THE PA BIBLE

ADDITION NUMBER ELEVEN
PORTABLE SOUND SYSTEMS FOR THE SMALL CLUB

SOME HISTORY

In the 50's, the club musician's portable music system was like the Knight system shown in Figure 1. It weighed 98 pounds, including a microphone with stand and cable. Both speakers could be carried in one hand with the amplifier-mixer in the other. It was small and light but sounded pretty bad by today's standards and wasn't very loud.

With the 60's came the era of rock and roll and the need for louder sound. Responding to this awareness was the Shure Vocal Master o with its two columns and a mixer-amplifier, as shown in Figure 2. This system was louder but was no longer small and light, and still sounded bad by today's standards.

In further pursuit of louder, better sound, really large systems were developed for rock and roll concerts. One such system used twenty-six microphones, eight speaker systems (each using two 15-inch speakers, a 100-watt midrange, and four tweeters), four consoles, six 200-watt amplifiers, and 4000 feet of mike cable; all carried in a twelve-foot truck! These large systems were an important element in creating very loud sound and also a better sound quality. These developments, while affecting the requirements for club systems, offered little equipment that was practical for the club musician.

Various products came along for club performers but they generally suffered drawbacks: if small, they were very inefficient; if efficient and loud enough, they were too big to be easily portable; and, most used cut-and-try design approaches with honky sounding horns and highly colored bass response. The system in Figure 2, in its many guises, is typical of the heavy, bulky, and low-fidelity products most working performers had to accept.

FIGURE 1

THE NEEDED SYSTEM

To keep audiences coming back, and club managers hiring, today's performer needs a clean, intelligible sound. Every seat in the room should hear the entire range of frequencies without the distortion that makes full sound seem too loud. Equally important is portability, so the performer doesn't have a back-breaking setup. In other words, there is need for a portable, distortion-free, accurate system capable of delivering crisp, clear sound to every seat in the room.

Most sound equipment for the musician, advertised as portable, fails to meet the definition "easily carried."1 Much of the equipment would more appropriately be described as capable of transport, requiring hand trucks and built-in wheels.

What are the criteria of portable equipment?

To be portable, the Human Engineering Guide to Equipment Design (2) suggests the following:

> "The best individual loads, if carried in either hand by means of handgrips, are about 60 pounds for short distances and 35 pounds for longer distances- The weight of bulky articles (around 30 inches to a side) should not exceed 20 pounds. In general, a weight is "heavy" when it reaches 35 percent or more of human body weight. . . "

The shape of the equipment should follow the long established practices of the luggage industry, with limited size, and handles located in line with the center gravity. A suitcase is a good model since it is carried by hand and is stackable, easy to slide, rugged, scuff resistant, and easily loaded into a car. The equipment should also be durable and able to withstand repeated transport.

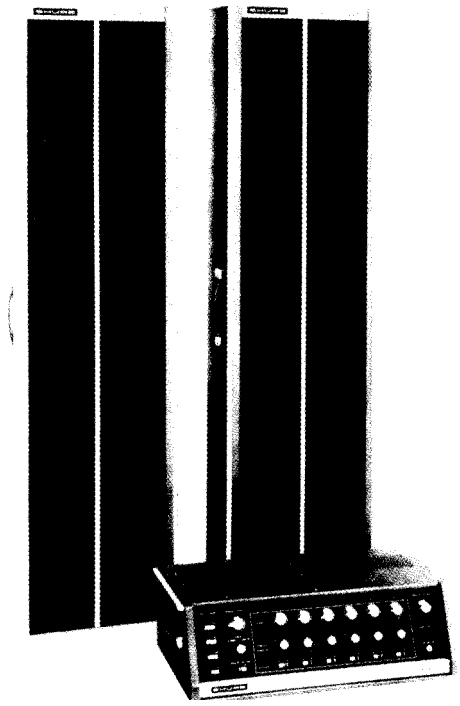

FIGURE 2 - Shure Vocal Master@

How much sound is enough?

Sound loudness is measured by the sound pressure that the system can generate in a club environment. To relate this sound pressure requirement to some recognizable sources, the chart shown in Figure 3 is reprinted from the original PA Bible publication. A **further aid to the evaluation** of these sound pressure levels is the speech interference criteria. A sound pressure level of 93 dB in the speech spectrum represents a serious impediment to normal conversation, requiring a person to shout at a distance of one foot.3 As the sound levels in Figure 3 and speech interference criteria indicate, a sound pressure level of 93 dB would appear to be loud enough for the club environment. Actually, sound pressures higher than 93 dB are occasionally needed in a typical program, so a sound system needs to produce high peaks, up to 103 dB maximum output measured about 3 feet from the speakers.

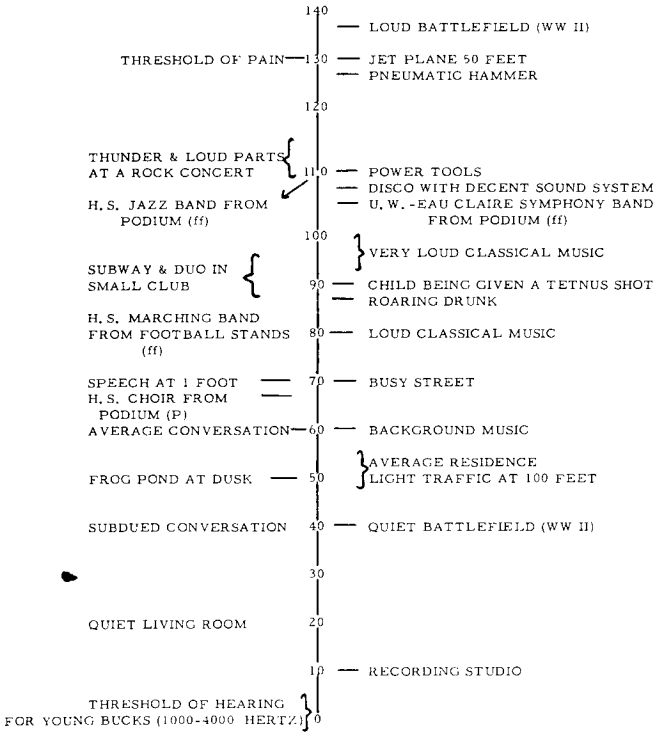

FIGURE 3 - Typical A-Weighted Average Sound Pressure Levels in Decibels (dB) RE .0002 Dynes/cm 2

What frequencies should be covered?

Designs encompassing the range of 70 Hz to 15,000 Hz will cover all the needs of the typical club environment. Fig. 4 shows clearly that these frequencies go beyond the range of nearly all instruments and voices. It is important to note, however, that all frequencies should be reproduced about equally. Otherwise, "honky", and other forms of colored sound, will result. This is a common problem with available products, making them sound too loud before they are really loud enough, causing feedback problems, and delivering "muddy" sound ("I can't understand the words"). A system that reproduces sound over all of the needed frequencies, without coloration or distortion, is said to be "accurate".

How can we get this good sound to all seats?

Recent developments in technology have dealt with this problem. In systems using design techniques of several years ago (most **available today) the** sound heard off the center line of the speakers lack most frequencies above about 2000 Hz. Using a tweeter does not resolve the problem because the horns used **with the tweeters aim the** highs in a narrow band to only a small part of the audience. With these systems the audience in front of the system hear a fairly well-balanced sound, while persons off-axis hear a muddy, unintelligible sound. This effect can not be corrected with equalization because the "beaming" is inherent in the physical shape of horn or speaker. To correct the problem the horn shape has to be changed, and a significant accomplishment in this regard has been the development of Constant Directivity horns. Systems using Constant Directivity horns spread the sound uniformly at all frequencies so that listeners sitting off-axis hear a balanced spectrum of highs, mids and low frequencies.

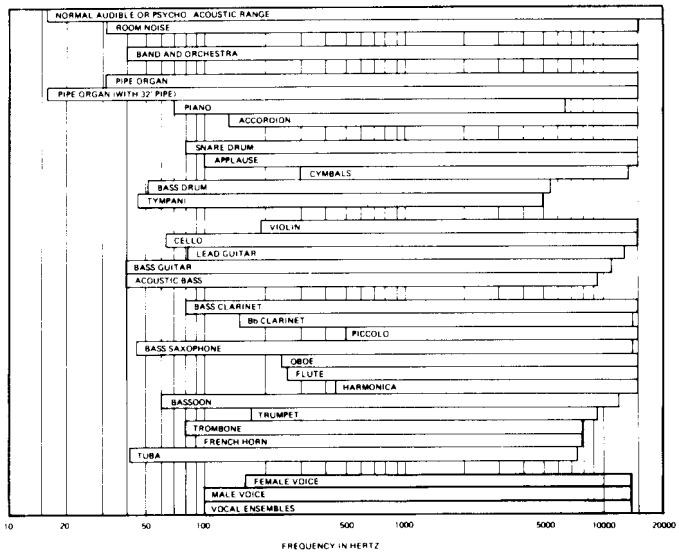

FIGURE 4 - Range of Sounds

A SYSTEM FOR TODAY

The **systems available to the club musician today generally emphasize** one or two of the necessary features, but fall short of being completely suitable. Some systems are loud enough but are neither accurate nor use constant directivity; some larger systems utilize constant directivity, and are loud enough, but are not portable.

A recent product from TAPCO demonstrates that new technology allows a solution.

The Entertainer'" system is a portable design that has the small size and light weight necessary to be portable, while providing the sound loudness and accuracy essential to the performer. The system provides two high efficiency loudspeakers systems based on Thiele concepts and a mixing board with two separate 100-watt amplifiers. It is conveniently packaged in three containers that do not exceed 30 inches in any dimension and weigh less than 36 pounds each. Thus, the system easily meets the criteria of portability (see Figure 5).

To give uniform coverage, a separate tweeter in each loudspeaker system utilizes a molded-in Constant Directivity horn to give a uniform sound dispersion (Figure 6) and the bandwidth shown in Figure 7.

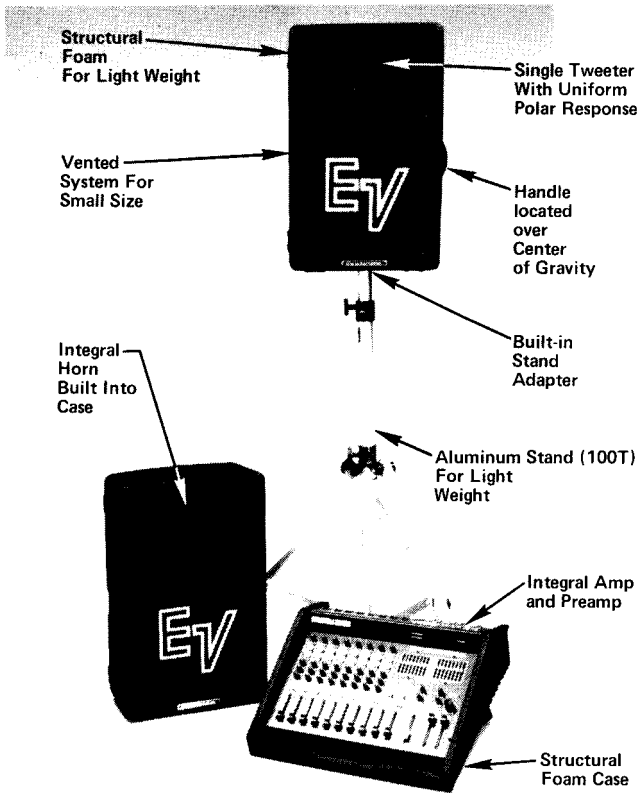

FIGURE 5 - The Entertainer'"

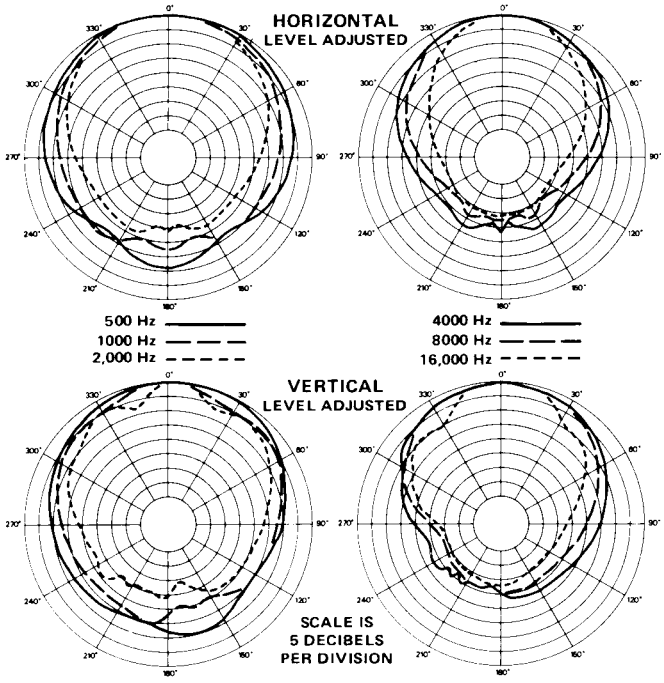

FIGURE 6 - 100S Polar Response (Dispersion)

Thus, it can be seen that the Entertainer fulfills requirements of the "needed system". At present there are no equivalent alternative products, but the Entertainer shows beyond doubt that today's technology permits performers, finally, to satisfy the vital need for a high performance sound reinforcement system that can be readily moved from job to job.

ADDENDUM

The combined capability of the Entertainer's two separate 100-watt amplifiers and two l00S speaker systems will produce a sound pressure level of 93 dB at 65 feet, out of doors. Used alone, each channel will produce 90 dB at the same distance. Figure 8 shows levels that may be expected at other distances.

Trying to figure out what sound pressure levels can be expected in a room is more complex, but it can generally be expected that a given system will be louder in a room than outside due to sound reflecting off of walls or other surfaces. As an example, in a reasonably "live" room 60 feet by 40 feet by 15 feet the same power as above to both speakers, the sound level would not be below 104 dB at any place in the room.

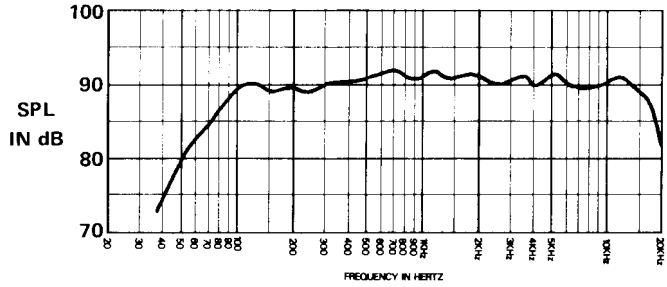

FIGURE 7 - Axial Frequency Response (Bandwidth)

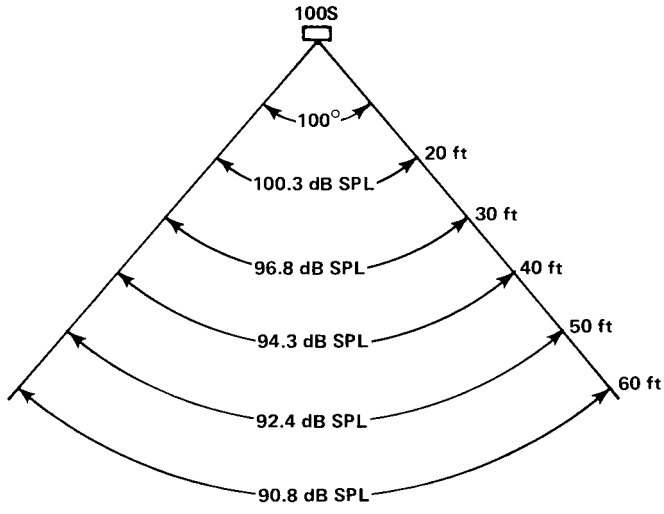

FIGURE 8 - Maximum Direct Sound Pressure Levels for 100S Loudspeaker System

REFERENCES

1. Webster's New Collegiate Dictionary
2. Human Engineering Guide to Equipment Design, ed. Clifford T. Morgan et al, (McGraw-Hill Book Company, Inc., 1963).
3. Handbook of Noise Measurement, Arnold Peterson and Ervin Gross, Jr., (General Radio, 1963), p. 38.

Editor's Comments:

In the last addition (No. 10) we described the sound systems installed in the Music Box, a nightclub in Mishawaka, Indiana. On the evening of April 10 a fire that started in an adjacent building damaged the interior of the Music Box, including the sound equipment. Portions of the building actually burned and the entire building filled with dense smoke. All of the equipment had to be cleaned, including the insides of the electronics. One driver failed due to a fire hose water jet entering one of the horns. The white horns turned yellow, but otherwise were O.K. One amplifier and the mixer were destroyed. The balance of the equipment was saved and placed back in working order, and the Music Box reopened on July 29th.

We had a couple of letters asking about the location of the mid-bass components of the Music Box system. For those that didn't write but also had the same question, the mid-bass cabinets were part of the central cluster and can be seen (dimly) just above and to each side of the horns in Fig. 5.

The next P. A. Bible addition will be about "Do It Yourself Boxes for Music Systems." If you would like to comment on this subject before the article is written, we would welcome your suggestions; and although we don't answer all letters we appreciate receiving your suggestions and criticisms.

Send your comments to:

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