

## **THE ABC'S OF NOISE CONTROL MATERIALS**

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### **INTRODUCTION**

Blachford Inc. is a manufacturer and supplier of noise control products primarily to Original Equipment Manufacturers (OEM's). Typical customers include manufacturers of heavy trucks, motor homes, construction equipment and agriculture equipment. Although some customers have very sophisticated acoustical laboratories, many customers do not have these resources and often rely on their acoustical materials supplier to solve noise control problems and recommend materials. If the supplier is not well integrated with their customer, the addition of noise control materials may come too late, and be used to correct noise problems that could have been better addressed with a different design.

To assist customers and others in the task of designing quieter products, Blachford began publishing The ABC of Noise Control Materials in 1980. This booklet, updated in 1995, provides basic information about acoustics and noise control materials. It also aids design engineers not formally trained in acoustics in learning some of the fundamentals of noise control. Building on this booklet, a seminar has been developed to educate engineers and other design team members. The seminar covers topics such as acoustical terminology, hearing and hearing loss, sound absorption, sound transmission loss, damping, and basic noise control techniques.

### **SEMINAR FORMAT**

The ABC's of Noise Control Materials was developed to provide design engineers and others with a crash course in acoustics. Unlike other seminars given by suppliers, this seminar is very objective. Noise control materials are discussed in general, without the use of trade names and nomenclature. The seminar is presented using overheads, audio and video presentations, and demonstrations. Copies of the overheads and a copy of the ABC booklet are provided for later reference.

Since many engineers have other design responsibilities besides noise control, it is difficult for them to justify attending a several day or week long course. To accommodate this time constraint, the seminar has been developed for a 2-4 hour time frame. With this shorter format,

many more engineers and additional design team members can attend. At one seminar all of the design engineers working on a truck cab design, including an outside vendor, were able to attend. This included engineers working on the interior trim, cab structure, electrical systems, and HVAC. Through the selection of materials and the design of firewall pass-throughs, the engineers in all of these disciplines make decisions which affect the interior cab acoustics. At other seminars members from sales, engineering, purchasing, and manufacturing all attended.

## **SEMINAR CONTENT**

The seminar is broken into three segments; acoustics, acoustical materials, and applications. The key concepts discussed and presented in each segment are listed below:

### **Acoustics**

Sound level	decibels, perception of changes in sound level, sound quality, decibel addition and subtraction, demonstrations of typical sound levels
Frequency	definition, audio demonstrations of tones, frequency bands, audio demonstrations of octave bands, A-weighting, audio demonstrations of un-weighted and A-weighted sounds
Hearing	anatomy, hearing loss, audio-video demonstration of hearing loss

### **Noise Control Materials**

Absorbers	how they work, demonstrations of sound waves, physical characteristics of good sound absorbers, examples of materials, effects of facings, test methods, typical applications
Barriers	how they work, mass law, physical characteristics of good sound barriers, examples of materials, decoupled barriers, effect of the decoupler material, effect of the substrate material, test methods, effects of openings in the barrier, typical applications
Dampers	how they work, physical characteristics of a good damper, examples of materials, test methods, demonstration of damped and undamped materials

### **Applications**

Sound Box	basic principles of enclosure design, effect of leaks, noise reduction due to foam barrier, noise reduction due to barrier, noise reduction with foam and barrier and foam-barrier-foam composites
Other	specific case studies are also presented based on the specific needs of the audience

Although most of the seminar participants are not exposed to occupational sound levels high enough to cause noise induced hearing loss (NIHL), the threat of non-occupational noise induced hearing loss is significant. Amplified music, firearms, and many recreational items can produce

sound levels high enough to cause permanent hearing loss. Through this brief education, it is hoped that the seminar participants will begin to develop an awareness about hearing loss and take steps towards reducing their exposure to potentially harmful sound levels.

## **DEMONSTRATIONS**

With a short time to convey a large amount of information, many demonstrations are utilized. The compact disc, "Auditory Demonstrations in Acoustics and Hearing Conservation"<sup>2</sup> is used for presenting typical sound levels, test frequencies, octave band filtering, and A-weighting. This CD was developed for the NASA Lewis Research Center for use in their hearing conservation program.

To demonstrate the effects of noise induced hearing loss, a segment from the video tape, "Hearing is Priceless"<sup>3</sup> is used. This segment uses a Flintstone cartoon and progressively filters the audio to simulate no hearing loss, a mild hearing loss, a moderate hearing loss, and a severe hearing loss.

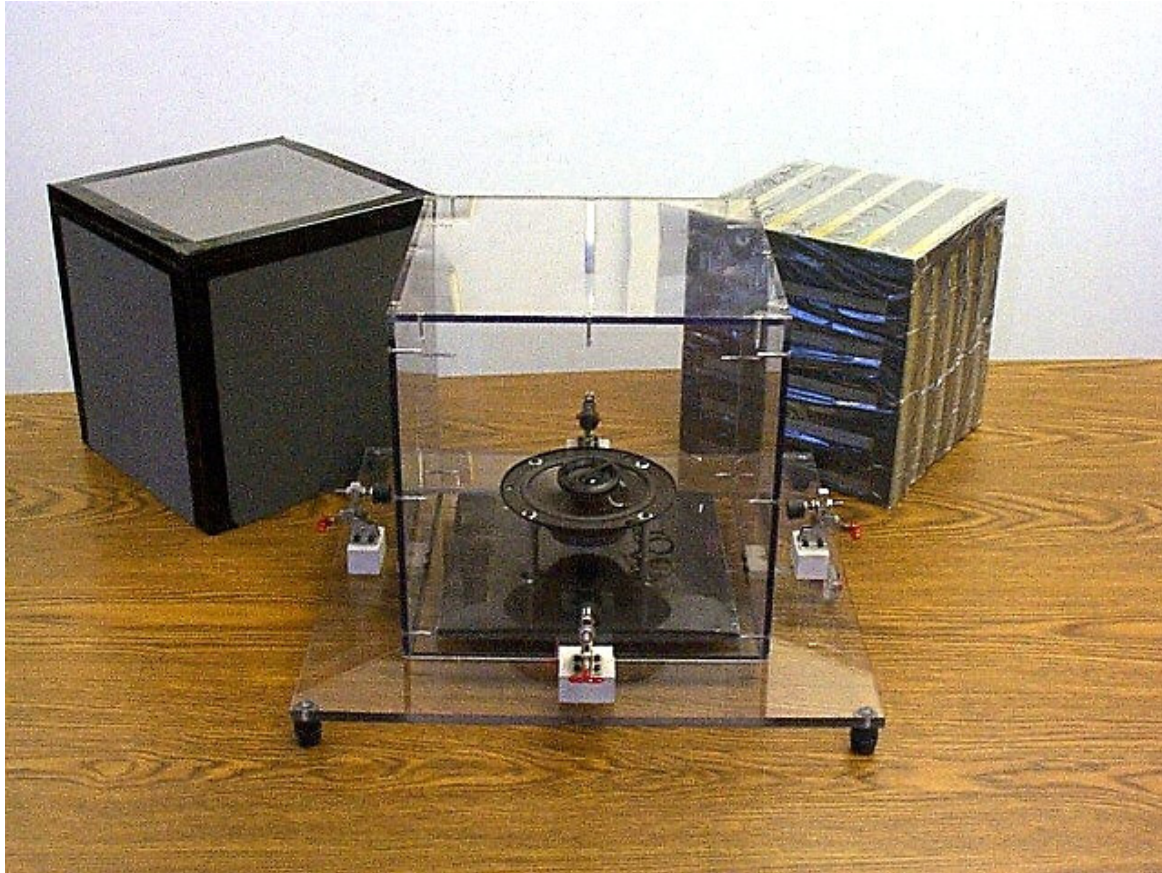
To show the effect of sound absorbers and barriers, the classic speaker-in-a-box is used. Our box, with associated inserts is shown in Figure 1. The sound of a diesel engine is played through the speaker, and various combinations of noise control treatments, ranging from a foam cover to a foam-barrier-foam insert with a solid cover, are compared. In addition, the effects of leaks can be demonstrated by slightly offsetting the cover.

To illustrate the effects of damping, two cymbals are used, one untreated and one with damping material applied. As expected, the untreated cymbal rings, while the treated cymbal does not.

## **SUMMARY**

This seminar began this year and has been very well received by the hundreds of persons who have attended. It has become very popular and has been requested by many customers. It is hoped that through this education process, acoustics will be considered early in the design stage. This allows acoustical materials to be used where they are most effective, instead of having to use treatments as band-aids that must be applied late in the design.

Unexpectedly, the portion of the seminar on hearing loss has evoked the most response from the audience. We encourage other suppliers of noise and vibration control products to include a discussion of noise induced hearing loss in their presentations.



**Figure 1. Sound Box**

### **REFERENCES**

1. Blachford, John, "The ABC of Noise Control Materials," H. L. Blachford Ltd., Mississauga, ON, 1995.
2. "Auditory Demonstrations in Acoustics and Hearing Conservation", Prepared for the NASA Lewis Research Center, Cleveland, Ohio by Hoover and Keith, Houston, TX.
3. "HIP Talk" A video tape, House Ear Institute, Los Angeles, CA 1992.