SECTION 11 70 01 AUDIO VIDEO SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. General

1. This specification covers installation, technical support, maintenance and warranty support associated with the AV systems for six (6) “Laptop Lounges” connected to the second floor in the Atlantic City Convention Center in Atlantic City, NJ. The objective is to procure and install the systems, associated wiring and devices, as well as establish pricing agreements covering ongoing support and maintenance for a period of one year commencing on the date of substantial completion of the display covered within this section.

2. Bids must also include separate pricing for and extended parts and labor warranty for each of the following durations:
   a. Year 2
   b. Years 2 & 3
   c. Years 2 through 4

3. Each warranty year shall include a 6 month and 12 month preventive maintenance inspection, 48-hour response time, hot-swap replacement parts, on-site labor and an online service log for all extended warranty service performed and parts provided.

B. Stipulations

1. The specifications section "General Conditions" or other correspondence provided by the owner with this document and related amendments, form a part of this specification by this reference thereto and shall have the same force and effect as if printed herewith in full.

C. Project Drawings

1. The drawings for the project include the following drawings provided in support of this Section dated 6-15-2018. The AV drawing set includes three (3) sheets including the following:
   a. AV-01 Drawing List, Legends and Notes
   b. AV-02 Device Locations in Plan
   c. AV-03 Device Locations in Ceiling Plan
   d. AV-04 Miscellaneous Details
   e. Single Line Diagrams

D. Project Specifications

Section 115202 Laptop Lounge AV Systems (this document)

1.2 SCOPE OF SPECIFICATION

A. This specification covers the procurement, installation and maintenance of Audio Video Systems for the Retail Building, Fitness & Technology Spaces within the Lancaster Housing

construction project at Villanova University. The objective is to provide fully professional Audio Video Systems, completely installed, tested, and approved for student use.

B. The intent of this section is to define the products, methods and scope of services required to provide a first class, professionally installed, performance tested Audio Video System. This section in conjunction with the project drawings defines the technical, functional and performance requirements for the specified Audio Video Systems.

C. The systems specified herein will be purchased by the project General Contractor from a qualified Audio and Video System contractor whose current business operations and experience include the successful integration of Audio Video Systems on Construction projects of size and scope similar to the systems specified herein. The Audio Video contractor's proposal shall be provided on a lump sum basis with unit price details.

D. The AV contractor's proposal is to be based on a Lump Sum price inclusive of all items required to meet the design intent. The design intent is specifically defined within Part 1, 2 and 3 of this Section and on the AV drawings that are referenced to, and part of this section. Equipment lists as described in part 2 of this section and on the provided Bid Form have been prepared as a convenience to the bidding contractors. The contractor's lump sum price shall include all materials and services as required to fulfill the design intent.

E. The bidder's lump sum price shall include all goods and services as shown on the project drawings and within these specifications.

1.3 SYSTEM DESCRIPTIONS

The AV systems for each Laptop Lounge will include the following features and capabilities:

A. Audio Systems
   1. High Quality Ceiling Loudspeakers
   2. Background Music and Paging from existing, building wide audio system
   3. Playback from HDMI Source on AV Input Plate
   4. Playback from Wireless/Laptop Video Source
   5. Analog Audio (Left/Right) Inputs on AV input Plate
   6. Stereo Audio Programmable Output from Video Display
   7. Relocate press feed audio, intercom and paging connections at Press & Show Manager office.

B. Video Systems
   1. One 65" Flat Panel Display with Articulating Wall Mount Assembly
   2. Source 1: Hard-Wired HDMI Input Source on AV Input Plate (located on short return wall adjacent to display)
   3. Source 2: Wireless Video Input Source w/Laptop Screen Sharing (Mirroring from multiple laptop/handheld devices)
   4. Source 3: CATV Set-Top Box / Receiver

C. Control Systems
   1. One wall mounted plate with volume control, video source selection and TV Channel Up/Down.

1.4 SUBSTITUTIONS

A. It is intended that the Contractor will provide materials and labor as necessary for the completion of the Audio Video Systems project and said contractor shall furnish all materials and labor in compliance with this specification.

B. Where conflict exists with other specifications concerning such materials and labor, this specification takes precedence unless otherwise addressed in writing, by the owner's representative. It shall be understood and agreed by the contractor that the systems herein described, shall be complete in every detail necessary to supply complete, working systems implemented in a professional, workmanlike manner commensurate with professional broadcast quality.

C. The specification text as well as any drawings provided with the bidding documents is detailed only to the extent necessary to define the design intent and anticipated performance requirements.

D. Equipment not mentioned herein nor shown on drawings, but necessary to meet the defined performance requirements shall be provided without claim for additional payment.

E. Drawings pertaining to this specification shall be considered part of this specification and shall be part of the contract documents. The Contractor will provide complete and operable systems including all labor and materials required for all assemblies and sub-assemblies either specified or implied within this document.

1. All functions and features specified herein are to be provided by the contractor. Where specific manufacturer's names and model numbers are specified, such identification is to identify the expected performance parameters and to functionally define the specific product requirement.

2. Where a contractor intends to provide goods other than those specifically identified, such "equivalent" items must be clearly identified in the Post Award Initial Submittal. "Equivalent" items included in the Post Award Initial Submittal must include written certification from the manufacturer of the “equivalent” item stating the equivalency of each and every substituted item relative to the specified items in regard to features, function, performance and future expansion capability.

3. Contractors wishing to provide "equivalent" products for specified devices may be required to demonstrate the equivalency of the proposed substitute items to the owner at the contractor’s expense. Such proof of equivalency, in addition to the manufacturer's letter as noted above may include the following:

1. An on-site, side-by-side demonstration of both the specified and proposed substitute items.
2. A formal bipartisan, laboratory test report comparing the technical performance of each and every proposed substitute, versus specified item.
3. Such test reports for Audio Video System components, will include a spreadsheet comparison of all critical distortion, power, frequency response, noise and dynamic range measurements.
4. All comparison tests for Audio Video System components will be performed following the established AES and/or ICIA defined, testing procedures.
5. The responsibility of proving the equivalency of substitute products with respect to the specified products shall lie solely with the contractor.
6. All costs associated with providing information or performing the above outlined tests and comparisons required to confirm the equivalency of substitute products will be at the sole expense of the contractor. Such costs may include but are not limited to:
   a. Independent laboratory tests
   b. Equipment items for demonstration of specified and proposed substitutions
   c. Contractor incurred travel costs and miscellaneous expenses

d. Professional Services Fees (architects, engineers and consultants) charged to the owner as a result of time charged to participating in the review of proposed substitutions.

1.5 REFERENCES

A. All work included in this specification is to be performed within the guidelines of the following standards:

1. NEC (National Electric Code)
2. ASTM (American Society of Tests and Measurements)
3. IEEE (Institute of Electrical and Electronic Engineers)
4. AES (Audio Engineering Society)
5. NAB (National Association of Broadcasters)
6. AVIXA (Audiovisual and Integrated Experience Association, formerly InfoComm)
7. ADA (Americans with Disabilities Act)
8. ANSI (American National Standards Institute)

1.6 DEFINITION OF TERMS

A. The term "Contractor" or "Audio Video Systems Contractor", refers to the Audio Video System contractor who has been awarded the contract for providing the goods and services specified and defined within this specification section.

B. The term "or equivalent" when mentioned in regard to a specified product or device will mean that the contractor may provide a functional and technical equivalent product in place of the listed item or device. Determination of equivalent models or products will be at discretion of the owner following the guidelines defined in paragraph 1.4 above.

C. The term “Work By Others” shall mean: Any work required by the project but not required of the contractor or subcontractor responsible for this section. Assignment of and Execution of, “Work by Others” as defined within this section shall be the responsibility of the owner, the owner’s general contractor or the project electrical contractor.

D. The term “Furnish” shall mean: Supply the referenced device, item or system including all applicable warranties to the owner.

E. The term “Install” shall mean: Deliver the referenced item to the project, physically install the item including all terminations, mounting or other labor necessary to successfully integrate the referenced device, item or system into the project including all applicable warranties.

F. The term “Provide” shall mean: Furnish and Install the referenced device, item or system.

G. The term AV System, Audio Video System or Audio Video Systems shall mean the complete systems as defined within this section including audio equipment, video equipment, lighting equipment, control system equipment, digital conversion equipment and related items that are described herein, mentioned herein, shown on the referenced AV drawing set or as necessary to fulfill the design intent.

H. The abbreviation AV shall mean Audio Video.

I. The term ETCP shall mean Entertainment Technician Certified Program. ETCP is an independent certification program provided to the theatrical industry as described at www.etcp.plasa.org.

J. The term CTS shall mean Certified Technology Specialist. The CTS certification program is ANSI certified, industry recognized certification program developed and administered by AVIXA/InfoComm International that confirms an individual's general knowledge of AV products, systems and generally accepted practices of the AV industry.

K. The term CTS-I shall mean Certified Technology Specialist with Installation Specialty. The CTS-I certification program is ANSI certified, industry recognized certification program developed and administered by AVIXA/InfoComm International that confirms an individual's specific knowledge and experience with respect to the installation and implementation processes, technical requirements and best practices associated with the installation and implementation of AV systems typical of those described within this section.

L. The term CTS-D shall mean Certified Technology Specialist with Design Specialty. The CTS-D certification program is ANSI certified, industry recognized certification program developed and administered by AVIXA/InfoComm International an individual's specific knowledge and experience with respect to the engineering, design, installation and implementation processes, technical requirements and best practices associated with the implementation of AV systems typical of those described within this section including the professional services and related integrities required to assure that a system of the type defined within this section is properly coordinated with all members of the project team and respective trade groups serving the project.

1.7 SUBMITTALS

A. Pre-Bid

1. All AV Contractor pre-bid questions pertaining to the AV System specifications and the scope of work described within this section shall be reviewed by, signed and submitted by an experienced and qualified staff member of the bidding contractor.

2. Qualifications and experience for the person who will review, sign and submit pre-bid AV questions shall be as described within paragraph 1.8.B below.

B. With Bid

1. Unit Price and AV System Cost Information

a. The contractor proposal shall include a complete Unit Price schedule identifying all system components, labor, miscellaneous materials, project management services, engineering services, programming services, warranty, field labor, in-house labor including unit price and extended price for each, a subtotal of equipment and material costs, a subtotal for all labor and services as well as a lump sum price for the overall scope of work for each specified AV System Type.

b. Provide a cost summary displaying the overall system cost for each AV system type multiplied by the total number of required systems.

c. Acceptable format for this submission is provided in the pages that follow this section.

2. Facility and Capabilities Report

a. Provide detailed professional resumes of the bidding contractor staff members who will be fulfilling the roles defined within paragraph 1.6 of this section. Provide a written statement signed by an officer of the company

stating that if the company is awarded the specified work, that the contractor will assign the identified staff members, or equivalently qualified staff members to the project for the duration of the project. Failure to include the above stated resumes and letter in the bid response shall be grounds for rejection of bid.

b. Provide a summary of the Audio Video System contractor's capabilities, which satisfactorily demonstrate that the selected Audio Video System vendor maintains the physical plant, personnel and equipment necessary to provide the specified systems.

c. The report shall also include a sheet identifying the contractor's test equipment inventory as of the date of bid. This inventory at a minimum must include the following equipment items:

a. Dual Channel 20MHz Oscilloscope
b. 1/3 Octave Spectrum Analyzer with calibrated microphone
c. Calibrated SPL meter
d. Audio Test Generator with Pink Noise and Variable Tone Generator (minimum 20 frequencies)
e. Polarity Tester
f. HDMI/HDCP Compliance Tester
g. Light Meter

3. Provide a list of five projects similar in scope and complexity to this project. Include client names and contact information for each project. Projects must include Audio Video Systems of similar size and scope.

4. All qualification information will be reviewed by the owner's representative to verify that the Audio Video System contractor maintains the capabilities and experience necessary to insure that a satisfactory system installation is accomplished.

5. Should the owner determine that the submitted qualifications do not meet the specified requirements, the general contractor will be required at no additional cost to the owner, to cancel any agreements with the proposed AV contractor and to then subcontract the services of an AV Contractor who's qualifications fulfill the specified requirements.

C. Shop Drawings

Within 45 days of award, provide the following information for review:

1. Bill of Material

Complete bill of material including all material, component devices and equipment required for complete and operable systems. The bill of material will contain the following information for each item listed:
a. Quantity
b. Description
c. Manufacturer's name and model number

2. Product Data Sheets

Provide a complete set of product data sheets for all equipment, devices, hardware and related items that will be provided. The Data Sheets shall be presented in 3 ring binder format, tab and organized such that the data sheets are readily referenced to the above noted Bill of Material Sheet.

3. Engineering documentation identifying any and all proposed variances from the specified system layout.

4. AV Plan Drawings, Device, Cable and Related Legends

   Provide Device legend information for all field installed AV equipment items. Device Legend information shall include the following:

   a. Device ID
   b. Device Name
   c. Device Description
   d. Manufacturer Name
   e. Manufacturer Model Number
   f. Back Box Description
   g. Back Box Dimension
   h. Back Box Height
   i. Device Weight
   j. Device Location
   k. Heat Load Information
   l. Electrical Load Information
   m. Clear Definition of Work Required By Others
   n. Conduit and Related Rough-in Requirements
   o. Cable Pull Information
   p. Device Color Information
   q. Applicable Notes

   Provide scaled device location drawings showing all wall and floor mounted AV system devices located in floor plan.

   Provide scaled device location drawings showing all ceiling mounted AV system devices within a properly coordinated ceiling plan.

5. Section and Elevation Details

   Provide scaled and properly dimensioned section and elevation details showing all video displays, projection screens, projector lifts, and wall mounted speakers systems, suspended speaker systems, video cameras, microphones, control equipment/user interfaces and related AV system devices.

   Projection system details shall include projection light paths coordinated with lighting devices, ceiling soffits and related information as necessary to properly coordinate the projection systems with mechanical devices, electrical devices as well as the planned construction finishes.

6. AV Plate and Panel Drawings

   Provide scaled drawings identifying all AV connection plates, panels and related devices. Plate and Panel drawings shall include:

   a. Plate Dimension
   b. Detailed view of each required connector
   c. Lettering Requirements
   d. Plate/Panel Material and Finish
   e. Plate Color
   f. Lettering Color
   g. Connector Colors

h. Any other information required for successful manufacture/ fabrication of the plate and panel devices for the project.

7. Single Line Diagrams

Provide single line drawings for each of the following disciplines:
a. Audio
b. Video
c. AV Control, Network and Data Connections
d. Electrical

Single line diagrams shall indicate each and every AV equipment item, signal flow, input connection information, output connection information, bus connection information, port information, audio impedance/level information, signal type, cable numbering and related circuit information for all AV equipment devices as well as the following information:
a. Location reference for each device shown in single line.
b. Cable system details including all input plates, panels and connectors.
c. Indicate device, panel and plate locations coordinated with the riser and block diagrams.
d. Organized cable numbering system for all system cables. Include cable schedules following the cable designations indicated on the schematic and functional diagrams. Cable schedules will be provided for field wiring, inner-rack and inter-rack terminals.

AV Control and Network diagrams shall indicate all interconnections between the AV system, building network devices, telephone equipment devices and any other connections associated with equipment being provided by others.

8. Equipment Rack Details

Provide properly scaled front and rear rack elevation details for all equipment rack assemblies. Equipment rack layouts shall include all front and rear mounted devices, including device name and number coordinated with the single line diagrams. Show all blank, vent, tie line and custom fabricated panels.

Show overall dimensions of each rack assembly including height, depth, width and weight.

Show scaled labeling details for each rack mounted equipment item.

Identify each equipment rack by make and model.

Provide EIA rack spacing reference adjacent to all rack elevation details such that rack locations and heights for all rack mounted devices can be easily identified by way of their vertical position in the rack.

Provide scaled, properly dimensioned details relevant to cable entry, ladder trays, cable management, back-boxes and appurtenances associated with the physical installation of each AV equipment rack.

Provide electrical connection information.

Show all vertically mounted electrical distribution devices within each rack assembly.

9. Suspended Device Drawings

Provide mechanical drawings depicting weights, scaled dimensions and related information required for fabrication, assembly and installation for all products covered by this section that will be suspended from walls, ceilings or other overhead installation conditions.

Suspended device drawings must be prepared, signed and sealed by a properly qualified engineering professional with demonstrable experience on projects of similar type and scope, or prepared, signed and sealed by an ETCP certified Theatrical Rigging Contractor.

10. AV Network Device Ledger

    Provide a well-organized ledger sheet presented in 8.5" x 11" format that clearly describes all AV devices requiring connection to any network, network switch, LAN, WAN or Wireless network connection.

    At a minimum, the AV Network Ledger Sheet shall include the following information for each and every network connected device:

    a. Device Name and ID #
    b. Manufacturer Name
    c. Model
    d. MAC Address (if not available, leave space blank for later use)
    e. IP Address (if not available, leave space blank for later use)
    f. Switch ID
    g. Port ID
    h. Device Location

11. Name and contact information of the CTS-D and CTS-I certified staff members who will be assigned to this project.

12. Submit completed project experience for the individual who will be responsible for preparing the DSP system program. DSP programmer for this project must be capable of demonstrating the successful completion of a minimum of three DSP system designs. Provide project names, locations and contact information for three recent DSP projects.

13. Submit completed project experience for the individual who will be responsible for preparing the AV control system programming. AV Control System programmer for this project must be capable of demonstrating the successful completion of a minimum of three AV Control System programs of similar size and scope to this project. Provide project names, locations and contact information for three recent AV Control System projects.

14. Name, contact information and project resume, of the staff member or members who will be responsible for final set-up and testing of the specified Audio Video Systems (see paragraph 1.6.E below).

15. The AV contractor shall provide a Shop Drawing Sheet Numbering scheme that clearly differentiates the shop drawing documents from the construction document set that is provided with these specifications. Recommended sheet names would begin with an alphabetical prefix indicative of the AV contractor firm name, followed by sheet number.

The contractor will be authorized to use the specification "AV" drawing files for the purpose of preparing the required submittal and as-built documentation.

These drawing files and related title blocks may be modified by the contractor in their preparation of shop drawings, to reflect the as-built conditions and to identify the contractor as a participant and responsible installing contractor for the project.
No other use or re-use of the specification drawings in whole or part will be allowed without the expressed written consent of the drawing author.

Unless specifically agreed to in writing by the owner and the drawing author, the contents of the AV drawing files shall not be re-used, copied or otherwise implemented by the contractor, it's employees or subcontractors for any other project, proposal, report, article or other form of publication.

If the contractor chooses to use the specification AV drawing files, the contractor shall clearly identify any changes, modifications or adjustments made to the drawings. The contractor shall clearly identify the original author of each drawing with notations of revisions including the name of the person making the revision, date of revisions and purpose of each revision.

D. Control System Submission, Presentation and Coordination

Within 120 Days of contract award or no less than 120 days prior to the scheduled completion of the project, the AV contractor shall fulfill the following presentation and coordination requirements relative to the AV Control System programming:

1. Graphical User Interface Design

   a. Provide graphical representation of all user interface screens, button panels, touch screens to be provided to the system users and technical operators.
   b. These layouts shall be provided in .pdf file format.
   c. Screen layouts shall be presented in 1" = 1" scale.
   d. All layouts shall be presented in color.
   e. Touch screens that include hard button controls adjacent to the touch screen device, shall be presented with an accurate screen shot of the touch screen surface with hard button devices shown to the proper scale and placement.
   f. User interfaces consisting of only hard button controls shall be presented in 1" = 1" scale.

2. AV Control System Presentation

   The AV contractor and its approved AV Control System Programmer will be required to provide a formal presentation of the user interface presentation described in paragraph 1.7.D.1 above. The AV Control System presentation will occur in the presence of the owner, the architect and the AV consultant.

   During the presentation, the AV contractor shall take detailed notes relating to comments, questions and requested changes made by the owner, the architect and AV consultant.

   Following the Presentation Meeting, the AV contractor shall revise the hard copy control system presentation as discussed and agreed during the presentation meeting and re-submit the updated presentation in a timely manner.

3. AV Control System Demonstration and Final Adjustments

Once the AV system has reached substantial completion and the AV system is in a functional operating condition, the AV contractor shall be required to provide a formal demonstration of the AV control system to the owner, architect and AV consultant.

During the demonstration, the AV contractor shall take detailed notes relating to comments, questions and requested changes/adjustments to the layouts, logic and related operations of the control system made by the owner, the architect and AV consultant.

Following the Control System Demonstration, the AV contractor shall revise the control system programming as discussed and agreed during the demonstration and revise the programming in a timely manner and as required to maintain the project completion schedule.

E. As-Built Documentation

Upon completion of the systems installation and prior to formal acceptance of the Audio Video Systems by the Owner, the Contractor will submit "As-Built" versions of the shop drawing set as well as other documentation covered within this section.

F. Contract Close-out

At the time of formal acceptance of the systems by the owner, the contractor will provide the following:

1. A minimum 12 page, 8.5” x 11” Simplified Audio Video System Instruction Manual for each subsystem. This document shall be prepared specifically for this project and shall provide the non-technical user with a step-by-step set of instructions defining all steps necessary to activate, connect and otherwise operate the specified Audio Video System. These instructions shall at a minimum, cover the following topics:

    a. System Turn On
    b. Display System Use
    c. Control System Use
    d. Audio System Use

2. One set of the owner/operator manuals for each Audio Video Systems component as supplied by the component manufacturers. Said manuals shall be provided, three hole punched and mounted in a three ring binder. The contents shall be organized with an alphabetized cover sheet and alphabetized tabs for each of the equipment items. The binder shall be turned over to a representative of the owner upon completion and acceptance of the systems installation.

    Binder shall be provided with clear identification of its purpose and content.

3. One set of system functional diagrams shall be provided for each system, laminated and mounted adjacent to each equipment rack assembly. These laminated drawings shall be either xerographic or plotted original drawings.
    Diazo, blue-line or black-line copies will not be acceptable for these specific documents.

4. Two complete sets of As-Built Drawings printed to the project sheet size.

5. Two sets of the As-Built drawings printed 18” x 24” Sheets.

6. Two USB Thumb Drives with the following files provided in an organized file folder format:

    a. Shop drawings in dwg. format
    b. Shop drawings in pdf format
    c. Uncompiled control system programming
    d. All software files provided by the equipment manufacturers
    e. Equipment owner/user/maintenance manuals in pdf format

1.8 QUALITY ASSURANCE

A. All qualification requirements of this paragraph must be met by the bidding contractor. If the bidding contractor will require the services of a qualified subcontractor in order to fulfill the specified qualification requirements, the qualified sub-contractor must be clearly identified in the bid response. All submittal requirements must be provided on the qualified vendor/subcontractor's letterhead.

B. The contractor shall provide qualified, industry certified staff members for all technical work associated with the work of this section.

At least one AVIXA/InfoComm International Certified Technical Specialist with Design Specialty (CTS-D), certified staff member must be provided by the contractor. The CTS-D staff member must maintain a minimum of five years design and/or project management experience.

The certified (CTS-D) staff member must be engaged in the project throughout all phases of design, integration and testing. The designated CTS-D staff member shall be responsible for the following:

1. Review and approval including signature of all shop drawings, submittals and documentation prepared by the contractor.

2. Review and approval of any scope of work associated with any change order, work modification or field work order. All change orders must be reviewed and approved by the project CTS-D prior to final submission of such change orders to the owner, general contractor or architect.

3. Review, approve and/or preparation of all Request For Information or similar documents submitted by the contractor.

4. Resolution of any technical, trade, scope of work or similar disputes that may arise throughout the course of the project.

5. Attendance at meetings with the owner, architect, general contractor or electrical contractor

6. Site inspection and approval of all work including shop fabricated items, field installed devices and the overall system installation prior to demonstration to the owner.

7. All demonstration to, and training of, the owner.

8. Review and approval of all as-built submissions including owner manuals.

The following items may be performed by either a CTS-D or CTS-I AVIXA/InfoComm/ANSI Certified or equivalently qualified staff member:

1. Field verification of all work by others including but not limited to:

    a. System Grounding
    b. Electrical Systems
    c. Rigging
    d. Millwork
    e. Mechanical Systems
    f. Cabling Systems

2. Supervision of Field Terminations

3. Fabrication, terminations and preliminary testing of pre-fabricated equipment rack assemblies.

4. All other contractor staff members performing technician level work specified within this section but not identified in items 1 through 11 above must be minimally certified as an AVIXA/InfoComm/ANSI Certified Technical Specialist (CTS).

5. Qualified contractors who do not participate in AVIXA/InfoComm/ANSI Certification and training, yet otherwise maintain personnel qualified to fulfill the intent of these specifications must provide the following information for review and approval by the project architect:

6. Personal resume of, including project references for six projects of similar size and scope and itemized list of technical capabilities of the staff member who will be responsible for the successful integration of the specified systems and all items defined above under items 1 through 8.

7. Said individual must maintain a minimum of five-years, experience in Audio Video Systems integration, and a bachelor's degree in electrical engineering from a fully accredited college or university and must be prepared to readily demonstrate capabilities equivalent to those of an AVIXA/InfoComm International CTS-D certified individual.

8. Personal resume of, including project references for six projects of similar size and scope and itemized list of technical capabilities of the staff member who will be responsible for the successful integration of the specified systems and all items defined above under items 9 through 11. Said individual must maintain a minimum of four years' experience in sound, video and television systems integration, an Associate's Degree in electrical-electronic engineering technology from a fully accredited college or university and must be prepared to readily demonstrate capabilities equivalent to those of an AVIXA/InfoComm/ANSI certified CTS-I individual.

9. Failure to comply with the Quality Assurance requirements defined above shall constitute breach of contract by the AV contractor. Should the AV contractor be found to be in breach of this paragraph, the owner reserves the right to hire an Independent Technical Service Provider of their choosing to provide the services described in item 1 through 11 above.

10. Should the owner choose to hire an Independent Technical Service Provider as a result of the AV contractor's failure to fulfill the requirements of items 1 through 11 above, all costs associated with hiring the Independent Technical Service Provider shall be deducted from the AV contractor's lump sum price for the project.

C. The contractor will be required to attend a minimum of two pre-installation conferences with the owner's representative. The intent of these conferences will be to review the

contractor's submittals and to review the proposed methods of implementation and to coordinate the Audio Video System installation with the work of other trades.

The contractor shall be responsible for providing coordination documentation that will insure that the owner's staff or designated contractors can properly provide electrical power to the Audio Equipment Rack as well as sufficient physical space for the Equipment Racks.

The Audio Video and Stage Lighting contractor shall be responsible for reviewing all AV work that will be provided by others. The review of work by others must be provided in a timely and well-coordinated manner. Any discrepancies found by the AV contractor must be clearly and concisely identified in writing and provided to the owner within five days of the date of review.

D. The AV contractor shall inspect and verify all work performed by the project electrical contractor as necessary to insure that all work including, device installation, power receptacles, back-boxes, conduits, etc, are performed in compliance with these specifications.

E. Audio and Video System final set-up shall be accomplished by a qualified Audio Video System technician or engineer who has been trained in the procedures and methods necessary for successful Audio Video System installation. The contractor must provide a qualified Audio Video System technician during the test and adjustment phase of the project. Lighting Systems must be set-up and tested by a production lighting technician maintaining a minimum of five years lighting production and installation experience.

F. All materials shall be new and shall conform to applicable provisions of Underwriters Laboratories and the American Standards Association.

G. Safety Certifications as required to meet local code and as required for obtaining the owner's Certificate of Occupancy, are the responsibility of the contractor.

H. Prior to the owner and/or the owners consultant review of the installed AV systems, the AV contractor's CTS-D certified staff member shall perform an initial review of the system's completeness and readiness for demonstration to the owner and/or the owners AV System consultant. The AV Contractor's review shall be performed using the "Standard Guide for Audiovisual Systems Performance Verification Checklist" as published by AVIXA/InfoComm International. All relevant elements of that checklist shall be verified, noted and submitted by the AV contractor for the owner's review, prior to demonstration of the system condition or training of owner personnel.

1.9 DELIVERY, HANDLING AND STORAGE

A. Packing and Shipping

1. All items delivered to the job-site shall be properly packaged and sealed.

2. All items to be delivered to the job-site via contractor vehicles shall be properly and adequately protected. Equipment racks are not to be delivered to the job-site, unprotected and unpacked.

B. Acceptance at Job-Site

1. All deliveries of specified components are to be received on the job site by the contractor.

C. Storage and Protection

1. The contractor will be required to maintain adequate fire and theft protection for all specified items of equipment through the duration of the project.

2. Upon written notice by the contractor to the owner, the owner may provide a secured area for equipment storage for a limited period of time during the installation.

3. The schedule of time where such secured areas will be required, must be identified by the contractor and submitted to the owner at least three weeks prior to the required delivery of equipment.

4. Although the owner may provide the aforementioned secured areas, responsibility of equipment protection and liability for fire and theft damage shall remain with the contractor.

1.10 SCOPE OF WORK

All labor, equipment, apparatus, and wiring devices, as required to provide the systems with broadcast quality in excellent working order, as specified herein, and as specified by relevant drawings, including:

A. Submission of drawings for approval by the owner's representative prior to fabrication and installation.

B. Furnish and Install all AV System related cabling.

C. Prefabrication of the specified equipment rack assemblies prior to delivery and installation of the rack assembly on-site.

D. Provide, mount and terminate all AV devices defined within this section.

E. Verification of dimensions and conditions at the job site.

F. Coordination of electrical and physical requirements.

G. Installation of all specified materials in accordance with these specifications, manufacturer's recommendations and all applicable code requirements.

H. Initial tests and adjustments of the systems as well as final equalization and alignment of the systems.

I. Training as defined in part 3 of this section.

J. Maintenance services and warranty repair service for one year following acceptance of the systems.

K. Provision of As-Built and Contract Closeout Documentation.

L. Provide all labor on-site as required to install the specified components and systems. On-site labor shall be performed in harmony with all other trades and trade jurisdictions working on the project site.

M. Provide all technical support and programming as necessary to insure that the specified Digital Signal Processing System has been properly programmed to provide the features and functions as specified herein. The DSP programming must be provided by a qualified individual with significant and demonstrable experience with the specified or equivalent, DSP system.

N. Provide all programming, development, software and design work as required to provide a complete and fully functional control system and user control interface as described throughout this section and shown on drawings. Control system interface design and implementation shall be coordinated with the owner and it's architect and AV consultant as described within this section.

O. Provide all technical support and programming services as required to provide a complete touch screen, remote control system as shown on the project drawings and as described within this section.

P. Deliver all portable items of equipment that are subject to a "furnish" only condition to the project site. Hand over such items to the owner's representative with complete, proof of delivery documentation, warranty information and related ownership documentation.

Q. Procure and pay for all necessary permits, licenses and inspections and observe any requirements stipulated therein.

R. Conform in all applicable trades with all local regulations and codes.

S. Comply with federal, state and local labor regulations and applicable union regulations.

T. Provide all Video Projector devices as specified within this section.

U. Provide miscellaneous AV cable assemblies as necessary to connect the specified devices to plates, panels and related devices.

W. Proof of Performance Demonstration

1. Following substantial completion of the AV system installation and following the contractor's effort to confirm that all systems have been installed and tested for compliance with the specified requirements, the AV contractor shall provide a complete system demonstration where all features, functions and system capabilities are demonstrated to the owner, the construction manager and their AV consultant.

2. The AV contractor's proof of performance demonstration shall be presented by the staff member who fulfills the requirements defined in paragraph 1.8.B.1 through 1.8.B.8 above. See also paragraph 1.8.H above.

X. Furnish and Install all AV Plates, Panels and Connectors.

Y. Provide Life Safety Mute if required by Local Codes.

1.11 RELATED WORK

The following items of work will be provided by the owner, project general contractor, the project electrical contractor, or the project IT/Data Contractor:

A. Computers and related accessories unless specifically identified for dedicated AV system use.

B. TV Set Top Boxes as required for TV signal reception.

C. Wireless Access Points & Related Network Infrastructure.

D. Electrical receptacles, breakers, panels, disconnects and related accessories as shown on the AV and Electrical drawings.

E. Conduit, Back boxes and Junction boxes as required for the AV Systems.

F. Life Safety Mute cabling and connection to Life Safety/Fire Alarm Systems

G. Cables and Connections associated with the Owner's Local Area Network.

H. AV Floor Boxes

I. Building Network/LAN

Refer to the Project T series drawings and specification section 11 70 01. All work described in that section shall be performed by the contractor responsible for that section.

Also refer to the AV drawing set legends and scope related notes.

1.12 PERFORMANCE REQUIREMENTS

Prior to formal acceptance by the owner, the specified systems will be tested in accordance with the procedures and requirements as outlined in section 3 of this document. The results of all systems tests and measurements shall be documented by the Audio Video Systems Contractor as specified and defined in Part 3 of this Section.

END OF PART ONE

PART TWO - PRODUCT SPECIFICATIONS

2.1 GENERAL

A. Manufactured Products

1. All equipment provided by contractor shall be "brand new".

2. Demonstration models or previously used equipment will not be acceptable.

3. Equipment that was specified as current but rendered obsolete by a manufacturer shall be identified by contractor in contractor's bid response.

4. Owner reserves the right to accept a substitute item as the closest replacement item at the expense of the contractor if not notified in advance of the obsolescence of the specified item.

5. Technical specifications for each item may or may not be identified within this document. Contractor shall be advised that in lieu of exact technical or functional specifications provided for each item, the technical and functional specifications of each item shall be implied by the specific make and model number identified herein.

6. The products listed within this section including manufacturer names and model numbers provide a definition of features, capabilities and quality required for each specified item. The contractor may submit alternative, equivalent product models for approval as defined in paragraph 1.4 of this section.

B. Custom Fabricated Items

All custom fabricated items are subject to the owner and engineer's approval of the contractor's shop drawings, samples or prototype submissions for the custom fabricated items. Custom fabricated items are to provide a professionally fabricated, "made to order" appearance.

2.2 MATERIALS

The material requirements for the Audio Video System are defined by the following material list and the project drawings. Quantities shown within the specification text are provided as a convenience to the bidding contractors. Contractor shall be responsible for providing all materials in the quantities required to fulfill the intent of the specified system, as defined within this document and as shown on the system design drawings. If a discrepancy exists between the drawings and text specification, the contractor shall provide the greater quantity, for instance:

If the drawings show 4 speaker assemblies and the specification text defines a quantity of 3 of the same speakers, the contractor shall provide 4 speaker assemblies.

or

If the drawings show 3 speaker assemblies and the specification text defines a quantity of 4 of the same speakers, the contractor shall provide 4 speaker assemblies.

The contractor is responsible for providing all equipment and devices shown on the drawings regardless of whether such devices are identified within the specification text. Refer also to paragraph 1.02 of this specification for further detail of the functional requirements of the specified system. Materials defined within paragraph 1.02 are required regardless of identification within this paragraph or shown on drawings.

END OF PART TWO

3.1 INSTALLATION

A. General:

1. All materials and equipment are to be new and unused.

2. Wiring practices unless herein specified to the contrary shall be in strict conformance with the contents of the “AV Installation Handbook” The Best Practices for Quality Audiovisual Systems Second Edition as published by AVIXA/InfoComm.

3. Fastenings and supports for all fixed equipment and components including conduit and cables, to provide a safety factor of 5 or better.

4. Installation with all precautions necessary to prevent against electromagnetic and electrostatic hum.

5. All precautions necessary to assure adequate ventilation.

6. Precautions to assure the safety of users shall be implemented as required by applicable codes.

7. Microphone and 600-ohm lines fully insulated from each other and from their conduit.

8. Lines in conduit free of any splices.

9. Wiring joints and connections made with rosin-core solder or approved mechanical connections.

10. Cables free from wiring damage.

11. All equipment installed neatly, with boxes and racks plumb, level and true to line and level.

12. Switches, connectors, jacks, receptacles, conduits, outlets and cable terminations clearly, logically, and permanently marked.

13. Moderate moves or changes as necessary to accommodate aesthetics to preserve symmetry, and for pleasing appearance without claim for additional payment.

14. Cooperation with other trades to achieve well-coordinated and satisfactory order.

15. Job shall be adequately staffed at all times.

16. Same individual in charge of work throughout execution, unless illness, loss of personnel or other circumstances beyond the control of the contractor intervenes.

17. Job site and all equipment and materials left clean and free of marks and blemishes.

18. All work shall be provided in a manner such that the work is provided in compliance with the general requirements stated within or implied by the “Standard Guide for Audiovisual Systems Performance Verification Checklist” as published by AVIXA/InfoComm International.

B. Conduit and Raceway Separation

1. Separate conduits or raceways for microphone-level circuits (less than 20 dBm) line-level circuits (-20 to +30 DB), loudspeaker circuit (+30 dBm or greater), switching and power circuits.

2. Provide minimum conduit separation between conduits carrying wiring of the different groups as follows:

	MIC	LIN	SPK	AC POWER
MIC	ADJACENT	6 INCHES	12 INCHES	12 INCHES
LIN	6 INCHES	ADJACENT	12 INCHES	6 INCHES
SPK	12 INCHES	12 INCHES	ADJACENT	ADJACENT
AC Power	24 INCHES	12 INCHES	12 INCHES	ADJACENT

	MIC	LIN	SPK	CONTROL
DIMMER CONTROL LED LIGHTING	24 INCHES	12INCHES	12 INCHES	6 INCHES
220/440 VOLT	24 INCHES	6 INCHES	12 INCHES	ADJACENT
ALL OTHER (NON SCR)	6 INCHES	6 INCHES	ADJACENT	ADJACENT

3. 90 degree crossings in close proximity are acceptable.

4. Should the contractors work in this regard be limited by site conditions or physical limitations beyond his control, the contractor shall notify the architect of such conditions and/or limitations prior to proceeding with the conduit/raceway installation.

5. As it may not be possible to fulfill these requirements at the entry/exit of enclosures, boxes and related devices, the intent of these guidelines is for the contractor to provide the stated separation wherever physically possible and specifically where the path of adjacent conduit will be parallel for distances greater than 10 feet.

6. The major groups shall not be intermixed.

C. Signal Grounding Procedures

To minimize problems resulting from improper grounding, and to achieve maximum signal to noise ratios, the following grounding procedures shall be adhered to:

1. System Grounds

a. A single Audio Video System ground point shall be provided at the Audio Video System breaker panel. All Audio Video System grounds shall connect directly to this ground point. Ground connections at the Audio Video System breaker panel shall be provided and distributed by way of captive screw, copper ground lug terminals.

b. The Audio Video System breaker panel ground shall be connected directly to the main building service ground connection. The Audio Video System breaker panel ground connection shall be provided using an insulated copper ground wire providing a maximum of 0.1 ohms total resistance. All ground wires shall be sized as necessary to properly serve the Audio Video System load and as required to meet all applicable codes.

c. All Audio Video System power receptacles including those mounted within equipment rack assemblies shall be provided as isolated ground receptacles. All receptacles shall include a ground conductor tied to the Audio Video System breaker panel ground connection.

d. Each audio equipment rack shall include a properly sized copper ground bar. Each ground bar shall be connected to the Audio Video System breaker panel ground point. The ground bar shall be electrically common to the equipment rack chassis. Connection between the ground bar and the rack chassis shall be readily removable for testing purposes by way of a standard screw lug terminal.

e. Each ground bar shall provide standard lug connections allowing direct connection between individual component chassis grounds and the ground bar assembly. These equipment chassis connection points shall be used only to trouble shoot and/or resolve hum and noise problems that cannot otherwise be eliminated.

f. The sound contractor shall be responsible for coordinating, inspecting and confirming that the specified grounding methods have been properly implemented by the project electrical contractor and by the sound contractor’s own fabrication methods.

2. Audio Shields

a. All line level sound cable shields shall be grounded at one point only. Un-terminated shields shall be insulated using proper size heat-shrink and completely protected against shorting to any other conductors.

3.2 IDENTIFICATION

A. Provide permanent intelligible identification on, or adjacent to all controls, fuses, circuit breakers, patching jacks, conduit receptacles, and the like. This identification will clearly and distinctly indicate the function of the item and will be numbered or lettered to correspond with the function, circuit and use consistent with the field and shop drawings.

1. Identification of fuses and circuit breakers shall indicate protected circuitry, rating of protective device and voltage across open circuited protected device.

2. Panel surfaces shall be engraved and filled, silk screened or shall be equipped with 1/16 inch laminated plastic labels with engraved characters at least 1/4" inch height (white characters on black background). Under no conditions will embossed plastic labels, transfer lettering (Chartpak, LetraSet, etc.) or other make shift labeling be considered acceptable. Engraving and other identification requirement specifically shown on the specification drawings prevail over this paragraph.

3. Each principal element of the system shall be completely integrated with consistently identified terminal strips or blocks for all connections. These designations shall be shown on related drawings and documentation.

4. All rack mounted devices shall include an engraved laminate tag (black tag with white letters) that identifies the rack mounted device using the abbreviated nomenclature shown for that device within the project shop drawings.

3.3 AUDIO SYSTEM INITIAL TESTS AND ADJUSTMENTS

Provide all necessary equipment and perform initial tests. Adjust or modify as necessary to provide system performance conforming to specifications.

A. Impedance and Phase

1. Check each microphone line for proper phase using a phase checker or voltmeter.

B. Measure and record the impedance of all loudspeaker lines.

2. Measure the absolute value of each loudspeaker line entering the equipment rack. Document loudspeaker impedance at the amplifier termination point at 250 Hz, 1000 & 4000 Hz.

3. For low impedance speaker systems (16 ohms or less) all impedance readings shall be within 10% of the calculated value based on driver quantity and wiring configuration.

C. Hum and Noise Level:

1. Hum and noise of system shall be inaudible under normal operating conditions. The measured signal to noise from any microphone input to power amplifier output shall be greater than 70 dB signal-to-noise, and greater than 80 dB signal-to-noise from any line input, to power amplifier output.

HUM AND NOISE LEVEL NOTE: All system level balancing must be completed before this test is conducted.

a. Terminate microphone inputs with shielded 150-ohm resistor.

b. With all equalizers switched out, and a microphone input signal of 1 KHz sine-wave at -50 dBm, adjust system gain controls for optimum signal-to-noise at full power amp output. Set gain controls for optimum signal-to-noise at full power amplifier output. Full power amplifier output shall be determined by maximum power capacity of the loudspeakers connected the amplifier under test.

c. At the output of each power amplifier, with all system equalizers switched out and under the above stated conditions measure and record the unweighted 40 Hz to 10 KHz band-width electrical hum and noise level for each of the microphone inputs.

d. Each recorded noise measurement shall be referred to the associated power amplifiers and maximum-in-system-voltage output and be expressed and recorded in decibels of signal to noise.

e. Signal to noise ratio shall be 70 dB or greater. Repeat the above stated procedure with all system equalizers switched in. Signal to noise ratio shall be 60 dB or greater.

D. Parasitic Oscillation and RF Pick-up

1. Set-up system for normal operation.

2. Use 10 MHz or greater oscilloscope and amplified loudspeaker monitor.

3. Insure that system at all useable gain settings that the system is free of spurious oscillation with no input signal and also with full output at 250 Hz on both sound monitor and oscilloscope presentation.

E. Acoustical Measurements

Acoustic measurements of sound system performance shall be made using sound system real time optimization software or hardware based equipment including, but not limited to: dual channel analysis capable of comparing the output of the system to its input, in both the frequency and time domain, a calibrated ANSI sound level meter, and a calibrated measurement grade microphone on the order of an MK10, M30, or TEF05. All interior finishes and furnishings shall be in place prior to these measurements being taken.

Documentation of acoustical testing shall include: frequency response of the room under normal quiet conditions with and without HVAC running (the room “fingerprint”), and frequency response to full bandwidth pink noise for each equalization zone comparing equalizers switched in and out.

1. Polarity:

a. Place the test microphone on axis with each loudspeaker component and check for absolute polarity using a shaped waveform or by generating an Energy Phase Curve or Nyquist Curve for each device.

b. Make changes as necessary.

2. Frequency Response:

a. With respect to a response which is flat from 60 Hz to 4 KHz then slopes off at 3 dB/octave from 4 KHz to 12.5 KHz, system response within + or - 4 dB with no peaks outside this range.

b. Using a Real Time Analyzer, a minimum of six (6) locations within each subsystem will be checked for compliance to the frequency response specifications stated above.

3. Coverage

a. Measurement of the loudspeaker distribution coverage using a one octave band of pink noise centered at 2 KHz, measurements taken using a calibrated sound level meter set for "slow" damping.

F. Buzzes, Rattles and Distortion

a. The Audio Video System shall be free of mechanical buzzes, rattling, distortion caused by loose attachments, faulty wiring, overdriven components, etc.

3.4 DIGITAL VIDEO SYSTEMS

A. Using an HD Pattern Signal Generator and HDCP compliance tester, verify all HDMI signal paths, inputs and displays.

B. Verify laptop connections and resolution settings using a contractor owner laptop, a contractor owner dvd player (blu ray and 720p) as well as at least one owner furnished laptop device.

3.5 ANALOG VIDEO SYSTEMS TESTING

A. Video Circuits

1. Using calibrated, industry accepted test equipment such as signal generators, waveform monitor, oscilloscopes, light meters and standard source equipment, connect at each input and output point and verify that the video signal path conforms to NAB NTSC RS-170A.

2. Verify that all video system equipment has been properly installed and is ready for use.

3.6 DEMONSTRATION AND ACCEPTANCE TESTING

A. General:

1. Upon approval of the above test report, and at a time set by the owner's representative, the contractor will demonstrate operation of each major component of the system, each microphone and line input.

2. After demonstration, contractor shall assist as required in the following acceptance tests which will be conducted by the owner's representative:

B. Listening Tests:

1. Tests may include speech intelligibility surveys and subjective listening tests by observers listening at various positions under operating conditions.

C. Equipment Tests:

1. May include measurements of frequency response, distortion or other performance characteristics.

2. May be performed on any item or group of items to verify conformity with specifications.

D. Additional Adjustments and Tests:

If need for additional adjustment becomes evident during demonstration and testing, contractor's work will be continued until the system installation operates properly.

3.7 TRAINING

A. Provide prepared and organized training sessions for the benefit of the owner’s personnel. These training sessions shall be of the following minimum duration:

B. Audio and Video Systems Training 12 Hours

C. Provide a technician who is familiar with the AV system installation for a minimum of two six hour events. Provide technical assistance to the owner’s staff or hired operators such that the initial events are properly served by the provided systems.

3.8 GUARANTEE

A. Labor and materials provided under this specification shall be warranted, commencing on the date of final acceptance of the installation by the owner, for a period of one year, to be free of defects and deficiencies, and to conform to the component specifications and this document as to kind, quality, function and characteristics.

B. Defects in labor, or materials, occurring within the warranty period will be rectified by replacement or repair without charge.

C. Paint and exterior finishes, fuses, lamps, and tubes, are excluded from this warranty, unless damage or failure is the result of defective materials or workmanship covered by warranty, or work performed under warranty in the repairing of defects.

D. Warranty service will be provided to the owner for the warranted items within 48 hours of notice to the contractor.

E. Manufacturer's warranties which will exceed the one year Contractor warranty shall be activated in the owner's name prior to system acceptance.

F. Warranty cards and registration information shall be executed in the owner's name and forwarded to the respective manufacturers prior to final system acceptance.

3.9 MAINTENANCE AND SERVICE

A. Provide one maintenance site visit at six months following the system acceptance.

B. During the maintenance site visit, activate all system components and verify proper operation of controls and devices.

C. Clean and adjust all recording and playback transports as recommended by the respective manufacturers. Repair or replace all defective materials within the scope of the above stated warranty.

D. All service calls answered by contractor within 48 hours.

E. Within 10 months of system acceptance provide a proposal for an annual maintenance and service agreement.

3.10 Performance Verification Checklist

A. The contractor shall provide all services necessary to complete the AV industry standard checklist questionnaire as defined on the following pages.

B. This checklist and report has been prepared using the AVIXA/InfoComm International Standard Guide for Audio Visual Systems Performance Verification Checklist as a basis for providing an organized report on the condition of the above noted AV system as of the dates noted above.

C. The AVIXA/InfoComm Standard Guide is intended to provide owners, consultants and integrators with a comprehensive and singular source of tests to determine if the audiovisual system achieves the client's goals or objectives and that the system performs in accordance with the best practices of the industry. By providing this list to the audiovisual industry, AVIXA/InfoComm is establishing a set of commissioning guidelines to help industry professionals and their clients communicate effectively about their expectations for system performance.

Standard Guide for Audio Visual Systems Performance Verification Checklist

Project Title:	
Description:	
Project Location:	
Project Architect:	
System Designer:	
Date of Report:	
Date of Site Visit/Tests:	
AV Contractor:	
Client:	

Contents of the Standard Audiovisual Systems Verification Tests Checklist

I AV-PH	Physical Installation
II AV-CM	Cable Management, Termination and Labeling
III AV-E	Electrical
IV AV-S	Serviceability
V AV-A	Audio Performance
VI AV-V	Video Performance
VII AV-N/AV-C	Control, Software and Networking
VIII AV-AC	Acoustical Environment
IX AV-DR	Verification and Documentation

Project Specific Notes and Reporting

Although not all segments or line items covered by the AVIXA/ InfoComm Standard Guide may be applicable to this specific project, all elements of the standard guide have been included in this report.

In cases where a particular test or reporting element of the standard guide is not applicable to this specific project, such items will be noted as Not Applicable (N/A) or otherwise explained.

I AV-PH: Physical Installation

AV-PH-01	Site Inventory of AV Equipment
	Is all equipment in shop or on site?
AV-PH-02	Installation Status of AV Equipment
	Is all rackable equipment installed?
AV-PH-03	AV Rack Cleanliness
	Racks are "clean" - grease markings removed, etc.
AV-PH-04	AV Rack Blanks and Vents Installation
	All blanks and vents installed in unused rack spaces?
AV-PH-05	AV Patch Bay Labeling
	All patchbays labeled.
AV-PH-06	AV Patch Bay Configuration
	Patchbays configured with all outputs on top rows, inputs on bottom rows.
AV-PH-07	AV Rack Thermal Gradient Performance
	Thermal gradient inspected; all equipment operating within manufacturers' guidelines.
AV-PH-08	AV Rack Protective Treatments
	Small racks have carpet tiles on bottom to avoid scratching credenzas.
AV-PH-09	AV Equipment Labeling
	All engraved labels permanently fastened.
AV-PH-10	AV System Cabling Verification
	All peripheral equipment hooked up as per flow diagram: microphones, loudspeakers, video monitors, projectors, PC's, USB switchers, etc.

II AV-CM: Cable Management, Termination and Labeling

AV-CM-01	AV Equipment Power Cable Management
	Equipment without IEC removable power cords are not tie-wrapped to the cabinet, and there are no obstructions to the item being pulled from the front of the rack.
AV-CM-02	Verification of AV Rack Cable Installation
	Tie wraps are not too tight as to deform the cable. UTP cables are laced and bound with Velcro ties.
AV-CM-03	Verification of AV Rack Cable Installation
	Terminations are free from stress due to gravity acting on the cabling or cable dressing technique.
AV-CM-04	Verification of AV Rack Cable Installation
	Terminations have sufficient service loop, allowing a re-termination or two without having to open a cable bundle or pathway to lay in a new cable.
AV-CM-05	Verification of AV Rack Cable Installation

Cables appropriately dressed and bundled according to cable type.

AV-CM-06 Verification of AV Rack Cable Installation

Verify cable supports are used depending on size and stiffness of cable.

AV-CM-07 Verification of AV Rack Cable Installation

Cables have appropriate separation according to signal type and level.

AV-CM-08 Verification of AV Rack Cable Installation

Verify all cables are installed with an adequate bend radius as recommended by the manufacturer and general system requirements.

AV-CM-09 AV System Cable Labeling

All cables have clearly legible, unambiguous identifying labels, and labels are oriented and positioned consistently. Labels are visible without system disassembly and are not hidden in cable bundles.

AV-CM-10 AV System Cable Labeling

All cable labels are permanent, non-slipping and according to specification.

AV-CM-11 AV Connector Verification

All terminations are in agreement with the equipment and system requirements.

AV-CM-12 AV Connector Verification

All connectors are correctly seated to its mating connector.

AV-CM-13 AV Connector Plate Labeling

All connectors on input and output plates are labeled.

AV-CM-14 AV Connector Plate Labeling

Confirm all labeling nomenclature for consistency between drawings, touch screen labels, wall plates and other labeling of connectors, connection points and devices.

III AV-E: Electrical

AV-E-01 AV System Power and Grounding

Verification Stray AC voltages on any equipment accessible to a user relative to ground?

AV-E-02 AV System Power and Grounding

Verification Neutral and isolated ground current test.

AV-E-03 AV System Power and Grounding Verification

Verify equipment is powered by correct circuits.

IV AV-S: Serviceability

AV-S-01 AV System Serviceability

Input/output panels are easily accessible.

AV-S-02 AV System Serviceability

If there are obstructions prohibiting the disconnection of terminations on the back of AV equipment, there must be sufficient cabling to permit the equipment to be pulled from the front, and disconnected there.

AV-S-03 AV System Serviceability

It is relatively easy to find proper cable termination points when removed or replaced equipment is re-installed.

AV-S-04 AV System Serviceability

Equipment can be pulled for repair or replacement without hindrance.

AV-S-05 AV System Serviceability

Equipment must be able to be serviced indefinitely; designed with the maintenance technician in mind (he or she will "own it" longer than the person who fabricated the system initially).

V AV-A: Audio Performance

All audio performance tests are made from all electronic system inputs (first physical output of source media, all I/O plates, mic inputs) to all electronic system outputs (all outputs connected to amplifier inputs, all connections to external facilities (to other rooms, buildings or external services such as broadcast connections).

AV-A-01 Audio System Total Harmonic Distortion

Measure total harmonic distortion of the audio system. Distortion level should not exceed best practices.

AV-A-02 Audio System Signal-to-Noise Ratio

Measure system signal to noise ratio. Noise level should not exceed best practices.

AV-A-03 Speech Reinforcement System Electronic Frequency Response

Measure frequency response of the audio system for speech sound reinforcement. System frequency response should be determined for the system during design process.

AV-A-04 Audio Playback System Electronic Frequency Response

Measure frequency response of the audio system for program sound amplification. System frequency response should be determined for the system during design process.

AV-A-05 Audio System Latency

Measure latency of the audio system. Latency should not exceed design requirements of the system.

AV-A-06 Audio Coverage in Listener Areas

Measure audio coverage uniformity in the listener area; see AVIXA/InfoComm Performance Standard for test procedure and acceptable performance criteria.

AV-A -07 Audio Level versus Background Noise Level

Measure background noise level during normal room operation. Measure audio system level during normal room operation. Audio level should exceed background noise level to provide for clear, intelligible amplified sound.

AV-A-08 Speech Reinforcement System Headroom

Measure audio system headroom. Audio system should be capable of performing above nominal operating levels without distortion.

AV-A-09 Program Loudspeaker Polarity

Program loudspeakers in the same system shall produce consistent polarity for a mono input signal in all channels.

AV-A-10 Speech Reinforcement Speaker Polarity

Speech reinforcement systems shall be polarized such that a positive acoustic pressure on a microphone results in a positive acoustic pressure at all loudspeakers.

AV-A-11 Alignment of Multiple Audio Sources

Calibrate audio system inputs so there is zero or minimal difference between any input signal levels.

AV-A-12 Audio Buzz and Rattles

There shall be no audible vibration caused by improper mechanical installation. Perform buzzes and rattles test, using continuous sweep signal (from generator or test CD) pass/ fail result or which device at what frequencies.

AV-A-13 Audio System Gain Before Feedback

The speech reinforcement system shall be stable and operate without feedback.

AV-A-14 Conferencing System Microphone Sensitivity & Gain Structure Alignment

For conference systems, adjust microphone input gain to demonstrate that "standard talker," positioned at each talker position in the room, produces a 0 dBu level at the output of the output bus of the audio conference DSP device. Verify signal levels for both transmit and receive using normal speech.

AV-A-15 Audio System Equalization for Speech Intelligibility

Equalizers shall be adjusted for best intelligibility, and in accordance with the preferred acoustic level response curves. For systems with equalizers, document the “house curve” before equalization, as well as after the equalizers have been tuned, with and without microphone input filters. If requested by the Consultant, produce this documentation for systems without equalizers, as this test may apply to the preamp filter settings in cases where intelligibility can be improved.

AV-A-16 Audio System Speech Intelligibility at Listener Positions

Audio system should provide intelligible sound above background noise levels. System design should anticipate background noise levels in the listener space.

AV-A-17 Audio System Amplifier Loading

No power amplifier shall have its rated load exceeded. Record the impedance (and at what frequency) of each loudspeaker line of each power amplifier. 63, 250, and 1,000 Hz are recommended if available.

AV-A-18 Conferencing Echo Suppression Performance

For a system with conference capability, system shall perform at nominal operating levels in a full duplex mode without echo or latency.

AV-A 19 DSP Signal Path Verification

All DSP programming installed and properly passing intended signal pathways and mixes.

VI AV-V: Video Performance

AV-V-01 Video System NTSC Signal Gain

For NTSC sources, demonstrate a consistent 1 volt peak-to-peak test signal at each source shall produce 1 volt peak-to-peak to each destination. Verify at each destination using NTSC bars, peak white and 5-step multiburst (0.5, 1.0, 2.0, 3.0, 3.58, and 4.2 MHz).

AV-V-02 Video System RGBHV Signal Gain

For RGB sources, demonstrate consistent 700 mV from each source to each destination. Observe results using a flat-field pattern signal at 1024 by 768 resolution (VESA 8). Measure peak-to-peak voltage using a 200 MHz oscilloscope at each destination when a test generator with either multi-burst or H pattern is at each source location. Adjust ‘peaking’ and ‘level’ control settings on any interface at the positions whereby the 700 mV voltages were attained.

AV-V-03 Video System Pixel Failure Tolerance

"White Purity" Test. Note number and location of stuck or lost pixels, if any.

AV-V-04 Video Camera Image

Verify camera performance and operation.

AV-V-05 NTSC Image Alignment

For NTSC sources, confirm optimum brightness, contrast, and color in displays using SMPTE source with PLUGE (Picture Line Up Generation Equipment) display.

AV-V-06 Consistency of Multiple NTSC Displays

When several NTSC displays are visible, demonstrate consistencies in displays using NTSC bars with PLUGE signal to all.

AV-V-07 Projected Display Physical Alignment

Verify that projected displays are focused, centered, and evenly-illuminated.

AV-V-08 Projected Display Physical Alignment

For projected displays, take actual measurements of image geometry to verify image is rectangular and proportional across the entire image.

AV-V-09 Projected Image Contrast Ratio

Measure the contrast ratio of the projected image with ambient lighting in normal operating mode.

AV-V-10 Projected Display Brightness Uniformity

For projected displays, using a calibrated light meter, determine the image has uniform brightness across the entire image.

AV-V-11 Multiple Resolution Performance of Video Displays

Display stable, properly scaled images, with no scaling-related visual artifacts when switching between, at a minimum, 1024 x 768, 1280 x 1024, 1280 x 720 sources, and/or all those specified in the performance criteria for this system.

AV-V-12 Image Size Relative to Furthest Viewer

Image size relative to furthest viewer: Record each, compare to recommended multiplier.

AV-V-13 Cable Television RF Tap Levels

Confirm TV RF levels, using the highest frequency channel of the system, with field strength meter at all system taps.

AV-V-14 On Screen Display Settings for Video

Displays have OSDs (on screen displays) "OFF", or as specified by the user.

AV-V-15 Video Standby Screen Setting

Video projector, if any, must have 'blue screen' off, or as directed by the user.

VII AV-N / AV-C: Control, Software and Networking

AV-N-01 Control System IP Address Assignment

All IP-controlled equipment properly configured with IP addresses, host names, time servers, Gatekeeper addresses, network configurations, and subnets as applicable. All system connections are operational and devices communication correctly.

AV-C-02 Control System Communications

All control system programming installed and properly communicating with the equipment intended.

AV-C-03 Control System User Interface Performance

Control system user interface conforms to user or specified requirements and all pages and buttons operate as intended.

AV-C-04 Interfacing and Control of External Devices and Systems

Confirm control system functions not obvious from the control flow diagrams (i.e., lighting presets that are activated when the control system enters a videoconferencing mode).

AV-C-05 Interfacing and Control of External Devices and Systems

Confirm control system interfaces exist and are functional for devices that may be outside AV scope such as drapes, shades, screens, lights, security, life safety and HVAC.

AV-C-06 Control System Power Cycling and Recovery

The control system will restart and resume full operation following an unanticipated cycling of AC power to the control system.

VIII AV-AC: Acoustical Environment

AV-AC-01 Acoustical Ambient Noise

Record ambient noise level with room is normal operating mode, see AV-A-07.

AV-AC-02 Acoustical Ambient Noise

Document octave band ambient noise and calculate NC or RC per ASHRAE if NC was part of design criteria

AV-AC-03 AV Room Reverberation Time

Document octave band reverberation times if speech intelligibility criterion is not met.

IX AV-DR: Verification and Documentation

AV-DR-01 AV System Documentation

There is perfect agreement between the "paper model" documentation (drawings), the control system user interface (i.e., touch panel screens, push button labels, panel engravings, etc.), and the physical wiring and labeling. This includes designation strips, equipment labeling, etc.

AV-DR-02 Video System Test Reporting

Video system tested (all pathways tested, all interconnections marked as tested on drawing).

AV-DR-03 Audio System Test Reporting

Audio Tested (all pathways tested, all interconnections marked as tested on drawing).

AV-DR-04 Control System Test Reporting

Control tested (all pathways tested, all interconnections marked as tested on drawing). Emulate closures for screens, motors, etc.

AV-DR-05 AV System Commissioning Sanity Check

Sanity Check: Is there any reason why this system should NOT be turned over to the owner for use.

AV-DR-06 Final Commissioning Report and System Turnover

Prepare document report, certifying the product, performance, and practices are in compliance and note any exceptions. Distribute accordingly.

END OF PART THREE

END OF SECTION 11 70 01