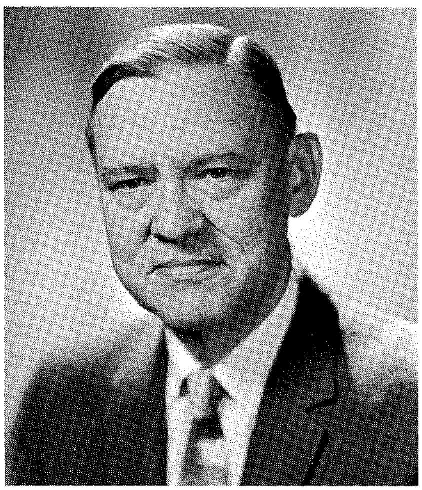
New York recording studios

J. E. Volkmann | A. Stevens

The acoustical environment of the recording studio and its associated monitoring control room has been a most important link in the sound recording and reproduction chain from microphone-to-ear. It has gone through several cycles of live-to-dead and back again over recent decades. The present trend in rock and pops music continues toward a "dead-dead", echoless, or free-field environment; and if the pendulum follows its regular course, it will swing to a "live-live" requirement which is occasionally heard in pops sound effects today. The newly designed studios being used by RCA Records in New York can accomodate several changes in the thrust of recorded music, since the reverberation can be changed as much as 2.5:1.

Fig. 1—The 44th Street entrance to the RCA Studio complex. This photograph was taken at night when many of the recording sessions occur.



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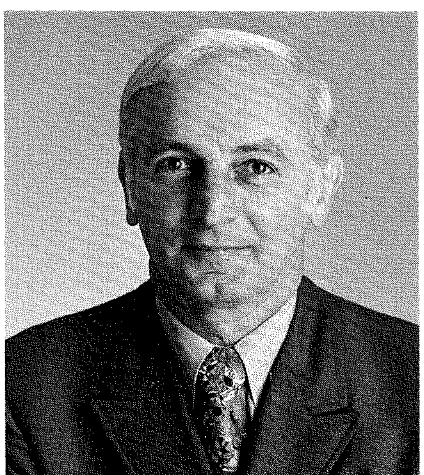
received the BS in 1927 and the MS in 1928, and the Professional Degree in Engineering Physics in 1940 from the University of Illinois. Since then he has worked continuously with RCA in the field of acoustics, specializing in the development and application of large-scale auditorium loudspeakers and stereophonic sound systems, as well as consultant on architectural, electronic, and acoustic problems. He has contributed to the solution of innumerable projects including: stereo sound systems for Radio City Music Hall, Hollywood Bowl, recording acoustics for Walt Disney's Fantasia, custom loudspeakers for New York World's Fairs of 1939 and 1964-65, and Jones Beach Marine Stadium. After joining the Technical Staff of RCA Laboratories in 1960, he served as consultant on the acoustic design of all of RCA's new recording studios including RCA Italiana's 364,000 cu. ft. Studio A. He likewise was consultant on the RCA "pops" studios in Hollywood, Nashville, Chicago, Montreal, and the new RCA Variable Acoustic Studios described in this paper. Now officially retired, he has continued in the field of acoustic consulting for RCA as well as for Disney World in Florida and the John F. Kennedy Center, Washington, D.C. In 1962 he received the RCA Achievement Award for "Advances in the Development of Architectural Acoustics"; and, in 1967, the John H. Potts Memorial Award from the Audio Engineering Society for "elegant application of acoustic principles in the development of large-scale loudspeakers and sound systems." Mr. Volkmann is a Charter Member and Fellow of the Acoustical Society of America, and a Fellow of both the Society of Motion Picture and Television Engineers and the Audio Engineering Society. He is a registered Professional Engineer in New York State.



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received the Bachelors and Masters degrees from Temple University and attended Drexel Institute of Technology. Mr. Stevens initially joined government service in Civil Engineering, and later transferred as an aeronautical engineer into research where he was chief engineer for design and construction of turbine test station and served as technical adviser to architects and engineers on design requirements for the Turbine Laboratory. In 1955, he joined a consulting engineering firm and was assigned as project manager covering building expansion program for RCA. Mr. Stevens joined RCA Records in 1957 as general plant engineer responsible for Facilities and Plant Engineering. He was assigned to prepare an engineering study of recording facilities to update design of recording studios and related auxiliaries. He was jointly responsible for the design of the world's largest recording studio for RCA, Italy, and was also responsible for the design and construction of new recording facilities in Chicago, L. A., and Nashville and, most recently, in New York, as well as new studio facilities for Argentina, Canada, Mexico and Spain. In his present position, Mr. Stevens is responsible for plant engineering facilities, record engineering, and international manufacturing and engineering services.

In 1969, RCA Records in New York City relocated to a new studio complex at 1133 Avenue of the Americas (Fig. 1); the complex consists of four large studios and two small studios with their respective control rooms, nine tape-mastering rooms, seven lacquer-cutting rooms, associated editing rooms, tape transfer rooms, engineering shops, and other necessary operating facilities. Two overdub studios with their control rooms were added to meet the high demand of rerecording, thus relieving the major recording studios for commercial and custom recordings.

The reasons for relocating were:

1) To improve the acoustic environmental conditions since the old studios at E. 24th Street were obsolete, too small, and non-competitive;
2) To consolidate the RCA Records home office into one location instead of four separate buildings;
3) To be closer to music publishers, thus increasing RCA's opportunities for hit products.

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Intricate specifications covering the basic acoustic requirements of the new studios were developed from extensive acoustic studies and from experience gained over several years in the new RCA studios at Hollywood, Nashville, Chicago, Montreal, and Rome. These specifications detailed the size, shape, materials, optimum reverberation times, reflection and sound absorption coefficients, transmission loss, vibration isolation, and other acoustical criteria; they were reviewed at several stages during the studies with various members of the engineering, operating, and producing staffs.

Variable acoustics—often the designers dream—had in the past been considered an unnecessary luxury, but to capture the wide range of sounds currently in vogue—ranging from Hard Rock and Rhythm and Blues to Country and Western and Classical—variable acoustics became a real economic necessity and a key requirement of the new studios.

Probably the most striking features of the studio complex are the fantastically changeable dimensions of the two large studios—A and B. Movable panels on walls and ceiling provide variable reverberation times adjustable over a range of approximately 2.5 times, from 0.8 to 1.8 seconds for Stu-

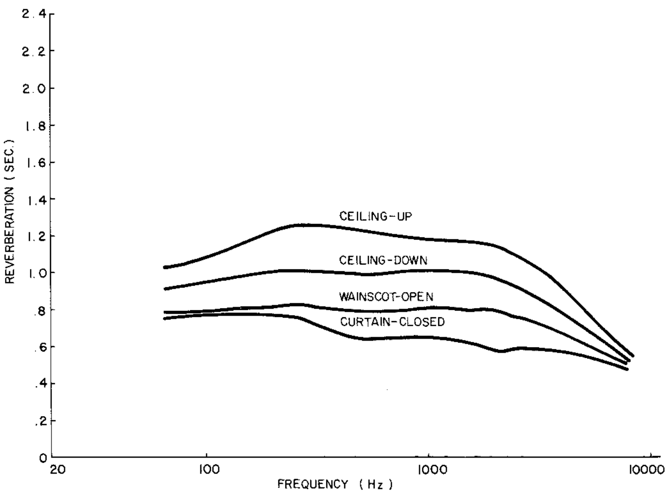

Fig. 2—Preliminary reverberation characteristics for the maximum and minimum reverberation times in Studio A (taken before final adjustment of the ceiling absorption).

Fig. 3—The platform end of Studio A, showing the convex wood panels of the stage ceiling and walls in a "flared" position to form an orchestra or choir shell. Note that the ceiling in the studio proper is raised to full height, approximately 10 ft. above the side-wall horizontal convex wood panelling. Under the wood panelling is the control room window which is convex to match the wall treatment contour.

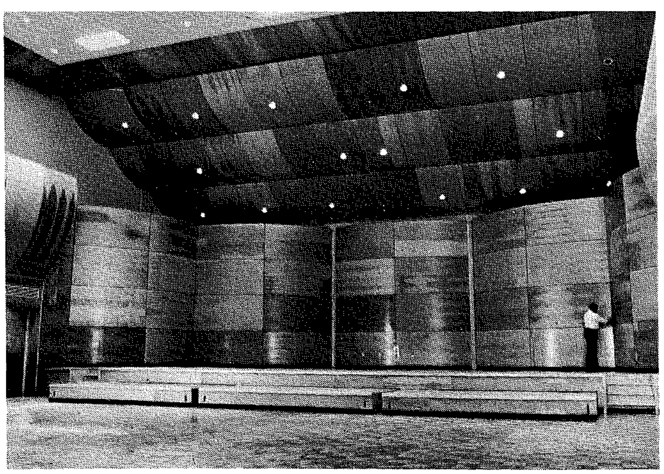

Fig. 4—Closeup view of the platform shell with wood panels in "flared out" position.

Fig. 5—Convex panels in "flat" position.

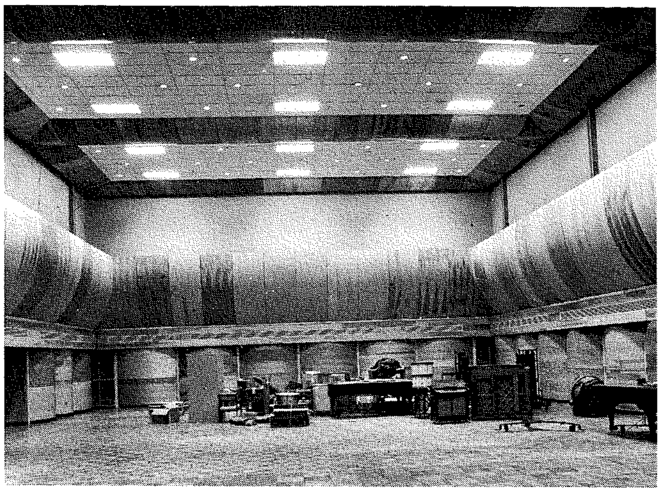

Fig. 6—Looking toward the wall opposite the platform in Studio A showing the ceiling sections raised to full height. Each of the three main ceiling sections has six fixtures distributed over the middle or absorptive area (0.8 coefficient) and a perimeter consisting of reflective convex wood panelling 4 ft. wide (0.2 coefficient). This illustration also gives a better view of the 8-ft-high horizontal convex plywood panelling covering the middle section of the walls. This horizontal panelling is hinged at the lower edge and may be lowered in individual 8-ft-wide sections by means of manually operated winches.

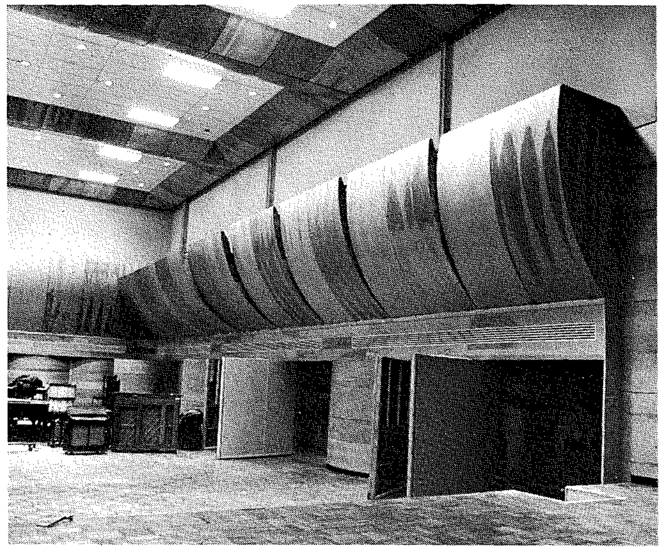

Fig. 7—The three types of adjustable acoustical elements in the main portion of Studio A: the lower hinged vertical wainscot panels for separating the direct sound sources and for controlling the local environment around them; the middle hinged horizontal wall panels for controlling the first or early reflections; and the movable ceiling sections for controlling the later diffuse reverberations.

dio A and 0.56 to 1.4 seconds for Studio B. The provisions for variable acoustics in both studios extends not only to the adjustability of reverberation time but to the control of the first or early reflections by adjusting the wainscot and lower wall panels that form the local acoustic environment around the musicians and microphone pickup areas. However, in the future, variable acoustics offering a 5:1 or even a 10:1 change in reverberation time may be required. Probably, such reverberation enhancement can be achieved only through the use of active electronic or synthetic room acoustics.

The three large studios—A, B, and C—are housed in a separate thirteen-story structure, mechanically isolated from the main office building, but linked communication-wise at the 4th, 7th, and 10th floors. Extreme care was taken in the construction of studios and its related facilities to ensure that no sound is transmitted from one studio to another and that sound generated by the air-conditioning system and electrical distribution does not interfere with the recordings. A noise

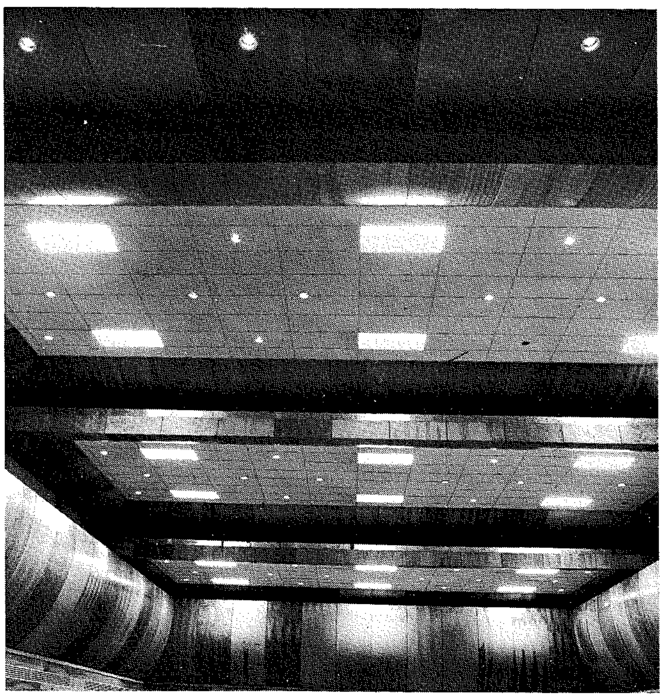

Fig. 10—Sections of the Studio A ceiling at three intermediate heights.

Fig. 11—One of the many combinations of adjustment possible with the three types of adjustable acoustical elements in the main portion of Studio A. These include the ceiling stepped, the middle wall panels staggered, and the wainscot panels opened at random.

Fig. 8—Studio A ceiling at maximum height.

Fig. 9—Studio A ceiling at minimum height.

criterion of not greater than NC 20 was specified for the interior of all studios, control rooms, tape-mastering rooms, and reverberation chambers. [An NC 20 rating corresponds approximately to the equal loudness contour of the ear at 20 dB above the threshold of hearing, or approximately 30 dBa on a standard ASA sound level meter.]

Studio A

The variable acoustic design features of the new Studio A—the largest in the complex—are shown in Figs. 2 through 11. The design was chosen to fit the all-purpose requirements of this studio; it can handle the livelier reverberation requirements of classical sounds as well as the "dead" echoless requirements of pop sounds.

The structural shell of Studio A is 100 ft × 60 ft × 34 ft while the interior dimensions are 95 ft × 56 ft × 29 ft. The ceiling consists of four huge movable sections or panels, each 24 ft × 56 ft, that individually can be lowered or raised approximately 10 ft, thereby varying the reverberation time by changing the volume of the studio as well as by changing the sound absorption. In other words, the great flexibility offered by the *adjustable absorption,* the *adjustable shape,* and the *adjustable volume* provisions permit practically complete control of the *initial direct,* the *early reflected,* and the *later reverberant components* that make up the complex sound energy waves picked up by the microphones.

Below the horizontal panelling in the wainscot area are the 8 ft × 8 ft convex wood panels that are each hinged as a door. The backside of these wainscot panels are treated with absorptive (0.8 coefficient) glass cloth-faced fiberglass panels of 2 lb/cu ft density and are convexly contoured, to blend with the front side appearance. When the wainscot panels are open, the absorptive side is exposed; when they are

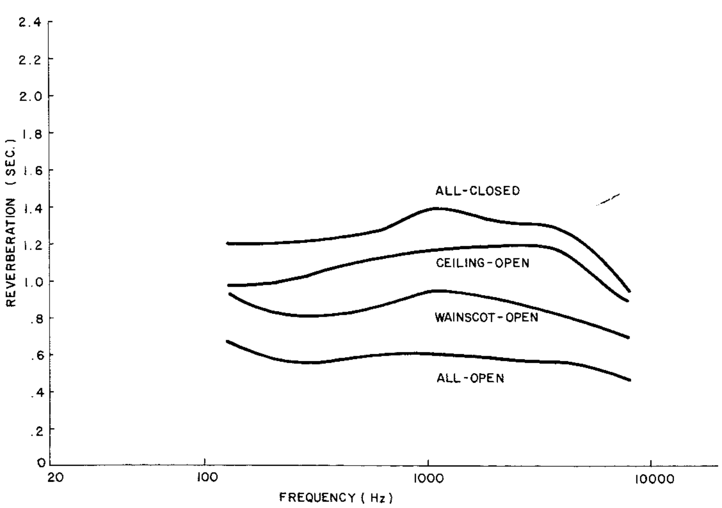

Fig. 12—Reverberation characteristics for the maximum and minimum reverberation times in Studio B.

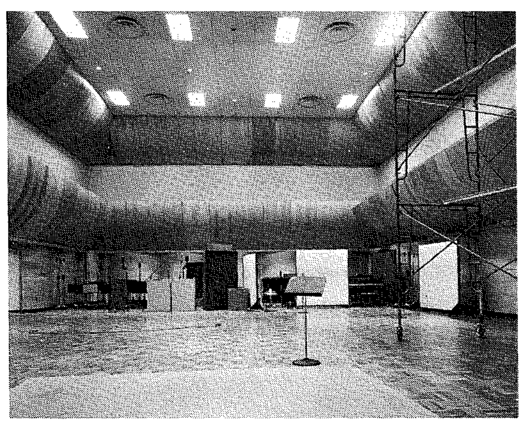

Fig. 13—View of Studio B showing the three types of adjustable acoustical elements used: the lower hinged verticle wainscot panels, similar to panels used in Studio A for the purpose of separating the direct sound sources; the middle hinged, horizontal wall panels, also similar to panels used in Studio A for controlling the first or early reflections; and the uppermost hinged wall panels at the ceiling junctures for controlling the later diffuse reverberations. Also shown is the suspended ceiling of glass-cloth-faced fiberglass panels (absorption coefficient is 0.8).

Fig. 14—General view of the studio with the uppermost hinged ceiling corner panels lowered, completely exposing the absorptive backside of the panels.

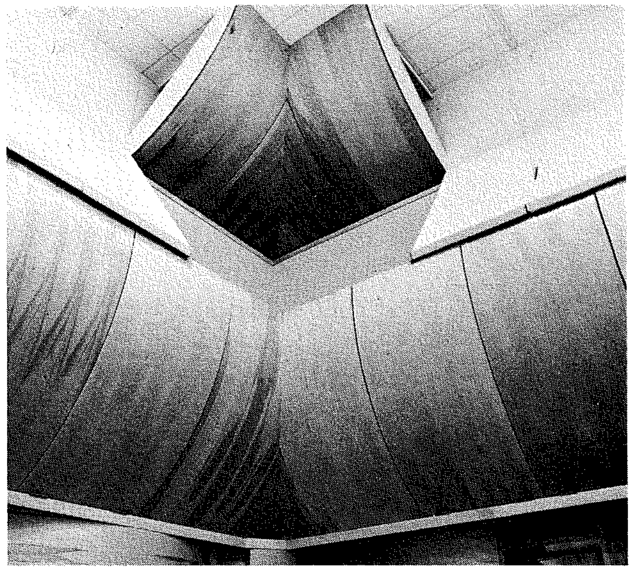

Fig. 15—Closeup view of one of the ceiling corners.

closed the reflective side is exposed. In addition to controlling reverberation, these planes function acoustically as "gobos" to control the local acoustic environment.

Another feature of interest is that provisions also have been incorporated in the basic studio acoustic design for the addition of active reverberation enhancement.

Thus studio A with the other studios in the complex provides the size and flexibility to meet any type of recording from the classical (Opera) to Hardrock (Psychedelic). The changes in the acoustic treatment can be made within minutes.

Studio B

The variable acoustic design features of Studio B are shown in Figs. 12 through 19. This studio is the second largest in the complex and, like Studio A, is of the general-purpose type. Since it is smaller and has a shorter reverberation time than Studio A, it will be used more frequently for semi-classical and pop recordings. The structural shell of Studio B is 75 ft × 50 ft × 34 ft and has interior dimensions of 72 ft × 47 ft × 27 ft.

Studio C

Studio C has a structural shell of 75 ft × 50 ft × 30 ft, and an interior of 72 ft × 47 ft × 24 ft. It is similar in size to the large RCA studios that have been so successful in Hollywood, Nashville, Chicago, and Montreal. Although the arrangement of convex plywood panels differs from the earlier studio design, the proportion of reflective panels versus absorptive panels and the reverberation time of 0.5 seconds remain the same. Figures 20, 21, and 22 show the design features of Studio C. Note that the entire ceiling is absorptive (0.8 coefficient) and that two thirds of the wall area is absorptive and one third reflective (convex plywood). Note also that the convex panels are disposed alternately in the vertical and in the horizontal to give

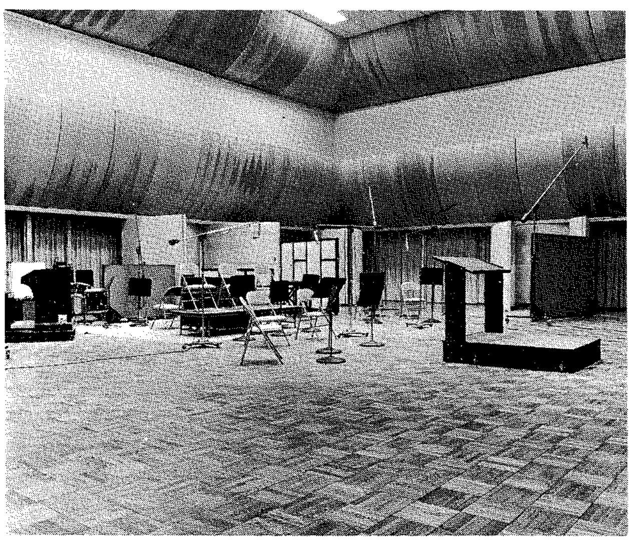

Fig. 18—A setup for recording in Studio B.

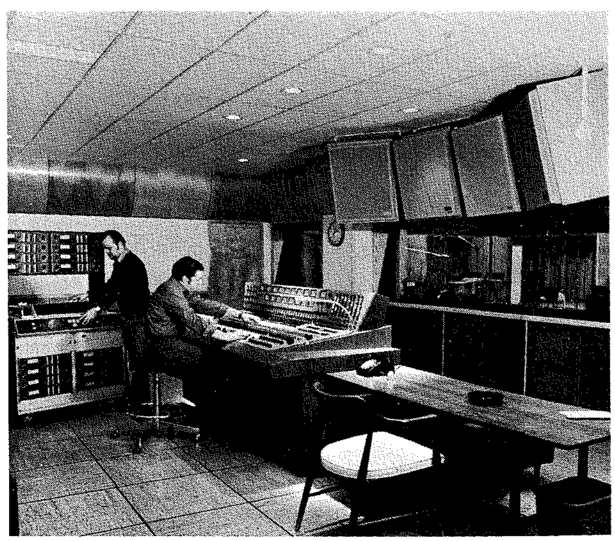

Fig. 19—Recording console in the studio B control room.

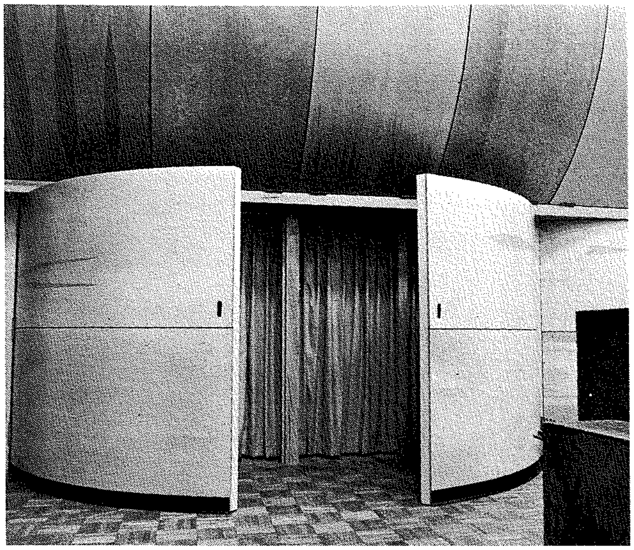

Fig. 16—Closeup of two wainscot panels partially opened along one wall.

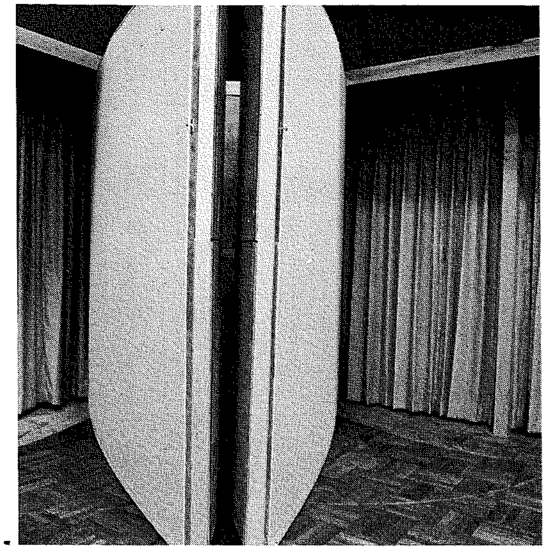

Fig. 17—Closeup of two wainscot panels opened in one corner.

a more diffuse and optimum reflection environment.

Studio D

Studio D has a structural shell of 40 ft × 27 ft × 22 ft and an interior of 39 ft × 24 ft × 15 ft (see Fig. 23). Note that the general configuration and location of intermediate convex plywood wall panelling and ceiling corner panelling is similar to that in Studio B. This studio is intended not only for rock and pop recording sessions but for experimental studies and unexplored areas in reverberation enhancement, multi-channel stereo, and free field recordings. The reverberation time for Studio D is approximately 0.35 seconds.

Studio E

Studio E is a small overdub-type of contemporary studio used for voice and overdub recording; see Fig. 24.

Control and tape mastering rooms

It is most important that the control rooms and tape-mastering rooms have the same acoustic treatment and sound environment. This assures that the producer will have the same listening conditions and quality in the tape-mastering room as those produced during the original recording in the Control Room.

Fig. 25 shows the interior outline of a typical wall section for all of the control rooms and tape mastering rooms. Every effort has been made to make the acoustics of these rooms similar with respect to uniform acoustic response, reverberation characteristics, flat absorption characteristics, and resonance-free characteristics. The reverberation has been set at 0.25 second. For uniform control of the distribution characteristics of the direct sound energy radiation, the loudspeakers in the control room and tape-mastering rooms are set on an arc of 8 ft radius with center located at the engineers listening position.

Conclusions

Provisions in the new studios for the

Fig. 20—General view looking toward a corner adjacent to the control room in Studio C.

Fig. 21—Closeup view of a recording setup in Studio C with convex panels in background.

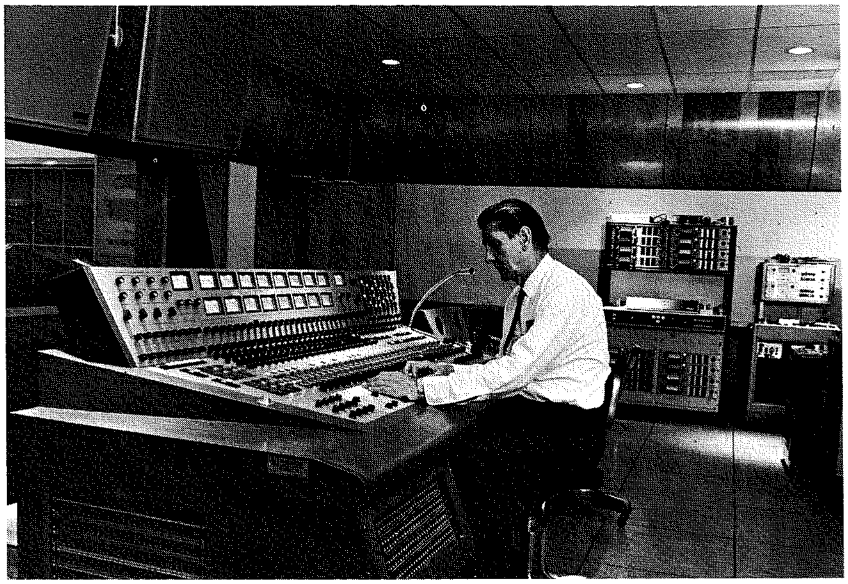

Fig. 22—Studio C Control Room with engineer at recording console.

Fig. 23—Studio D looking toward the control room.

separation and control of the *three basic room acoustic energy components: initial direct, early delay, and later decay components,* we feel, is a definite step toward the goal of good acoustics in sound recording—true *3d* reproduction on multi-channel stereo-acoustic systems. Hopefully, the new RCA studio complex with its variable acoustical environment and its "tri-wave-energy" concept in studio acoustic design will serve not only to extend the scope of the pop and rock artist but also offer the classical musician fresh opportunities for achieving greater spatial or room acoustic realism and auditory or directional perspective in the new multi-channel recording of traditional and modern compositions.

Acknowledgment

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Fig. 24—Studio E—a typical overdub studio.

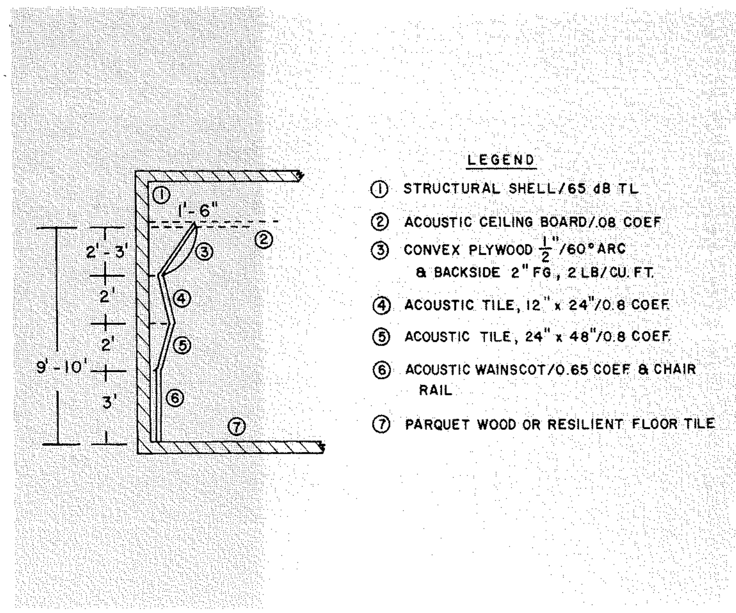

Fig. 25—Interior outline of the wall sections for control rooms and tape mastering rooms.