



STIC Note

Noise Attenuation with Engineering Controls



BACKGROUND/PROBLEM

Noise is a major issue across the Coast Guard. Not only does loud equipment onboard Coast Guard units interfere with communication during operations, the safety of units could be at risk when they are exposed to sound levels in excess of 85 dB (at which point single hearing protection is required). The area directly in front of the combustion intakes onboard FRCs is one such location where noise is a concern. Crew frequent this area, and apprehended migrants are sometimes placed in front of the intakes during interdiction operations. According to the TTP provided by HSWL-SEH for developing a hearing conservation program, engineering controls are preferable to administrative controls for preventing occupational noise-induced hearing loss. As such, the purpose of this effort is to consider engineering controls that reduce noise levels in front of FRC's combustion intakes.

METHODS

To determine the effectiveness of engineering controls, the XL2 sound level meter (SLM) and M2230 microphone were purchased. This SLM and microphone jointly cost \$3,325 and constitute a Class 1 SLM, meaning it can measure a wider sound frequency range and meets narrower tolerances. This model is also capable of measuring octave band sound data, allowing the SLM to measure the frequency composition of a sound field.

Using the XL2, two sets of sound measurements were taken onboard CGC ROLLIN FRITCH in Cape May, NJ: 1) Baseline measurements were taken during power trials to determine sound levels without engineering controls, and 2) follow-on measurements were conducted after engineering controls were installed on a combustion intake.

Various noise attenuating engineering controls were considered to reduce sound levels, but ultimately an acoustical louver was considered the most feasible. Other equipment, such as silencers and noise attenuating fabrics/duct liners, required internal installation and may have impacted the ability to clean the inside of the vent. The acoustical louver was installed in front of the intake, making maintenance easier.



Figure 1. Combustion intake onboard CGC ROLLIN FRITCH without (top) and with (bottom) an acoustical louver (Source: U.S. Coast Guard).

The acoustical louver has the following specifications: A fiberglass acoustic media is used to attenuate noise generated by the intake. The dimensions of the louver in inches are 45 x 45 x 8 and it weighs approximately 115 pounds. The manufacturers of the louver estimate that the louver will block airflow and create a pressure drop of .73 in w.g. [w.g. = water gauge pressure used as an air flow resistance measure]. Consulting with SFLC ESD concluded that the max allowable pressure drop for a dirty intake was 3.66 in w.g.

The following table shows how material impacts the cost of the louver given the dimensions are the same as above.

Table 1. Price, weight, and pressure drop for a 45 x 45 x 8 louver for different types of steel (Source: Louver vendor).

Material	316 SS	304 SS	Galvanized
Price	\$4,850	\$3,850	\$1,970
Weight	115 lb	115 lb	138 lb
Pressure Drop	.73 in wg	.73 in wg	.56 in wg

EVALUATION

Initially, the plan was to install the louver onto the face of the combustion intake using stainless steel angle brackets. One leg of the bracket would be bolted directly to the face of the intake while the other leg would be either welded or screwed directly onto the louver. However, while preparing to install the louver, the crew of CGC ROLLIN FRITCH noticed that the backside of the intake’s cover had cross beams that disallowed the cover from being pressed flush with the louver. Additionally, the drainage slits at the bottom of the intake would not be covered by the cover with the louver installed.

This posed a safety hazard, as in the event of a fire, the presence of the louver would mean there would still be some airflow into the combustion intake. To continue with the evaluation, the louver was installed using ratchet straps (see Figure 1), which adequately held the louver in place and allowed for its quick removal in the event of a fire.

The second set of power trials revealed that the louver reduced noise levels by 4-6 decibels in front of the intake, depending on the engine’s RPM (Figure 2). Figure 2 also shows octave band measurements before and after the louver was installed when the engine was at 1650 RPM.

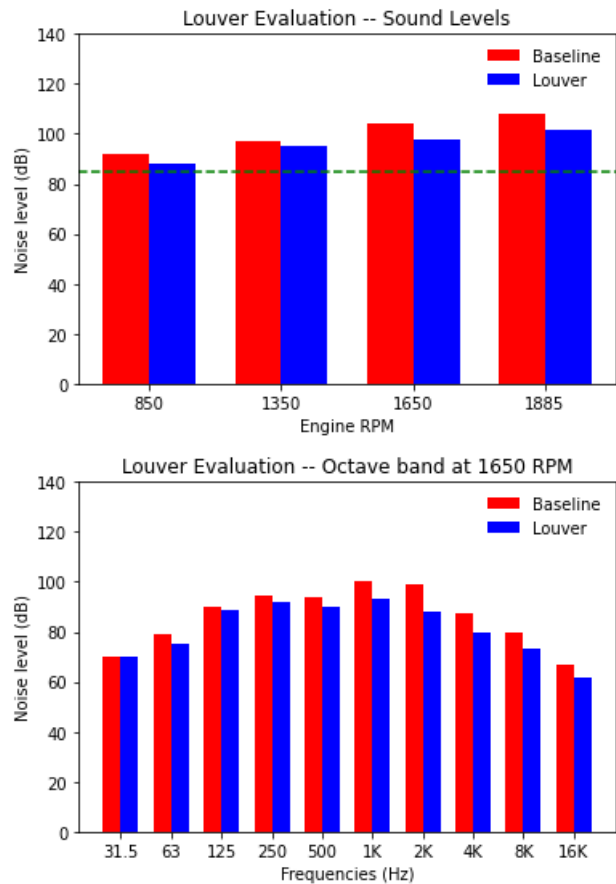


Figure 2. Baseline sound measurements (red) and louver measurements (blue) for overall sound levels (top) and octave band measurements at 1650 RPM (bottom) (Source: U.S. Coast Guard).

The green dashed line represents 85 dB – the threshold at which single hearing protections is required.

CONCLUSIONS

The louver was able to reduce noise levels in front of the intake. SFLC was notified of the results of this effort following the second set of power trials and they were interested to know if it is possible to reduce noise levels to below the single hearing protection range. At lower RPMs (in the 850 range) this may be feasible if the dimensions of the louver were altered (a thicker louver will result in more noise attenuation). As the engines approach 1150 RPM, the sounds generated by the engines and turbos are most likely too great to be reduced to single hearing protection by just louvers, although additional testing would be needed to confirm this. Based off quotes from the louver vendor, it is estimated that it will cost between \$5,700-\$7,100 per intake to reduce sound levels to single hearing protection at low RPMs. Note this price represents the price of the louver and the shipment of the louver, and not the cost of additional installation equipment.

The Science and Technology Innovation Center (STIC) is a DHS S&T and USCG collaboration.