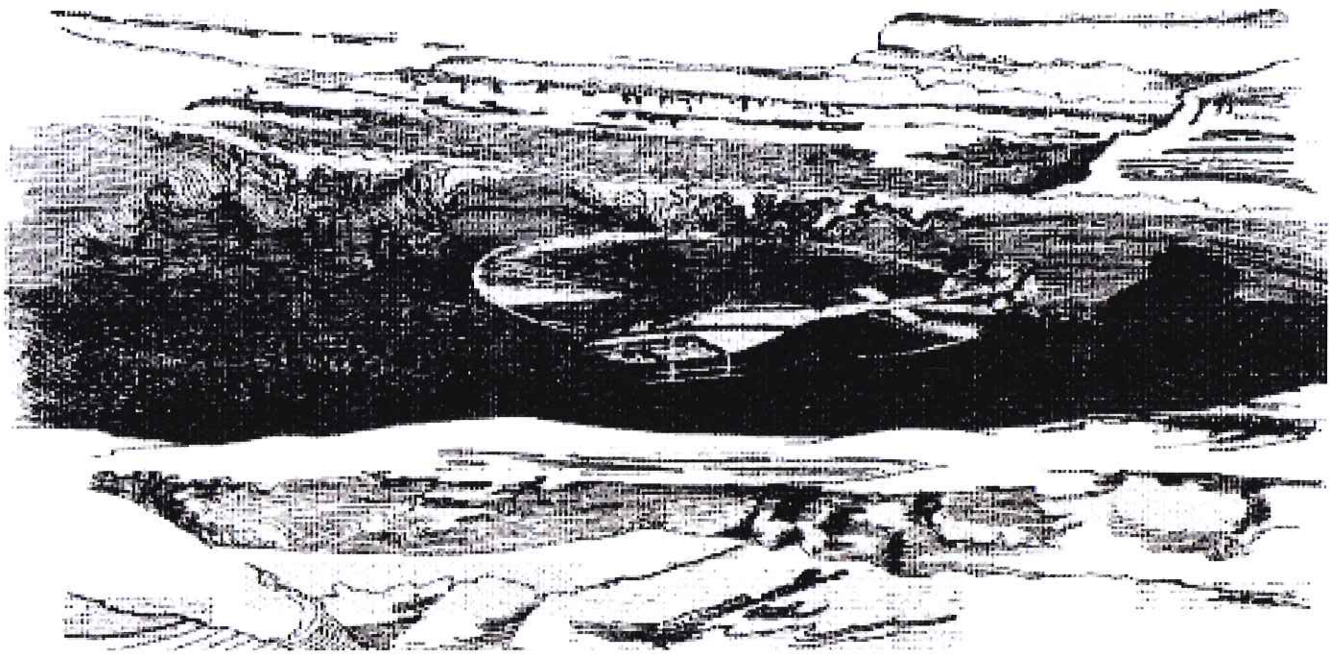

DRAFT FINAL
City and Borough of Juneau

Flightseeing Noise Assessment

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SECTION 1.0

EXECUTIVE SUMMARY

1.0 Project Description

This study documents and analyzes noise levels in the City and Borough of Juneau caused by helicopter and fixed wing flightseeing and presents potential mitigation options that may be used to reduce the noise impacts associated with these operations. The study is based on a detailed noise measurement survey done in residential areas of Juneau between July 29th and September 1st, 2000 and on subsequent modeling analysis of the data.

1.1 Outline of Noise Analysis

This report is presented in six sections.

Section 1.0	Executive Summary
Section 2.0	Background Information on Sound
Section 3.0	Methodology
Section 4.0	Existing Noise Environment
Section 5.0	Mitigation Options
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1.2 Background Information on Sound

Section 1.2 presents background information on the characteristics of noise and summarizes methods and criteria commonly used to assess aircraft noise. Noise metrics and methodologies are discussed in this section and it is divided into the following sub-sections:

<u>Characteristics of Sound</u> - Properties of sound that are important for technically describing noise in the airport setting.

<u>Factors Influencing Human Response to Sound</u> -Acoustic factors in human subjective response to a sound that affects its perception.

<u>Health Effects of Noise</u> - Potential human disturbances and health effects from noise.

<u>Sound Rating Scales</u> - Sound rating scales and how they may be applied to address aircraft operations.

<u>Noise Assessment Guidelines</u> - Current noise assessment criteria used to assess aircraft noise impacts.

<u>JUNEAU STUDY DESIGN</u> – The FAA's criteria on noise are focused on airports and do not satisfactorily measure and describe the flightseeing situation in Juneau. As part of this study, and with the input from public hearings, a number of noise metrics were developed to accurately identify the Juneau flightseeing noise situation. (Noise metrics are methods of describing a variable aircraft noise environment into a single number rating system.) The bullets below summarize the criteria and characteristics of this city's flightseeing noise as well as the other noise metrics used in this study.

- The FAA has a long history of publishing noise/land use assessment criteria to judge the compatibility of various land uses with airport noise. The criteria were developed from extensive research around major airports on human response to different levels of jet aircraft noise.

- The criteria are generally in terms of the Day Night Noise Level (DNL) based on an A-weighted decibel to approximate the sensitivity of the human ear. The DNL is a 24-hour metric that places special weighting on nighttime noise. This is the measure used in nearly all community noise environments and is required by the Federal Aviation Administration (FAA). FAA's guidelines generally consider DNL noise levels greater than 65 DNL as incompatible with conversation.

- Juneau's flightseeing noise occurs during the daytime hours. This noise is created primarily from aircraft in flight and it does not come fromtakeoffs or landings at the airport.

- The unique environment of Juneau also affects the rate of how noise is propagated and perceived by the listener. The terrain and weather constrict available flight paths from existing heliports so they must pass over residential areas. Low clouds, humidity, the sides of mountains, and close proximity to large bodies of water all result in noise propagation at a greater rate than in typical settings.

- Since flightseeing noise occurs only during the daytime hours, a modified daytime DNL noise level was developed and used for this study in combination with other metrics.

- In Juneau, noise from helicopters is a major component of the flightseeing noise. Helicopters have a lower frequency sound to which some have greater objection. Frequency data was developed and used to illustrate the special characteristics of this noise and help explain why it can be more intrusive than noise from other sources.

- Two supplemental metrics are useful in measuring noise impact from flightseeing activities. The first is the maximum noise level (Lmax) which is a good descriptor of single event noise levels caused by flightseeing. The second is the Time Above noise level. Time Above noise is measure of the cumulative time that the noise levels are above a given noise level for a given day.

- The National Park Service (NPS) has sponsored several recent studies of the impacts of aircraft noise on national parks with a focus on appropriate measure of impact. The NPS was interested in assessing the interference of aircraft overflight noise with enjoyment of natural quiet. To do this, the NPS developed dose-response curves similar to the curves developed for traditional airport studies, except they utilize different noise metrics and are based on surveys of visitors in park settings. These curves are measured by the percentage of time aircraftare audible and also in terms of the hourly equivalent sound level (LEQ). Juneau is not a national park, but this study does use a number of the same metrics as the NPS studies in addition to more traditional measurements and others.

- Years of research have identified potential effects from noise. These potential effects of noise on people include: hearing loss (not a factor with typical community noise), communication interference, sleep interference, physiological responses and annoyance. Based on testimony at public hearings and discussions with citizens concerned about noise levels, communication interference and annoyance are the main concerns regarding flightseeing noise in Juneau.

- Research on aircraft noise and its effects on people have primarily occurred at major airports that are dominated by jet aircraft operations. There is little community noise research in a setting such as Juneau and with the type of aircraft operations that are characteristic of flightseeing activities. There is also few studies relative to the effects from helicopter noise. Therefore, applying traditional community noise research to Juneau flightseeing activities may not completely describe community reaction to aircraft noise. Similarly, the NPS research was developed in National Park settings that are designed to characterize the affects of noise on park visitors and their expectations. Therefore, apply NPS noise research to Juneau flightseeing activities may also not completely describe community reaction to aircraft noise. Juneau flightseeing noise is a unique acoustic environment that has not been fully evaluated in existing research.

1.3 Methodology

The flightseeing noise environment for the City and Borough of Juneau was determined through a comprehensive noise measurement survey, a modeling assessment, public hearings, and informal discussions with many residents. The foundation of an aircraft noise analysis is the accurate prediction of aircraft noise levels. The noise environment at the City & Borough of Juneau has been depicted through the employment of noise measurement surveys. These surveys include data on aircraft events, ambient noise levels, collection of aircraft operational and local weather data and finally, the incorporation of this information into aircraft noise computer models.

The following bullet points detail the methodology that was used in the measurement survey and the computer modeling:

- **Semi-Permanent Monitoring Sites** - Noise measurements were conducted at locations around the City & Borough of Juneau. These sites were selected to cover the flightseeing paths over residential areas of Juneau. Data collection was typically for a seven to ten day period or greater period between July 29th and August 19th, with one location continuing to September 1st. There were sixteen semi-permanent locations. The semi-permanent sites were intended to collect continuous 1-second noise levels during the entire time the noise monitor was at a given location.

- **Temporary Monitoring Sites** - Noise measurement data was collected at 21 temporary noise-monitoring sites utilizing the same measurement technology. However, each site was measured for a total of roughly eight hours in duration during different time periods. Each site was visited two to four separate times with each measurement period lasting about four hours. The temporary noise monitoring was completed between July 30th and August 16th.

- **Spectral Data** - One-third octave spectral data was collected at several of the semi-permanent noise monitoring locations. This data will be used to show the frequency components of the different types of flightseeing aircraft.

- **Interior Noise Measurements** - A series of interior noise measurements were made during the survey. Data was collected inside the homes of four semi-permanent sites located throughout the study area. This data can be used to determine the noise levels inside typical residences. In addition, data can give an estimation of the outdoor-to-indoor noise reduction characteristics of the residence.

- **Noise Data Measurement** - The noise measurement survey utilized specialized noise monitoring instrumentation that allowed for the measurement of aircraft single event data and ambient noise levels. The noise data that was determined from each of the semi-permanent noise measurement sites is listed below:

    - Continuous One-Second Noise Levels
    - Single Event Data (SEL, Lmax and Duration) for Individual Aircraft
    - Hourly Noise Data (LEQ, Level Percent, Time Above)
    - Daily DNL, Time Above and Modified DNL Noise Level
    - Correlation of Noise Data with Aircraft Identification
    - Non-aircraft Ambient Sound Level (Level Percent)

- **Monitoring Network** - The methodology employed in this study was designed to continuously and simultaneously measure the noise and the noise flow at each of the individual sites. With multiple noise monitors, it is possible to identify a pattern in the form of a time sequence measuring noise events among each of the measurement sites. This network of noise monitors ensures the distinction of aircraft noise from other noise sources.

- **Aircraft Identification** - Aircraft identification was determined from on-site field observations by the acoustical engineer, operator flight logs, and flight data from Juneau International Airport. This data included the time of the operation, the type of aircraft, and the flight track used. Knowing the time of operation, the type of aircraft and the path of operation, it was then possible to reconstruct the flight of each operation. With this information, along with knowledge of the speed of the aircraft, the reconstructed flight of each operation was used to predict where an aircraft was at any point in time. A software program was used to correlate the noise event with the aircraft operating near the noise monitor at that same point in time.

1.4 Measurement Results

Noise measurements consisted of: (1) single event noise levels from individual aircraft, (2) cumulative 24-hour continuous measurements, and (3) measurements of ambient non-aircraft noise sources. The survey utilized specialized equipment that allowed for the recording and display of the compete time history of the noise. The results of the measurement survey are summarized in the following bullets. Additional data with more detailed results at each of the measurement sites is presented in the Appendix.

- **Flight Paths**. Flightseeing aircraft flight paths were documented during the survey. The paths are presented in maps in the report for both helicopter and floatplane flights. The mapped paths are the primary flight paths, but there is deviation due to local activity, weather and pilot procedures. A GIS database of these flight paths has been developed and can be imported into the CBJ GIS database.

- **Continuous Noise.** The noise level was continuously recorded at each of the sixteen semi-permanent noise-monitoring sites, including noise events from aircraft, and ambient noise. The difference between an aircraft event and the ambient noise can be easily distinguished in these plots. The sequence of each of the noise events is also presented.

- **Ambient Noise**. The ambient noise environment was quantified from the noise measurement survey at each of the measurement sites. The data was used to help establish the ambient noise environment for all sources of noise. Knowledge of the ambient or background noise helps in assessing the degree of intrusiveness of aircraft noise relative to other sources of noise. Sources of ambient noise include roadway, commercial sources, natural, and other residual background noise.

The L90 noise is a good representation of the background noise level. This represents the noise level that is exceeded 90 percent of the time, and it is commonly referred to as the residual noise when other sources of noise are not present.
The results of the measurements from the permanent sites showed L90 noise levels ranging from a low of 37 dBA to a high of 48 dBA. Most sites had background L90 noise levels in the low 40s dBA. The majority of these sites were located in relatively quiet noise environments that were not exposed to other types of sources, such as highways. Some of the temporary sites where located in areas with higher background noise levels. These sites, such as Bartlett Memorial hospital, had background L90 noise levels in the low 50s dBA. In general, except for locations downtown or near the major roadways, the background ambient noise levels were relatively similar throughout the Juneau area and were typical of a quiet suburban area.

- **Single Event Noise.** Aircraft single event noise levels were determined at each of the measurement sites. The acoustic data included the maximum noise level (Lmax), Sound Exposure Level (SEL), and the time duration of the aircraft events. Measured single events were correlated with flight operations information. With this correlated single event noise data, it was possible to separately determine single event noise levels from the different sources of aircraft noise.

  The correlated events at each of the monitoring sites were sorted to determine which operations produced the loudest events. The results show the loudest events measured from flightseeing aircraft was 87 dBA with typical highest levels in the mid to high 70s dBA. The average Lmax noise event for each type of aircraft operation was measured in the high 60s dBA. This was the same for both the floatplanes and the helicopter operations.

- **Duration of Noise Events.** The typical duration of flightseeing noise event is longer than the overflight of a jet, with the duration of helicopter flights longer than that of floatplanes. Helicopter noise events most often lasted from one to three minutes and floatplane noise events from ½ to 1 minute. The longer durations for helicopter noise events was due to the fact that helicopters fly slower than prop planes and are also more likely to be flying in groups. A single helicopter overflight was typically 1 minute in duration; however, for a group as many as six helicopters, the noise event lasted 3 minutes. Near the helicopter landing and takeoff points, such as Bonnie Brae and the airport, the noise events lasted as long as even 5 minutes.

- **DNL Noise Levels.** Aircraft DNL noise levels were measured at each of the 16 semi-permanent noise monitoring locations. The DNL noise levels from flightseeing operations typically ranged from 50 to 58 DNL. The locations with the highest DNL are located near the airport or heliport. As would be expected, the DNL was less at more remote locations. Peak day DNL noise levels were 3 to 5 dBA higher than the average DNL day. The day only modified DNL Noise Levels measured similar to the total DNL, but was higher by about 2 dBA.

- **Time Above Noise Levels.** Time Above was determined in terms of the time in minutes per day that noise levels were greater than three specific noise thresholds. These thresholds were designed to reflect different degrees of impact. These levels are: 55 dBA which is designed to reflect when aircraft are clearly audible; 65 dBA which is designed to reflect when aircraft would start to cause speech interference, and 75 dBA which is designed to reflect when aircraft are sufficiently loud to clearly interfere with speech. The high interruption levels occur less than 1% of the time (Time Above 75 dBA). The medium Time Above level (65 dBA) occurs 2% to 5% of the time. The lower Time Above level (55 dBA), occurs 10% to 20% of the time. During certain hours of the day, the aircraft noise will be above this 55 dBA level up to 80% of the hour.

1.5 Mitigation Options

This section describes potential mitigation options, which may be used to reduce the impacts from flightseeing noise. Mitigation measures are described qualitatively. The potential reductions in noise that may occur are estimated where appropriate, but are not evaluated in detail. These measures include regulatory access restrictions, utilization of new technology and changes in flight procedures. Implementation options are also in being presented. Implementation could occur in a regulatory manner through a Part 161 type process or in a voluntary manner such as mediation. Mitigation options are listed below:

- new Technology
- alternative flight paths
- alternative operational procedures
- satellite heliports
- Noise Budget
- FAR Part 161
- Fly Quiet
- seasonal noise monitoring
- mediation process

1.6 Recommended Mitigation Alternatives

New Technology

- New technology rotorcraft and floatplane aircraft can result in lower noise levels. In terms of single event noise levels, these aircraft can reduce the noise by 3 to 5 dBA. This will also reduce the cumulative levels. The CBJ should explore methods to promote and encourage the use of new technology aircraft by the flightseeing industry in Juneau.

Alternative Flight Paths and Procedures

- Provide for improved weather reporting information throughout the complete helicopter flightseeing flight path. Complete knowledge of the weather for all areas along a flight path will give the pilot more information as to which path he is actually able to safely fly. More precise weather information may allow for greater usability of these preferred procedures when the pilot can more confidently know that it can actually be flown.

- Improved compliance monitoring of the preferred flight path. Incentives tied to increased use of these procedures can be implemented through an enhanced Fly Neighborly, Fly Quiet program or through developments in the mediation process.

- For floatplane aircraft departing southbound from downtown, measurements show that lower altitude operations down the center of the channel result in the lowest noise levels. Noise from aircraft at higher altitudes tends to propagate further in comparison to when the aircraft is closer to the water. This lower climb rate procedure should only be utilized when departures travel down the centerline of the channel. Delaying the climb out until past Thane will also reduce noise levels in Thane and Douglas.

- The pitch setting used in the propeller can have a significant impact on the magnitude and character of noise. A higher pitch setting often results in the sounds that have pure tone characteristics that are more intrusive. This alternative would require work with Wings of Alaska to determine a pitch setting that results in lower noise impacts to communities along the primary departure paths.

Evaluate Satellite Heliports

- The development of satellite heliports offer a potential for reducing the noise impacts from flightseeing helicopter operations. Existing heliport locations (airport and ERA) require helicopters to fly over core residential areas in order to reach the tour destinations. Given the nature of the terrain, residential development and meteorology, it is difficult to achieve much improvement in flight paths from the existing heliport locations.

By moving arrival and departure points to satellite heliports located away from core residential areas, the impacts of associated noise could be reduced. Given the destinations of the two major operators, a south location for ERA and a north location for Temsco and Northstarwould offer the greatest potential for noise mitigation. There are two areas of special concern relative to satellite heliports. First, if satellite heliports are used only to increase the total number of operations it will make the noise problem worse, rather than better. Second, unless the satellite heliports are located very carefully, the result could simplyshift the noise problem from one residential area to another.

Fly Quiet Program and Seasonal Noise Monitoring

- Fly Quiet is a family of programs designed to motivate operators and pilots to operate aircraft as quietly as possible. A Fly Quiet program in Juneau would be built upon existing voluntary Fly Neighborly noise abatement programs, along with new potential elements that may evolve. Fly Quiet reports should communicate compliance with existing and future noise abatement programs in a clear, understandable format that allows broad comparisons between operators over time. The primary purpose of Fly Quiet reports is to rewarding good noise abatement procedures. By providing this information publicly, Fly Quiet will enable operators to engage in informed self-evaluation and improvement.

- Seasonal noise monitoring would involve a noise measurement program similar to what was completed in this study. The noise monitoring would be used to document noise levels and provide information to be used in the Fly Quiet program. This measurement program could be a pilot study the first year, with possible expansion over time if the results are found to be useful.

Mediation Process

The mediation process offers the best potential for implementing mitigation options. Mediation in itself is not a noise abatement alternative, but a means of implementing noise abatement operations. The primary benefit of mediation is its ability to more successfully facilitate the implementation of actions or noise abatement, which are difficult to achieve thorough the Part 161 process.