From: Perez, Chris
To: Bilodeau, Stephanie A
Subject: Re: [EXTERNAL] Super heavy
Date: Wednesday, April 26, 2023 9:14:18 AM

Let me see about it. Do you have an idea of costs?

From: Bilodeau, Stephanie A <stephanie_bilodeau@fws.gov>
Sent: Wednesday, April 26, 2023 9:08 AM
To: Perez, Chris <chris_perez@fws.gov>
Subject: FW: [EXTERNAL] Super heavy

Hey Chris,

Karl has gotten some feedback about his sound level readings; see below. It is clear we don't have the proper equipment for this (multiple devices, environmental condition sensors, software, etc.), so should we look into potential funding sources to acquire or potentially rent the necessary equipment from the company? Are there even ways to get funding for something like this that quickly? Or is there hope of acquiring sound data from SpaceX?

Karl also recommended reaching out to the Colorado State University light and sound ecology team (https://sites.warnercnr.colostate.edu/soundandlightecologyteam/team/#npsscientists) to see if they'd have some expertise that could help us, or if they'd be interested in taking up a project at Boca.

Thanks,
Stephanie

From: Karl Berg <karl.berg@utrgv.edu>
Sent: Wednesday, April 26, 2023 6:44 AM
To: Bilodeau, Stephanie A <stephanie_bilodeau@fws.gov>
Subject: [EXTERNAL] Super heavy

Hi Stephanie,

I am getting good feedback from the sound engineer. Fortunately, everything seemed to be working properly, including the calibration. My mic only records up to 143.8 dB, so my Lamaxpeak values of 143.8 means the sound was louder. However, it is significant that it overloaded or exceeded 140 dB for 33 seconds. Because SPL increases by about 6 dB at half

the distance to the sound source, a mile radius around the launch pad would have experienced at least 146 dB and a half a mile 152 dB, a quarter mile 158 dB, a 1/8 of a mile 164 dB, at 330 feet 170 db, 176 db at 165 feet, 182 db at 82 feet, 188 db at 41 feet, at which point you are pretty close to the origin (and fire ball). So in my humble opinion modeling should have been done beginning with AT LEAST 188 dB.

I think we talked about this, but standing water on the mudflats between launch pad and sound meter would greatly influence how the contours are made. I can't imagine that water depth differences between the Gulf and the mudflats would make much difference, but I could be wrong. It would not be difficult to test.

Of course, the above calculations are based on 140 db and it was likely much louder, which would take us above 188 dB at sound source. To avoid overloading he recommended using a less sensitive microphone or placing the meter at 3-miles from the launch pad, each of which involves tradeoffs. There will invariably be more error at greater distances, so my inclination is to buy a less sensitive mic and put it closer (1 mile?). They also sell mics that don't overload until 190 dB (!). They can also rent to us additional sound meters if we want to place them at different distances to better understand propagation. One tradeoff is that these have a higher "noise floor," which as I understand means they will underestimate very low frequencies. So, I should also buy the FFT spectral software so we can see which frequency bands contain the most energy, which ultimately would be relevant for estimating damage to bird ears.

And my recording of 110 dB at 3 miles, would mean the static fire was 116 dB at 2 miles compared to over 140 dB for the launch so a big difference. Am I correct that they did not produce contour maps for the super heavy launch, only the super heavy static test fire (fig. 29)?

They also sell wind, atmospheric pressure, temperature, humidity sensors that integrate with the sound meter. Those offshore winds on 20 April could have caused more energy at our mics, which is still biologically relevant but would be good to measure and incorporate into calcs.

Sounds like things are on hold but doubt it will last...

Karl