

## HMMH

8880 Cal Center Drive, Suite 430  
Sacramento, California 95826  
916.368.0707  
www.hmmh.com

### MEMORANDUM

---

**To:** Hardy S. Bullock  
Director of Aviation & Community Services  
Truckee Tahoe Airport District  
10356 Truckee Airport Rd.  
Truckee, CA 96160

**From:** Rhea A. Gundry  
Senior Consultant

**Date:** July 9, 2015

**Subject:** Measured Aircraft Noise Comparison

**Reference:** HMMH Job No.307560.000

---



HMMH assisted Truckee Tahoe Airport (TRK) to compare noise levels of two, fixed wing single-engine aircraft: (1) A standard Cessna 172N (N1968F) that is based at TRK and (2) A RedHawk Cessna 172P (N64686) with a retrofitted Jet A diesel engine and smaller diameter three bladed propeller. TRK arranged for the RedHawk to fly in from Texas for a side by side comparison of these nearly identical aircraft to demonstrate the difference in noise level with the retrofitted diesel engine.

Formatted: Font: 14 pt

This memorandum provides the results of the noise measurements conducted on June 24, 2015 at TRK and in the nearby surrounding community.

HMMH deployed four (4) Rion 22 noise meters on the airfield and in the community to obtain the A-weighted one-second time history noise levels in decibels (dB). Figure 1 shows the locations of each monitoring site and the flight tracks. Observers were stationed with the noise meters to listen and record each flyover event. Using the observer logs and recorded time histories, HMMH calculated the Single Event Noise Exposure Level (SENEL), which is also known as the Sound Exposure Level (SEL), for each of the demonstration aircraft noise events captured by the noise meters.

Commented [RAH1]: Can we get the flight tracks in KML files format to display on google earth?



**Figure 1 Noise Monitoring Sites**

Three TRK airfield locations along the runway sideline (L1-L3) were measured to capture the difference between four unique elements of an aircraft departure, touch-and-go procedure, and arrival:

- L1) Start of takeoff roll
- L2) Engine rev 1000' down the runway of a touch-and-go procedure
- L3) 1) Touch-and-go procedure at rotation and  
 2) Touch down and final taxi on taxiway G

Table 1 shows the measured noise levels of both aircraft for each of the above identified aircraft events and the noise level difference between the standard aircraft and the retrofitted (RedHawk) aircraft. The RedHawk, with the retrofitted diesel engine, is approximately 8 dB quieter than the standard (non-retrofitted aircraft) on the airfield. The arrival event, touchdown and final taxi, is the exception with the RedHawk only 2 dB quieter.

| Table 1: Noise Levels from Aircraft Operations as Measured on the TRK Airfield |          |         |            |
|--|----------|---------|------------|
| Event  | Standard | RedHawk | Difference |
| L1   | 98.6     | 90.1    | -8.5       |
| L2   | 90.9     | 82.8    | -8.0       |

Formatted: Font: 12 pt



|      |      |      |      |
|------|------|------|------|
| L3-1 | 94.6 | 85.8 | -8.8 |
| L3-2 | 72.8 | 70.5 | -2.3 |

*Note: Noise levels presented herein are A-weighted SENEL in dB*

Table 2 and Table 3 show the noise level results for each demonstration aircraft event measured at each community location and the average noise level of all demonstration aircraft events. While the aircraft operations of each aircraft were not completely identical, the pilots attempted to maintain similar aircraft path, altitude and weight for the standard aircraft and the RedHawk. On average the RedHawk is 5 to 10 dB quieter than the standard aircraft, which is in the range of a perception of being "half as loud".

Formatted: Font: 12 pt



| Table 2: Noise Levels from Aircraft Operations as Measured at Rosa Ct. |          |         |            |
|--|----------|---------|------------|
| Event  | Standard | RedHawk | Difference |
| E1   | 78.6     | 71.2    | -7.4       |
| E2   | 79.0     | 70.4    | -8.7       |
| E3   | 81.4     | 78.2    | -3.1       |
| Average  | 79.8     | 74.8    | -5.1       |

*Note: Noise levels presented herein are A-weighted SENEL in dB*

| Table 3: Noise Levels from Aircraft Operations as Measured at Olympic Blvd. |          |         |            |
|---|----------|---------|------------|
| Event   | Standard | RedHawk | Difference |
| E1  | 82.1     | 72.2    | -9.9       |
| E2  | 83.3     | 71.9    | -11.5      |
| E3  | 81.3     | 71.9    | -9.4       |
| Average   | 82.3     | 72.0    | -10.3      |

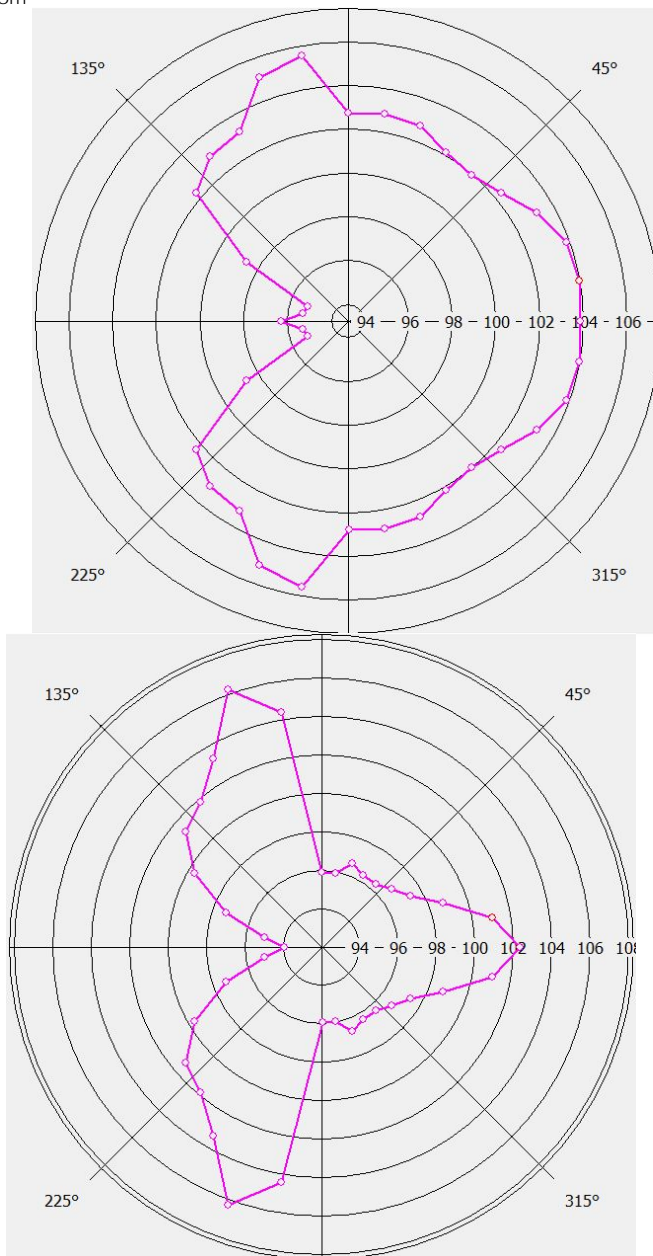
*Note: Noise levels presented herein are A-weighted SENEL in dB*

Formatted: Font: 12 pt

Using the same Rion noise meters and collecting one-second noise level time histories, HMMH calculated the equivalent sound level, Leq, of a full power run-up at 20 degree increments, 30 feet from each engine. Leq is the equivalent sound level measured throughout the noise event as though the sound level was constant throughout the event. Figure 2 shows a side by side comparison of the directivities of each aircraft in terms of the Leq noise metric.

# HMMH

8880 Cal Center Drive, Suite 430  
Sacramento, California 95826  
916.368.0707  
www.hmmh.com



**Figure 2 Directivity of 1968F (top) and RedHawk (bottom)**

Note: Engine at center, nose/propeller of plane facing 0°