DATE:       February 2, 2017

TO:         Mark Reichin
            Propeller Airports LLC

FROM:       Paul Dunholter, P.E.
            BridgeNet International

SUBJECT:    Snohomish County Airport Commercial Service EA Noise Assessment -
            AEDT Noise Contour Update

BACKGROUND

The following memo presents the results of the updated 2018 noise contours from the Commercial Air Service Environmental Assessment (EA) at Paine Field, referred to as the contour modeling update or project. The EA shows no significant foreseeable adverse noise impacts associated with the proposal. Nor does the update. The noise contours were updated using the latest Federal Aviation Administration (FAA) noise model, Aviation Environmental Design Tool (AEDT) Version 2c. AEDT is the most recent evolution of the noise models developed by the FAA; it replaced the Integrated Noise Model (INM) that was used in the EA study. AEDT was developed by the FAA to combine its multiple environmental modeling requirements into one model, including single airport noise analysis, multi-airport airspace noise analysis, air quality emissions, greenhouse gases and fuel consumption. This model also enhanced the aircraft noise prediction process, added the ability to import and utilize radar data, weather and GIS information that was not supported in INM.

The new AEDT model uses the same underlying acoustic principals and aircraft base data as the INM, with more advanced features, new aircraft types, parameter adjustments and plotting capabilities. Given the same assumptions, the noise contours generated by the two models are generally similar but there can be some differences in the size and shape of the contours generated from the same data and assumptions that were contained in the original EA analysis.
The scope of this project is to use the assumptions from the EA study and update the noise contours utilizing the new AEDT noise model. This study evaluated the following model runs from the original report in the EA using the new AEDT noise model. These include:

- 2018 No Action conditions
- 2018 With Commercial Service Project conditions
- 2018 With Commercial Service Conditions at the Maximum Throughput conditions that were presented in the Appendix P of the EA (also referred to as the Hursh Report).

The contour modeling update used the same modeling assumptions presented in the EA with the following differences explained as herein.

1. **Boeing Aircraft Company Aircraft Types.** At the time of the study, the INM database did not contain data for new Boeing commercial aircraft types (747-8 and 787) being built and flown at Paine Field; thus, per FAA guidelines, substitute aircraft were used. This updated study used the actual aircraft types that are now contained in the AEDT noise model database.

2. **Assumed Commercial Aircraft Types.** The EA assumed that the commercial aircraft would be served by the MD80 series commercial jet (MD83 in the noise model) and the Dash8-Q400 (referred to as the Q400) turboprop for the regional service. In addition to these previously modeled aircraft, this contour modeling update also evaluated other aircraft (referred to throughout this document as “Current generation”) that could possibly be used for the proposed commercial and regional service. It is important to note that many air carriers are replacing their older aircraft (such as the MD80 series) with newer, quieter, more fuel-efficient aircraft, for example, the Airbus A320 series and the Boeing 737 series. The Dash8-Q400 turboprop is also being replaced by regional jets such as the EMB175. This study modeled both the aircraft analyzed in the EA (MD83/Q400) as well as the Current Generation regional and narrow-body commercial jets that are flown today and assumed to be in service within the project’s planning horizon found in the EA.

This study also evaluated the EMB175 and 737800 aircraft as Current Generation regional and commercial aircraft, respectively (Note: Carrier Allegiant has been updating its fleet from MD80 series aircraft to Airbus A320 type aircraft and Horizon is adding EMB175 while reducing their Q400 fleet). The EMB175 is a regional jet of similar size to the Q400 turboprop aircraft and generates greater noise than the Q400. The 737800 is one of many types of narrow-body aircraft of similar size and engine type (737700, A319, A320, A319NEO, A320NEO, 737-7MAX and 737-8MAX) that could be used to provide the commercial service. The Airbus NEO and Boeing MAX are the next generation version of the same legacy aircraft, with updated engines and technology that result in lower noise levels than the current aircraft models. However, AEDT does not contain aircraft data for these planes. The 737800 represents an aircraft from a
similar fleet of aircraft types that the noise model shows will generate noise at the higher end of the noise range of these aircraft including the A320 series used by Allegiant. This approach presents a more conservative noise contour.

3. **Maximum Throughput Operations.** The number of commercial service operations for both the “With Project” and “Maximum Throughput” used the same assumptions as presented in the EA. The EA used the term “No Action Alternative” for the “Base Case” conditions in 2018, and used the term “Preferred Alternative” for the “With Project” conditions in 2018. The “Maximum Throughput” assumptions were derived from the “Hursh Study” (presented in Appendix P of the EA) that assumed six departures of the regional aircraft (Q400) and six of the commercial aircraft (MD83) for a total of 12 departures (24 operations) per day. The Maximum Throughput refers to the maximum number of operations per day that could reasonably be assumed to operate at the proposed terminal.

While the Hursh Study represented a reasonable prediction of the maximum use of the terminal, to further illustrate a maximum throughput evaluation, another revised alternative is presented. This alternative increased the maximum throughput assumptions from six to eight departures per day for each aircraft type for a total of 16 departures (32 operations) per day. This alternative was developed to represent an increase of 33% over what the EA estimated Maximum Throughput. The Maximum Throughput assumptions in the EA was the predicted number of maximum departures per day that could be used at each gate. (Noise contours for the Revised Maximum Throughput were modelled using the EMB175/737800 assumptions case in that they result in the larger noise contours and represent the worst case of the two commercial operational assumptions.)

For this revised worst-case maximum throughput modeling analysis, the study modeled some additional operations that could occur. In the DNL noise metric, nighttime is defined as 10:00 pm to 7:00 am. The DNL noise metric includes a nighttime penalty during these hours to account for the increased sensitivity to aircraft noise during the nighttime hours. For the revised commercial service operations, we modeled one departure and one arrival of the 737-800 aircraft and two departures and one arrival of the EMB175 aircraft in the nighttime hours.

In my professional opinion and extensive personal knowledge of airport terminal operations, that based on reasonably foreseeable “full” operations at each gate, eight (8) turns per gate, per day is a reasonable assumption. Calculating the maximum reasonable capacity of the terminal requires a series of forecasts and professional judgments. This presents a more conservative prediction by increasing that number by 33% and assumed more of these operations in the “nighttime hours.” The NEPA document and the SEPA document both make reasonable conclusions about the probable, most likely use of the terminal but this additional analysis looks
at a reasonable worst case or maximum capacity scenario, that is a scenario in which the terminal is used to its maximum practical capacity.

Forecasting the maximum reasonable or practical capacity of the terminal requires assessment of a number of variables: the number of hours a day when aircraft that will reasonably use the terminal (it is not reasonable to assume use of the terminal 24/7; no terminal is used in this manner); the number of aircraft “turns” (each airport has different operating characteristics, e.g., number of gates, and each airline has different operational practices for how quickly they turn an aircraft); what type and size of aircraft will be used (while each airline has a known fleet today, forecasting the future fleet requires an understanding of industry dynamics, each airline’s business model, aircraft retirement schedules, and the types and density of routes that the airline will fly); and the seat capacity of the aircraft that will be used (not only does each aircraft have a different physical capacity but each airline outfits their aircraft with different seat configurations and each airline operates a different average load factor).

As an example, using the Original Aircraft Fleet, and factors and available industry data, it is reasonable to assume that carriers using the terminal would operate as follows under a maximum practical capacity scenario.

- Allegiant will operate MD80 series aircraft with an average of 166 seats per aircraft and a load factor of 83 percent. (as noted in Allegiant’s public disclosure documents)
- Horizon will operate Q400 aircraft with an average of 76 seats and a load factor of 80 percent. (as noted in Horizon’s public disclosure documents)

MODELING RESULTS

This section presents the DNL noise modeling results for “No Action”, “With Commercial Service”, “With Commercial Service Maximum Throughput” and “Maximum Throughput Revised Alternative”. The “No Action” run is the same as the final year (2018) evaluated in the EA, and used the operational assumptions that were presented in the EA unless noted below. As presented in the NEPA EA, DNL noise contours for the 70 and 65 DNL noise level were developed in this Noise Contour Update. Each of the model runs are listed below, along with the assumptions used.

The noise contour results are presented in Figures 1 through 5. Figure 1 and 2 present individual contours for 2018 No Action conditions. Figures 3, 4 and 5 present the contours for the “No Action”, “With Project” and “With Project with Max Throughput” combined into one figure. Figure 3 assumes that the original commercial aircraft are used, while Figure 4 assumes that the Current Generation commercial aircraft are used; “original commercial aircraft” refers to the Q400 and MD83 while “Current Generation commercial aircraft” refers to the 737800
and EMB175 aircraft. Figures 3 and 4 use the original assumptions for the “Maximum Throughput” (6 departures per day per aircraft type). Figure 5 uses the “Revised Maximum Throughput” and Current Generation commercial aircraft (8 departures per day per aircraft type). Figures 1a through 5a present the same information, but on an aerial base map. For comparative purposes, the 2018 noise contours from the EA are presented at the end of this document.

**Figure 1 - 2018 Original Assumptions No Action**
- Original Boeing Aircraft Substitutions

**Figure 2 - Updated 2018 No Action**
- Updated Actual Boeing Aircraft, No Substitutions

**Figure 3 - Updated 2018 No Action, With Project and Original Max Throughput**
- (Original Commercial Aircraft)
  - Updated Actual Boeing Aircraft, No Substitutions
  - Original Commercial Operations (Q400 and MD80)
  - Original Max Throughput of 12 departures per day (6 Regional and 6 Commercial)

**Figure 4 - Updated 2018 No Action, With Project and Original Max Throughput**
- (Current Generation Commercial Aircraft)
  - Updated Actual Boeing Aircraft, No Substitutions
  - Current Generation Commercial Operations (EMB175 and 737800)
  - Original Max Throughput of 12 departures per day (6 Regional and 6 Commercial)

**Figure 5 - Updated 2018 No Action, With Project and Revised Max Throughput**
- (Current Generation Commercial Aircraft)
  - Updated Actual Boeing Aircraft, No Substitutions
  - Current Generation Commercial Operations (EMB175 and 737800)
  - Revised Max throughput of 16 departures per day (8 Regional and 8 Commercial)

The results of the noise contour analysis show that the noise contours generated in this project are similar in size and shape for each of the alternatives to those that were generated in the NEPA EA. The 65 DNL noise contour for the 2018 “No Action alternative” from the EA using the INM noise model was 696 acres in size. Using the same assumptions, the size of the contour using the AEDT noise model was 732 acres. This is a small increase that is difficult to visually see the difference.

These results are presented in Table 1, which shows the total acres in the 65 DNL for each of the model runs. These AEDT noise contours are slightly larger than the INM contours; this change is most attributable to the engine run-up and general aviation runway than operations on the main runway. Note that general aviation operations and engine run-up activity is airport operational activity that is not part of or affected by the Commercial Service Project.
For the Updated No Action using actual Boeing aircraft types (and not substitute types), the noise contours are slightly smaller, 709 acres. This is attributed to the actual aircraft being quieter than the aircraft used as substitutes in the NEPA EA. The “With-Project” noise contours (for both the “With Project Commercial Service” and “Maximum Throughput” conditions) are slightly larger for the Current Generation commercial aircraft (EMB175/737800) than those originally assumed in the EA (Q400/MD83). The MD83 is a louder aircraft than the 737800; however, the EMB175 is a louder aircraft than the Q400.

The “Revised Maximum Throughput” DNL noise contours with eight departures for each aircraft type per day (16 departures total/32 operations) resulted in a bit larger contours than those based upon the original “Maximum Throughput” contours (six departures for each aircraft type). The contour area of the 65 DNL increased from 798 acres to 835 acres. This increase of 37 acres is attributable to the increase from 6 to 8 departures per day and the added modeling assumption of the greater number of night operations.

As with the NEPA EA contours, there are no population or noise sensitive land uses within the 70 or 65 DNL noise contours. This is the same for the “Original Maximum Throughput” and the “Revised Maximum Throughput” assumptions.

Table 1
Noise Contour Size (65 DNL)
AEDT 2C Noise Model

<table>
<thead>
<tr>
<th>Figure</th>
<th>MODEL RUN</th>
<th>CONTOUR AREA (Acres (65 DNL))</th>
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<tr>
<td></td>
<td>No Action</td>
<td>2018 Original Assumptions No Action (Original Boeing Aircraft Subs)</td>
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<td>Figure 1</td>
<td>Updated 2018 No Action (Actual Boeing Aircraft, No Substations)</td>
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<td>With Project (Original Commercial Aircraft)</td>
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<td>Figure 3</td>
<td>Updated 2018 With Original Max Throughput (Original Commercial Aircraft)</td>
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<td>With Project (Current Generation Commercial Aircraft)</td>
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<td>Figure 4</td>
<td>Updated 2018 With Original Max Throughput (Current Generation Commercial Aircraft)</td>
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<td>Figure 5</td>
<td>Updated 2018 With Revised Max Throughput (Current Generation Commercial Aircraft)</td>
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</table>
SUMMARY

The DNL noise contours were generated based upon the EA 2018 forecast operations assumptions. These forecast operations predicted future activity levels in terms of total operations and operations by different categories and types of aircraft. These categories include general aviation, corporate jets, Boeing commercial aircraft, air taxi and military. These 2018 forecast operations were compared to the most recent 12 months (November 2015 through October 2016) of activity at the airport from the Traffic Flow Management System Counts (TFMSC). This data does not include operations from small aircraft flying visual flight rules but does include most aircraft that operate in the National Airspace System (NAS). The results show that the current operations and the forecast 2018 operations are similar in terms of total activity and types of activity. It is my professional opinion that noise contours and impacts developed based upon current activity would be similar to those predicted based upon the 2018 forecast activity level contained in the NEPA EA. Again, the EA analysis and this update to the contours demonstrates that noise associated with Propeller Airports’ project is below the FAA’s thresholds of significance.
Figure 1
2018 Original Assumptions Base Case Noise Contours (65 and 70 DNL)

Assumptions:
- AEDT Noise Model
- EA 2018 Operational Assumptions
- Original Boeing Aircraft Substitutions

Source: BridgeNet International 2017
Figure 2
Updated 2018 Base Case Noise Contours (65 and 70 DNL)

Assumptions:
- AEDT Noise Model
- EA 2018 Operational Assumptions
- Updated Actual Boeing Aircraft, No Substitutions

Source: BridgeNet International 2017
Figure 3
Updated 2018 No Action, With Project and Max Throughput Noise Contours
Original Commercial Operations -- (65 and 70 DNL)

Assumptions:
- AEDT Noise Model
- EA 2018 Operational Assumptions
- Updated Actual Boeing Aircraft, No Substitutions
- Original Commercial Operations (DASH8-Q400 and MD83)
- Original Max Throughput of 12 Departures per Day
Figure 4
Updated 2018 No Action, With Project and Max Throughput Noise Contours
Current Generation Commercial Operations -- (65 and 70 DNL)

Assumptions:
- AEDT Noise Model
- EA 2018 Operational Assumptions
- Updated Actual Boeing Aircraft, No Substitutions
- Current Generation Commercial Operations (EMB175 and 737800)
- Original Max Throughput of 12 Departures per Day

Source: BridgeNet International 2017
Figure 5
Updated 2018 No Action, With Project and Revised Max Throughput Noise Contours
Current Generation Commercial Operations -- (65 and 70 DNL)

Assumptions:
- AEDT Noise Model
- EA 2018 Operational Assumptions
- Updated Actual Boeing Aircraft, No Substitutions
- Current Generation Commercial Operations (EMB175 and 737800)
- Revised Max Throughput of 16 Departures per Day

2018 DNL NOISE CONTOURS
- No Action Conditions
- With Project Conditions
- Rev Max Throughput

Source: BridgeNet International 2017
Figure 1a
2018 Original Assumptions Base Case Noise Contours (65 and 70 DNL)

**Assumptions:**
- AEDT Noise Model
- EA 2018 Operational Assumptions
- Original Boeing Aircraft Substitutions

Source: BridgeNet International 2017
Figure 2a
Updated 2018 Base Case Noise Contours (65 and 70 DNL)

Assumptions:
- AEDT Noise Model
- EA 2018 Operational Assumptions
- Updated Actual Boeing Aircraft, No Substitutions

Source: BridgeNet International 2017
**Figure 3a**
Updated 2018 No Action, With Project and Max Throughput Noise Contours
Original Commercial Operations -- (65 and 70 DNL)

**Assumptions:**
- AEDT Noise Model
- EA 2018 Operational Assumptions
- Updated Actual Boeing Aircraft, No Substitutions
- Original Commercial Operations (DASH8-Q400 and MD83)
- Original Max Throughput of 12 Departures per Day

2018 DNL NOISE CONTOURS
No Action Conditions
With Project Conditions
With Max Throughput

Source: BridgeNet International 2017
Figure 4a
Updated 2018 No Action, With Project and Max Throughput Noise Contours
Current Generation Commercial Operations -- (65 and 70 DNL)

Assumptions:
- AEDT Noise Model
- EA 2018 Operational Assumptions
- Updated Actual Boeing Aircraft, No Substitutions
- Current Generation Commercial Operations (EMB175 and 737800)
- Original Max Throughput of 12 Departures per Day

Source: BridgeNet International 2017
Figure 5a
Updated 2018 No Action, With Project and Revised Max Throughput Noise Contours
Current Generation Commercial Operations -- (65 and 70 DNL)

Assumptions:
- AEDT Noise Model
- EA 2018 Operational Assumptions
- Updated Actual Boeing Aircraft, No Substitutions
- Current Generation Commercial Operations (EMB175 and 737800)
- Revised Max Throughput of 16 Departures per Day

Source: BridgeNet International 2017
Environmental Assessment Figures
Figure D4 Future Noise Contours (2018) without Project

Source: Google Maps-June 2010.

(1) **Note:** "These Parks Are Protected Under Section 6(f) of the Land and Water Conservation Fund (LWCF) Act, which Requires Replacement Property as Mitigation for Conservation of Park Property that was Purchased or Deveoped with Stateside LWCF Funds".

**NOISE CONTOUR LEGEND**
- Noise Contour
- Airport Property Line
- School
- Church
- Hospital/Nursing Home

**Scale in Feet**

0 1,500' 3,000'
Figure D6 Future Noise Contours (2018) with Project

Source: Google Maps-June 2010.
Figure D2 Future Noise Contours (2018) with and without Project

Source: Google Maps-June 2010.
Figure 1  Future Noise Contours (2018) Max Thruput

Source: Google Maps-June 2010.