DATE: June 17, 2003

TO: Steve Gilbertson,
City and Borough of Juneau

FROM: Paul Dunholter, P.E.,
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SUBJECT: Float Plane Noise Monitoring –Report of Findings

The following report summaries the results of the Float Plane noise monitoring tests. The purpose of the tests were to compare the relative difference between the exiting piston driven Twin Otter float planes that are operated by Wings of Alaska with re-engine turbo prop Twin Otter aircraft.

Test Aircraft. Three different aircraft were tested. These aircraft are the current standard Otter operated by Wings and two types of turbo prop Otters. These aircraft are listed below:

Wings	Otter piston engine aircraft that is the current Otter operated by Wings from the downtown float plane dock
Promech	Otter re-engine turboprop with a Pratt-Whitney engine. The prop for this aircraft has three blades
Ward Air	Otter re-engine turboprop with a Garrett engine. The prop for this aircraft has four blades

Flight Operations. Nearly all of the operations from the Downtown Float Plane dock are to and from the southeast, down channel from the docks. From a safety and stability standpoint, aircraft land and takeoff into the wind. So when the wind is from the north or west, the aircraft takeoff and land to the northwest. When the wind is from the south or east, the aircraft takeoff and land to the southeast. Each of these different operational conditions was measured during the monitoring study. They are described below:

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1.	*Southeast Departure*	Departure southeast down channel (most common departure and used in calm conditions)
2.	*Southeast Arrival*	Arrival up channel and circle to land back to the southeast
3.	*Departure Northwest*	Departure northwest and circle back to fly down channel
4.	*Arrival Northwest*	Arrival up channel to land to the northwest (most common arrival and used in calm conditions)

The flight test consisted of each aircraft flying each of the four procedures three times. Southeast flow conditions were tested first. The aircraft taxied out from the float plane docks to the standard departure point near the center of the channel. Then three southeast departures and three southeast arrivals were conducted for each of the three aircraft types. The aircraft then taxied back to the docks. The second set of measurements tested northwest flow conditions. The aircraft again taxied out to the departure point and complete the three northwest departures and three northwest arrivals for each of the three aircraft types.

<u>Noise Measurement Locations.</u> A total of seven noise measurements sites were used for the tests. Each of these locations is listed below. These sites were designed to measure the noise from the float plane operations at a variety of locations within Juneau. The noise measurement equipment continuously measured the noise throughout the test period. The noise monitoring attendant would also log the time of an operation and the maximum noise value reached during the flyover (Lmax).

Downtown Float Plane Dock
Sheep Creek
West Juneau
Edgewater Apartments
Sandy Beach
Maintenance Yard North of Bridge
Yacht Club

<u>Noise Measurement Results.</u> The noise measurement results are summarized in the following table. This table presents the type of aircraft, if the operation is a departure or arrival, the operational flow (departing and arriving to the southeast or departing and arriving to the northwest) and the measured Lmax (dBA) recorded at each site. The measured Lmax is the average of all of the events for that operation that were measured at each site. This includes all three flights of the same aircraft. In addition, at some locations the aircraft will overfly a site more than once. Each of these overflights is included in the average. *(For comparative purposes, at jet departure may have a noise level of 96 dBA; a passenger car at 25 feet from a roadway is 77 dBA; an air conditioning unit is 60 dBA; and normal outdoor speech is 65 dBA.)*

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All aircraft attempted to follow the same flight path. Thus, the difference in the measured noise is typical of the difference in noise generated by each type of aircraft. The one exception is at the Yacht Club, where the aircraft flew at different distances from the measurement site. At this site, aircraft were turning toward the south, and that turning point would vary with each flight.

Summary of Findings. Based upon the measurement results, a number of observations were identified. These are summarized below.

1. The turbine engine aircraft were significantly quieter than the current piston engine aircraft. The Ward Air turbine was also typically quieter than the Promech turbine.

2. On average, the departure noise from Promech aircraft was 9 dBA quieter than the Wing's Aircraft. The Ward Air aircraft was 13 dBA quieter. Reduction in the departure noise is important, in that departure noise is typically louder than arrival noise. To the human ear, a 10 dBA reduction in noise is judged to be half as loud. As an example, to get the same reduction in noise, an aircraft flying overhead at 1,000 feet would need to be raised to 5,000 feet. This is a similar reduction in noise that occurs with the changeover from Stage 2 to Stage 3 commercial jets.

3. On average, the arrival noise from the Promech aircraft was 4 dBA quieter than the Wing's aircraft. The Ward Air Aircraft was 7 dBA quieter.

4. Engine start and taxiing resulted in similar noise levels. This measurement was more difficult to quantify because of the varying distances between the aircraft and the measurement points. The turbine powered aircraft can be louder at engine start-up. The taxiing was similar in magnitude. The Ward Air turbine was slightly louder than the Promech turbine during taxiing.

5. The turbine powered aircraft have better flight performance characteristics. These aircraft fly faster and climb more quickly than the piston aircraft. The faster speed results in shorter duration noise events. The duration of the noise from the turbine aircraft operation was typically 20% shorter than the piston aircraft.

6. The character of the noise for the turbine aircraft is different than with the piston aircraft. The noise is more broadband and less pure tone in nature. Most people find this type of noise less annoying.

7. For the measurement points that were situated in residential communities, the typically measured Lmax noise levels were below 65 dBA. This is an

important threshold. Typically, for most speech to be interfered with, noise must reach 65 dBA. These noise levels are now below the level which activity interference such as speech communication typically starts to occur. Additional, the indoor noise (with windows closed) typically would be less than 45 dBA. This is also below the level that indoor activities such as listening to the TV would be interfered with.

Recommendation. Based upon these measurement results and our experience at other aviation noise environments, it is our recommendation that the City/Borough of Juneau promote the replacement of the standard Otters with turbine-engine Otters. These aircraft are significantly quieter than the current aircraft. This reduction is not just in terms of the magnitude of the noise, but also the duration of the noise events are reduced, the characteristics of the noise is less annoying and the overall cumulative noise levels are lowered. Another important factor that at these reduced levels, the noise would be below the level which speech interference and other activity interference typically occurs. It is rare that this significant level of potential improvement ever occurs in aviation noise.

If you have any questions, or comments, please do not hesitate to contact me.

Yours Very Truly,

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