

Paradise Garage Sound System



Larry Levan & Richard Long

World - Class **Discotheque Sound Systems** are engineered to fit each unique space with it's own design criteria. To achieve maximum impact, the system designer and the acoustician work in close harmony. The designer determines equipment requirements, while the acoustician considers interior acoustics and noise isolation. Impulse testing, equalization, T60 fine tuning TDS tests, etc. complete the installation, examples will be presented.

The sound system to be discussed is currently installed at the "**Paradise Garage**" in **New York City**. The disco is located on the second floor of a 2-story garage and contains approximately 20,000 square feet of space. An attempt to locate a disco here was made 2 years prior to the current installation. However at the time the entire 20,000 square feet of space was utilized with no subdivision into smaller areas, no acoustical

treatment and an entirely inadequate sound system.

The result was disastrous and the club went out of business in a short time. The current owners did not want to make the same mistakes and therefore subdivided the 20,000 square feet into a larger number of smaller areas, which included a 5000 square foot dance floor and a 2000 square foot lounge.

Initially do to lack of funds, the decision was made to hold a number of "construction parties" in the lounge while work was continued on the large dance area. The sound system from their previous location consisted of 4 horn-loaded home speakers passively crossed over, 4 scaled-up pseudo-Klipsch corner horns using 18" for sub bass crossed over electronically and 2 tweeter arrays also crossed over electronically. However this system was inadequate to handle 800 to 1000 persons in the lounge at the sound pressure levels desired by the disc jockey. At this point we were retained to design a new sound system which could be expanded as finances permitted, and eventually completely replace the old system.

The first part of the new system consisted of 4 "**Waldorf**" bass speakers. First used in a rental at the **Waldorf Astoria**, it is similar to the **JBL** double 15" scoop enclosure but is based on the old **Jensen Imperial** design. The enclosure was made larger to accommodate a larger rear loaded horn, which was designed with a hyperbolic rather than an exponential flare. The high end consisted of the largest JBL horn lens for smooth wide dispersion and the system is electronically crossed over at 80hzr These replaced the corner home-type speakers.



The next area to be improved was the sub-bass **Klipsch**-type speakers in the existing system. We found these speakers to be incapable of clean bass reproduction, particularly the very deep bass, at the high sound levels required. The problem was due to the exponential flare used in the design, the particular 18" driver installed in the cabinet and the small mouth area of the cabinet.

To solve this problem we designed a special sub-bass horn which is now a standard item in our line of speakers. The horn called the "**Levan Horn**" after the DJ consisted of 2 parts: The main cabinet which is a large "**W**" type hyperbolic folded horn using two 500 watt custom built 18" drivers and an extension which bolts on to the mouth of the "**W**" horn. The mouth of the extension is a full 8 feet wide and 3 1/2 ft high or 28 square feet. The horn is capable of awesome reproduction at very high sound pressure levels down to 30hz. One of these speakers was found to overwhelm four of the scaled-up klipsch horns all playing together.



The tweeter arrays were the only part of the original speaker system that was retained. For those of you not familiar with this item, the most common tweeter array consists of four JBL tweeters mounted on a plate at 90-degree angles to each other and hung at a height of approximately 9 feet above the dancefloor. These arrays are controlled by a special electronic crossover with gain that allows the DJ to play them at a level even higher than the main system for special effects.

The next consideration was give to designing a special full range speaker system to be used in addition to the Waldorfs when the move was made onto the 5000 square foot dancefloor. The result of this was the Ultima, which is of a modular design in three stackable sections. The base sections of the Ultima is similar to the Waldorf except it is designed with a W type horn configuration rather than single sided.

$$T = 0.161 \frac{V}{A}$$



Example of a room ceiling with sabins absorption panel

Prior to moving into the large room, the speakers location was designed as follows: Each corner of the room would contain 1 Levan sub-bass horn and one complete tri-amplified Ultima and the larger sides of the room would have at their corner point 2 Waldorfs and 2 smaller sub-bass woofers. Six tweeter arrays would be hung over the dancefloor in appropriate positions. The double amp rack to power all of the speakers was installed in the balcony area DJ Booth which overlooked the entire dancefloor.

As the main room was nearing completion and speaker locations were being chosen, it became obvious that there were serious acoustical problems with the room. The reverberation was so pervasive that workmen could not communicate with each other across the room. The reverberation curve was measured and is shown. This is an empty room T60 and would of course be lower with a crowded dancefloor. The Garage was previously a parking garage and the mostly concrete construction provided very little bass absorption.

A computer print out of this recommended treatment to the room yielded the requirements of almost 3000 **sabins of broadband absorption**, as shown (here). It was determined that the high exposed sidewalls would need broadband absorption to tame horizontally -traveling reflections above the dancers heads. The 1" thick 3 lb./cubic ft. destiny fiberglass used was predicted to have near perfect absorption down to 500 Hz. To reduce low-end reverberation, an arrangement of V shaped panels of the same fiberglass were hung from the ceiling. This was done with some difficulty, as the concrete ceiling required the installation of over 1000 shot-in hooks with support wires.

To achieve the desired acoustics as accurately as possible, Acoustilog usually uses a three-step measurement and adjust program with regards to the T60. This way the inevitable variation in the installation technique and materials are measured and compensated for. This doesn't cause inconvenient interruptions to the workmen because the measurement of the reverberation curve takes only 15 minutes and can be performed during lunch hour. Recommendations for absorptive treatment are deliberately made slightly shy, to avoid having to either over order material, or rip down material already installed.



bozak mixer

After secondary tests showed T60 to be high at 63 HZ. And 125 HZ, the thickness of the side wall absorption was increased in certain areas. Additionally the skylights were used for bass absorption by

significantly thickening their fiberglass treatment. By the 3rd T60 measurement session, the desired T60 of 1 second was achieved with a deviation of not more than 5% from 250 Hz. To 2 kHz. And not more than 25% from 125 Hz to 8 kHz.



The **Paradise Garage** used a special electronic crossover designed to our specification by **Alan Fierstein** of **Acoustilog** Inc. it is a 4 way crossover with a subsonic filter at 20 Hz. All filters are 18 dB/octave Butterworth. The output impedance of the crossover is necessarily low as the amplifier racks are remotely located from the DJ console, and the high cable capacitance could otherwise take its toll in high frequency roll off. Stability consideration is also important for the same reasons. All critical elements of the crossover circuit are extremely derated for negligible heat build up and therefore high reliability. The standard ranges are 20 to 100 Hz. For sub-bass, 20 to 800 Hz for main bass, 800 to 20,000 Hz for mid range and 7,00 to 20,000 Hz for tweeters. Its most unique feature is that the two extreme ranges of 20 to 100 Hz and 7k to 20k Hz are controllable in volume by the Disc Jockey with up to 16 dB of gain built into the circuit.

The initial reaction of most audio engineers to the idea of a non-technical person such as a DJ controlling the frequency response of a sophisticated sound system is complete shock and disbelief. In order to explain our concept of a disco system, let us give this analogy: In a discotheque a sound system can be considered to be the orchestra while the DJ is the conductor. The conductor's job is to stimulate and entertain the audience; the DJ must entertain the dancers. The DJ is not reproducing the works of Bach or Brahms as performed in a symphony hall, but is instead playing music which was created in a multi-track studio under artificial conditions mixed by an engineer also attempting to create the most exciting sound possible.

There can be no doubt that many people, especially those trained in music and audio sciences, have been at one time or another to a disco and been totally offended by the sound. One's first reaction was probably that the music was too loud, but of course this is not the whole answer. The quality of the components, particularly the speakers, is one potential source of offensive sound, but more important is the relative loudness of the various frequency ranges. For example, sub-bass is ranged below 100 Hz when played at 110 dB SPL is not annoying at all whereas upper mid range from 2k to 4k Hz at 110dB is extremely offensive. A prominent mid range around 500 Hz with a lack of mid bass around 100 to 200 Hz can be very annoying.



In other words, the frequency response must be tailored to be smooth with no prominent peaks or dips while at the same time de-accentuating certain frequency ranges which can be offensive at high sound pressure levels common in most discotheques. When properly done the result will be a pleasing and exciting sound with no offensive or listener fatigue even at continuous high sound pressure levels. For the same reason by giving the DJ control over the extreme low end and extreme high end but not allowing him any control over the main full frequency range, he is allowed to create extremely exciting sound effects without affecting the overall balance.



bozak mixer

the immunity from feedback such as a curve provides. The **Garage** frequently hosts live acts on a huge stage and complete professionalism is expected, from mandatory sound checks to a lack of feedback during the shows. Maintaining a stable system, with adequate microphone volume to match the loud music, while the performer may walk to within 10 feet of a full range speaker stack, is no easy trick and the equalization plays a major role in allowing this. Furthermore, the shows are recorded live and subsequently aired over a major New York FM station which accentuates the need for a complete absence of annoying ringing and howls.

Because of the large bass horns we use in most of our installations along with the special crossover, the potential for feedback through the turntables was of particular concern. This was solved by our development of a very simple means of suspending the turntables on a platform, which is floating on an elastic suspension consisting of \$1.00

Another advantage to achieving a smooth and accurate equalization characteristic is

worth of rubber bands. The natural frequency of this system is approximately 2 Hz, which provides vibration isolation at the lowest frequency produced in the system, which is 30 Hz.

Since the DJ is responsible for creating an exciting sound we try to make sure he has enough tools at his disposal. Such special effects devices are



DBX boom box

- 1. Our special electronic crossover (discussed earlier);
- 2. The **DBX boom box**, which provides a blend of 25 - 50 Hz bass, synthesized from 50 - 100 Hz information present on the recording;
- 3. Dynamic Range Expanders, used to undo compression found in most recordings;
- 4. The **Detalab Acousticcomputer** and similar devices used to alter or add to the sound of the recording;
- 5. The **Audionics Space & Image Composer**, a 4 channel synthesizer; and
- 6. New devices currently under development, such as the **Acoustilog Image** enhancer which expands the stereo effect. All of these devices except the last two are currently installed at the Garage

The **Detalab Acousticcomputer** hookup deserves special mention. This special effect unit is installed in a loop within the full- range circuit of the electronic crossover. However the complexity of the unit and the wide range of sounds it can produce requires that the parameters be preset carefully before bringing the device into the actual sound system. There fore a special pre-cueing switch, along with a house blending control, was incorporated into the main mixer. Once the DJ has achieved the sound he wants in his headset, he can either abruptly or gradually bring the effect into play.



Audionics Space & Image Composer

In Disco installations, and particularly at the **Garage**, it is important to coordinate the design of the DJ console and control electronics with the desires of the DJ whenever possible. The special console of the garage satisfies all the needs of the garage DJ, putting all the control electronics, which he uses immediately at his fingertips. It may be interesting to

note that the front angle portion housing the electronics is controlled by a motor driven mechanism allowing the DJ to instantly change the tilt angle. Monitor speakers, when required, are installed to satisfy the Disc Jockey's need to hear the system in the booth without the time delayed sound arriving from the main speakers affecting his sense of timing.

About two years after the full garage system had been installed, a device designed by **Acoustilog** called the **Impulser** allowed us to easily impulse-test the entire system for phase alignment and polarity. We found the entire system to be in correct polarity except for the sub-bass horns. One of the speaker cables had been accidentally ripped out of the connector and rewired in reverse by the Garage maintenance crew. With this horns output essentially canceling that of another bass horns, the Garage's sub-bass output of four speakers had been effectively reduced to that of two. Now, we always impulse test new sound systems for polarity agreement prior to final equalization.

All of the above considerations have resulted in the garage winning every award for the best **Disco Sound System** ever given by **Billboard's International Disco Forums**.

Authors: Alan Fierstein & Richard Long
www.acoustilog.com