NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorders Division
Washington, DC 20594

April 29, 2003

ATC Recording

Sound Spectrum Study

Specialist's Report by
Joseph A. Gregor

A. ACCIDENT

Location:	San Dimas, California
Date:	July 4, 2002
Time:	1230 Pacific Daylight Time (PDT)*
Aircraft:	Cessna 310I, N8145M
NTSB Number:	LAX02FA214

B. GROUP

No Group.

C. SUMMARY

On July 4, 2002, at 1230 PDT, a Cessna 310I twin engine aircraft, N8145M, was destroyed when it impacted the terrain during a forced landing after takeoff from Brackett Field Airport, San Dimas, California. The commercial pilot and his rated passenger received fatal injuries. Visual meteorological conditions prevailed at the time of the accident. A copy of the ATC control tower tape was received at the audio laboratory of the NTSB on August 9, 2002. Transmissions from the pilot to tower were analyzed for spectral signatures related to engine operation.

* All times are expressed in pacific daylight time (PDT), unless otherwise noted.

D. DETAILS OF INVESTIGATION

The focus of this sound spectrum investigation was on identification of sounds which may be related to operation of the engines on the twin engine Cessna 310I aircraft. The aircraft was equipped with Teledyne continental model IO-470-U six cylinder engines rated for 260 horsepower @ 2625 rpm. The engines were driving two McCauley two-bladed, 80 inch diameter propellers. The order of events recorded on the ATC tape is summarized in Table 1 below. Time is expressed in minutes:seconds from the beginning of the recording.

TIME (mm:ss.s)	***SOURCE***	***COMMENT***
00:05.2	N8145M	*[*] tower twin Cessna eight one four five mike holding short a two six left for departure
00:10.0	TWR	twin four five mike mike tower runway ah two six left…cleared for takeoff
00:15.8	N8145M	roger twin Cessna eight one four five mike understand cleared for takeoff?
00:19.0	TWR	yes sir, two six left you're cleared for takeoff. say direction of flight
00:22.2	N8145M	roger we'll be out the freeway turning out toward the ah south
00:25.6	TWR	left crosswind departure approved
00:27.7	N8145M	eight one four five mike, thank you sir
01:52.8	N8145M	four five mike mayday mayday mayday

Table 1. Order of events on the ATC recording from N8145M.

Spectrographs for the last transmission made by the pilot just prior to takeoff and for the mayday transmission are illustrated in figures 1 and 2. These figures show the frequency distribution (vertical axis) vs. time (horizontal axis) during each transmission. No clear engine signatures are discernable. The weak line at 9923 Hz is present due bleed-though of the nominally 10 kHz IRIG-E time code signal also recorded on the tape.

[*] unintelligible word.

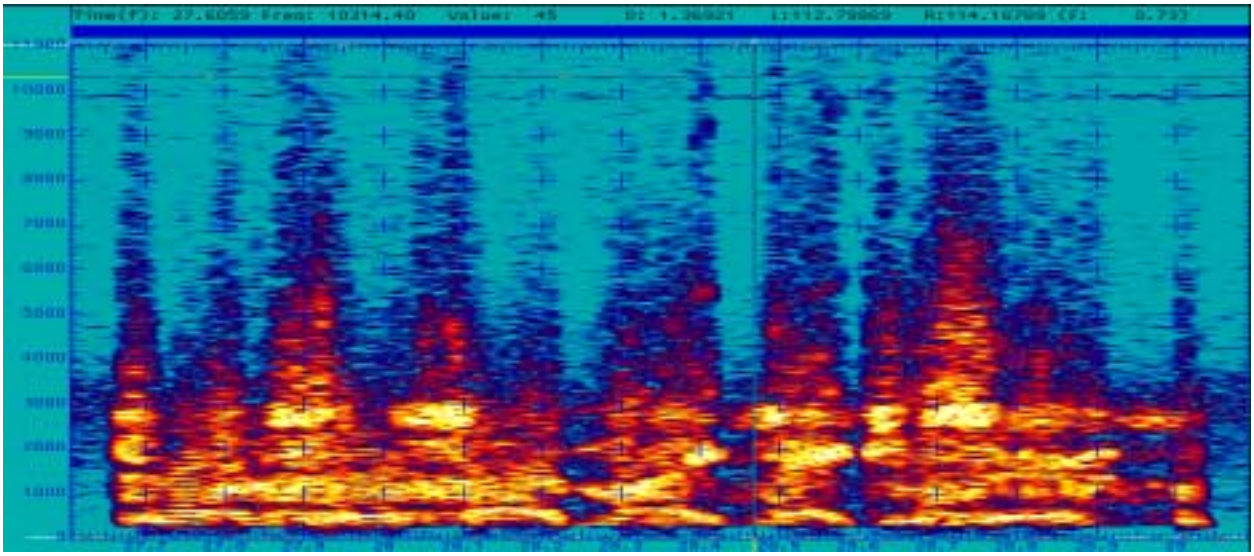

Figure 1: Spectrograph of the 00:27.7 pilot transmission. The horizontal axis corresponds to elapsed time in seconds. The vertical axis corresponds to amplitude in arbitrary units. Color indicates intensity (squared-magnitude) with red being highest and light blue being lowest.

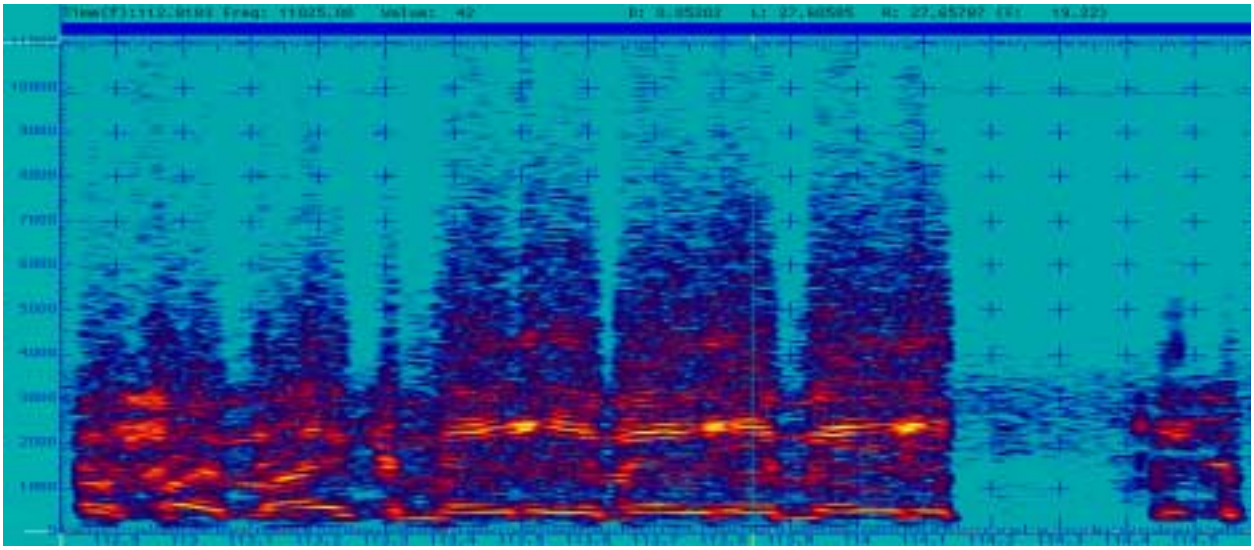

Figure 2: Spectrograph of the 01:52.8 pilot transmission. The horizontal axis corresponds to elapsed time in seconds. The vertical axis corresponds to amplitude in arbitrary units. Color indicates intensity (squared-magnitude) with red being highest and light blue being lowest.

A comparison was made of the total signal energy as a function of frequency over the length of each transmission. This is illustrated in figure 3, which shows the total signal amplitude as a function of frequency for the 00:27.7 pilot transmission made just before takeoff (purple) and the 01:52.8 mayday transmission (yellow). Direct

comparison between the relative magnitude of the two transmissions cannot be made due to the presence of an automatic gain control, active noise canceller, or some other active device in the microphone channel. This changes the relative gain of the pilot microphone, and hence the level of the signal, from one transmission to the next in response to changes in pilot voice level and/or background noise level. Figure 3 does indicate that the 00:27.7 transmission contains a significantly higher level broadband noise than does the 01:52.8 mayday transmission. It was not possible to match this noise spectra to any reasonable engine signatures.

Another check was made for engine signatures by looking at any modulation of the background noise. A filter was employed to remove all sound energy below approximately 3500 Hz, where most voice energy lies. The high frequency component was then low-pass filtered to obtain and modulation of the background noise, possibly due to engine operation. The result are illustrated in figure 4. It was not possible to match this spectra to any reasonable engine signatures.

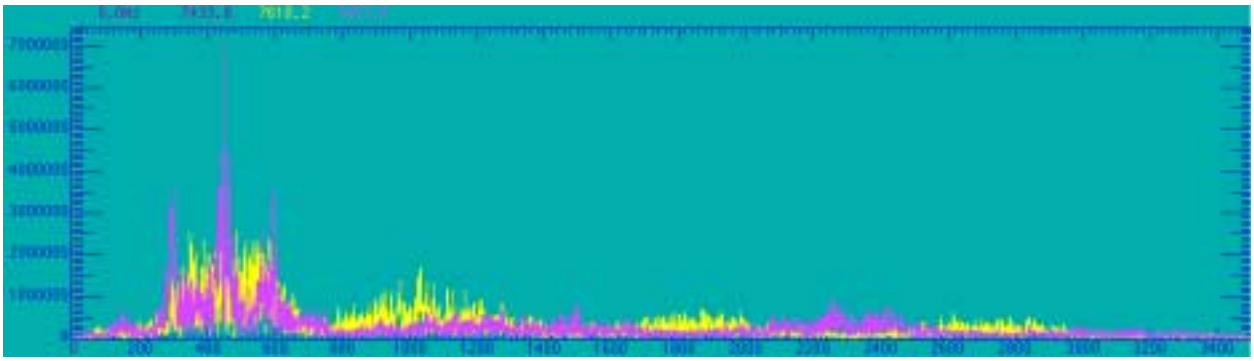

Figure 3: Comparison of time-integrated spectra of the 00:27.7 pilot transmission just before takeoff (purple) with the 01:52.8 mayday transmission (yellow). The horizontal axis corresponds frequency in Hz. This vertical axis represent amplitude as a function of frequency integrated over the length of each transmission.

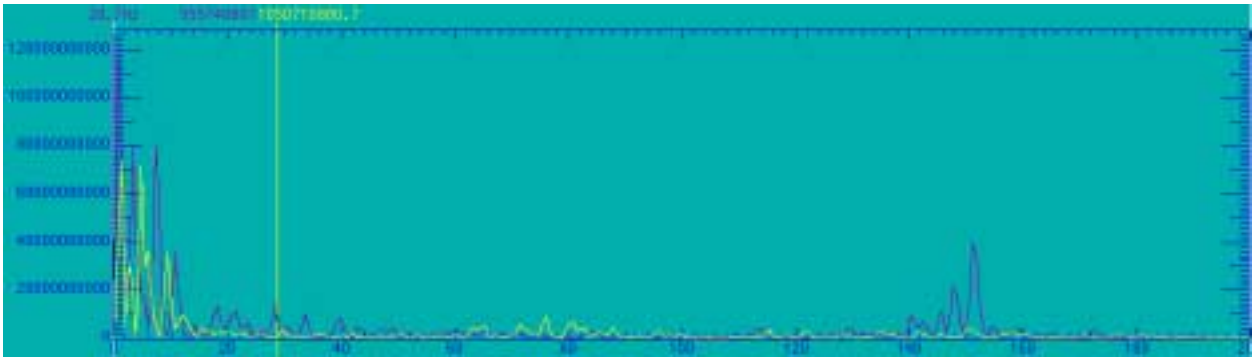

Figure 4: Comparison of the modulation on the 00:27.7 pilot transmission just before takeoff (yellow) with the 01:52.8 mayday transmission (purple). The horizontal axis corresponds frequency in Hz. The vertical axis corresponds to amplitude in arbitrary units.

The data from the ATC tapes indicates that a mechanical device was operating while the aircraft was on the ground just prior to takeoff which produced broad-spectrum noise. The data further indicates that this device was not operating, or was operating and a much reduced level, during the single mayday transmission last made by the pilot. The nature and operating parameters of this device could not be determined from the data provided.

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