



Cable 8 Productions
Edward R. Murrow School of Communication
Washington State University - Pullman, Washington

studio a renovation: technical program document



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Technical Program Narrative

1 Introduction

The following is a summary of technical program requirements associated with the renovation of Cable 8 Productions Studio A, located within the Edward R. Murrow School of Communications at Washington State University. The requirements set forth reflect discussions with representatives of the Edward R. Murrow School of Communications, Marvin Marcelo (Director/Coordinator, Murrow Symposium), the Board of Directors of Cable 8, and representatives from the Campus Architectural and Engineering Services department.

This summary focuses on the technical aspects of the proposed renovation and upgrade of the existing Studio A facilities, systems, and ancillary support areas. We have divided our findings into major categories which correspond to the technical disciplines associated with the project, and have summarized requirements for each space within the planned facilities.

2 Executive Overview

The current Studio A facilities have served well the educational curriculum of the School for many years. However, many of the technical components comprising the Studio facilities are now well beyond the end of their anticipated useful life, and the current physical Production Control and Observation areas within the facility are not accessible to all Washington State University students. The time has long past where a physical renovation and systems upgrade became necessary to maintain program relevancy.

Renovation to provide accommodation in conformance with the Americans with Disabilities Act (ADA) provisions is critical to the School's philosophy of inclusion.

At the same time accessibility is provided for all students, the existing facilities can benefit from a "facelift" that will create a modern instructional environment commensurate with other areas of the School of Communications, and that which will be found within the Commercial Broadcast Workplace where graduating students aspire to become employed.

Three key areas of the Studio A studio space and control room were identified to become the primary focus of this document: The Studio A lighting systems, the physical control room layout and infrastructure, and the production audio and video systems and technology. Each of these systems needs to be upgraded in a way that complements the multiple uses of the facility and will provide for maximum longevity of the improvements made.

The Cable 8 master control facilities currently use a manual system of tape playout to get programs to air. A modern system with a simple automation system, small server for program play out, will improve the on air look of Cable 8, and allow for unattended program play out during school breaks

2.1 Lighting Systems

The Studio A lighting grid, dimming and control system, and lighting instruments and grip equipment are antiquated and at end of life. Safety concerns for worn electrical wiring, home brewed grip equipment, and potential presence of asbestos should be a large part of the of the WSU initiative to upgrade these systems. The proposed lighting systems upgrade will eliminate these safety concerns by replacing the old equipment, and strengthening the existing lighting grid. In addition the proposed lighting package incorporates current technology for both the dimming systems and the lighting instruments that is far more energy efficient than the current systems. A distributed dimming system with computer control and a combination of energy efficient fluorescent and incandescent lighting is the core of the new system. The drapes and track will also be replaced.

2.2 Control Room Infrastructure

The split level control room and observation room are based on a floor plan inherited from the original building design. This layout is not conducive to current technology or use of the facility. The upper level of the control room and observation room will be removed so the entire floor space is one flat area. The space will be rearranged for better workflow, ergonomics, and to meet ADA requirements. The new layout provides for 9 operator positions arranged in two rows of four plus a separate audio room position. A separate equipment rack room will hold core equipment and reduce noise and heat in the operator spaces. The observation room will now have a small work desk at the window.

2.3 Production Systems And Technology

The audio and video systems in the current facility are for the most part obsolete. The current studio does not integrate with the Avid Unity server or iNEWS systems that are part of the WSU infrastructure and teaching program. The systems need to be upgraded in a way that incorporates current technology, allows for real world teaching scenarios, and is easily upgradeable over the years as technology changes.

Two major upgrades are incorporated into the new system, use of serial digital video and integration of Avid server and iNEWS technology. The core infrastructure of cameras, switcher and router and much of the video monitoring will be both standard definition (SD) and high definition (HD) capable. The primary signal path between equipment will be via serial digital interface (SDI) not analog. The initial system will run at SD rates and resolution but all key components will also support HD making future upgrades and technology changes easier. The incorporation of Avid AirSpeed servers linked to the Unity system with a PortServer Pro interface allows both the use of pre edited clips for incorporation into productions and fast transfer of completed productions to the Unity server for final editing and polish. Avid iNEWS workstation will be used for managing the media transfer.

2.4 Master Control Room Technology

Cable 8 master control is currently a manually controlled tape based play out system. The upgrade would include a simple play list based automation system that can control VTR's, servers, switchers and routers. The automation system would allow unattended playback on Cable 8 during school break periods.

Play out on Cable 8 would be primarily handled by a small video server. It will be capable of holding up to 170 hours of material at a data rate of 12Mb/sec. With a DV and Graphics option installed in the server it is possible to directly import via FTP multiple file formats including DV format video and Targa files.

3 System Description

A more detailed description of the Studio A control room and Cable 8 Master control system follow.

3.1 Key Technologies for Studio A

Core Production Systems:

- Sony 1.5 ME Digital production switcher with 16 inputs and 8 outputs. Built in 2 channel DVE. SD and HD capable.
- Routing system with 64 x 64 SD/HD digital video matrix and 64 x 64 analog audio matrix. Control system and router control panels.
- Two channel intercom system with IFB capability and four wireless belt packs.
- SD/HD test and sync generator
- Terminal and distribution gear.
- Audio and Video Patching

Camera Systems:

- Four new Sony SD/HD capable digital cameras with CCU's and remote setup panels. SMPTE fiber camera cables.
- Three new camera pedestals and pan tilt heads.
- One new camera jib system.

Video Tape Systems:

- Two Avid AirSpeed servers with 1 in or 2 out capability. Linked to the existing Unity server.
- Two XDCAM VTR's
- Two DVD recorders.

Audio Production:

- Yamaha digital audio mixer
- Digital Cart machine
- Telephone interface for call in shows.

Monitor Wall:

- Sony 23 inch LCD program and preset monitors
- Clarity 40 inch LCD monitors fed by 12 input multiviewers
- Genelec program audio speakers

3.2 Studio

The studio is studio space of approximately 60 x 36 feet. The lighting systems are at end of life and the grid and drape systems need updating and replacement.

Studio Lighting Upgrades

- Complete replacement of the existing dimming and distribution system with new distributed dimming system.
- Replacement of the existing lighting fixtures with a combination of fluorescent and incandescent luminaries.
- Enhancing the strength of the lighting grid with new clamps and attachment points at the walls.
- Adding a complement of grip equipment.
- Upgrading the I/O panels

3.3 Production Control Room

The existing production control room will be remodeled to enable an improved teaching environment and production workflow. The room will be made ADA compliant by removing the existing upper tier level and creating a flat floor. The existing single row production bench will be expanded to a two row arrangement. The audio control room will be relocated and expanded. A separate rack room will be created to reduce heat and fan noise in the control room space.

The existing Studio A control room space:



Visualization of the remodeled Studio A control room:



Monitor Wall

The monitor wall will include two 23 inch LCD's for program and preset and two 40 inch LCD's fed by 12 input multiviewer processors. The multiviewers will allow flexible arrangement and sizing of the different video sources and accept analog, SD and HD signals. The multiviewers will be fed with a combination of dedicated camera server, VTR and graphics inputs and routable inputs. Also at the monitor wall are left and right program audio speakers.

Front Production Bench

The front production bench is six console bays wide and includes the technical director, director, producer, and assistant director positions. Each console bay includes a four rack unit tall turret for equipment.

The technical director position has the switcher control panel. The director position has an up/down timer and two local LCD screens for near field monitoring. The LCD's are fed from the router. The producer position shares the up/down timer and near field LCD monitors. The assistant director position is a flexible position that includes a computer LCD on an arm. All positions include a dedicated intercom station.

Rear Production Bench

The rear production bench is six console bays wide and includes the combination video control and engineering position, video tape, and graphics positions. The right most four console bays have a 20 rack unit tall turret to hold equipment. The left two console bays are four rack units tall. All positions have an intercom station.

The video control and engineering position has the camera remote control panels, six LCD monitors for cameras and program/preset, and an evaluation quality 14 inch CRT monitor. Also located here are the engineering waveform monitor and a good quality combination audio monitor and VU meter unit.

The video tape operator position includes two Avid AirSpeed servers that will be linked to the Avid Unity system via a local PortServer Pro. The AirSpeed units will allow material to be moved from the Unity system for local playback in Studio A productions. They will also allow for recording of productions and transfer to the Unity system for further editing and show finishing. Each AirSpeed server is capable of either one record or two playback streams. Ideally one of the AirSpeed units would be used for recording the production and the other for clip play out. There are two XDCam VTR's and two DVD recorder/players. The DVD recorders allow students or teachers to walk away from a production with an easily reviewed copy of the production. Six LCD monitors and two multi input audio monitors allow monitoring of the servers and VTR's. The VTR position will need a computer linked to the Unity system to allow for AirSpeed media transfer. An LCD on an arm is located to the left of the VTR position for this purpose.

The graphics position includes an LCD computer monitor on an arm and the Pinnacle Deko keyboard. All positions include a dedicated intercom station.

3.4 Audio Room

The Audio Room will contain the digital audio mixer. It will have 32 analog inputs, 12 analog outputs and one stereo AES output. The mixers internal processing is digital and it can be upgraded to have additional digital I/O in the future. Also located in the audio room are a digital cart machine, CD player, and an analog telephone interface. Audio monitor speakers are provided for program left and right audio and one channel of cue. Six LCD monitors provide for camera and program/preset monitoring. The central IFB control station will be in the audio room along with the wireless intercom base station.

3.5 Rack Room

The rack room will contain two equipment racks that will accommodate the majority of the equipment frames and patch bays. All the equipment requiring operator control will be located in the production control room. Separating the equipment racks from the production space will reduce noise and heat in the production space. An additional benefit of the separate rack room is the added security it provides against well meaning but unauthorized adjustment of the core systems.

The rack room will house several core systems:

- 64x64 multi bit rate SD SDI and HD SDI routing matrix.
- 64x64 stereo analog audio routing matrix
- Router controller
- Switcher mainframe
- Patch panels
- Reference and test signal generator
- Distribution and processing frames
- Camera CCU's
- Intercom power supplies

3.6 Observation Room

The Observation room will be resized to accommodate the larger production control room and will have both video and audio monitoring. Remote cameras will give a wide angle view of the studio floor and a close up view of the Technical Director's control surface. Talkback capability to the production control room and studio will be included. A work surface at the observation window will provide space for note taking and laptops.

4 Technical Requirements

The criteria listed below have been used to develop the appended preliminary broadcast systems designs and conceptual architectural plans. The requirements appearing herein will also form the basis for further design development and final systems engineering, subsequent to project funding.

4.1 Studio

4.1.1 General Observations

1. All code requirements, including Title 24 Handicapped Persons Access and ADA provisions must be met.

2. The Studio is immediately adjacent to the Production Control Room, Audio Booth, and Observation Room, and is proximate to the Equipment Room Room. Although there is currently direct line of sight between the Production Control Room and the Studio, this is not required. Interaction between operators / instructors within the Production Control Room and Observation Room and be accommodate via video monitoring and intercom/talk-back functionality.
3. The Studio will be accessible from an existing 4'-0" wide door opening onto a vestibule off the main access corridor. This door will remain and primarily accommodate foot traffic into and out of the Studio, but will also allow sets and "grip" equipment to be transported between an adjacent Set Shop / Storage Room and the Studio.
4. The renovated Studio should be designed to accommodate a variety of sets, including an Interview Set and News Set.
5. A theatrical lighting grid currently exists and is to remain. This grid should be reinforced with "Rota-lock" type connectors at each of the intersections and augmented with "removable" cross supports accommodating additional rigging positions. The removable cross supports will also be secured using 'rota-lock' hardware. We anticipate that approximately twenty-four (24) 4'-0" lengths of Schedule 40, 1.5" inside diameter steel pipe and sixty (60) rota-locks will be required.
6. Safe rigging points for suspension of paper rolls and various pieces of miscellaneous equipment (e.g., speakers, microphones, light set pieces, etc.) should be provided on the grid. These rigging points should include safety chains and a secure "over-clamping" method that encircles the pipe.
7. The existing acoustic ceiling above the Studio has, unfortunately, been finished using improper "bridging" type paint that has substantially reduced acoustic absorption characteristics of the ceiling tile. As part of the renovation, we recommend that the existing finish ceiling within the Studio be removed and replaced with a spray-on acoustic insulation product. This modification will "clean-up" the existing ceiling, add height to the interior of the Studio, and restore the acoustic absorption required at the ceiling plan to affect proper reverberation control.
8. Interior ceiling height should be maintained at a minimum of 19'-0" clear to facilitate lighting grid use and new work lights mounted above the grid.

9. The existing curtain track should be replaced with a dual, non-motorized, 360-degree curtain track. A track switching mechanism should also be provided. This curtain track will create a "soft" cyclorama and backdrop for the various sets. This "soft cyc" should have radius coves of 12" minimum.
10. It is unknown whether the existing drapery curtain complies with current NFPA codes for flame and smoke spread within a broadcast studio. As such, we recommend that the new curtain track be outfitted with a new "Rosebrand" 118", 18-ounce 'Commando' series theatrical curtains fabricated from class-A fabric, flame spread less than 25.
11. A radius curve in the drywall at the base of the rear Studio wall currently exists. This "base cove" does not really provide the benefit one would anticipate from a true hard cyclorama (i.e., a "horizonless" backdrop to sets). However, as the current program criteria do not include a hard cyc, this feature will remain unmodified.
12. One wall of the Studio should be painted for Ultimatte Blue or Green for chroma-key work.
13. The floor of the Studio must be of level such that television cameras may be rolled across the floor without affecting the television picture. This requirement typically implies a floor which is level within 1/8" over 20'. The existing floor should be checked for level and 'floated' as required. Use 'Ardex' K500, self-leveling floor compound to affect leveling.
14. Emergency lighting (strobe) and audible life safety systems must be provided.
15. "Recording" warning lights should be installed at the major entrance points to the Studio. These lights should be capable of being activated from within the Studio, and both the Production Control Room and Observation Room.

4.1.2 Structural Considerations

1. Structural reinforcement for the lighting grid may be required. A design load of 125 lbs. per linear foot across the grid should be assumed.

4.1.3 Acoustical Considerations

1. The interior acoustics within the Studio should promote good speech articulation and minimize adverse acoustic interference that may affect the quality of the audio recording.

2. The ambient noise level within the Studio should be commensurate with its functional use and adhere to, as closely as possible, generally accepted industry standards.
3. Typically, a maximum Noise Criterion value of 20 is considered optimum for a Studio in which sound recording is to take place. This value equates to approximately 28 dBA of "background noise" in an unoccupied room with the HVAC system in operation. The existing base ambient noise level within the Studio should be measured and charted using a properly calibrated sound pressure level meter outfitted with octave-band filters. In the event the resultant sound pressure levels do not adhere to the prescribed NC 20 value, appropriate HVAC noise mitigation measures should be affected as outlined within the guidelines appended to this document.
4. To assist in achieving the stated acoustic criterion, the Studio should be adequately isolated from airborne noise intrusion. Specific values for transmission loss characteristics of partitions demising the Studio will be developed in due course.
5. The recommended reverberation (or sound field) decay time associated with the Studio should not exceed .40 seconds. To achieve this value, we recommend that appropriate sound absorptive, reflective, and diffusive surfaces be created within the Studio. Our recommended acoustic surface treatments appear within the appended Conceptual Design.

4.1.4 Electrical Considerations

1. The electrical system servicing the Studio should be sized to accommodate all currently anticipated loads and provide for approximately 10% future expansion.
2. 20 Amp, ground-isolated electrical receptacles should be provided to service audio/video equipment mounted at, or near the lighting grid level. Based on the size of the current lighting grid, we suggest that such receptacles be located approximately 8'-0" on center, and that a minimum of twelve (12) receptacle locations be installed. The location of these receptacles shall be determined during the design development phase of the project. The receptacles should be connected to the "technical power" panel reserved for servicing electronic broadcast equipment (not theatrical lighting).
3. Branch circuits servicing equipment within the Studio should possess oversized neutrals to accommodate over current conditions associated with switching power supplies on electronic equipment. Current overage on the neutral can be double that measured on other power conductors.

4. Both ground-isolated "technical" power, and non-isolated convenience receptacles should be provided within the Studio. All audio and video equipment will be powered from ground-isolated receptacles.
5. Theatrical lighting wall boxes with electrical receptacles will be required around the perimeter of the Studio to provide service to theatrical lighting instruments mounted on floor stands, or foot light instruments.
6. Electrical service will be required for the lighting grid. The nature of the service will vary depending on whether a "centralized" or "distributed" system is employed (see discussion under Lighting, below). Transformer power required to service the theatrical lighting is approximately 165 kVA (demand load referenced to single phase 120VAC).
7. Ground feeds should be made available at wall select wall outlets within the room so that proper electronic grounding can be facilitated.

4.1.5 Mechanical Considerations

1. The heating, ventilation, and air conditioning (HVAC) system servicing the Studio should be capable of maintaining a constant temperature range of 70 - 74 degrees, 24-hours a day, 365 days a year.
2. The anticipated load from the Theatrical Lighting system necessitates approximately 35 tons of sensible cooling (see appended Studio Lighting Load Calculations).
3. The HVAC system should operate free of unwanted noise, and comply with the stated Noise Criterion.
4. The HVAC system servicing the Studio should be on a single zone with the thermostatic control sensing temperature only in the Studio.
5. The thermostatic control used in the Studio should be a direct-digital control model (i.e., must not be pneumatic type).
6. Filtration is not required.
7. No special de-humidification or humidification is required in this room.
8. As yet, no requirements exist for specialized fire suppression systems. Building standard, wet-pipe sprinkler systems are sufficient. However the existing sprinkler heads should be caged.

4.1.6 Studio Lighting Considerations

Dimming and Control System

1. The Kliegl dimmer system used in Studio A, circa 1972, has long ago reached the end of its serviceable lifetime. This equipment is no longer manufactured and replacement parts have become difficult to obtain. Ongoing maintenance of this equipment will continue to be more difficult and expensive. This system is also quite inefficient when it comes to electrical energy, particularly when compared to currently available technology. These dimmers and related controls should be taken out of service and replaced as soon as possible.
2. The existing grid-mounted circuit distribution system, consisting of raceways, wiring, and connectors, is also in desperate need of replacement. The poor condition of this equipment, along with its age makes repair economically infeasible. Greater operating efficiency and energy savings can be gained by complete replacement of this equipment. Additionally, this will create a safer studio work environment.
3. It is also very important to note that asbestos is typically present within equipment of this vintage. The matter of asbestos abatement and removal should be confirmed, and if present addressed immediately and directly by WSU.
4. There are two types of dimming systems to be considered; conventional, centralized rack based dimmers, or a system of distributed-type dimming equipment.
5. The centralized system would require space in the existing dimmer room for the new rack, and will also need to have new connector strips and cable runs installed from the rack room to the grid. A DMX network connection would be needed to the rack with inputs in the Production Control Room as well as in Studio A.
6. The centralized system provides a more traditional solution, with dimmed circuits hanging from connector strips mounted to the grid.
7. A distributed system would have all dimmers mounted in the grid (and at studio floor level), requiring no space in the existing dimmer room. This equipment will need installation of 3-phase, 120VAC power points at locations throughout the Studio, as well as a DMX control network running to each unit, with inputs in the control room and studio.

8. An advantage of the distributed system over the centralized approach is that the equipment can easily be moved around the Studio and placed where the dimmers are needed for a production. This flexibility often allows the installation of fewer dimmers to meet production requirements.
9. The economic and functional advantages to each of these systems should be evaluated in order to select the approach that meets the long term needs of WSU. We have provided a comparative analysis of theatrical equipment cost that has been appended to this document.

Lighting Fixtures and Grip

1. The existing lighting fixtures and related grip equipment are outdated and have become operational liabilities. Replacement parts for most of the inventory are no longer available, as these units have not been manufactured for several years.
2. Many of the fixtures do not have control accessories (barn doors, gel frames, etc.), which makes them somewhat useless in production and most teaching applications. In addition, the electrical components of the fixtures have aged to the extent that many are not safe to operate. The current condition of the fixtures is also causing premature aging and failure of lamps, which further increases studio operating costs.
3. We recommend replacing the existing fixtures with a package combining fluorescent and quartz instruments possessing a variety of control accessories.
4. The current grip equipment is dangerous and should be replaced immediately. The “Beck Bars” currently in use present a danger to students, staff, and talent as they do not provide a secure means of mounting fixtures or the units themselves to the grid.
5. The recommended replacement grip equipment package would feature adjustable grid hangers, various clamps, and safety cables. A complement of flags, scrim, overhead arms, gobo heads/arms, and stands would be included.
6. Approximately 230 kW of circuited power will be required to accommodate the connected load associated with theatrical lighting. However, please note that the actual demand load (per NEC 530-19a) is only 165 kVA.

7. The existing High Intensity Downlights (HIDs) located within the area designated to be remodeled will remain and be used as "Work lights".

4.1.7 Video and Audio Systems Design Considerations

1. Interconnections between Production Control Room and the Studio, and between the Equipment Room and the Studio should be available at wall-mounted Broadcast Service Panels (BSPs) within the Studio. These interconnections should facilitate audio (both mic and line level), video, camera, and control signal distribution.
2. The camera complement in Studio should include four studio cameras with SMPTE 311 hybrid cable studio kits.
3. A complement of hand mics, lavalier mics, mic stands and related accessories should be included in the audio package for the Studio.
4. Studio video monitoring, Audio PA, intercom / IFB, and talkback should be provided between the Studio, Production Control, and the Observation Room.

4.1.8 Special Telecommunications Requirements

1. Building standard voice/data outlets will be required within the Studio.
2. A separate Production sub-net should be considered.

4.2 Production Control Room

4.2.1 General Considerations

1. The Production Control Room will function as the primary broadcast production control room. Students within the Production Control Room will function as production personnel for programs originating in the Studio. Instructors will assist and oversee the activities in the Production Control Room from an adjacent Observation Room.
2. The room should be configured to accommodate operators / production personnel at a front or main console position, center console, and a rear "audio" position. A total of eight (9) positions should be created for: Technical Director, Director, Associate Director, Producer, Graphics, Tape Operator (2), Camera Shading/Quality Control, and Audio Engineer.

3. Direct line of sight to the Studio is not required, as production monitoring will be provided via a bank of video monitors.
4. Direct line of sight between the Observation Room and the Production Control Room is required.
5. All code requirements, including Title 24 Handicapped Persons Access and ADA provisions must be met.
6. Emergency lighting (strobe) and audible life safety systems must be provided.
7. The room design should accommodate changing technologies.

4.2.2 Acoustical Considerations

1. In the portion of the Production Control Room used for audio production, room acoustics should promote stereo monitoring of dynamic program material in a near-field environment. The frequency response required for these near-field monitors will be 70 Hz to 16 kHz (+/- 3 dB - equalization acceptable).
2. The Noise Criterion should be NC 20-25 (approx. 28 - 33 dBA SPL) with all electronic equipment in the room powered off.
3. Acoustic isolation between the Production Control Room and adjacent areas should be provided so as to achieve noise criterion within Production Control and surrounding technical spaces.
4. Appropriate placement of absorptive, reflective, and diffusive acoustic surfaces should be employed to facilitate accurate audio monitoring and speech intelligibility between operators within Production Control.

4.2.3 Electrical Considerations

1. The electrical system servicing Production Control should be sized to accommodate all currently anticipated loads and provide for approximately 20% future expansion.
2. Branch circuits servicing equipment within Production Control should possess oversized neutrals to accommodate over current conditions associated with switching power supplies on electronic equipment. Current overage on the neutral can be double that measured on other power conductors.

3. Both ground-isolated "technical" power, and non-isolated convenience receptacles should be provided within the Production Control Room. All audio and video equipment should be powered from ground-isolated receptacles.
4. Ground feeds should be made available at technical equipment rack locations so that proper electronic grounding can be facilitated.
5. Emergency power is not required. However, 15-minute UPS back up should be provided to facilitate an orderly shutdown of equipment.

4.2.4 Mechanical Considerations

1. The heating, ventilation, and air conditioning (HVAC) system servicing the Production Control Room should be capable of maintaining a constant temperature range of 68 - 72 degrees, 24-hours a day, 365 days a year.
2. The HVAC system should operate free of unwanted noise, and comply with the stated Noise Criterion.
3. The HVAC system servicing the Production Control Room should be on a single zone with the thermostatic control sensing temperature only in the Control Room.
4. The thermostatic control used in the Production Control Room should be a direct-digital control model (i.e. must not be pneumatic type).
5. No special de-humidification or humidification is required in this room.
6. No requirements exist for specialized fire suppression systems. Building standard, wet-pipe sprinkler systems are sufficient. However, we would like to suggest obtaining a bid alternate for a pre-action, dry-pipe configuration.

4.2.5 Special Lighting Considerations

1. Even, well controlled, task lighting should be provided within the Production Control Room. Lighting should be designed and installed so as to evenly light the tops of work surfaces without creating unwanted glare in the video monitors located at the front of the room, and within the vertical faces of the console.

2. The task lighting installed should be positioned so as to effectively "cross-light" the keyboard associated with the main edit controller. This cross-lighting will eliminate unwanted shadows from developing across the keycaps.
3. All task lighting within the Production Control Room should be capable of being varied in intensity. Any dimmers installed to provide this capability shall operate free of noise, and shall not create unwanted "filament buzz" within the lamps installed.
4. Task lighting should be of the low voltage, incandescent type. The fixtures should be "lamped" with bulbs providing a high Color Rendering Index (CRI). A color temperature of approximately 3500 Kelvin delivered by lamps possessing a color rendering index (CRI) of 98 is assumed sufficient for this purpose.
5. The lighting should be designed in various zones to facilitate flexibility in room lighting. The selection of different "scenes" should also be possible.
6. Zone / Scene control should be facilitated by an architectural lighting controller which is easy to use for non-technical operators.

4.2.6 Video and Audio Systems Design Considerations

1. The systems design should be integrated with the architectural design of the Project. Provisions should be made for concealment of electronic wiring to achieve a clean, uncluttered, professional systems installation.
2. Cables interconnecting this room with the Equipment Room should be run through cable ways to a nearby partition, and then up to be conveyed within an overhead conduit / cable tray system.
3. Extensive patching / matrix switching should be incorporated within the systems design to promote flexibility within the overall electronic configuration of the facility.
4. Operator equipment for this room should be installed within custom equipment consoles. This console should not exceed 42" in height to preserve acoustic integrity.

5. A main monitor wall should be installed at the front of the room.
6. Audio communications between Production Control Room operators and production staff working within the Studio should be facilitated via a production IFB (intercom fold back) system. Communication with on-camera talent will also be accommodated via this system.
7. The Production Control Room should be equipped with a broadcast quality, digital video switcher.

4.1.7 Special Communications Requirements

1. Equipment within the Control Room will likely require Fast Ethernet connectivity (100 BaseT) to Servers.
2. Consideration should be given to fiber optic connectivity supporting fiber channel architecture and Gigabit Ethernet.
3. Building standard voice/data outlets will be required within the Production Control Room.
4. A separate Production sub-net should be considered.

4.3 Equipment Room

4.3.1 General Observations

1. This room will function as the electronic hub of the facility. The room will be populated with rack cabinets containing video control electronics, an audio/video router, patch bays, test equipment, intercom, tape machines, servers, storage devices, terminal equipment, graphics generators, and other equipment required to support facility operations.
2. Additional equipment in this room may include the master sync generator, master timecode generator, master clock standard generator.
3. A high quality monitoring station consisting of a color critical monitor, audio monitor, and waveform monitor and vectorscope should also be provided in this room.
4. All code requirements, including Title 24 Handicapped Persons Access and ADA provisions must be met.

5. Emergency lighting (strobe) and audible life safety systems must be provided.
6. The Equipment Room should be in close proximity to the other technical production spaces.

4.3.2 Structural Considerations

1. Seismic bracing at the equipment racks may be advisable. This would typically require connecting the top of the racks to the structure above using diagonal bracing set at 45-degree angles to the front and back vertical face of each rack. This type of bracing may be concealed within a soffit constructed above each rack cluster.
2. However, if cable tray is installed atop the open frame racks that are seismically restrained via connection to the side walls and/or ceiling, bracing the individual racks may not be required.

4.3.3 Acoustical Considerations

1. Interior acoustics treatments should be specified to reduce machine noise.

4.3.4 Electrical Considerations

1. The electrical system servicing the Equipment Room should be sized to accommodate all currently anticipated loads and provide for approximately 30% future expansion.
2. Ground-isolated, voltage conditioned, "technical" power should be provided for all electronic audio/video equipment within the Equipment Room. Additional non-technical power (general service) receptacles should also be provided.
3. Power should be distributed to the racks via electrical raceway located above or behind the rack lay. Individual power strips located in each rack would be connected to ground isolated receptacles mounted in the raceway.
4. Ground feeds should be made available at the technical equipment rack locations so that proper electronic grounding can be facilitated.
5. It is not necessary that the technical power sub panel(s) be located within the Equipment Room, although this may be a convenient location for technical power branch circuit distribution.

6. Emergency power is not required. However, 15-minute UPS back up should be provided to facilitate an orderly shutdown of equipment.

4.3.5 Mechanical Considerations

1. The heating, ventilation, and air conditioning (HVAC) system servicing the Equipment Room should be capable of maintaining a constant temperature range of 68 - 72 degrees, 24-hours a day, 365 days a year.
2. The HVAC system should operate free of unwanted noise, and comply with the stated Noise Criterion.
3. The HVAC system servicing the Equipment Room should be on an independent zone.
4. Special attention needs to be given to delivering forced, cool air to the equipment racks. Air should be forced down over (or in front of) each rack area, possibly by installing a supply register over alternate racks.
5. As yet, no requirements exist for specialized fire suppression systems. Building standard, wet-pipe sprinkler systems are sufficient. However, we would like to suggest obtaining a bid alternate for a pre-action, dry-pipe configuration.

4.3.6 Special Lighting Considerations

1. Even, indirect fluorescent-type lighting should be installed within the Equipment Room. Lighting shall be designed and installed so as to evenly light the floor space and racks without creating unwanted glare in the video monitors located within the vertical faces of select equipment racks.
2. The fluorescent lamps selected for use in the Equipment Room should be color-matched to the color-corrected, low voltage incandescent lamps used in the Production Control Room. A color temperature of approximately 3500 Kelvin delivered by lamps possessing a color rendering index (CRI) of 98 is assumed sufficient for this purpose.

4.3.7 Video and Audio Systems Design Considerations

1. The systems design should be integrated with the architectural design of the Project. Provisions should be made of concealment of electronic wiring to achieve a clean, uncluttered, professional systems installation.

4.3.8 Special Telecommunications Requirements

1. Equipment within the Equipment Room will require Fast Ethernet connectivity (100 BaseT) to Video Servers.
2. Consideration should be given to fiber optic connectivity supporting fiber channel architecture to raid-array storage devices.
3. A multi-strand, multimode fiber tie cable and/or a series of CAT6 UTP tie cables should be installed between the Equipment Room and the Intermediate Distribution Center (IDF) located elsewhere on the floor. This tie cable may be required for outbound signal transmission over the WAN.
4. A separate Production sub-net should be considered.

4.4 Observation Room

4.4.1 General Considerations

1. All code requirements, including Title 24 Handicapped Persons Access and ADA provisions must be met.
2. The Observation Room should be directly adjacent to the Production Control Room and proximate to the Studio.
3. The room should be designed to accommodate two (2) seated faculty members. Countertop workspace should be provided for instructors to use when evaluating students.

4.4.2 Acoustical Considerations

1. Sound isolation should be provided to ensure that occupants do not disturb students during production activities within the Control Room.
2. The Noise Criterion should be NC 30 - 35 (approx. 38 - 43 dBA SPL) with all electronic equipment in the room powered off.

4.4.3 Electrical Considerations

1. The electrical system servicing the Observation Room should be sized to accommodate all currently anticipated loads and provide for approximately 5% future expansion.

2. Branch circuits servicing equipment within the Observation Room should possess oversized neutrals to accommodate over current conditions associated with switching power supplies on electronic equipment. Current overage on the neutral can be double that measured on other power conductors.
3. Both ground-isolated "technical" power, and non-isolated convenience receptacles will be provided within the Observation Room. All audio and video equipment will be powered from ground-isolated receptacles.

4.4.4 Mechanical Considerations

1. The heating, ventilation, and air conditioning (HVAC) system servicing the Narration Studio should be capable of maintaining a constant temperature range of 68 - 72 degrees.
2. The HVAC system should operate free of unwanted noise, and comply with the stated Noise Criterion.
3. The HVAC system servicing Observation Room can be zoned with the Production Control Room.
4. No special de-humidification or humidification is required in this room.
5. No requirements exist for specialized fire suppression systems in this room.

4.4.5 Special Lighting Considerations

1. Indirect lighting should be provided for general room illumination using 2 x 2 fluorescent indirect troffers.
2. Low voltage, low wattage, focused incandescent down lights should be installed to provide task lighting at the countertop. These lights must be "dimmable" to as to not distract activities within the Production Control Room.

4.4.6 Video and Audio Systems Design Considerations

1. Interconnections between the Observation Room and Production Control Room should be provided to support a "show progress" video monitor, intercom, and talkback functionality.

4.5.7 Special Telecommunications Requirements

1. Building standard voice/data outlets will be required at the workspaces along the counter.

General Acoustic Construction Notes

1. All framing shall be screwed together (metal) **OR** nailed and glued (wood). Glue shall be appropriate for adhering wood to wood. All wood and/or metal stud framing shall be horizontally cross-blocked at intervals no greater than 24 inches.
2. All layered sheathing (ie. multi-layered gypsum board) shall have the first layer attached to studs using screws. The second layer shall be screwed to the first. The final layer shall be attached to second layer using glue **only** (except where layers are applied to ceiling). Screws may be used to hold second layer in place while glue is drying. However, screws must be removed, and screw holes filled before painting and texturing. All seams in final layer shall be caulked and taped. All seams in sheathing shall be staggered. **Note: If second layer is final layer then specifications for application of final layer are to be observed.**
3. Screws shall be "Grabber" brand fasteners or approved alternate. Glue shall be appropriate for intended use, and of sufficient bonding strength to assure that glued layers will not be displaced. Caulk shall be "USG" brand acoustical sealant, no substitutions. Caulk shall be applied to all seams and perimeter joints of final layer of sheathing.
4. All gypsum board joints and corners shall be staggered.
5. All gypsum board shall be "x-core" type, square-edged, of USG manufacturer, unless otherwise noted on drawings.
6. Gypsum board attached to resilient mountings shall be attached according to manufacturer's specifications. Any future attachments made to the gypsum board (mounted on resilient channel) shall not make contact with the underlayer of gypsum board, or framing member, on which the resilient mounting is mounted.
7. All fiberglass insulation used shall be of the unfaced variety, or shall be paper faced on one side only and shall have the unfaced side oriented towards the wall cavity interior, unless otherwise noted on drawings.
8. All partition constructions surrounding acoustically critical spaces (i.e. floors, ceilings, walls, doors, windows, etc.) shall be constructed and/or installed as to be airtight.

9. All pipe, electrical conduit, low voltage wiring conduit, HVAC duct, etc. penetrating the sheathing associated with the sound critical spaces shall be surrounded with 1/4" Sponge Neoprene rubber, or neoprene "backing rod", at all points of penetration. Acoustical sealant shall be applied, in addition to the specified neoprene, to render any penetrations in said sheathing airtight. Acoustical sealant shall be "USG" brand, or approved alternate.

10. Upon completion of low voltage/electrical wiring installation, all low voltage/electrical wiring conduit providing room-to-room connections shall be sealed airtight. Recommended sealant for wiring conduit is "Nelson" brand, Type FSP, fire stop pillows or "Manville" brand, Duxseal applied over fiberglass insulation.

Typical Acoustic Finish Material Specifications

1. The following acoustic products shall be as manufactured by Kinetics Noise Control, and of model numbers as noted below. Kinetics products are available from Kinetics Noise Control, Inc. 6300 Irelan Place, Dublin, Ohio 43017. Tel. (614) 889-0480. Specific products are as follows:

NAFP-10 Partition Isolation Board - Load bearing partition isolation material to be installed under drywall partitions as indicated on drawings. Material shall consist of 7/16" thick, 10-PCF molded fiber glass, coated with a flexible moisture impervious membrane, factory bonded to 1/8" thick hardboard, sized to the exact width of the partition.

All Kinetics products shall be installed per manufacturer's specifications.

2. Vibration isolation springs specified for use in this work are to be "Mason Industries" brand, of model numbers and deflection rating as indicated on the drawings. Isolators are to be installed as noted on drawings and in accordance with the manufacturer's specifications.
3. Spray-on acoustic insulation applied to underside of the ceiling in the Studio shall be "International Cellulose Corporation" brand, Type K-13 spray-on insulation. Insulation shall be pigmented black. Insulation shall be applied to a uniform depth of 3" minimum.
4. Quilted, acoustic batts to be applied to the walls of the Studio shall be "Insul-Quilts, Inc." brand, type GF Insul-Quilt sound batts, installed as indicated within the acoustic details. Insul-Quilt products are available regionally from Thorpe Insulation Company, 2741 South Yates Avenue, Los Angeles, CA 90040. Tel. (213) 726-7171.

Isolated Electrical Power Distribution System Design Guidelines

1.0 General Guidelines

The following are to be used as general design guidelines in the design development of a technical power distribution system for the Facilities planned.

1. Provide an independent, "technical" power distribution system for electrical service to all audio/video equipment.
2. Power all audio/video equipment from the single-phase, 120-volt secondary of an isolation device (transformer). Said device should provide greater than 80 dB of common mode rejection, and should attenuate transverse noise by more than 50 dB.
3. Provide said isolation device sized as required, and having three separate electrostatic shields for isolation of the primary windings, the secondary windings, and the overall transformer section.
4. Specify an isolation device that is capable of also providing transient protection from voltage "spikes" and filtration of electrical "noise" in the 1 kHz - 50 kHz frequency range.
5. Locate the isolation device and all other transformers no closer than ten (10) feet from any Technical Equipment Area, or any technical equipment racks, to isolate low-level signal electronics from electromagnetic radiation generated by these devices.
6. Bond the primary shield, secondary shield, the overall shield, and the case of the isolation device to the building ground system via the electrical conduit system (non-technical equipment or mechanical ground).
7. Verify that the neutral and ground lugs of the secondary are not connected to the isolation device case, or the non-technical equipment ground. (Verify through continuity check.)
8. Verify that the neutral and ground lugs of the secondary are bonded together (as per NEC).
9. Bond the isolated ground lug of the isolation device secondary directly to the main building ground electrode - at the service entrance. Use a ground conductor of sufficient cross-sectional area to ensure that impedance (direct ground resistance) between the device secondary and the building ground electrode is less than 0.25 ohms. Cad-weld the isolated ground conductor to the building ground electrode as required.

10. Increase the cross-sectional area of the main building ground electrode (possibly through the installation of additional grounding electrodes connected in series) as required to ensure minimum ground impedance for the technical power system.
11. Connect the isolation device secondary (provide power) to a technical power distribution panel having separate ground and neutral busses, insulated from each other and from the panel.
12. Connect the neutral and ground busses of the technical power distribution panel to the isolated ground lug of the isolation device.
13. Provide non-technical equipment ground for the technical power panel through conduit connected to the case of the isolation device (said case has been connected to the building equipment ground).
14. Provide ground-isolated power receptacles (Ex. "Hubbell" brand IG-5362 model) throughout the Facilities and Technical Equipment Areas. Isolate the ground pin of each power receptacle from the conduit system.
15. Wire each isolated ground receptacle using three conductors of black, white, and green No. 10 or 12 wiring, insulated from the conduit at all points. Home run the ground and neutral conductors from each isolated ground receptacle back to the isolated ground and neutral busses in the Technical Power Panel. Oversize the neutral conductor in each run to minimize overcurrent conditions created by harmonics in switching power supplies associated with the technical equipment. Size the neutral conductors to No. 10 or greater.
16. If individual hot and neutral conductors are pulled in conduit, braid (twist) the hot and neutral conductors to reduce EMI field strength. Do not braid the ground conductor with the hot and neutral conductors.
17. Provide isolated ground receptacles for each individual piece and each component within a technical equipment rack.
18. Note: If plugstrips are used to power equipment within equipment racks, each receptacle in plugstrip should be wired individually. Individually wired receptacles assure that every powered device has a direct path to the unipoint (service entrance) ground without noise injected by other outlets. Also, if plugstrips are used within equipment racks, provide same with three-wire extension cords. Do not connect plugstrips within racks to power distribution system using rigid electrical conduit. Connect plugstrips within equipment racks to local isolated ground receptacles via extension cord.
19. For each technical equipment rack and auxiliary equipment rack, provide at least two spare isolated-ground 3-wire power receptacles in addition to those necessary to power each equipment item in the rack.

20. Provide an isolated ground buss bar in each technical equipment rack and auxiliary equipment rack. For each rack-mounted equipment item with 2-wire power cable, ground the equipment chassis to the ground buss bar in the rack with No. 12 insulated stranded wire through a spade lug underneath a self-tapping metal screw and lockwasher on the equipment chassis. Clear termination points of any coating or paint and treat termination with "Cramolin" brand cleaner and preservative.
21. Provide an additional ground feed, using a no. 12 conductor, to each technical equipment rack. Bond this additional ground conductor to the isolated ground buss bar in the technical equipment rack.
22. Bond isolated ground buss bars within technical equipment racks to a local "ground enclosure" via appropriately size conductors. Said ground enclosure should possess a ground bar equipped with numerous ground lugs to accommodate connection of several conductors (run from nearby equipment racks).
23. Bond local ground enclosures to isolated ground buss bar within the technical power distribution panel.
24. Conduits or raceways carrying system cables to the equipment racks should not contact equipment racks. Use insulated bushings and clamps as required. Outlet boxes housing IG duplex receptacles must not contact the rack.
25. Isolate the technical equipment racks and auxiliary equipment racks from metallic conduits or any other metallic construction. Use insulated flexible conduit for connection of power to the technical equipment racks or provide connection via extension cord from plugstrips, as noted above.
26. Route audio/video signal cables in cable tray and/or conduit of non-metallic construction; conduit to possess a minimum diameter of 2", and be sized for 40% fill with all present and future proposed conductors within the conduit. Provide trough wireways for the distribution of large cable bundles between all present and future Technical Areas.
27. Provide separate conduit for each of the following wiring groups:
 - a. Audio Microphone and line level cables (-60 to +30 dBM).
 - b. Speaker level cables (above +30 dBM).
 - c. Video cables.
 - d. Power conductors.
 - e. Ground conductors.

28. All electrical conduit should be placed a minimum of 12 inches away from any audio (or other low voltage) wiring conduit or trough, when running in parallel with said audio (or low voltage) conduit. If electrical conduit must cross with audio/low voltage wiring conduit, the point of intersection should be at 90 degrees. Also, any electrical conduit crossing audio/low voltage conduit, and coming into direct contact with same, should be electrically isolated by neoprene rubber at the point of intersection.

The above are guidelines only. The design of any electrical system should follow applicable local building codes. Good electrical engineering practices should be employed in the design of the system being considered.

Acoustical Guidelines for HVAC System Design

1.0 Acoustic Design Performance Criteria

1. The HVAC system designed to service the technical facilities should comply with the stated Noise Criterion value for each respective space within the Facility.
2. The HVAC system should be designed to meet specified NC value as measured at a point 1 meter from air diffuser/register.

2.0 Vibration Control - General

1. All mechanical units possessing motor driven systems that are to be used in the HVAC system (i.e., compressors, etc.) should be appropriately vibration isolated.
2. In general, vibration isolation systems employed should be of the spring type possessing a minimum static deflection of 2 inches. However, calculations should be performed to select the appropriate deflection rating for the given conditions. A 95%+ degree of vibration isolation should be achieved.
3. All ductwork connected to the main mechanical unit should be vibration decoupled by inserting a neoprene flexible connector between the ducting and the unit (ex. "Durodyne" brand, neoprene flex connector).
4. All ducting suspended from, or attached to, any partition or device that is susceptible to vibration inducement (ie. metal roof decking, process piping, etc.) should be appropriately vibration isolated. Methods used for vibration isolating ducting are identical to those mentioned under Item 2, above, excepting that the minimum static deflection should be 1 inch.

3.0 Compressors, Fans, and Other Motor Driven Systems - General

1. All motor driven systems should be checked for proper rotational balance subsequent to installation. Any deficiencies in said system should be corrected by proper alignment.
2. Any fan used in the HVAC system should be a low noise type. Any fan considered for use must have current sound power level data supplied by the manufacturer.
3. All fans used in the HVAC system should be properly vibration isolated.
4. All process piping connections to motor driven systems should be vibration decoupled using an appropriate in-line neoprene-type coupler.

5. All electrical connections that are made to mechanical units should be vibration dampened before passing through any adjoining partitions (i.e., roof decking). A sleeve of roofing tar, and/or neoprene pipe insulation may be used to accomplish the required vibration damping. Electrical conduit used to provide electrical connection to the mechanical unit should be of the flexible type where permitted by local codes.
6. No rigid connections should be made to any mechanical which would compromise the installed vibration isolation system.

4.0 Ducting - General

1. A combination of lined sheet metal ducting, acoustical flexible fiberglass duct, commercially available "Duct Silencers", "Turning Vanes", and/or "Acoustic Plenums" should be used to achieve the required noise reduction and the desired NC value.
2. In the portion of the HVAC system servicing the sound critical rooms, rigid fiberglass ducting or flexible fiberglass duct should not be used in duct runs exterior to the "outer shell" of said rooms (i.e., the area between the roof decking the ceiling of said rooms). Use only acoustically lined sheet metal ducting for the aforementioned duct runs. Flexible or rigid fiberglass duct is acceptable to use between the outer and inner shell constructions of the sound critical rooms.
3. In general, the minimum thickness of duct lining used should be 1.5 inches. However, calculations should be performed to determine the appropriate thickness and type of duct liner for the given criteria and conditions.
4. Acoustic turning vanes should be inserted to reduce air friction where right angle turns occur in metal ducting.
5. When flex duct is used in the HVAC system, care should be taken to position the diffuser to be connected to the flex duct at a 90 degrees to the main ducting (i.e., flex duct drops should be kept perpendicular to the main duct).

5.0 Volume Dampers - General

1. Any volume dampers used in the HVAC system should be of the opposing blade type.
2. All volume dampers should be installed a minimum of ten duct diameters upstream from the nearest diffuser (i.e., if duct is 10" in diameter damper should be 100 inches upstream from diffuser).

6.0 Terminal Devices (Diffusers, Registers, Grilles, etc.)

1. All supply diffusers used in conjunction with the HVAC system servicing the sound critical rooms should be ordered and installed **without** movable louvers and internal volume dampers.
2. All individual terminal devices within the sound critical rooms should be attached to the supply fan, and also the return opening, via separate isolated duct lines (where possible). The separate duct lines may be connected to a main feeder plenum(s) (preferably located near the compressor fan).
3. All terminal devices used in the sound critical rooms should be rated a maximum of -5 dB below the Noise Criteria value specified for the area being served by said diffuser, etc. This implies that if the criterion for a room is NC 20, then all terminal devices servicing said room must be rated a maximum of NC 15 for the design velocity chosen.
4. Terminal devices servicing sound critical rooms should be mounted in such a manner as to eliminate any mechanical vibration. An application of neoprene rubber (ex. "Pemko" brand weather stripping tape) around the perimeter of the device to dampen vibration is recommended.

7.0 Face Velocities @ Diffusers - General

1. The following air velocities (in feet per minute - FPM) should typically not be exceeded within the last 10 feet of ducting prior to the face of the diffuser (for the NC ratings indicated).

<u>NC Level</u>	<u>Velocity at Face of Diffuser</u>
15	300 FPM
20	350 FPM
25	425 FPM
30	500 FPM

8.0 Duct Penetration Through Partitions

1. All penetrations in constructed partitions should be vibration decoupled using neoprene rubber between the device and the penetration cut-out. After the device is inserted in the penetration cut-out, the perimeter of the neoprene decoupled device should be caulked using "USG" brand Acoustical Sealant to render the penetration airtight. An alternate method of acoustic decoupling would be to use a neoprene-type flexible connector placed in the duct line either before or after the penetration. However, if such a flexible connector is used, the connector should be insulated against sound transmission through the connector wall.

The above are guidelines only. The design of any HVAC system should follow applicable local building codes. Good mechanical engineering practices should be employed in the design of the HVAC system being considered. In the case of a HVAC system designed for use in acoustically critical areas, the proposed system design should be reviewed by the project acoustical consultant to ensure compliance with the stated performance criteria.