
THORBURN ASSOCIATES INC.
Acoustic and Technology Consultants
Newsletter

Fall 2000

During the 7th Annual Themed Entertainment Association Awards on September 16th, 2000, the coveted THEA Award trophies were presented. Three projects on which TA worked were awarded THEA's. TA developed the acoustical design for the "Amazing Adventures of Spiderman," audio, video and control design requirements for attractions in Toon Lagoon Islands of Adventure, and audio system design and engineering for the iWERKS 15/70 Theatre at the Columbus Center of Science and Technology (COSI).

The Code of Silence

Maxwell Smart's Cone of Silence was a nice idea. Wouldn't it be great to be able to use such a device in today's busy and energetic society? Well, for some types of noise it has been possible for a person to have their own personal Cone of Silence.

Active noise control is the solution. This is a technology that was first introduced and commercially developed in the late 1970s for manufacturing and plant noise. Now individuals can use this technology for themselves. We have had a set of noise cancelling headphones in our office for the past year and they are primarily used for airplane flights. We have also seen individuals use the headphones in open office areas at dot.com companies.

The Principle of Anti Noise

Just like the concept of anti-matter mentioned by engineer Scotty on the television series "Star Trek," the concept is as simple as its name. We make noise that has an equal and opposite phase (polarity) as the tone we want to cancel. Our headphones work on this very principle. There is a tiny microphone on the outside of the headset. It picks up the noise that is in the environment around us and then, looking at the signal, turns it 180 degrees out of phase and mixes this signal into what we are listening to on the headphone. The results are like night and day. The drone of noise, whether it is airplane or office noise, is filtered out. The problem is that the system does not filter out impulse noise such as voices or chimes.

In the 1970s anti-noise or active silencers were developed for mechanical duct work and flues. This type of product typically had a low frequency component that could be heard. Traditional noise control concepts such as duct lining or silencers were either not effective or could not stand up to the heat or corrosion of the duct or flue. By inserting a measurement microphone in the duct or flue, the character and level of noise could be determined. A little further down the duct a series of loudspeakers generating noise opposite to that measured by the microphones were bolted to the outside of the duct or flue. Openings cut into the surface of the duct allowed the sound produced by the loudspeakers to mix with the noise from the flue. When this happened, the levels cancelled each other out and the noise was significantly reduced. To make sure that the system was working, the noise from the furnace or fan was checked with a microphone further down the duct, beyond the loudspeakers, which sensed the sound levels and made tiny correction to the anti-noise being produced by the loudspeakers. The second microphone provided controlled feedback allowing the system to make subtle changes over time.

The Closed Loop Control System

From a control system description, when we have feedback we have what is called a closed loop control system. This means that we can track and follow changes. This is what allows our headphones to work. The relationship between the headphone, the microphone and the ear all remain the same. This means that as the noise environment slowly changes, the headphone can keep up with the noise. Military,



commercial, and now private pilots use this technology to allow radio communications to be more easily heard and understood.

But if it works so well for ducts, flues, and headphones, why don't we see more of this technology? Well, it goes back to that closed loop. The microphone, noise source, loudspeaker and listener all need to remain in the same fixed physical relationship. If one of these components is moving we cannot create reliable anti-noise. The State of California Department of Transportation tried to work with this a few years ago in Northern California. They placed microphones and loudspeakers along a portion of a highway north of San Francisco. The goal was to see if by using active noise control, they could achieve the same results as a noise wall would.

They could not. They did not have enough loudspeakers, microphones and computer processing to track all of these moving auto sources as well as moving listeners. The test did not work. Based on what is needed to track each source and listener, it will be a very long time before we can use active noise control for traffic noise.

New Active Noise Control Products

We are now seeing active noise control being introduced in new products. By now we have all heard how loud the new digital projection systems are. The fans that are needed to control the heat build-up are loud. Panasonic has developed a projector that can have active noise control added to it. People who have heard it, or should we say, have not heard it, say that you hardly know that the projector is on. This would be a plus for any boardroom. The downside is that the projector is expensive and the active noise control package adds about \$20,000 to the projector. Active noise control works here because the noise source (the fan), the microphone, and the loudspeaker are always in the same relationship, just like the duct or the flue.

A quick search of the Internet brought up some samples of projectors and headphones which might be of interest:

Panasonic PT-D9500U Projector

Readily compatible with a wide variety of video sources.

Low fan noise, easy set-up.

Aiwa HPCNS Noise Cancelling Headphones

Approximately \$50.00.

Bose Quiet Comfort Noise Cancelling Headphones

Approximately \$299.00.

Sony MDR-NC5 Noise Cancelling Open-Air Headphones

Approximately \$80.00

It is our guess that this is the way things will be addressed in the future. As computer processing speeds up, microphones and loudspeakers will get better and smaller. Active noise control will be coming to other locations near you.

Register Now!
"Essentials of Acoustics: Theory and Hands-On Applications" and "Presentation Facility Design and Audiovisual Considerations"

Offered on the following dates and locations:

San Francisco, CA	January 12 – 13, 2001
St. Louis, MO	February 9 – 10, 2001
Los Angeles, CA	March 9 – 10, 2001

These two powerful one-day sessions are specifically designed for architects and end-users. They're packed with information and hands-on activities such as acquiring tips and tricks to make your design time more effective, determining your needs for audio and video teleconferencing, balancing architectural issues with technical requirements, and much much more! So come join us for an interesting two days and earn up to twelve AIA Learning Units! For more information visit our website at www.TA-Inc.com/AIA.

Thorburn Associates has added two new members to its consulting/design team. John Jenson and Judd Jelincic have been hard at work on new projects awarded to the firm. With new projects coming in at a faster pace than ever before, we welcome their expertise and enthusiasm.

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