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Land Use Management and Airport Controls

A further study of trends and indicators of
incompatible land use

prepared by
Kai Ming Li

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Table of Contents

Acknowledgments

Executive Summary ----- 1

1. Introduction ----- 2

2. Manassas Regional Airport

2.1 Introduction ----- 3

2.2 Operational Statistics ----- 4

2.3 Economic Impact ----- 4

2.4 Land Use ----- 4

2.4.1 History

2.4.2 Current Projects

2.4.3 Future Projects

2.5 Local Government/Airport Relations ----- 8

2.6 Noise and its Effects ----- 8

2.6.1 Noise Complaint Collection

2.6.2 Patterns in Noise Complaints

2.6.3 Noise Complaint Statistics

2.7 Discussions ----- 10

3. Norman Y. Mineta San Jose Airport

3.1 Introduction ----- 11

3.2 Operational Statistics ----- 12

3.3 Economic Impact ----- 14

3.4 Land Use ----- 14

3.4.1 History

3.4.2 Current Projects

3.4.3 Future Projects

3.5 Local Government/ Airport Relations ----- 17

3.6 Noise and its Effects ----- 18

3.6.1 Noise Complaint Collection

3.6.2 Patterns in Noise Complaints

3.6.3 Noise Complaint Statistics

3.6.4 Community Program for Addressing Issues Relating to SJC

3.7 Discussions ----- 24

4. Cleveland Hopkins International

4.1 Introduction ----- 25

4.2 Operational Statistics ----- 26

4.3 Economic Impact ----- 27

4.4 Land Use ----- 27

4.4.1 History

4.4.2 Land Use Issues at CLE

4.4.3 Current Projects

4.5 Local Government/Airport Relations -----	30
4.6 Noise and its Effects -----	31
4.6.1 Noise Complaint Collection	
4.6.2 Patterns in Noise Complaints	
4.6.3 Noise Complaint Statistics	
4.6.4 Community Program for Addressing Issues Relating to CLE	
4.7 Discussions -----	36
5. Conclusions and Suggestions of Future Work	
5.1 Concluding Remarks -----	36
5.2 Recommendations and Suggestions of Future Work -----	37
6. References -----	39
Appendix A Glossary of Terms -----	42

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Executive Summary

This follow-on study of land use and noise complaint patterns near airports was conducted in order to better understand the dynamics of land use management, public concerns, and annoyance related to aviation noise. In Phase 1 of the project, Fort Lauderdale-Hollywood International Airport, Orlando-Sanford International Airport, and Denver International Airport were selected for in-depth study. In this one-year, follow-on project, Manassas Regional Airport, Norman Y. Mineta San José International Airport, and Hopkins Cleveland International Airport were studied. These additional airports provide three more exemplary profiles: one is a general aviation airport seeking to expand, another is a medium hub airport located in a densely populated residential area. The third airport is surrounded by suburban cities which are scrutinizing its operation and expansion. This report offers insight into issues that may affect public opinion regarding incompatible land use in airport vicinities. Recommendations are also provided for further study to explore the dynamics and drivers of public concerns in order to more effectively address noise complaint issues and associated land use problems.

1. Introduction

An earlier study¹ examined the dynamics of land use management, public concerns, and annoyance related to aircraft noise impacting residential areas near airports. Land use and noise complaints patterns were studied for three airports: Denver International Airport (DEN), Fort Lauderdale-Hollywood International Airport (FLL) and Orlando-Sanford International Airport (SFB). These facilities were selected as representative of three distinct profiles for airports and their surrounding neighborhoods. DEN was chosen because it has good geographical separation from populated areas; it characterizes one of the busiest airports in the country. FLL was studied for its rapid growth in airline traffic in recent years; it represents a mid-sized origin and destination airport. SFB exemplifies a medium-sized commercial airport with a history of moderate commercial air traffic; it is a typical regional airport that is used as a reliever hub.

A common feature of the study results for DEN, FLL and SFB was that a few residents around the airport neighborhoods filed a disproportionate number of noise complaints to the airport administrations. The study results also suggested a tendency for increasing populations near the selected airports.

This follow-on study was motivated by the need to further understand the dynamics and drivers of public concerns regarding the impact of aviation noise on residential communities in airport vicinities. To support this study, three additional airports were examined: Manassas Regional Airport (HEF), Norman Y. Mineta San José International Airport (SJC) and Hopkins Cleveland International Airport (CLE).

HEF, also known as the Harry P. Davis Field Airport, is owned by the City of Manassas. Currently, this public airport in the commonwealth of Virginia is dominated by general aviation traffic. Most of the flights, both private and commercial, are not scheduled services offered by commercial airlines. HEF represents a typical regional airport that is planning for expansion into commercial scheduled flights and supporting city growth through increased economic impacts in surrounding areas.

SJC is a medium hub, primary airport. The Federal Aviation Administration defines a primary airport as a commercial service airport with more than 10,000 passenger enplanements (boarding) each year. Medium hub airports are those with annual enplaned (revenue) passengers between 0.25 percent and 1 percent of the total enplanements of all airports in the country. SJC is located within 2 miles from the downtowns of both San José City and Santa Clara City; its problems are representative of those faced by many downtown airports. How airport administrations address the incompatible land use issues of airports surrounded by densely populated residential communities is of particular note in this study.

CLE, which is owned by the City of Cleveland, is another medium hub, primary airport. It is an established airport bordered by many suburban cities and counties. CLE represents a typical medium hub airport that seeks to upgrade its facility and negotiate additional air services. It is also located at the center of the country's Midwest airspace enhancement program. As part of this program, some flights in the region were re-routed to improve airspace usage. The study of CLE offers additional insight for understanding public concerns associated with aviation noise near airports.

In this one-year, follow-on study for the project "Land Use Management & Airport Controls: Trends and Indicators of Incompatible Land Use" interviews and personal meetings were held with various land-use stakeholders associated with each airport (e.g., airport administrators, city and county planners, neighboring residents and local activist groups). As a neutral party, we established independent, informal communications with each stakeholder. This

arrangement allowed for the examination of how well these stakeholders communicated with each other and what type of information they shared. Indeed, without effective communication, the creation of a compatible land use plan that meets the needs of all stakeholders is greatly hindered.

In this report, we present assessments of the communications between land-use stakeholders of each airport. Through independent interviews, we examine community perceptions of the impact from airport activities. The history of land-use development around each airport is provided to help develop an indicator or establish a trend for identifying incompatible land uses.

For the arrangement of this report, HEF information will be provided in Section 2, SJC in Section 3, and CLE in Section 4. Each section has a brief introduction of the airport presented: operation statistics, economic impacts, land-use issues, and community relations between the airport and surrounding residential areas. In addition, the effects of aviation noise including the airport's noise complaint policy, data collection, patterns of noise complaint, discussions and observations for each airport are included. Conclusions and suggestions for future work are offered in Section 5. A glossary of acronyms used in this report is provided in the appendix.

2. Manassas Regional Airport (HEF)

2.1 Introduction

Manassas is located in Virginia approximately 30 miles southwest of Washington, DC, see Fig. 2.1. The Manassas Regional Airport (HEF), was established at its present location in 1964, and today is the largest general aviation airport in Virginia. HEF is an aerial gateway for business coming to or from the City of Manassas and surrounding Prince William County. The airport has experienced tremendous growth and renovation over the years, improving its facilities to provide services to its customers and tenants.

The airport was originally constructed in 1928 by prominent businessmen who saw a need for an airport in the Manassas area. For the facility, 98 acres of land in an area known today as the Manaport Shopping Center were purchased and construction began on two turf intersecting runways approximately 2,000 feet in length along Virginia Route 234. At that time the population of Manassas was 1,215. In 1945, the city of Manassas purchased the airport from its private investors. The airport flourished over the next two decades, but with the increase in air traffic and growing housing developments, the town decided to move the airport to a new location. In 1964, the city began construction at the airport's current location with a single 3,700-foot paved runway, a rotating beacon, maintenance hangar, and thirty T-Hangars. In 1992, the city of Manassas expanded its airport facilities by installing an air traffic control tower for its main runway. In the past two decades, the airport has undergone many other changes, including the construction of a parallel runway, terminal building, new airfield lighting

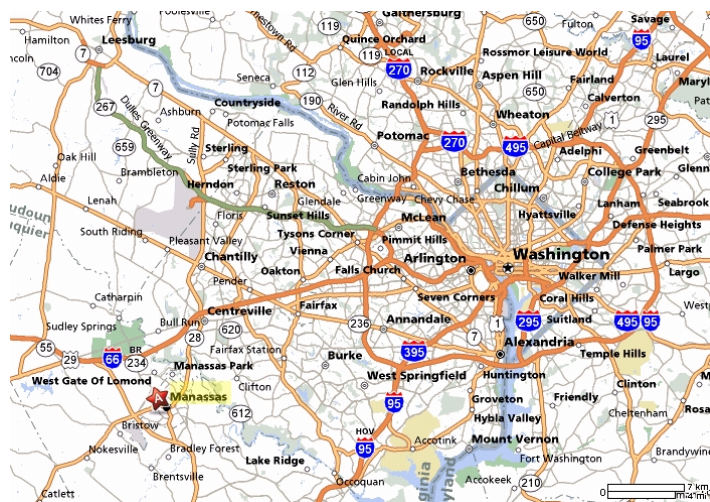


Fig. 2.1: Regional map of Manassas and Washington, D.C. (Source: MapQuest)

vault, segmented circles and the Precision Approach Path Indicator (PAPI) lighting system for its main runway. Currently, it is adding 30 more T-Hangars and developing into the busiest general aviation airport (not served by commercial airlines) in the Commonwealth of Virginia.

The city of Manassas has grown steadily throughout HEF's history with a population of 9,164 in 1970, 15,438 in 1980, 27,957 in 1990 and 35,135 in 2000.² During this period, the number of housing units in the region rose from 2,845 to 5,511, 10,232 and 12,114 for the same census periods.² These figures represent an increase of 93.7 percent, 85.6 percent and 18.3 percent in the 1970s, 1980s and 1990s respectively.

2.2 Operation Statistics

Manassas Regional Airport (HEF) is located 7 km southwest of the central business district of Manassas. It covers an area of 888 acres at an elevation of 59 m above mean sea level. HEF is mostly located within the city of Manassas, but a small section of the airport grounds are located in unincorporated Prince William County. HEF has two asphalt paved runways: 16L/34R of a size 1,737 m × 30 m (3700' × 100') and 16R/34L of a size 1,128 m × 30 m (3702' × 100').

Since 1992, the HEF air traffic control tower has handled an average of 134,000 aircraft operations per year. The Airport Master Plan was prepared in 1990 and the integral Airport Layout Plan (ALP) was updated in October 2002. The ALP report predicted that there would be 168,000 aircraft operations per year and more than 340 aircraft based at HEF.³ A recent report for a 12-month period, ending August 2006, suggested that the airport had 139,625 aircraft operations, an average of 382 per day: 68 percent transient general aviation, 30 percent local general aviation, 1 percent military and 1 percent air taxi. During the same time period, 401 aircraft were based at the airport including 72 percent single-engine, 18 percent multi-engine, 6 percent jet and 4 percent helicopter.⁴

2.3 Economic Impact

Manassas Regional Airport has greatly impacted the surrounding communities in many ways. The Manassas City Council has adopted a business development⁵ plan in which the city will "develop and implement strategies marketing the Airport (HEF) as the perfect choice for corporate businesses and as an overflow feeder airport for Dulles International and Reagan National Airport." HEF has continually had a significant economic impact in the community and surrounding county. In 2002, a study indicated that the airport has produced a \$45.8 million gain in the local economy.⁶ The airport was also responsible for producing 562 new jobs for the City of Manassas and Prince William County. HEF has also provided air ambulance, bank check transport, State Police, and charter services.

The airport has 26 tenants and 2 Fixed Base Operators (FBO). It is also actively seeking new tenants to further diversify services offered on the field. Currently, the airport houses one government agency, two research and developmental companies, a regional airline maintenance facility, an aircraft sales company, and other companies offering a range of services.

2.4 Land Use

2.4.1 History

HEF has kept its history in mind when addressing the issues of land acquisition and compatible land use. The need to maintain good relations with nearby neighborhoods and businesses is essential for the survival of an airport, and HEF has remained proactive in its approach. However, this objective has proven to be a challenge as the population of Manassas

has grown recently from 35,135 (according to the 2000 census)² to an estimated 38,066 in 2006. The number of housing units was estimated to be 12,750 in 2005 up from 12,114 recorded in the 2000 census. Many local municipalities oppose the plan for expansion of HEF; although, they do see the economic reward of residential and commercial development around the airport. The HEF administration, however, has taken proactive actions to purchase land and prevent future residents from moving closer to the airport.

One of the most problematic neighborhoods for the airport has been Moor Green, located half a mile from the south end of runway 16L-34R. In maintaining a proactive approach, the airport administration has purchased 112 acres, which translates into about 48 percent of the voting rights in the Moor Green Home Owners Association. The airport administration is extremely active in working with the Association to ensure a positive relationship with the residents. And, as a landowner, HEF participates in neighborhood decisions. The airport recognizes the need to continue buying surrounding property, yet currently has limited funding from the Manassas City Council for such efforts (Private communication, Spring 2007).

In addition to acquiring land in Moor Green, HEF has purchased land north of the airport. Prior to the airport's purchase of that land, a crane company was located on the site, posing a safety concern to incoming air traffic, particularly on instrument approaches. The airport administration was instrumental in purchasing that land and is now reselling it, although no buyer has been identified. The land is currently used as a training ground for drivers who wish to obtain a Commercial Driver's License (CDL).

The City of Manassas and Prince William County are booming with the development of residential neighborhoods, apartments, and shopping centers. This growth has caused the Airport Director to note a new area for concern northwest of the airport. A group of single-family town homes were recently built west of the airport and pose a potential problem because residents of this type typically expect a quiet living environment. However, new apartments recently built northwest of the airport are less problematic in terms of noise complaints because tenants in this apartment complex are typically accustomed to "city living" and associated background noise. In addition to these particular developments, 17 more housing developments are currently being built northwest of the airport.

The booming Manassas economy is not the only challenge for HEF. Current zoning laws also pose a potential dilemma for the future. Officials at the Prince William County Planning and Development Office noted that the area southwest of the airport is zoned semi-residential. This zoning may be a serious problem for the airport, not only because it could be developed residentially, but also because of the land's proximity to the airport. A Prince William County planner clarified the associated land use concerns as follows. For example, if someone were to buy a 10 acre plot, they would then be entitled to disperse this land as an estate, and divide it equally among several individuals, thus, allowing each individual to build one or more homes on their property, creating a potentially challenging situation for airport administration.

HEF recognized quite early in its existence a potential problem of housing developments near the airport. The Manassas City Council understood that it was difficult to address the problem of aircraft noise with a resistant community. Although communication remains open, the City of Manassas and Prince William County clearly have very different plans for the airport and their communities.

2.4.2 Current Projects

Since the arrival of HEF's current Airport Director, the facility has grown significantly. The airport administration has built three new business hangars on the northeast side of the airport, 32 new T-hangars on the southeast side of the airport, and a new taxi-lane for the aircraft. These expansions assure that HEF meets general aviation demands that are thrusting HEF into the role of a leading reliever airport for Washington Dulles International.

Currently, three businesses are expanding their operations to the northeast side of the airport. NextFlight, a major FBO, has plans to build on the northernmost part of the airport. South of NextFlight's plot is Springfield Financial Services Company. The southernmost construction area belongs to Chantilly Air, a charter aircraft company, which is located next to Optical Air and Data Solutions (OADS).

On the southeast side of the airport, 32 T-hangars are currently being constructed. The airport will own these hangars and lease them to individuals and businesses. There is also construction of a new taxi lane, known as taxi lane Golf, which will connect the new T-hangars to taxiway Bravo. The new taxi lane is considered a non-movement area and is not controlled by the tower.

2.4.3 Future Projects

As a small regional airport, HEF realizes the importance of maintaining and expanding its facilities and equipment in order to meet current and future demands. In doing so, a full list of future projects have been identified for the airport, including: expanding the south end of runway 16L-34R by 500 feet; updating paint on the taxiways and runways; building an internal connecting road; relocating the localizer antenna; updating the Air Traffic Control Tower; installing an Aircraft Rescue and Firefighting Station; and the possibility of adding Very Light Jet (VLJ) service. Figure 2.2 shows Manassas Regional Airport (HEF), City of Manassas and Prince William County.



Fig. 2.2: HEF, Manassas and Prince William County.
(Source: MapQuest)

The largest project that the airport is attempting to complete is the expansion of runway 16L-34R.

This expansion will lengthen the runway to the south by up to 500 feet, increasing it to 6,200 feet. In addition to allowing larger aircraft to take off and land, the extension will also allow current aircraft departing the airport to carry more fuel, therefore increasing their range significantly. However, the Airport Director stated that the airport is in no rush to extend the runway and has a tentative construction date of 2010. An environmental assessment must be completed before construction can begin according to the Manassas Five-Year Capital Improvement Program for 2007.⁶ Additionally, the bridges for taxiway Bravo and runway 16L-34R must be enlarged to meet the Federal Aviation Administration (FAA) standards. In the 2007

environmental assessment, the runway extension has been removed from consideration, however all information regarding the extension is still included in the assessment.

According to the HEF Airport Layout Plan, an internal road is also deemed a necessity. To meet this need, the airport is considering installing an internal road to connect the east and west side of the airport. Figure 2.3 displays a map of HEF and its adjacent roads. Currently, two roads, Observation Road and Wakeman Drive, connect both sides of the airport. However, these roads are maintained by the city and are used heavily by commuters going to the nearby rail station. The east-west road is needed since airport fuel trucks are unable to use the external road because they are not certified for use on public roads due to the position of their exhaust pipe. Therefore, the fuel trucks have to cross both runways each time they go to the

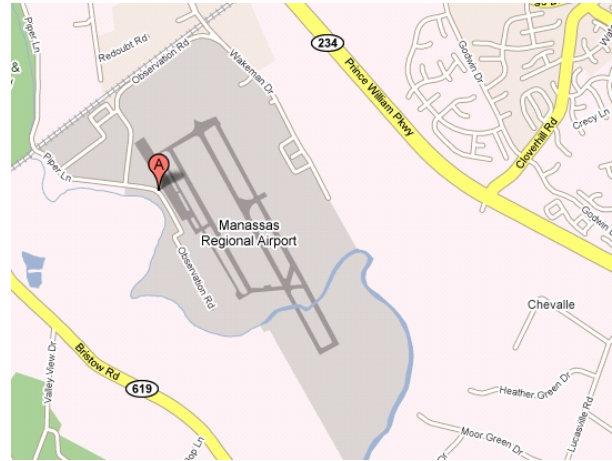


Fig. 2.3: A map of HEF (Source: Google Map)

other side of the airport, creating a major safety concern. Furthermore, if the airport is to become Part 139 certified they must build the internal road for any trucks due to the FAA regulations.

HEF administration is also interested in the possibility of adding the internal road since the airport is blocked to the north by Norfolk Southern Railroad and to the west by a low bridge. If an emergency were to arise at the airport and the railroad tracks were blocked, rescue vehicles would be stalled. Unfortunately, the only other entrance to the airport is Observation Road which blocks the entrance of large vehicles because of a low bridge. These barriers pose serious problems to the response times of emergency vehicles. The 2002 Airport Layout Plan proposed that a dedicated Aircraft Rescue and Firefighting Station be built on site near the fuel farms east of the airport. Three potential sites for such a station have been approved, all having a response time of less than three minutes to anywhere in the airport. While, FAA regulations do not require an on-site fire station, the airport feels there may be a need for one in the future.

Another possible project at HEF is realignment of the localizer for runway 16L Instrument Landing System (ILS) approach. The localizer is offset by 2.44 degrees due to a crane company that was once positioned just north of the airport. The airport administration recognized potential problems posed by the crane company and has since purchased the land and relocated the company. The airport administrators plan to realign the localizer straight down the runway thereby reducing landing minimums. The plan is to complete this project at the same time that the extension of the runway 16L-34R is implemented.

In April 1992, HEF dedicated a control tower that was previously used at Centennial Airport in Denver, Colorado. This control tower has been extremely expensive to maintain and is partially funded by the FAA. HEF is currently investigating building a new one because of the high maintenance costs. The airport would like to locate a new tower on the opposite side of Observation Road to enable more tie-down parking spaces and allow for future expansion, as noted in the 2002 Airport Layout Plan.

Furthermore, the addition of Very Light Jet (VLJ) operations at HEF may be considered. Eclipse Aviation approached HEF administration offering to make the airport an east coast distributor. Eclipse Aviation requested additional tax breaks, discounted hangar space, and other

incentives for coming to HEF. It was noted that the HEF terminal would be ideal for this use because of its small size; additionally, the future runway extension might help bring VLJ service into the airport. However, the airport administrators chose to observe the growth and success of this new business model before deciding whether to allow such operation at the airport. (Private communication, Spring, 2007).

2.5 Local Government/Airport Relations

It is important to understand the dynamics between the airport, the City of Manassas, and Prince William County. The airport is owned by the City of Manassas, but creates a peninsula extending into the surrounding Prince William County. This interesting dynamic forces the airport to work with both municipalities on matters important to the airport. In Spring 2007, the Planning Office of Prince William County provided greater insight on communications between the county, the City of Manassas, and the airport. One planner described the relationship between the airport and City Office as having open communication yet each having different opinions on certain key issues.

For example, building permits can be awarded to any zoned area, residential or commercial, without review from the County Board. However, issues concerning re-zoning must be approved by the county. In addition, there is no formal mandatory process for providing information regarding the height of a building to the airport administration. Although Manassas City planners try to identify these hazards as they review building plans, there is no formal practice for doing so. In most circumstances, the airport generally would review navigation charts to see if the new structure interferes with any flight routes or instrument approaches. It is important to note that the City does have the right to make objections to any proposed plans the County may have but carries no formal authority to deny or change their proposed plans.

The City of Manassas Development Office also provided insight on the municipality's relationship with the airport. Their Director of Community Development paraphrased Virginia Law 15.2-2204,⁷ which states that any change in zoning map classification or comprehensive plan within 3,000 feet of a licensed public-use airport must have a written notification given to the airport owner within 10 days. This law allows the airport to view proposed changes and recommend any necessary amendments to ensure the safety of arriving and departing aircraft.

2.6 Noise and its Effects

As housing developments increase around HEF, there is fear that noise complaints will increase. The Airport Director stated that use of aviation easements are non-existent in real estate contracts in Virginia; and, the implementation of an overlay district was met with great resistance from Prince William County (personal communication, October 27, 2006).

Although the City of Manassas supported the plan, resistance met by the county has prevented implementation of aviation easements and the overlay district. The county felt that property values of local homes would be diminished if these two programs at HEF were implemented. While the Airport Director argued that the value of those homes was already diminished, their fair market value had been adjusted for the presence of the airport. The proposed overlay district included the areas within the 1 mile 65 DNL⁸ zone. In the 65 DNL zone, an aviation easement would be implemented, and within the ½ mile 65 DNL zone, no residential zoning would be allowed. Eventually, HEF abandoned its push to implement the two programs but will attempt to revisit the issue in the future.

In addition, Prince William County has encouraged the airport administration to perform

a Federal Aviation Regulation (FAR) Part 150 Airport Noise Compatibility Program,⁹ but the airport has yet to agree. If a FAR Part 150 study were to be completed, the airport feels the contour lines would shrink around the airport, thus allowing land around the airport to be rezoned from industrial to residential thereby compounding the airport's problem. However, if the airport were to conduct the FAR Part 150 study, the county may agree to an overlay district.

2.6.1 Noise Complaint Collection and Noise Abatement Policy

HEF, like most airports, has a noise abatement program in place to accommodate associated complaints from the surrounding community. Noise complaints can be made via telephone or internet on the Manassas City website (<http://www.manassascity.org>). Recently, a 24-hour Noise Abatement Hotline has been established, allowing residents to register complaints due to excessive aircraft noise. When the airport receives noise complaints, an airport employee returns all calls or emails within 24 hours of the complaint. This process ensures that proper information is extracted from the community member. Moreover, it conveys the message that HEF is taking strides to address noise issues. The airport is advertising this new service in local newspapers and developing a commercial to be aired on local television stations.

The airport administration also requires the evening on-site security company to log all engine run-ups, takeoffs and landing. This procedure enables the airport to provide better documentation of aircraft activities that take place at night, identify any trends, and develop solutions.

In the Fall 2006, HEF's administration took a significant step toward addressing their noise issue for the City of Manassas by developing a Voluntary Good Neighbor Noise Abatement Policy.¹⁰ The purpose of this program is to inform local community members of the source and cause of aviation noise. It also created a set of voluntary operating procedures for aircraft to minimize the impact of aviation noise in the city of Manassas. The policy provides guidelines for pilots, FBO, and maintenance facilities. The policy also recognizes that the local FAA air traffic control tower and the dictates of aviation safety are the most important influences on flight operation. The policy encourages the airport tenants to follow the recommended guidelines as far as practicable. These guidelines include the relevant information for flight training, fixed wing flight operators, helicopter operators, preferred arrival and departure procedures for aircraft, preferred helicopter routes, engine run-up operations for all aircraft stationed at HEF, and noise compliant procedures. In particular, the policy recommends that that aircraft should climb 800 feet before turning over homes or populated areas. The policy further states minimum altitudes should comply with federal aviation regulations, which require minimums of 1000 feet over congested areas and 500 feet over non-congested areas.

The Voluntary Good Neighbor Noise Abatement Policy was distributed to airport tenants and local residents for review and comment. A final copy of the policy was agreed upon and put into place during the spring of 2007. The airport also distributed posters and brochures to the flight schools and Fixed Base Operators at the airport to inform transient aircraft and new flight students of the voluntary noise abatement procedures. This proactive approach has shown the community that the airport is attempting to address and curtail aircraft noise.

2.6.2 Patterns in Noise Complaints

During a tour of the community surrounding the airport, we visited Moor Green Drive and Flint Rock Road, which are both to the south of the airport and under the flight path of aircraft on final approach. According to noise complaint documentation, these neighborhoods are

the largest source of complaints in the area. As stated earlier, the airport has purchased over 100 acres around Moor Green Drive and near Flint Rock Road to stop any further developments in the area.

A resident living 3.5 miles away from the airport has frequently complained about run-ups during the middle of the night, and all of the complaints have been verified by airport security records. Colgan Air, a tenant on the field, was the sole reason for these night run-ups. Colgan Air is a regional carrier for United Express, Continental Express, and US Airways Express. HEF has housed the maintenance facility for Colgan's fleet of Saab 340's and Beech 1900's.

HEF addressed the issue by changing the location and position of the aircraft during night run-ups. Airport employees were sent to this resident's home with noise monitoring devices to measure the noise levels while the run-ups were taking place. The employees then measured noise levels again once the position of aircraft was changed. The measured results showed that noise levels decreased in the new position. Airport administration took no further action to mitigate related aircraft noise.

Another frequent complaint resulted from low flying helicopters taking off and landing at HEF. The airport is the home of a helicopter flight school and a base for helicopters used by local government agencies. Government helicopters are typically operated in emergency situations and their routes of departure are often selected as the most direct paths for arriving at the requested destinations. Helicopter activities usually generate excess noise levels. HEF brought this issue to the attention of the helicopter operators, and they willingly made changes in their operation procedures to address the noise concerns raised by local residents.

Since enactment of the Voluntary Good Neighbor Noise Abatement Policy in the Spring of 2007, there has been very positive feedback from airport tenants and the community. HEF administration has only received two aircraft noise complaints since its approval. Publications have been distributed at local flight schools and FBOs informing pilots of the new procedures. The decrease in complaints appears to indicate that, although voluntary, the new recommended procedures are being followed.

2.6.3 Noise Complaint Statistics

Unfortunately, the HEF airport administration did not normally keep a record of completed noise complaint forms over an extended period of time. Copies of all noise complaints dating back to 2005 were difficult to obtain (Private communication, Spring 2007). Nevertheless, recent records showed that the airport receives an average of 65 noise complaints per year, with approximately 90 percent of those related to the excessive noise from engine run-ups at night. Another significant source of complaint comes from the operation of helicopters which make low approaches and departures from the airport.

2.7 Discussions

HEF has seen significant growth and development since its inception in 1964. Following the historic tragedies of September 11, 2001, the airport has seen tremendous growth from corporate aircraft due to new restrictions at Washington Dulles and Reagan National. This increase in traffic has inevitably led to a heightened noise level at the airport and its surrounding areas, and further exacerbated noise issues at HEF. Despite proactive efforts of the airport administration to develop the Voluntary Good Neighbor Noise Abatement Policy and to work with homeowners in the airport's vicinity, resistance from local municipalities has prevented

HEF from enacting better solutions. Noise impact to the local community is often understated because HEF has a significant foothold in the aviation community and, particularly, in the area of Washington, D.C., preventing the facility's growth could be detrimental to development of the surrounding communities.

HEF has unique demographics because of its "peninsula" position in its nearby county. This poses great problems for the airport to expand and simultaneously keep its surrounding communities satisfied with the noise levels. In addition, there seems to be no formal lines of communication between the city and county regarding zoning around the airport. To prevent future problems from arising, a provision should be developed allowing the city to have jurisdiction over future zoning around the airport. This change will not only curtail residential zoning, but also reduce the prospect of the FAA having to purchase already developed homes residing in the current or future 65 DNL zone.

Moreover, there are also no formal channels of notifying the airport of height hazards, e.g. cell phone towers or tall buildings, around the airport. We suggested that an ordinance be put into place that makes it mandatory to obtain approval from the Airport Director for construction of any substantial structure within the immediate area of the airport.

Due to the success of the Voluntary Good Neighbor Noise Abatement Policy initiated by the administration of HEF, we suggest the airport make these noise abatement procedures mandatory for all aircraft operating on the field. This will not only make the facility quieter; it will give residents confidence in knowing that the airport understands their complaints and is taking strides to address the issue.

3. Norman Y. Mineta San José International Airport (SJC)

3.1 Introduction

San José is the third largest city in California and tenth largest in the nation with an estimated population of 974,000 in 2006. It is located about 50 miles southeast of San Francisco, California. Norman Y. Mineta San José International Airport (SJC) is the only major airport in Santa Clara County which encompasses Silicon Valley. It is situated two miles northwest of downtown San José and one mile east of downtown Santa Clara. See Figure 3.1 for a regional map of the San Francisco Bay area. The airport is bordered on the south by I-880, on the east by Route 87, and on the north by Highway 101. SJC is a so-called "downtown airport" which offers a convenient location for residents and visitors. However, this location has somewhat limited the scope of its development and further expansion because of its proximity to the cities. The heights of buildings are restricted in the downtown area of San José due to safety margins set in FAA regulations.¹¹⁻¹³

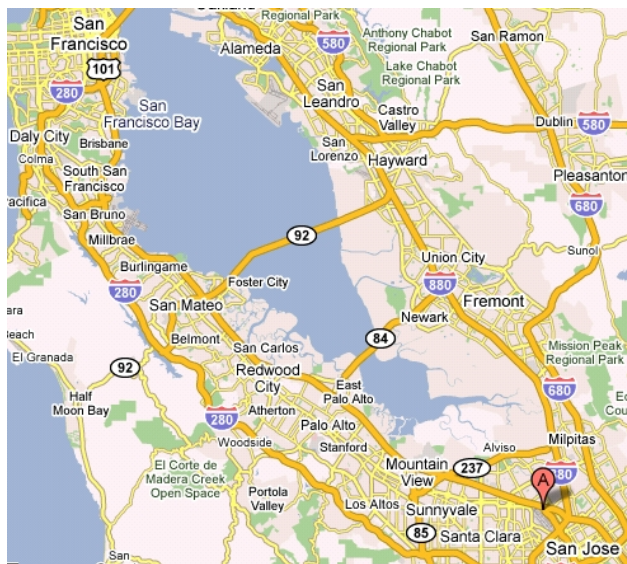


Fig. 3.1: A regional map of San Francisco Bay area and San José (Source: Google)

Vancouver, Canada. American Airlines also cut its non-stop service to Seattle, Portland, Denver, St. Louis, Phoenix and Miami, and downgraded its flights to Southern California as regional services. Air Canada suspended its SJC flight program to Toronto and Ottawa, Canada. The reduction in flight services continued throughout 2004. During that time, Alaska Airlines cut its seasonal services from San José to Puerto Vallarta and Cabo San Lucas, Mexico. American Airlines finally halted its international route from SJC to Narita Airport, Japan. To revive its local economy, the city of San José called to restore international flight from SJC to other destinations in Asian and European countries in April 2004. However, there is currently no flight service linking SJC directly to any country outside North America (Private communication, Spring 2007).

Following this decline in flights over recent years, 13 airlines currently provide service at SJC with over 31 destinations in the United States and 6 in Mexico as of April 2007. There are 82 passenger flights departing from SJC to another non-stop destination daily. The average number of departures and arrivals per day is 338 commercial and 156 general aviation operations. Approximately 30,000 passengers travel through the airport every day and 10.9 million per year in 2007.¹⁸

Since 2002, airline passenger traffic has remained relatively constant, while cargo (mail/freight) operations have decreased significantly. The airport handled approximately 51,000 tons of mail and freight in 2006 versus 89,000 tons (approximately) in 2002. In addition, the number of aircraft departures has declined slightly. For comparison, Table 3.1 shows statistics of the airport activities of certificated air carriers from 1999 to 2007.

Year	Total Passengers (Enplaned & Deplaned)	Passenger (Enplaned only)	Aircraft Departures	Mail & Freight/Tons
2007	10.7 Million (estimated)	5,255,216	***	***
2006	10,708,065	5,196,515	64,317	50,994.34
2005	10,756,786	5,233,967	64,462	53,315.05
2004	10,733,532	5,189,970	67,943	56,733.24
2003	10,335,975	5,041,304	67,280	58,088.13
2002	10,935,830	5,095,873	65,540	66,682.56
2001	***	5,865,995	76,286	88,932.05
2000	***	6,045,141	70,975	95,273.61
1999	***	5,487,338	67,453	83,445.01
<ul style="list-style-type: none"> • Records for total passengers (enplaned and deplaned) were obtained through the contact of SJC (Private communication, Spring 2007). Data was not available for the years 1999, 2000 and 2001. • Data for the numbers of enplaned passengers and departures of large certificated aircraft and the Mail & Freight tonnages are taken from U.S. Department of Transportation, Bureau of Transportation Statistics, Airport Activity Statistics of Certificated Air Carriers, Summary Tables, yearly records from 1999 to 2006. • As of August 2008, data was not available for aircraft departures and the tonnage of mail and freight for 2007. 				

Table 3.1: *The activities of Mineta Y. San José International Airport from 1999 to 2007.*

Throughout the calendar year of 2007, there were a total of 184,025 aircraft operations at SJC, an average of 502 aircraft operations per day. Of these operations, 53 percent were scheduled commercial, 22 percent were transient general aviation, 17 percent were air taxi, 9 percent were general aviation, and 78 operations (<1 percent) were from military aircraft. During that same time period, 166 aircraft were based at SJC of which 47.6 percent were single-engine airplanes, 6 percent were multi-engine airplanes, 45.8 percent were jet airplanes, and 1 (<1 percent) was a helicopter.¹⁶ In terms of the overall number of aircraft operations at a U.S. airport, SJC was ranked as the 42nd busiest airport in 2006 and 41st in 2007.

3.3 Economic Impact

SJC serves as an important engine within Silicon Valley's economy. According to the 2002 Annual Report, SJC generates 70,000 jobs in the San José area. It also contributes \$4 billion a year in direct business spending to the local community and \$136.6 million a year in direct business revenue, plus local, state and federal taxes.¹⁸

3.4 Land Use

3.4.1 History

A master plan is required for long-term development of an airport. A master plan may be defined as "the planner's concept of the long-term development of an airport. It displays the concept graphically and reports the data and logic upon which the plan is based. Master plans are prepared to support modernization of existing airports and creation of new airports, regardless of size, complexity, or role."¹⁹ The purpose of a master plan is to provide airport administration and surrounding communities with achievable goals and guidelines for future developments. These goals and guidelines should meet both aviation demand and community acceptance. They address important issues such as environmental compatibility and the coordination of air transportation with other modes of local, state and national transportation. An airport administration will normally prepare an airport layout plan in conjunction with a master plan.

The development of a master plan for SJC began at the end of 1987 and did not reach completion until the end of 1997. During the 1990s, SJC's airport administration faced increased community opposition from some residential areas. This opposition was due in part to rapid growth of the San José and surrounding areas in the 1980s and 1990s in conjunction with pending completion of the airport's master plan. These developments increased public sensitivity to the adverse impacts of the airport expansion. Throughout the master plan's development process, the SJC planner engaged with the local communities to seek feedback from residents. The airport planner noted that the residents and businesses close to the airport, who used the airport's services more frequently, tended to be more supportive of the plan than those residents and businesses located farther away and hence did not use the airport's services extensively (Private communication, Spring, 2007).

In light of the increase in opposition to the airport expansion plan, the airport administration took proactive actions to conduct a FAR Part 161 (Notice and Approval of Airport Noise and Access Restriction) study in addition to the standard FAR Part 150 (Airport Noise Compatibility Planning) study. The airport administration initiated this second study to explore the possibility of phasing out Stage 2 aircraft before January 1, 2000. However, no further actions were taken on the Part 161 study, because it was concluded that imposing the phase-out earlier was not an economically-viable solution.

Throughout the past decade, the airport administration has taken active steps to engage

surrounding communities in its planning decisions. The SJC's original master plan was adopted in 1997. It was amended in 2001. However, the scope, scheduling and financing of planned capital improvements in the revised plan have been unfavorably impacted by changes in economic conditions and security-related requirements affecting the aviation industry following September 11, 2001. In addition, SJC's administration further amended the potential development program in the master plan which led to a reduction of the estimated capital costs by two-thirds. The total capital program is now estimated to cost \$1.5 billion in future dollars for a two-phase program through 2017. The San José City Council approved the revision of the development program in November 5, 2005.²⁰

3.4.2 Current Projects

The first major land acquisition SJC pursued was an incompatible land use area consisting of 625 acres south of the airport, referred to as Guadalupe Gardens. The airport began purchase of this residential area in the 1960s through federal grants and completed the purchase in the 1990s. The City of San José plans to use this land as a landscaped garden and park area.²¹

Figure 3.3 shows an aerial photograph of Guadalupe River Park and Gardens. It is located directly south of SJC. Previously, it was the location of over 630 homes that were removed because of the adverse impacts from airport noise. The homes were located within one mile of the end of the airport's border. In 1975, the City of San Jose and the FAA approved implementation of the Airport Approach Zone Land Acquisition Program to remove incompatible land use from the area and restrict the use of acquired property to compatible open space or agriculture. Funding for the relocation of these homes was provided by the FAA. In 1986, the Mayor of San José proposed the creation of an open space and recreation area within the airport approach zone.



Figure 3.3: Picture showing the runways of SJC and Guadalupe River Park and Gardens (Source: Guadalupe Gardens – Design Guidelines & Implementation Strategy)

Furthermore, a Citizens Task Force was formed in 1990 to develop a master plan for the land that called for extensive gardens, to reflect the history of San José as the “Garden City.” In recent years, empty land in the area is starting to be restored and transformed into a variety of gardens for the public to enjoy.

In April 2002, the Master Plan for Guadalupe Gardens was approved by the San José City Council and the FAA. With the approved plan, the City of San José was successful in obtaining two grants for site preparation, irrigation and grass cover. These two projects were completed by May 2005. The City continues to look for other funding opportunities for further development of the Guadalupe Gardens area.

The City of San Jose has recently acquired land north of the airport, which is located in the city of Santa Clara. The land includes mobile home parks and older residential areas. To the west of the airport, FMC Corporation sold its 25-acre manufacturing complex to the City of San José, which has temporarily granted use of the area to SJC. The airport administration has no immediate plan for use of the land; however, there have been discussions of converting it into additional airport parking. In the future, SJC plans to build a cargo facility on the west side of the airport where a large parking area is currently located. The former land of FMC Corporation may then become relocation space for this displaced parking. Currently, the FMC land is zoned as future airport property but there have been discussions of rezoning this area as residential and using it for new light residential development. While the San José City Council and the city planning offices study SJC’s impact on industry and commercial availability, there is no associated study for the potential noise impact on future residents in this area. An interesting point arises here. Other than the requirements of road and water access, there is no formal mechanism to control the use of a land in the immediate vicinity of the airport after it is sold by the city (Private communication, 2006). Therefore, in principle, a real estate developer could buy the FMC land and turn it into residential projects with multi-family housing and retail shops.

An ongoing airport project examines the maximum height for high-rise developments in downtown San Jose, which is situated two miles from the south end of the airport runways. The project will eventually encompass the whole three-mile radius of the airport. At present, it solely focuses on the downtown area which is the only place where there are height restrictions on buildings. The purpose of this project is to ensure that high-rise developments comply with Federal Aviation Regulations (FAR) Part 77, Objects Affecting Navigable Airspace, or FAR Part 25, Airworthiness Standards: Transport Category Airplanes, restrictions. It is remarkable that the City currently uses only FAR Part 77 as a guideline for approving construction plans from its planning office. The airport administration commissioned this study because it was hoped that FAR Part 25 would be incorporated formally into the approval process for high rise constructions. This is an important decision for the airport because the San Jose City Council wishes to create a dynamic city skyline with high-rise buildings. Many of these high rise buildings are located merely three miles from the south end of the airport’s runways, and thus are a safety concern to the airport and its users.

The City Council of San José has yet to determine whether it will incorporate FAR Part 77 and Part 25 as a part of the approval process for future construction projects. If included, a database of parcels with minimum altitudes for FAR Part 77, FAR Part 25, and Terminal Instrument Procedures (TERPS) will assist with guidance for development heights of tall buildings. If FAR Part 25 is not included, the city will have the authority to control and impose height restrictions. Presently, local land use jurisdiction has the final decision for building approvals, and the FAA only gives recommendations. However, it is the responsibility of an

airport administration to ensure the compliance of all Federal Aviation Regulations. A non-compliance of FAR Part 25 or Part 77 can lead to closure of an airport.

Another important ongoing project is the Acoustical Treatment Program (ACT) which was created in order to minimize the impact of aviation noise on communities surrounding the airport. ACT works directly with property owners to offer sound insulation at no cost. Typical sound insulation treatments include replacement of doors and windows, weather stripping, attic insulation, electrical upgrade, and insulation of air conditioning units. The airport is currently in the last phase of the ACT program. To date, over 2,200 homes have been completed and another 550 will be completed by the summer of 2007. All properties which are located within the boundary of the 65 dB Community Noise Equivalent Level (CNEL) are eligible for the ACT program. The Noise Exposure Map (NEM) serves as the guide for the ACT program and determines eligibility within the program. SJC's administration will contact the owners of all eligibility properties. Those owners who have chosen to take part in the ACT program have been included within the completion timeline. The average amount of money spent on improvements in one household is \$34,000. An additional \$10,000 is spent on each house for design and coordination of the program.

3.4.3 Future Projects

As mentioned in Sec. 3.2, the San José City Council approved a scaled-back airport improvement plan in November 2005. This new two-phase development plan will be implemented by the city. Phase I called for a North Concourse and a simplified Terminal B to replace the aging Terminal C. Terminal A will be expanded to add more check-in counters, security checkpoints, and more curbside space for passenger drop-off and pick-up. As of the end of 2007, North Concourse steel framework was topped, and modifications of Terminal C including the demolition of its North end were completed. Construction for the Phase I plan will be completed by 2010 at an estimated cost of \$1.4 billion. The second phase of the airport improvement plan, which has an estimated cost of \$400 million, includes construction of the second half of the Terminal B and a South Concourse that matches the North Concourse. This construction will bring the total number of aircraft gates to the maximum of 40 allowed by the SJC's master plan in order to manage an estimated 17 million passengers annually.

3.5 Local Government/ Airport Relations

Situated between two cities, San Jose and Santa Clara, the airport is also part of Santa Clara County. However, the county of Santa Clara does not keep land use information involving the airport or any area covered by the cities of San Jose or Santa Clara. Any requests to the county for this information will result in a referral to the cities of San Jose and Santa Clara. The city of Santa Clara keeps land use information for areas north and northwest of the airport. The city of San Jose keeps land use information for areas south, southeast, east and northeast of the airport. Both city planning offices keep zoning maps, as well as a general plan which is updated approximately every ten years. San Jose's planning office has records in digital GIS format dating back to the year 2000. Santa Clara's planning office has limited records in digital format, including the general plan of its city.

The airport commission of SJC is in constant liaison with the Airport Land Use Commission (ALUC) of Santa Clara County. Its aim is to improve communications between city planners and airport planners regarding issues related to compatible land use planning in the City and the County. The ALUC was established in 1971 and monitors land use development

surrounding public airports in Santa Clara County (Reid Hillview Airport, Palo Alto Airport and South County Airport) and SJC. The ALUC maintains a “Land Use Plan” which defines policies and provisions for the regulation of land use, building height, safety, and noise insulation of areas surrounding public airports. The plan was implemented in 1973 and was rewritten in 1992. The ALUC holds monthly meetings and workshops in the city of San Jose. It has a primary responsibility of reviewing individual land use actions for areas surrounding public airports, including SJC.

The ALUC has developed and adopted a Comprehensive Land Use Plan (CLUP) since 1963. However, some of the CLUP land use policies are not necessarily adopted by the SJC Airport Commission and the City Council. For instance, ALUC has used the FAR Part 77 for reviewing applications from San José in the downtown area but the City Council has yet to decide on this issue. At one point, such inconsistencies in the land use policies between the City and CLUP led to a situation in which the City Council took an “override” action on CLUP’s recommendations.

There is an advocacy group, Citizens Against Airport Pollution (CAAP), which often contacts the SJC administration. CAAP is an advocate group of individuals from neighborhoods around San José and Santa Clara. It tends to battle for more stringent regulations for airport noise, air quality, and other environmental issues in the neighborhood area of SJC. CAAP has a website (<http://www.caap.org>) and publishes a seasonal newsletter (one issue in 2007 and two issues in 2006). The mission of CAAP is “to protect and restore environmental quality of the Santa Clara Valley. We focus on noise, air and water quality, as well as other critical environmental issues to keep our neighborhoods clean and quiet.” Additionally, CAAP often submits articles to the San Jose Mercury News related to environmental issues and their negative effects. When we met with the president as well as the legal council of CAAP, organization representatives stated that they are overall pleased with the airport and its concern for noise mitigation (Private communications, Spring 2007). CAAP believes they have attained an adequate level of compromise regarding noise issues. It is now focused on emissions issues and is currently pursuing monitoring surrounding communities.

3.6 Noise and its Effects

3.6.1 Collection of Noise Data

Noise is a significant concern for California residents and airport operators alike. The state of California has attempted to control land use surrounding airports to reduce noise and emission impact. California is unique in that it has a set of regulations that specifically govern airport noise, emissions, and land use. These laws are organized under California Title 21 (Public Works): Division 2.5 (Division of Aeronautics – Department of Transportation), Chapter 6 (Noise Standards). “The purpose of the ‘Noise Standards’ is to provide a positive basis to work toward resolving existing airport noise problems and to prevent new ones by providing a useful tool for land use planning.” The noise standards apply to any airport that has been designated as a “Noise Problem Airport” by the local County Board of Supervisors.

The noise standards specify the method to be used to measure noise, and the daily Community Noise Equivalent Level (CNEL) is used as the metric. CNEL is a measurement which represents the average A-weighted daytime noise level during a 24-hour day, with adjustments during evening and night time periods. These adjustments account for the lower tolerance of noise during those periods when ambient noise levels are lower. The noise standards specify a CNEL value of 65 dB as the maximum reasonable level of noise acceptable to a person

residing in the vicinity of an airport. The standard takes into account a variety of factors, including typical California home construction, partially open windows, speech, and possible sleep disturbance by aviation noise and community reaction.

Under Title 21, any airport may be designated as a Noise Problem Airport by the local county. The county must investigate noise complaints and litigation filed by local residents, examine the existence of a noise impact area, and coordinate with and consider recommendations of the airport land use commission. Once an airport has been designated as a Noise Problem Airport, the county, airport and the California Department of Transportation (DOT) each take on a variety of responsibilities which are described as follows.

The county has several responsibilities which include enforcement, auditing and reporting. The county is required to review and audit noise monitoring data provided by the airport to verify that it complies with requirements of the noise monitoring system plan approved by the DOT. The County is also responsible for submitting a quarterly report to the DOT within 75 calendar days of the end of the quarter. This report must contain a map illustrating the location of the noise impact boundary, an estimate of the number of people and homes residing in the impact area, the daily CNEL measurements identified by date, number of aircraft operations during the quarter, the number of aircraft operations of the highest noise level, the type of aircraft and any additional relevant information.

The responsibilities of the airport include cooperating with the county, establishing and verifying the Noise Impact Boundary, developing and scheduling a noise monitoring plan for implementation, controlling and reduction of noise problems. The airport is required to fully cooperate with the county government in any county investigation and provide any data regarding the location of noise contours. The airport is required to measure and validate noise impact boundaries with the use of acceptable noise monitoring equipment, which may include noise monitors and computer models. The boundary must be accurate to ± 1.5 dB of the annual CNEL. The airport is required to submit a noise monitoring plan to DOT consisting of locations and types of equipment to be used, justification for any deviations from the measurement system locations specified in the laws of Noise Standards, a statistical sampling plan for intermittent monitoring at community locations and any additional relevant information.

The airport is required to continuously monitor noise levels for at least 48 weeks every year if there are more than 1000 homes in residential areas that exist within the noise impact boundary with CNEL of 70dB. An intermittent monitoring schedule is also encouraged which would require obtaining a statistical sample of noise at each community location requested in the statistical sampling plan. This requires at least four non-consecutive weeks throughout the year of noise monitoring at these locations. The airport is required to submit a schedule of actions and events involved with the initiation of the noise monitoring plan within 90 days of the airport being deemed a Noise Problem Airport. This schedule must include an estimate of the number of homes within the 70 dB CNEL contour based on current airport operations and other relevant information. Lastly, the airport is encouraged to control and reduce current and future noise problems; several suggestions are included in the regulations of Noise Standards.

The California DOT has several responsibilities including review of county decisions to declare an airport a Noise Problem Airport, holding a hearing if requested, approval of the noise monitoring plan submitted by the airport, reviewing quarterly reports submitted by the county, retaining noise monitoring data, and approving variances requested by the airport. If the county decides to declare an airport a Noise Problem Airport, the department is required to investigate and review the decision made by the county. The department may choose to approve or deny the

request made by the county. The department must hold a hearing if requested regarding the department’s decision to approve or deny the declaration of the airport being a Noise Problem Airport. A hearing may be requested within ten days of the decision by the department, the county, the airport, or any other relevant party. An administrative law judge will make the final decision. The department is required to approve the noise monitoring plan submitted by the airport and review quarterly reports submitted by the county. The department is required to retain the county reports for a minimum of three years. The department is also responsible for approving deviations to the regulations to allow for certain geographic and land issues to fit the needs of the airport noise monitoring system. Deviations may include alternative locations for noise monitors and/or alternative measurement systems.

Variations are required by any airport deemed a Noise Problem Airport which has a noise impact area. The airport is responsible for applying for a variance and the department is responsible for approving the variances. The department may grant the airport a variance if it is in the public interest to do so. Variations are active for three years after which they must be renewed should the airport still have an active noise impact area.

The noise monitoring requirements and regulations include specific actions for any noise monitoring system implemented by an airport. Implementation is required if an airport is deemed a “noise problem airport” according to California Title 21. Any noise measurement system must be accurate to within ± 1.5 dB CNEL and must record continuously. The number and location of noise monitors is also specified in the regulations according to specific operations and airport size. The noise monitors, which record aircraft noise, must be placed in a location where the measurements will not be interfered by non-aircraft or other industrial noise sources. The number of required noise monitors present depends on the minimum number needed to achieve a tolerance of ± 1.5 dB CNEL when aircraft noise is recorded continuously. One monitor is normally required for intermittent operations. The regulations also include specific requirements for frequency response, range, microphone characteristics, linearity, and other performance characteristics for the noise monitors. They must be able to be externally calibrated and maintained and must not be degraded by weather or other environmental factors. Title 21 establishes the importance of monitoring, collecting, analyzing, and disseminating noise information. These requirements establish a norm through which California airports, including SJC, can provide the best service to their communities.

Should airport ownership change, the new airport owner must comply with all noise standards and apply for a new variance within twenty days after assuming ownership of the airport. The new owner must not allow any airport activity that would result in an increase in the size of the noise impact area.

3.6.2 Patterns in Noise Complaints

The development of some housing units over the past couple of years, are more problematic to SJC in terms of noise complaints. One such housing estate is the Communications Hill area, which is a

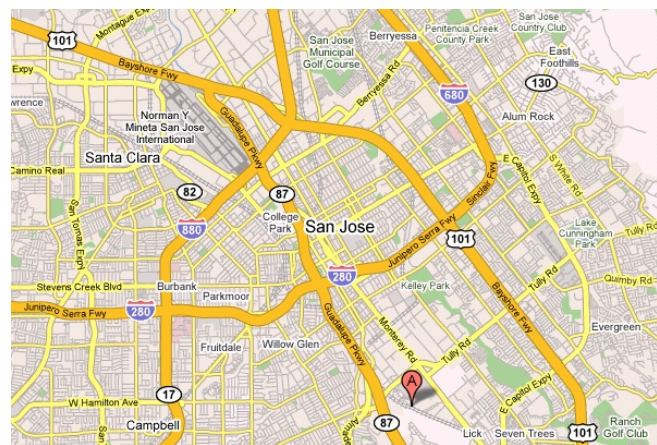


Fig. 3.4: A map of the City of San José. Communications Hill is marked as “A” in the vicinity of Route 87. (Source: Google Map)

residential community located seven miles south of the airport, see Fig. 3.4 for a map of Communications Hill (marked as “A” in the map) and SJC in the City of San José. Much of the community is situated atop a large hill, with remarkable views of the valley. However, its location at the top of the hill makes residences in this area more susceptible to the impact of air traffic noise because the arriving and departing aircraft are closer to the residential units. In fact, Communications Hill is a residential area which has been under continual development in the past few years. It is projected to have over 10,000 residential units upon completion of the construction project. Many homes have been completed and are occupied yet others are still under construction.

The flight path of aircraft arriving into SJC from the south is over the eastern edge of the hill. The elevation of the hill puts these homes hundreds of feet closer to flight paths during the take-off and landing of aircraft. There has been an increase in noise complaints from Communications Hill but there has been no formal communication between real estate developers and prospective home buyers about the proximity to these residential units to the flight paths of aircraft.

Rivermark, Santa Clara is located in close proximity to SJC, approximately one mile north of the main runways. The area is a high-density residential community mixed with some commercial buildings. Figure 3.5 shows an aerial map of Rivermark (marked as A). The airport administration has noted an increase in noise complaints from residents in this area.

The designated noise impact area around SJC includes several schools, churches and neighborhoods, all of which have been deemed “incompatible” by FAA standards. The acoustical treatment program has been proactive for mitigating noise in the area of “incompatible” land uses. Neighborhoods in the noise impact area include parts of San José, located on each side of the airfield and to the south, and Santa Clara, which is located directly north of the airfield (see Fig. 3.4 and 3.5). Other neighborhoods affected by noise but located out of the noise impact area include Willow Glenn, Rose Garden, Shasta/Hanchett, Hensley Park, and Civic Center in the City of San José. Willow Glenn is an affluent neighborhood located approximately three miles south of the airport. Rose Garden and Shasta/Hanchett are residential areas located approximately one mile south of the airport. Hensley Park and Civic Center are regions located within two miles southeast from SJC.

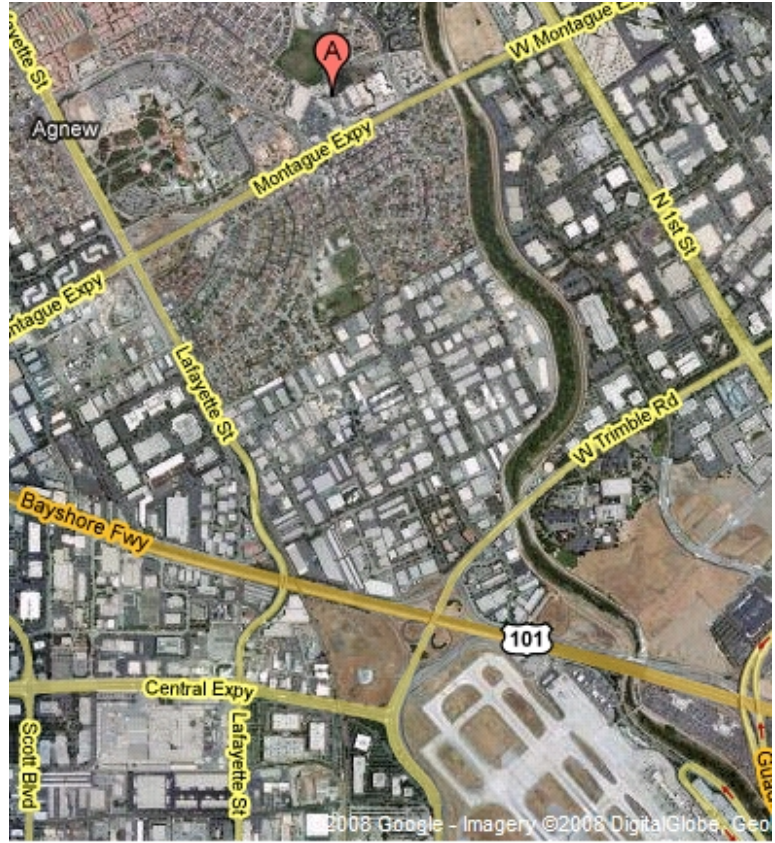


Fig. 3.5: Aerial map of the City of San José. Rivermark is shown as “A” in the map. (Source: Google Map)

To understand the noise complaint pattern for SJC, it is important to note air traffic patterns in the airport. Generally speaking, there are two air traffic flow directions at the facility. On an annual basis, approximately 85 percent of aircraft operations occur in a northerly direction. The remaining 15 percent of the aircraft operations occur in the southerly direction. During the southern reverse traffic flow, areas to the south of the airport will experience higher noise levels from takeoffs than the normal levels heard from landing aircraft. Hence, in this situation, there is a greater chance that residents who live in Willow Glenn, Rose Garden, Shasta/Hanchett, Hensley Park and, Civic Center will submit noise complaints.

The Noise Monitoring Center (NMC) monitors airport noise and the impact of noise on communities surrounding the airport. The NMC is responsible for the airport's noise monitoring plan and establishing the noise impact area. The NMC is also responsible for gathering noise complaints from the community and producing a monthly noise report. Figure 3.6 shows a typical predicted noise contour map in the vicinities of SJC.

The NMC has installed and maintained 15 remote monitoring stations around the neighborhoods near the airport. Seven of these monitoring stations are placed at different locations in the City of San José. Another seven monitoring stations are placed in the City of Santa Clara. The last monitoring station is placed in Santa Clara County.

The NMC has a dedicated hotline for taking noise complaints from community members. The number is connected to a voice recording system which has prompts requesting certain information. Community members familiar with the system may forward through the prompts to leave their complaint information. Information requested during the complaint process includes the complainant's name, address, phone number, date and time of the noise event and whether or not a callback is requested. If a callback is requested from the community member who left a

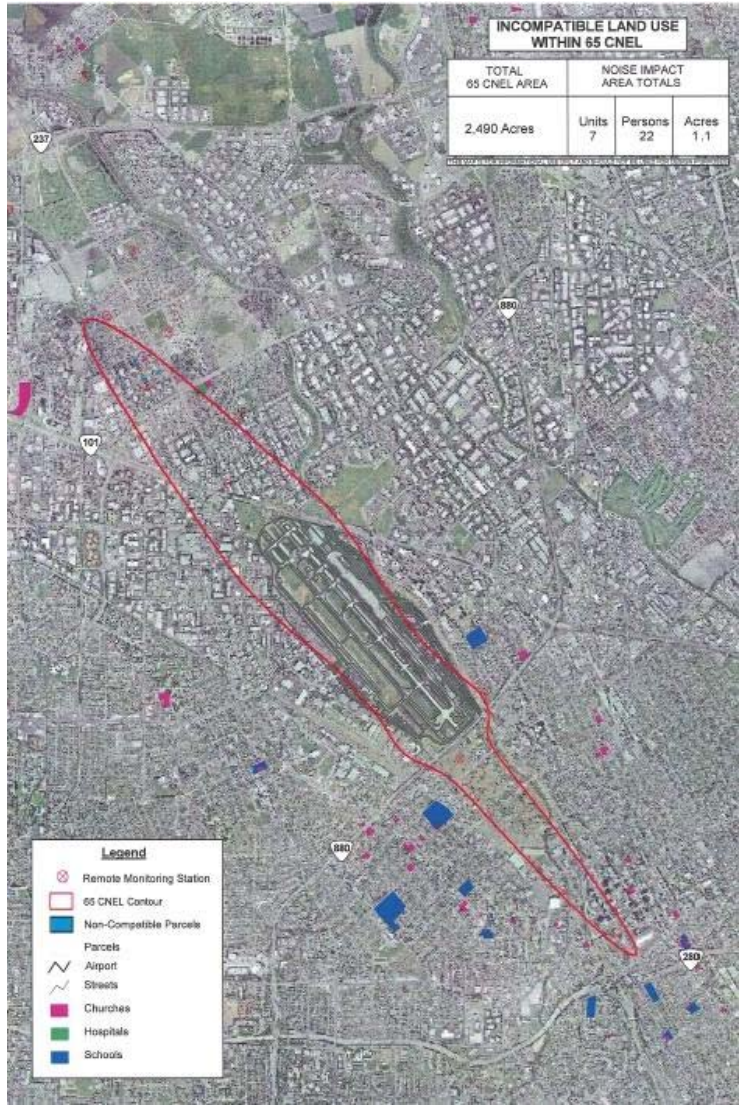


Fig. 3.6: A Contour Map of the predicted noise level in the neighborhood communities of SJC for third quarter of 2007. (Source: SJC website)

complaint, the NMC must return the call within 24 hours. This 24-hour window includes weekends and holidays.

The NMC investigates all noise complaints received and keeps a record of the outcomes of all investigations in the monthly report. Caller information remains confidential to prevent media and neighborhood groups such as CAAP from contacting the caller, which had occurred in the past. All complaints are published on the airport's website and each complainant is identified, not by their name, but by the general location of the call. For example, a "John Doe" may have made 25 calls from Willow Glenn, but would be published as "Willow-25". This way an individual can recognize how many calls they have made that month without divulging their identity to the entire community. New callers are sent a "first-time caller package" which consists of a letter and FAQ brochure. Chronic complainants are sent a postcard at the end of the week thanking them for their complaints. Complaints arising from unusual airport activities are handled differently; the NMC sends a customized letter to the caller explaining the situation.

3.6.3 Noise Complaint Statistics

The average number of noise complaints received per month is typically under 100. Ninety percent of all complaints involve normal airport operations. Seventy to eighty percent of complaints are from chronic callers (Private communication, Spring, 2007). The majority of complaints are received from Santa Clara residents north of the airport. Seasonal changes in weather have a profound effect on the surrounding communities which drives complaint levels. As mentioned in the last section, about 85 percent of the time aircraft depart the airport to the North. During winter months, the wind shifts from the north to the south, resulting in aircraft departures to the south. Communities such as Willow Glenn, Rose Garden, Shasta/Hanchett, Hensley Park and Civic Center typically complain more when aircraft are departing to the south. It is noted that the number of complaints are usually reduced during the winter holiday period.

3.6.4 Community Program for Addressing Issues Relating to SJC

SJC complies with the noise standard regulations through various programs run by the airport administration, which include the Neighborhood Services Group, Noise Monitoring Center and Acoustical Treatment Program.

The Neighborhood Services Group (NSG) actively communicates with surrounding communities and works with neighborhood associations and local business regarding all of the airport's community programs. The Neighborhood NSG attends local festivals, city council meetings, and neighborhood meetings when requested. Previously, the NSG held quarterly meetings with the surrounding communities. Meetings were held in a large room, but this approach ended due to lack of productivity. Currently, the NSG holds meetings with the community on request, and separates into several groups each focusing on a certain issue related to the airport, resulting in much more productive meetings. The FAA and other expert speakers have also attended meetings to provide information to the community. There are Airport Community Liaisons who provide information to interested parties on the host of issues including the Airport Improvement Program, Acoustical Treatment Program, and Noise Monitoring Center. In addition to the NSG, the San José Airport Noise Abatement Committee (ANAC) serves as an advisory committee to the San Jose City Council and the Director of Aviation. The ANAC holds quarterly meetings to discuss airport policies and decisions. The public is invited to attend all ANAC meetings and provide community input.

SJC is unique in that the City adopted its weight-based airport curfew as early as 1984 to reduce noise impact on airport neighborhoods. In 1990, federal law limited the ability of local airports to adopt new curfews or additional restrictions. Although federal law allowed the curfew ordinance of San José to remain in effect, the City faced legal challenges by aircraft owners and operators. It was argued in court that improvements in technology have allowed larger (and hence heavier) aircraft to be produced that are significantly quieter. The judge ruled that the curfew program based on the weight of an aircraft was illegal.

A new noise-based curfew has been developed and approved by FAA since October 2003. The new curfew is designed to prevent certain types of jet aircraft from landing or departing during times when community members are more likely to be affected by airport noise. The curfew prohibits Stage 3 aircraft louder than 89 EPNdB from operating between the hours from 11:30 pm to 6:30 am. Stage 2 aircraft under 75,000 pounds are prohibited from operating between the hours from 11:00 pm to 7:00 am.

The City Council of San José adopted the City Airport Curfew Ordinance in October 2003. The Airport Curfew has a number of exclusions built in to allow for mechanical issues, severe weather, security issues and emergencies beyond the aircraft operator's control. Under the ordinance, the Director of Aviation has authority to issue administrative fines of \$2,500 to any person responsible for each curfew violation. Any recipient of an administrative citation may request a hearing before the Airport Commission to contest the citation, but the Airport Commission's decision is final. As of the end of October 2006, the airport had collected \$316,160 in curfew administrative citation fines.

Recently the San Jose City Council decided to spend the collected curfew administrative citation fines on several new airport programs. In November 2006, the council voted to spend \$303,000 on implementation of the Fly Quiet program, an internship program, and an alternative fuel grant program. The overall goal of the Fly Quiet Program is to influence airlines to operate as quietly as possible in the local area. Monitoring, collecting, and analyzing aircraft noise data serves to highlight both airport trends and individual airline performance on specific noise abatement issues. Through the Fly Quiet Program, the airport administration ranks airlines on their noise abatement procedure and publishes a quarterly report. Through the competition, the airport administration hopes to encourage airlines to provide a quieter environment for the surrounding communities. The Fly Quiet program was anticipated to begin toward the end of 2007.

The internship program is a community outreach effort that offers academic mentorship, flight opportunities, scholarships, internship and career exploration and preparation coordinated by ANSG. The alternative fuel grant program is an initiative supported by the airport administration. This program aims to reduce emissions from motor vehicles that visit SJC by encouraging and promoting the use of alternative fuel vehicles, particularly compressed natural gas vehicles. The internship program and the alternative fuel grant program are now active.

3.7 Discussions

With the oversight of Title 21, SJC has been proactive in achieving a high level of air service to the Silicon Valley area while also utilizing the best methods for compatible land use planning and noise mitigation. While open lines of communication between the city and airport exist, there are still breakdowns regardless of the cooperative efforts on some issues. Similar to other airports within this study and previous studies, inconsistencies in the land use policies of the neighborhood cities and the county exist. Another problem resides in the conflicting goals of

city, county, and airport. The airport desires to limit the number of residential and tall buildings in close proximity to the airport, while the city and county desire an increase in residential areas since the Silicon Valley area is a highly desirable place to live. These factors are not unlike problems existing at other airports. The airport also desires to increase the use of SJC by Bay Area residents instead of using the San Francisco or Oakland airports. This would of course increase traffic and may receive opposition from residents in San José and Santa Clara. The airport believes that it will be successful in increasing future usage of its new Terminal 2 currently in construction as well as the airport's ease of use. SJC will continue to provide an important economical benefit to the Bay area and will serve as a primary business travel airport for the high technology industry that is so prevalent in Silicon Valley.

Although there are communication channels between the airport and residents in order to ensure that residential development is located at a significant distance from it, these channels will often be overlooked. Land in the airport's neighborhood will be saturated with residential developments as long as the property values continue to increase in San José (Private communication, 2006).

4. Cleveland Hopkins International Airport

4.1 Introduction

Cleveland is the county seat of Cuyahoga County, the most populous county in Ohio. According to the 2000 census, Cleveland was the 33rd largest city in the U.S. and the 2nd largest city in Ohio. Figure 4.1 shows a map of the city and its surrounding areas. The city is served by Cleveland Hopkins International Airport (CLE) which was founded in 1925 as the nation's first municipally-owned airport. Figure 4.2 details the airport in relation to the city. CLE is currently the largest airport by passenger volume in Ohio; it was 33rd largest nationally in 2006. The airport field is situated nine miles southwest of Cleveland's central business district. CLE is located adjacent to the Rocky River Reservation, of the Cleveland Metroparks system, and in the midst of the area's rural communities of North Olmstead, Olmstead Falls, Berea, and Brook Park. The proximity of CLE to Rocky River Reservation and the rural communities has placed constraints on the facility's possible growth. Located on-site at the airport are the International

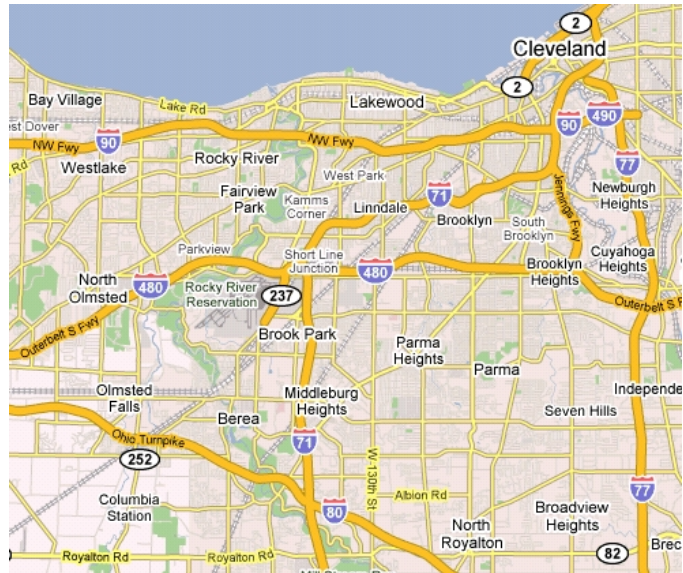


Fig. 4.1: A map showing the City of Cleveland. CLE is marked with A in the map. (Source: Google Map)

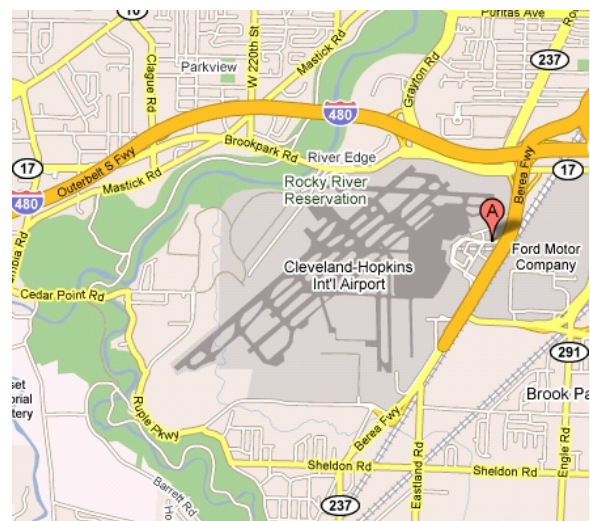


Fig. 4.2: A map showing Cleveland Hopkins International Airport. (Source: Google Map)

Exhibition Center (IX Center) and NASA’s Glenn Research Center, each of which have undergone changes of ownership and physical relocation in the interest of CLE. The Cleveland Airport system directly employs approximately 400 employees at the airport; there are approximately 9,000 on-site airport jobs in total. CLE, which is a self-sustaining operation managed under the ownership of the City of Cleveland, has an annual operating budget of \$129 million. All revenue earned by the airport is spent solely for airport purposes. The airport is funded by non-aviation related incomes, (e.g. concessions and parking fees), aviation-related incomes, (e.g. rents and landing fees) and federal grants.

CLE, which was named after its founder (former city manager William R. Hopkins) in 1951, has a colorful history. In 1930, the facility had the first air traffic control tower with ground-to-air radio control and the first airfield lighting system. Additionally, in 1968, it was the first U.S. airport that had a direct link to a local or regional rail transit system.

There has been a steady reduction in the population of Cleveland and its surrounding areas in the past four decades. The population counts of Cleveland City in 1970, 1980, 1990 and 2000 were 750,903; 573,822; 505,616; and 478,403 respectively. In the same period, the respective numbers of housing units were 264,090; 239,557; 224,311; and 215,856.

4.2 Operational Statistics

Cleveland Hopkins International Airport (CLE)²⁴ currently occupies an area of 1,900 acres of land and at an elevation of 791’ (24 m) above mean sea level. It has three runways:

- 6R/24L: a concrete runway of 8,999’ (2,743 m) long and 150’ (46 m) wide,
- 6L/24R: a concrete runway of 9,000’ (2,743 m) long and 150’ (46 m) wide, and
- 10/28: an asphalt/concrete runway of 6,017’ (1,834 m) long and 150’ (46 m) wide.

Year	Total Passengers (Enplaned & Deplaned)	Passengers (Enplaned Only)	Aircraft Departures	Mail & Freight/Tons
2007	11,459,390	5,571,260	***	***
2006	11,321,050	5,453,171	114,118	51,721.52
2005	11,463,391	5,506,040	116,216	50,925.54
2004	11,264,937	5,282,239	115,505	52,593.50
2003	10,555,387	4,989,325	110,356	51,343.73
2002	10,795,270	5,057,645	104,469	50,290.42
2001	11,864,411	5,528,785	119,607	61,957.79
2000	13,288,059	6,154,662	137,731	63,474.98
1999	13,020,285	5,921,429	129,712	83,445.01
<ul style="list-style-type: none"> • Records for total passengers (enplaned and deplaned) were obtained through the official website of CLE (http://www.clevelandairport.com). Data was not available for the year 1999, 2000 and 2001. • Data for the numbers of enplaned passengers and departures of large certificated aircraft and the Mail and freight tonnages are taken from U.S. Department of Transportation, Bureau of Transportation Statistics, Airport Activity Statistics of Certificated Air Carriers, Summary Tables, yearly records from 1999 to 2007. • As of August 2008, data was not available for aircraft departures and the tonnage of mail and freight for 2007. 				

Table 4.1: The activities of Cleveland Hopkins International Airport from 1999 to 2007.

The statistics of airport activities for CLE between 1999 and 2007 are shown in Table 4.1. It is worthy of noting that the population of Cleveland City and Greater Cleveland Metropolitan area has continued to decline due in large part to the loss of heavy manufacturing in the area. Despite this downturn in population, there is a modest growth of 4.5 percent in the number of passengers using CLE and 2.8 percent growth in mail and freight between 2002 and 2006.

CLE ranked 36th and 34th in the United States for arriving and departing passenger traffic, respectively. It handled approximately 10.5 million people in the 12-month period ending December 2005. The same period saw in excess of 110,500 scheduled departures of large certificated aircraft with a seating capacity of more than 60 seats or a maximum payload capacity of more than 18,000. CLE was ranked as the 27th busiest airport for scheduled departures of certificated aircraft in the nation in 2005. There were other airport activities in addition to the operations of large certificated aircraft. In 2005, records showed that CLE had 80,676 air carrier operations, 164,722 air taxi operations, 13,149 general aviation aircraft operations and 377 military aircraft operations. There were 14 single-engine aircraft, 6 multi-engine aircraft and 92 jet aircraft based at CLE in 2005.²⁴

Twenty-nine air carriers operate at CLE, the most prominent being Continental Airlines and its regional arm, ExpressJet. Together, these two companies account for 60.53 percent of the airport traffic and over 6,410,000 total passengers during the aforementioned 12-month period. Other notable operators include Southwest (10.52 percent), American Eagle (4.45 percent), and United Airlines (2.78 percent) (Private communication, Spring 2007).

CLE has three terminals and their estimated annual capacity can reach approximately 20 million passengers. Airport runway usage by departing direction for 2005 was as follows: 59 percent of aircraft departing to the southwest, 38 percent to the northeast, and 1 percent each to the east and west. For corresponding landing usage, 37 percent of aircraft land to the southwest, 60 percent to the northeast, 2 percent to the west, and the remaining 1 percent to the east.²⁵

4.3 Economic Impact

The Cleveland Airport System (CAS), which includes CLE and Cleveland Burke Lakefront (BKL) airports, has 378 direct-employees with another 9,500 positions related to the day-to-day operation of CLE and BKL. An estimated 29,000 regional jobs are also created as a result of airport activity.

For 2006, the CAS projected a \$4 billion impact on the City of Cleveland, a significant growth over the \$3 billion impact in 2004.²⁶

Continental Airlines is viewed as vital to the region's economy and has invested more than \$800 million in the airport over the past decade.²⁷ With the support from the State of Ohio, Continental Airlines will expand its capacity at CLE by 40 percent over a two-year period between 2007 and 2009. It will hire more than 700 new employees including, airport sales agents, customer service agents, pilots and flight attendants.²⁸

4.4 Land Use

4.4.1 History

CLE has a rich past that helped earn the airport a place in history when it was still known as Cleveland Municipal Airport. By 1925, the airport was already well established and at 1,014 acres, was the world's largest airport at that time. Major Jon Berry, the airport's founder and a former World War I engineer, increased the airport's size to 1,200 acres by 1944, twice as large as its nearest competitor, Washington National Airport in the District of Columbia.

The increase in size was also met with large increases in innovation. The airport was the first in the country to have lights for night flight and the first to have a radio-equipped control tower to put pilots in touch with ground personnel.

In the 1950s, the airport's growth and stability began to falter. Directly adjacent to the airport's boundaries were new residential communities used by war veterans. The airport, at that time, was not inhibited by community resistance from further expansion. Instead, the airport concentrated on revamping its existing facilities such as terminal concourses that were completed in 1958. With the introduction of turbojet and turbo fan aircraft in service, CLE saw another wave of rapid expansion in 1968. However, due to the lack of participation from the City of Cleveland, the airport's runways and facilities were not updated during this period.

In the 1970s, it was suggested that a regional airport be built on reclaimed land in Lake Erie for an approximate \$2.8 billion. Some city politicians labeled the airport project as a waste of taxpayer funds and terminated it. When the Airline Deregulation Act of 1978 was passed, the City of Cleveland was seemingly weakened by its decades-long "hemorrhage of people and money from its neighborhoods to the suburbs" (Private Communication, Spring 2007). To exacerbate the situation, the region was also losing jobs due to the decline of the manufacturing industry. In the past, United Airlines was the largest airline in CLE. Yet, by 1980, United Airlines discontinued its Cleveland hub operation in order to cut the operational costs. As a result, United Airlines reduced its scheduled flights and jobs from CLE and pulled out most of its service by 1986 in order to concentrate on using their freed-up aircraft and personnel to expand its respective hub operations at Chicago's O'Hare International Airport and Washington Dulles International Airport.

Over the next two decades, the airport has slowly recovered and expanded through small projects that included a \$1.4 million expansion of runway that was required by the FAA. In 1990, Continental Airlines underwrote a \$60 million expansion to Concourse C as the airline built up its respective hub operation at the airport.²⁹

As shown in Table 4.1, enplanements of large certificated aircraft at CLE rose steadily from 1999 to 2006. However, due to the ensuing economic recession and the events of September 11, 2001, the total passengers using CLE began to decline and have not seemed to fully recover from the level reached in 1999. More recently, the road and rail infrastructure that currently supports CLE has been placed under review for possible redevelopment, a study for which will be completed for the 2008 revision of the Airport Master Plan.

4.4.2 Land Use Issues at CLE

Potential problems for the airport and its surrounding communities lie within the fact that the airfield needs to expand in order to accommodate changes in the aviation industry and to bring new economic stimulation to the metropolitan area, the region and state.

The residential area to the south of the airfield poses the greatest difficulty to the airport and the respective communities. The airport administration acquired some land immediately south of the airfield for a proposed third parallel runway to be built. The land in question, which was mainly middle class residential housing, was able to be acquired due to an agreement between two suburban mayors. The airport was not able to purchase the land with funds provided by the City of Cleveland as the program did not qualify as an airport improvement, and the lands had to be purchased with funds coming directly from airport revenue. As of the most recent figures, the airport has spent \$36 million on this development phase which is nearly half of what the city anticipates on spending.

This respective land acquisition made up Phase 1 of the airport’s land acquisition program, and the airport has allocated seven years to finish the phase. To the east of this acquired land lies a residential area that is under the municipal direction of the City of Brook Park.³⁰ This area is scheduled to be acquired after Phase 1 is completed; the airport has put aside seven years to notify the municipality if the acquisition will begin.

According to the Cleveland City Planning Commission, the land that the airport has acquired to the south and any additional land it wishes to acquire will be very difficult to develop. Furthermore, the airport seemingly lacks the funding to develop the land into a usable site. The airport administration has tried to lease the land as a short-term solution and hopes the lessee will develop the land using private funds.

The airport administration has set up a Real Estate and Land Acquisition unit that handles the preceding land acquisitions and explores new revenue opportunities for the airport. One such opportunity the airport administration described was the acquisition of the International Exhibition Center (IX Center). It lies to the south of the airfield within immediate airport property and occupies a land area of 30-40 acres. The airport spent \$66 million to acquire the International Exhibition Center (IX Center) in the 2001 acquisition. The City of Cleveland provided \$30 million and the airport administration used its surplus from its operating budget of the year to cover the remaining \$36 million for the acquisitions. The International Exhibition Center (IX Center) had airside access and could potentially be demolished for a third runway. Due to a significant reduction in the number of the annual passengers using CLE, the airport administration reviewed the time frame for construction of the third runway from 2005 to the period around 2015 to 2020.³¹

A potential problem for the airport administration is the construction of Stone Ridge Apartments to the south. It is a real estate development project for a new apartment complex across from the airport on Sheldon Road; this land was acquired in the Phase 1 land acquisition program by the airport, see Fig. 4.3. The City of Brook Park owns the land and did not see that the completion of the complex would cause a problem of incompatible land use with the airport. The CLE administration expressed its concerns for the development but construction is continuing on the land.



Figure 4.3: The location of Stoneridge Apartments. (Source: Google Map)

To the west and southwest of the airport lies the Rocky River Reservation which falls under the jurisdiction of the Cleveland MetroParks. The area is a rugged, hilly terrain and includes a long ravine which is home to the Rocky River. Also within the area lies Aerospace Technology Park, which houses various operations. Further to the west lies an older middle class community beyond Cedar Point Road. These rural areas have limited the capability of the airport for its expansion to the west.

To the northwest of the airport lies a new condominium development, though not as close in proximity as the Stone Ridge complex. The NASA Glenn Research Facility, which conducts jet/aerodynamic research, is connected to airport property. It locks the airport land to the northwest.

4.4.3 Current Projects

Development plans at CLE involve the permanent closure of runway 6C/24C, the expansion of runway 6L/24R, and the uncoupling of runways 6R/24L and 10/28 as per a Record of Decision issued by the FAA in 2000. The Chief Airport Planner for the Cleveland Airport System until November 2006 discussed these projects with the research team and stated that the relocation and 2,500-foot extension of runway 6L/24R is expected to be completed in 2009. Additionally, runway 6C/24C will be decommissioned and transformed into a permanent taxiway.

On December 12, 2002, the airport's first major recent expansion was finished in the formation of runway 6L/24R. The City of Cleveland spent slightly under \$129 million for the new runway. With the 2,500 ft extension, the runway can handle 120 operations an hour – a 50 percent improvement in airport performance.³² In order to build the runway and include the extension, CLE filled a creek, cleaned up a landfill, moved a part of a bordering road (Brookpark Road as shown in Fig. 4.1) north of the airport, and relocated several buildings belonging to the NASA Glenn Research Center.

When the airport began drawing up plans for building the new runway, 6L/24R, community members began to question whether the project would harm 5,400-linear feet of Abrams Creek and 2,500-linear feet of two unnamed tributaries. The 87.85 acres of wetland in question were classified as Category 3 – an EPA designation that includes the most valuable wetlands. The City of Cleveland mitigated the impact of its project by restoring wetlands in other areas. The Native American Cultural Foundation stressed that the lands need to be handled with care as there were burials in the affected area. Yet, the city wanted more studies done to prove that Native Americans had lived in the Abrams Creek area. In addition, there was a concern for violating the water-quality standards due to the airport expansion plan. The City of Cleveland mitigated the situation further by running Abrams Creek through a culvert under the new runway.³³

4.5 Local Government/Airport Relations

There are two community organizations with which CLE has official relationships: The West Park Aviation Committee which represents approximately 40,000 residents in the Greater Cleveland Area, and the Suburban Mayor's Forum.

The Suburban Mayor's Forum was created by the former Chief of Planning for the Cleveland Airport System. The Forum is a private meeting in which Airport Planners meet quarterly with presidents of surrounding city councils. These meetings provide a mode of communication between airport administration and community leaders. Items discussed regularly at meetings include but are not limited to: capital investment information and plans; noise reports and statistics from noise monitors; and discussions of findings and impacts on the various communities. Coordination and consensus is sometimes difficult to achieve among the forum members from different cities. Nevertheless, a notable coordinated effort of the group was the implementation of a new electronic Total Airport Management Information System (eTAMIS) in

2007. It is a web-based software product for airport noise and flight operations monitoring which provides real-time flight tracking data and analytical tools for flight and noise analysis.

During a visit to the airport and the City of Cleveland, we had the impression that the level of communication between CLE with its neighborhood communities, planners of other cities and Cuyahoga County was somewhat inadequate. For instance, the Cleveland City Planning Commission (CCPC) has expressed concerns for their lack of information about proposed expansion plans of the airport and the plans of other communities surrounding the airport. CCPC also noted that a top-down approach was used for the zoning changes of the land around the airport. Many of these zoning decisions were taken without the involvement of CCPC. (Private communication, Spring 2007).

4.6 Noise and its Effects

4.6.1 Noise Complaint Collection

The airport noise compatibility officers in CLE handle all noise complaints. A dedicated hotline is set up to record complaints of aviation noise. Information about the date and time of the unusual aircraft occurrences and the contact information of complainants are collected. The noise compatibility officers normally register the complaint, obtain information in greater details about the ‘offending’ flight, evaluate the situations, and contact the complainant within the next business day. However, some community members expressed reservations over the usefulness of such information provided by the Noise Compatibility Officers (Private communication, Spring, 2007).

In addition to the Airport Noise Hotline, CLE has installed a total of 11 noise monitoring stations in areas around the airport to collect data on noise events. These noise monitoring

stations are mainly positioned off the approach and departure ends of the two parallel runways: Four of these stations are located in Cleveland (Stations 1, 2, 11 and 12), three in Brook Park, (Stations 4, 5, 6) two in Olmsted Township (Stations 7 and 10), and one each in Olmsted Falls (Station 8), and Berea (Station 9). Figure 4.4 shows the geographical locations of these noise monitoring stations. The measured annual DNL from 2002 to 2006 at these noise monitoring stations are shown in Fig. 4.5.

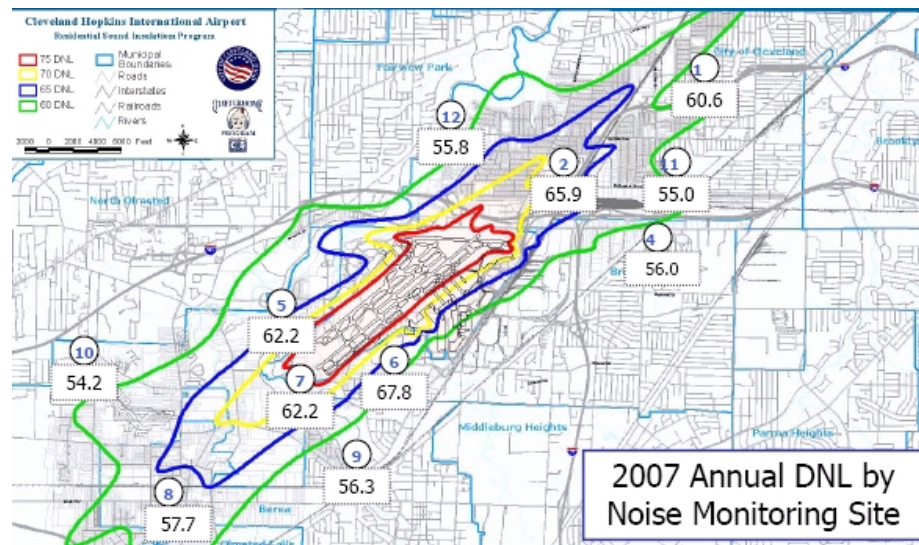


Fig. 4.4: A contour map of the predicted average Day-night noise levels (DNL) for neighboring areas around CLE. The eleven monitoring stations deployed around the airport are also shown. Station 3 is replaced by Station 12. (Source: Aircraft Noise Report for 2007 prepared by the airport administration)

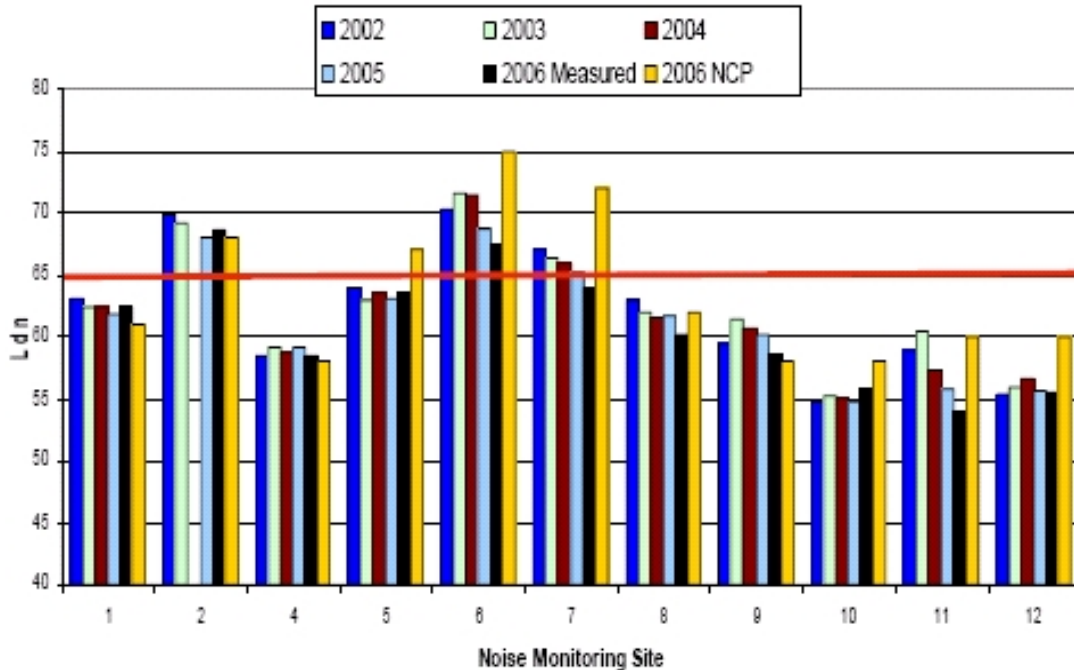


Figure 4.5: The measured DNL levels at 11 stations for the period between 2002 and 2006. The figure is taken from the Aircraft Noise Report for 2006 prepared by the airport administration. (The caption ‘2006 NCP’ in the above figure represents the predicted DNL at 2006.)

4.6.2 Patterns in Noise Complaints

From 2002 to 2005, data collected by the 11 noise monitoring stations showed that the average daily noise levels have decreased steadily in most of the 11 monitoring stations discussed in Sec. 4.6.3, see Fig. 4.3. Noise complaints for CLE are most common between 11 pm and 6 am, 7 days a week. There were roughly 250 complaints from neighbor residents related to aircraft noise annually before 2005. In 2005, there were a total of 131 complainants lodging 201 complaints to the Airport Noise Hotline. Of these 201 complaints, approximately 50 percent came from chronic complainants who made repeated complaints (Private communications, Spring 2007). One chronic complainant is a resident who was at one time, according to the airport, eligible for sound insulation in his home and now is no longer eligible. He is a knowledgeable and well organized critic of the airport, and has been responsible for mobilizing neighbors against the airport. The most notable instance of his mobilization efforts was his authorship of the “Terror in the Skies” pamphlet that he and his activist group distributed throughout the community.

The current political climate in the surrounding communities greatly affects the amount and type of noise complaints received by the airport as the community leaders are very active concerning the airport. Noise complaints, however, are not always directly related to noise events. For example, Brook Park has seen an increase in complaints recently. According to the airport, this is due to the recent determination by the airport and FAA that the community is no longer eligible for noise insulation (Private communication, Spring 2007).

A change in the noise complaint trends took place after the closure of runway 18/36 in 2000. Previously, many complaints came from the Fairview Park/Cleveland area and the Berea area. When the runway was closed, complaints of the aircraft noise due to residents from these areas had dropped.

There has been a steady downward trend of noise complaints between 2000 and the second quarter of 2006. However, the number of neighborhood residents that have negative views on the airport activities has increased significantly since June 2006 when the Federal Aviation Administration (FAA) implemented an airspace redesign known as the Midwest AirSpace Enhancement (MASE). MASE was a large-scale integrated airspace redesign, spanning airspace monitored and controlled by multiple FAA Air Route Traffic Control Centers (ARTCCs). It involved significant changes in route design that balance air traffic flows and reduce congestion and complexity.

Changes in air traffic routes in Cleveland and Detroit were one of the results of MASE. The southern and western departure routes from CLE were changed to optimize access to the overhead jet streams. Two additional departure routes were added, which headed north, then turned west and finally southwest over West Park, Fairview Park and Rocky River. Eliminated was a route that headed north, and then east before turning southwest over Brook Park. Due to the change of flight routes, there is significant increase in the number of annual noise complaints in the areas north of CLE at West Park, Fairview Park and Rocky River. On the other hand, there is a modest reduction in noise complaints from the areas south of the airport at North Olmsted and Olmsted Falls.

With the increased level of noise complaints, the FAA recently awarded CLE a grant of \$880,000 in June 2008 for the study of noise impact in the affected areas. The study will provide important information for the region’s response to the MASE program.

4.6.3 Noise Complaint Statistics

As discussed in the last section, the number of noise complaints received in 2005 was 201. In these incidents, 81 complaints were received in the 1st quarter (Q1), 48 in the 2nd quarter (Q2), 61 in the 3rd quarter (Q3) and 11 in the 4th quarter (Q4). Table 4.2 shows the annual noise complaints received by the airport administration and the number of complainants during the period from 2005 to 2007.

	2005	2006	2007
No. of complaints	201	311	651
No. of complainants	94	131	118

Table 4.2: *The number of noise complaints and complainants from 2005 to 2007.*
(Source: the quarterly Aircraft Noise Report published by the CLE administration, 2005 - 2007)

According the record, the number of complaints was around the level 250 between 2002 and 2005 (Private communication, Spring, 2007). Table 4.2 shows a marked increase in the number for 2006 with 311 noise complaints and it soared to 651 for 2007. The table also shows that the number of complainants increased by 39.4 percent from 2005 to 2006 but was reduced by 11.0 percent from 2006 to 2007. This statistic represents a significant increase in the number of chronic complainants who submit repeated complaints for noise events in the areas around the airport within this period. To understand the transition of the pattern, it is useful to show the quarterly noise complaint data for the period from the 1st quarter (Q1) to the 4th Quarter (Q4) of 2006 and 2007 as well as the data for Q1, 2008 in Table 4.3. In addition, Table 4.3 shows statistics for the areas where residents submitted their noise complains.

	Q1, 2006	Q2, 2006	Q3, 2006	Q4, 2006	Q1, 2007	Q2, 2007	Q3, 2007	Q4, 2007	Q1, 2008
(I) Areas north of CLE									
(1) West Park									
No. of complaints	6	10	116	21	26	59	131	143	79
No. of complainants	4	6	35	**	4	16	29	***	15
(2) Fairview Park									
No. of complaints	3	16	20	20	5	12	20	2	0
No. of complainants	3	9	12	**	3	4	11	*	0
(3) Rocky River									
No. of complaints	1	4	14	10	11	36	109	41	8
No. of complainants	1	4	9	**	4	7	14	**	2
(II) Areas south of CLE									
(1) North Olmsted									
No. of complaints	0	12	4	0	0	6	0	0	0
No. of complainants	0	2	2	0	0	2	0	0	0
(2) Olmsted Falls									
No. of complaints	4	2	8	3	1	4	2	0	1
No. of complainants	3	1	3	*	1	2	2	0	1
(3) Olmsted Township									
No. of complaints	3	3	8	1	0	5	10	5	0
No. of complainants	3	3	6	*	0	4	8	*	0
(III) All other areas									
No. of complaints	8	4	6	4	0	8	12	1	12
No. of complainants	6	4	5	*	0	4	10	*	6
Total (Inclusive of I, II and III)									
No. of complaints	25	51	176	59	44	130	284	192	100
No. of complainants	51	30	72	**	13	39	74	***	24
<ul style="list-style-type: none"> • Data extracted from the quarterly Aircraft Noise Reports between 2006 and 2008 published by the CLE administration. • Data for the number of complainants for the 4th quarters of 2006 and 2007 were not given in the Aircraft Noise Reports. 									

Table 4.3: Quarterly data for the number of noise complaints and complainants from 2005 to the 1st quarter of 2008. The symbols Q1, Q2, Q3 and Q4 denote 1st, 2nd, 3rd and 4th quarter of a calendar year.

A close examination of the map shown in Fig. 4.1 reveals that West Park, Fairview Park and Rocky River are within three miles radius north of the main runways, 6R/24L and 6L/24R. The areas for Olmsted Township including Olmsted Falls and North Olmsted, lay on the south end of the main runway. These cities represent the most affected areas by the operations of the airport. Residents in these two areas contribute over 80 percent of the noise complaints lodged to the Airport Hotline. A significant change in the pattern of noise complaints occurs between Q2 and Q3 of 2006, especially for the West Park, Cleveland where the number of complaints increased tenfold. This was largely due to the implementation of MASE in June 2006. The number of complaints eased for Q2 and Q3 of 2006 but the number rose steadily in the next three

quarters and dropped back slightly in Q1 of 2008. In 2007, the annual measured DNL showed reductions in all noise monitoring stations except Station 6 located at Brook Park, Stations 11 and 12 both located at Cleveland. There was an increase of 1 dBA compared with the 2006 level in Station 11 but less than 1 dBA in Stations 6 and 12. The bar chart of the measured DNL between 2003 and 2006 is shown in Fig. 4.6.

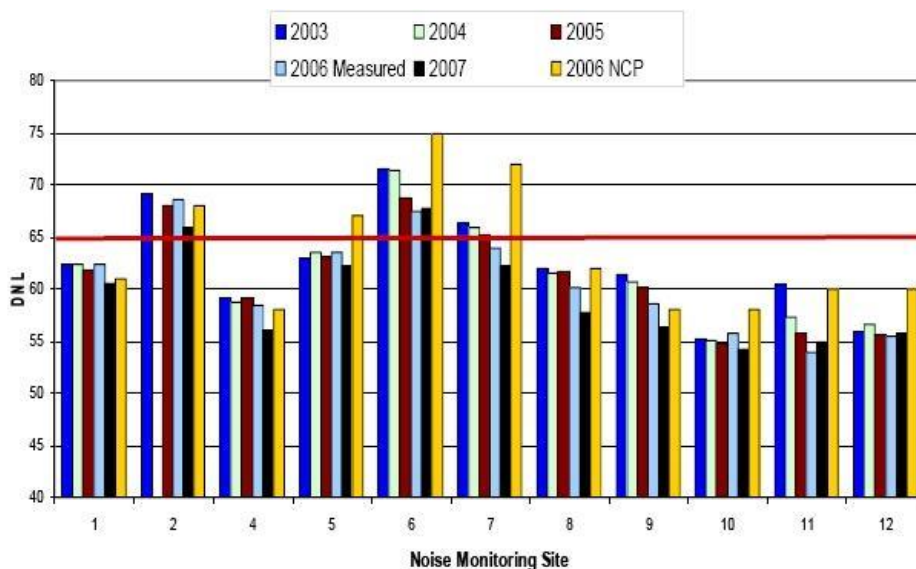


Figure 4.6: The measured DNL levels at 11 stations for the period between 2003 and 2007. The figure is taken from the Aircraft Noise Report for 2076 prepared by the airport administration. (The caption ‘2006 NCP’ in the above figure represents the predicted DNL at 2006.)

Most of the facility’s landing and take-off use is on the two main runways that align from southwest to northeast (6L/24R and (6R/24L). This usage accounts for over 97 percent of aircraft operations in CLE. Due to the prevailing weather conditions in Cleveland, aircraft fly in and out of the airport in the southwest direction about 61 percent and in the northeast direction about 36 percent. The number of noise complaints rise with the increase in the number of departure flights taking the northeast route. In addition, the number of chronic complainants has increased even more in recent months. There were a total of 24 complainants making 100 noise complaints in the Q1 of 2008.

4.6.4 Community Program for Addressing Issues Relating to CLE

For two decades, CLE has established a noise compatibility program to relieve the impact of aviation noise on its local communities. The airport administration has incorporated a Residential Sound Insulation Program (RSIP) to install acoustical windows and doors in neighboring properties since 1996. The program was freely available to homeowners of the area residents for reducing their indoor noise levels. The City also implemented two large acquisition projects since the 1980’s: the Airport Acquisition Program (North) and the Brook Home Acquisition Program.

The airport administration has enforced a policy for restricting the testing of aircraft engines within a designated time period in the airport. The airport administration has also provided operational guidelines to all aircraft owners and operators to maintain compliance with the aircraft run-up policy.

4.7 Discussions

Issues pertaining to CLE which can be controlled directly by the airport administration include:

- The airport administration appears to communicate well with those who are involved in the land acquisition program and those who participate in the sound insulation program. There is no evidence to show that there are effective communications between the airport administration and other civic and private authorities of the neighborhood communities.
- The airport administration lacks a consistent communication process with the various planning divisions of surrounding cities and counties.
- The airport administration does not appear to publicize its land use plans and policies to neighboring city councils.
- There was a lack of direct communication with its neighboring communities for the potential noise impact due to the Midwest AirSpace Enhancement (MASE) program before its implementation in June 2006. The unexpected increase in noise levels in some neighborhood areas (especially at the north end of the main runways) led to a significant increase in the number of noise complaints by lodged by the residents.
- The airport administration appears to lack direct engagement with local community members regarding the potential impact of airport activities. Community activist groups tend to view their liaison with the airport and city authorities as futile on these issues.

The main issue pertaining to the various municipalities is as follows. The various planning offices of cities bordering the airport do not communicate with airport administration on procedures for land rezoning and land swaps especially for areas in the airport's vicinity. For instance, the airport administration objected to the construction of Stone Ridge Apartments but the City Councils of Brook Park and Berea granted the developer a building permit to construct the complex for single-family apartments. The site of Stone Ridge Apartment, which is in a close proximity to the south end of the runways of the airport, can lead to a major issue of incompatible land use around CLE.

5. Conclusions and Suggestions of Future Work

The following section summarizes the outcomes of this one-year project and offers concluding remarks, recommendations and suggestions of further work.

5.1 Concluding Remarks

In the Phase I study, SFB, FLL, and DEN were chosen to represent three main categories of airports in the United States. SFB is a reliever hub airport that was used for general aviation operations in the past, but it is now faced with increased commercial operations and growing noise complaints. FLL is an established airfield located in a densely populated area facing issues related to airport expansion and changes in airport operations. DEN is a large hub, primary airport which was built as a long-term solution for airport land use issues. The three additional airports chosen for this follow-on study, HEF, SJC and CLE, present different perspectives to the problems faced by airport administrations. HEF is a general aviation airport which has a plan of upgrading its service as a possible reliever hub airport for the areas near Washington D.C. SJC is an airport located very close to the downtowns of two adjacent cities. It plans to re-vitalize its services for international flights connecting to Asia and Europe. SJC is faced with continuous scrutiny from local communities on its operations and its expansion plan. CLE is another

medium hub airport chosen for this study. It represents an airport facing the challenge of rerouting air traffic where the airport administration has met with increased noise complaints in the recent year. CLE has also been dealing with the same near-airport residential development concerns faced by many airports around the world.

Although all airports share the same basic purpose and infrastructure, their size, history, and environment make each one distinct. These characteristics are very important to understand when making land use development decisions. HEF, SJC and CLE all have certain similarities observed and conclusions can be drawn in an attempt to generalize these facilities to other airports in the United States. Lack of effective communication between airports, counties, city planners, developers, and the communities is the key issue in all three cases.

In the case of CLE, the airport is surrounded by four cities. Interviews with key personnel revealed that inter-city coordination occurs only at the mayoral level, and the airport is not involved in any zoning change decisions. Residential housing is being constructed directly adjacent to airport-acquired land as seen in the case of Stoneridge Apartments. At HEF, even though the City tries to identify the challenges as they review building plans, there are no formal means of notifying the airport of height hazards. In the case of SJC, interviews with City planners demonstrate inconsistencies in the usage of airport opinion with respect to residential zoning of the FMC property, which is a mere one mile away from the airfield. At all of the airports in these cities, market demand supersedes the fact that the resulting land use will most likely be incompatible with the airport activities.

Although each airport is unique, a lack of communication between all stakeholders involved was found to be the root of almost every issue the airports faced. These gaps in communication led to noise annoyance experienced by the residents of surrounding communities. Because of these complex situations, the airports studied had no real plans to solve either noise complaints or incompatible land use in the long term. Each airport found it difficult to enact noise mitigation strategies which would alleviate community concerns as a whole without creating other issues of similar magnitude. In addition, local airports do not have the authority to control near-airport land use or development. This lack of involvement allows local municipalities to zone the land surrounding airports for incompatible purposes. Airports often make attempts to work with municipalities and real estate developers to prevent incompatible land developments; however, these are not always successful. The need for greater cooperation and coordination between airports, local governments, and real estate developers is essential if any positive changes are to occur.

Negative outcomes of near-airport residential development include noise complaints and decreased community support for the airport. It is important to understand that annoyance with aviation noise and noise complaints are two separate issues. The subjective nature of complaints makes it extremely hard to understand and mitigate the surrounding issues. It is difficult to mitigate every type of noise complaint with one or even several mitigation techniques. In many instances, solving one complainant's problem will create problems for other residents who were previously not affected.

5.2 Recommendations and Suggestions of Future Work

Findings of the Phase I study and research done over the past year confirmed many previously held ideas regarding airport land use development, stakeholder communication, and their effects on surrounding communities. It also shed light on airport noise and its relationship to incompatible land use development. At times, the findings of our studies created more

questions than answers indicating that there is a great deal of research to be continued.

Certain recommendations are suggested in order to prevent incompatible airport land use and to minimize impact on citizens' lives. First and foremost, a proactive and effective communication link should be established and maintained between city, county, airport, neighborhood communities, and real estate developers. Airport administrations should be able to voice their concerns about near-airport incompatible land use and have a substantial influence in the decisions on the use of lands in the vicinities of airports. They should also make efforts to educate surrounding communities and provide forums where aviation education can take place and questions and concerns can be addressed. A nationally-standardized method of complaint collection and reporting should be designed and implemented in order to increase the value of noise complaint data and the ability to draw conclusions from its comparison and analysis. Community members should be informed of future projects and how they may impact their lives. Due to the importance of local airports, a cooperative and successful relationship between these parties will serve to benefit everyone involved.

It is suggested that an ordinance be put into place making it mandatory for any individual, city, county or real estate developers to obtain approval from the Airport Director for any substantial structure or zoning change occurring within the immediate vicinity of an airport and under flight paths. In addition, noise abatement procedures are currently voluntary at each of these airports. Making these procedures mandatory will certainly help in alleviating the issues between airports and the communities.

One limiting factor of the Phase 1 study and the current studies was the small number of airports that were investigated. An even larger sample of airports will give a broader spectrum of demographics and enable one to generalize common land use trends, local and state laws, and overall land use development history.

In addition, a supplemental study at emerging secondary airports similar in size to HEF would be helpful to compare how they are handling their prominent land use and noise issues, especially with the expected high volume of very light jet aircraft within the next ten years.

Airport land use, planning and noise management are formidable challenges faced by airports around the world. If local airports and surrounding municipalities are to coexist effectively, greater emphasis must be placed on these issues and continued study must be done to understand such dynamic and complex issues.

6. References

- ¹ K M Li, G Eiff, J Laffitte and D McDaniel, 2007. "Land use management & Airport Controls: Trends and indicators of incompatible land use," Report submitted to Partnership for AiR Transportation Noise & Emissions Reduction Center of Excellence, MIT. The report is downloadable at <http://web.mit.edu/aeroastro/partner/reports/landmgt-proj6-2008-01.pdf>.
- ² U.S. Department of Commerce, Bureau of Census, Data taken from the Census 1970, 1980, 1990, and 2000. In the data for 1999, it indicates counts of Manassas town prior to becoming an independent city.
- ³ Campbell and Paris Engineers, 2002. "Manassas Regional Airport Layout Plan."
- ⁴ Airport Information, accessed through <http://www.airnav.com/airport/HEF> (accessed on August 7, 2008), AirNav, LLC.
- ⁵ City of Manassas, 2003. "Comprehensive Plan, 2002," Plan obtainable at the website of Manassas City: <http://va-manassas2.civicplus.com/index.asp?NID=414> (accessed on August 7, 2008).
- ⁶ City of Manassas, 2006. "City of Manassas, Virginia Fiscal Year 2007 Five-Year Capital Improvement Plan."
- ⁷ Virginia General Assembly, 2008. "Virginia Law 15.2-2204 Advertisement of plans, ordinances, etc.; joint public hearings; written notice of certain amendments," the legislation is retrievable at the Legislative Information System, Virginia General Assembly at the following site address: <http://198.246.135.1/lis.htm> (Accessed on August 7, 2008).
- ⁸ DNL is known as the day-night average sound level. It is the average noise level over a 24-hour period with a 10 dB adjustment added to noise events between 10 pm and 7 am. A 65 DNL zone is the area where the 24-hour average noise level is below 65 dB.
- ⁹ See Glossary for the explanation of the FAR Part 150 Study.
- ¹⁰ Manassas Regional Airport, 2008. "Noise Abatement Policy," The policy is available at the following website: <http://www.manassascity.org/index.asp?nid=390> (Accessed on August 7, 2008).
- ¹¹ A. Hamm, 2006. "San Jose studying building heights vs. airport flights issue," San Jose Business Journal on February 24, 2006. The article is downloadable at the Website: <http://www.bizjournals.com/sanjose/stories/2006/02/27/story4.html> (Accessed on August 10, 2008).
- ¹² "Zoning Ordinance: Downtown Height Study". City of San Jose (2007-01-29). Website: http://www.sanjoseca.gov/planning/zoning/height_study/ (Accessed on August 7, 2008).
- ¹³ D. Lohse, 2007. "San Jose skyline vs. flight path," San Jose Mercury News published on January 30, 2007. The article is downloadable at the website : http://www.mercurynews.com/search/ci_5117866?nclick_check=1 (Accessed on August 7,2008). (2007-01-30)
- ¹⁴ Airport Report, Norman Y. Mineta San Jose International Airport, 2(8), January 2004. Website: http://www.sjc.org/AirportReport/Jan04/AR_content.html (Retrieved 1008/7/28).
- ¹⁵ C M Hogan and B George, 1985. "Design of Acoustical Insulation for Existing Residences in the Vicinity of San Jose Municipal Airport," Issues in Transportation Related Environmental Quality, Transportation Research Board, National Research Council, Transportation Research Record 1033, Washington D.C.
- ¹⁶ Airport Information, accessed through <http://www.airnav.com/airport/SJC> (accessed on August 7, 2008), AirNav, LLC.

- 17 Federal Aviation Administration, 2008. "Passenger boarding (Enplanement) and all-cargo Data:
http://www.faa.gov/airports_airtraffic/airports/planning_capacity/passenger_allcargo_stats/passenger/index.cfm?year=2006 (Accessed on August 10, 2008).
- 18 Norman Y. Mineta International Airport, 2008. "Airport Fast fact," Information can be obtained at the official website of SJC at <http://www.sjc.org/>
- 19 Federal Aviation Administration, 1985. "Airport Master Plans, 1985" Available from the Government Printing Office SN 050-007-00703-5.
- 20 Norman Y. Mineta San José International Airport, 2005. "News Release on November 15, 2005." Available for download at http://www.sjc.org/newsroom/archive_05.html
- 21 Royston Hanamoto Alley and Abey, 2008. "Guadalupe Gardens: Design guidelines & Implementation Strategy," Master Plan prepared for Friends of Guadalupe River park and Garden and the City of San José, July 2008. The report is downloadable at <http://www.grpg.org/Files/GuadalupeGardensDesignGuidelines.pdf.pdf> (Accessed on August 10, 2008). The photograph shown in Fig. 3.3 is taken from the Master Plan.
- 22 City of San José, 2004. "Memorandum issued from Stephen M Haase to Honorable Mayor and City Council on June 11, 2004." The information is downloadable at [http://www.sanjoseca.gov/clerk/Agenda/06_15_04docs/06_15_04_12.2\(a\).pdf](http://www.sanjoseca.gov/clerk/Agenda/06_15_04docs/06_15_04_12.2(a).pdf) (Access on August 10, 2008).
- 23 City of San José, 2008. "Resolution No. 74257," The information is downloadable at http://www.sanjoseca.gov/clerk/ORDS_RESOS/RESO_74257.pdf (accessed on August 7, 2008)
- 24 Airport Information, accessed through <http://www.airnav.com/airport/CLE> (accessed on August 7, 2008), AirNav, LLC.
- 25 Hopkins Cleveland International Airport, 2006, Quarterly Aircraft noise report, 4th quarter/year-end, 2006. The file is downloadable at <http://www.clevelandairport.com/site/547/default.aspx>. (Accessed on August 10, 2008).
- 26 C McGraw, 2005. "Cleveland Hopkins International Airport Celebrates 80th Anniversary" News released on July 27, 2005. The document is downloadable at: <http://www.clevelandairport.com/Portals/Documents/cbcb68f2-5802-4738-b602-cca7f587223f.pdf>
- 27 J Ewinger, 2005. "Cleveland officials aim to make airport fly as marketing tool." *The Plain Dealer*, p. B4, published on July 28, 2005.
- 28 Continental Airlines and City of Cleveland, 2007. "News Release on September 14, 2007."
- 29 A Benson, 1996. "High-flying stakes at Hopkins bigger, busier airport would boost Cleveland's economy," *The Plain Dealer*, p. 1A published on May 5, 1996.
- 30 City of Brookpark..2002 "Residential acquisition program: FAQs". Information downloadable at www.cityofbrookpark.com/airport%20relations/pdf/faq_version_1.2.pdf (Accessed on August 7, 2008).
- 31 M Rollenhagen, 2003. "Cleveland backs off airport home deal," *The Plain Dealer*, p. A1 published on June 30, 2003.
- 32 M Rollenhagen, 2002. "Hopkins gets breathing room: Cleveland to inaugurate long-awaited runway," *The Plain Dealer*, p. A1, published on December 8, 2002.
- 33 E Reed, 2001. "EPA hosts session of proposed airport expansion, Cleveland seeking OK to build runway in valuable wetlands," *The Plain Dealer*, p. 5B published on February 2, 2001.

³⁴ City of Cleveland, 2007. “Part three - Zoning Code, Title VII – Zoning code, Chapter 325 – Definitions,” Information is downloadable at FindLaw Web site: http://caselaw.lp.findlaw.com/clevelandcodes/cco_part3_325.html (Accessed on August 10, 2008).

Appendix A: Glossary of Terms

ACT	Acoustical Treatment Program
ALP	Airport Layout Plan
ALUC	Airport Land Use Commission
ANAC	Airport Noise Abatement Committee
ARTCC	Air Route Traffic Control Center
CAAP	Citizen Against Airport Pollution
CAS	Cleveland Airport System
CCPC	Cleveland City Planning Commission
CDL	Commercial Driver's License
CLE	Hopkins Cleveland International Airport
CLUP	Comprehensive Land Use Plan
CNEL	Community Noise Equivalent Level
COE	Center of Excellence
dB	Decibel
DEN	Denver International Airport
DNL	Day-Night Average Sound Level
DOT	Department of Transportation
EPA	Environmental Protection Agency
eTAMIS	electronic Total Airport Management Information System
FAA	Federal Aviation Administration
FAAP	Federal Aid to Airports Program
FAR	Federal Aviation Regulation
FBO	Fixed Base Operator
FLL	Fort Lauderdale-Hollywood International Airport
HEF	Manassas Regional Airport
ILS	Instrument Landing System
Ldn	Also referred to as DNL: 24-hour Average Day-Night Sound Level
Leq	Equivalent Conditions Sound Level
MASE	Midwest AirSpace Enhancement
MP	Master Plan
NSG	Neighborhood Services Group
NEM	Noise Exposure Map
NMC	Noise Monitoring Center
Q1	First Quarter
Q2	Second Quarter
Q3	Third Quarter
Q4	Fourth Quarter
RPIS	Residential Sound Insulation Program
TRACON	Terminal Radar Approach Control

Explanation of Terminology Used

The **Federal Aviation Regulation (FAR) Part 150 Noise Compatibility Program** is the primary Federal regulation guiding and controlling planning for aviation noise compatibility on and around airports. It is a voluntary program for airport operators aimed at balancing an airport's operational needs and its impact on the surrounding community. The purpose of the program is to identify what measures the airport operator has taken or proposes to take to reduce incompatible land uses and to prevent the introduction of additional incompatible uses within the area covered by the airport's noise exposure map. An approved NCP enables airport operators to apply for Federal grants for noise abatement projects.

The **Day-Night Average Sound Level (Ldn or DNL)** is the average noise level over a 24 hour period. DNL logarithmically averages aircraft sound levels at a location over a complete 24-hour period, with a 10-decibel adjustment added to those noise events occurring between 10:00 pm and 7:00 am (local time) the following morning. Because of the increased sensitivity to noise during normal sleeping hours and because ambient (without aircraft) sound levels during nighttime are typically about 10 dB lower than during daytime hours, the 10-decibel adjustment, or "penalty," represents the added intrusiveness of sounds occurring during nighttime hours.