3.8 Stage Monitors

The dominant factors in the performance of a stage monitor system are:

- The interaction of the speaker and microphone.
- The speaker response.
- Near-field boundary conditions.

The interaction of the speaker and microphone can be broken down into:

- The directional characteristics of the mic and speaker.
- The distance between the speaker and the mic.

The signals passing through a stage monitor is a mixture of direct (such as a synthesizer or a bass direct input) and regenerative (such as a vocalist). This summation of direct and delayed energy into the microphone has all of the same aspects of comb filtering as discussed in Section 2, and will have a dramatic effect on the vocal signal quality, both on stage and in the house. The comb filtering can be to some extent reduced by equalization. It could also be reduced by turning the stage monitor down, but let's be practical!

The equalization process for stage monitors can be broken into three stages:

- Equalization of the speaker system itself and the local acoustical environment. This is typically done with an outboard equalizer.
- Equalization of the regenerative path signals (vocal mics). This can be done with an inserted outboard EQ or with a channel EQ.
- Equalization of the direct signals by channel EQ.

The reason for breaking these factors apart is that when you equalize the system for the regenerative path, there are likely to be drastic measures taken. The direct path signal, which does not need this EQ will sound bad.

One solution is to double the number of stage monitors and separate them into music and vocal systems. This has the advantage allowing for separate EQ and, in addition, the musicians find it easier to localize their voice and their instruments since they come from different positions. This same psychoacoustic mechanism allows us to localize a particular conversation at a noisy party.

Another option is to route the vocal channel through an outboard equalizer, compensating for the regenerative effects there and leaving the speaker linear. Then both direct and regenerative signals will sound natural.

Monitor engineers learn to be extremely careful regarding the position of stage monitors and microphones. Slight changes in position can change the frequency response resulting in feedback. What is the mechanism that causes this?

Fig 3.8a shows the relationship of a typical stage monitor and microphone. With the mic at a height of five feet the comb filtering will result from a time offset of 5.4 ms. This relationship defines where the peaks and dips will be, and the rejection of the mic and level required to deafen the musician will determine the depth of the combing. If we move the mic up for a taller musician the time offset changes to 5.9 ms.

Now let's look at what happens with this 0.5 ms change. The deep null at 1 kHz is now a peak. The same effect will occur at 3 kHz, 5 kHz and upward. The opposite effect will occur at 2 kHz, 4 kHz etc. A change of one inch will reverse the response at 5 kHz, 10 kHz and 15 kHz. Unfortunately, however, it is a universal law of musicians that they must readjust their mic stand immediately upon coming on stage.

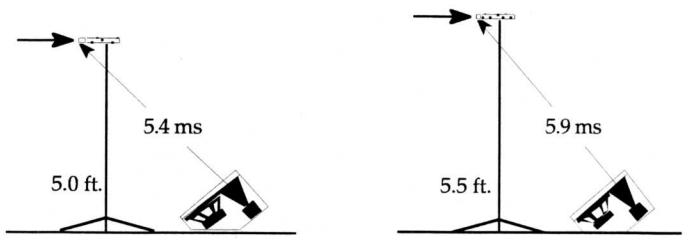

Fig 3.8a The repositioning of the mic stand creates a new time offset relationship between the mic and speaker. This 0.5 ms change can change the response at 1 kHz by over 20 dB.