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TECHNICAL NOTE #9 : STUDIO EQUIPMENT SELECTION

This Technical Note has been written to provide an elementary overview of the equipment most frequently found in an on-air studio. A station should find the descriptions useful in responding to the queries of non-broadcasters who wish to understand the need for particular items. The objective of this list is to provide some recommendations of equipment and indicate some of the more cost-effective choices available.

For every item listed, the reader (and the author) can doubtlessly substitute a less expensive "consumer" model, which may appear to offer similar qualities. As in so many specialized fields, broadcast equipment purchased at the lowest possible price can easily become the most expensive. Broadcasting conditions are very different from "consumer" ones, as they require continuous use of the equipment. Broadcast CD players often see more use in one week than a consumer unit would see in one year. Survival rates under these conditions are often parallel the price.

◆ Studio Furniture

The furniture that a station chooses should conform to the equipment requirements and not vice-versa. Certainly there is inexpensive standard studio furniture available from a number of sources, but it will not necessarily perform adequately. Determine equipment requirements prior to deciding on furniture requirements. Never purchase furniture without first determining a desired studio layout and equipment locations. Function, strength and durability should be foremost in the determination of furniture requirements, not appearance. A good furniture supplier will be able to provide drawings and configuration information based on your needs and equipment list. Remember that the school will want to see some results from the money they put into the station and a professional layout and furniture package will really reflect well on the station.

◆ Audio Consoles

The audio console is the heart of any studio, providing switching, mixing and control over all of the various input devices. An audio console is truly the key item and represents a significant investment. One of limited growth capability or which might become a maintenance problem would be a bad choice. There are dozens of manufacturers out there, so ask questions when someone offers a suggestion, and get references from users!

LPB offers two separate console lines for a variety of studio applications. The Signature III and 7000 Series lines are available in nearly any configuration that a station may desire.

The LPB 7000 Series consoles offer either 12 or 18 channels, 2 inputs per channel, 3 stereo output busses, slide faders and a great deal of flexibility for customizing features to suit a station's needs. Remote start buttons are standard for every channel and can be set to meet the needs of each component. It continues the LPB tradition of durability and adds improved control and convenience.

The LPB Signature III console line is available in several configurations to fit the needs of any station. In either Stereo 6, 8, 10, 12 channel or Mono 6, 8, and 10 channel models there is a Signature for any size studio. With a standard 3 inputs per channel and individual remote starts for each channel but the first (normally used for a microphone), the Signature offers a great deal of flexibility and ease of use. Hundreds of colleges and thousands of stations worldwide use Signature consoles.

Choosing a console should be saved until all of the station requirements and plans have been defined. A smaller station on a tight budget may opt for a 6 channel console, initially and save upgrading for later. When the time comes for a larger console, the original should serve well in a production or remote studio facility. The knowledge gained in the use of the original will aid in the definition of all upgrade requirements.

If you have any doubts regarding the choice of consoles, we recommend discussions with other college stations, and commercial broadcast engineers. You will likely find that there is a feeling of security in colleges with rotary fader consoles rather than slide faders. The reason for so many rotary consoles is simple - Survival. Slide faders offer large unprotected access to their innards for any spilled drink, dropped pencil, paper clips, etc... which inevitably shorten their lifespan. If you anticipate DJs who are more concerned with the equipment than anything else, you shouldn't worry. The other 99% of stations with normal school DJs should.

♦ Turntables, Tonearms, Cartridges and Preamplifiers

The tight timing needed for broadcasting requires that turntables come up to full speed in less than 1/10th of a revolution. Once turning, speed irregularities are intolerable. Add the required strength and reliability and the turntable becomes a precision machine powered by a constant-speed, heavy-duty motor. If you ever wonder why broadcast quality turntables are so much more expensive than a consumer model, consider the unique requirements and examine the construction differences.

The prices of broadcast turntables do not always include either the tonearm or a pickup cartridge (the Technics SL-1200 MK II does, however, at a good price). In selecting the tonearm, look for high mechanical quality and the convenience of a removable head shell to contain the cartridge. Tonearm prices are generally from \$120.00 to \$250.00. The complete Technics SL-1200 turntable includes a base, tonearm, and cover for about \$650.00. You can wire a remote start into one of these turntables fairly easily as well.

The elliptical stylus that is commonly used in consumer model mono phono cartridges is inappropriate for broadcasting. In addition to lacking the necessary weight and durability (required by the greater tracking force of broadcast turntables), it is incorrectly shaped for the back-cueing required by on-air work (it will damage the record and destroy the stylus). We recommend the Stanton 500AL as a low cost, durable cartridge due to its outstanding record (sorry) in broadcast stations. Stations with a higher budget may opt for the Stanton 681A or 680EL cartridges for enhanced fidelity with the same degree of ruggedness. Regardless of the cartridge you choose, it is always a good idea to have a few spare styli on hand. Expect to change the styli at least every 5-6 months, and the cartridge annually. Stanton has a number of other styli as well, so it may pay to evaluate your operation. If you plan to run Club-type music which requires a great deal of "scratching" from the styli, you should look at some of the other options they have available.

Because the output signal from a record is so low, it requires both amplification and equalization to compensate for the rising frequency response that is employed in the recording process to minimize surface noise. This requirement, together with the need for flexibility of console input switching, dictates a separate turntable preamplifier/equalizer be used. Mass produced consumer models lack the required interface characteristics for audio consoles. There are many broadcast units available, often with extensive and elaborate features (and prices) which you may not need. We recommend the ATI P-100S models for their price, features and durability. Typically the phono preamplifier will cost \$300.00-\$400.00. Note that one stereo preamp can be used for two mono turntables. Recommended for All Stations.

FINYL VINYL?

Much ado about nothing? Not really. The idea of abandoning turntables is certainly valid, especially for a new station with a limited budget, in the face of the diminishing market share of vinyl. A very high percentage of record labels have ceased to produce new vinyl releases. Pretty soon the LP will follow leaded gas and the 8-track into oblivion...Well, maybe not. Still, it is worth noting that the LP is in its twilight years, while the CD is barely into its second decade.

From the standpoint of an existing station with a library full of LPs, it is a medium that cannot be abandoned, but slowly retrofitted. For new commercial stations, the CD is the way - even dance remixes, the purely vinyl domain, have become easier to find on CD. A new college station, however, must consider a bit more information first.

Many alternative artists and smaller record labels simply cannot afford to give out CD releases. To abandon the LP would be to abandon these groups. Some servicing companies offer a vast array of artists through monthly shipments - many of which remain on vinyl. A major consideration for a new station might also be the commercial stations in the area. It is not unusual for a commercial station converting to CD to offer its vinyl library to a local school station. Who would want to miss that opportunity?

Certainly the CD has a number of advantages over the LP in the areas of cue time, durability and storage space, but a few questions remain. As the CD passes its first decade, one wonders about the rumors regarding planned obsolescence. Will a CD's coating begin to oxidize as predicted? Will this happen only to the first generation? We hope not, but who knows? The cost of a broadcast quality CD player is still quite high and the CDs themselves are hardly inexpensive, and no one seems to be lowering prices despite obvious manufacturing cost decreases. We recommended hedging your bets with an absolute minimum of one CD player and one turntable. Ideally, a station would be set up with two of each for easy transitions and a backup CD player.

♦ Compact Disc Players

As with turntables, there are consumer level models which inevitably lack the features and longevity required for broadcasting. Much debate exists over whether it is better to purchase cheap consumer models and replace them annually (or more often), or to pay the initial expense and get a more durable broadcast model. Consumer models also generally require an impedance matcher to get the best quality audio into your console, which adds to their low price. We strongly recommend against consumer models as

they are far more prone to failure and damage. When they fail (as they frequently do) it is inevitably on the air, and the resulting stalls and/or skips embarrass both the DJ and the station.

Another major decision is required in the area of broadcast CD players : a cartridge-based system or the standard drawer-type. Cartridge players such as the Denon DN-951FA and DN-970FA offer many advantages over their plain counterparts. A plastic cartridge contains the CD, allowing for permanent closure for protection, or theft prevention. The cartridge only allows access through a sliding door so there is little risk of damage, even if the cartridge is dropped or abused. Once in a cartridge, the CD slaps into the player as if it were a cart, just a quick push in the front door. Remote start, easy programming, rapid access and cueing down to frames (1/75 of a second) the Denon CD Carts offer far more than conventional CD players.

The CD cartridges are of nearly identical dimensions as the standard CD jewel case, which allows for convenient storage. The top of the case is clear to permit easy reading of the contents, or labels (for those CDs without contents listed), and labels for the ends are included to allow quick identification of CDs in racks. The only major disadvantage is found in the cost of purchasing the cartridges. This can be offset in several ways, the most significant of which is the reduced number of replacement CDs the station has to purchase due to theft and damage. In addition, many school bookstores can be persuaded to purchase the empty jewel cases from the station (paying about \$1 each), for resale to students. Recommended for All Stations.

◆ Compact Disc Recorders

Yes, it's true - you can now make your own CDs. If you have a lot of spare cash. The newest line of "affordable" CD Recorders (CD-R) are priced in the \$2000-range. This is a significant drop from the previous minimum of \$20K, but still puts them well out of reach of the average college station. Keep an eye on them though, as the computer peripheral versions are under \$600 in many cases. With DVD coming into the arena, there will be a new drop in the prices for CD-R machines. It is an amazing technology with limitless applications, but it is still a bit high in cost. Recommended for Advanced Stations

◆ Tape Recorders/Players

Reel-to-Reel

This format is less frequently used in stations than it once was, but remains an industry standard for production. Many commercials and public service announcements are supplied to college stations on reels for conversion to the stations preferred format. It is recommended that a reel-to-reel unit be used in the production studio for format conversion and production work. Most DJs are not skilled in the use and handling of open reel tape, and should not be expected to handle it in the course of a broadcast. Conversion to cart, cassette, DAT, etc... should be handled by an engineer or person in charge of production. Recommended for Advanced Stations.

Cassette, Analog

The common analog cassette format is seldom used the same way a DAT would be due to long access time and inaccurate cueing. Cassettes are great for reproducing long segments, or recording a show, but generally they are not used along with CDs and LPs for a show. There are still a number of alternative college-oriented musicians who supply their latest releases on cassettes (frequently a local or unsigned band will do so), so again it is a question of isolating an area of music. A high quality cassette deck is expensive, but worth it in the long run for durability and audio reproduction. Recommended for Starter Stations or above.

Cassette, DAT

With the cassette we again come to the question of digital format options. The current Digital Audio Tape (DAT) format offers outstanding frequency response, storage and access times. Its cost has remained high, however, preventing it from becoming a common format. DAT has the precise cueing features offered by CDs and allows for the insertion of cue points on tapes. Only a limited number of prerecorded DATs are available, so it should be purchased with archives and conversion in mind rather than constant use. Recent price cuts have made some excellent portable DAT recorders available for \$1000 or less, so field recording is another option (concerts, interviews, sound effects, etc...). DAT offers excellent storage opportunities for production and master tape archives as it is less prone to the deterioration of other tape formats, and offers a very compact size. Recommended for Advanced Stations.

Cassette, DCC

The newest format is the Digital Compact Cassette, showed promise as a center between a DAT and standard cassette. Its greatest selling point is that it retrofits your studios by allowing you to play regular analog cassettes as well as the DCC. It appears that the format has failed in the US so it is probably best ignored.

Cartridge Tape

Cart Machines have long been a standard and indispensable part of the radio broadcast industry. They are frequently used for short segments such as station IDs, commercials or public service announcements, etc... They are cost-effective for short lived spots as they can be erased and reused fairly easily.

Both mono and stereo models are available. Stereo cart machines are really only recommended for larger stations or those where a full-time well-equipped technician is available. Not only are they more difficult to maintain in proper alignment, but there is seldom much value in having stereo for the typical short message delivered by cart tapes (especially with the additional cost involved).

Cart tapes are available in pre-loaded lengths from 20 seconds to 10.5 minutes, or they can be custom loaded by the station (a difficult and time consuming task). Cart machines do not have erase heads, so plan on purchasing a bulk tape eraser as well. Cart machines are precision devices, costing a lot of money and requiring a great deal of regular attention. Be wary of bargain priced used cart machines, there is usually a good reason for the cheap price. It may be affordable, but it may also only be useful as a boat anchor. If you have an engineering resource to maintain Cart machines, you are in luck as there are hundreds available now as stations add digital systems. You can probably get machines for the station for FREE from many commercial broadcasters in your area. Check around, don't be shy!

Digital Cartridge Machines

Digital audio is now available in cart formats as well. A number of manufacturers are producing digital stereo units which use computer floppy disks or removable cartridges as their storage media. The storage capacity, durability, access time, and space required by these units are all far superior to the standard cart machine. Perhaps the most important feature is that the price of these new units corresponds well to that of good stereo record/play cart machines. The 360 Systems Digidart machine offers such extensive extras as an alpha-numeric display for entering track titles, Bernoulli cartridge storage for excellent reliability and large storage capacity, and internal hard disks for permanent storage of station IDs or commercial spots. These systems, like the Digidart, are exceptional for audio quality, but expensive. Recommended for Advanced Stations. Possibly for any station ready to purchase new stereo cart machines...

Mini-Disc

The Mini-Disc format is a consumer format that has been applied to the world of professional broadcasting at a hefty price. Mini-Disc offers the advantage of easy recording, multiple cuts to a disc, digital storage and CD player-type controls. There is a lot of debate over the MD format as a viable broadcast format due, in part, to the extreme use of compression in the audio storage. Since most listeners can't tell the difference, this is probably a moot point, but you need to know that it is an issue. Please contact LPB if you wish to delve deeper into the issues of mixing digital signals and compression problems. It is too complex to add to this discussion. The cost of entry in the professional MD machines is \$1500 and up. Consumer units are heavily discounted by Sony in an effort to spread the format. Recently Sony offered a combo pack of portable and desk units for \$400! So we would recommend sticking with the consumer models and using MD in place of Cart machines.

◆ **Microphones**

Choosing a microphone can be an intimidating task. Prices range from \$100-\$5,000.00 and a variety of confusing terms abound through this price range. Simply put, there are directional and omnidirectional microphones, and it would be in a station's best interest to have a supply of both. Directional, or cardioid, microphones are especially suited for areas where background noise may be a problem - audience noise on a stage, equipment noise in a studio, echoes in a control booth, etc... The windows in a studio can reflect the DJs voice, which would be picked up by an omnidirectional microphone. Each microphone has its own pickup pattern, and should be selected to match a specific application.

A wide variety of sizes and styles are available from many manufacturers. We recommend the Electro-Voice 635A microphones as basic and inexpensive studio units. These have proven extremely rugged and reliable, and include a generous manufacturers warranty. If the station has the funding, the RE-20 or RE-27 offer significant sonic improvements (including user-selectable patterns), and are in use at many commercial stations, but they are nearly triple the cost of the 635A. Other mainstays include the Sennheiser MD421 (\$400) and the Shure SM7 (\$550). We would be pleased to make a recommendation for any specialized applications a station may have, such as live music or remote interviews. A high quality microphone can mean the difference between night and day in a broadcast. A top model Neumann, for example, will pick up brightness, subtlety and range in a voice that no amount of processing could hope to produce. But it will also set the station back a couple of thousand dollars...

Microphone mounting in a studio will have to conform to the contents and desired functions of that studio. There are a variety of stands and booms available to match up with any need. We recommend the Luxo KM-1 boom as it has proven durable and inexpensive (\$75), and can be supplied with several mounting options. A shock mount is also recommended for any sensitive microphone as it will prevent bumps against the boom from getting into the microphone pickup. Required in All Stations.

◆ **Audio Processors**

Whenever one processes an audio signal they make changes to the original program. Although this may be artistically incorrect, it is technically advantageous to compress the audio dynamic range, and limit the maximum volume level of the audio fed to the transmitter. State-of-the-art audio processors offer very successful and sophisticated processing techniques, at a price.

Some stations equalize their audio in addition to compression. They may add bass boost for additional “richness” of sound, treble boost for “brightness” or mid-range boost for “loudness”. Please keep in mind that you can only equalize a poor audio signal so much. Money spent on microphones and consoles is better spent than that on equalizers and attempts to improve an initially poor audio feed. Make sure everything else sounds right before you try to process it!

Compression of the audio dynamic range allows an increase in the modulation level of the transmitter and makes the station sound “louder” than others. Limiting the audio peaks allows the modulation level to be held higher, because the fear of sideband splatter and overmodulation on the transmitter with occasional volume peaks is eliminated. Compression and limiting offer an increase in average modulation, which can be abused in a broadcaster’s zeal for the “loudest” signal in a market. Done to excess the results can be quite unpleasant. Prices start around \$300 for microphone processors and run over \$10,000 for full station processing systems. Please speak with LPB or a trusted broadcast engineer for advice on these components. Recommended for All Stations.

◆ **Monitor Speakers**

Most audio consoles offer an external monitor or off-air position to allow the DJ to both visually and audibly monitor the audio output of the station. The console operator should be the most critical of the on-air sound. Because of this it is highly recommended that a quality pair of monitor speakers be used in the studio. The critical aspect is not size and power, but clarity and accuracy. A basic pair of monitors such as JBL Control 1 monitors is about \$300.00. We recommend a set of near field monitors, designed for studio operations such as the LPB Spatial One at \$695 per pair. Monitors designed for studios offer much more accurate reproduction of your sound and can still satisfy the booming needs of your most crazed DJ.

We also recommend a separate amplifier for studio monitors. Of course, this amplifier should be located out of the reach of DJs as they have a tendency to crank up the volume when they play their favorite songs. The author used to cause great consternation in the Career Counseling Department, which was directly above the broadcast studios, in this manner. It’s fun, but bad PR for the station. Rarely would a station need an amplifier rated over 55 watts as even poor quality speakers can shake a room with less power. Avoid amplifiers over 75 watts as you will never see their full power and many amplifiers offer poor reproduction until you hit their peak operating power. Recommended for All Stations.

◆ **Rack and Patch Bays**

An equipment rack is critical in the broadcast studio. It will house audio sources for on-air (CD, DAT, Carts, etc...) and audio processing equipment in an organized and efficient manner. Typically, a good set of studio furniture will integrate racks for equipment. Often the main processing and transmitting racks are isolated from the studio as a method of avoiding DJ adjustment.

An audio patch bay should be housed in the rack. This will provide great flexibility in the interchanging of signal paths and avoid time-consuming rewiring. LPB Tech Note #3 contains details on recommended patch bay equipment and its use. Recommended for Advanced Stations.

◆ **And Finally...**

The first step in designing is to determine how much money you have. Using that as a basis try to figure out what percentage will go to the studio and what will go to the music. This will of course, not be the easiest thing to do. It is best not to put any of these numbers in concrete. After you have a rough idea of the budget for your studio try to assemble a list of the types of equipment you want, in order of priority. It would be great if you could afford 2 DAT machines, a 16 track production reel-to-reel, etc... , but realistically, you probably can’t - at least not on day one. Even if you can, you might want to look at your staff critically and see if they can operate the equipment in an effective, careful and capable manner. If not, spend the money on more music instead.

Here is some simple advice for designing your new studios : ASK FOR HELP! Don’t be afraid to ask everyone you can find for an opinion. Even if you ignore all of their ideas, you may find a few people who have more experience or can guide you through the process. Call LPB, we’ll help (and we won’t try to sell you gold plated equipment!), we’ve certainly got the experience. Call your local commercial stations, call other colleges, try to go see a few studios. The more information you get the more practical your final design will be. Your are determining the future of your radio station with this design - Don’t do it alone!