

## **JETCRAFT 2175XS QUIETING EXPERIMENT**

In June of 2006 I took delivery of a Harbercraft/Jetcraft 2175XS from the good folks at The Boat Shop in Fairbanks, Alaska. Although this Mercury Optimax 200 powered jet boat is an excellent shallow water performer it is very loud while operating. Rather than wearing headphones or resorting to a flight com system for my passengers and myself I decided to experiment with noise reduction techniques and some new technology sound isolation material. I initially contacted Dave Freisen, the former head judge of the nationwide IASCA car audio competitions and now president of Big Bear Marketing in Seattle, which represents a variety of high-end car audio products and Hushmat sound deadening material. Dave set up a phone meeting with Tim McCarthy of Hushmat, a division of RMD LLC which is the sound deadening vendor for GM, Ford, Daimler Chrysler, Honda, Nissan, Semi-truck manufacturers, some of the aero industry, and marine industry. Graciously, Mr. McCarthy agreed to provide the material for this experiment based on a rather basic photo log and specs I submitted to he and his engineers.

As a point of reference all readings were taken with a Radio Shack digital sound level meter (Cat# 33-2055) that I bought locally for \$50. The accuracy of exact pressure levels might vary from others using better test equipment and frequency analysis would have been nice. However, my interests were not to measure precise sound levels to publish in a brochure, but rather the amount of noise reduction I could achieve. So, if the meter read 102 db and I was able to reduce it to 96 db, or if the meter read 100 db and I was able to reduce it to 94 db, it would be the same sound reduction to my hearing, -6db. I ran the boat top up, no side or rear curtains, at 4150 to 4200 RPM, upstream on calm river water for the readings, which were taken in 20-second segments from the passenger seat with the sound level meter microphone facing to the stern. I did find that running the boat with the side and rear curtains down reduced ambient noise by almost 3 db. It should also be noted that the rear curtain sits forward of the engine's doghouse and that I had insulated canvas covers made to replace the stock canvas covering the battery and oil access ports.

My initial readings were 100 to 102dbC before the application of the sound deadening material. This is Freaking LOUD. It may not be as loud as an airboat, but it is within 4db of the dance floor at the Howling Dog Saloon on a loud Friday night where one must yell to speak to the person next to you (hey, I had to go there to measure it, for science sake). I also measured a level of 82dbC from the inside of my 05 diesel Dodge pick up @ 55 MPH (windows up, no Jimmy Buffet on the sound system). As many of you know, sonically speaking, a 9db increase in sound pressure level is what most humans perceive to be "doubling" the volume. Electrically speaking it takes twice as much power output from an amplifier to produce a 3db increase in volume at the speakers. OSHA regulations state that a worker cannot be subjected to 102db noise for longer than 1.5hrs per day without approved hearing protection, 4hrs @ 95db, and 8 hrs @ 90db. So, a 9db noise reduction would be significant, 12-15db would be outstanding. One more technical note, sound meters read at either "A" weighted or "C" weighted. "C" weighting is a linear sound pressure reading. So, sound pressure levels must be reduced over a spectrum of 20 to 20k hz (once specific frequency spikes are leveled out) to show a reduction in noise. "A" weighting looks more at the areas of sound in the human hearing range and theoretically would show larger reductions in noise levels during the course of this experiment. That being said, I chose to use "C" weighting, as I was interested in reducing not only the noise that I heard, but also the vibrations I felt while driving the boat.

There are four main sources of noise in this boat. Engine and exhaust noise (mid to high frequency), the jet drive (low frequency), fundamental vibrations generated by both and carried through the aluminum (low to mid frequency), and sympathetic harmonics also transmitted through the aluminum hull and consoles (full range).

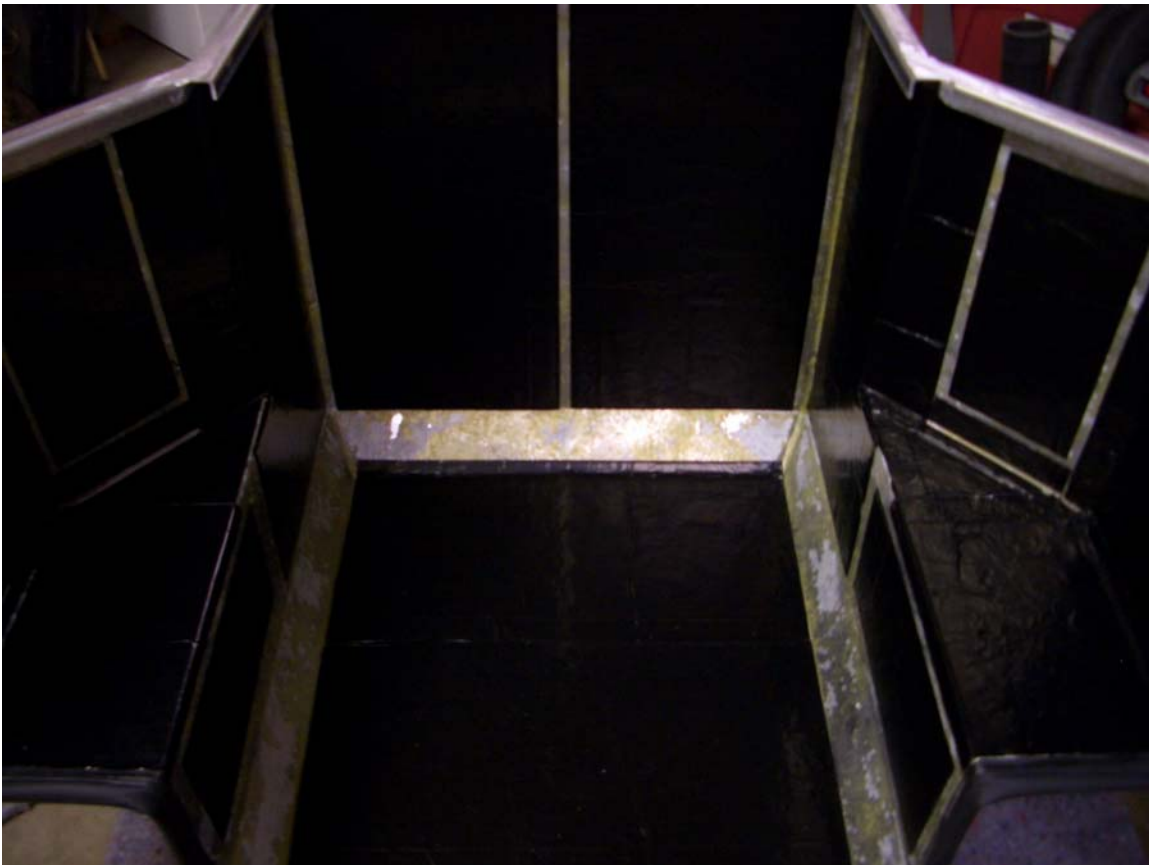
The first order of business was to remove Jetcraft's "sound insulation" which consists of foil faced and backed 1/2" bubble wrap that is glued with contact cement to the inside of the doghouse. This stuff falls under the philosophy of "it may not work well, but it sure is cheap" and is gawd

awful to remove. It takes patience, scrapers, wire wheels, strong hands, several band-aids, many hours, and beer...lots of beer.



**Pictures of housing during bubble wrap removal**

The next step for almost any other type of sound deadening material besides Hushmat would have been to remove the contact cement using some type of caustic chemical. Fortunately, Hushmat's Ultra Mat adhesive allows it to be laid directly over the contact cement remnants (even WD-40) without prep. All I did was use a wire wheel to smooth it out. You have about a minute to position the Ultra Mat before the adhesive takes hold and then the Ultra Mat is stuck there, presumably forever. Ultra Mat is designed to deaden fundamental and sympathetic vibrations that travel along and through solid surfaces, which in this experiment will be the aluminum in the hull, consoles, and doghouse of the 2175XS. It is important that this type of material/compound has direct contact with the surface you are attempting to deaden. Products that are "sandwiched" (foam/deadening material/foam) will have substantially less effect on wave forms traveling through the aluminum than a direct contact of an inert deadening compound applied to the surface of the aluminum.



**Picture of Ultra mat during installation on doghouse**

Because the engine, compressor, and exhaust emit a substantial amount of sound in the mid to high frequency range, Tim McCarthy spec'd the use of ½" Hushmat Silencer High Frequency sound absorbing foam to be applied over the Ultra Mat on the inside of the engines doghouse. I applied the foam over the entire inside of the doghouse with the exception of surfaces directly adjacent to the mufflers since neither Tim or I knew exactly how hot the mufflers would get during operation and the Silencer foam is not rated for use in extreme high temp applications. After the removal of the stock bubble wrap and prior to the installation of the Hushmat products I had picked up the doghouse and tapped it with a hammer, it rang like a bell. After the installation of the Hushmat products I again picked it up and tapped it with a hammer, it's now a dead ringer.



#### **Picture of completed Hushmat installation on doghouse**

Upon testing the sound levels after the doghouse deadening project I was happy to see readings of 95-96 dbC compared to the pre sound dampened readings of 100 dbC to 102 dbC, a substantial noise reduction of 5 to 7db. I can even hear the water against the hull now while driving the boat.

Since my goal is a 10-12 dbC noise reduction there was more work to be done. My next task was to cover the inside of the transom, bottom of the swim platform, and underside of the rear deck with Ultra Mat. For this effort I was rewarded with an additional 2-3 dbC noise reduction, a reading of 92-94 dbC. Then old man winter rolled in and the remainder of the project will have to wait until spring.

This fall I made a run up to the cabin with a load of insulation that filled the passenger compartment from the floor to the top of the canvas (I had removed the rear passenger bench seats). I left the sound meter at home on that trip, so I couldn't measure the sound levels. I can say that the ride was quiet, very quiet. I was even able to make cell phone calls and my buddy and I were talking at normal levels. This experience lends some credibility to my "sound chamber" theory below and is my new goal for sound level in the boat.

Future noise reduction projects on my 2175XS include the application of Hushmat Ultra to the inside of the hull, outside of the fuel cell, inside of the consoles, and sides of the Jetcraft to reduce primary and sympathetic vibrations. Because the area underneath the stern deck, directly aft of the attached dog house, and including the inside of the transom, are open to the engine compartment, I surmise that noise in the mid to high frequency range is being amplified in that "sound chamber". I will attempt to reduce noise in this area by applying either ½" or ¼" Silencer

High Frequency sound absorbing foam to these areas. The theory is similar to the acoustic properties of an acoustic guitar. In order to deaden the sound, without covering the sound hole in the guitar, one would need to deaden the sound board, the inside of the guitar body, and use sound absorbing foam to deaden the incoming mid to hi frequencies entering the sound chamber. Hopefully, I'm right about this and will comment on the results later. Also some exhaust noise reduction will be in order, but I haven't quite formed a plan of attack for that as of yet.

So far I am pleased with the 8 db noise reduction that has been achieved and the performance as well as ease of installation of the Hushmat products. The current noise level reduction has made the use of this boat much more pleasurable for my wife, friends, our dogs and myself.