

Initial Noise Abatement Alternatives

Introduction

The responsibility for evaluating alternative noise abatement and mitigation measures and taking the steps which are essential to minimizing the number of people who are adversely affected by noise does not rest with one individual, one governmental entity or agency, or one community. To the contrary, the authority and responsibility lie with a wide variety of federal, state, local and private entities. A coordinated approach to noise abatement and the sometimes difficult task of resolving noise impacts was outlined in the Department of Transportation/Federal Aviation Administration (DOT/FAA) Noise Abatement Policy of November 18, 1976. The need for noise compatibility programs has been nationally recognized since that time through passage of the Aviation Safety and Noise Abatement (ASNA) Act in 1979, the statutory authority for Federal Aviation Regulation (FAR) Part 150. Responsibility for the coordinated effort to abate noise impacts rests with the airport users, aircraft manufacturers, airport proprietors, federal, state and local governments, and residents within the environs of the airport.

The Federal government has the authority and responsibility to control aircraft noise sources, implement and enforce flight operational procedures and manage the air traffic control system in ways that minimize noise impacts on people. State and local governments have the responsibility to provide for land use planning, zoning and development controls that will encourage development or redevelopment of land that is compatible with both present and projected airport operations. In order to accomplish this task, the state must provide enabling legislation which grants authority to the local units of government to implement land use controls which are not confiscatory or discriminatory, based on the police power to protect the public health, safety and welfare.

In addition, the local units of government must work closely with airport management and staff, for it is the responsibility of the governmental unit having land use controls to ensure land use compatibility planning beyond the airport's boundary. The airport management has no authority to control the types of land uses outside the airport ownership boundary; this is the responsibility of the appropriate local unit of government.

The aircraft noise standards established by the Federal government must be met by the aircraft manufacturers through newly-designed engines and aircraft. The airlines are then responsible for replacing or retrofitting their fleet with these new aircraft and/or engines. The government established a timetable with which the airlines must comply, and full compliance was established in January 1, 1988 (FAR Part 36). Subsequent to this timeframe, Congress passed the Noise Act (The Airport Noise and Capacity Act of 1990 [ANCA], PL 101-508, 104 Stat. 1388) which established two broad directives for the FAA. The first directive established a method to review aircraft noise and airport use or access restrictions imposed by airport proprietors, and the second was to institute a program of phase-out of Stage II aircraft over 75,000 pounds by December 31, 1999. To implement ANCA, FAA amended FAR Part 91 and issued a new FAR Part 161. Part 91 addresses the phase-out of large Stage II aircraft and the phase-in of Stage III aircraft. The airlines were responsible for meeting this deadline by whatever method they could.

FAR Part 161 was established to work in conjunction with Part 91, in that it establishes a stringent review and approval process for implementing use or access restrictions by airport proprietors. This is in keeping with one of the major reasons for the Act, which was to discourage local restrictions more stringent than the Act's 1999 phase-out. Part 161 makes it more difficult for airport proprietors to implement use or access restrictions, especially those associated with Stage III aircraft. These difficulties are so significant that to date there have been no Part 161 plans approved by the FAA.

The Airport Proprietor is responsible for planning and implementing airport development actions designed to reduce noise. Such actions include improvements in airport design and noise abatement ground procedures, in addition to evaluating and recommending restrictions on airport use that do not unjustly discriminate against any user, impede the federal interest in safety and management of the air navigation system, unreasonably interfere with interstate commerce and are consistent with the provisions of ANCA. The proprietor of a public airport may establish restrictions, as long as the airport is available for public use, that do not unjustly discriminate among or between classes of aircraft; do not create an exclusive right; are reasonably related to a demonstrated noise problem; do not regulate aircraft safety or flight operations; do not regulate rates, routes or services of air carrier aircraft; and do not create an undue burden on interstate commerce (Airport Sponsor Grant Assurances; Airport and Airway Improvement Act of 1982, as amended; Federal Aviation Act of 1958, as amended; and the U.S. Constitution).

Basically, an airport proprietor, and state and local governments, are preempted from regulating the operations of aircraft, with one exception. They may exclude aircraft from an airport for noise reasons as long as the exclusion is reasonable and nondiscriminatory. In addition, it must comply with the provisions of the Airport Noise and Capacity Act of 1990, through FAR Part 161, and it must not attempt to regulate military aircraft.

Residents and prospective residents in areas surrounding the airport should seek to understand the existing and projected aircraft noise environment and what steps can

be taken to minimize its effect on people. Prospective residents of areas impacted by aircraft-generated noise should be aware of the effect of noise on their prospective residences and allow this to influence any decision to move into the area.

The development of reasonable alternatives is the focus of the FAR Part 150 noise compatibility planning process. The objective is to explore a wide range of feasible alternatives of land use patterns, noise control actions and noise impact patterns, seeking optimum accommodation of both airport users and airport neighbors within acceptable safety, economic and environmental parameters. Consideration of alternatives should address both physical planning and the implementation aspects of proposed solutions. Some alternatives may have little or no value in the particular situation, especially if used alone. Each alternative considered should: 1) have the potential of resolving the problem; 2) be implementable within acceptable economic, environmental and social costs; and, 3) be legally implementable within existing federal, state and local legislation, regulations, and ordinances.

This section contains a description of potential noise abatement and mitigation measures or actions for King County International Airport. A general evaluation of each is made on the basis of the three factors listed above, and will be presented in three different categories: a) those alternatives available to the airport proprietor; b) those alternatives available to the state or local unit of government; and, c) those alternatives dependent upon Federal government concurrence for implementation.

In addition, the Regulation identifies several alternatives that are required for evaluation. These required alternatives are:

- Acquisition of land or interest therein;
- Construction of barriers and acoustical shielding, including soundproofing of public buildings;
- Implementation of a preferential runway system;
- The use of flight procedures (including modification of flight tracks) to control operation of aircraft to reduce exposure to individuals;
- The implementation of any restriction on the use of airport by any type or class of aircraft based on the noise characteristics of those aircraft;
- Other actions or combination of actions which would have a beneficial noise control or abatement impact on the public; and
- Other actions recommended by the FAA.

These are explained in greater detail in the following sections.

A. Options Available to the Airport Proprietor

A.1. Denial of Use of Airport to Aircraft Not Meeting FAR Part 36 Standards.

This alternative is implemented by limiting access to the airport to allow aircraft that conform with certain FAR Part 36, Stage II, noise level requirements. Most turboprops and other large aircraft produced after 1964 were required to meet those standards. Older, noncomplying (Stage I) turbojets over 75,000 pounds maximum gross takeoff weight, which have standard airworthiness certificates, were required to be retrofitted with quieter engines and/or nacelles or cease operating in U. S. airspace as of January 1, 1985 (Part 91, Subpart E). Two provisions of Part 91, Subpart E, allow the operation of noncomplying two engine airplanes after the January 1, 1985, deadline. The "Replacement Plan" provisions allowed a one year extension (January 1, 1986) and the "Small Community Exemption" provision allowed a three year extension (January 1, 1988) for two engine aircraft with one hundred passenger seats or fewer. These dates have all been achieved and there is now full compliance.

Denying such Stage I aircraft use of the airport is a feasible option, provided the action is not unjustly discriminatory, does not constitute a burden on interstate and foreign air commerce, and does not conflict with any airport policy or requirement. In addition, military aircraft do not have to comply with these regulations during the same timeframe. This alternative is feasible where the majority of the aircraft fall within the parameters of FAR Part 36. However, to restrict Stage III or Stage II aircraft under 75,000 pounds, the provisions of Part 161 must be complied with. This includes a cost/benefit analysis of the proposed restriction (with FAA approval of the methodology or results) and proper notice must be given, not only to the public but to all affected parties. This is a very difficult task, which can be very expensive and time consuming. To date, no such plans have been approved. However, as part of this Study, such an Alternative will be evaluated.

A.2. Capacity Limits Based on Noise.

Restrictions on airport use may be based upon noise limits. However, such restrictions often have uneven economic consequences and should be implemented only after careful consideration of other alternatives. The implementation of this type of restriction can take three broad forms. These are outlined below.

A.2.1. Restrictions Based on Cumulative Impact. With this alternative, a maximum cumulative impact (such as the total area within the existing DNL 65, 70 or 75 contour) is established as the baseline cumulative impact and then the airport's operations are adjusted or limited so as not to exceed that maximum in the future. This is accomplished through "capacity limitations", whereas either the aircraft types, based upon their "noisiness", or the numbers and mix of aircraft, are limited or adjusted so as not to exceed the existing noise impact. One variation of this alternative can be referred to as a "noise budget".

A.2.2. Restrictions Based on Certificated Single Event Noise Levels. Most aircraft today have been certificated for noise by the FAA, as part of the FAR Part 36 process explained earlier. These levels are published as part of Advisory Circular 36-1C and 36-3C, and it is possible to devise limitations based upon those certificated data. This alternative can be formulated so as to set a threshold noise level which cannot be exceeded, or different levels can be implemented for either day or night operations. An aircraft's compliance with this limit would be determined from the published FAA certification data. It should be noted that aircraft can be operated at less than certificated noise levels under certain operational conditions.

A.2.3. Restrictions Based on Measured Single Event Noise Levels. Although aircraft noise levels vary widely with changes in operational procedures as well as with atmospheric conditions, it is possible to set limits on estimated single event noise levels. Aircraft which exceed this limit can be prohibited from using the airport. This does not mean that the airport, the community or citizen group can set up a microphone and noise level limit and challenge the pilots to "beat the box". Compliance with the single event level should be measured over an extended period of time for many single events, and violation is determined from repeated excess noise.

These are also the types of restrictions that are under the jurisdiction of Part 161 and are historically used in place of a general Stage II aircraft restriction. In addition, military aircraft are not subject to such restrictions.

A.3. Landing Fees Based on Noise.

This alternative is based on the premise that all or part of the landing fee for each aircraft focuses on the noise emitted by that individual aircraft. This would apportion the "cost" of producing the noise to those aircraft which contribute the most to it. This alternative would encourage the use of quieter aircraft while generating additional revenue for the airport. In order to avoid discrimination, the noise fee should be based upon a published standard for single event noise levels, such as those contained in Advisory Circular 36-3C. As a corollary to this, the opposite strategy can also be used. In other words, quieter aircraft could be apportioned a lesser fee than noisier aircraft, thus serving as an incentive for quieter aircraft. In this manner, operators which go to extra lengths to reduce noise generated by their aircraft are rewarded.

The cost of implementing this alternative, in terms of manpower, finances and public relations, many times is not offset by the revenue or benefit derived from it. The administrative cost involved in maintaining records of aircraft types and numbers, and billing statements are not commensurate with the noise reduction achieved. In addition, this does not apply to military aircraft as they do not pay landing fees. The implementation of this alternative would most likely require a Part 161 Study.

A.4. Complete or Partial Curfews.

Airport curfews are an effective but costly means of controlling noise intrusion into areas adjacent or close to the airport. Curfews can have a very significant negative effect on both aviation and the community, having economic impacts upon airport users, those providing airport-related services, and upon the community as a whole. In addition, other communities may also be impacted through curtailment of service. Thus there is a concern of an unreasonable burden to interstate or foreign commerce. A curfew can take various forms, from restrictions upon some or all flights during certain times of the day or night, or restrictions based upon noise thresholds and certificated aircraft noise levels contained in AC 36-3C. Curfews are usually implemented to restrict operations during periods when people are most sensitive to noise intrusion, which most often occurs between the hours of 11:00 p.m. to 7:00 a.m., and are effective if there is a significant night noise problem. Curfews have been upheld by a Federal Court in California for a general aviation airport (*Santa Monica Airport Assoc. v. City of Santa Monica*, 659 F. 2d. 100,[9th Cir., 1981]), while at the same time, they have been denied by a Federal District Court in New York (*Westchester County v. United States of America*, 571 F. Supp. 786 [Southern District of New York, 1983]). The implementation of this alternative would require a Part 161 Study.

A.5. Noise Barriers (Shielding).

Noise generated from ground-level sources on an airport can be a result of engine run-up and maintenance operations, taxiways, thrust reverse on landing and warehouse activities. Noise intrusion from these sources is usually only significant to those areas close to the airport. One method of mitigating this type of noise is through the use of noise barriers or earthen berms. These can protect adjacent areas from the unwanted noise. Another method is through the strategic and well planned location of airport structures that can provide shielding to adjacent areas to prevent noise intrusion. Run-up and maintenance areas can also be moved to locations which are away from noise sensitive uses adjacent the airport, and if necessary "hush houses" can be constructed to absorb sound for specific run-up and maintenance operations. The evaluation of a ground run-up facility or hush house will be evaluated as part of this Study.

A.6. Ban All Jet Aircraft.

This alternative is sometimes proposed at airports to relieve noise intrusion, but it has been well settled and documented by case law that this is not legally possible (*Santa Monica Airport Assoc. v. City of Santa Monica*, 659 F. 2d. 100,[9th Cir. 1981]). It not only puts an unreasonable burden on interstate commerce, which is an area of regulation reserved for the federal government, but it also results in a discriminatory regulation and which is violative of the U.S. Constitution, along with violating the equal protection clause. An outright ban on all jet aircraft cannot be legally implemented, and therefore, is not recommended.

A.7. Acquisition of Land or Interest Therein.

The most complete method to totally control and mitigate noise intrusion is to purchase the impacted property in fee simple, but it is also the most costly and it removes the property from the tax rolls of the community, although a leasehold excise tax may be appropriate. However, certain land areas are more critical than others and can be purchased to mitigate severe noise intrusion where purchase of the full or partial interest may be the only means of achieving compatibility. This is especially true for residences within the 75 DNL noise contour.

An alternative to purchasing land in fee simple is to purchase an easement, which is the right to do something (positive easement) or the right to preclude the owner of the rest of the property from doing something (negative easement). An easement is sometimes preferred because it keeps property on the tax rolls, but may cost as much as the entire fee. There are two main types of easements associated with airports, the clear zone easement and a noise easement (an avigation easement sometimes combines portions of both), which was discussed in Working Paper One. Easements can be purchased, condemned or dedicated through the subdivision process.

One method of keeping the area on the tax rolls is to purchase the property and then resell it for a compatible use or to resell it for residential use but retain a portion of the "bundle of rights" that are part of property ownership. In other words, the airport can resell the property to the original homeowner or anyone else, but retain a covenant or easement which identifies the airport's right to fly over the property and to create noise. This results in the property owner giving up his/her right to initiate litigation against the airport for noise intrusion. In addition, this method allows the market to set the price and value of the noise easement which is retained by the airport. The airport could also develop or resell the property to another government agency to develop it as a compatible use (golf course, nature area, cemetery, etc.), or the agency could purchase the property outright for their own use. This would have to be coordinated with the airport staff and management to ensure redevelopment with a compatible use.

As an alternative to land purchase, sound attenuation is often recommended. Sound attenuation is the process of adding structural components to a structure to reduce the inside noise levels to a specific degree. Normally, a 25 to 30 dB(A) reduction from outside to inside noise levels is recommended. Such noise reductions are normally achieved through such activities as double paned windows, solid core doors, special ventilation systems and some wall treatments. Many residents prefer this alternative because it reduces the inside noise levels and allows the homeowner to remain in his/her home. Sound attenuation when funded with public monies often requires the granting of a noise easement in return.

No matter what interest of land is purchased, if federal assistance is used, the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policy Act of 1970 (URARPAPA, PL 91-646) must be followed.

A.8. Construct a New Runway in a Different Orientation.

Often the construction of a new runway with a different orientation will shift noise impacts away from noise sensitive uses to more tolerant and less populated areas. The orientation of a runway is dependent upon many factors, including prevailing winds, topography, obstacles and other conditions. A new runway cannot be constructed if wind direction and topographic conditions are such that safety criteria cannot be met. In addition, both existing and future land uses must be considered so that the noise is not shifted to other populated areas. This is an expensive endeavor which must be beneficial to both the airport users and the surrounding community. The on-going Airport Master Plan evaluated several runway alternatives, including the construction of a new runway. Based on physical constraints, surrounding land uses and other considerations, this alternative was eliminated. Thus it will not be evaluated in this Study.

A.9. Runway Extensions.

Often a runway extension, coupled with other noise abatement procedures can mitigate noise impacts on areas in close proximity to the airport. The extension can allow aircraft to gain altitude sooner and produce less noise impact at ground level. In addition, noise abatement turns are sometimes possible with an extension as a result of enhanced altitude position. Many times, with an extension, the area off the end of the runway with the extension can experience greater amounts of noise due to lower approach altitudes at this end of the runway. This can sometimes be corrected by establishing a displaced threshold so that aircraft land farther down the runway and maintain altitude over the area beyond the extension. This practice is not generally recommended by the FAA. An additional factor to consider with a runway extension is that many times heavier, larger aircraft can be accommodated at the airport which were unable to operate in a safe manner previously. This may not necessarily be undesirable, however, because many of the larger, heavier aircraft are new generation aircraft and are actually quieter than those smaller aircraft presently operating. Runway extensions can also be used as a noise abatement measure to help reduce the need for using reverse thrust upon landing, which can generate a considerable amount of ground-level noise to areas close to the airport. As with the previous alternative, this alternative was eliminated during the Airport Master Plan development process.

A.10. Touch and Go Restrictions.

Restrictions on training flights performing touch-and-go operations can mitigate noise impacts at airports where there are a significant number of such operations, especially jet training. This alternative is also effective if the operations are occurring during the nighttime and early morning hours, for the restriction may be for certain time periods. However, such restrictions may not be legal as it may be interpreted as a capacity restriction. Capacity restrictions are different from access restrictions based on noise (which may be possible subsequent to a Part 161 Study) as they are beyond the ability of an airport Sponsor to implement. They are pre-empted by Federal regulation.

A.11. High Speed Taxiways.

High speed taxiways can help reduce noise intrusion by allowing aircraft to exit the runway quicker and reducing the need for extended use of reverse thrust. This alternative is only viable with a runway of sufficient length to allow aircraft the opportunity to slow down to a speed sufficient enough to exit the runway. This alternative does little good as an independent measure, and must be implemented along with other alternatives.

A.12. Noise Monitoring Program.

Noise monitoring programs can enhance the effectiveness of noise compatibility programs. Continuous noise monitoring systems have been used as a part of aircraft noise abatement programs at airports experiencing severe encroachment. These airports have used the system to demonstrate how they were reducing noise impact. The noise monitoring of aircraft operations is a means of showing progress toward reducing the problem. At airports with less intense problems, the purchase of noise monitoring equipment and manpower is generally less justified. Most of the systems have several remote microphone units that sample the weighted sound level once or twice per second, code the samples, and transmit the data to a minicomputer system with printouts. Any FAA approved noise monitoring system would have the following minimum capabilities to provide: continuous measurement of dBA at each site, hourly Leq data, daily Ldn data, and single event maximum A-weighted sound level data. This is an expensive system that is recommended for airports with significant noise/land use compatibility concerns, and the Airport currently has such a system in place.

A.13. Noise Complaint/Citizen Liaison Program.

A comprehensive noise complaint handling system has many advantages, including identification of and notice to aberrant pilots, public accessibility, data collection to identify sensitive areas and positive public relations. The airport management will usually identify one person to handle noise complaints from citizens. The complaint officer then keeps a file on each complaint, noting the time, place, type of complaint, type of aircraft and N-number or other identifying characteristic of the aircraft. This will help identify problem areas and can be used to notify pilots of the noise abatement program, what they did to generate a noise complaint and why noise abatement is of particular concern at that airport. This will give the citizens of the community one central location to lodge noise complaints and to gain information concerning aircraft operations or changes in flight procedures. The airport currently has such a system in place and is keeping records of noise complaints. This program will be reviewed and revised as necessary.

B. Options Available to State or Local Governments

B.1. Land Use Controls.

Federal guidelines contained in FAR Part 150 indicate that residential development, along with other noise sensitive uses such as schools, churches, hospitals, rest homes, etc. should be prohibited from siting within areas with annual noise levels in excess of the DNL 65. These guidelines are recognized not only by the FAA but also by the Department of Housing and Urban Development, Department of Defense and the Environmental Protection Agency, as well as numerous state and local agencies. Land use and development controls are one method of ensuring such uses will be controlled within the noise contours. It should be remembered that it is within the discretion and authority of the local unit of government to determine what are incompatible land uses and to define their own threshold of sensitivity.

Land use and development controls which are based on a well defined and thoroughly documented comprehensive plan are among the easiest and most powerful tools available to the local unit of government to ensure land use compatibility. It is very important for the local unit of government to exercise these controls, for they are beyond the authority of the airport management to implement. It is the responsibility of the local unit of government having land use jurisdiction to implement these controls to protect its residents from impacts and the airport from encroachment of incompatible land uses. Traditionally, even if the airport is managed by the same unit of government that has land use control authority for the land area beyond the airport's boundary, there has been little coordination and discussion as to what land use controls should be implemented and which land uses are compatible with airport development. This is very important and cannot be over-emphasized to ensure coordination of development plans for all parties involved. This is particularly important where more than one unit of government has land use control authority for the area outside the airport's boundary. It is extremely critical that the local unit of government accept the responsibility for ensuring land use compatibility in their planning and development actions. It is also important that the state government provide the necessary enabling legislation that will allow the local unit of government to institute land use controls. The most common forms of land use controls available to the local governments include: zoning, easements, transfer of development rights, building code modifications, capital improvement programs, subdivision regulations and comprehensive planning. These forms of land use controls have all been discussed earlier in a previous Working Paper, and will only be briefly outlined in the following paragraphs.

B.1.1. Zoning. Zoning is the most common and traditional form of land use control used in the United States today. It controls the type and placement of different land uses within designated areas. It is used to encourage land use compatibility while leaving property ownership in the hands of private individuals or business entities, thus leaving the land on the tax rolls. Zoning is not applied retroactively and is not necessarily permanent. It is most effective in areas which

are not presently developed and which can be encouraged to develop with compatible uses. As stated earlier, all jurisdictions have typical zoning ordinances in effect concerning the way use districts are delineated. There are no Airport Overlay Zones in effect nor are there any specific noise contour/land use zoning districts. Recommendations may be made concerning these items once the Future Noise Exposure Map is finalized.

B.1.2. Easements. An easement is a right held by one to make use of the property of another for a limited purpose. Two specific types of easements are usually referenced in airport planning, a positive easement which would allow the generation of noise over the land and a negative easement to prevent the creation of a hazard or obstacle on the property of another.

B.1.3. Transfer of Development Rights. The transfer of development rights involves separate ownership of the "bundle of rights" associated with property ownership. The concept involves the transfer of the right to develop a certain parcel of property to a certain density/intensity to another parcel of property under separate ownership. This would allow the property that obtains the added development rights to develop to an intensity/density that is beyond that which would normally be allowed. The airport could also purchase these rights from the landowner and retain them or sell them to another landowner. This concept can be used to retain property in compatible uses and still compensate the landowner for his loss of development. The idea depends upon market conditions of the area and (there is some disagreement on this point) upon the availability of state enabling legislation authorizing the development of the concept at the local level.

B.1.4. Building Code Modifications. This alternative is to modify existing or potential building codes to include specific sound attenuation provisions for structures within areas impacted by aircraft noise. Such sound attenuation measures are currently required by King County and the City of SeaTac. Recommendations will be made to other jurisdictions.

B.1.5. Capital Improvements Program. This is a document that establishes priorities and costs on the funding and development of public facilities (roads, streets, sewers, libraries, etc.). It can be used very successfully, in concert with subdivision regulations and a comprehensive plan, to control not only the areas of development but the timing of development by controlling the timing and location of public facilities construction.

B.1.6. Subdivision Regulations. Subdivision regulations are used to control the design and placement of public and private facilities in the conversion of raw land to developed property. The surrounding jurisdictions have adopted subdivision regulations.

B.1.7. Comprehensive Planning. Comprehensive future land use planning, when it is coordinated with the zoning ordinance, subdivision regulations and the capital improvements program, can reduce or avoid land use incompatibilities in the

future. The surrounding jurisdictions have an adopted comprehensive plan for their areas of jurisdiction.

All of the land use controls mentioned above will be analyzed in greater depth as to their feasibility for implementation when the final noise contours are produced and a Future Noise Exposure Map is presented.

C. Options Dependent Upon the Federal Government

C.1. Departure Thrust Cutback.

This alternative would involve the imposition of thrust cutbacks following take-off. Because of system-wide needs, each operator has developed its own standardized take-off procedure. This alternative is recommended where the operators have the opportunity to utilize a different departure thrust setting and still be within safety limits as per the particular type of aircraft they are flying given the characteristics of the particular airport concerned. It is better for aircraft to climb faster and turn earlier than to fly over noise sensitive uses at lower power. In addition, this alternative cannot be implemented without the direct concurrence of the Federal Aviation Administration taking into account operational, safety and airspace considerations. The Federal Aviation Administration has recently revised AC 91-53 to identify two standard departure procedures for aircraft, a “close in” departure and a “distant” departure.

C.2. Noise Abatement Take-off/Approach Procedures (Flight Tracks).

This alternative is very similar to the previous one, except that it concerns take-off/approach procedures that dictate the location of aircraft during certain altitude and turning procedures. These procedures are dictated by considerations of operational safety and air traffic control procedures. Generally, the air traffic control procedures can be resolved, perhaps with penalties involving reductions in airport and airspace capacity. However, aircraft turns at low altitudes, when the aircraft are in a low-speed, high-drag configuration, can cut deeply into aircraft operating margins. Turns during the last three to four miles of the final approach in good weather, and within the final six to seven miles during poor weather, are undesirable for safety reasons because they do not allow pilots to establish and maintain a stabilized approach. Aircraft bank angles near the ground need to be restricted to no more than 15-20 degrees. These procedures cannot be implemented without the concurrence of the Federal Aviation Administration, taking into account both operational, safety and airspace considerations.

C.3. Preferential Runway System.

This alternative is to utilize one runway end the majority of the time, establishing operations in a certain direction, with operations occurring in the opposite direction

held to a minimum. This alternative is very closely related to wind direction and airspace safety considerations. The FAA has the responsibility to implement this alternative through air traffic routing, with aircraft safety being the prime concern. This is only available for use during certain wind conditions and is only recommended when there is a severe noise compatibility problem directly off one end of the runway. The airspace conflicts that occur with Sea-Tac traffic make this alternatives rather limited in operational efficiency. In addition, only one runway is capable of accommodating jet aircraft, which limits the effectiveness of such a system.

C.4. Power and Flap Settings.

A variety of operating procedures are possible for implementation at the airport. These include minimum flap landings and delaying flap and gear deployment. To help minimize fuel costs and flight time, most operators of large jet aircraft have adopted procedures for reduced flap setting and delaying flap and gear extension, consistent with safety and current aircraft and air crew capabilities. During VFR weather conditions and low traffic conditions, large jet aircraft generally land with minimum flap settings at the airport. More sophisticated delayed flap procedures have not been considered safe with current air traffic control procedures and safety criteria.

C.5. Microwave/GPS Landing System.

A global positioning satellite (GPS) system is a new type of instrument landing system which, when fully installed, could allow new noise abatement landing procedures. The GPS system uses satellites to determine exact locations, and with the addition of a ground unit, can determine altitude. It is being considered as the precision instrument landing system of the future, as it is less expensive to equip and maintain both onboard and ground facilities. The airport currently has precision instrument landing systems in place, although the use of GPS for approaches, coupled with FMS (Flight Management Systems) for departures will be explored as part of this Study.