SECTION 27 41 16
GROUP III AUDIO-VIDEO SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor shall read, review and understand all documents listed below prior to bidding or proceeding with work. The Contractor shall also refer to and understand all other related documents indicated herein.

B. This section of the Specification

C. Division 1

1. Applicable provisions of Division 1 (or other "general conditions" section made part of the Contract) shall govern all work under this section.

D. Contract

1. In addition to the conditions and work described herein, all conditions of the Contract shall apply.

E. EAV Equipment Schedule, observing:

1. Product descriptions

2. Manufacturers' names and model numbers.

3. Quantities (to be confirmed by Bidder) for base pricing.

4. Listed additive and/or deductive alternates.

F. Audio/Video (AV) System Drawings

G. G. Other Drawings

1. Related Architectural Drawings; for reference only.

2. Related Electrical Drawings; for reference only.

a. Drawings with "E" prefix identify all power requirements of the project including dedicated transformer(s) and panel boards as required for audio/video purposes.

b. Drawings with prefix "EA" identify electrical rough-in including conduit, junction and pull boxes, et cetera, for use in distributing audio/video signal levels..

c. "EAP" drawings, as follows:

1) For Classrooms:

a) EAP" drawings identify required AV signal-level conduit and backboxes and, also, locations for receptacles and hard-wired power circuits serving audio/video purposes. Power required for AV in the subject spaces shall be provided according to the

EAP drawings. Distribution and panel loading shall be determined by the Electrical Contractor using the information on these drawings. Work described by "E", "EA" and "EAP" drawings is not included in this Section.

2) For Theater, Lecture Hall and Television Studio:

a) "EAP" drawings identify required locations for receptacles and hard-wired power circuits serving audio/video purposes. Power required for AV in the subject spaces shall be provided according to the EAP drawings. Distribution and panel loading shall be determined by the Electrical Contractor using the information on these drawings. AV signal-level conduit for these spaces is shown on the "EA" drawings.

d. Work described by "E", "EA" and "EAP" drawings is not included in this Section (i.e., 274100) of the Specification.

3. Other, as appropriate, for reference only.

1.2 DEFINITIONS

A. The following definitions and acronyms are used in the AV Contract Documents and it is assumed that the reader understands their meaning.

1. ADA: Americans with Disabilities Act.

2. Ancillary Equipment Rack: The moveable equipment rack with equipment serving the main mixing console.

3. ASITG: Audio System Isolated Technical Ground.

4. Audio Video Panel: Input/Output panel for audio connectors and/or video connectors. (Single-use connector panels shown on drawings are, in some instances, identified ac-cording to use.)

5. AV: Audio/Video.

6. AVC: Section 27400 Contractor.

7. AVP: Used herein and on Drawings to abbreviate Audio Video Panel.

8. Bid: Herein, used interchangeably with "proposal."

9. "Burn-In" or "Break-In": The process by which components of a system are exercised and proven to function properly prior to being placed in service or prior to the system being completely assembled from those components. The intention is to detect and replace components that experience early failure, which is statistically more likely than failure during the remaining normal life of the product. The system can be trusted to be mostly free of further early failures once the burn-in process is complete

10. C.A.: Contracting Authority or recognized representative of the Contracting Authority.

11. Campus: State University of New York, Purchase, NY

12. CATV: Central or Master Antenna Television (broadband).
13. Center Cluster or Center Loudspeaker: Loudspeakers at center of proscenium.
14. Contracting Authority: The entity issuing the contract for the work of this section.
15. Contractor: Used herein to describe the AV Systems Electronic Integrating Contractor, as distinguished from the AV Systems Infrastructure Contractor.
16. Control Booth: Synonymous with “Control Room”. Unless otherwise noted, references that which is made part of the particular space being described.
17. Control Room: Synonymous with “Control Booth”. Unless otherwise noted, references that which is made part of the particular space being described.
18. Dedicated Movable Equipment: Equipment furnished for a specific facility and not considered part of an AV equipment pool.
19. Delay: When referring to audio signal, same as “electronic delay.”
20. DSP: Digital Signal Processor.
21. EC: Division 26 Contractor.
22. EE: Registered professional Electrical Engineer of record on this project.
23. Facility-Wide: For purposes of the Project, inclusive of the performance spaces and ancillary and technical support spaces; Lecture Hall and Classrooms according to the drawings.
24. Floor Box: Audio/Video/Power floor boxes.
25. Furnish: Supply, to Owner’s representative, all equipment, parts or materials not requiring installation. Such equipment, parts and material may be supplied loose but must be appropriately packaged. Excludes test equipment, et cetera, and “furnished” for use during system testing.
26. GC: General Contractor
27. General Contractor: The entity holding the prime construction contract for the project. Used herein without regard to how the contract for the work of this section is held. The term “Contractor”, herein, refers to the Audio/Video Systems electronics Integrating Contactor regardless of whether, or not, the contract for this section is held by the General Contractor or other contracting authority.
28. He, Him, His, et cetera: Third-person singular used without preference or regard to gender.
29. ICT: Information Communication Technology.
30. IHMP: In House Mix Position.
31. Incidental: A minor item or expense associated with this work that a reasonable person would believe to be included without requiring explicit description.
32. IR: Infrared.

33. Jack: A receptacle used to make electrical low-voltage signal connections via a cord-mounted plug.
34. Left Cluster: Loudspeakers at house-left with respect to audience members' view of stage.
35. MDF: Master Distribution Facility (IT Head-End).
36. MIAGP: Main Isolated Audio Ground Point (within audio equipment racks).
37. Mobile Equipment: Generally, equipment on wheels. Considered part of an AV equipment pool furnished as part of these systems.
38. Mobile Rack: See Ancillary Equipment Rack.
39. Movable Equipment: Generally, equipment that may be employed at various positions but requiring infrequent repositioning, or, requiring more effort to reposition than "Port-able Equipment". Considered part of an AV equipment pool furnished as part of these systems.
40. N.I.C.: Not included in AV Systems Contract.
41. Normalled: Connected through a patchbay so that no patch cable is required to make the subject connection. Unless otherwise noted, insertion of patch cable breaks "nor-mal".
42. Obvious Errors: Errors in the Specification, Drawings or Equipment Schedule that would be readily identified by technical personnel having the experience and training necessary to qualify for this work. (By example: Errors of omission – Equipment Schedule lists only two power amplifier channels for a bi-amplified stereo system.)
43. Others: Persons or contractors other than the Audio/Video Systems Contractor responsible for the work described by this section of the overall project Specification.
44. Owner: State University of New York or State University Construction Fund
45. Portable Equipment: Generally, equipment that may be readily carried or repositioned or deployed by one person.
46. Proposal: Herein, used interchangeably with "bid."
47. Provide: Unless otherwise indicated, requires contractor to furnish and install.
48. Right Cluster: Loudspeakers at house-right with respect to audience members' view of stage.
49. Terminate: Provide end-of-line impedance matching if specifically indicated, otherwise, synonymous with "connect" or "land".
50. Volume: Sometimes used in lieu of "level" or "sound pressure level" when the former may be confused with elevation or height and when the latter is cumbersome.
51. Work: When used as a noun, refers to the overall materials and labor required by the Contract to be provided or furnished.

1.3 SCOPE OF WORK

A. Complete System

1. Provide labor, and major and incidental equipment and materials as required to provide complete and operating systems according to the detailed information contained in the Contract Documents, the omission of minor details notwithstanding.

B. Contractor shall provide the following in accordance with the Contact Documents:

1. Submittals in a timely manner as described hereinafter.

2. Components

a. AV electronic and loudspeaker equipment.

b. AV interconnect equipment, as in cabling, wiring connectors, connector panels and associated accessories.

c. AV mounting and hanging hardware.

d. Equipment racks and associated accessories except as described as provided according to “AV Extended Infrastructure” (aka, Bulletin #74).

e. Power distribution within equipment racks made part of this work, ready for power connection as described in electrical section of building construction documents. Such power distribution include that required for racks provided ac-cording to “AV Extended Infrastructure” (aka, Bulletin #74).

f. Remote-control equipment and accessories.

g. Portable equipment.

h. Incidentals necessary for a complete working system.

i. Other, as indicated herein and elsewhere in the Contract Documents.

3. Safe mounting and rigging of all AV equipment especially equipment suspended over-head, such as loudspeakers.

4. Specialty Design

a. Programming of remote-control equipment including command codes and graphic user-interface design. Upon acceptance of the Work and prior to final payment, the Contractor shall provide to the C.A., the source code for all programmable integrated remote control systems including that for the central processing units and user interfaces. The source code for this project shall then become the property of the Owner.

b. Detailed design of Digital Signal Processor system “maps”, including remote-control accommodations.

c. Other, as indicated herein and elsewhere in the Contract Documents.

5. Initial testing and adjustments, demonstration of system for approval, participation in acceptance tests and final adjustments as required.

6. Record Documents including but not limited to "As-Built" drawings and Owner's Manual.

7. Training/instruction of operating personnel in the use of the various systems.

C. Contractor shall include the following coordination, verification, administration and quality assurance in their work under this Specification:

1. Verify correctness of Equipment Schedule with regard to quantities and model numbers with respect to the Drawings and System Descriptions herein.

2. Verify dimensions and other conditions at project site.

3. Review conduit system as shown in electrical section of building construction documents and, where applicable, as built. (During the conduit review process, Contractor is encouraged to communicate openly with Consultant and Architect to seek clarification when the intent of conduit usage and intended cable routes are not clear.)

4. Notify C.A. and other appropriate parties in a timely manner if AV design errors or construction conflicts are discovered.

5. Work cooperatively with other trades to resolve conflicts.

6. Meet requirements and milestones of Project Schedule.

7. Use equipment in the manner specified.

8. To the greatest extent possible, test electronic equipment, and, assemble and wire equipment racks off-site.

9. "Burn-in" or "Break-in" electronic equipment for 72 hours minimum.

10. Test cables and terminations for quality.

11. Provide warranty services for one year following acceptance of system.

12. Replace failed equipment.

13. Repair or replace with approved alternates, new components found not to meet manufacturers' specifications, when, in the opinion of the Consultant or C.A., such failure has an adverse effect on the installation.

14. In addition to submitted approved Shop-and-Field Drawings, provide field personnel with a copy of this Specification and the original AV, EA and EAP drawings for reference in the field.

15. Other, as indicated herein and elsewhere in the Contract Documents and as appropriate for a professional entity in this field.

D. Special Insurance

1. Provide insurance fully covering all equipment against loss and damage during shipment, storage, installation, testing, adjustment and demonstration.

E. Related Work NOT Included in the Scope of Work of this Section:

1. All conduits, cable trays, junction boxes, pull boxes, outlet boxes, installation of floor boxes, installation of in-ceiling loudspeaker backboxes made part of the wire raceway system.

2. All project AC power, including but not limited to:

a. Dedicated Audio AC power system.

1) AC power to individual equipment racks from dedicated AC power system.

2) AC power receptacles not within equipment racks but dedicated for audio use and served by the dedicated AC power system.

3) AC power receptacles not served by the dedicated AC power system but serving AV purposes.

4) Audio System Isolated Technical Ground (ASITG) conductors from the facilities main technical ground point(s) to Main Isolated Audio Ground Points (MIAGP) in AV equipment racks

3. All equipment and cable terminations provided by "AV Extended Infrastructure" (aka, Bulletin #74) including:

a. Provision and installation of all AV cable in conduit as described for "Group 1 AV Infrastructure"

b. Provision and installation of all steel-frame, fixed-in-place equipment racks.

c. Provision of all "long-frame jack" patchbays.

d. Termination of field cables at patchbays, as delineated in the Drawings and Equipment Schedule. (Termination of cables between patchbays and local electronic devices are made part of Group III AV Systems versus "AV Extended Infrastructure".

4. All architectural millwork required in support of the AV systems.

5. Work provided by Owner/C.A.

1.4 1.4 SUBMITTALS

A. The Contractor shall provide all requested submittals in a timely manner according to the descriptions below, and the following list. Prior to receipt of approval of Submittals, Contractor proceeds at his own risk with regard to purchasing and/or installation of equipment.

1. Within Two Weeks of Contract Award:

a. Testament of Understanding the Contract Documents

b. Milestone Dates

c. Project Personnel

2. Within Three Weeks of Contract Award:
    a. Conduit/Containment Verification
3. Prior to Equipment Purchase
    a. Shop and Field Drawings
4. Prior to Equipment Installation
    a. Rigging and Mounting Drawings
5. Prior to AV Commissioning (Checkout)
    a. Initial Testing and Adjustment Documentation
6. Prior to Completion
    a. Operating and Maintenance Manuals
    b. As-Built Drawings

B. Form

1. Submit all materials for review as described below, referenced to the Specification paragraph number (where applicable).
    a. Submit all material electronically by CD or DVD. Arrange folders on submittal disks with a naming convention that makes clear the contents of files which, otherwise, have no distinguishable names.
    b. Contractor drawings submitted electronically shall be plotted to PDF format and at the standard sheet size for the project. Thus, if the recipient chooses to plot to paper at 1:1, the drawing will fit properly on this sheet size. (This paragraph intends to assure that drawings are well defined and readable, whether viewed electronically or on paper.)
    c. On Submittal drawings, maintain 3/32" (or 2.5mm) minimum lettering height wherever possible. Submittals with text less than 1/16" (or 1.6mm) in height may be rejected.
2. Partial Submittals may be rejected.

C. Documents

1. Provide, prior to purchase, fabrication, assembly and installation of equipment and materials, the following documents for review by C.A. and other Owner's representatives:
    a. Provide written verification that:
        1) Contractor and all key personnel (as listed herein) have read and under-stood:
            a) This Specification Section in its entirety
            b) Without diminishing the importance of any other Specification paragraphs, read paragraphs relating to audio cable shield

grounding (Compliant shield grounding has been identified as a common area where installation errors occur.)

c) The Equipment Schedule made part of this Specification

d) The AV system drawings with prefix "AV".

e) The AV conduit system drawings with prefixes "EA" and "EAP".

(1) The Specification acknowledges that, in the course of the project, Contractor may require clarification information typical of projects of this scale. By providing this testament, Contractor is not waiving his right to request information.

b. Milestones- Provide schedule of work with milestones for following tasks:

1) Submittals complete.

2) Shop fabrication complete.

3) Shipment to site.

4) Installation.

5) Field testing.

6) Training.

7) First Event Date.

8) The scheduled project completion date will be provided to Contractor prior to making the contract. As of this date systems should be usable and substantially complete.

9) At the discretion of the C.A., Final Acceptance Testing and correction of "punch list" items may extend beyond the date for substantial completion. Contractor will be advised as to any changes in expected date of completion.

c. Personnel

1) Provide, in writing within four weeks after award of Contract, names, mailing address, phone numbers with extensions, email addresses and paging service numbers (if available) of following project personnel:

a) Administrative Project Manager.

b) Technical Project Manager.

c) Service and Installation Manager(s).

d) Field Foreman.

d. Conduit/Raceway Verification

1) Within three weeks after award of Contract, submit:

a) Statement confirming that Contractor has reviewed the conduit/raceway system as shown in electrical section of building construction documents and, where applicable, as built.

b) Notification to C.A. of deficiencies or inadequacies, if any, in conduit/raceway system design or installation. If none, so indicate.

e. Documentation of substitutions (described hereinbefore).

f. Shop and Field Drawings

1) Provide the following Shop and Field drawings for review and approval prior to purchase, fabrication or assembly of equipment:

a) System functional diagrams showing all wire-tag numbers or nomenclature to be used in the assembly shop or in the field.

b) For all wiring which cannot be accurately represented by one-line functional diagrams, provide detailed schematic wiring diagrams showing all wire-tag numbers or nomenclature to be used in the assembly shop or in the field.

c) System conduit/raceway plan or riser drawing showing wire type and wire fill including quantity of each wire type.

d) Patchbay layouts referenced to system functional diagrams.

e) Equipment rack layouts.

f) Shop drawings of all custom assemblies such as racks, panels, et cetera

g) Video projector installation details including methods, hardware and layout on project coordination plans (showing relationships with ductwork, piping, lighting, air diffusers, et cetera).

h) Physical arrangement and circuiting of AC power distribution within AV equipment racks.

i) Drawings detailing cable management including:

(a) Wire type and physical arrangement of wire ducts, trays, harness bars, et cetera.

(b) Major wire routes in racks according to signal groups.

(c) Transition at junction boxes and equipment racks.

j) Catalog sheets only if requested by C.A. or for products for which the Contractor has choice allowed by this Specification.

g. Rigging and Mounting Drawings

1) Mounting and installation details of AV equipment requiring integration with cabinetry or architectural elements.

2) Details, stamped and signed by an appropriately licensed engineer, of all equipment mounting methods and materials provided by the Scope of Work, wherein failure of method or materials used for mounting or hanging permanently installed equipment could result in serious personal in-jury.

a) Details provided by or requiring approval by licensed engineer may include: method of attachment to building structure or attachment and/or suspension points; method of attachment to supported equipment; all suspension materials; a materials list including specifications of all suspension materials; calculations used to determine loads and strengths of suspension materials; other as deemed necessary by the engineer.

b) In the absence of submitted approved, stamped and signed mounting and hanging details, the C.A. reserves the right to acquire such engineering approval at the expense of the Contractor. C.A. will notify Contractor of such intent. Contractor shall remedy within two weeks or C.A. may proceed without Contractor approval and without relieving Contractor from any other obligations set forth by Contract.

h. Samples

1) Color and finish samples as required by this Specification and, addition-ally, as may be requested by C.A.. In the absence of specific requests from the C.A., minimally submit samples of…

a) …each wall plate/panel finish type and color combination.

b) …each round, ceiling or wall-mounted, loudspeaker grille type

c) …for any AV furnishings provided by Scope of Work, samples of finishes including wood or plastic veneers, exposed cabinet hardware, et cetera.

D. Initial Testing and Adjustment Documentation

1. Submit at least two weeks prior to final acceptance testing.

2. Preliminary performance test results.

1.5 APPROVALS

A. Do not proceed with the Work until approvals required by the Contract and this Specification Section are granted by the C.A.

B. Receive written approval and editorial review from the Owner prior to publication of any references, articles, and/or acknowledgments regarding this project.

1.6 RECORD DOCUMENTS

A. Operating and Maintenance Manuals

1. Submit one paper set of Operating and Maintenance Manuals. Bind these in heavy-duty locking binders with steel hinges. Binders shall include heavy duty dividers and contain the following sections:

a. Table of contents.

b. Updated system functional descriptions edited by Contractor to reflect changes in systems made subsequent to award of Contract.

c. List of provided equipment, material, accessories, and loose items including quantities.

d. Complete instructions including:

1) System-specific operating instructions written by the Contractor to instruct current and future users how to run the systems whether or not those users have had the benefit of site training or oral history.

2) Equipment-specific operating instructions including manufacturers' manuals, arranged alphabetically by manufacturer and then by model number.

3) Tabular, graphic, or photographic record of settings and adjustments of semi-fixed controls not otherwise savable through software.

e. Test reports.

f. Key Schedule.

g. Copies of warranty amendment letters.

h. Copy of this Specification.

2. Submit three copies of the above on CD or DVD media. Include all of the above except for, or with the addition of, the following:

a. Do not provide a "Table of Contents". Instead, organize data in folders with clear organization and readily understood file names (e.g.: "Equipment/(manufacturer's name)/(model number)"; "Software/Remote Controls (room name)/(control system name)", et cetera).

b. Provide software settings and data files for all computer-controlled equipment.

c. Include DVD(s) shot during all Owner training sessions as recorded and edited by the Contractor.

d. Provide, in "pdf" format, manufacturers' catalogue sheet for each piece of equipment.

3. On separate CDs packaged in well-labeled shipping envelopes, provide two copies of source code(s) for integrated remote control system CPUs and user interfaces (touch panels, et cetera). On delivery, obtain signature of C.A. verifying receipt and acknowledging that use of the source code(s) by other than the providing contractor

will void warranty on the operability of the integrated remote control system and may void warranty on control and other AV hardware. Include a copy of this warning in each of the provided envelopes.

B. System Drawings.

1. Provide one paper copy and, on CD, "pdf" copy of "As Bid" drawings.

2. Upon completion of the project and final acceptance of the installation, update original drawings to accurately reflect the as-built conditions of all required modifications, executed change orders or other field conditions.

3. Provide, in "pdf" format, drawings as follows:

a. "As-Built" (Any such hand-drawn diagrams must be scanned for inclusion.)

1) System block diagrams.

2) Detailed wiring diagrams including wire tag numbers and wire color codes.

3) Rack layouts.

4) Patchbay layouts.

5) AVP elevations.

6) Terminal block layouts.

7) Conduit/raceway diagrams.

8) Conduit/raceway-fill schedules or diagrams.

9) 9) Other relevant drawings as appropriate.

b. Provide two paper copies of the above "As Built" drawings on Project's standard drawing size or reduced to sheets no smaller than one-half size. Maintain 3/32" (or 2.5mm) minimum lettering height wherever possible and allow no lettering less than 1/16" (or 1.6mm) in height.

C. Posted Operating and Maintenance Instructions

1. Provide and post at each equipment rack location and equipment backboard, mounted behind glass or acrylic plastic, a bond-paper xerographic reproduction of the following:

a. Instructions indicating the method and/or sequence for powering the system on and off.

b. System block diagram. If large paper (ANSI ARCH C or larger) is used, fold and store in protective envelope in back of equipment rack at the applicable Rack Room. Provide heavy-duty envelope(s), as required.

D. Infrastructure Testing Manuals

1. Submit, as recorded media, one Infrastructure Testing Data Manual containing the following sections:

a. Table of contents.

b. Logical section breakdown of testing conducted

c. Test reports.

2. Submit three copies of the above on CD or DVD media.

E. Software Passwords

1. Software Password Schedule (i.e., a document listing the manufacturer, model number and location in the Facility, of each piece of audio/video equipment, the software for which is password-protected).

2. Provide three copies of software passwords as unprotected .pdf files on CD or DVD media.

3. Provide to C.A. as a secure document separate from Operating and Maintenance Manuals and As-Built Drawings.

1.7 PRICING OF OWNER-REQUESTED CHANGES

A. Changes to the specified equipment, as may be requested and approved by the C.A. or other Owner's representative, shall be priced as follows or in a manor more favoring the owner:

1. When a manufacturer does not provide a Manufacturer's Suggested Retail Price (MSRP) or List Price, additions shall be at no more than 33% above wholesale or dealer cost based on the manufacturer's wholesale or dealer price list, according to the quantities required, and without regard for additional discounts afforded to preferred dealers by manufacturers. Conversely, deletions shall be at no less than 120% of wholesale.

2. When a manufacturer does provide an MSRP or List Price, equipment additions shall be at no more than 90% of MSRP or no more than 33% above wholesale, as described above, whichever is less. Conversely, credited deletions shall be at no less than 90% of MSRP or 20% above wholesale, whichever is more.

3. Additions, as approved by the C.A. or Owner's representative, to the required labor shall be priced at no more than rates quoted with the bid (if such quote is made part of Bid Form) for this project and therefore made part of the Contract. Price conversely for credited deletions. Absent quoted labor rates, change order labor may not exceed lowest certified prevailing wage for category of work in the project jurisdiction.

B. If any are directed by Owner, Owner shall bear ancillary costs of deletions, as in non-refundable deposits, shipping charges and restocking costs.

C. To the degree that changes in the required equipment warrant additional engineering time, the Contractor may submit for additional engineering amounts at the change-order labor rate for the project.

1.8 REQUESTS FOR SUBSTITUTIONS

A. Substitutions requested by Contractor before and/or after the Contract award shall be in accordance with the requirements of the Contract, this Specification Section, and, as applicable, the General Conditions. In any case, requests for substitutions, before and/or after the Contract award, must be in writing. Contractor shall receive authorization in writing from the C.A. prior to implementing substitutions.

B. Prior to purchase, fabrication or assembly of related equipment, provide:

1. A list of all requested substitutions granted during or since the bidding and contract negotiation process, including the date granted and name of grantor. Written verification of granted substitutions may be required.

2. A list of requested substitutions pending acceptance.

3. Documentation in support of requested substitutions pending acceptance.

1.9 QUALITY ASSURANCE

A. Contractor Qualification

1. All Contractors submitting proposals on any work covered by the Audio/Video Systems Contract Documents shall be recognized contractors engaged in the types of work covered under said Contract Documents. Contractors must possess sufficient technical, operational, and financial resources to perform and complete the contract, and shall furnish evidence thereof on request and prior to contract award. Contractors not having the requisite applicable experience may be disqualified.

2. To qualify as a Contractor, the subject firm shall have been, for at least the past five years, in the business of providing systems comparable to those described by the Audio/Video Systems Contract Documents.

3. 3. To qualify as a Contractor, a contracting firm shall maintain facilities, test equipment and trained technicians for fabricating, installing, and servicing the equipment specified, and have done so for at least the past five years.

4. To qualify as a Contractor, a contractor shall be an experienced user, and be able to provide at least one-each during Initial Testing and Acceptance Testing, of test equipment items listed below. Alternatively, professional-grade test-equipment which com-bines the functions of the individual pieces of equipment listed may be used in the testing procedures. Kits, "home-built" and other nonprofessional test equipment shall not be acceptable.

a. 1/3-Octave Real Time Analyzer.

b. Distortion Analyzer (Tektronix, Hewlett Packard, Audio Precision, B&K or Neutrik).

c. Low Distortion Audio Oscillator.

d. Precision Sound Level Meter.

e. Impedance Bridge.

f. Oscilloscope.

g. Random Noise Generator.

h. Digital Volt-Meter.

i. SIM System, EASRA or SIA Smaart Live version 4 or later.

j. HDMI/DVI Video test generator.

k. "VGA" (multiple resolution) Video test generator.

l. Network cable tester with cable length feature.

B. Contractor Responsibilities and Miscellaneous Understandings at Time of Proposal

1. The Contractor shall verify correctness and completeness of Equipment Schedule prior to bidding and shall assume responsibility for correctness of quantities. If a conflict exists between contract documents, the Contractor shall provide the higher quantity if system requires that quantity.

2. A Contractor must report to the C.A., at the time of bidding, any intent to subcontract some or all of the project work. Subcontractors may not be used without C.A. approval.

3. The Contractor shall submit a complete, concise, and unambiguous proposal inclusive of all design, materials, equipment, technical and non-technical installation labor, specialized tools and test equipment, system warranty and documentation and any and all applicable taxes, fees and permits.

4. Provide a Letter of Qualifications with the Proposal according to the following guidelines:

a. Send letter to C.A., Architect and Consultant.

b. List the Contractor's name, address, email address, telephone and fax numbers, number of employees, date of establishment as a business, date of incorporation (if applicable) and contractor's license number (if applicable).

c. List at least two previously completed systems of similar scope and complexity completed within the previous seven years. Provide names, addresses, and phone numbers of Owner, Consultant (if any), Construction Manager, and Architect contact for each project listed. Submission of Bid represents Bidder's re-lease allowing Owner's representative to contact these references.

d. List and profile experience and training (formal and factory) of proposed:

1) Technical Project Manager.

2) Service and Installation Manager(s)

3) Field Foreman.

e. List analysis equipment owned and maintained by Contractor.

f. List subcontracting intent (including testing services):

1) List, for each subcontractor, name, address, email address, telephone and fax numbers, number of employees, date of establishment as a business, date of incorporation (if applicable) and contractor's license number (if applicable).

2) Proposed subcontractor scopes of work.

3) List and profile experience of each subcontractor in designated scopes.

g. Letter of Qualification shall be signed, with name and title printed below signature, by a corporate officer or owner of the bidding contractor.

5. Pre-Proposal Questions and Site Visits:

a. Pre-proposal questions shall be addressed to the C.A. in writing. Verbal instructions to either bid or perform the Work in a manner which does not comply with the Contract Documents do not bind the C.A. or Contractor.

b. A guided, pre-proposal site visit will be arranged through the C.A., either on request of the Contractor or made mandatory, at the discretion of the C.A.

C. Field Personnel

1. When such training is available, Technical Project Manager and Field Foreman shall be factory trained in installation and adjustment of specified equipment prior to commencement of installation.

2. Maintain the same individual in charge of work throughout execution unless illness, loss of personnel, or other circumstance(s) beyond the control of the Contractor intervenes. Immediately inform C.A. Architect, Consultant, GC, EC and ICT Contractor, by email, of change of individual in charge.

D. Coordination

1. Coordinate work of this Section with work of other Project Manual sections and associated trades.

2. Specific references, herein, requiring coordination of certain work shall not obviate responsibility for other required coordination.

E. FF. Testing

1. Submit preliminary performance test data at least of one week prior to Final Acceptance Testing.

2. Equipment shall be operated under standard conditions as recommended by manufacturer during performance testing.

3. Final Acceptance Testing shall be performed in presence of Owner's representative to demonstrate acceptability of project as installed.

4. Repair conditions caused by defective workmanship.

5. Replace defective material and equipment.

6. Re-testing may be required to demonstrate compliance with drawings and Specification.

F. Standards and Codes

1. Comply with local, state and federal codes and applicable National Electrical Code, American National Standards Institute and Underwriters' Laboratories, Inc. standards.

2. All equipment, material, accessories, and loose items provided by Contractor shall be new and shall conform to applicable requirements of the above-mentioned agencies.

3. If required by local authorities, provide certificates and labels indicating compliance with above-mentioned codes and standards where applicable.

1.10 WARRANTY AND TECHNICAL SUPPORT

A. One year warranty

1. Contractor shall warrant the system against failure resulting from defects in material or workmanship for a period of one year from final acceptance by C.A.

2. If the manufacturer of any equipment used in these systems provides less than a one-year warranty for that equipment, Contractor shall assume warranty responsibility for the balance of the two-year period not covered by the manufacturer.

3. Within warranty period, Contractor shall make necessary repairs and replacements at the convenience of and at no cost to Owner. Within warranty period, provide prompt replacement of defective materials and repair of faulty workmanship at no cost to the owner.

4. Paint, exterior finishes, fuses, lamps and other expendables are excluded from guarantee except when damage or failure results from defective materials covered by guarantee.

B. On-site service

1. Provide, at no cost to Owner, maintenance service during the above-mentioned warranty period. At minimum, this service shall include two visits to the site for the express purpose of checking AV systems and equipment for evident need of warranty service. Schedule these visits six months, and two to four weeks prior to expiration of the warranty period. Perform standard maintenance and affect any warranty service requirements revealed during these visits. (No limitation of warranty service is intended by these instructions).

2. During warranty period, Contactor shall answer all service calls within one business-day.

3. Provide on-site service within 24 hours of notice by Owner if instructions from Contractor to Owner fail to correct system-critical faults within two hours of notice by Owner.

4. Provide on-site service within 72 hours for faults determined by the Owner to be not system-critical. Alternatively, at the discretion of the Owner, components to be removed and replaced by Owner may be transported via common carrier shipments.

1.11 SYSTEM DESCRIPTION

A. General

1. This System Description supplements other information in this Specification, AV System Drawings, AV Equipment Schedule, and related architectural, electrical and other drawings. The Work shall include, but not be limited to, the systems, system elements, components and related cabling infrastructure, panels and hardware described in this System Description.

B. Theater

1. Speech Reinforcement

a. Utilize the permanently suspended main center loudspeaker cluster supplemented by the front-fill loudspeakers for speech reinforcement. The system shall serve for performance announcements, lectures, panel discussions and other events requiring speech reinforcement.

1) Dedicated “Utility Mic” inputs on stage and in the Sound Control Booth shall be served by an automatic microphone mixer within the main digital signal processor (DSP), allowing for simple events without the assistance of an experienced sound operator. It shall also be possible to make basic adjustments to these inputs (including the option to change to total manual utility mix) using the portable Remote Control System touch panel. Wireless microphone systems installed in the Mobile Ancillary Rack may be used with the speech system by connecting to Utility Mic inputs.

2) If desired, multiple microphones may be connected to a small portable mixer (N.I.C.), which, in turn, is connected at one Utility Mic input. This approach could serve a panel discussion without needing the services of a skilled sound system operator to operate the main mixing console. Activation and level control of the Utility Mic input for this purpose will be via the portable Remote Control System touch panel, which shall be programmed accordingly.

3) The main mixing console may be used for speech-only by sending inputs to the center channel.

2. Drama and Music Reinforcement

a. Provide drama, music-and audio-for-video reinforcement loudspeaker system to serve such live programs in the Theater as well as playback of music or sound-cue sources.

b. Main Loudspeakers

1) Reinstall existing left, center and right loudspeakers according to Drawings. Provide all hardware required for suspending the loudspeakers from the structure above, including any hardware from the loudspeaker manufacturer as may be required for this purpose, regardless of specific listing in the Equipment Schedule. Use loudspeaker installation methods only as approved through the Submittal process. The left, right and center loudspeakers will each be aimed to serve the entire main-floor seating area (thus, improving stereo sound imaging), except where front-fill loudspeakers are required.

2) Provide an analog patchable input through the DSP to the center cluster, providing the ability for Users to drive this system independent of the main feeds from the mixing console or the utility feature in the DSP. In addition to other possible uses, this function provides for the use of the center cluster should there be a main mixing console failure. Similar in-dependent drive is not provided for main left and right loudspeakers, whose amplifiers can be accessed by patching, if necessary. This independent mode of operation shall be selectable via the Remote Control System.

c. Subwoofers

1) Reinstall existing subwoofers beneath the stage as indicated on the Drawings.

2) Provide a patchable input to the subwoofer system for use by theater sound designers or touring acts choosing to drive the subwoofers independent of main left, right and center loudspeakers.

3) Mode of operation, On/Off and level control of the subwoofers shall be controllable via the Remote Control System

d. Front Fill

1) Install permanent front-fill loudspeakers within the stage-lip fascia mill-work in the locations provided for this purpose. These loudspeakers shall provide coverage serving the first few rows of seating while also localizing program in front of those listeners, instead of from loudspeakers high above.

2) Provide a patchable input to the front-fill system for use by theater sound designers or touring acts choosing to drive the front-fill loudspeakers independent of main left, center right clusters.

3) The option to use this system and control of its balance with the main system shall be available via the Remote Control System.

e. Surround/Effects Loudspeakers

1) Reinstall existing surround loudspeakers at the locations indicated on the Drawings for use with 5.1 or 7.1 surround-sound video or music, or for sound effects used in theatrical or music presentations

2) Provide surround-sound electronics to process or de-embed multichannel surround-sound from various source formats (e.g.: Dolby® Pro Logic®, Dolby Pro Logic II Movie/Music, Dolby Pro Logic IIx Movie/Music, and DTS™ Neo:6 Cinema/Music). Needed functions of the surround-sound processor shall be controllable from the Remote Control System touch screen.

f. Stage Foldback Loudspeakers

1) Reinstall existing stage foldback loudspeakers on the upstage side of the proscenium. Verify exact mounting heights and positions with Architect prior to installation.

g. Stage Monitor and Effects Loudspeakers

1) Loudspeaker output connections around the stage and at other selected locations shall allow for the use of portable monitor, effects and ancillary loudspeakers as necessary. Outputs of mixing console may be fed to dedicated stage monitoring amplifier channels via patching facilities at the Sound Control Booth. The amplifier outputs would then be patchable to the loudspeaker output connections at various audio-video connection panels (“AVP”s) on stage and around the Theater.

2) A complement of professional quality portable monitor loudspeakers shall be provided for use onstage.

h. Main Mixing Console

1) Provide a 32-input (minimum) digital main mixing console for use at the Sound Control Booth or at the rear of the Theater in front of the Sound Control Booth wall.

2) Provide portable snake cables for connection of the mixing console at the dedicated panel in the Sound Control Booth.

3) Typically, it is preferable to mix audio-critical performances from an in-house mix position (IHMP). Therefore, the portable snake cables are intentionally long enough to route through a cable-pass in the front wall of the Sound Control Booth, By so doing, the mixing console and the Mobile Ancillary Rack can relocated in front of the Booth as an IHMP.

i. Ancillary Equipment Rack

1) Provide a Mobile Ancillary Rack including, but not limited to, source playback and recording equipment, connection panel, remote intercom master station and mixing console power supplies (if separate).

2) Analog connections to Ancillary Rack shall be through an input/output connection panel dedicated for this purpose.

j. Wireless Microphones

1) Provide four wireless microphone receivers in the Mobile Ancillary Rack for use when positioned at the Sound Control Booth, IHMP (at the rear of the seating area) or onstage, The outputs from the wireless microphone receivers will route to analog inputs at the digital mixer or, at the discretion of the Users, to "Microphone" inputs at AVPs onstage. Allow space for up to four additional future receivers.

2) Provide two handheld transmitters, two body-pack transmitters and two subminiature lavaliere microphones.

k. Mixer Connectivity

1) The drama/music system shall be served by wired microphone inputs, line-level "tie-lines" on the stage and the wireless microphone systems.

2) The principal wired microphone inputs from AVPs on stage shall be normalled though patching facilities to a multi-pin output connector in the Sound Control Booth. The remaining microphone inputs (including four from upstage AVPs) shall be routed to non-normalled patch points on the microphone patchbay. Eight patchable microphone lines shall be routed from the microphone patchbay to single-channel output connectors on the aforementioned AVP. These microphone output connectors provide the means for routing microphones for direct connection to the main digital mixing console via included snake cables.

3) Playback Sources and Audio Recording Equipment

a) Provide SS/CDR (solid-state/compact disc recorder) in the Mobile Ancillary Rack for archival or production recording of presentations in the Theater. This unit may also be used for playback according to the needs of the Users. Signal routing shall be patchable from mobile rack connection panel.

b) Provide a Blu-Ray player in the Mobile Ancillary Rack for connection at any of the digital video input connection locations. In addition to digital audio via HDMI, analog and AES/EBU digital audio shall also be available. Signal routing shall be patchable from mobile rack connection panel.

c) Provide a Blu-Ray player in the Sound Control Booth racks for use when it is not practical or needed to employ the Mobile Ancillary Rack.

d) Provide a CD/USB Media player in the Mobile Ancillary Rack for general program playback or for show sound cues. Signal routing shall be patchable from mobile rack connection panel.

e) While manual transport controls for the above devices may be used as desired, the Remote Control System shall also be programmed for control of each of the above-listed playback and recording devices, including status tally feedback.

3. Hearing Assistance System

a. Provide an FM (radio frequency) hearing assistance system compatible with the requirements of the Americans with Disabilities Act 2010 Amendments.

b. Provide a complement of hearing assistance accessories.

c. Provide a semi-permanent stereo microphone pair suspended in the Theater, in-tended for stage pickup.

1) Stereo microphone pair will be used for feeding the hearing assistance system during unamplified presentations. These microphones will typically be left connected at a given panel, however, they may be moved and re-patched to the monitor/hearing assistance microphone preamplifier as desired by the Users.

2) For amplified program, the hearing assistance system will receive its signal from the main mixing console. Selection of mode for the hearing assistance system will be via the Remote Control System.

3) This microphone pair shall also be available for archival recording via patching from DSP outputs to SS/CDR recorder at Mobile Ancillary Rack.

4. Line-Level Audio Connectivity System

a. Provide line-level “Tie Line” audio connection points at panels on and around the stage, audience area, and related spaces. This system shall provide for flexibility in deploying portable audio equipment as the User’s deem necessary.

5. AV Data Connectivity System

a. Provide AV Data connection points, utilizing CAT6 network cable, at panels on and around the stage, audience area, and related spaces. This system shall support dedicated AV-system uses. Additionally, this system shall provide flexibility in support of portable equipment utilizing “UTP” network cable for the distribution of various signal types, as in video, digital microphone snakes, remote control, et cetera. AV Data patching and switching facilities shall be located in the Sound Control Booth.

b. AV data patchbay(s) provided according to separate "AV Extended Infrastructure" (aka Bulleting #74) infrastructure contract.

6. Video systems

a. Provide computer video and audio inputs on stage (downstage right and down-stage-center floorbox) and at the Sound Control Booth. These inputs shall allow for routing any video source with HDMI, DVI (via adaptor) or VGA output formats for video projection, recording or viewing at other video monitors in the system. Routing of sources connected at these inputs shall be via the Remote Control System. (Note that Blu-Ray program and protected programming from the inter-net cannot be recorded due to HDCP content protection protocol.)

b. Provide video cable connection points, utilizing precision-video coaxial cable, at panels on and around the stage, audience area, and related spaces. These connections will allow for the use of portable video cameras for routing captured video to any other such video connection point in the Theater, booth spaces, or Lecture Hall, as may be needed for monitoring or recording. Other video uses may also be served by this system. Video patching facilities for routing composite and/or SD/HD-SDI/3G-SDI video signal shall be provided at Sound Control Booth racks

c. Provide a high-definition video projector in the Projection Booth. Program the Remote Control System for operation of the video projector.

d. Provide a structural mounting frame as a robust, stable and secure means of suspending the projector from the overhead structure while spanning the duct-work in the attic space immediately above the projector location.

e. Provide a high-definition manual-aim, motor-zoom stage-capture video camera mounted at the rear wall of the Theater above the Projection Booth window for capturing the image of the stage for production monitoring, image magnification and archival recording. Provide video distribution according to the drawings. Program the Remote Control System touch panel to control presets and zoom functions.

f. Proved two onstage video monitors mounted near and served by the connection panels dedicated to this purpose. Verify locations with Architect. These monitors receive signal directly from the stage-capture video camera.

7. Archival Recording of Audio and Video

a. There shall be infrastructure to allow simple and complex archival recording of audio and video. A fixed microphone pair hung in the Theater that feeds this system shall also serve as a source for the hearing assistance system and monitor/page system. Recordings can be made using the provided SS/CD recorder or via the USB recording function included in the main mixing console.

b. For video, there shall be input and output points at convenient locations to enable occasional recording of events. A video distribution system shall be

included for routing video signals to multiple locations. Video camera signals routed to the digital video switcher may , in turn, be routed to a designated video output for use with the portable video capture interface for recording to computer (latter, N.I.C.). The Remote Control System shall be programmed to accomplish the routing described here.

8. Production Intercom

   a. For communication amongst technical staff, there shall be a production intercom system that enables multi-channel communication between various locations in and around the Theater. The wired system shall include a four-channel party-line intercom system with connectors on AV panels around the facility such that communications between stage and control positions are readily facilitated.

   b. Provide two channels of intercommunication between the Theater and TV Studio.

9. Integrated Remote Control System

   a. Provide a touch-screen controlled integrated Remote Control System to implement functions within the various controllable equipment.

   b. Provide all of the functions and controllability described herein. More extensive description of the Integrated Remote Control System will be provided to bidders by addendum.

C. Lecture Hall

1. Presenter's Lectern

   a. Provide a fixed-in-place lectern at the front of the room, on audience-right, and positioned over two furniture-feed poke-thru devices provided (by E.C.) for this purpose. This lectern shall include the following features and accessories from the manufacturer:

      1) Built-in equipment rack rails to accommodate 12 rack-units of equipment.

      2) Openings in base to allow entry of furniture-feed conduit whips.

      3) Cabinet space for OFE desktop PC computer. (Millwork to include raised platform for computer such that furniture-feed conduit whips from poke-thrus can enter bottom of lectern while maintaining allowed bend radii.)

      4) Tilt up side shelf to increase available desk space.

      5) Gooseneck-type light.

      6) Cooling fan(s)

      7) Slide-out keyboard shelf.

8) Cable deployment pocket with extendable HDMI, VGA, audio (3.5mm TRS plug), and two LAN cables.

9) Video monitor mounting arm.

10) Cable grommet in desk surface for LAN cable serving portable Remote Control System touch panel.

11) Two locking presenter-side doors and locking front equipment access panel.

12) Wood veneer finish (to be submitted for approval).

13) Omit casters typically provided by manufacturer.

b. Provide the following AV equipment with the presenter's lectern:

1) Gooseneck microphone

2) Touch-screen computer video monitor

3) Portable remote-control touch panel

4) Power conditioner with light

5) Power sequencing control requirements

6) CD/USB player

7) Blu-Ray Player

8) Scaling video switcher

9) Remote control processor(s)

10) Locking rack drawer

11) Other, as indicated in the drawings.

2. Loudspeakers

a. Main Loudspeakers

1) Install left, right and center main loudspeakers according to the drawings. Typically, speech will be routed to the center loudspeaker while music and video program utilize left and right for stereo, or left, center and right for multichannel program exceeding stereo.

b. Subwoofers

1) Install two subwoofers according to the drawings. Typically, subwoofers will not be used in conjunction with lecture speech, but may be employed for performance vocals. The main purpose for subwoofers is to support video and recording music playback.

c. Surround-Sound Loudspeakers

1) Install six surround-sound loudspeakers according to the drawings for use with video or music presentations using 5.1 or 7.1 surround formats.

2) Provide surround-sound electronics to process or de-embed multichannel surround-sound from various source formats (e.g.: Dolby® Pro Logic®, Dolby Pro Logic II Movie/Music, Dolby Pro Logic IIx Movie/Music, and DTS™ Neo:6 Cinema/Music). Needed functions of the surround-sound processor shall be controllable from the Remote Control System touch screen.

d. Power Amplifiers

1) Provide power amplifiers in equipment rack at the rear of the Lecture Hall [rack provided by "AV Extended Infrastructure" (aka, bulleting #74)].

e. Wireless Microphone

1) Provide one wireless microphone system with body-pack transmitter and lavaliere microphone.

2) Install receiver in rack at rear of Lecture Hall.

f. Microphone Mixing

1) Automatic microphone mixing shall be provided by the main DSP. The Remote Control System shall be programmed to allow minor level adjustments in conjunction with automatic mixing and, also, to switch from automatic mixing to manual mixing.

3. Video systems

a. Provide HDMI and VGA video inputs in the lectern's cable deployment pocket. Route these through the video switcher/scaler then to the video projector via appropriate digital video extenders.

b. In addition to other connectivity, the center floorbox is configured to allow for the use of a laptop computer (or other video source) while using a table, desk or lectern. The Remote Control System shall be programmed to select between the fixed lectern or the center floorbox as the video source.

c. Provide a high-definition video projector on the roll-out platform in the niche at the rear of the room constructed for this purpose. Program the Remote Control System for operation of the video projector.

1) Prior to projector installation, assure that there is no debris whatsoever in the projector niche. If necessary, contact C.A. to have debris left by other trades removed. Use a vacuum to clean as much of the projector niche as can be practically reached. Report to C.A. any instability, poor workmanship, out-of level, or rough slide movement in the roll-out platform.

2) Install projector such that it is stable on the roll-out platform. Provide alignment marks on the roll-out platform to assure that the projector is positioned properly after any servicing. Dress cables to projector such that they travel smoothly without binding and without displacing the projector when the roll-out platform is extended for service.

4. Playback and Recording Equipment

   a. Provide CF/SD/USB recorder in the main rack at the rear of the room for archival recording of presentations in the Lecture Hall. This unit may also be used for playback according to the needs of the Users. Playback shall be routed through the surround-sound processor, requiring appropriate switching controlled by the Remote Control System.

   b. Provide a Blu-Ray player in the lectern.

   c. Provide a CD/USB player in the lectern.

   d. Program the Remote Control System for control of each of these devices including status tally feedback.

5. Hearing Assistance System

   a. Provide an FM (radio frequency) hearing assistance system compatible with the requirements of the Americans with Disabilities Act 2010 Amendments.

   b. Provide a complement of hearing assistance accessories.

   c. The hearing assistance system shall receive its signal from the DSP as a monaural mix of left, center and right program.

6. Line-Level Audio Connectivity System

   a. Provide line-level “Tie Line” audio connection points at panels on and around the stage, audience area, and related spaces. This system shall provide for flexibility in deploying portable audio equipment as the User’s deem necessary.

7. AV Data Connectivity System

   a. Functions similar to as described for Theater.

   b. AV data patchbay(s) provided according to separate “AV Extended Infrastructure” (aka Bulleting #74) infrastructure contract.

8. Integrated Remote Control System

   a. Provide a touch-screen controlled integrated Remote Control System to implement functions within the various controllable equipment.

   b. Provide all of the functions and controllability described herein. More extensive description of the Integrated Remote Control System will be provided to bidders by addendum.

D. Classrooms

1. Instructor's Lectern

a. Provide a fixed-in-place lectern at the front of the room positioned over two furniture-feed poke-thru devices provided (by E.C.) for this purpose. Lecterns occurring in the Equipment Schedule are designated for specific rooms, depending on the side of the room to which they are deployed. Lecterns on the right, as viewed by students, will have their video monitors and side shelves to the instructor's right and the remote control panel to the instructor's left. The opposite applies for lecterns on the left, as viewed by students. Lecterns shall include the following features and accessories from the manufacturer:

1) Built-in equipment rack rails to accommodate 12 rack-units of equipment.

2) Openings in base to allow entry of furniture-feed conduit whips.

3) Cabinet space for OFE desktop PC computer. (Millwork to include raised platform for computer such that furniture-feed conduit whips from poke-thrus can enter bottom of lectern while maintaining allowed bend radii.)

4) Tilt up side shelf to increase available desk space.

5) Gooseneck-type light.

6) Cooling fan(s)

7) Slide-out keyboard shelf.

8) Cable deployment pocket with extendable HDMI, VGA, audio (3.5mm TRS plug), and LAN cables.

9) Video monitor mounting arm.

10) Dashboard for installation of remote control panel (Extron MLC 226 IP AAP)

11) Two locking presenter-side doors and locking front equipment access panel.

12) Wood veneer finish (to be submitted for approval).

13) Omit casters typically provided by manufacturer.

b. Provide the following AV equipment in the presenter's lectern:

1) Touch-screen computer video monitor

2) Remote-control button panel with integrated control processor

3) Power conditioner and sequencer

4) Blu-Ray Player (OFE)

5) Scaling video switcher

6) Locking rack drawer

7) Power Amplifier

8) Other, as indicated in the drawings.

2. Loudspeakers

a. Main Loudspeakers

1) Install stereo left and right loudspeakers oriented horizontally with mounts oriented vertically (confirm this orientation is possible). Mount loudspeakers at JB-S10's with loudspeaker center height equal to JB-S10 center height and to the inside such that loudspeaker width hides JB-S10.

b. Power Amplifiers

1) Provide power amplifier in the instructor's lectern.

3. Video Playback and Presentation

a. Provide a high-definition video projector mounted to structure above ACT ceiling.

1) The Remote Control System shall be programmed to control various projector functions and motorized projection screens as represented by the button-panel layouts shown on AV323.

2) All classrooms, except Rm, 235 and 246 (which have motorized screens), utilize the wall surface as the projection surface.

3) Carefully coordinate each projector's installation location such that image occurs in plan along the front wall of the room, as indicated on "EAP" drawings (or falls on the motorized screens) without exceeding the projector's lens shift capabilities and, while keeping the projector square with the screen surface. Refer to Sheet AV503 for mounting location reference and additional directives.

4) For Rms. 235 and 246, fill the screen with the image. (Note that projectors are 16:10 native aspect ratio and screens are 16:9 aspect ratio. Implement projector settings to operate at 16:9 aspect ratio without "squeezing".)

5) All projectors shall operate at 16:9 aspect ratio and be set to create the image sizes shown on "EAP" drawings, regardless of the use of the wall surface as the screen material. Wherever possible, the bottom of an image projected on the wall surface should maintain 48" to 54" above the floor. This will not be possible for images indicated as 65" high.

b. Install OFE Blu-Ray player in the lectern. Remote Control System shall be programmed for Blu-Ray operation. The OFE Blu-Ray players, at time of this writing must be controlled by infrared emitter, therefore, no status tally

feedback would be possible. If Owner revises Blu-Ray to type with RS232 control, provide said status feedback (i.e., illuminated buttons to indicate "Play", "Stop", et cetera.

c. Video playback and presentations shall also be possible via the installed PC computer (OFE) and/or a laptop computer.

4. Hearing Assistance System

a. Provide an infrared hearing assistance system compatible with the requirements of the Americans with Disabilities Act 2010 Amendments.

1) Install hearing assistance system emitter toward the outside, adjacent to the loudspeaker connected at JB-S10 with dedicated emitter connector.

b. Provide a complement of hearing assistance accessories.

c. The hearing assistance system shall receive its signal from the video switcher/scaler as a monaural mix of left and right program.

5. Integrated Remote Control System

a. Provide a button-panel with integrated Remote Control System to implement functions of controllable equipment.

b. Provide all of the functions and controllability described herein. More extensive description of the Integrated Remote Control System will be provided to bidders by addendum.

E. Conference/Seminar Rooms (Except Rms. 050 and 157)

1. Conference Table

a. A fixed-in-place conference table section will be furnished and installed by others (within a separate furnishings package).

1) The conference table will include the following features and accommodations for the installation of AV equipment provided in this Scope:

a) Sits above and hides furniture-feed poke-thrus for routing AV and LAN cables to the surface via the table leg.

b) Precut holes in the surface for the installation of AV pockets.

c) Table leg will hide pocketed User cables when stowed and not in use.

2) Install table-top pocket for the installation of Remote Control System button panel.

3) Install button panel in pocket.

4) Install cable deployment pocket and user-deployable cables.

2. Equipment Credenza

   a. Provide equipment credenzas at the locations shown on the drawings. Each credenza shall include the following from the manufacturer:

      1) Cooling fan(s)

      2) Two locking front doors

      3) Cabinet space for slide-out 12-space rack frame.

      4) Wood veneer finish (to be submitted for approval).

      5) Omit casters typically provided by manufacturer.

   b. Fasten each credenza to the wall from the inside (such that no hardware shows). Credenzas shall have open backs to minimize coordination necessary for routing AV and LAN cables into credenzas from wall mounted junction boxes.

   c. Provide the following AV equipment with the credenza:

      1) Power conditioner and sequencer

      2) Scaling video switcher

      3) Locking rack drawer

      4) Power Amplifier

      5) Slide-out rack-rail system.

      6) Other, as indicated in the drawings.

3. Loudspeakers

   a. (As per Classrooms, except, install power amplifier in credenza.)

4. Video Playback and Presentation

   a. Provide a high-definition video projector mounted to structure above ACT ceiling. (as per Classrooms, except, motorized screen occurs in Rm. 231)

5. Hearing Assistance System

   a. (As per Classrooms.)

6. 18. Integrated Remote Control System

   a. (As per Classrooms.)

F. Conference/Seminar Rooms 050 and 157

1. Conference Table

   a. Differing from other conference/seminar rooms, includes no AV facilities.

2. Equipment Credenza

a. Provide equipment credenzas at the locations shown on the drawings. Each credenza shall include (or exclude) the following from the manufacturer:

1) Cooling fan(s)

2) Two locking front doors

3) Cabinet space for slide-out 12-space rack frame.

4) Wood veneer finish (to be submitted for approval).

5) Cable deployment pocket in top surface.

6) Omit casters typically provided by manufacturer.

b. Fasten each credenza to the wall as previously described.

c. Provide the following AV equipment with the credenza:

1) Power conditioner and sequencer

2) Scaling video switcher

3) Locking rack drawer

4) Power Amplifier

5) Slide-out rack-rail system.

6) Other, as indicated in the drawings.

3. Loudspeakers

a. (As per Classrooms, except, install power amplifier in credenza.)

4. Video Playback and Presentation

a. Provide a high-definition video projector mounted to structure above ACT ceiling. (as per Classrooms, except, motorized screen occurs in Rm. 231)

5. Hearing Assistance System

a. (As per Classrooms.)

6. Integrated Remote Control System

a. Install remote-control button panel/control processor in wall box dedicated for this purpose

b. (Remaining, as per Classrooms.)

1.12 PERFORMANCE REQUIREMENTS

A. General

1. Certain of the AV System's overall performance requirements may be checked readily by measurement.

2. The systems included in this work, as designed, are expected to meet the functional requirements stated hereinafter, based upon available data and the manufacturers' published specifications.

3. During the Bid Phase, the Contractor shall have made himself familiar with the System Description stated hereinbefore, the overall system requirements and the capabilities of specified equipment.

4. The functional requirements stated hereinafter shall be used as a basis for evaluating requested substitutions and performing initial testing and tuning.

5. Report obvious errors in the Contract Documents wherein such errors would preclude the possibility of fulfilling the functional requirements.

6. Aspects of the design which can only be verified by measurement of installed systems are not subject to error reporting requirements. (However, the contractor is urged to share any concerns regarding the suitability of systems).

B. Frequency Response and Sound Output

1. Measure with "tone" controls set for flat response, using broadband calibrated pink noise applied to any microphone input for speech system or auxiliary line input for stereo system, measuring in specified bands using real-time analyzer or using specified bands of filtered pink noise centered on ANSI preferred frequencies, measuring with sound level meter.

2. Measure system acoustical performance using a calibrated real-time analyzer or an ANSI Standard Type 1 or IEC Precision Sound Level Meter set for "slow" meter damping and flat response at normal incidence, at a height of 4 feet and pointed at the loudspeakers. All interior finishes and furnishings shall be in place, and system gain shall be adjusted to provide levels of 70 to 85 dB during normal operation at the measuring locations for these tests, unless otherwise noted herein.

3. Unless restricted by the published specifications of a particular piece of equipment, or unless otherwise required by these Specifications, the following performance standards shall be met by each system:

   a. Set system gain to provide 75 to 85 dB SPL in measurement area during frequency response adjustments.

   b. Loudspeaker Systems in the Theater and Lecture Hall working together (e.g., at Theater, main loudspeakers and front-fill loudspeakers): with respect to a response which is flat (0 dB) from 80 to 3,150 Hz, -1 dB at 4,000 Hz, and decreases 1 dB per one-third-octave band thereafter to 6 dB at 12,500 Hz, system response in one-third-octave bands averaged over at least six locations throughout the audience shall be adjusted to be within ±3 dB with all loud-speakers working together.

   c. Back-of-House and Public Space Loudspeaker Systems: with respect to a response which is flat (0 dB) from 150 to 2,000 Hz, -4 dB at 4,000 Hz, and -9 dB at 8,000 Hz, system response in octave bands averaged over at least

three locations distributed throughout the areas served shall be adjusted to be within ±3 dB.

d. Sound Output Capability: Systems shall be capable of producing peak program levels as specified below throughout the area served without objectionable distortion, buzz, or rattle, employing as test signals several samples of recorded speech and music.

1) Theater, loudspeakers working together: 102dB.

2) Lecture Hall: 92 dB.

3) Back-of-House and Public Space Loudspeaker Systems: 86 dB.

4. Electrical performance for Sound Reinforcement Systems

a. Frequency Response shall be +0 dB, - 0.5 dB from 20 to 20,000 Hz for any individual electronic component.

b. Signal to Noise Ratio shall be 80 dB minimum from 20 to 20,000 Hz for any individual electronic component.

c. Crosstalk shall be better than -60 dB from 20 to 15,000 Hz, better than -55 dB at 20,000 Hz, between adjacent channels for any individual electronic component.

1) Total Harmonic Distortion shall be less than 0.30% from 20 to 20,000 Hz for any individual power amplifier operating at rated power; less than 0.10% from 20 to 20,000 Hz for any other electronic audio component driven at maximum rated input.

d. Hum and Noise:

5. With building air-handling systems operating, hum and noise shall be inaudible at nor-mal gain settings

6. Measured at amplifier outputs: -80 dB or better relative to rated maximum amplifier output, with minimum of six inputs, master set at normal operating levels.

a. Feedback Stability Margin:

1) Adjust all systems for optimum feedback stability margin.

b. Audio-for-Video Systems

1) Audio Frequency Response: 50 Hz-15 kHz 0, + 3 dB.

2) Audio Wow and Flutter: 0.005% Wrms.

7. Electrical performance of NTSC Video Systems:

a. S/N (peak to RMS) unweighted dc to 4.2 MHz; 55 dB minimum.

b. Crosstalk, unweighted dc to 4.2 MHz; 45 dB minimum.

c. Frequency Response: within + 0.5 dB to 4.2 MHz.

d. Line and Field Tilt 2% maximum.

e. Differential Gain 3% maximum.

f. Differential Phase 2 degrees maximum.

8. Electrical performance of HDMI and HD-SDI systems:

a. According to accepted industry standards resulting in video noise/"hash"- free performance.

9. Performance Test Signal Paths:

a. Audio: Test from all source inputs (for microphones, audio tape units, et cetera) through all mixers, amplifiers, et cetera, to all signal destinations.

b. Video: Test from all source inputs (for cameras, video recording and playback, et cetera) through all video distribution amplifiers, processors, switchers, et cetera.

c. Test video tie lines for compliance with the appropriate SMPTE HD-SDI Specification.

d. Delineation of above signal paths shall not exempt Contractor from the responsibility of checking all paths and outlets for appropriate compliance with Performance Requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. Refer to "Equipment Schedule" and Drawings. The specific products listed in the Equipment Schedule and/or shown on the drawings represent the Design Basis for the described systems. Substitutions for specific equipment will be considered only according to the conditions listed herein in the "Quality Assurance" section, and, according to any additional conditions set forth in Division 1 of the Specification.

B. Refer to "System Description", herein, and Contract Drawings and manufacturers' manuals for certain product use, assembly and mounting information.

C. For required incidental and miscellaneous products not listed in the "Equipment Schedule", the Audio Systems Contractor shall select products that satisfy the Contract Documents including "System Descriptions", "Performance Requirements", Drawings and general product descriptions that follow.

D. Incidental wording of this "Products" section shall not be construed to diminish product quantities indicated by the Equipment Schedule or other Contract Documents.

2.2 Microphones and Accessories

A. Semi-Fixed Stereo Monitor/Recording Microphone Pair at Theater

1. For initial testing, suspend the stereo pair on center as directed by Consultant prior to installation.

2. Connect stereo microphone pair at selected input connectors and patch to the stereo microphone preamplifier.

B. Permanent Wireless Microphone Receiver (UHF)

1. Confirm with manufacturer, and with advice from experienced users, frequencies appropriate for use in the project geographical area. Determine antenna splitter model per these frequency ranges.

2. For receivers in mobile racks, mount antennas (or, in the case of stand-mounted antennas, mount connectors) on front of racks. For receivers mounted in fixed remote racks, utilize dedicated remote antenna connectors served by RG8U cable.

2.3 Audio Patchbays, Panels and Miscellaneous Distribution Components (Fixed/Permanent) [Applicable to Group III AV Systems and/or AV Extended Infrastructure (aka, Bulletin #74), depending on responsibilities delineated herein.]

A. Locate as shown on Rack Elevations or according to approved submittal with alternate approach..

1. Patchbays are listed as if a single assembly provided by manufacturer. Assemble from components at Contractor's discretion, and as required per layout with regard to single point terminations and normalling.

2. Some patchbay items require slight modification of stock part. Provide as custom part from manufacturer at Contractor's discretion.

3. Refer to grounding and normalling description elsewhere in this document.

B. Microphone Snake – Contractor shall verify lengths indicated in Equipment Schedule.

C. Loudspeaker Patch Panel

1. Install in Equipment Rack according to the elevations shown in the Drawings.

2. Refer to Drawings for special wiring of connectors and patch cables; this method pre vents connecting two amplifier outputs to each other.

3. Engraved labeling must include warning: "Use Special Loudspeaker Jumper Cables Only".

D. Tie-Lines Patchbays

1. Install where indicated in the Drawings.

2. Provide unitized or harness-type routing to terminal block at Contractor's discretion.

3. Refer to grounding and normalling description elsewhere in this document.

2.4 2.4 Loudspeakers

A. (Refer to System Description)

2.5 Miscellaneous

A. Equipment racks – see hereinafter

B. Provide thermal ventilation at Equipment and Amplifier Racks. Refer to Fixed-in-Place Equipment and Amplifier Rack requirements. – see hereinafter.

2.6 Monitor/Page System

A. Provide loudspeaker backboxes for ceiling loudspeakers to the Electrical Contractor. Use, where appropriate, torsion spring mounting method.

1. Architecturally integrated loudspeakers:

a. Coordinate mounting and installation with other trades.

b. Instruct trades on Architectural integration; be present on-site to observe architectural integration.

c. Test loudspeakers after mounting yet before 'taping' and 'painting'.

d. Test loudspeakers after integration is completed.

2.7 Power Sequencing

A. Provide, at equipment racks in the project and as indicated in the Equipment Schedule and Drawings, AC power sequencing system(s) to control the turn-on and turn-off sequence of audio electronics to avoid damage and disturbance due to power transients. The system shall consist of the following groups:

1. First On- AV Source Devices

2. Main Mixing Console/Audio Core and ancillary equipment racks.

3. AV Routing Equipment and Loudspeaker Processing

4. Amplifiers

5. First Off- Amplifiers

B. Include power on/off switches in the Control Booth, Amplifier Rack Room and at the stage-right equipment racks. Include power system control in the Integrated Remote-Control System.

C. Submit drawing showing power sequence design for approval by Consultant. The Sequencers are generally located in the AV Rack.

1. Certain equipment within the main and mobile equipment racks shall not be sequenced. Confirm with Consultant which equipment shall be always-on.

2.8 2.8 RECEPTACLES

A. Use specified brand and type or approved equal.

B. For each receptacle-type, use same make and model throughout the project.

C. Provide connector colors as listed in the schedule.

D. Use termination types listed:

1. Single circuit audio signal cabling shall use soldered connections; crimp-down, or other terminations not acceptable.

a. For multi-circuit audio cabling, using high-density connectors, crimp connections are preferred for convenience of maintenance.

b. Single circuit video signal cabling shall typically use crimp connections terminated with appropriate, manufacturer recommended crimp equipment.

c. For soldered connections, use flux-core 60/40 Sn/Pb or, 62/36/2 Sn/Pb/Ag solder containing 2% silver.

d. For crimp connections, use appropriate, manufacturer recommended crimp equipment, used by trained and experienced personnel.

E. Audio Receptacles

1. Portable Cabling

a. In-line connectors:

1) XLR: use Neutrik Digital XLR series.

2) RCA: for male use Neutrik Profi (soldered) or Canare true 75 ohm impedance (crimped).

3) BNC: use true 75 ohm impedance connectors (Canare/ADC/Kings).

4) Multipin: also see Drawings;

a) For audio: use Whirlwind Mass Connectors as indicated in the Drawings

b) For audio, video and data combinations: use Wireworks AV-2000 series connectors with 'Broadway' BLS latching mechanism.

2. Microphone:

a. Use soldered connections at AV panels.

b. Use only soldered, "3-pin" or Elco/EDAC connections at patchbays; crimp down, direct to PCB, or other terminations not acceptable.

c. Microphone female chassis-mount connector:

1) Nickel shell: NC3FD-L-1 (silver).

2) Black Shell: Neutrik NC3FD-L-B-1 (gold).

d. Microphone male chassis-mount connector:

1) Nickel shell: NC3MD-L-1 (silver).

2) Black shell: Neutrik NC3MD-L-B-1 (gold).

3. Audio Tie Lines:

a. Use soldered connections at AV panels.

b. Punchdowns as well as soldered, "3-pin" or Elco/EDAC connections are allowed at patchbays.

c. Female chassis-mount connector:

1) Nickel Shell: Neutrik Combo NCJ6FI-S (silver).

2) Black Shell: Neutrik Combo NCJ6FI-S-B (gold).

d. Male chassis-mount connector:

1) Nickel Shell: Neutrik NC3MD-L-1 (silver).

2) Black Shell: Neutrik NC3MD-L-B-1 (gold).

4. Unbalanced "Auxiliary In" female chassis-mount RCA connector: Neutrik NF2D. For stereo pairs use one each NF2D-R-B (red/right) and NF2D-WT-B (white/left). For mono connectors use NF2D-BLK-B (black). Use soldered connections; crimp, direct to PCB, or other terminations not acceptable.

5. Unbalanced "Auxiliary In" female 3.5mm stereo mini-jack: DGS Pro-Audio (Mouser Electronics Stock #161-3502). Use soldered connections, crimp down, direct to PCB, or other terminations not acceptable.

6. Intercom male chassis-mount connector:

a. Use soldered connections; crimp down, direct to PCB, or other terminations not acceptable.

1) Nickel Shell: Neutrik NC3MD-L-1 (silver).

2) Black Shell: Neutrik NC3MD-L-BAG-1 (silver).

7. Loudspeaker Receptacles: Neutrik NL4MP.

8. Stage-boxes for tie lines and microphones, if included in this system, shall be furnished with pairs of XLR-F and XLR-M, as listed above, wired in parallel.

9. Multipin connectors (when applicable):

a. Audio only

1) Use circular Whirlwind MASS connector (or equivalent) as indicated in the Drawings

b. Video only or with audio combined:

1) Use Wireworks AV-2000 series connectors as shown in the Drawings.

2) Provide connectors with "Broadway Latching System" (BLS) option.

10. Panel color coordination:

a. Use brushed 'steel' color connectors on white and steel color AV panels

b. Use black anodized connectors (if available) for black color AV panels.

F. Video and RGBx

1. BNC bulkhead connectors: Kings or Canare 75 ohm impedance connectors.

2. BNC chassis-mount connector: Neutrik, Kings or Canare 75 ohm impedance connectors.

3. Inline: Kings or Canare 75 ohm impedance connectors, crimped.

G. "ST" Multimode Fiberoptic Panel Connectors

1. Black Box, Inc.FOT109 bulkhead ST-ST connectors.

H. AV DATA on AVP's

1. Neutrik NE8FDY-C6-B
2. Neutrik NE8FDY-C6, if panel is brushed aluminum or other light finish for aesthetic reasons
3. No substitutes. Plastic keystone feed-through connectors are not acceptable and, if used, will result in requiring the replacement of panels. (Bold font used here shall not be interpreted as diminishing other requirements.)
4. Mixing Console cables dedicated to connection at proprietary mixing console snake receptacles must utilize mating Neutrik etherCON cable connectors.

2.9 CABLES

(In no case shall a substitute "or equal" cable have a larger outside diameter than the largest model indicated in this list or in the Equipment Schedule. In all cases, Contractor shall verify fit of cables in every conduit prior to start of construction.)

A. Cables listed by brand and model number in the Equipment Schedule take precedence over those listed below. Use cable listed below in the absence of such listing in Equipment Schedule.

B. Use specified brand and model number or approved equal.

C. For each cable-type, use same make and model throughout the project.

D. Verify adequate conduit area for selected cables.

E. Audio Cables

1. Individual microphone and line-level shielded-pair cable in conduit (except as noted for below for intercom and utility program): 110 ohm, AES3-rated, low capacitance cabling:
   a. Belden 1800B,
   b. West Penn DA2401
   c. Or equal submitted for approval.
2. Individual line-level cables for intercom and utility program inputs: (Listed separately for price and conduit-fill considerations)
   a. Belden 1883A
   b. West Penn 291
   c. Or equal submitted for approval.
3. Loudspeaker cables in conduit:
   a. Main Loudspeaker Feeds: #10 AWG, twisted-pair wire; Belden 5T00UP, West Penn C210, (or approved equal).

b. Stage Monitor and Surround/Effects Loudspeaker Receptacles: #12 AWG, twisted-pair wire; Belden 1860A, West Penn C207 (or approved equal).

c. Monitor/Page System Loudspeaker Cable: #16 AWG, twisted-pair wire; Belden 5200UP, GEPCO 1600, West Penn C205 (or approved equal), or #16 AWG three conductor wire; Belden 5201UE, West Penn 235 (or approved equal).

4. Lines Dropped to Main Loudspeaker Clusters:

a. Provide heavy-duty extra-flexible portable cordage with black neoprene, rubber or PVC jacket from hoist loft to each cluster.

b. Harness all lines for a neat installation, leaving a service-loop at each termination facilitating servicing loudspeakers.

5. AV Contractor may pursue multi-pair versions of cabling for convenience of cable-pull and termination for point-to-point connections only observing cable dressing requirements specified herein.

F. Video Cables

1. Individual composite/HD-SDI video lines in conduit, precision video cable: Belden 1694A, only.

2. RGBx lines in conduit and equipment racks, individual cables: Belden 1505A or West Penn 819.

3. Local, short length (10' or less) multi-coax RGBx lines: West Penn WP8254 (or approved equal).

4. Medium length (30' or less) multi-coax RGBx lines: West Penn WP6354 (or approved equal).

G. Antenna Cables

1. Antenna Cable in conduit for wireless microphones: 50 Ohm, RG8 #10 AWG antenna cable: Belden 7810R, GEPCO V5010 or West Penn 808F (or approved equal).

H. AV Data and Other Non-LAN Cables

1. Data over UTP: Provide as specified for required Category rating: Verify cable type to be adequate for installed length of cable run.

a. Provide solid bare copper, 4 twisted-pair cable in conduit as in Category 6 (CAT6) UTP cable for all "AV DATA" lines between AV data patchbays and AVP's. Use CAT6 UTP for all AV-related Ethernet signals or proprietary signals using such cable except as described hereinafter.

1) Belden 2412

2) West Penn WP4246

3) Or equal submitted for approval.

2. Crestron Digital Media "8+"

a. Crestron DM-CBL-8G-NP

b. Any submitted alternate cable must tightly adhere to the criteria required by Crestron "8+" equipment and will be closely scrutinized prior to approval being granted, if at all.

3. Proprietary "AVB" Mixing Console Snake Cable

a. Provide solid bare copper, 4 twisted-pair cable in conduit as in Category 6 (CAT6) F/UTP (shielded) cable.

1) Belden 2412F

2) West Penn 4246F

3) Or equal submitted for approval.

4. Digital Video via Category Cable

a. Provide solid bare copper, 4 twisted-pair cable in conduit as in Category 6 (CAT6) F/UTP (shielded) cable.

1) Belden 2412F

2) West Penn 4246F

3) Or equal submitted for approval.

I. DC Control Cables

1. Provide multi-conductor, #20 AWG stranded cable in conduit: Belden 94xx series, GEPCO 69xx series, or West Penn 26x series (or approved equal),

J. Serial Data Cables

1. Provide stranded shield-pair cable as necessary according to good engineering practice. Verify cable type to be adequate for length of signal run.

K. Fiber Optics Cables

1. Single Mode Enhanced, Indoor Riser, Distribution, tight buffered Fiber Optics in conduit: Belden M9W037 thru M9W042, GEPCO FSDxR series, West Penn WP9W037 thru WP9W042 (or approved equal).

2. Multi-Mode 50/125um, 1Gbe, Indoor Riser, Distribution, tight buffered Fiber Optics in conduit: Belden M9A037 thru M9A042, GEPCO FMDxR series, West Penn WP9A037 thru WP9A042 (or approved equal).

2.10 RESISTORS AND PADS

A. Half-watt, 5% tolerance, non-inductive resistors, except where otherwise shown on functional diagrams. Values may require modification, or additional resistors may be required to suit operating conditions.

B. For loudspeakers use wattages in concurrence with actual loads.

2.11 MISCELLANEOUS EQUIPMENT

A. Panels

1. Maintain a uniform appearance of panels throughout the project. Specifically, but not exclusively, use this guideline if panels are fabricated by multiple manufacturers.

2. Fabricate cover plates for outlet boxes, input/output boxes and AVP's from 5052-H32 or 6061-T6 aluminum sheet no less than 0.090" thick for standard "ganged" outlet boxes of three gangs or less, and not less than 0.120" elsewhere.

3. Aluminum panels:

a. For black aluminum panels, grain on horizontal axis and anodize.

b. Finish in epoxy-based paint only if directed by, and to color approved by, Architect.

c. Engrave all nomenclature and graphics. If mill engraved, ink fill. If laser engraved, submit sample of text color versus background.

4. Provide panel colors (and connector colors, see elsewhere herein) according to the schedule. The color combinations are:

a. Black panel, white lettering – generally in stage areas and in the audience chamber, and on equipment racks

b. Brushed steel (or aluminum), clear coated, with black lettering - generally in public spaces (confirm with architect or owner).

c. See also panel schedule at EA drawings (if such schedule is included).

d. Use black connectors at black panels, brushed nickel connectors at white and steel color panels (if applicable; for instance, video bulkhead only come in brushed nickel, but XLR connectors come in black and brushed nickel).

5. Contractor may submit plastic strata for approval.

a. Gravoglass 2-plex or Gravograph Ultra panels of 1/16" thickness are acceptable.

b. For these panels, use 14 Ga. steel as substrate panel.

c. Use glue recommended by the manufacturer.

6. See Submittals for submission of one panel of each color combination for approval.

B. Equipment and Amplifier Racks

1. Provide internal 120 V.A.C. wiring and power outlets as required for equipment and such as not to overload branch circuits.

2. Fill all unused panel spaces with blank solid or vent panels, shelves and drawers where indicated in the drawings. Observe cooling and ventilation requirements of surrounding equipment for choice of panel.

C. Fixed-in-Place Equipment and Amplifier Racks

1. Locate racks so that equipment may be operated from the front and serviced from the rear without moving the racks (as conduits shall render them immovable). Install racks according to the drawings. Verify a minimum of 36" clear in front of racks and 30" be-hind. Absent these clearances, seek direction from Architect and Consultant before fixing racks in place or installing wiring. Carefully coordinate the electrical connection and conduit entries to racks as installed according to the Electrical section of this Specification.

2. Provide sides, doors and tops for a complete assembly.

3. Provide at Equipment Racks, thermal control, monitoring and cooling devices as indicated in the Drawings and/or Equipment Schedule.

4. Seal racks against spurious air intake or exhaust that can diminish the cooling effect of active or passive equipment cooling approaches.

5. Provide patch-cord holders near all patch bays at fixed locations including the Stage Rack, Control Booth and Amp Racks.

6. Provide security covers over all equipment with front panel controls intended for semi-fixed settings and not capable of software security.

PART 3 EXECUTION

3.1 INSTALLATION

A. General

1. Install equipment with all precautions necessary to prevent and guard against electro-magnetic and electrostatic hum, to assure adequate ventilation, and to provide for safety of users.

a. Employ the latest and safest techniques throughout the installation.

b. Perform all work in strict conformance with the highest industry and craftsman-ship standards. The following shall serve as guidelines:

1) Current broadcast standards;

2) Current recording studio practice and techniques outlined in:

a) "Handbook for Sound Engineers" by Glen M. Balou, 3rd Edition, Focal Press, 2002

b) "Sound System Engineering" by Don and Carolyn Davis, 2nd Edition, Focal Press, 1997;

c) "Audio Systems– Design and Installation" by Phillip Giddings, Focal Press, 1990.

d) "Sound Reinforcement Handbook" by Gary Davis and Ralph Jones, Hal Leonard Publishing Corp., 1987

e) "AV Design Reference Manual" by Bicsi & ICIA

f) "Video Demystified, 4th Edition" by Keith Jack

2. Install all equipment neatly, plumb, square and true to line and level except as necessary for loudspeaker or microphone aiming.

   a. Routing of raceways and cables shall be in accordance with the Penetration Control Plans. Penetrations through acoustically significant construction shall be sealed airtight in accordance with the Penetration Control Plans, Resiliently Sealed Penetration Details, and Section 079005 - Joint Sealers

   b. Install all ceiling loudspeaker enclosures or mounting rings securely in ceiling using purpose-designed mounting devices or custom-fabricated bracing. In either case, assure that loudspeakers will not sag the ceiling structure or tiles, cannot fall out of ceiling, and mounted with grilles properly against the ceiling surface.

   c. At Owner's discretion, repair or reimburse Owner for damage caused by any action of Contractor's employees or resulting from the process of installation.

   d. Provide a safety factor of at least 4:1 for all fastening and supports for fixed equipment, cabling, and components.

   e. Install all equipment, except portable equipment, such that it is held firmly in place. This shall include loudspeakers, amplifiers, cables, et cetera (an exception to this rigid mounting clause is when it is required to use resilient shock mounting to decouple a loudspeaker from the structure it is being mounted in/on).

   f. Use no fan-cooled equipment in mobile equipment racks intended for use within a performance space.

   g. Mount all permanent electronic equipment and patching facilities (if any) in electronic equipment rack cabinets (or frames, according to these documents).

   h. Avoid damage to cables, equipment, and wiring.

   i. Provide incidentals and accessories, compatible with other equipment, necessary to meet requirements specified herein even though not specifically called out in this specification.

   j. Remove dirt and debris from audio system racks, panels and junction, pull and device boxes.

   k. Seal all pre-assembled equipment racks in plastic before shipping to Project Site. Maintain plastic cover when storing racks on site prior to installation to pre-vent damage by materials from other trades.

   l. Leave job site and all equipment and materials clean and free from marks, blemishes and Contractor's debris.

B. Audio System Isolated Technical Ground (ASITG)

1. Feeds to in-rack Power Distribution are to be provided according to work described in the Electrical section of the Specification.

2. Maintain isolation between ASITG and building electrical system ground except at the Building Ground Bus connection

3. Provide a main isolated audio ground point (MIAGP) within each bank of audio equipment racks (i.e., one rack or multiple adjacent racks). MIAGP shall consist of a copper bus bar bonded to the rack frame and of sufficient size to accommodate all secondary ground conductors. Provide a lug on MIAGP for connection of an insulated copper, isolated technical ground conductor having a maximum of 0.1 ohm total resistance. Said ground conductor to be installed as described here and by work required by the Electrical section of this Specification. Contractor shall be responsible for confirming technical ground is properly electrically bonded to the building technical ground system. Aluminum lugs are not allowed.

4. Secondary system grounding conductors shall be provided from all racks, audio consoles, and otherwise-ungrounded audio equipment in each area, to MIAGP. Each of these grounding conductors shall have a maximum of 0.1 ohm total resistance. Alternatively, adjacent racks may be bonded together via grounding conductors terminated at lugs attached to abutting rack sides. Each such grounding conductor shall have a maximum of 0.01 ohm total resistance. Care shall be exercised to assure grounding lugs make low-resistance contact with the rack.

C. Shield Treatments

1. General: Cable Shields for Balanced Lines Serving Installed Equipment

a. Cable shields for balanced lines serving installed equipment shall be grounded to ASITG by a single path. Connect shields to ground at the source end (i.e., equipment outputs) only, except as applies to special conditions noted herein or according to approved submittal

2. Packaged or Harnessed Patchbays: Balanced-Line Cable Shields between Installed Equipment and Patchbays with intermediate terminations before or after patchbay jacks (e.g., on backplane of patchbay chassis)

a. For cables from intermediate terminals to all output jacks (generally, top row), float shields from sleeve terminals on inside (or patchbay side) of intermediate backplane and connect shields at jack sleeve terminals. Bus these jack sleeve terminals together at the jacks and route this bus to the green ground binding post on the back plane or, in the absence of a binding post, route directly to MIAGP in rack.(Note that this is an exception to the general rule, for the purpose of shielding cables between backplane intermediate connection points and patchbay jacks.)

b. For cables from input jacks (generally, bottom row) float shields from the sleeve terminals at the jacks and leave sleeve terminals unconnected. Connect shields at the sleeve terminals on the inside (or patchbay side) of the intermediate backplane. Bus these sleeve terminals together inside the

backplane and route this bus as described for the output-jack bus. For patchbays configured (or, preconfigured) to this method, wires to and from patchbays may have their shields terminated on the patchbay's external sleeve terminal connectors, as requirements for floated shields are built into the patchbay.

3. Raw Patchbays: Balanced-Line Cable Shields between Installed Equipment and Patchbays without intermediate terminations before or after patchbay jacks.

   a. Connect the shields of balanced audio output cables from installed equipment to ground at that equipment. Float shields of these cables at patchbay output jacks. Leave sleeve terminals at output jacks unconnected.

   b. Connect the shields of balanced audio output cables to installed equipment at the sleeve terminal of the patchbay input jack. Float the shields of these cables at the inputs of the installed equipment.

4. Patchbays for Audio Tie-Lines

   a. Connect the shields of balanced audio tie-lines, used for temporary interconnection, to the ground pins of panel connectors and though to jack sleeve connections at patchbays. Do not bus together the shields of these lines either to or from patchbays.

5. Other Shield Treatments

   a. The shields of portable cordage, such as, microphone cables, shall be connected at both ends to cable-connector ground terminal (or pin).

   b. Insulate all cables from conduit and extraneous grounds. Do not tie the shell of cable-type microphone connectors to shield except within microphones them-selves. Chassis connectors, which utilize their shells as conductors for shields (i.e. ¼" phone jacks, 3.5mm mini-jacks, RCA jacks, et cetera), shall be insulated from their mounting plate.

   c. Maintain continuity of shields at all connecting points except as required by standard practice for 'floating' shields.

   d. Follow good engineering practice, as outlined above; deviate from these practices only when necessary to minimize crosstalk or to maximize signal-to-noise ratios in the audio and video systems; report deviations to the Associate Architect and Consultant prior to implementation

D. Wiring and Cables

1. Make wiring connections with rosin-core solder or mechanical connectors. Use mechanical connectors in strict conformance with the manufacturers' specifications with regard to wire gauge, wire type (stranding), insulation type and thickness, number of conductors at a single termination, terminal-screw diameter requirements, et cetera. Restrict use of 'wire nuts' to mains power wiring where acceptable to code and related sections. Wire nuts are not acceptable for audio connections.

2. Punch-down"-type wire terminations are not allowed for microphone signals.

3. Clear all raceways, racks, and junction boxes of foreign matter and substances prior to installation of wire or cable.

4. Make no cable or wire splices inside of conduit or raceways.

5. Make no splices in any microphone lines. (Termination of a microphone line at an approved mechanical connector for making parallel wiring connections, or connection to pre-wired patch panels is not considered a 'splice').

6. Connections to rack-mounted equipment by means of phone plugs are not acceptable if the equipment has alternate connectors.

7. Use heat-shrinkable tubing to dress the shield and cable jacket wherever shielded cable is stripped-back for termination. The exception to this rule is when the cable terminates within the back shell of a single-circuit cable plug (accordingly, such terminations within multi-circuit plugs do require heat-shrinkable lead dress).

8. Install required microphone, line-level, production communications, loudspeaker, video and control wiring in conduits provided and installed as required by the Electrical section of this Specification. Coordinate conduit-fill to minimize mixing of signal types. If cables of different signal types must be combined in conduits or raceways, the following schedule shall be used for determining acceptability of conduit fill:

    a. Microphone-level circuits below -30 dBu, 20 to 20,000 Hz; non-relay DC control less than 50 volts; DC power less than 30 VA into resistive loads; CATV signal less than 1000 microvolt peak-to-peak into 50 or 75 ohms, 47 to 890 MHz.

    b. Line level audio, -30 dBu to +24 dBu, 20 to 20,000 Hz; baseband and compo-site video, 1 volt peak-to-peak into 75 ohm, 0 to 10 MHz; color subcarrier, 0 to 4 volts peak-to-peak into 75 ohm, 3.57 to 4.43 MHz; non-relay DC control less than 50 volts; relay DC control less than 50 volts for runs less than 20 feet.

    c. Loudspeaker-level circuits, greater than +24 dBu, 20 to 20,000 Hz; relay or non-relay DC control less than 50 volts; DC power less than 60 VA; synchronous control or data wiring less than 40 volts.

    d. Baseband and composite video, 1 volt peak-to-peak into 75 ohm, 0 to 10 MHz; color subcarrier, 0 to 4 volts peak-to-peak into 75 ohm, 3.57 to 4.43 MHz; video synchronization and switching pulses, 4 volts peak-to-peak into 75 ohm; digital Video 0 to 3 GHz, 1Vp-p, non-relay DC control less than 50 volts; DC power less than 30 VA into resistive loads.

    e. AC Power alone.

    f. Additional cable combinations as approved by Consultant or specifically indicated by the Contract Documents.

9. Dress all cables within racks neatly and such that there is adequate service loop adjacent to terminations to allow at least one termination repair without unharnessing loom.

10. Dress all cables to/from patchbays with adequate service loop to allow front removal of patchbay for service.

11. Install proper-fitting neoprene or nylon grommets where cables pass through holes in racks, boxes, or any other cabinetry, to prevent abrasion of the cables.

12. Test all cable lengths for serviceability before and after installation in conduit and before connection to equipment and panel connectors.

E. Labels

1. Upon request by Owner, remove visible logos from loudspeaker systems.

a. Affix a single, small acknowledgment plate listing “Designed By:” and “Installed By:” to one AV equipment rack in the Control Room. This plate shall list the firm name, address, phone number, email address and web site of the System Consultant and AV Systems Contractor.

b. Apply no advertising to racks, equipment, and accessories.

F. Wires and Cabling

1. Label each and every cable in system with machine-printed wire tags protected by clear heat shrinkable tubing or with self-laminating “write-on” labels.

2. Use a logically sequenced alphanumeric system, maintaining the same circuit designation from origin to destination.

3. Use a color scheme that is legible and easy to understand.

4. Attach wire tags to the cables such that they are easily read and the cable easily identified, usually about ½” from the cable end. Tag both ends of each cable.

5. No two cables shall bear the same number.

6. Multi-paired and multi-conductor cables shall bear a single number with number and conductor colors appearing on “As-Built” record documents.

7. Ground wires need not be wire tagged.

G. Panels

1. Clearly, logically and permanently label all custom controls, jacks and receptacles.

a. Methods:

1) Engrave and fill or silk screen custom rack panels.

2) Engrave and fill receptacle box plates.

2. Use characters at least 1/8" high on equipment mounted in rack cabinets and at least ¼" high elsewhere, with character stroke width at least 10% of character height, wherever possible.

    a. Printed labels and embossed tape will not be accepted for labeling.

3. Racks, rack-mounted equipment and controls

    a. Preferred method, see "Panels".

    b. Label all rack-mounted equipment items and their controls where utilized.

    c. Engraved plastic lamicoid labels are acceptable. See "Panels" for character heights and spacing.

    d. Use simple and tasteful color scheme that is legible and easy to understand.

    e. e. Use uniform type face, font size and label size.

    f. Printed tape may be approved for labeling of racks, rack-mounted equipment and controls under specific circumstance(s). Submit request for approval to Consultant.

    g. Embossed tape will not be accepted for labeling.

    h. See "Panels" for character heights and spacing.

H. Polarity

1. Install all loudspeakers to exhibit uniform polarity.

    a. Polarity of adjacent loudspeakers with respect to each other: a listener moving from in front of one loudspeaker to the next should sense a single apparent sound source which shifts smoothly and continuously as he moves. At midpoint, sound source should appear to be midway between loudspeakers.

    b. Polarity of lines and microphones: check for uniform polarity with respect to each other, of: microphone lines; lines to loudspeaker receptacles; loudspeakers; reinforcement microphones of the same type.

    c. Follow the "pin two is hot" standard for wiring 'XLR' terminations and '"tip is hot" for TRS-terminated lines.

I. Loudspeaker Components

1. Install loudspeaker systems so that loudspeaker devices may be removed and replaced from enclosures for service in the simplest possible manner.

    a. Where specifically instructed to do so, provide vibration isolation (shock mounting) of all loudspeakers sufficient to insure that there is no mechanical coupling from loudspeaker to support members or structure which might limit system acoustic gain before feedback within full frequency range of sound system, or which might audibly degrade sound quality. Use isolators such as those manufactured by Mason Industries or Peabody. Contractor shall insure that all safety considerations are satisfied.

b. Provide sound insulation totaling at least one half of the enclosure volume to in-side of all metal back-cans. As a minimum, in cylindrical loudspeaker enclosures, line inside back and circumference. In rectangular loudspeaker enclosures, line inside back, top and/or bottom and left and/or right side. Commercially available, professional-grade, loudspeaker systems shall include internal sound insulation according to the manufacturer.

J. Trade Coordination

1. Make moderate moves or changes as necessary to accommodate other equipment or preserve symmetry and pleasing appearance without claim for extra payments.

a. Obtain approval from Consultant and Owner's Representative before making changes necessitated by field conditions.

b. Cooperate with other trades to achieve well-coordinated progress and satisfactory final results.

3.2 INITIAL TESTING AND ADJUSTMENTS

A. Equipment

1. Provide necessary calibrated test equipment.

B. Settings and Tuning

1. Adjust settings or modify components as necessary to achieve System performance conforming to Contract Documents.

C. Tests

1. Upon completion of installation, perform the following initial tests and record results:

a. Absolute Impedance

1) Measure impedance of each loudspeaker line at amplifier location at 250 Hz, 1 kHz; 8 kHz.

2) With lines disconnected from their destination, measure resistance in lines to microphone, auxiliary and line inputs with receptacles open and short-circuited.

b. Mechanical

1) Verify integrity of support provisions.

2) Verify absence of debris of any kind, tools, et cetera

c. Power and Isolated Ground

1) Verify isolation of Audio System Isolated Technical Ground from raceway and building electrical ground.

2) Verify integrity of signal-ground and Audio System Isolated Technical Ground connections.

3) Verify proper provision of AC power to devices and equipment.

4) Signal Wiring and Cables

5) Verify absence of continuity in XLR cables between pin #1 and connector shell. Modify wiring of cables that do not conform to this standard.

6) Verify integrity of insulation, connections and shield terminations.

7) Verify integrity of soldered connections including absence of solder splatter, solder bridges and cold-solder joints.

8) Verify routing and dressing of wire and cable as neat and in accordance with good engineering practice. Correct installation conditions that do not meet these requirements.

9) Verify point-to-point continuity of all signal and control wiring and cables.

10) Verify conformance with wire designations on "As- Built" wiring diagrams.

11) Test microphones, loudspeakers and cables for proper polarity, correcting any discrepancies found.

12) Provide report 3 days before site visits and check-out(s).

d. Hum and Noise Level

1) Adjust mixer/switcher input gain controls for 0 dB reading with pink noise at -55 dBu level at microphone input; 0 dBu at line level input.

2) Without changing gain, terminate microphone and line-level inputs with shielded resistors of 150 and 1,000 ohm, respectively.

3) Terminate power amplifier outputs with power load resistors matching nominal impedance of output terminals used in System.

4) With amplifiers at full power, measure overall hum and noise level at each power amplifier output.

5) Acceptable noise level: 80 dB below rated output of amplifier, minimum.

e. Electrical Distortion. (Only required during acceptance testing in the event of the use of non-approved equipment or evident audible electrical distortion.)

1) Adjust mixer/switcher input gain controls as described for "Hum and Noise Level" tests.

2) Terminate power amplifier outputs as described for "Hum and Noise Level" tests.

3) Apply 800 Hz sine-wave signal from oscillator having less than 0.5% total harmonic distortion to line-level input at level required to produce measured full amplifier output.

4) Measure distortion with distortion analyzer or observe waveform on oscilloscope to ascertain that distortion is less than that specified.

a) Total Harmonic Distortion: less than 0.20% max. from 20 Hz to 20 kHz.

f. Upon completion of installation, perform the following verifications, record results, indicate date and name of verifier(s):

1) Parasitic Oscillation and RF Pickup.

2) Set up system for typical modes of operation (i.e., microphones connected, auxiliary audio source connected, control system connected, et cetera).

3) Use 10 MHz bandwidth oscilloscope and loudspeaker monitoring.

4) Check to ensure that system is free of spurious oscillation, RF pickup in absence of input signal; also with system driven momentarily to full out-put at 160 Hz.

5) Remedy causes of parasitic oscillation and RF Pickup.

6) Report results 3 days before final check-out.

g. Buzzes, Rattles, and Acoustic Distortion

1) Apply sine-wave sweep from 30 to 8,000 Hz at 6 dB below rated power amplifier output voltage.

2) Listen carefully for buzzes, rattles and objectionable distortion in loud-speaker systems and room furnishings, fixtures and finishes.

3) Remedy causes of objectionable electronic or loudspeaker distortion.

4) If within these systems remedy causes of buzzes or rattles.

5) If within room furnishings, fixtures or finishes, promptly notify Architect, Consultant and General Contractor indicating cause and suggesting corrective procedures.

6) Work with other trades to correct problems.

h. Measurement criteria for basic video components shall be:

1) Looking at NTSC Bars, overall levels:

a) Luminance 100 IRE

b) Sync 40 IRE

c) Burst 40 IRE

2) Color values:

a) Color Luminance (IRE) Chrominance Level IRE

b) White 100.0 0

c)	Yellow	89.5		82.8			
d)	Cyan		72.3		117.0		
e)	Green	61.8		109.2			
f)	Magenta	45.7		109.2			
g)	Red		35.2		117.0		
h)	Blue		18.0		82.8		
i)	Black		7.5			0	

3) When testing each video line using the NTC-7 Combination Test signal for NTSC, which contains a white flag, Multiburst and a modulated pedestal signal: minimal roll off across the band from .4MHz to 4.2MHz.

i. Gain Control Settings.

1) Adjust gain controls on rack-mounted equipment for optimum signal-to-noise and signal balance. Place temporary marks on settings using small pressure-sensitive arrows (preferred) or pressure-sensitive dots with indicating line. “White-Out”, masking tape and other slipshod methods are not acceptable.

2. Report.

a. Upon completion of above tests and necessary adjustments, submit two copies of a written report presenting test results, including numerical values where necessary, for review by the Architect and Consultant prior to demonstration and acceptance testing.

3. Certification.

a. With the above report, submit written notice that the installation conforms to specifications, is complete, and is ready for inspection and testing by representatives of the Owner, Architect and Consultant.

3.3 ACCEPTANCE TESTING and DEMONSTRATION of COMPLETED INSTALLATION

A. Upon approval of the above report, and at a time set by the Owner, demonstrate operation of each major component, using all input, control, amplification, and projection equipment. After demonstration, assist as required in the following acceptance tests by representatives of the Owner.

B. To comply with Project Schedule and to avoid conflict with work of other sections, testing procedures may be required by Consultant to be performed at any hour of day or night. With a minimum of three-day notice of Acceptance Testing, provide specified personnel and equipment at any time during Acceptance Testing without claim for additional labor or other costs.

C. Provide services of designated supervisor and an adequate number of technicians familiar with Work of this Section as required to comply with Project Schedule.

D. Provide the following:

1. Tools, as required for performance of adjustment and corrections to this Work.

a. Spare wire and connectors and specialized connector tools if applicable.

b. Ladders, scaffolding, lifts required to access sound system devices, connection points, junction boxes, including clusters.

c. Test equipment specified, used for Initial Testing and Adjustments.

d. A Complete set of latest stamped and actioned submittals for reference.

e. A Complete set of Shop Drawings and Initial Testing Reports.

f. Complete set of manufacturer's original operation, instruction and service manuals for each equipment item for reference.

E. Equipment Tests

1. All aspects of the AV installation are subject to testing by the Owner or Owner's representatives to determine compliance with project specifications. Non-compliant components or systems shall, at the Owner's discretion, be corrected or replaced at the Con-tractor's expense. The Contractor may appeal Owner's test results by providing proof-of-compliance to be considered by Owner. Owner's testing notwithstanding, Contractor shall test all systems and components for compliance with project specifications. The AV Contractor will report findings of non-compliance with manufacturer's specifications to the manufacturer, Owner and Consultant.

2. If need for adjustment becomes evident during demonstration and testing, the Con-tractor's work shall be continued until the installation operates properly in the opinion of the Consultant.

3. If final acceptance is significantly delayed because of defective new equipment or be-cause of installation not in accordance with Contract Documents, the Contractor shall pay for all additional time and expenses of the Owner's representatives during any resultant extensions of the acceptance-testing period.

F. Listening Tests shall consist of subjective evaluations by observers listening at various positions under various operating conditions, using speech, music and recorded program material.

3.4 CLOSE-OUT

A. Punch List

1. Perform required remedial work, without claim for additional labor or other costs. Where required, re-test and submit revised Test Report.

2. Notify Consultant and Owner's Representative of completion of Punch List.

B. Training and instruction

1. Provide up to 32 hours of on-site training sessions to Owner in operation of system with various user groups.

2. Provide training and instruction by personnel thoroughly familiar with systems and infrastructure provided.

3. Submit session outline, copies of "handouts" for review by Consultant 10 business days prior to scheduled sessions. Instruction shall include:

   a. Demonstration of purpose for, and operation of, each component and associated infrastructure.

   b. Review of functional diagrams and Owner's manual.

   c. Demonstration and explanation of operation of system controls and components including functional variations.

   d. Attendance at minimally two events involving major use of each specified systems and provision of any helpful suggestions that may be appropriate.

C. Warranty

1. Submit one-year warranty dated to begin with Acceptance of the Work of this Section.

2. Submit proposal for one year and three years of additional, continued warranty and maintenance service

3.5 OWNER'S RIGHT TO USE EQUIPMENT

A. Acceptance of the Work of this Section shall occur after completion of corrections and adjustments required by "Punch List" (as generated during Demonstration and Acceptance Testing of Completed Installation).

B. Owner reserves the right to use equipment, material and services provided as part of Work of this Section, prior to Acceptance, without incurring any obligation to Accept any equipment or completed systems until Punch List work is complete and systems comply with Contract Documents.

END OF SPECIFICATION TEXT