

## Moonbounce (EME) on 40m Carl Luetzelschwab K9LA

A January 17, 2008 story on the ARRL web site ([www.arrl.org](http://www.arrl.org)) titled *Lunar Echo Experiment looking for Amateur Radio Participants* reported that the HAARP (HF Active Auroral Research Program) facility in Alaska would be used to conduct an EME experiment on frequencies near the 40m band. The tests were run on January 19 and 20, and details of the transmission format were given in the story.

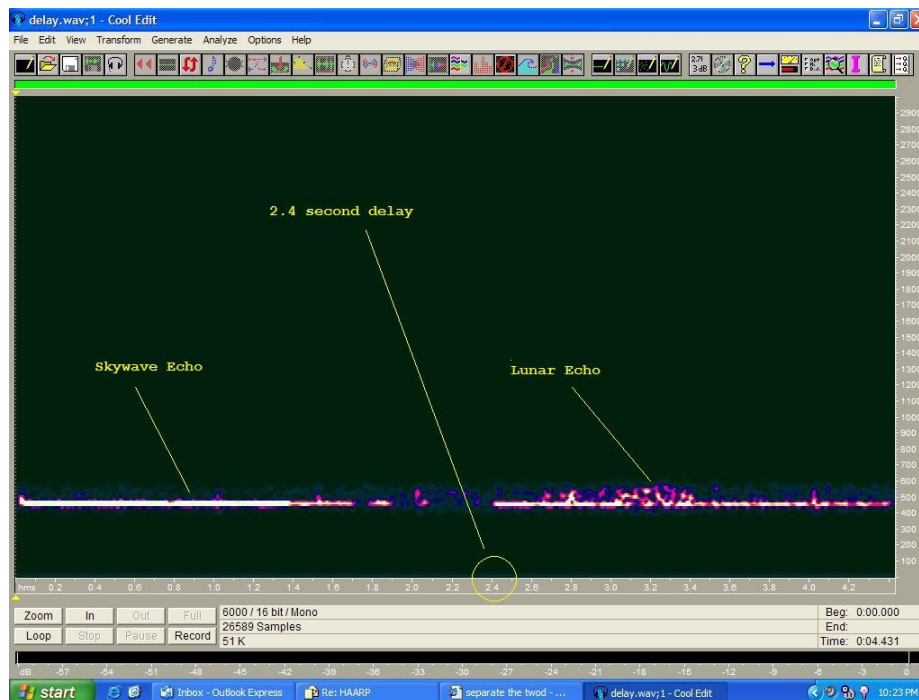
HAARP scientists believed it should be possible to hear the lunar echoes with a standard communications receiver and a simple 40 meter dipole antenna. That proved to be true. Tony K2MO (in New York) is one of many who reported reception of the lunar echoes. The .wav file he sent me had very Q5 echoes. A quick back-of-the-envelope calculation shows why Tony (and others) heard the HAARP lunar echoes.

From the HAARP web site ([www.haarp.alaska.edu](http://www.haarp.alaska.edu)), the ERP (effective radiated power) towards the Moon on 6.9 MHz was around +124 dBm (3.6 MW from the transmitter into an antenna system with 28.5 dB gain). That +124 dBm is a bunch – a top-tier contest station has an ERP of around +75 dBm.

The +124 dBm signal, when reduced by estimated losses (166 dB for the free space path loss for the approximate 700,000 km round trip and 10-15 dB for the reflection coefficient of the Moon at 7 MHz), still gives a decent signal off the Moon with margin for other losses (for example, polarization mismatch).

What about the direct (skywave) signal that Tony heard? This was more “iffy” than the lunar echo path. The  $F_2$  region critical frequency over North America at night in January at solar minimum would be just above 2 MHz. That’s marginal for 7 MHz skywave, and dictates a very low elevation angle – which would result in far less ERP from the HAARP facility due to being way down on the HAARP antenna pattern.

The following is Tony’s screen shot of the Cool Edit software showing reception of the direct signal and the lunar echoes. The expected 2.4 second delay is annotated. The vertical scale on the right is in Hz, but the resolution is not good enough to show the approximate -5 Hz Doppler shift.



Moonbounce on 40m is not an everyday event (now there’s an understatement!). The HAARP people and associated personnel should be commended for getting Amateur Radio involved. Thanks, guys!