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Acoustics of the Recording Arts

MOTION PICTURE SCORING STAGES AN OVERVIEW

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Introduction

The Motion Picture Scoring Stage holds a unique place in the universe of recording and performance venues. Originally a necessity, the Scoring Stage has become the center of recording versatility and technical innovation over the past three decades.

This piece intends to describe a short history of the stages and the included technology. The current state of the scoring/recording art and utilized technology will be examined with some examples from current projects. The approach is not scientific; it is a personal description and history from a music mixer/engineer who has resided in this business for over thirty-five years.

"Scoring Stage monitor environment must be both accurate and dramatically viable, several choices of monitoring elements are provided."

The composer

The art of film scoring originates with the form itself. Live music accompaniment to moving images began with the introduction of film storytelling. With the marriage of sound and picture in synchronization, the film composer now had the ability to permanently enhance the drama, describe the action and enrich the emotion of the story.

The composer reads the script, screens the edited picture and commits to a discussion of style and form with the director. Often a process of thematic demonstration follows and further refinement of musical approach is accomplished. The composer then "spots" the picture for music with the director, film editor and sometimes the producer. Specific cue timings and functions are discussed. The music editor then creates "spotting/timing notes" and a cue-by-cue "breakdown" of the music in the film. This breakdown includes start and stop times for cues, all dialog timings, and important action timing within the cues. The timings were originally noted in feet and film frames and are now indicated by the Society of Motion Picture and Television Engineers (SMPTE) time code numbers in minutes-seconds and frames. Currently, timings within frames are common due to the resolution of film composition software.

The composer then begins writing the music for each indicated cue. He includes timings of important action and dialog, which align with the editors' timing notes. The tempo, bar structure and musical notation is included in a "sketch" which is developed over a period of composition and refinement. The sketch may be made by hand or via computerized music notation software and usually includes at least eight musical staves and often numerous "midi" lines recorded in the notation software. The composer constantly checks and re-checks his composition for picture sync and includes changes and enhancements required by the director.

After the cues are approved, his sketch is turned over to an orchestrator, who fills out the parts needed for full performance on the recording stage. Often, the orchestrator will create "cued" parts to enhance the composition if needed in the recording process. The orchestrator will assign parts to instruments bearing in mind the range of each instrument and it's ability to play the desired part. The orchestrator is by far the key person after the composer in the recording process. The qualities of the orchestration determine the speed and ease of the performance and recording process on the scoring stage.

The orchestrator then submits his full score to the music copyist/library to make transposed parts for each individual musician to be used on the scoring session. Given a standard scoring orchestra of between 65-90 players, this can result in the manufacture of more than 50 parts per cue, for the specified number of bars in each cue. The music library also manufactures full scores for the composer, the booth score reader (often the orchestrator), the music editor, the engineer and the assistant engineer. The library also produces a breakdown of which musicians perform on each cue, the cue timing/number of bars, as well as a breakdown specification of percussion, keyboards and solo instruments. It also indicates doubles in the winds and brass departments and any score-indicated overdubs.

The next step in the process is scheduling the music scoring sessions into a scoring stage by the production company. Professional musicians are then engaged for the sessions by a contractor, who includes the input of the composer and the orchestrator in regards to specific players and soloists. The scoring mixer is engaged, and he schedules the equipment needed, the stage setup and the required crew. A comprehensive recording schedule is developed based on the complexity of the score and the number of minutes to be recorded for the score. A typical film scoring session would schedule six to seven minutes of completed music per three-hour session. Most film scores include between forty and one hundred minutes of finished music. However, the inclusion of alternates and on-session fixes can increase the minute count by twenty percent.

On the scoring stage, specific picture sync is maintained either by mechanical means (sprockets), or by electronic methods involving SMPTE time code and video picture synchronization. Picture cues, based on the composer's notes

and scores, are determined by the music editor and are marked on the film picture or programmed into an editorial computer that runs in sync with the picture via SMPTE time code. Picture cues include streamers (vertical lines crossing the picture from left to right in timed intervals of 3 to 5 feet to prepare for a picture "hit"), punches (to specifically indicate a "hit") or flutters (to indicate a passing bar line). Additionally, the music editor will often prepare a "click track" which will coincide with the composer's indicated tempo for all or part of each cue. The click tracks were originally a punched optical track and evolved to edited magnetic click tracks, click loops, analog metronomes, digital metronomes and finally computerized click tracks. Click tracks can be steady state or variable in the above forms. The current computerized click can adjust in minute increments to place music exactly on hits, even when a steady tempo would slightly miss.

Click tracks are played back to musicians via headphones (single or double sided) during the performance of each cue. Often, timing of a cue will involve clicked measures and free timed or conducted measures. The picture marks that are described above are used to support the click bars and to manually time the conducted bars.

The composer supervises the recording process in terms of performance and sound quality. Often, multiple elements will be recorded to form a complete cue. Separation of elements is necessary for the final film mix process, described later in this presentation. The composer oversees the final music mix and production of the music track and sometimes supervises the music mix in the final dub as well.

The stages

Shortly following the introduction of sound for picture, the requirement to record an accompanying music score to picture came to the foreground. Quickly realizing this requirement, Film Studios converted the most appropriate and underused facility on their production lots to the purpose of music recording. Invariably this was an unused shooting stage. Examples are Stage 1 at MGM/Sony, Stage 1 at Disney and Stage 10 at Universal. These shooting stages were not equipped for sound recording or musical performance. They were a large enough space to house the studio orchestra and usually had an adjacent insert stage space, which could be used as a control room.

Slowly, over the next decade, these spaces were adapted for better noise isolation and acoustic character. Sometimes, they were replaced by purpose-built scoring facilities. While orchestral scores were initially the norm, the size of ensemble varied from a few players to a "large" studio orchestral of 40-60 players. Often, there were soloists and rhythm players involved as well which required special isolation, baffling or separate recording treatments. The current large orchestra of 85-105 players did not come in to play until the late 1970's, and clearly overworks the available volume of the earlier dedicated spaces.

Recording formats initially were single track optical and soon evolved to multiple single channel recorders operated in sync to facilitate separation of instruments, vocals and musical effects. Progressively, multi-track formats flourished following the introduction of magnetic recording. The recording formats have followed or lead the artistic ideals on magnetic film carrying up to six separate tracks, then to 2" 24 track analog, to 48-track digital and now to an unlimited track count.

Control room monitoring was based on theatrical playback systems and generally included only a single channel. Currently, multichannel monitoring systems, both permanent and portable, are utilized in scoring venues worldwide. Musician headphone monitoring for synchronization (click) performances, was provided by single-ear carbon headsets, and is still in use today.

Microphone technology advanced swiftly during the 1930-1950 period. Designs introduced during that period are still in use today. Similarly, tube and later solid-state technology quickly responded to artistic requirement and became state of the art.

Scoring Stage electronic and acoustic control sophistication has increased during the recent past, and the development of digital and network technologies have driven the technical implementation of these spaces dramatically.

Venues other than Scoring Stages have been adapted for use in Film Score Recording. Multi-track record recording facilities, concert halls, radio and television production facilities have all fallen into this category.

Acoustic scoring requirements

The initial requirement of "a place to record the score" has given way to some very organized acoustic environments. The scoring stages at MGM, Fox, and Warner's have all received treatment to normalize the acoustics for film score recording. The Disney Stage A and the Republic/CBS/Todd-AO Stage were both purpose built Scoring Stages constructed in the 1940s. Having said that, none of the three remaining stages present an ideal orchestral environment. The versatility of the recording stage takes precedence to the single-purpose orchestral treatment.

Typical usage of Scoring Stages could encompass a full symphony orchestra during the day to a small rhythm section in the evenings. Even within the same session, one can encounter diverse ensemble configurations. To accomplish this, stages were designed with less active acoustics, that ability for musicians to hear each other properly without adversely injecting an acoustical signature to the recording. Treatments to existing stages varied, some resulting in "happy accidents." The MGM Scoring Stage is probably the best example of this; with dimensions of 66'x93' and a volume of approximately 160,000 cu ft., it maintains a mid-band reverb characteristic of 1.0-1.3 seconds and can support large ensembles without apparent acoustic overload.

The Warner's and Fox Scoring Stages exhibit a lower reverb time but still provide adequate musician-to-musician feedback. The CBS/Todd-AO Stage, now closed, was redesigned acoustically in the early 1990's to provide a more symphonic environment. While somewhat variable, the basic reverberation signature of the 72'x108' 250,000 cubic foot scoring stage was approximately 1.8 seconds mid-band.

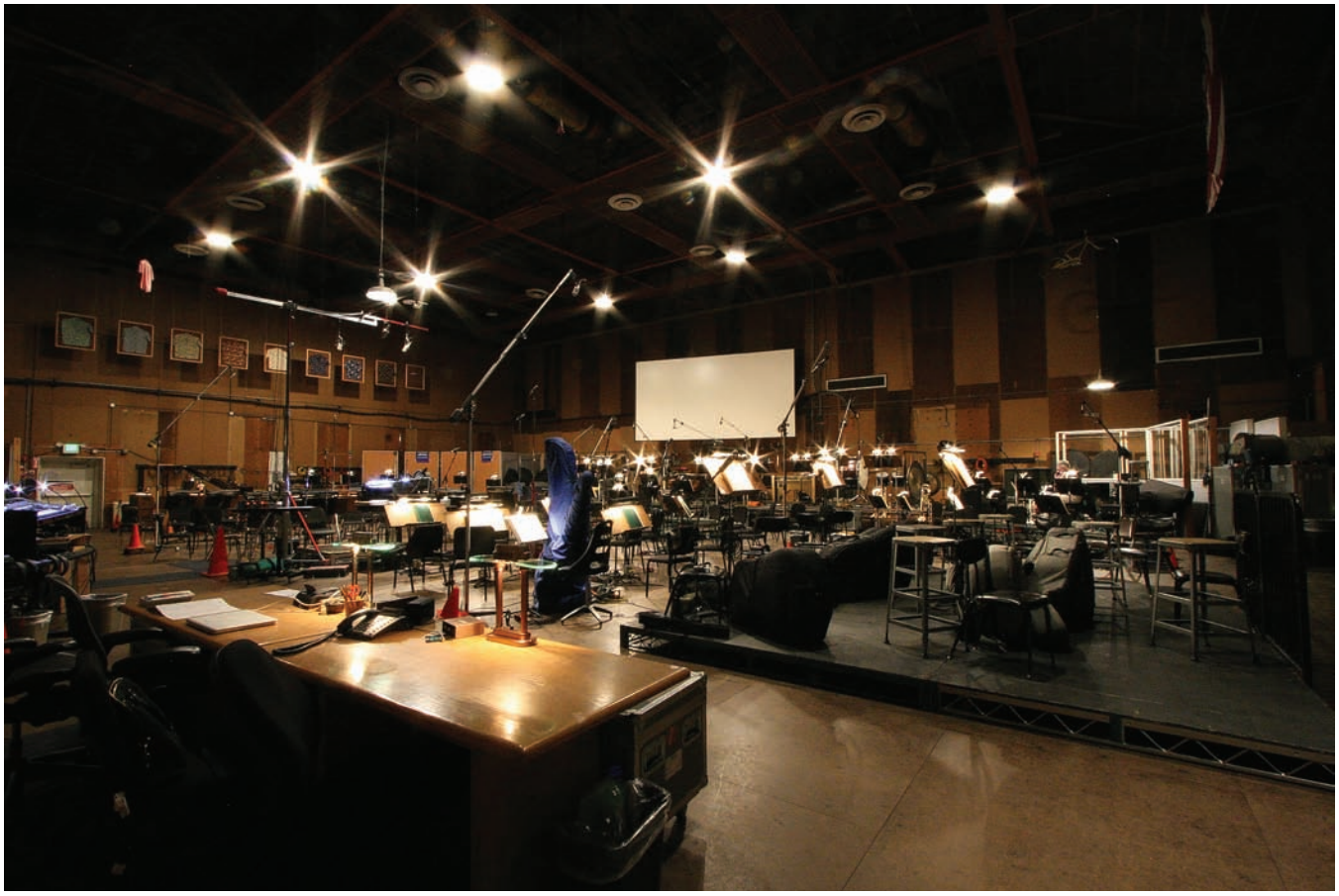

Fig. 1 Sony Pictures Scoring Stage.4

The volumes indicated above do not approach concert hall sizes, yet the reverberation times are sometimes in the concert hall range. This factor alone can result in a very active acoustic environment, which can overwhelm the direct microphone pickup. Even purpose-built classical studios, such as Abbey Road Studio 1, do not possess adequate volume to support their 2.2+ second reverb time with a large symphony orchestra. Most classical engineers will prefer concert halls, assembly halls or churches to recording studios for their largest ensemble projects.

Because Scoring Stages are required to support diverse ensembles, there has been an increased use of isolation rooms in these facilities. All of the four existing US Stages (MCM/Fox/Warner's/Skywalker) and both of the UK Stages (Air Lyndhurst/Abbey Road) have multiple isolation rooms capable of housing drums, percussion, grand pianos and small vocal groups. This permits simultaneous recording of performances by ensembles, which might not balance acoustically in the same space. The requirements of music mix delivery also often specify separation of solo elements for use in the final mix.

Sometimes, separate sections of the orchestra or ensemble are recorded in isolation. Often, the entire ensemble is rehearsed and then each section is recorded separately. This could include but not be limited to: Strings, Winds, Brass, Percussion, Harp and Keyboard. Individual section microphones are recorded while the room or overall pickup is duplicated for each pass. This provides a recording with the same overall room/hall sound/ambience and allows the musicians to rehearse together. Again, delivery or editorial requirements often drive this technique.

Dramatic requirements often shape the technique used to record on the Scoring Stage. While the overall approach may be symphonic, there could be instances where individual instruments need to be featured, sometimes in an unmusical fashion. The use of portable baffles and microphone technique often substitute for isolation rooms when the featured instrument is also playing along with the full ensemble. Additionally, the perspective of the recording often needs to change with the dramatics. A chase scene would require a closer, more aggressive orchestral pickup than a love scene, even though the cues may be recorded back-to-back.

Recent experimentation with active electronic modification has been prevalent. The ability to extend reverberation times through electronic enhancement has proven workable, as well as slight modification in the overall characteristic of the room (via equalization). A more inert environment can be adjusted to a larger hall acoustic for a symphonic approach, while shorter reverb times with increased early reflections can aid in musician monitoring across the room.

The key word is versatility—any ensemble, any recording technique and a quick change between sizes and techniques are mandatory. (See Figs. 1 and 2)

Recording and mixdown techniques and technology

Even with the introduction of sound-for-film, there has

been a requirement for multi-track or quasi-multi-track techniques. The earliest disc and optical recording often used multiple recorders either as backup or to receive separate and complementary material. Although the earliest mechanical synchronization methods did not allow for a cohesive stereophonic recording, the implementation of multi-track recording in notable productions such as "Fantasia," allowed for more depth and dramatic effect when synchronized with picture.

Progressively, the introduction of magnetic recording in multi-track (3/4/6 track) and large format magnetic analog recording (8/16/24 track) have allowed for a diverse stereo and multi-channel sound field for music presentation. Beginning with multi optical recorders and continuing through multiple magnetic film recorders and multiple large format multi track recorders, more and more tracks have been utilized in the production of film scores. One hopes that this track utilization is all in the interest of best sound quality. However, in some cases, it merely represents the adage that one will always fill the maximum available number of tracks.

Fast forward to current day, we have witnessed a revolution in recording technology while still utilizing similar musical and dramatic techniques to obtain the dramatic and musical effect.

Digital recording, via reel-to-reel recorders and current workstations, provides a virtually unlimited track count and state-of-the-art audio quality in the scoring industry.

Our current record format for orchestral/acoustic music is often 192kHz/32bit in a multi-track format of multiple 96-track workstations. One current production utilized two 96-track 192kHz workstations plus a 128 channel 44.1kHz/24 bit workstation to build multiple stems for presentation to the final dub of 64-track at 96kHz/24bit.

As an example of recording formats used during a recent project (See Fig. 3):

Elements of the live score included:

- 95-piece orchestra
- Ethnic percussion
- 40-voice choir
- Ethnic winds
- Early instrument Consort (12 piece)
- Cello solo
- Piano Solo (1 and 2 Piano)

For the Orchestra, the entire 95-piece ensemble was assembled and recorded both as a single unit and as sectional stems. Often, the cue was rehearsed extensively and recorded as a single unit, and then it was broken into record-

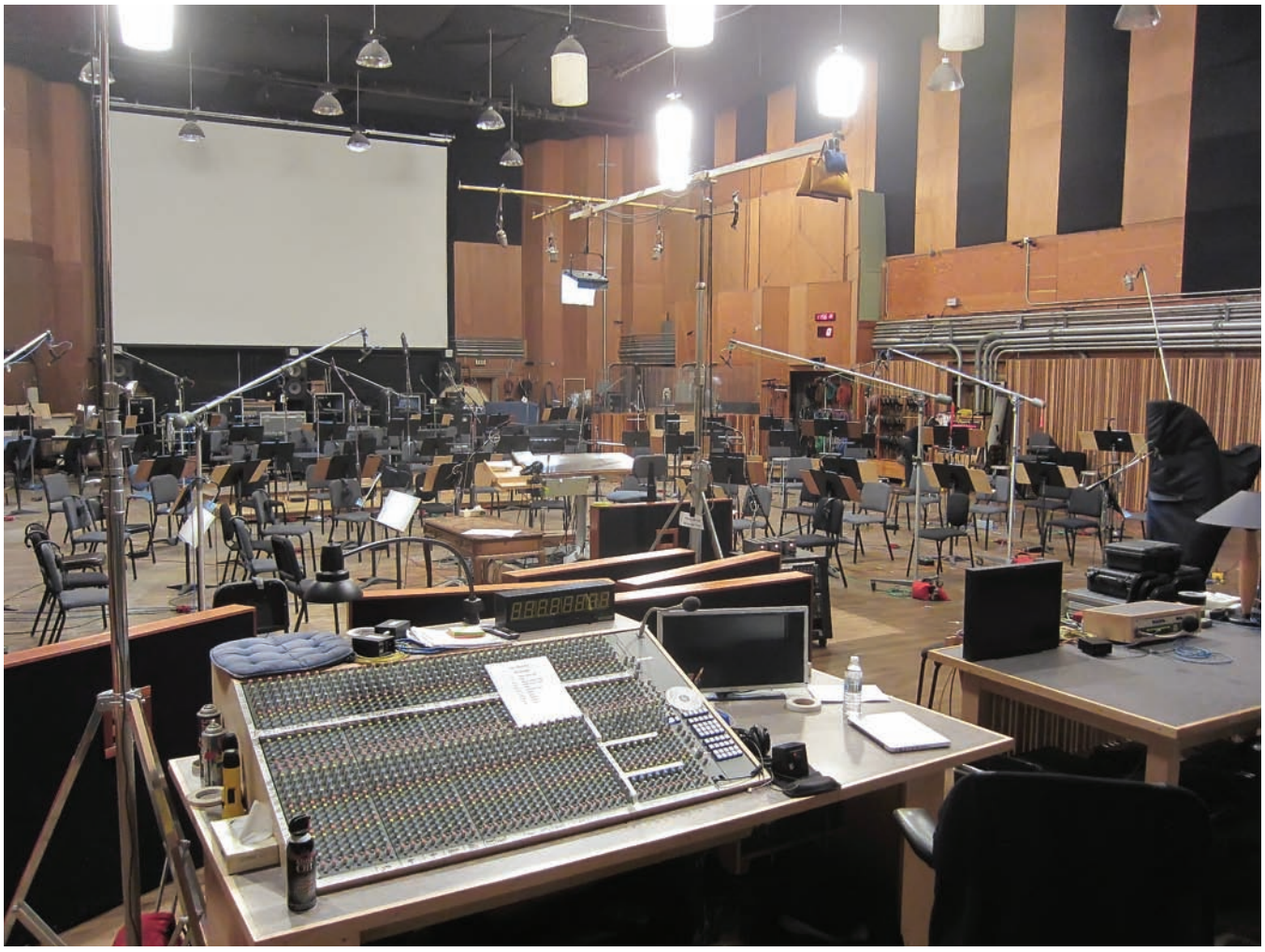

Fig. 2 Fox Scoring Stage.

AFTER EARTH 192/32 X 64 TRACKS
JAMES NEWTON HOWARD AVID HD I/O@-20
SONY SCORING

1	WW OHL	CMC3/MK8	8'	G1
2	WW OHC	CMC3/MK8	8'	G2
3	WW OHR	CMC3/MK8	8'	G3
4	SOLO WW	TLM170		G4
5	FLUTES	DPA4011		G5
6	OBOES	DPA4011		G6
7	CLARINETS	DPA4011		G7
8	BASSOONS	DPA4011		G8
9	WIDE LEFT	EHRLUND	12'	P1
10	TREE LEFT	M50BRIGHT	11'	P2
11	TREE CENTER	M50BRIGHT	11'	P3
12	TREE RIGHT	M50BRIGHT	11'	P4
13	WIDE RIGHT	EHRLUND	12'	P5
14	BASS 1	LUCAS CS4-CARDOID		P6
15	SURROUND LEFT	CMC3/MK3	20'	P7
16	SURROUND RIGHT	CMC3/MK3	20'	P8
17	HARP HIGH	LUCAS CS4-CARDOID		P9
18	HARP LOW	U67		P10
19	PIANO LEFT	C222/MK21H		P11
20	PIANO RIGHT	C222/MK21H		P12
21	STRINGS LEFT	KM56-FIG8	9'	G9
22	STRINGS CENTER	KM86-FIG8	9'	G10
23	STRINGS RIGHT	KM56-FIG8	9'	G11
24	BASSES	KORBY C12-WIDE CARD	8'	G12
25	PERC OHL	CMC6/MK2S	9'	G13
26	PERC OHC/TYMP	CMC6/MK21	8'	G14
27	PERC OHR	CMC6/MK2S	9'	G15
28	GC	CMC3/MK2		G16
29	PERC LEFT	2XMKH40		N17/18
30	PERC CENTER	2XMKH40		N19/20
31	PERC RIGHT	2XMKH40		N21/22
32	TUBA	KORBY U67		G32
33	HORNS FRONT LEFT	C24-XY-CARDOID		P13
34	HORNS FRONT RIGHT	C24-XY-CARDOID		P14
35	HORNS REAR LEFT	KM140		G17
36	HORNS REAR RIGHT	KM140		G18
37	TRUMPETS LEFT	SF12		G19R
38	TRUMPETS RIGHT	SF12		G20R
39	TROMBONES LEFT	ARABELLA-CARDOID		P15
40	TROMBONES RIGHT	ARABELLA-CARDOID		P16

Fig. 3 After Earth microphone type and placement

ed stems for editorial and dramatic purposes. Approximately 10% of the score was recorded as Orchestral stems and 90% was recorded as a Complete Orchestra. The Orchestral stems included:

- Strings (33Tracks) (Violins/Violas/Celli/Basses)/
- Winds (Flutes/Oboes/Clarinets/Bassoons)/
- Harp/Keyboard (Piano/Celeste)
- Additional String Overlay (20 tracks)
- Brass (18 Tracks) (Horns/Trumpets/Trombones/Tuba)
- Orchestral Percussion (14 Tracks)
- (Tympani/Gran Casa/Orchestral Toms/Tam Tam/ Suspended Cymbals)

The Ethnic Percussion was recorded during separate sessions and included The use of numerous large and small drums, shakers, metal effects, etc. (Multiple of 11 tracks)

The Choir was recorded during a separate session and was multi-tracked with two or more passes to increase size and for editorial isolation. (Multiple of 8 tracks)

The Consort was recorded during a separate session as a single unit as well as the Consort with Cello Solo. (Multiple of 24 tracks)

The Cello solo was recorded during the Consort session, separately from the Consort. (Multiple of 16 tracks)

The Solo Piano(s) were recorded during a separate session. (Multiple of 11 tracks)

The recorded tracks were spread across two digital workstations, each with a total of 96 tracks available at 192kHz/32bit. (Workstation Systems #1 & #2).

The live material was combined with various pre-recorded tracks from the composer's production studio. This material included orchestral samples (not used), guitars, sampled percussion, choir, ethnic flutes and various synthesized effects. Although this material was delivered to the mix down at 44.1kHz/24bit, it was sample rate converted to 96kHz/24bit as stem outputs via a Multichannel Audio to Digital Interface (MADI) converter/router. (Workstation System #3)

The output of the 192kHz/32bit mix stems was converted to 96kHz/24bit via Digital to Analog (D/A) and Analog to Digital (A/D) converters. During the analog stage of conversion, overall bus equalization was applied to the orchestral material. All of the 96kHz/24bit material, as stems, was returned to a digital mixing console to finalize the balance between stems for the final music mix.

The stem outputs included:

Left/Center/Right/Left Surround/Right Surround/Low Frequency Effects (L/C/R/LS/RS/LFE)

- Orchestra A (Composite Orchestra or String Stem) 5.1
- Orchestra B (Orchestral Solos or Brass) 5.1
- Low Percussion (Orchestral Percussion and/or Low Ethnic Drums) 5.1
- Mid Percussion (Ethnic Drums) 5.0
- High Percussion (Ethnic Percussion/Metals) 3.0
- Synthesizer Pads 5.1
- Synthesizer Pulses/Rhythm (5.1
- Solos #1 (Cello Solo, Piano Solo, Ethnic Winds) 5.0
- Solos #2 (Ethnic Winds)
- Choir (Live Choir and Vocal Samples) 5.0
- Consort (Live Early Instrument Consort & String Effects) 5.1
- Extra (Anything not covered above: Guitars, Effects, etc.) 5.1

The console output was routed to a 64 channel digital workstation at 96kHz/24bit/-20. (Workstation System #4) This material is then conformed to picture and finally mixed with dialog and sound effects to complete the soundtrack.

The picture, along with temporary music tracks, dialog tracks and sound effect pre-mix tracks, was played back on another digital workstation. (Workstation System #5)

Because various outboard effects are not able to operate at the 192kHz/32bit sample rate, an additional workstation was needed to run these plug-in effects via sample rate conversion or analog converters. This workstation ran at 96kHz/24bit resolution. (Workstation System #6)

Complexity notwithstanding, the number of tracks typically utilized for soundtrack production has soared with the introduction of digital workstations. The most current iteration of the workstation delivers an exceedingly high technical quality potential of recording. High bit and sample rates have reduced the difference between bus and playback to nearly negligible. However, more often than not, these technical advances are not fully utilized in lieu of obtaining the maximum number of tracks.

Picture synchronization

Synchronization of picture and music is what film scoring is all about. The dramatic impact of a film score coupled with the storytelling and pacing available with musical accompaniment defines the traditional art of the film soundtrack. Only in the past three decades have sound effects become a significant contributor to the film soundtrack. Reviewing the composition of soundtracks from the late 1920s through the mid 1980s, one may observe the preponderance of music contribution versus that of the sound effects. For the initial history of the film soundtrack, effects were used primarily to support the visuals and not often used as a separate dramatic element.

Methods of picture synchronization have progressed from the mechanical through various electronic techniques. Currently, all picture sync methods are electronic, and this can introduce all sorts of variables, which must be considered when producing the music tracks.

Early picture synchronization was purely mechanical. A belt or chain drive attaching the projector or picture source to a sound recording device. This assured repeatable synchronization within some variation and allowed for the music, and later dialog and effects, to be kept in sync with the picture.

Technology quickly advanced to support electromechanical synchronization via line driven selsyn systems. A central drive motor supplied power to a bus on to which various projectors and sound recording devices were connected. Driven in sync with the line frequency (60Hz), the system locked all elements into tight sync with one another. Typically, one perforation (10ms) was the window of sync accuracy. This system was used until the 1980s when electronic motor drives allowed synchronization with high speed forward and reverse. Still typically using only magnetic film as a recording medium, multi-track analog playback machines were slowly integrated starting in the late 1970s using SMPTE time code printed on magnetic film and locked to the sync system. Later, shaft encoders and finally master time code generators locked to the electronic drive system were used to lock multi-track machines to picture. Later, multi-track digital machines were introduced and synchronized (beginning in 1981) with difficulty, due to the speed vs. sample rate variable inherent in these devices. Lock-up time

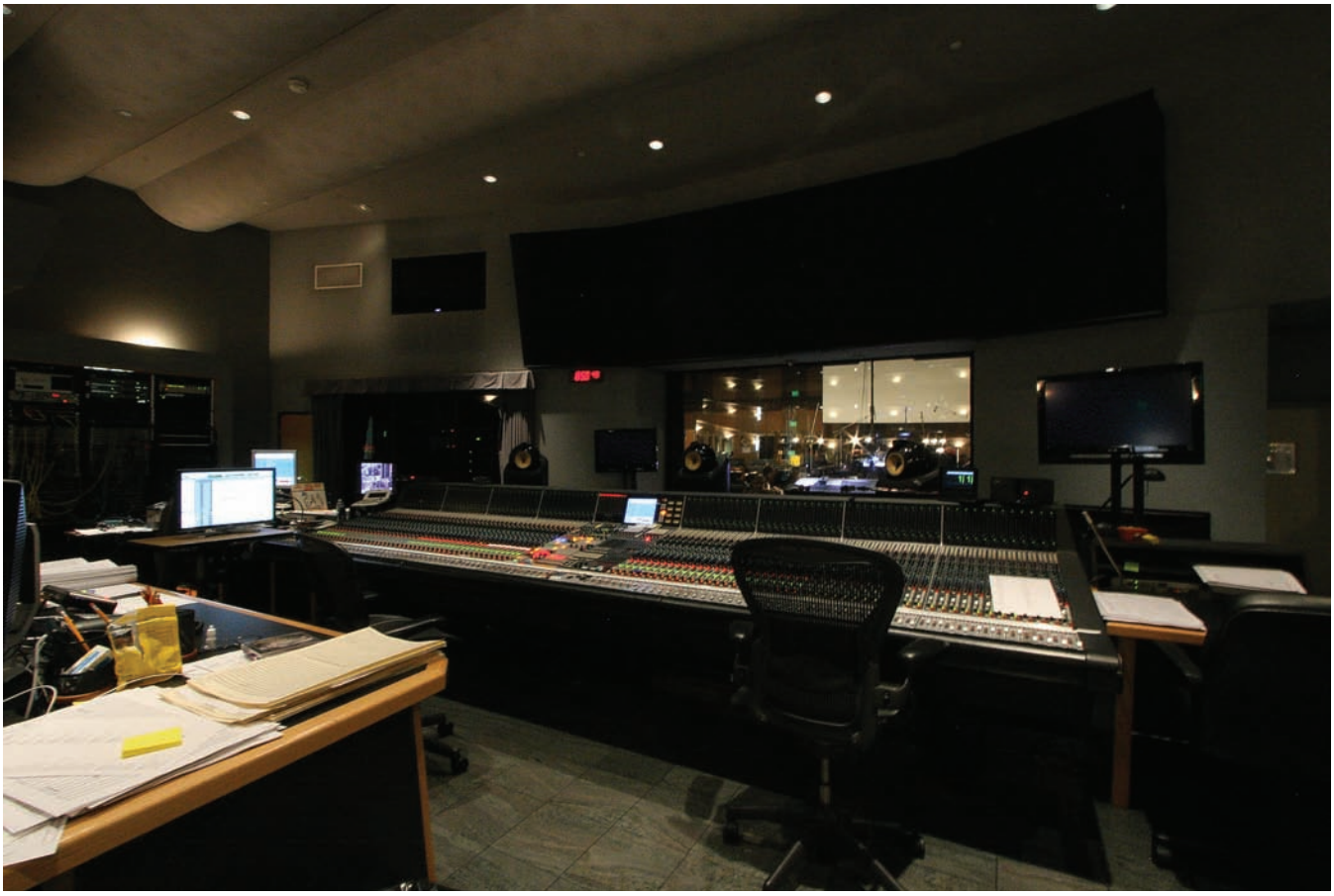

Fig. 4 Sony Pictures Control Room.

varied, and tight synchronization, especially with digital machines, was not assured due to synchronizer programming and the typical "lock and drop" mode of operation. This necessitated running the film master sync system on a master clock, which matched the digital machines, so speed control could be assured.

Finally, in the mid-1990s, the workstation provided a fully synchronized platform between picture and sound/music. Variables in lock-up time prevented perfect sync for a few iterations, but finally, the sync can be held to within one or two milliseconds. Film picture was still the norm, but within the next ten years, it would all but disappear from the post-production scene. High definition video has replaced film in all areas of scoring and sound post-production. Typically we now run high definition video at 24fps. Sometimes, scoring copies are made to run 30fps (29.97) for ease of stage operation.

Control room/mix room specifications and monitoring

While all recording studios require a control room and monitoring environment, the Scoring Stage differs in several significant respects:

- The number of participants in the recording process can exceed twenty, and many must be in a position to judge the recording and performance within the monitoring direct field.
- Film playback formats must be mimicked in the scoring monitor environment. Therefore, both versatility and easy changeability must be designed into the monitor systems.
- There are several standard playback response curves that must be built into the speaker tuning.
- Several different formatted recording sessions may be scheduled within one day. Therefore, size of support areas and ease of changeover are mandatory. Most scoring stages have extensive wiring and routing capabilities to handle any required format.
- Extensive communication systems are required to enable easy and fast contact between the composer, conductor, musicians, editors and technical crew.
- Picture cueing systems differ between editors and composers. The control room technical capabilities must encompass all current and future cueing and picture playback systems.

The current standard monitoring format for Scoring Stages is the 5.1 surround system. Speaker systems appropriate to the room size and dimensions are included in each stage design. Typical monitor system manufacturers include ATC, PMC, Genelec, JBL, Dynaudio, and B&W. While only theatrical playback systems may differ in size, the response of the scoring monitor system is typically tailored to follow closely the theatrical playback curve. Near field and midfield monitoring is typical as an alternate to the main monitor systems provided by the stage.

Quite often, the Scoring Mixer will bring his own preferred system for use as a midfield or near field monitor.

Utilizing a preferred portable speaker system enables a quick translation between various stages and mixdown rooms using the same or similar speaker systems. Also quite often, the mixer will bring only the Left/Center/Right front speakers and utilize the built-in surrounds and sub-woofer system. All scoring consoles have multiple speaker outputs with trims available for "guest" speaker systems. This allows for the fine tuning of levels between the main house monitor system and the guest or scoring mixer portable system.

Film monitor systems utilize similar front Left/Center/Right systems and smaller diffuse surround speaker systems typically used in theaters. The bass response of the control room versus theaters makes tuning and specification of sub-woofers problematic, but the specification is still adhered to in terms of having an low frequency effects (LFE) channel and monitor system available.

Main monitor systems are leveled front (Left/Center/Right) similarly to theaters at 85dBC at the mix position based on standard electronic level (-20 digital). Surround speakers are often leveled at 79dBC each and 82dBC combined. This is due to the proximity of the speakers in control rooms versus theaters; there is less air or volume to move in order to hear the surrounds in the closer environment. This slightly lower monitor calibration allows the mixer to increase his electronic level sufficiently to overcome the extra volume of the theater, which is leveled at 85dBC, the same as the front. Sub-woofers are leveled at 91dBC and again, depending on room response, may or may not be used in the scoring environment.

There has been some discussion and a bit of controversy regarding the restricted response and dynamic range of the "standard" theatrical monitoring and playback systems. The Scoring community utilizes typically higher quality monitoring due to the demands of purely music recording. Response of dialog (restricted) and sound effects (wide) are less considered on the Scoring Stage than in the re-recording environment, where a close match to theatrical playback qualities must be maintained. While the move toward higher resolution monitoring in theatrical playback systems is commendable, one must always bear in mind the restrictions of original dialog recording (storytelling element) versus the potentially higher resolution demands of music and effects. The playback systems must be supportive of the storytelling, not an end unto itself.

Because the Scoring Stage monitor environment must be both accurate and dramatically viable, several choices of monitoring elements are provided. Dialog and Sound Effects faders are available to make sample mixes with music playback, so the film Director and the Composer can hear the music in context.

The monitor speaker system is then removed from cali-

Fig. 5 Fox Scoring Stage Control Room.

brate and the music played at a level which can satisfactorily give the best impression of cue. This is sometimes necessary to "sell" the cue, even though the playback may be out of scale and unrealistically loud. (See Figs. 4 and 5)

Musician support

More than in any other recording environment, the Scoring Stages must provide extensive audio and visual monitoring support for the musicians and performers. Utilizing extensive headphone/cue systems and picture monitors, most players receive multiple levels of performance support. These include:

- Multiple and extensive headphone mixes, often more than twelve mono mixes (divided among Orchestra sections) and six stereo mixes (for conductors, editors, rhythm section and soloists). The mono headphones are single or dual sided and carry a mix of cue/click tracks and other musical elements performing live or prerecorded. The stereo mixes also carry click tracks plus a more extensive mix of associated musical elements.
- Video monitors carrying the film picture (with or without streamers/cue marks).
- Video monitors of the conductor for players in isolation or without a clear view of the conductor.
- Video monitors with the bar/beat count. This assists players in locating/counting during complex cues that have had little or no rehearsal.
- Video monitors with pictures of other soloists for visual cueing. Rhythm sections often use multiple personal video monitors to see each other for performance cueing.
- Electronic music stands. While this is a new technique, used more often in live performances, the future of a unique video driven electronic music stand for each player or group of players is certainly in our future. The ability to turn pages remotely (foot switch) and for each player to mark his/her music uniquely would be included. This would facilitate fast composition changes and re-assignment of parts to other musicians. The Music Library would typically integrate the electronic stands into their copy-composition software.
- Studio Loudspeakers. Often used for general playback, these loudspeakers are also often used to send tuning notes from pre-recorded tracks to the entire orchestra.
- Local Loudspeakers are often used for soloists in isolation who do not wear headphones. Sometimes, the speakers are wired out-of-phase and placed on either side of the performer/microphone to reduce leakage.

Technical facility

One may ask, following all of this description, what is the difference between a Scoring Stage and a Recording Studio?

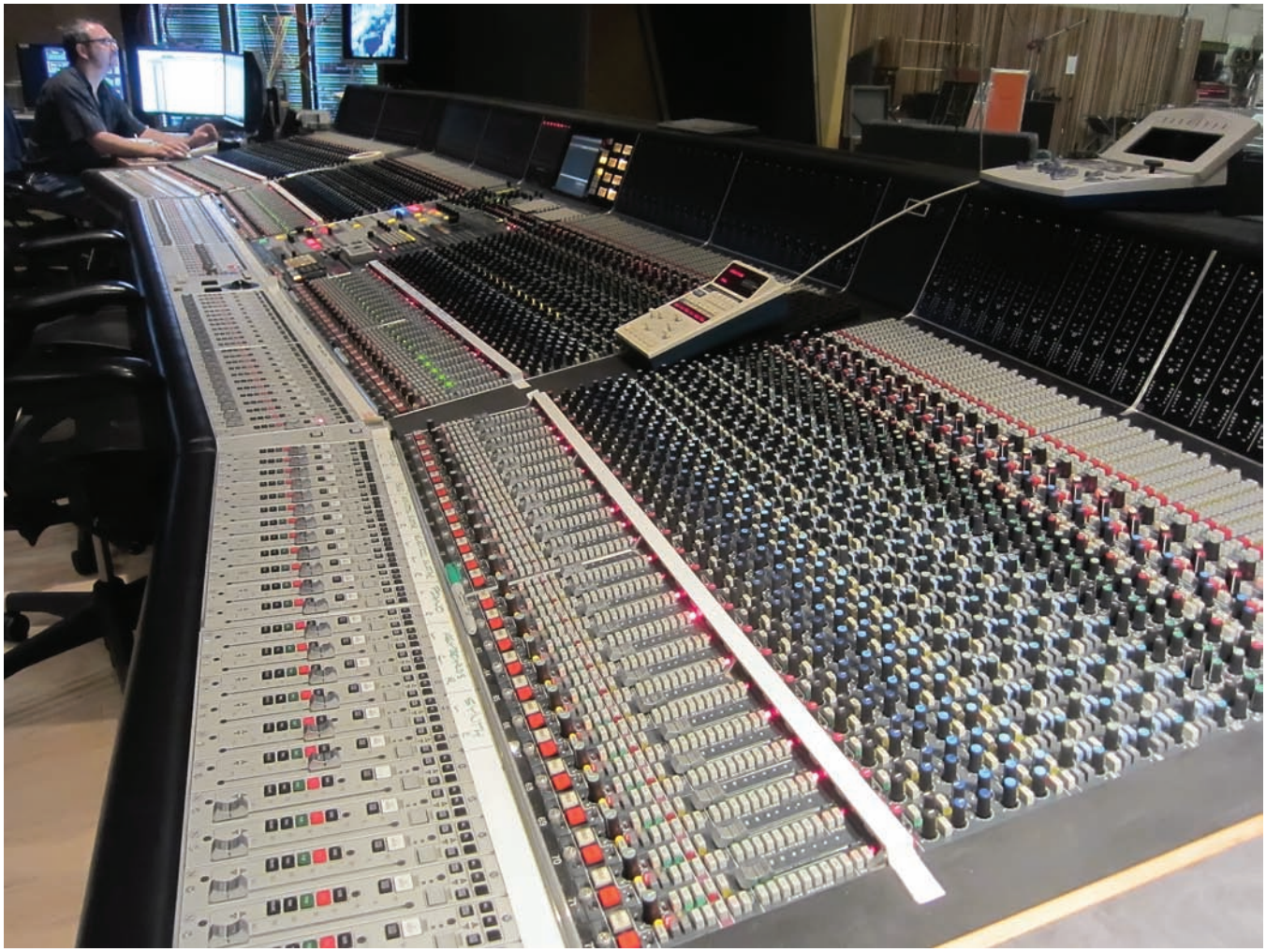

Fig. 6 Fox Scoring Stage. Neve 88RS. Input Section.

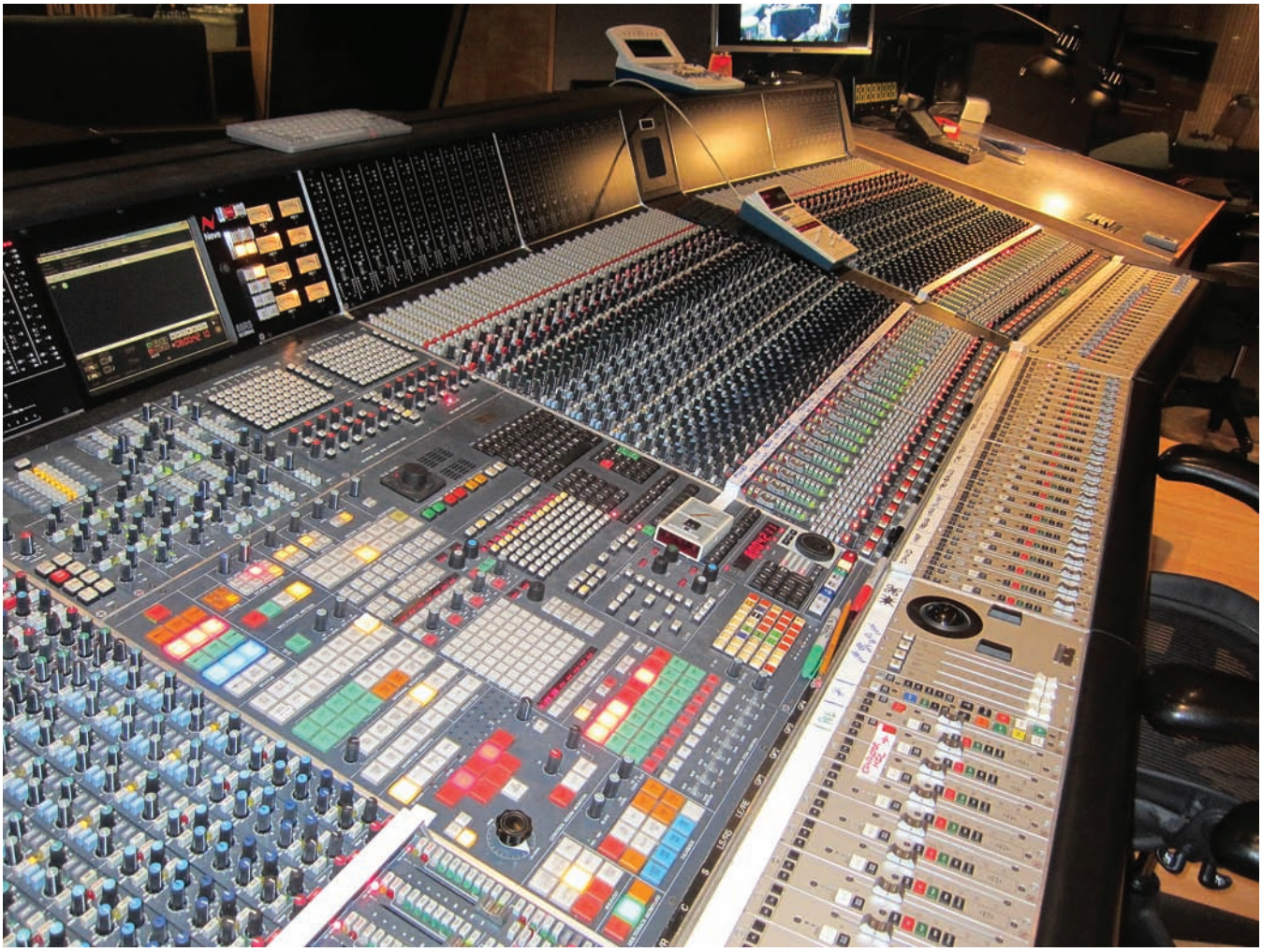

Fig. 7 Fox Scoring Stage. Neve 88RS. Monitor Section.

Aside from the size of the recording space, and the ability to seat over one hundred players, the Scoring Stage technical capability encompasses the following:

- Numerous isolated recording spaces adjacent to the larger recording space.
- The ability to provide picture projection in any format to numerous locations.
- The ability to provide extensive cue/headphone monitor feeds (often more than 32) to the performers.
- The ability to monitor in the Control Room various and diverse formats. This
- includes multiple surround formats on several alternate speaker systems.
- Availability of baffling and platforms for various stage setups.
- Often, the availability of variable acoustical treatment in the main recording room. This would be attained by mechanical and/or electronic means. (Meyer Sound/Lexicon)
- The immediate flexibility of setup and configuration of recording systems.
- An experienced crew to accomplish all of the above, and more.

The Scoring Stage technical support systems have grown from the basic requirement for monophonic optical recording to complicated and extensive multi-track surround production in many formats.

During the later analog years, it was not uncommon for a stage to be wired for sixty to seventy microphones and up to five multi-track (24 track) recorders. Currently, with the proliferation of digital workstations, the stages are wired for one hundred twenty to two hundred microphones and at least four ninety-six channel record rigs. This recording capability is in addition to master clock systems, networking of audio and control, system backups and diagnostics.

Large multi-track analog recording consoles are still the norm. In fact, all current stages in the US and UK utilize the Neve 88RS Scoring console with between one hundred twenty and one hundred ninety-two inputs. This console is custom designed to afford great flexibility in monitoring and configuration. It includes forty-eight times two multi-track busses, thirty-six stem mix busses (patchable to many more), and up to twenty-four auxiliary sends. While this is the latest and probably last generation of analog desk, it does provide the extensive capabilities required by current scoring sessions. (See Figs. 6 and 7)

Many mix downs are accomplished in the digital domain and here we find both console and controllers a common ingredient. The use of higher sample rates in recording normally defines the use of controllers (mix in the box) rather

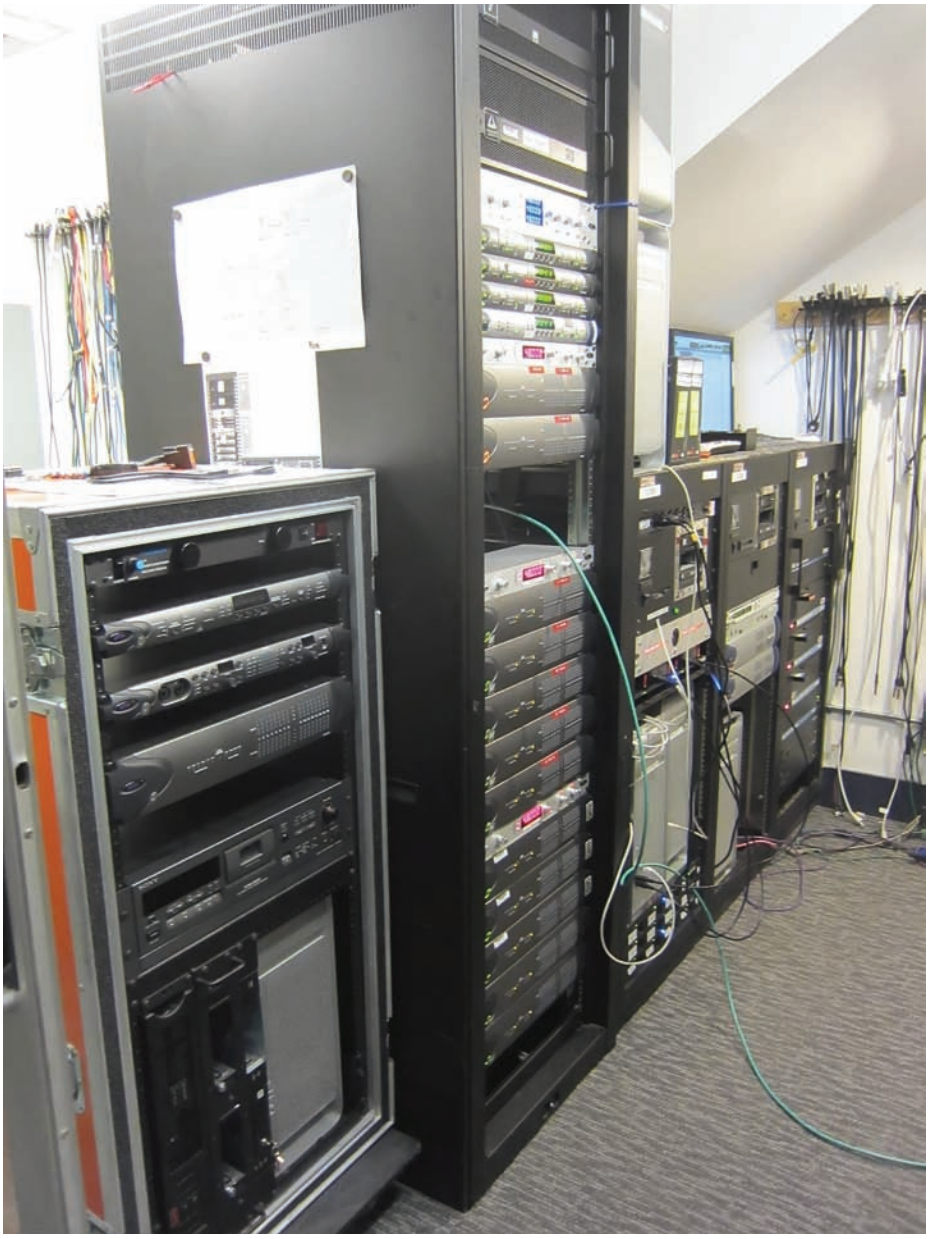

Fig. 8 Fox Scoring Stage Machine Room (left side).

than consoles with the heavy demand of DSP in the higher sample rates.

Digital mix consoles are configurable, with up to one hundred eighty inputs available at 96kHz/24bit. Additionally, up to sixty-four mix busses can be configured along with twenty-four auxiliary sends. This capability, along with hybrid technology enabling workstation control from the mix desk, allows the mix engineer great latitude in assigning effects and mixdown stems.

Plug-in technology, especially at high sample rates, has taken the place of much of the analog mix gear previously used for signal processing. However, many engineers still utilize vintage and/or highest quality devices for equalization (Manley/Avalon/ Massenburg) and reverberation effects (Lexicon/ Bricasti). This requires digital-to-analog conversion into the device and a reconversion to digital for final printing of mix stems. Often, this conversion process is used to accomplish sample rate conversion to the final mix format, normally 96kHz/24bit.

The need to provide nearly instantaneously edited material for review mandates complex and extensive network capabilities on the stages and mix rooms. When a cue or portion of cue is recorded, it is immediately saved and backed up on several (usually three) drive arrays. At least one of these arrays is available to the editors on site to assemble and composite the pieces of the cue. This assembly is then sent back to the playback rig for future use as review and /or overdub material. This network requirement for audio, video and control now exist on all stages and via large rental systems in the scoring industry. Master clock systems, as well as clock, time code and control system distribution, is also a normal function in the technical infrastructure.

Many, if not all, Scoring Mixers utilize some personal equipment for recording and monitoring. The interface of this gear must be anticipated in the construction and configuration of the stage and control room. (See Figs. 8 and 9)

Considerations include:

- Microphone powering and mounting hardware.
- Microphone preamp wiring and remote control.
- Remote A/D Converter clocking and wiring (Digital and Analog).
- Portable monitor system configuration. (Leveling and integration with in-house multichannel monitoring systems.)
- Capability to integrate rental and outside engineer workstation to in-house wiring infrastructure.
- Stereo fold down and headphone integration.
- Portable clock wiring, triggering and remote integration.
- Portable communication systems, such as two-way radios, cue radios, etc.

Future of scoring stages

The opening of this article stated the necessity for a "place to record the music" as the initial requirements for a Scoring Stage. Over the nearly ninety years since, there have been numerous stages and facilities built for film scoring. At the height of the "Studio System" and TV production years, there were a minimum of ten Scoring Stages on studio lots (depending on how one counts) and at least ten other stages at independent facilities adequately equipped and staffed for a scoring session. This group of facilities existed in Los Angeles alone. Coupled with New York, London, etc., there were over thirty facilities world-

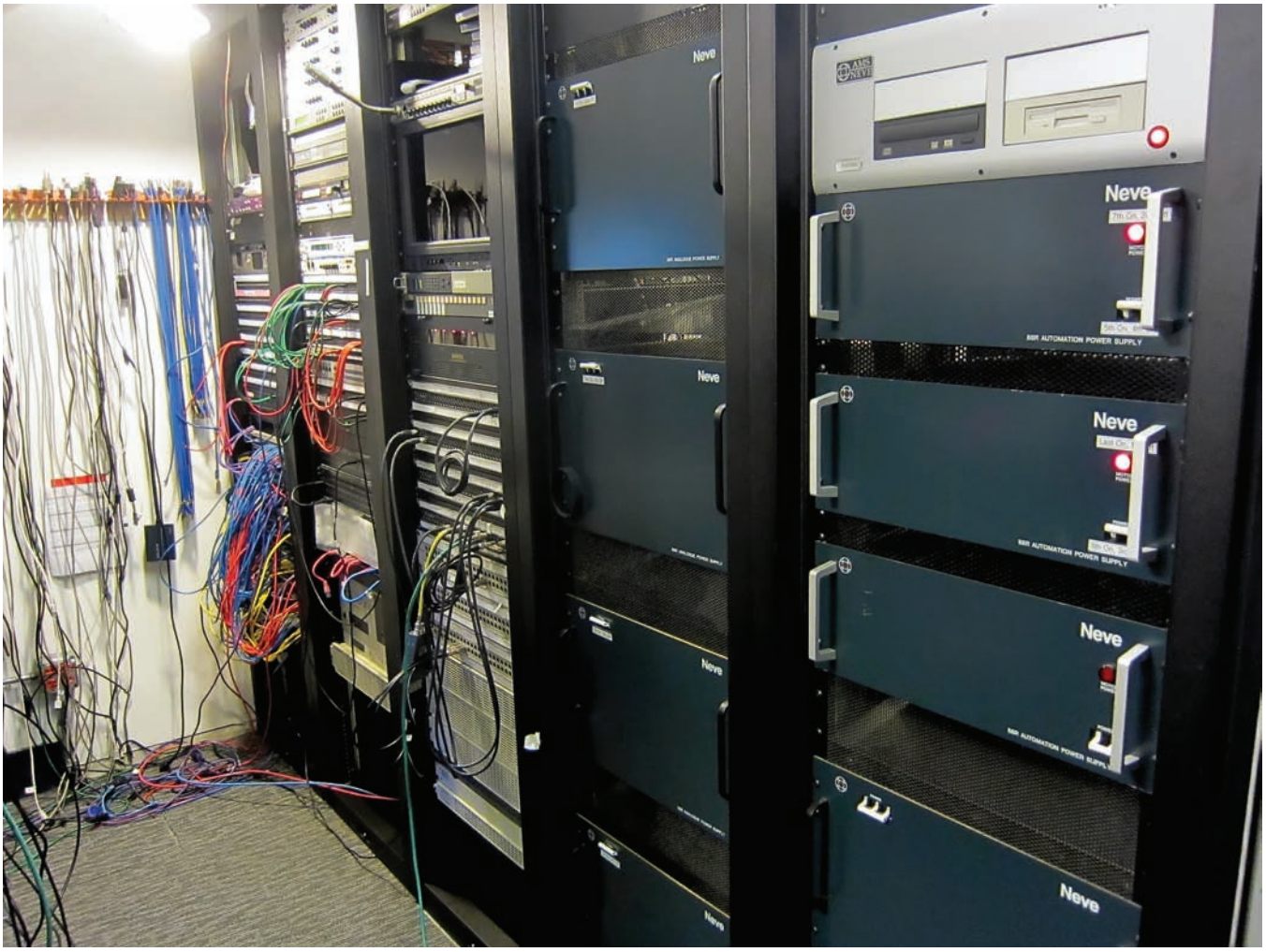

Fig. 9 Fox Scoring Stage Machine Room (right side).

wide under the umbrella of Scoring Stage.

Since the heyday of film and television production, the industry has become more diffuse and much of the previous studio production has shifted to smaller independent facilities and to in-house composers' studios.

The economics of the Scoring Stage has never been attractive to the financial arm of the film studios. When the simple real estate equation is used, the return on investment for a 100,000 square foot facility for music recording never makes sense. Consequently, the major studios have, over the past twenty-five years, slowly divested themselves of music recording facilities while assuming there would always be someone else who would continue to offer this service. At this date, there are three remaining large Scoring Stages in Los Angeles (Sony/MGM, Fox and Warner Brothers), two in London (Abbey Road and Air/Lyndhurst), none in New York and one each in Sydney, Australia and San Francisco. There are a few large venues around the world, which can be and are used for scoring and numerous smaller studios and concert halls, which are used as needed. Unfortunately, the likelihood of any new Scoring Stages being constructed in the future is slim. Nearly all of the mix downs are now accomplished at smaller studios or dub stages (with Theatrical monitoring). Much of the recording of smaller ensembles is done as overdubs at small studios or composer facilities. The performing ensemble is rarely recorded as one and live in the studio.

The drive for these techniques has arisen from the popular notion that film music must be "produced" rather than only composed and recorded. Pop record production and performers now populate the Film Scoring world. The generation of classically trained composers is fading rapidly. While there is a younger generation of highly skilled musician/composers utilizing the orchestral palette, they also rely on overdubs, sectional recording and samples as part of their "sound". The classical orchestra utilized for Film Music is becoming a thing of the past, hence decreasing the need or requirements for appropriate large recording facilities.

The industry requirement to record the music for films will always exist. However, it remains to be seen whether this will encompass the large and formalized environment of the Scoring Stage or some hybridization of Concert Hall, Church, Small Studio, Overdub Room and Mix Room/DubTheater.

Appendix/crew titles and duties

Scoring Mixer: Administrative and artistic head of crew. Specifies recording formats, stage layout, microphone choices, mix layout and monitoring system. Directs setup and coordinates with editorial and music library regarding

recording order, stage positioning and technical lash up. Confers with composers and orchestrators regarding sonic approach and recording quality. Balances musical elements and directs playbacks and editorial approach to score. The Scoring Mixer is responsible for the ultimate audio quality of the score, all technical and stage scheduling, and for the on-time delivery of mixes. The mixer is sometimes a trained musician and often utilizes a full score to reference musical elements in the original composition.

Stage Engineer: Chief Technical Engineer for the session and Stage. Otherwise known as the Maintenance Engineer, he/she is responsible for the actual technical wiring and hookup of all gear. This would include microphones, preamps, analog and digital consoles, recorders/workstations, clocking, communications, networking of control and audio, cue systems, monitor systems, projection systems, etc. The engineer solves all system problems and assists in the setup of rental and composer gear on the recording session. The engineer manages all outside setup of remote feeds via satellite or Internet, involving remote performers, directors or studio executives. The Stage Engineer is on hand to assist during sessions and to prevent any potential down time.

Digital Recordist: This is the recordist responsible for the main record/workstation systems. He/she sets up the sessions in the workstation, pre-programs the input/output configuration and operates the workstation on the session. Often, this person performs preliminary edits and organizes the tracks for overdubs and later mixing. This recordist interfaces with the Stage Recordist regarding patching, clocking of digital gear, routing, etc. He/she also coordinates with the Music Editor and composer staff to load tempo maps and other session documents. She/he is responsible for data management, backups and distribution of recorded material. This recordist normally follows the project through preparation, recording and mix down at numerous facilities.

Stage Recordist: The Stage Recordist manages the control room portion of the Scoring Stage. This recordist is familiar with the in-house wiring, consoles, communications and playback systems. He/she works with the Digital Recordist and Music Editor to connect/patch all recording systems. This recordist often operates the backup workstation and manages the picture playback workstation. He/she also coordinates with the stage crew to route all inputs and outputs as needed to the headphone console and main recording console. He/she also coordinates audio and video feeds to the outside world, such as telephone communication feeds to remote locations and Integrated Services Digital Network (ISDN) or synchronous feeds to overdub or record performers at other locations (Satellite or Internet feeds.)

Digital Editor/Conforming: The session and mix conforming editor receives material from the session (via local network) and immediately edits this material for use in overdubs or temporary mix situations. This editor also moves material musically to provide best sync and performance when the orchestral sections are recorded separately. Additionally, this editor checks sync with the prerecorded material from the composer's studio to assure best musical performance when combined with the various live elements. This editor works from the score and is usually a trained musician. He/she also follows the project through scoring and mix down.

Stage Manager: The Stage Manager handles the studio side of the glass. He/she is responsible for executing the setup of chairs, stands, headphones and microphones in the studio. Most importantly, this position deals directly with the musicians and their endless litany of requests and problems. ("It's too hot/It's too cold/Too much space/Too little space" etc.) The combination of setting up the stage for best recording results along with keeping the players happy is a real art. The Stage Manager also checks microphone positions—and repositions microphones as needed (particularly percussion and keyboards) for each cue. The best Stage Managers can assist the Scoring Mixer in the choice of microphone type, seating position and stage layout with regards to their particular venue. If risers and baffles are needed, he/she places and/or supervises the placement of these elements.

Stage Assistant/Cue Mixer: The Stage Assistant also acts as the cue/headphone mixer on the session. On most Scoring Stages, the Cue Mixer is placed on stage, allowing easy communication between the players and mixer. The mixing consoles have between 56-72 inputs and upwards of 32-48 outputs, all for cue mixes and headphones. The sources are derived from the workstations and console in the control room and distributed to the cue mixer by the Stage Recordist. The Stage Assistant helps with microphone and headphone setup prior to the session. During the session he/she manages the multiple mixes going to the headphones and "rides" the click level to the headphones. The dynamics of the music determine the available headphone level allowed before leakage into the microphone would occur. It is the duty of the Cue Mixer to set and constantly adjust this level to avoid click leakage, which could ruin the take.

Click/Auricle Operator: Most scoring sessions utilize both visual and audible cues to synchronize the music track being recorded with the picture. Computerization of this cueing has been systemized through the use of onboard generation of clicks and streamers in the workstation and via outboard computer programs such as Auricle. Many sessions utilize both onboard and outboard systems. The Auricle operator has pre-programmed the cue marks and clicks prior to the session to correspond with the bars and beats of the recorded cue. The clicks can be subdivided to allow for easier performance of difficult time sequences. Picture cues are often determined both by the composer and conductor to assist in accurately placing musical emphasis with picture. The Auricle Operator can change any of these parameters on the spot to allow for instant music-to-picture adjustments. Music can be speeded up or slowed down, and bars and beats can be added or subtracted, all with corresponding click and picture cueing changes. This operator normally sits on the stage in proximity to the conductor. Changes in click construction are often ongoing in the recording process. Additionally, it is often desirable to free-time (conduct) a section of a cue (that is, to eliminate the click track and allow the conductor to perform the cue to picture only). In many cases, the cue will include sections of click and non-click bars. In

these cases, the Auricle operator will build warning clicks to prepare the musicians for the incoming section of music.

Session/Composer Engineer: In the current era of hybrid scores, and the need to demo each cue for the director and studio prior to recording, nearly all composers now employ assistants and in-house engineers to facilitate this process. The composer's engineer typically prepares the pre-record playback machine, lays out the demo tracks to picture, and builds the tempo map for each cue. This engineer often attends the session to operate the pre-lay/playback workstation in order to edit "on the fly" any material subject to change, or to include any alternates included in the session. Since this engineer has been associated with the initial composition and construction of the cue, she/he is often the best reference for questions regarding sync and musical content of the pre-orchestrated cue.

Music Editor: Described in some detail earlier, the Music Editor takes the score from the earliest conceptual stages through composition, demos, recording, editing and final mix. The Music Editor is usually the final word involving sync and picture changes/adjustments. Many Music Editors are composers themselves, and are capable of sophisticated sync and musical adjustments if required to do so by picture changes. The Music Editor confers with the Scoring Mixers regarding stem layouts for dubbing, and arranges for final print takes and alternates to be included in the final mix session. The Music Editor usually is the designator of take numbers and session notation regarding best takes, director and producer requests and desires regarding music, and dubbing notes.

Assistant Music Editor: The Assistant Music Editor manages the data from the recording and mix sessions and sets up the final music mix material in picture sync sessions to be played back in dubbing. The assistant typically keeps track of updated picture and change notes and manages the input of updated mixes into the dub sessions. The Assistant Music Editor often handles the technical interface with the Digital Recordist and the final dub stage. This position requires a very detail-oriented approach to the project involving multiple mixes, stems and alternate takes and choices requested by the director.

While often commuting between the Pacific Northwest, Los Angeles, Boston, and Chicago, Shawn Murphy actually does enjoy listening to music (all types) as well as cycling and snow skiing. He resides in Seattle with his wife and two canine children.