SCHOOL SOUND

SOUND ADVICE FOR TODAY'S SOUND OPERATOR

FALL 2009

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A newsletter for anyone who wants to learn about sound!

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In This Issue

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Microphone Mysteries

There are many microphone mysteries. Many users do not really understand how they work and why some microphones work better for certain applications. The microphone facts in this article will help you better use your microphones.

The Vacuum Cleaner Myth

Myth: Many people feel that microphones are like vacuum cleaners. The microphone is mounted on a stand and it "sucks" in sound. Better microphones have more suction so they pick up sounds from farther away. The term "reach" is often heard. One microphone is said to have better reach than another.

Fact: However, microphones are not like vacuum cleaners. They only sit at a point in space and measure (pick up) what happens to the change in air pressure at that particular point. The air pressure changes when someone talks, sings or plays an instrument. Of course, the microphone will also pick up unwanted pressure changes from airplanes flying overhead or babies crying in the audience. The vocal cords of the baby produce changes in the air pressure which emanates from the baby's mouth. The sound waves are like ripples producing from a rock thrown into a smooth pond. The ripples move out from a central point where the rock first hit the water. As the ripples travel outward, they gradually get weaker and weaker until the water is smooth again.

The microphone measures the tiny changes in air pressure. This change is converted into a very small electrical voltage by the microphone transducer. Therefore, one particular microphone will not naturally "pick up" better than another at a certain distance. There are other factors which may make one microphone appear to work better.

Common Types of Microphones

The dynamic microphone (Figure 1) is the most common type of modern microphone. It has three basic parts: the diaphragm, coil and magnet. The diaphragm is a very light dome-shaped form. A coil of a very thin wire is

Figure 1 Dynamic Microphone

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attached to the rear of the diaphragm. The coil movement within the magnetic field produces a tiny voltage in the coil. This tiny voltage is sent down the microphone cable to a preamplifier in the microphone mixer.

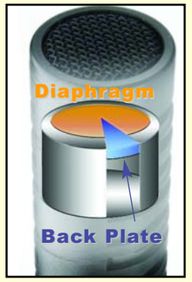

Figure 2 Electret Microphone

The other major type of microphone transducer is the capacitance or electret microphone (Figure 2). This type has a diaphragm like the dynamic microphone. However, it does not use a coil and magnet. Instead, the diaphragm is actually a capacitor (it has the ability to store and release electricity). When air pressure moves the diaphragm of this microphone, the distance between the diaphragm and the back plate changes. This produces a change in capacitance which is converted to an electrical voltage that is sent to the microphone preamplifier. Power must be provided for the capacitance microphone since it utilizes some electronics. Power can be furnished by a battery or from the mixer itself. This type of power is usually called phantom power since the power from the mixer uses the same wires the tiny audio voltage travels along.

Capacitance microphones have traditionally been more sensitive than dynamic microphones. In other words, for the same change in air pressure, the capacitance microphone will produce a greater voltage. This advantage has become less distinct as better magnets in dynamic microphones have produced higher outputs.

Microphone Placement

Let's go back to the analogy of the rock and ripples. The ripples are the strongest or highest at the point of impact. As they radiate from the center, they become weaker. This is the same way sound waves travel. The sound pressure level is called the SPL for short. The SPL will decrease by 6 dB every time the distance from the sound source doubles. A 10 dB decrease would seem as though the sound level dropped in half. A 3 dB drop is barely perceived. The 6 dB drop is about a quarter drop in perceived level to your ears.

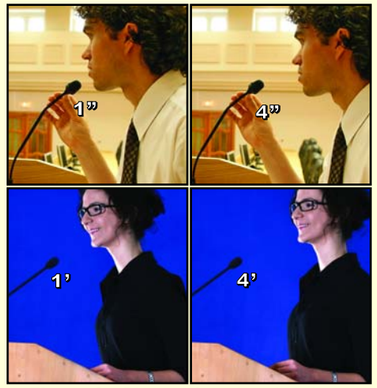

Figure 3 Distance from the microphone affects volume dynamics

How is this fact used in real applications or microphone techniques? Let's say a talker places a microphone 1" from his mouth (see Figure 3). The microphone is mounted on a gooseneck which is attached to the podium. If the talker moves away another 1" he will have doubled the distance from the microphone, so the SPL reaching the microphone will have dropped 6 dB. If he now moves back another 2 inches, the distance will have doubled again, so the SPL will be down a total of 12 dB. The sound level from the sound system will have apparently dropped in half. If the listener could hear the talker just right when the talker was at the 1" position, he will probably not hear very well after the talker moved back only 3". It would be very easy for a talker to move this much while speaking. The result would be wildly varying volumes for the listener.

What if the talker started at a position of one foot from the microphone. Moving to the two foot mark would produce only 6 dB drop in level. The talker would have to move another 2 feet for a total of 4 feet to get to the 12 dB level drop. In other words, natural movement would not be very audible if the talker started at the 1 foot position.

Maximum Gain-Before-Feedback

What can be done if the volume is not loud enough before that annoying feedback occurs? There are some things which can be adjusted before deciding to order new microphones or change the sound system (see Figure 4).

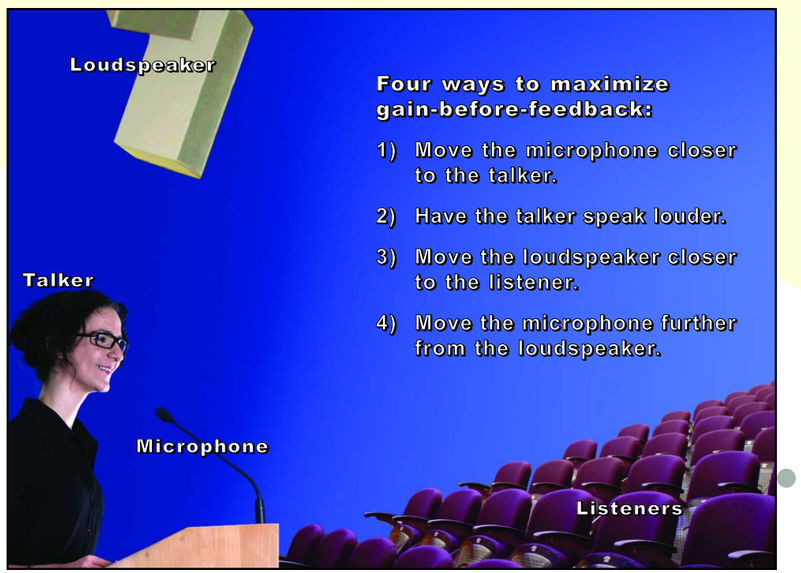

Figure 4 Maximum Gain-Before-Feedback

The absolute gain of your sound system is primarily set by the physical distance between the loudspeaker system and the microphone. The room's acoustics are also an important factor. The absolute gain is the maximum gain in volume you can achieve before feedback occurs. The actual absolute gain can be influenced by high quality equipment and proper design, installation, and positioning of the equipment. If the sound system is operated at a level below the absolute gain, feedback will not occur whether the talker whispers or shouts. The sound system is said to be stable. Increasing the gain by turning up the volume control on the mixer will eventually exceed the absolute available gain and feedback will be heard. Since we do not want to hear feedback, the only option is to turn down the volume control, which decreases the system gain, until the feedback stops. However, the talker may not be loud enough for easy listening. There are two methods which can increase the volume.

The first method is to have the talker speaker louder. When the talker speaks louder, the microphone will pick up a louder signal and that will be amplified louder. Too often the natural reaction of the talker to hearing feedback is to talk softer. This is exactly opposite of what should happen. The talker needs to talk louder so the sound system gain can be turned down.

If the talker can't speak louder, they then need to get closer to the microphone. Remember the ripple example? The sound level reaching the microphone will be louder if the talker moves closer. The sound system gain or volume has not been adjusted, but the signal entering it has increased in volume. The result is louder volume from the loudspeaker system and the listener can hear better.

Summary

Using these basic microphone facts will help you better understand how to get the most out of your present equipment. If you still have problems, please call us for help. We desire to serve you by helping you remove your sound system frustrations.

■ *Ron Huisinga*

TECH TALK

Pre or Post . . . What language is that?

Like most technical crafts, sound system operators have a language of their own. The key to understanding other operators and technical manuals is understanding the language. However, it is not enough to know the words. The key to expert sound system operation is knowing the meaning of the words, too. *Pre* or *post* are terms that are often used in relation to operating a sound system mixer. Let's explore the meaning of these terms. *Pre* and *post* are usually heard when someone is talking or reading about the Auxiliary (Aux) Sends of the mixer. These sends could also be called Monitor or Effects Sends. Whatever the name on your mixer, they are used to send a signal to another separate loudspeaker or device besides the main loudspeakers. We will use the term Aux Send in this article.

Pre or *post* tells the operator what path the microphone signal is traveling. But pre- or post-what? The "what" is the Channel Fader or Volume Control. In other words, the Aux Send is *pre* (before) or *post* (after) the Channel Fader (Figure 5).

If the Aux Send is pre-fader, the Aux signal is independent of the Channel Fader. Any change in the Channel Fader will not affect the Aux Send. This is commonly used for sending a signal to a monitor loudspeaker. Because the Aux is pre-fader, the sound operator can adjust the sound level in the main system without changing the level of the monitor loudspeaker. In other words, the signal will route through the Aux Send before the Channel Fader adjustment. This is very important when accompaniment CD's (trax) are used. The operator may turn the level down in the main system, but the singers still need the trax at a level to hear the sound for proper pitch and tempo.

Post-fader means the Aux Send gets its signal after the Channel Fader. Now a change in the Channel Fader will affect the Aux Send. The Aux "follows" the Channel Fader. This would be used when the operator wants to add artificial reverb to the vocal. The signal to the reverb device would need to "follow" the volume of the singer. If the operator turned down the vocalist with the Channel Fader, the signal going to the reverb device should also decrease proportionally.

Knowing whether the Aux Sends are *pre* or *post* lets the operator use the mixer wisely and properly. Many mixers have 3 or 4 Aux Sends. More recent mixers may have 6 or 8 Aux Sends. The manufacturer will designate some of the Aux Sends to be *pre* and some *post*. Often there may be a switch to allow some Aux Sends to be switched to either *pre* or *post*. That feature provides a lot of flexibility to the operator. Some situations may require the use of the pre-fader control on some channels and post-fader on others.

If you have a mixer with Aux Sends, take the time to learn which Aux Sends are pre-fader and post-fader. Your mixer manual will help you or you could find out by experimenting. It will pay off with better sound and happier musicians. If you have trouble understanding your mixer give us a call. We would be glad to help solve the mystery.

■ *Ron Huisinga*

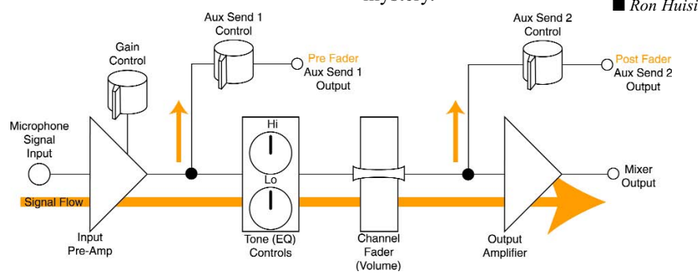

Figure 5 The path of a signal through a mixer.