NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, DC 20594

April 17, 2009

Sound Spectrum Study

Specialist's Summary Report
By Christopher Babcock

A. EVENT

Location:	North Canton, Ohio
Date:	December 19, 2008, 1753 Central Daylight Time (CDT)
Aircraft:	Piper PA-32R-301T, Registration N9299N
Operator:	Private
NTSB Number:	CEN09FA099

B. GROUP

A group was not convened.

C. SUMMARY

On December 19, 2008, a Piper PA-32R-301T, N9299N crashed two miles east-northeast of the Akron-Canton Regional Airport, Akron, OH, during a precision approach to Runway 23. The Title 14 CFR Part 91 personal flight was operating under an instrument flight rules (IFR) flight plan from College Park, MD, to Akron, OH. Recorded audio from the Akron radar approach and Akron local control facilities was sent to the National Transportation Safety Board's Audio Laboratory for analysis in order to identify any background sounds that could be identified with the engine, propeller, or cockpit warnings.

D. DETAILS OF INVESTIGATION

On January 27, 2009, the NTSB Vehicle Recorder Division's Audio Laboratory received a compact disc containing 786 seconds of digital audio from the radar approach facility and 340 seconds of digital audio from the local control facility. Table 1 shows the timing, duration, and contents of transmissions made by N9299N.

Table 1. N9299N radio transmissions.

Transmission ID	Relative Time (sec)	Duration (sec)	Contents
Transmissions to Approach Control			
1	179.0	5.3	Akron Canton Saratoga 9299N checking in with you at six thousand. we've got alpha.
2	191.1	2.6	two niner seven six expecting ILS two three.
3	402.2	2.0	three four zero for nine nine november.
4	526.4	7.2	nine nine november out of six thousand for three thousand two hundred. uh any PIREPs of icing below six?
5	537.7	1.5	nine nine november thank you.
6	567.7	5.0	two five zero cleared ILS two three approach nine nine november.
7	602.3	1.7	nine nine november going to tower.
Transmissions to Local Control			
8	245.6	4.2	Akron Canton Tower Saratoga nine two nine nine november with you on the ILS two three.
9	258.0	2.6	nine nine november correcting.
10	270.4	1.2	nine nine novmeber please repeat.
11	279.2	1.9	due north nine nine november we'd like to correct.
12	288.7	1.4	uh nine nine november.
13	298.2	3.8	do a three sixty and uh re-establish ourselves.
14	308.8	2.1	nine nine november we're heading due north and climbing.
15	326.3	6.9	nine nine november declaring an emergency…oh [expletive].

The Piper PA-32R-301T is equipped with a single turbocharged Lycoming TIO-540-AH1A direct drive engine and a 3-bladed, constant speed propeller. According to the FAA Type Certificate Data Sheet, maximum rated RPM as installed is 2500 RPM. At maximum RPM, the engine will produce acoustic signatures at a blade passage frequency of 125 Hz and harmonics shown in Table 2.

Table 2. Blade passage and harmonic frequencies of propeller.

Engine Shaft/Propeller	42 Hz
2nd Harmonic	84 Hz
3rd Harmonic & Blade Passage	126 Hz
4th Harmonic	168 Hz
5th Harmonic	210 Hz
6th Harmonic	252 Hz
7th Harmonic	294 Hz
8th Harmonic	336 Hz
9th Harmonic	378 Hz

To determine engine speed the study concentrated on non-voice sections of audio since voice signatures tend to dominate the audio and obscure background sounds. Of the fifteen transmissions identified from N9299N, only transmissions 6, 10, 13, and 15 contain enough non-voice audio to isolate propeller and engine sounds. Figures 1 through 4 show the identified engine/propeller frequencies and harmonics.

Both transmission 6 and transmission 10 show evidence of the engine/propeller operating at approximately 2458 RPM. Both transmission 13 and transmission 15 show evidence of the engine/propeller operating at approximately 2497 RPM.

A review of each transmission indicated no evidence of aural cockpit warnings.

Figure 1. Spectrum of engine and propeller frequencies for transmission 6.

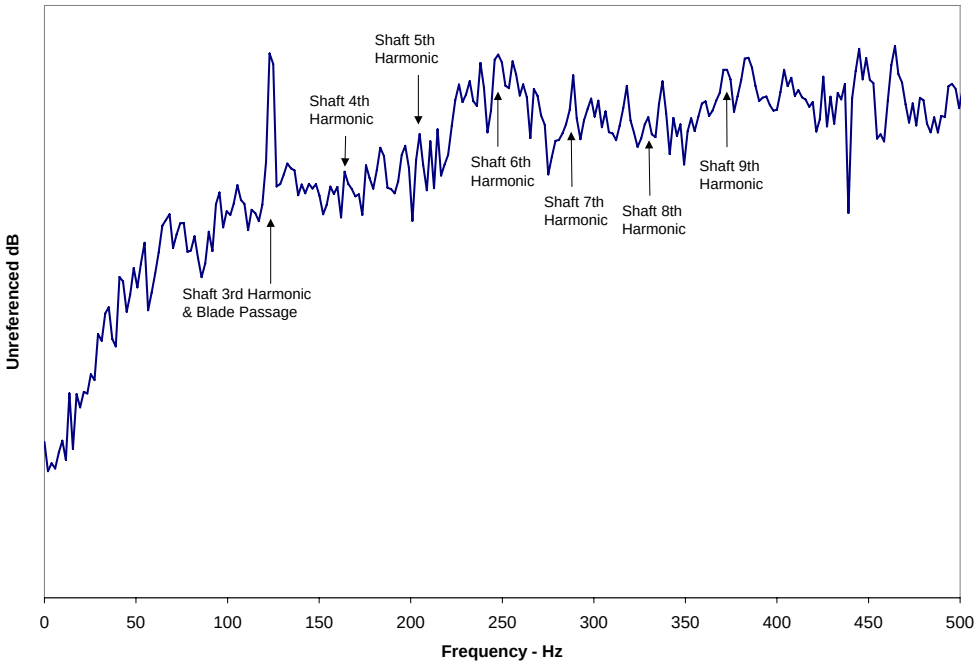


Figure 2. Spectrum of engine and propeller frequencies for transmission 10.

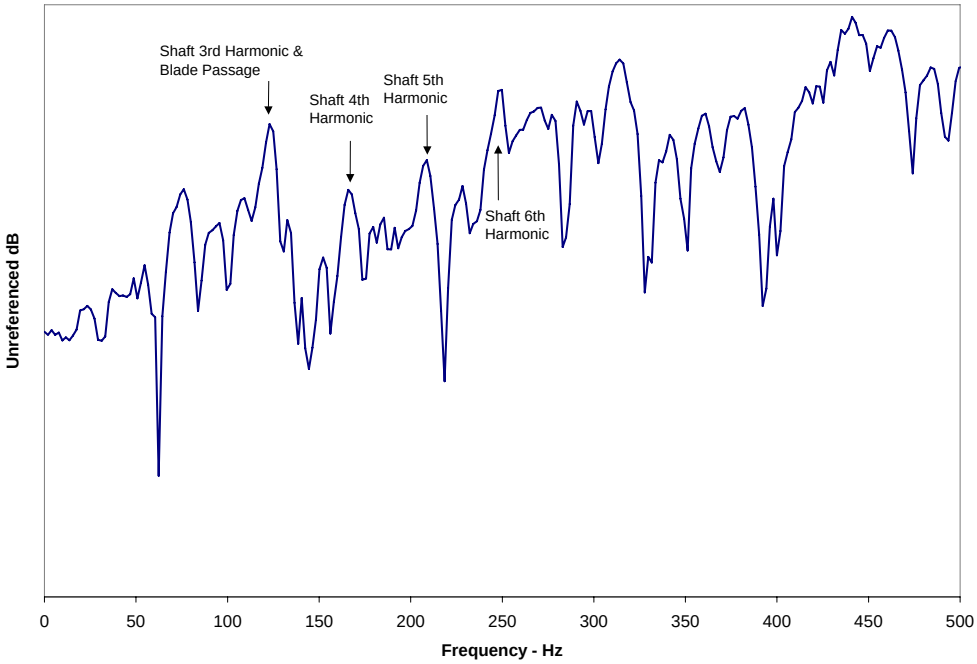


Figure 3. Spectrum of engine and propeller frequencies for transmission 13.

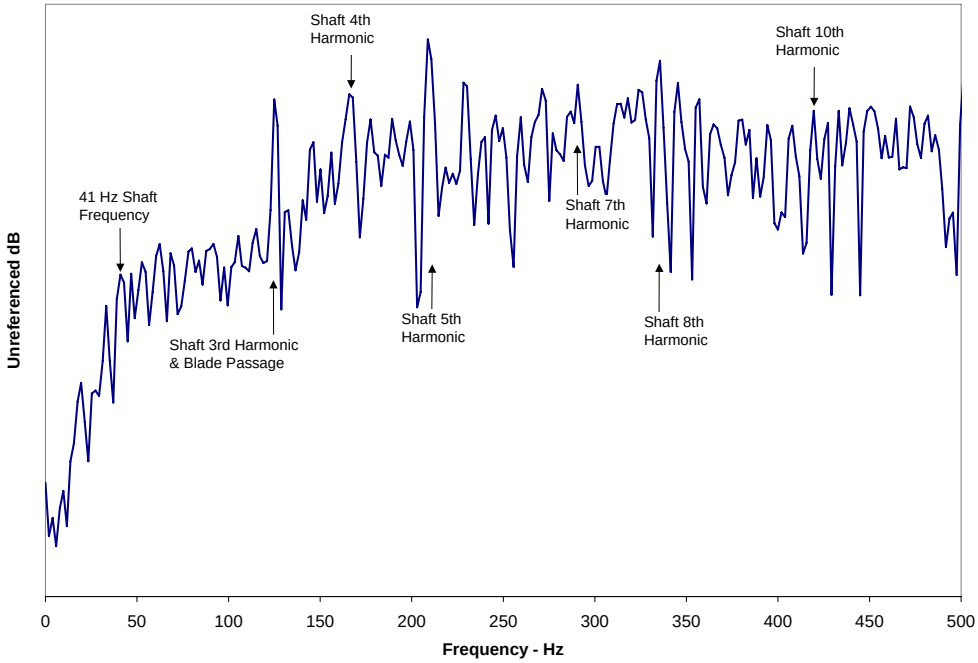
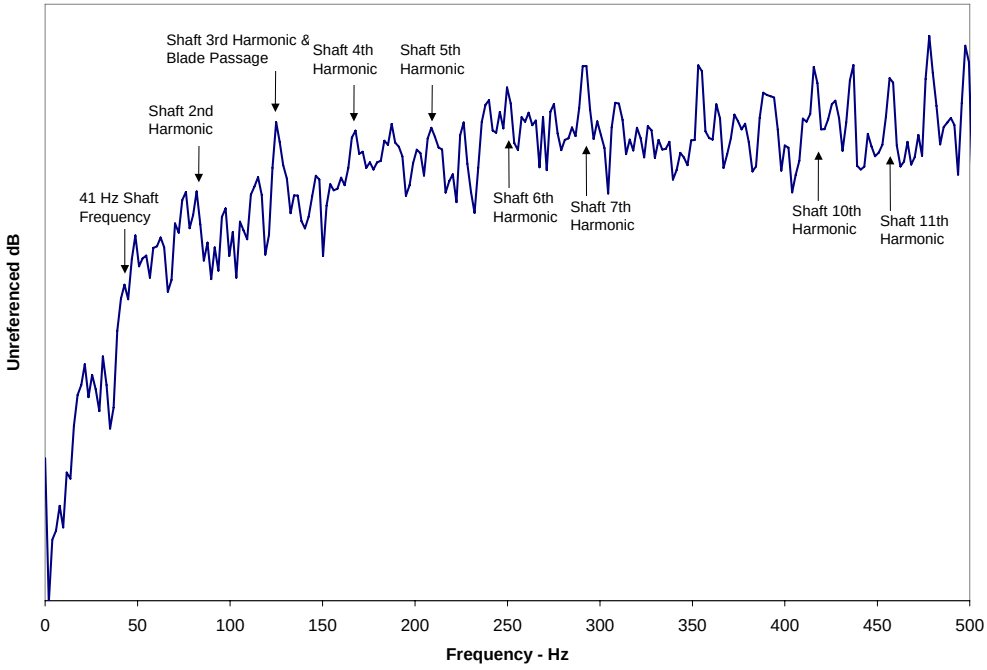


Figure 4. Spectrum of engine and propeller frequencies for transmission 15.



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