June 2012

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The Magazine Of American Beekeeping

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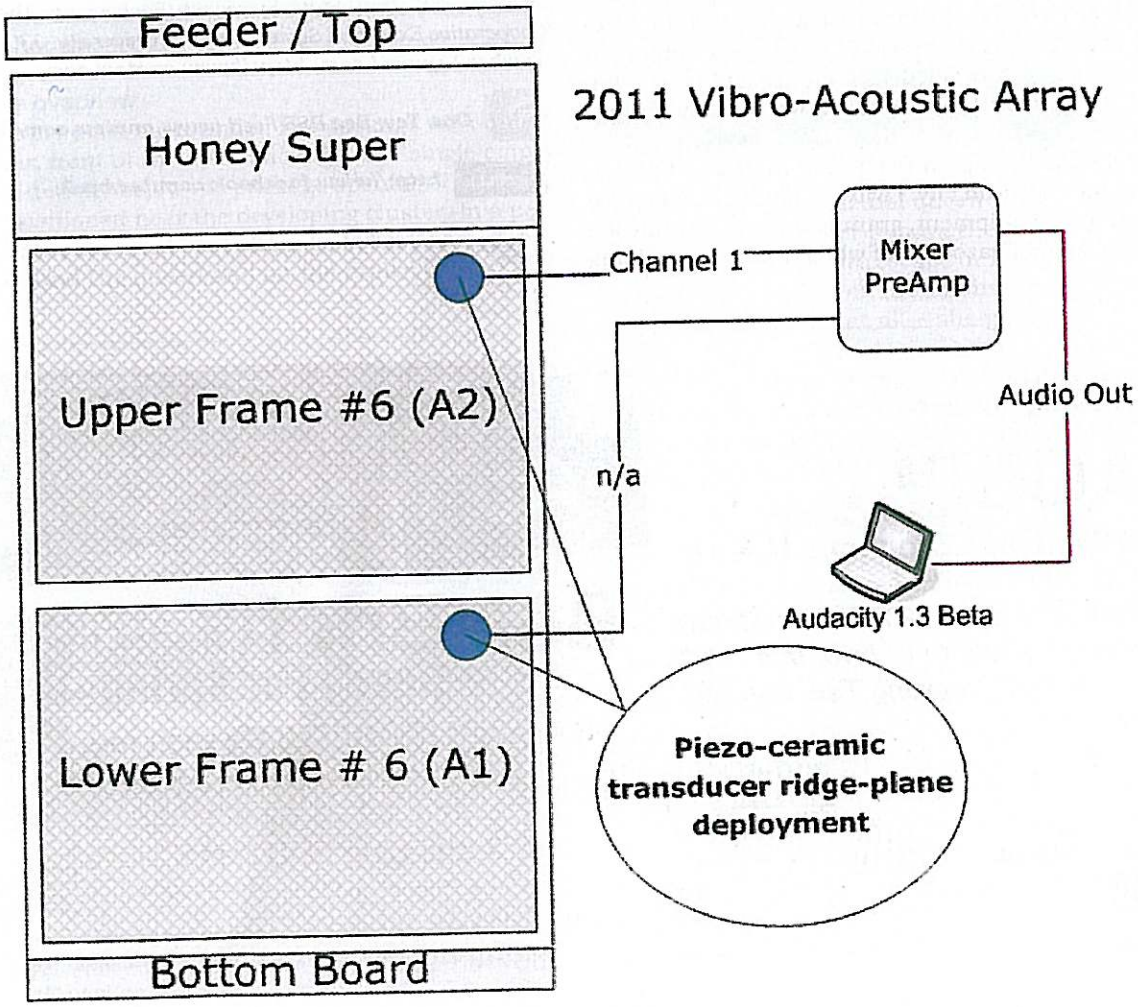
Honey Bee Music?

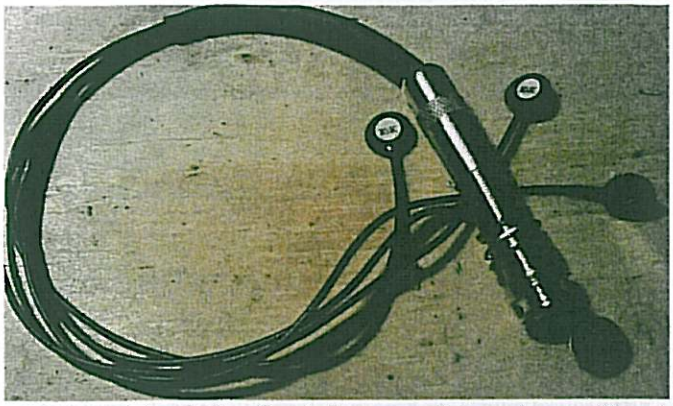
Are the bees playing music?

Stephen **Engel**

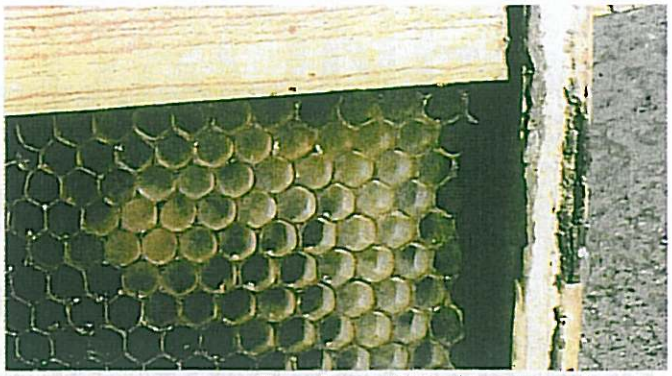
2011 was a very busy year on many accounts. I manage a small, experimental remotely-monitored apiary that I call StephensApiary.com. It is a beehive continuous lifecycle/behavior monitor combined with the vibro-acoustic array. I call it a platform or suite of *mechatronic* applications for a beehive. Basically a bunch of mechanical stuff mixed with electronics all connected to the internet. During early Spring of 2011, I moved the entire operation from Sacramento to a new facility near San Jose, California. The hives enjoyed a similar lifestyle as the previous year, with a plethora of forage options for their any desire within less than a quarter mile radius all year long. I had a similar array of piezo-ceramic transducers deployed in my two hives during 2011 as in 2010. Additionally, I continued to identify these initiator and responder signals within the combs of both hives throughout the year. During the 2011 hive year I identified some seasonal variance in the number of pulses of the initiator signal. In the Spring and during the Summer the signal had eight pulses and during the Winter the signal had nine pulses. Now that I know that the signal varies, I may find even more variance in the future.

In 2011 just after 3 p.m. on December 5th, well after all of the Summer bees were gone, I was able to record this file: ***Alpha_UpperF6_12_5_2011_1520pm.wav*** This file may be downloaded from my Google site from this link: **http://goo.gl/cKRI3** If you open this link in your browser, you will be directed to a Google site with a File menu link in the upper left corner which will give you the option to save or open this file in your media player. I think this file represents the initiator and responder signals much better since only winter bees exist in the hive. This recording was done with Audacity 1.3 Beta with my notebook computer. Only Channel 1 is recorded due to the cluster existing mostly in the upper box and no signal was coming from the lower frame; not one of my best recordings so I apologize ahead of time for the high-gain in the file.





K&K Pure Classic (four-head piezo-ceramic transducer with end-pin jack). I cut off the connector and installed each in a single frame.



Transducer within ridge plane of comb.

I still do not know exactly what is generating the initiator or responder signals conclusively, but I have a few guesses and thought maybe I could share my wild ideas a little and see what kind of responses or better ideas I can get.

One thing I have learned this year is the initiator signal is out of the acoustic range of a honey bee (200-350 Hz). The initiator signal was measured to have a fundamental frequency of 4 kHz with detectable harmonics at 8 kHz and 12 kHz.

The responder signal "sounds-like" a flutter of the wings or legs against the combs coincidentally after each initiator signal.

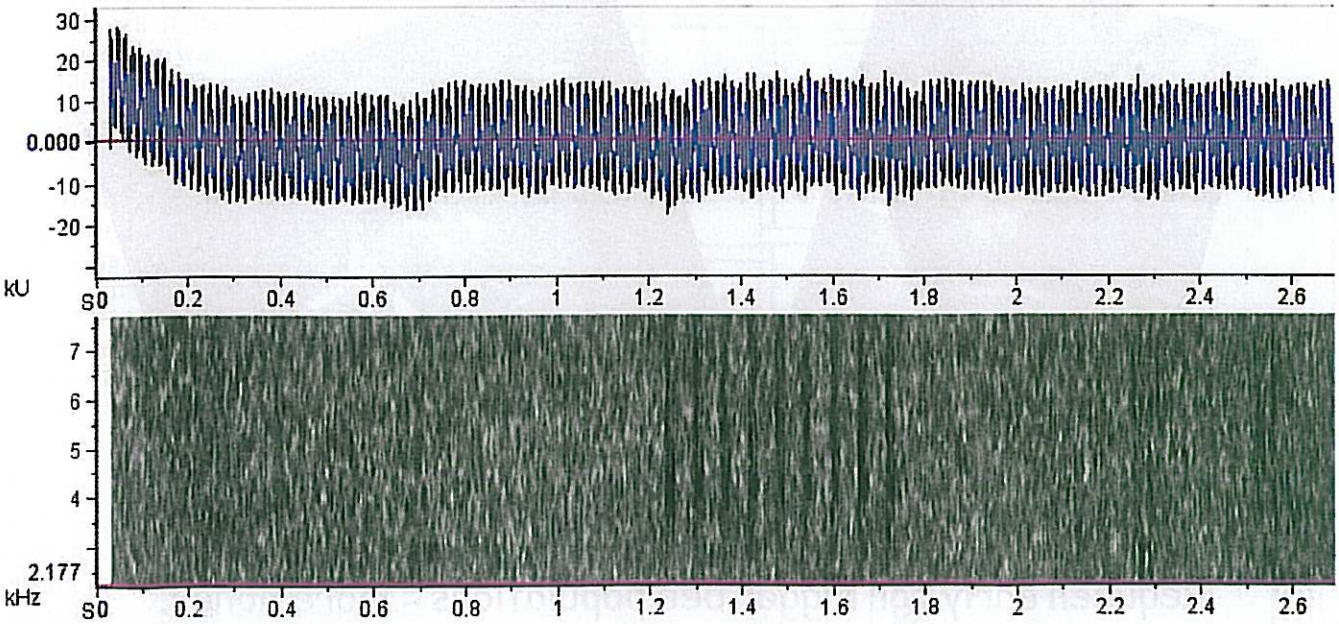
The initiator signal could come from some other critter in the hive, but I suspect that it is a bee. I have detected a similar signal in every hive I have tried my array in, both in Sacramento and in San Jose and with completely different sound equipment and frames. I have also detected the signal in a new package before the queen had been released.

If it is a bee, how could a bee generate a signal that it could not acoustically detect I thought? It seemed to me that a logical possibility might be that a bee generates the signal by rubbing the comb somehow. I am not sure how a bee rubs the comb, but I think it is performed near the ridgeline of the combs or within a cell at or near the ridge plane. Some behavior produces the rubbing that leads to signal generation. That signal gets to the transducer within the ridge plane. An analogy to this system might be similar to the incidental harmonics generated in a violin while it is played.

To consistently produce this signaling with seasonal variance during the year suggests to me that it is an intentional and integral signaling behavior of their lifecycle. Since the bees consistently "flutter", it seems to me to be a response to the initiator signal. Is it related to the initiator signal or just a coincidental response? A bee might be "playing" the honeycombs like a musical instrument. Honey bees could be musicians, wow!

...or some other life form or phenomena is playing for the bees, any ideas? BC

Send your thoughts to Stephen Engel, ***Stephen@StephensApiary.com.***



Waveform & Spectogram for initiator.