## Commercial Aviation



## General Aviation

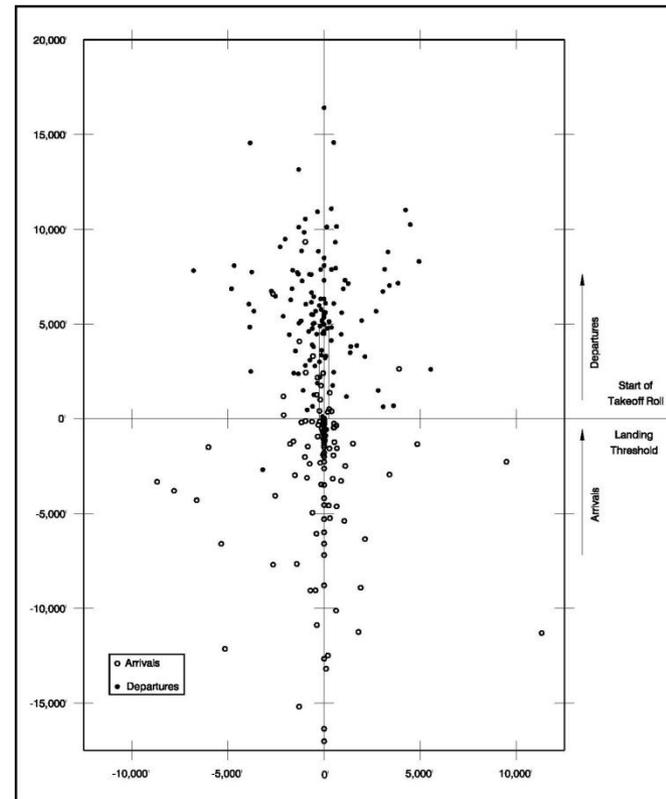


Source: California Airport Land Use Planning Handbook 2002



# Aircraft Accidents

- Primary Findings:
  - Need for Additional Parameters in Accident Reporting
    - Terrain
    - Phase of Flight
    - Type of Aircraft
    - Cause of Accident
    - Time of Accident





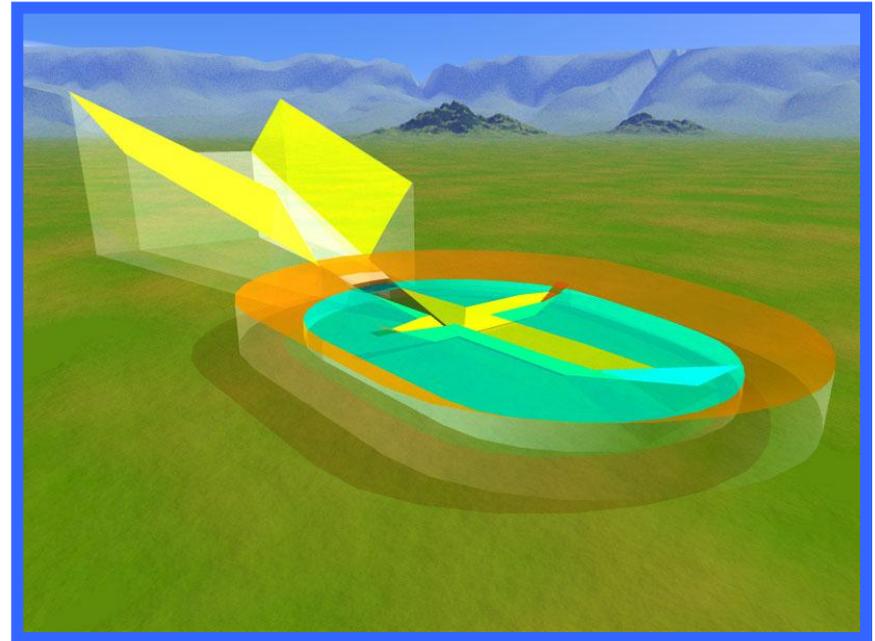
# Land Use Concerns & Types

## ■ Four Common Concerns

- Population Density
- Tall Structures
- Visual Obstructions
- Wildlife Attractants

## ■ Land Use Types

- Residential
- Commercial
- Industrial/Manufacturing
- Institutional
- Infrastructure
- Agricultural/Open Space
- Parks & Recreational

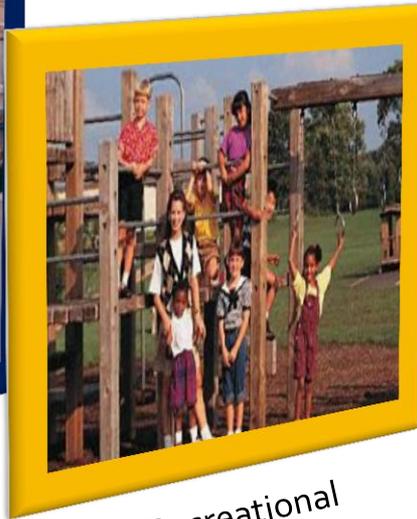




# Population Density



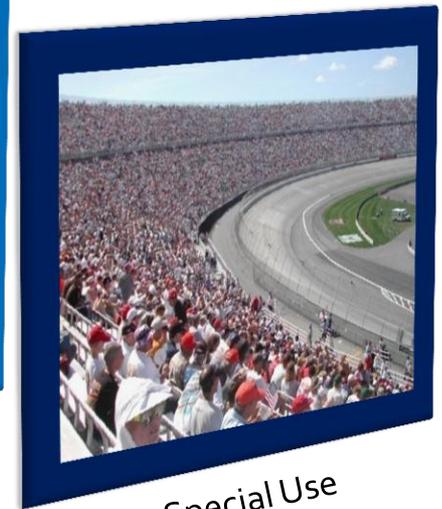
Special Use



Recreational



Residential



Special Use

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# Tall Structures



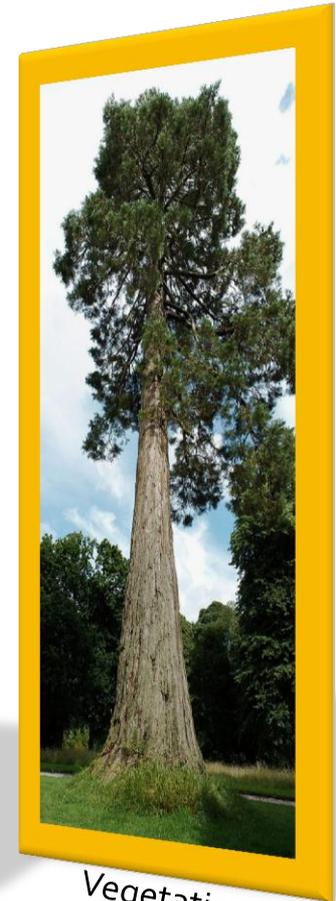
Power lines



Wind turbine



Cell tower



Vegetation

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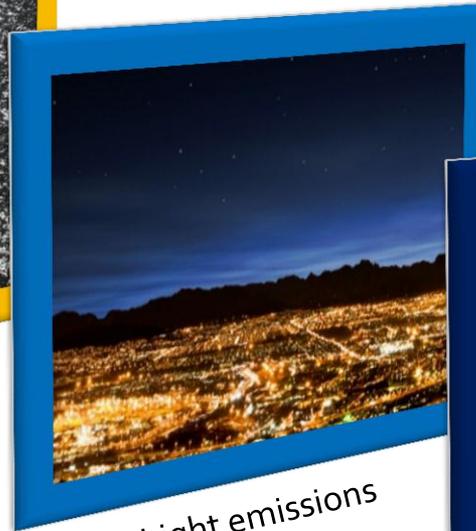
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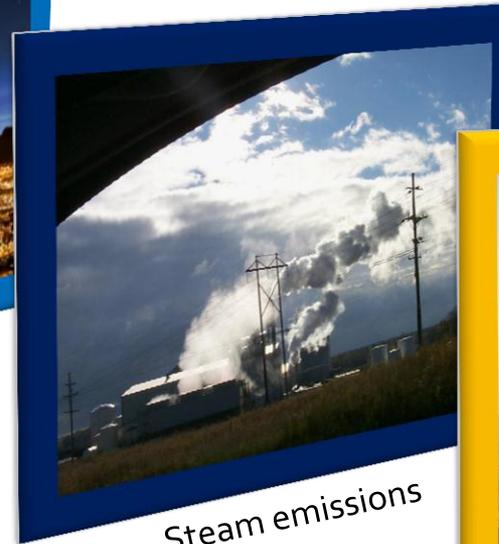
# Visual Obstructions



Glare – body of water



Light emissions



Steam emissions



Dust

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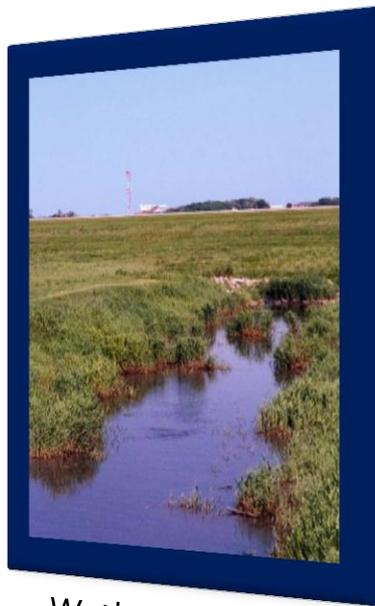
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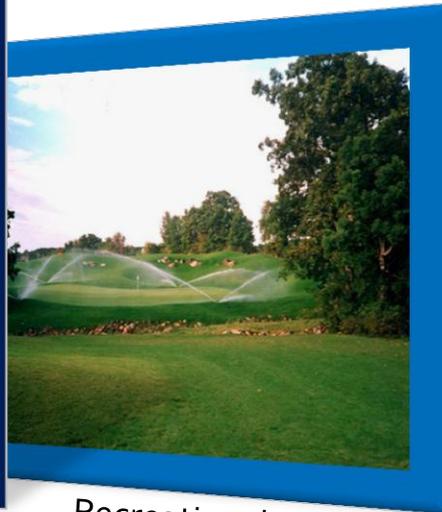
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# Wildlife Attractants



Wetlands &  
Water Bodies



Recreational use



Farmland



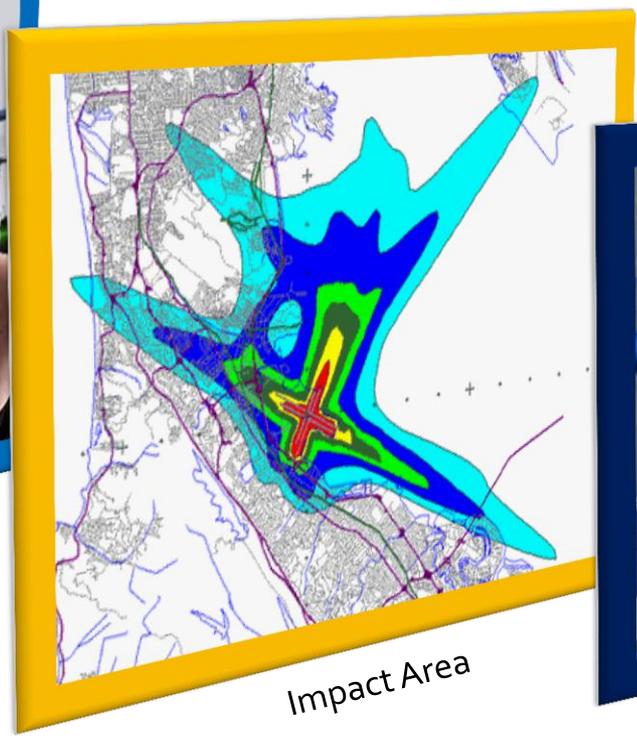
Sewage Lagoon



# Noise



Overflight



Impact Area



Proximity



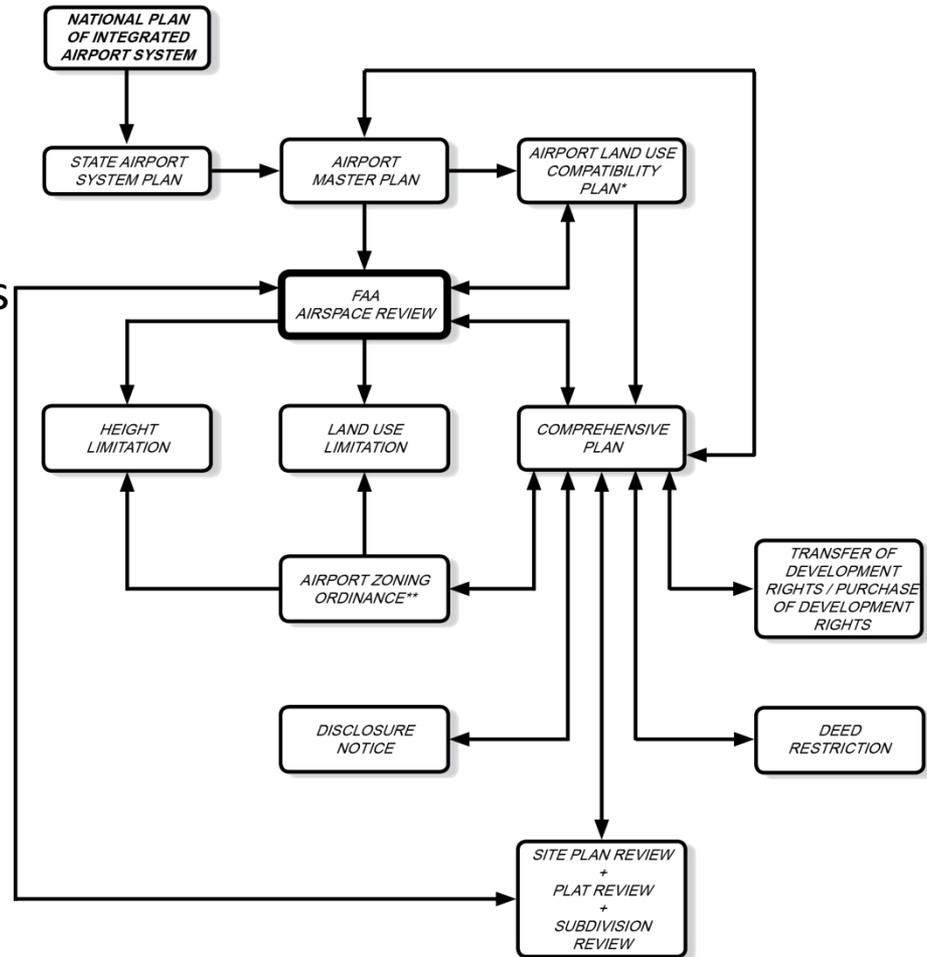
## Land Use Compatibility Chart – Residential Example

Land Uses <sup>1</sup>	I=Impact	P=Possible Impact	N=No Impact		
	Noise Sensitivity	Concentration of People	Tall Structures	Visual Obstructions <sup>2</sup>	Wildlife and Bird Attractants
<b>Residential Activities</b>					
<b>Single-Family Uses</b> (1 dwelling per lot)					
<b>Multi-Family Uses</b> (Three or more principal dwelling units within a single building on the same parcel) (e.g. apartment, condominium, townhouse-style)					
<i>Low-Rise</i> (2 to 3 Levels) or <i>Mid-Rise</i> (4-12 Levels)	I	P	N	P	P
<i>High-Rise</i> (13+ Levels)	I	I	I	I	I
<b>Group Living Uses</b> (e.g. assisted living, group care, independent group living, nursing and convalescent home)					
<i>Residential Group Living Units</i> (1 dwelling per lot)	I	P	N	P	P
<i>Low-Rise</i> (2 to 3 Levels) or <i>Mid-Rise</i> (4-12 Levels)	I	P	N	P	P
<i>High-Rise</i> (13+ Levels)	I	I	I	I	I
<b>Manufactured Housing Parks</b>	I	I	N	P	I



# Roles and Responsibilities

- Federal Stakeholders
- State Stakeholders
- Regional Stakeholders
- Local Stakeholders
  - Planning & Zoning Authorities
  - Local Citizens
  - Local Communities
- Airport Related
  - Airport Sponsors
  - Airport Managers



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# Federal Land Use Regulations & Guidance

- Federal Aviation Administration (FAA)
- Department of Defense
  - Design
  - Airspace
  - Noise
  - Environmental
- Other Agencies

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# Noise

- Noise remains a primary constraint on aviation capacity
- Why? Airports and residential land uses are too close to each other
  - Historical reasons – airports in cities
  - Lack of coordinated planning
  - Misunderstood assumptions about noise and land use compatibility



# Noise

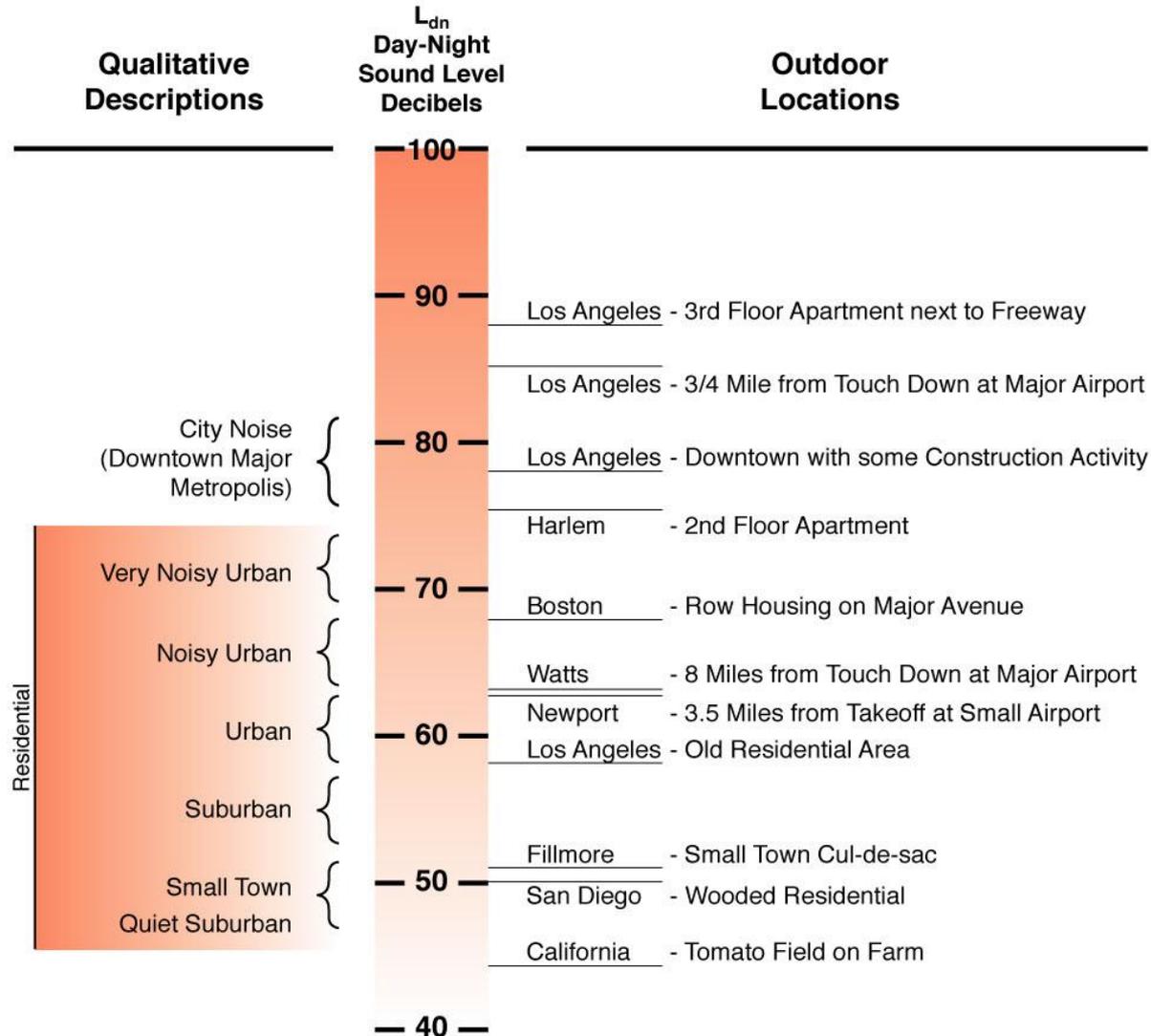
- DNL 65 selected in early 1970's
  - Based on limiting effects of noise
    - Annoyance
    - Speech interference
    - Sleep disturbance
    - Complaints
  - Aircraft were 10 to 20 dB louder and noise contours much larger
  - Review of DNL 65 was recommended

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# Noise

- Land use planning
  - Airports and communities generally have different objectives, but both want to grow
  - Planning with DNL 65 has helped, but may not work for all airport / community situations
  - Better understanding of DNL might help communities / airports to address land use compatibility



# Noise

- Different types of operations yield DNL 65

<b>Maximum Aircraft Sound Level</b>	<b>Required No. of Operations in 24 Hrs (none at night)</b>	<b>~Time Above 60 dB (A), Each (speech interference)</b>	<b>~Total Time Above 60 dB (A)</b>
<b>95 dB (A)</b>	<b>10</b>	<b>50 Seconds</b>	<b>8 Minutes</b>
<b>85 dB (A)</b>	<b>100</b>	<b>35 Seconds</b>	<b>1 Hour</b>
<b>75 dB (A)</b>	<b>1000</b>	<b>20 Seconds</b>	<b>6 Hours</b>



# Noise

- What's an airport or community to do?
  - Nothing – continue with DNL 65 for purposes of Part 150 and NEPA as need arises
  - Establish on-going outreach to communities; keep them informed
  - Work with communities to establish more effective land use compatibility by-laws



# Noise

- A Land Use Ordinance to Address Noise
  - Must be cooperative effort
  
- Both airport and community need long-term master plans
  
- Choosing compatibility criteria
  - Use FAA's DNL 65?
  - Explore an alternative level?



# Noise

- Exploring an alternative level
  - First, understand the airport's DNL
    - Use supplemental / additional metrics
      - number of operations above a level
      - Percent use of various corridors
  - See Australia's approach:  
([http://www.infrastructure.gov.au/aviation/environmental/transparent\\_noise/index.aspx](http://www.infrastructure.gov.au/aviation/environmental/transparent_noise/index.aspx))

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# Noise

DNL Range (dB)	Percent of Population		Number of Aircraft Events that:	
	Awakened at least once by aircraft noise	Annoyed	Interfere with Conversation Indoors (windows open)	Cause Feelable House Vibration
>70	> 40%	> 40%	> 250	>200
65 - 70	35% - 40%	30% - 40%	100 - 250	50 - 200
60 - 65	30% - 35%	20% - 30%	50 - 100	<50
55 - 60	20% - 30%	10% - 20%	< 50	negligible



# Case Study – Naples FL

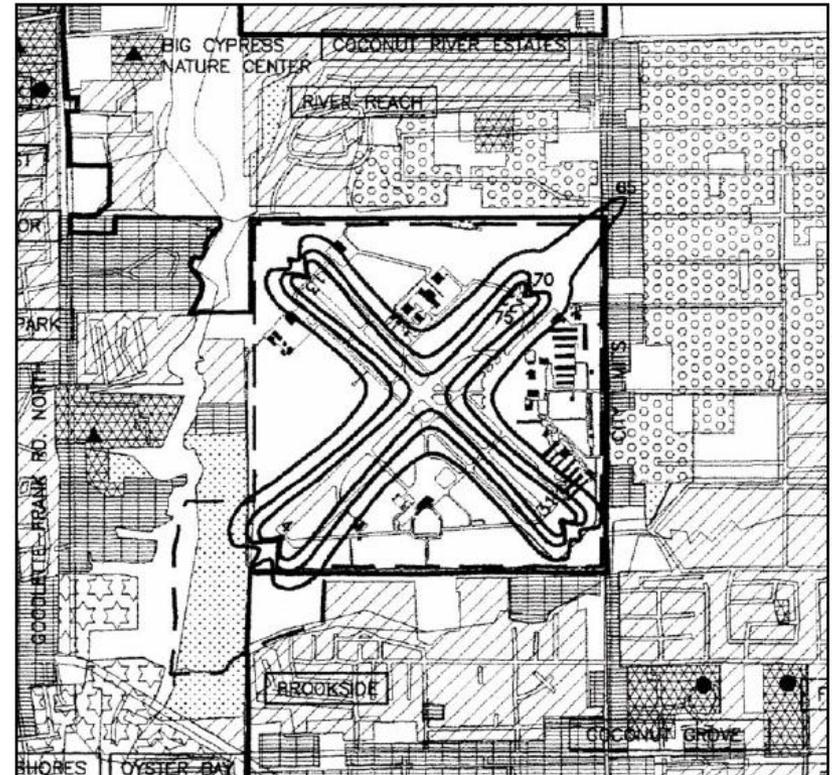
- Long-term effort to control aircraft noise (1970's)
- Had no noise sensitive land in  $\geq$  DNL 65 (1996 )
- Complaints from areas outside DNL 65
- Identified “High Noise Impact Area” as within DNL 60, 1997
- Since then, no residential land development permitted within DNL 60





# Case Study – Naples FL

- Stage 2 jets (<75,000 lbs) primary source of complaints (25 times more likely than Stage 3, 250 times more likely than propeller)
- Part 161 recommended complete ban on Stage 2 jets
- U.S. Court of Appeals agreed that DNL 60 is a significant threshold for Naples and complaints feature in this determination



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# Noise Summary

- Aircraft noise continues as a source of conflict between airports and communities
- Solutions, if any, will likely require efforts on both open dialog and mutual understanding of the details of aircraft noise exposure



# Tools & Techniques

- Planning & Zoning
  - Comprehensive Plans, Master Plans, Compatibility Plans
- Natural Features
  - Wildlife Management Plan & Inventory
- Acquisition & Notification
  - Fee Simple, Avigation Easements, Real Estate Disclosure
- Noise Mitigation
  - Sound Insulation, Sound Barriers

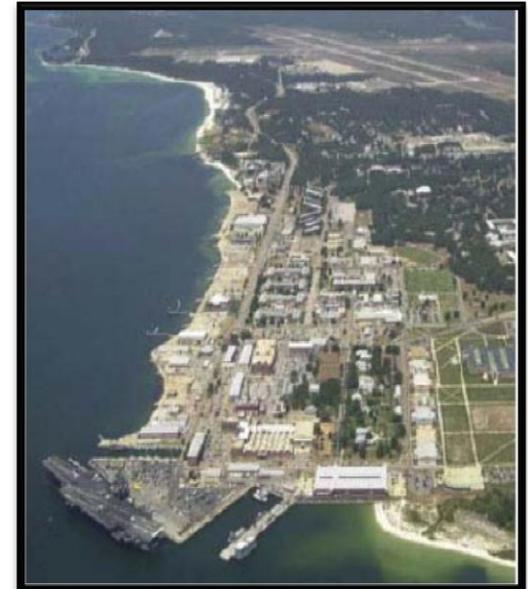
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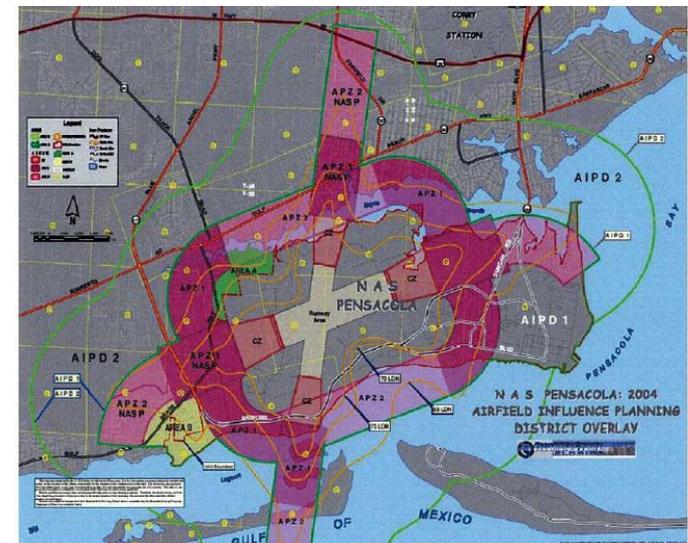
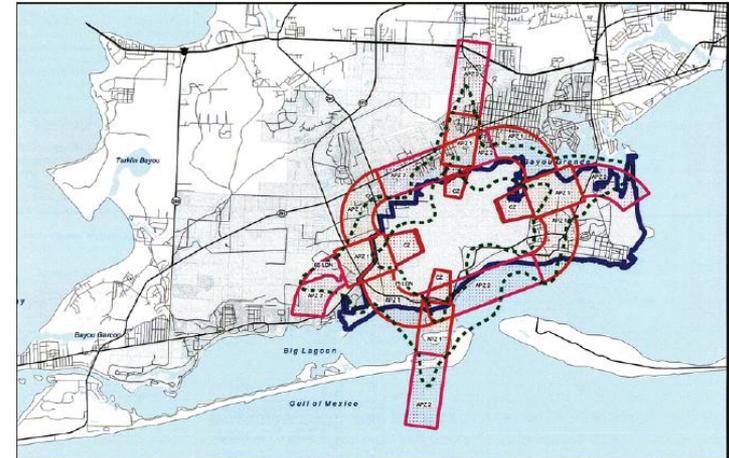
# Case Study – NAS Pensacola, FL

- Location—Florida Panhandle
- Airport Operations
  - Military Operations
- History and Development
  - Built in early 1900s through the Naval Appropriation Act
  - 3 runways (8,002', 8,001', 7,137')
  - Home to the Blue Angels
  - Initial civilian growth surrounding was slow
  - Today, encroachment is a concern



# Case Study – NAS Pensacola, FL

- **Governance**
  - Joint responsibility between Escambia County and the U.S. Navy
  
- **Land Use Compatibility**
  - Conducted a Joint Land Use Study (JLUS) which works with local comprehensive plans to protect the military installation and civilian community from incompatible land uses. It also works to minimize operational impacts on adjacent land.



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# Templates

- Model State Zoning Legislation
- Model Local Zoning Ordinance

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# Airport Zoning Background

- **Local Zoning:**
  - Primary local tool to control potentially incompatible land uses around airports
- **FAA Advisory Circulars**
  - 150/5190-4A: A Model Zoning Ordinance to Limit Heights Around Airports
  - 150/5020-1: Noise Control and Compatibility Planning for Airports
  - 150-5190-4B: Compatible Airspace and Land Use (forthcoming)
- **State Airport Zoning Enabling Legislation**
  - General Zoning Enabling Legislation
  - Special Airport Zoning Legislation

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# Model State Legislation

- Role of State Legislation:
  - Encourage, Enable, Require Adoption of Protective Zoning
- Case Studies:
  - Clear State Guidance And Minimum Standards = Improve Compatibility
- Target Audience:
  - State/Regional Officials
- Based On Most Effective State Airport Zoning Laws and Case Studies
- Provides Minimum Standards and Best Practice Options

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# Model Zoning Legislation

### STANDARDS [BP]

**BP COMMENTARY:** This Section sets out minimum land use compatibility requirements of local zoning regulations. Although some state legislation does not include minimum standards, case studies and other research conducted as part of the ACRP 03-03 project indicate that such guidance usually results in better land use compatibility outcomes.

This Section offers two equally effective approaches for setting out minimum state standards. The first option is to enumerate minimum standards in the legislation. The second option is to direct local governments to meet standards as indicated in a guidance manual. In the second option, local governments are typically directed to conform to a state-specific manual adopted by an appropriate state agency, but another option would be to direct local governments to conform to the Federal Aviation Administration (FAA) guidance manual, *Land Use Compatibility and Airports*. A hybrid approach is also possible, with the legislation setting out some limited minimum standards and the guidance document providing additional detail.

Some of the standards in Option 1 of this Section refer to FAA land use compatibility guidance. If the state has other guidance, references to FAA guidance would typically be replaced with appropriate references to state guidance.

Whether the minimum standards are enumerated in the legislation or in a stand-alone manual, each state should tailor them as appropriate to the unique context of that state.

Finally, regardless of the approach selected for minimum standards (in the legislation or a stand-alone manual), most states explicitly allow local governments to establish more stringent local land use controls than the minimum standards.

### (J) MINIMUM STANDARDS [BP]

**[Option 1: INDICATE SPECIFIC STATUTORY MINIMUMS]**  
This option clearly indicates a minimum set of standards to which local airport land use compatibility zoning must conform. This approach is most appropriate when state requirements are limited to a small number of measurable standards.

A local political subdivision or agency shall adopt airport compatibility requirements that shall, at a minimum:

- (1) Prohibit new residential development and public assembly uses within the Runway Protection Zone as defined in FAA AC 150/5300-13, *Airport Design*;
- (2) Control the height of buildings, structures, towers and other objects in a manner consistent with Federal Aviation Administration FAR Part 77, *Objects Affecting Navigable Airspace*;
- (3) Limit the establishment of uses within a noise impact boundary consistent with the levels identified in FAR Part 150, *Noise Compatibility Program*, Appendix A, Table 1;



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# Model State Legislation Key Provisions

- Enable or Require Local Protective Zoning
- Minimum Local Standards Required or State Adopts

## Model Guidelines

- Residential/Assembly Uses
  - Structure height controls
  - Noise
  - Other (smoke, lighting, landfills, etc.)
- Non-Conforming Uses
- Airport Land Use Compatibility Zones
- Review Procedures and Enforcement

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# Model Local Airport Zoning Ordinance

- Primary Concerns:
  - Incompatible land uses/densities
  - Flight hazards that interfere with aircraft operations
  - Noise
  - Airport runway approach and departure zones
- Target Audience:
  - Local Elected/Appointed Officials, Staff, and Legal Counsel
- Based On Effective Local Airport Zoning Laws, Case Studies, Interviews, Research
- Provides Suggested Minimum Standards Plus Best Practice Options



# Model Local Zoning Ordinance

Appendix C C7

## SECTION 1: TITLE AND INTRODUCTION

*COMMENTARY: This Section is used to identify the title and provide a brief introduction to the ordinance and identify the airport(s) which the ordinance is applicable.*

\_\_\_\_\_ [Insert name of airport] AIRPORT ZONING ORDINANCE

An ordinance regulating and restricting the height of structures and objects of natural growth, and otherwise regulating the use of property, in the vicinity of the \_\_\_\_\_ Airport by creating the appropriate zones and establishing the boundaries thereof; providing for changes in the restrictions and boundaries of such zones; defining certain terms used herein; referring to the \_\_\_\_\_ Airport Zoning Map that is incorporated in and made a part of this ordinance; providing for enforcement; and imposing penalties.

## SECTION 2: AUTHORITY

*COMMENTARY: This Section is used to indicate any state statutes that enable or require local municipality to enact land use regulations, either for the general purpose of the protection of the public safety and welfare or public facilities, or for the specific purpose of the maintaining land use compatibility around an airport(s).*

This ordinance is authorized by \_\_\_\_\_ [Insert reference to applicable state enabling statute].

## SECTION 3: STATEMENT OF PURPOSE AND FINDINGS

*COMMENTARY: This Section establishes the importance of the airport to the community by acknowledging hazards posed to public health, safety, and quality of life to individuals affected by airport operations. It identifies any specific findings that local government has made in the adoption process for the airport land use compatibility ordinance. The suggested findings can be modified as appropriate to the individual airport.*

The \_\_\_\_\_ [Insert name of jurisdictional governing board], hereby finds and declares that:

- (1) The \_\_\_\_\_ [Insert name of airport] Airport is an essential public facility.
- (2) An airport hazard endangers the lives and property of users of the \_\_\_\_\_ Airport, and property or occupants of land in its vicinity, and also if of the obstructive type, in effect reduces the size of the area available for the landing, takeoff, and maneuvering of aircraft, thus tending to destroy or impair the utility of the \_\_\_\_\_ Airport and the public investment therein.
- (3) The creation or establishment of an airport hazard is a threat to public health safety and welfare of the jurisdictions served by the \_\_\_\_\_ Airport.
- (4) For the protection of the public health, safety, order, convenience, prosperity, and general welfare, and for the promotion of the most appropriate use of land, it is necessary to prevent the creation or establishment of airport hazards.
- (5) The prevention of these airport hazards should be accomplished, to the extent legally possible, by the exercise of the police power without compensation.

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# Model Local Legislation

## Key Provisions

- **Airspace Obstruction/Height Limit Zone**
- **Airport Land Use Compatibility Zones**
- **Land Use Compatibility Standards**
  - Option 1: Performance standards re density, lighting, etc.
  - Option 2: Detailed airport zone use tables
- **Airport Noise Impact Zone**
- **Nonconforming Uses**
- **Administration: Who Decides and How**
  - Decision-making authority, airport zoning permits, variances
- **Avigation Easements/Real Estate Disclosure**



# Model Local Zoning Ordinance

TABLE 7-C: AIRPORT LAND USE COMPATIBILITY BY ZONE					
Use Categories and Specific Use Types	Compatibility Zones				Conditions Required to Achieve Compatibility
	Zone A	Zone B	Zone C	Zone D	
Ø = Incompatible use - recommend that local jurisdictions prohibit in the Zone C = Compatible use - recommend that local jurisdictions allow in the Zone CC = Conditionally compatible use - may be made compatible through compliance with indicated conditions. Recommend that local jurisdictions require discretionary local review and/or conformance with standards.					
Uses or structures that promote concentrations of flammable substances or materials	Ø	Ø	Ø	Ø	
<b>EXISTING STRUCTURES AND USES IN ALL ZONES</b>					
Existing residential structures, including residential accessory structures	C-1, 2	C-1, 2	C-1, 2	C-1, 2	1: Existing structures may remain unless determined to pose an imminent danger to public safety. 2: Existing structures that do not meet the applicable standards for a new use are subject to Section 11, <i>Treatment of Non-conforming Structures and Uses</i> .
Existing non-residential uses	C-1, 2	C-1, 2	C-1, 2	C-1, 2	
Existing Trees that exceed the height limitations of this Ordinance	Ø	Ø	Ø	Ø	
<b>NEW RESIDENTIAL AND ACCOMMODATION USES</b>					
<b>Residential Uses</b>					
Single Family, Two-Family, Duplex Dwellings	Ø	CC-1, 2	CC-1, 2	CC-2	1: Limit density per Section 7(C)(6). 2: Construct to reduce interior noise to safe level. <sup>2</sup>
Multi-Family Dwellings	Ø	Ø	CC-1, 2	CC-2	
Nursing Homes and Other Group Living	Ø	Ø	CC-1, 2	CC-2	
Permanent Mobile Home Parks and Courts	Ø	Ø	CC-1	CC-2	
<b>Accommodation Uses</b>					
Hotels & motels	Ø	Ø	CC-1, 2	CC-2	1: Limit density per Section 7(C) (6). 2: Construct to reduce interior noise to safe level.
Transient mobile home parks courts (RV Parks) or lodgings	Ø	Ø	CC-1	CC-2	
<b>NEW PUBLIC, CIVIC, AND INSTITUTIONAL USES</b>					
<b>Educational Uses</b>					
Schools and Other Educational Services	Ø	Ø	CC-1, 2	CC-2	1: Limit density per Section 7(C) (6). 2: Construct to reduce interior noise to safe level.
Day Care Facilities	Ø	Ø	CC-1, 2	CC-2	
<b>Institutional and Assembly Uses</b>					
Correctional Institutions	Ø	Ø	CC-1, 2	C-2	1: Limit density per Section 7(C) (6). 2: Construct to reduce interior noise to safe level.
Government Offices	Ø	CC-1	CC-1, 2	C	



# Case Study – Willmar, MN

- Location
  - 2 hours west of Minneapolis
- Airport Operations
  - General aviation
    - —no commercial flights
  - 25,000 operations annually
- History and Development
  - Built in 1930s
  - 2 runways
    - (5,700 asphalt; 3,500 turf)
  - Substantial commercial/industrial development in city
  - Located next to industrial/business park





# Case Study – Willmar, MN

- History and Development
  - 1997 expansion thwarted by incompatible land uses
    - Lighted sports field
    - 130-foot high grain elevator
    - Single-family homes
    - Nursing home
  - Relocation cost (\$16.2 million) comparable to buy-out costs (city share = \$2.7 million)
  - City can redevelop old airport site and use to finance move
  - New airport is two miles west of city in county
  - 5,500-foot runway, improved instrument approaches, larger hangar area, modern terminal







# Project Volumes

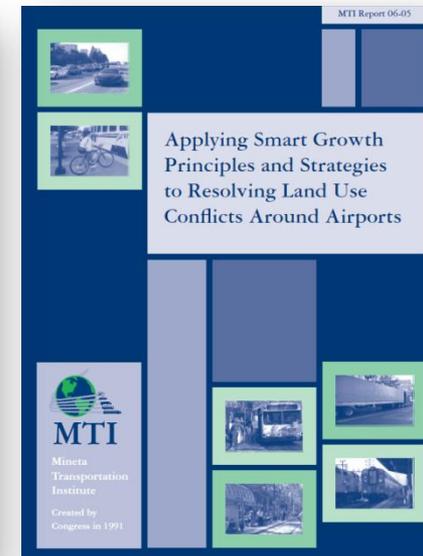
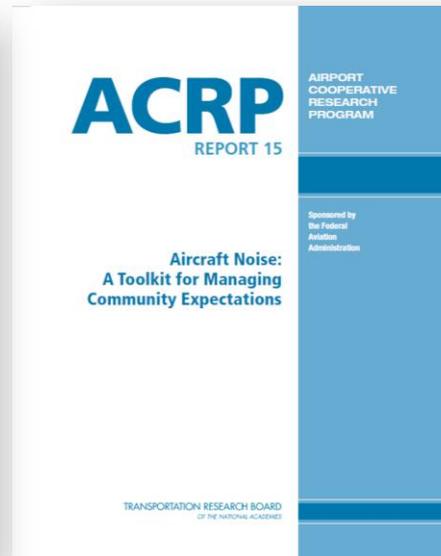
- Volume 1 (print)
  - Land Use Fundamentals & Implementation Resources
- Volume 2 (print)
  - Land Use Survey & Case Study Summaries
- Volume 3 (online)
  - Additional Resources
    - Aircraft Accident Data/3<sup>rd</sup> Party Risk
    - Economic Methodology
    - Annotated Bibliography





# Additional Resources

- Legal Research Digest 5, Responsibility for Implementation of Airport Land Use Zoning Restrictions
- ACRP Project 02-05 – Aircraft Noise: A Toolkit for Managing Community Expectations
- Mineta Transportation Institute Report 06-05





# Additional Information

- Please refer to the entire guidebook (Volumes 1-3) for additional information and guidance.

[www.TRB.org/ACRP](http://www.TRB.org/ACRP)

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