The Recording Studio

— George Alexandrovich*

This state-of-the-art picture of the recording studio is the preamble to a series under preparation. In this installment the author ranges wide to cover much of what is likely to be encountered in the studio. Future installments will tend to concentrate on specific areas of interest.

The past decade has seen advances in the field of electronics no one has expected. New discoveries in the field of semi-conductors have led to new technologies and changed most of the design concepts overnight. Gradually new technologies are making their way into the audio field, awakening audio engineers and specialists to the advantages of the new concepts over the older kind, a kind inferior in performance reliability and convenience.

The advent of semiconductors into audio closely coincided with the development of the stereo disc. This led to further developments of multi-track tape recording. Such tape machines in turn led to the redesign and rework of the mixing consoles and control rooms. As a result, the problems of the recording engineer and maintenance man suddenly increased two fold. Several channels of audio now had to be recorded simultaneously and monitored at the same time, each channel individually as well as the total mono mix, to be sure of proper phase relationships. Instead of caring for one channel only, maintenance had to be pulled on several, keeping proper balance, frequency response, phase and separation.

Disc cutting rooms had to be fitted with new equipment capable of stereo. Recording and cutting personnel had to be trained to use stereo equipment as well as to maintain it. Enormous new problems arose when semiconductor circuits were applied to the design of audio equipment, because of the inability of a majority of maintenance men to grasp immediately the basic operating principles of these new circuits. For quite some time a negative attitude existed among audio engineers and management toward the transistorized equipment. True, the first transistorized circuits were not designed with the same degree of sophistication as they are now, at times leaving more to be desired from their performance. At this time, the advantages of transistors over tubes have still not been recognized by many professionals. Many not yet set to accept semiconductors are those that were probing for faults in the equipment available at an earlier time and, as a result, continue criticizing it. Some of these criticisms are utterly ridiculous; for example, the claim that transistorized equipment does not produce "air around the sound."

I can prove that this is not so and that transistorized equipment can outperform tubes in distortion, frequency response, noise, in stable operation and reliability. As far as the air around the sound is concerned I need only say that transistorized circuits with their extended performance range reproduce information more faithfully than tubes without creating any side effects. True, they reveal more faults in the recording than do tubes, leaving the impression that tube circuits are cleaner sounding because of poorer transient response and restricted frequency range.

These innovations and changes in operating as well as in maintenance procedures have met strong opposition for another reason. Up to this time, recording was more often an art, with skill in it acquired more through experimentation and cut and try methods than through a proper scientific approach and knowledge of what conditions have to be met in order to achieve good recording. Today, new technologies require more science prerequisites for the audio man; he must have more theoretical knowledge and skill.

Advances and improvements have been made in every branch of audio recording. The most significant are in the design of the *equipment*. This inevitably has affected *operating procedures* and *techniques*. With new equipment and new technology *maintenance* gets the lion's share of the changes in procedures and requirements. It is my intention to use these three topics for future discussions, developing each one into an individual review of the tasks and problems facing the audio recording engineer today.

And those problems are numerous. As systems become more complex, operating procedures have to be more precisely controlled, maintenance of unfamiliar equipment and circuits becomes more painful. It is my goal to guide you men in the studio, behind the mixing consoles, and in front of the editing machines or disc-cutting lathes, to the correct approach used in solving the myriads of individual problems. I would like to shed light on the facts about the new equipment and operating methods showing how much their flexibility offers chances for a successful session. I want to cover the methods of preparation of the studio and control room for a session; how to conduct the session; proper storage of recorded information; mixing and editing; preparation of the master tape and master disc. Some topics will be discussed in greater detail than others; I hope to be able to share with the reader a few "trade secrets." These

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secrets are nothing more than short cuts to the solution of problems or ways in saving money that may turn out to be important to smaller studios with limited budgets. I will direct my efforts to be as down to earth in these discussions as possible so that every recording man can understand all that is being talked about. And there is a lot to talk about.

Today you can hardly find a studio not already in possession of a multi-track recording system (or at least contemplating acquiring one). A few studios are still operating on two tracks, more are set for four tracks and some for eight tracks. Since eight-track machines are possible because of miniaturization with transistorized equipment quite a number of professionals are now thinking of eight and even fifteen or sixteen tracks on one- or even half-inch tape.

The advantages of an entry into multi-track narrow tape recording should be obvious to every engineer as well as his management. The ability to record virtually every microphone on a separate track offers an easy remixing job with better chances for correction if during the take balance between the microphones was other than acceptable. Equalization, reverberation, and other effects can be added at will to an individual instrument or groups.

With the help of selective recording, better known as *selsync*, recording on the multi-track machines can be economical. One or more tracks can be recorded independently of each other. When the remaining tracks are to be recorded, the previously recorded ones are played back through the record head and fed into a separate circuit. This output is fed into the headphones placed on the heads of performers so that perfect synchronism is achieved between all tracks. In this way a few performers proficient on several different instruments can be used, eliminating the need for large group, yet achieving the same results. If the take is unsuccessful one track or any number of selected tracks can be erased and re-recorded again without affecting other tracks.

Almost all of the newer consoles incorporate separate equalization on each microphone channel, with separate echo or reverb feed, sometimes compression, as well as many other features. But it is important to know how and when to use these features. For instance, compression during the original take should be used *only* as an overload protection rather than for altering the dynamics. It means that the threshold of compression should be set above normal operating levels in the console. Equalization should also be used with discretion. In the original recording it should be used only to improve crosstalk by restricting the frequency range or as a means to better noise figures.

With multi-track recording there is a strong trend to record and store audio information with the least amount of deviation from the original sound. This way original performance is always at hand and special effects can easily be added during the remixing session.

The storage medium for original recording or tape has also seen numerous improvements. Electrical as well as physical properties have been affected. Tapes are manufactured today from better materials (Mylar) and coated with oxides capable of carrying higher magnetization forces and producing lower electrical noise when fully demagnetized. They also offer less friction with the recording heads. All of this produces a wider dynamic recording range.

Work is being done on high frequency bias to lower the hiss level normally generated by the bias currents. Networks, producing predistortion into the recording, compensate and cancel 3rd harmonic distortion caused by the tape itself when it is being recorded with levels approaching saturation of the oxide. Naturally this predistortion would vary with the type of tape used and should be adjusted for each individual brand. This technique can improve the dynamic range of the recorder up to 6 dB with attendant low distortion.

To ease the tasks of phase control, equipment has been developed to insure proper mike placement in the studio. Phase detection monitors are used in some installations to avoid phase cancellations at low frequencies.

All these improvements allow the recording engineer to work with wider margins of safety for better recordings.

A great deal has been accomplished in the past decade in the field of tape recording. Nevertheless, disc recording and disc pressing are still with us and are sure to remain for a long time to come. With the advent of the stereo disc, a multitude of new problems arose. Precision control of groove geometry and position as well as stylus alignment for best channel separation and minimum distortion calls for an increased ingenuity by the cutting engineer or technician. Earlier I talked about the conversion of an art into a science in general, but this part of sound recording belongs in a separate category, since there is still much "know-how" and ingenuity as well as experience required of a cutting man. Every step in setting up for cutting stereo is a critical one. In order to achieve optimum results in both the sound and the appearance of a record one must be thoroughly familiar with all facets of this skill. This part of recording contains the most trade secrets and shall be treated as such in a future separate section on disc recording. Many recording engineers can benefit from the information that has been assembled from many cutting rooms and as many ingenious operators and technicians.

I have reviewed hastily the basic problems of sound recording and some of many improvements that have been made in this field in the past few years. But no equipment is immune to mishandling or misuse. One of the biggest handicaps of studio setups today is the lack of maintenance and quality control. This might be through incompetent personnel or simply because of an absence of trained technicians.

It is quite common to find multimillion dollar installations without a good 'scope or signal generator; never mind looking for a distortion analyzer. Commonly, there is an absence of any maintenance records or studio block diagrams.

On numerous occasions it has been found that because of the lack of maintenance or negligence the best equipment was operating as poorly as the worst kind. Hum, noise, susceptibility to clicks, crosstalk, and intermodulation distortion have been found as results of wrong terminations and a lack of proper grounding. Correct phasing, proper wire identification, good soldering, and wire dressing as well as equipment location, are major items which shouldn't be forgotten. Maintenance may well make or break the studio, so I will continually place special emphasis on proper maintenance.

Let this short review be an introduction into the coming series of talks about the wide field of practical professional audio engineering.