Then and Now: Reclaiming the Eight

I was preparing to write another manuscript arguing that the so called advancements in the materials used to make loudspeaker cones have not been advancements. To help make this argument, I wanted to have an example of an ordinary cone from before the era of material sciences. The transducer I had on hand from the 1960s was an eight-inch from an inexpensive Utah brand loudspeaker.

As designed, this unmarked transducer used a medium weight, two-sided smooth paper and had a rigid, shallow dome paper dust cap attached to the top of the voice coil former and a whizzer cone. Both the dust cap and the whizzer cone was removed to make the comparison of cone performance amongst the transducers tested more valid. While I knew there was a problem with what is currently marketed as advanced cone design, even I was surprised by how well the forty year old transducer performed.

While the performance of this old, archaic paper cone far exceeded the modern composites, it still suffered from material vibration modes. It performed well, but it could be better after controlling the vibration modes.

Figures one and two show the impulse response and frequency response of the eight-inch Utah transducer with a plug replacing the dust cap and whizzer cone.

Figure One. Impulse response of eight-inch Utah transducer with plug replacing dust cap and whizzer cone.

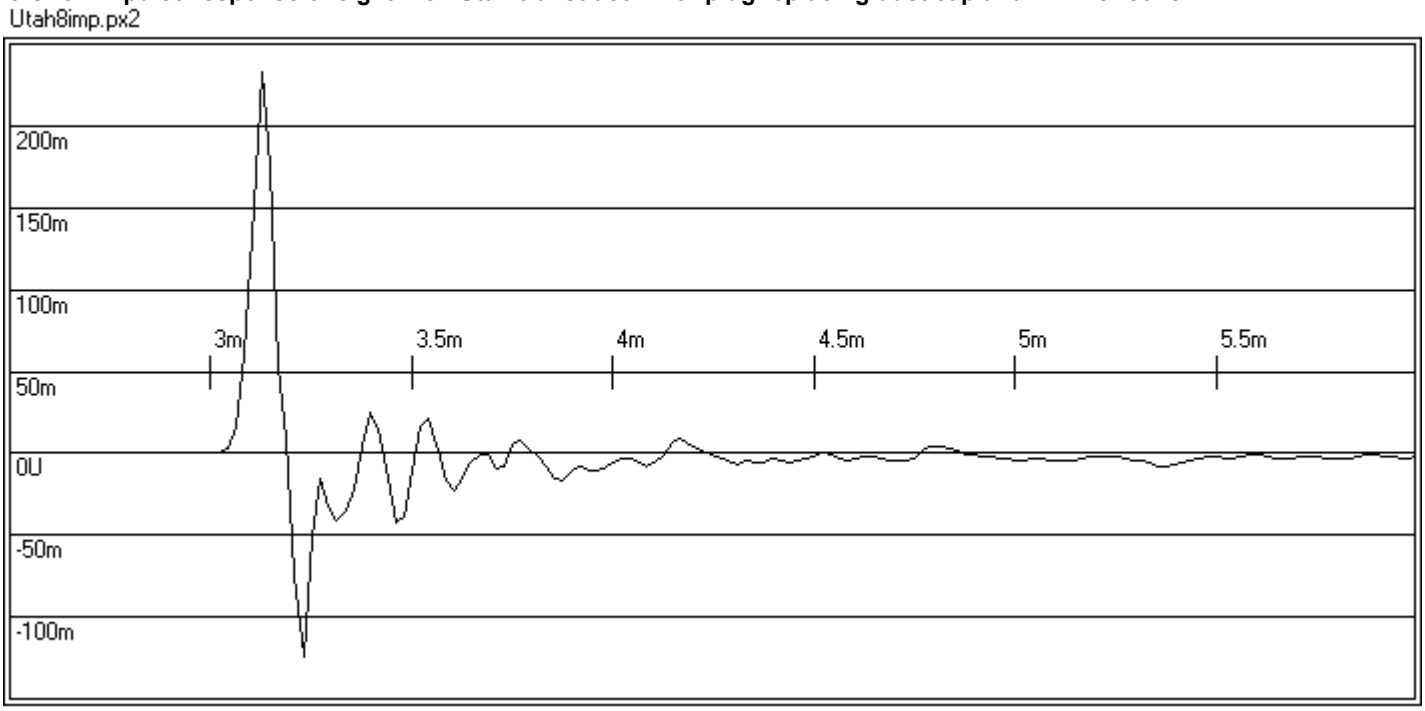
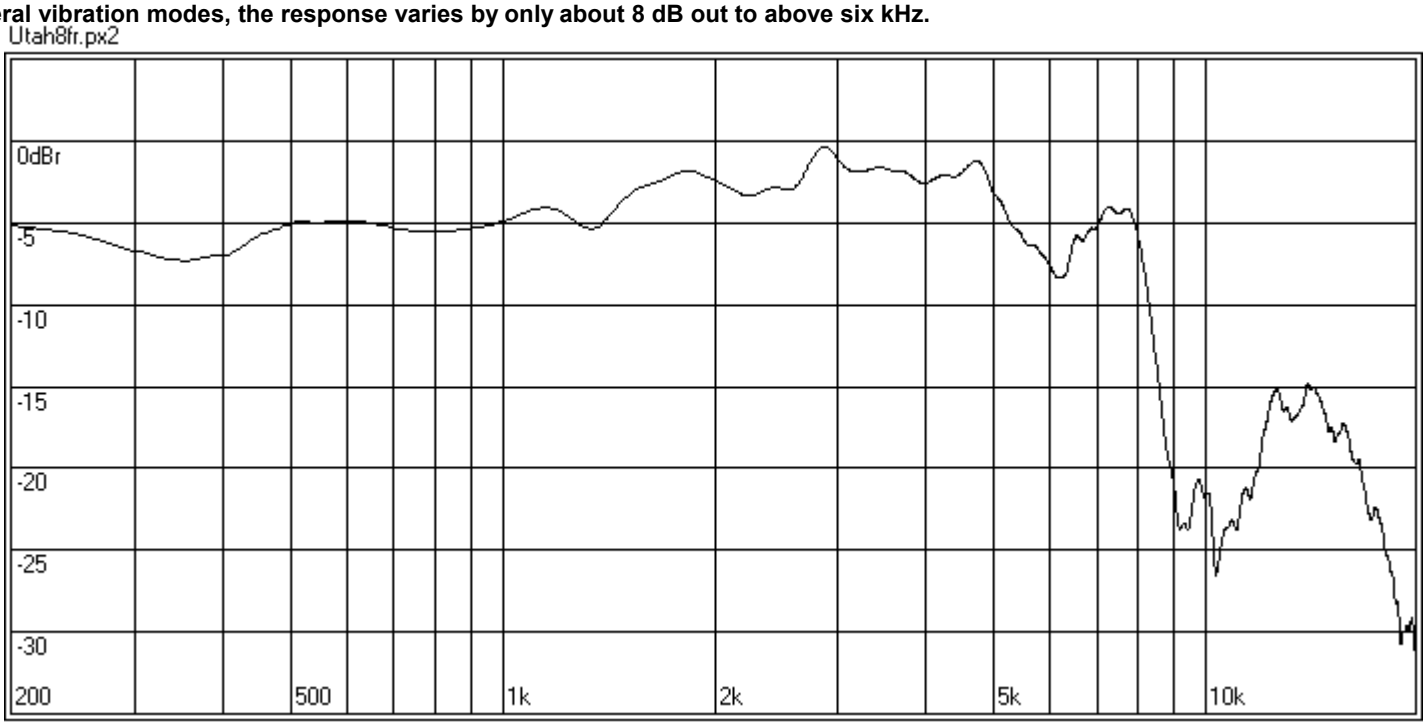


Figure Two. Frequency response of eight-inch Utah with plug replacing dust cap and whizzer cone. Despite the presence of several vibration modes, the response varies by only about 8 dB out to above six kHz.



I mapped the cone's vibration modes and identified two critical areas associated with what I thought were the two most critical vibration modes within the transducer's natural bandwidth. The two modes show up in the frequency response as peaks at just under three kHz and between seven and eight kHz.

The two critical areas were treated. Because the magnitude of each vibration mode was small, each required very minimal changes to control the respective modes.

Figures three and four show the impulse and frequency response of the vibration mode controlled forty-year old paper cone. The overhang and ringing in the impulse response has been cut in half. The rising frequency response that characterized the starting condition is now gone. And the magnitude variance over the transducer's bandwidth is now only about four-dB.

Problems remain in the response. Only two of the four vibration modes whose center frequencies were within the range of the natural bandwidth were treated. The two high frequency vibration modes in the high frequency were not treated. These two modes contribute a great deal to the remaining overhang in the impulse response. Despite this, the transducer may possibly outperform any eight-inch transducer available.

Figure Three. Impulse response with the two most significant cone material vibration modes treated.

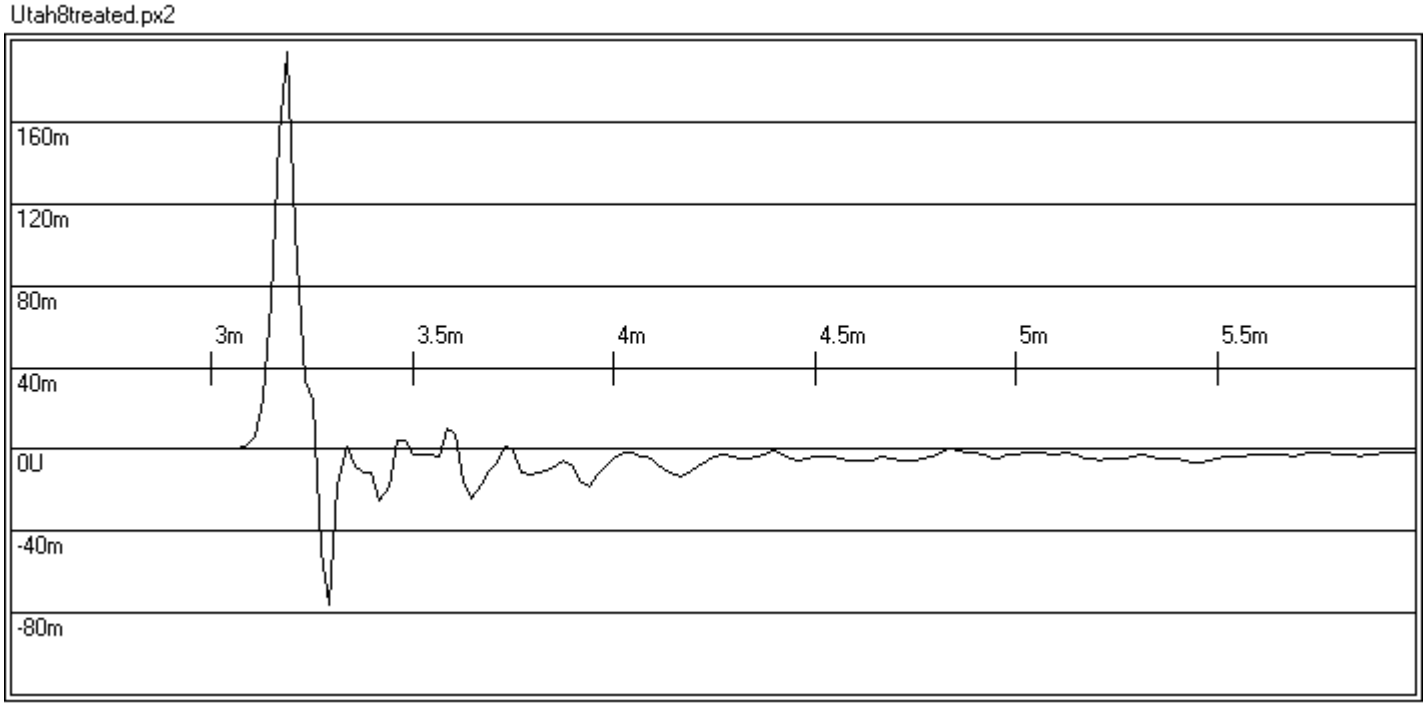


Figure Four. Frequency response after cone treated to control two most significant material vibration modes.

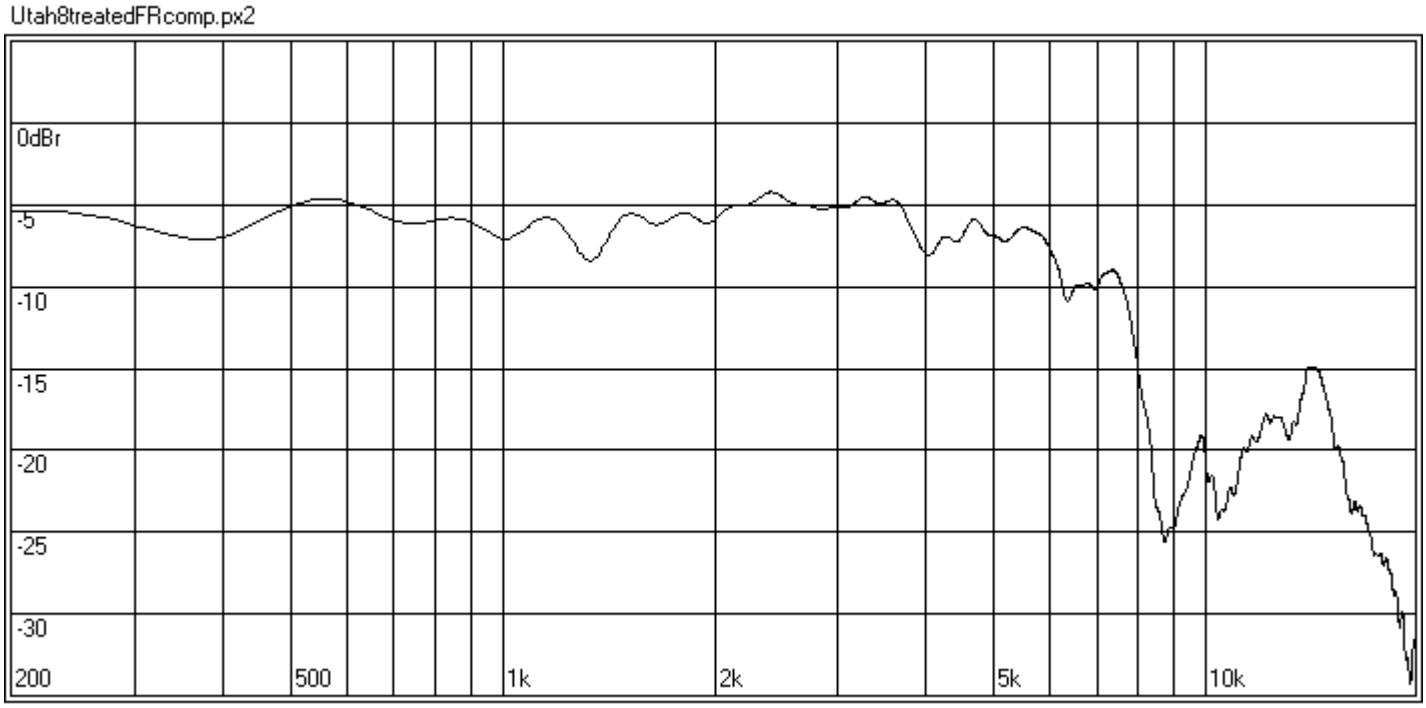


Figure five shows the treated frequency response with the starting response overdrawn in red for easy comparison. Considering what I started with, I would propose that this should represent the minimum reproduction quality for any eight-inch transducer.

If you buy transducers to make loudspeakers, why not ask your transducer producer for better performance? If you manufacture transducers and your customers start asking for better performance, why not ask your soft parts suppliers to rethink their R&D?

The evidence suggests that from soft parts manufacturers on, there has been too little real advancement in performance and too much satisfaction with whatever comes. I do not know why cone breakup has been just accepted over the last forty years, but there is no longer any reason to do so in the future.

Figure Five. Comparison frequency response of treated and untreated Utah eight-inch. Untreated response is drawn in red and is overdrawn stock response in black.