

SECTION 11 61 70 - PERFORMANCE AUDIO, VIDEO AND COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work in this section includes the engineering, manufacturing, furnishing, coordination and installation of an Audio, Video and Intercommunications system for the following purposes:
1. Recording of events.
 2. Reproduction of pre-recorded sound and video.
 3. Amplification or "reinforcement" of performers' voices.
 4. Amplification of lecturers' voices.
 5. Provisions for audio and video monitoring in support and ancillary spaces.
 6. Video displays and digital media content management.
 7. Dedicated digital and analog cabling system for presentation, support, and exhibit areas.
 8. Small portable systems for use throughout the building.
 9. Portable Recording and Playback Equipment.
- B. Work in this section includes the following spaces:
1. Auditorium
 2. Cafeteria
 3. Food Science Lab
 4. Exhibit Halls
 5. Planetarium
 6. Prefunction Area.
 7. Lobby and Support Spaces.
- C. Performance Audio, Video, and Communications System is an integrated grouping of several subsystems. These include:
1. Racks And Wiring Infrastructure
 2. Faceplates
 3. Sound systems
 4. Paging systems:
 - a. Show relay monitor system which derives its feed from the sound system or from separate systems.
 - b. In public lobbies.
 - c. In support areas
 - d. In exhibit halls
 - e. In other spaces.
 - f. Paging is zoned from portable programmable paging stations located in different areas of the building.
 5. Intercom system
 - a. A two-channel analog party line system.
 6. Assistive Listening Systems – A Bluetooth enabled system with interchangeable headsets.
 7. Video
 - a. A digital wiring infrastructure.
 - b. Programmable digital signage system.
 - c. Video displays.
 - d. Video presentation system.
 1. Projectors
 2. Displays
 3. Source Devices
 4. Owner Furnished Devices such as laptop computers.
 8. Central Control System
 9. Power Components – Reuse existing power systems.
 10. Sequencing Panel Boards – Reuse existing Panel Boards. Provide power sequencing control.
- D. Installation of the following owner furnished subsystems.
1. Owner furnished equipment to be tested and updated as necessary in order to provide fully

- functioning systems. This includes all firmware and software where applicable.
2. Provide Dante compatible audio devices..
 3. Audio Monitoring / Paging for lobby and support areas. – Test and Reuse existing ceiling speakers.
- E. Section Includes:
1. Materials, components, modifications, assemblies, equipment and services as specified herein. These include, but are not limited to:
 - a. Verification of site dimensions and conditions.
 - b. Submittals of shop drawings, samples, operation and maintenance manuals as specified herein and depicted in the contract documents.
 - c. Engineering of equipment and systems as specified herein and depicted elsewhere in the contract documents.
 - d. Manufacture of equipment and systems as specified herein and depicted on the Drawings.
 - e. Scheduling, sequencing and coordination with other trades.
 - f. Provision of on site supervision during the installation of systems described herein for the entire period required to complete the work. This work includes verification of wiring, labeling, cable type, grounding scheme and other technical requirements as described herein.
 - g. Testing, inspection, alignment and final adjustment of completed installation
 - h. Demonstration for the Owner and Theatre Consultant for acceptance and instruction of the Owner in the systems specified herein.
 - i. Submission of Shop Drawings related to speaker or other overhead device suspension that are signed and sealed by a licensed Professional Engineer experienced in work of similar nature and scope and licensed in the State of installation.
 2. General requirements
 3. Accessories.
- F. Coordination:
1. 11 61 61 Performance Dimmers and Control.
 - a. There is no 11 61 61 contractor on this project. The 11 61 70 contractor will be required to develop with the Owner's Representative a syntax for programming the logic controller to allow the controller to control the architectural lighting in the various spaces similar to the original design.
 - b. The 11 61 70 contractor will provide the cable linking the 11 61 70 logic controller and the lighting controller, including termination at both ends.
 2. Division 26: Electrical – There is no Electrical Contractor on this project. All work must be performed by the 116170 contractor or a qualified sub-contractor under their supervision.
 - a. Wiring and cable in the field and to the racks is provided under 11 61 70.
 - b. Wiring and cable internal to the racks is provided under 11 61 70.
 - c. Interconnection with fire alarm system: Fire alarm system provides dry contacts to sound system which open upon an alarm.

1.2 DEFINITIONS

- A. The term "furnish" means to supply and deliver to the job site, ready for unloading, unpacking, assembly, installation, and similar operations.
- B. The term "install" is used to describe operations at the job site including the actual anchoring, applying, assembly, cleaning, curing, cutting, erection, finishing, patching, placing, protecting, pulling, terminating, unloading, unpacking, working to dimension, and similar operations that will render the systems complete and ready for the intended use.
- C. The term "provide" means to furnish and install.
- D. The term "primary components" refer to elements of the system which acquire, modify or reproduce the signal, such as microphones, digital signal processor, mixer and speakers.

- E. The term "sensitivity" as used herein for microphones and expressed in dBm (dB referenced to .001 W) is the microphones available electrical input power level, when driven by a sound pressure of 10 dynes/cm².

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Provide integrated sound, video, and intercommunications systems. These systems are capable of providing the characteristics specified herein.
- B. Standards and Regulations
 1. Components must comply with applicable regulations and ANSI Standards.
 2. Provide systems and components that are approved by an accredited independent testing laboratory such as Underwriters Laboratory.

1.4 QUALIFICATIONS:

- A. The contractor shall be a Specialist in the provision of systems for playback and reinforcement of sound in similar venues.
- B. The Contractor shall have been an authorized dealers or representatives of the manufacturers of the primary components of the systems for a minimum of two (2) years.
- C. Where a manufacturer of a primary component offers factory training in the use of that component the Contractor is to have received that training.
- D. The Contractor shall have been involved in Sound Systems Contracting for Entertainment and Worship facilities for a period of five (5) years or more and shall have completed at least three (3) installations of this project's type and scope which have been in service for not less than two (2) years.
- E. The Contractor shall provide, as part of their internal organization, the base system and not less than one (1) of the sub-systems specified. Additional Work in the Contract will be performed under their authority and responsibility as defined in the Contract Documents.
- F. The Contractor shall maintain and operate shops for the integration and service of the system components.
- G. The right is reserved to inspect previous equipment or systems as furnished or installed by this Contractor. In addition, the right is reserved to reject a Contractor who has failed in any respect to comply with the provisions of previous contracts.
- H. No sub-contracting of the primary work is permissible, unless the Sub-Contractor is named and included as part of the bid. All terms and requirements herein apply to the Sub-Contractor. The right is reserved to reject the proposed Sub-Contractor based on the terms stated herein.
- I. The Design Consultant shall be the final judge of suitability of experience.

1.5 SUBMITTALS

- A. Product Data
 1. Submittal shall include manufacturer's information sheets of equipment not explicitly specified by make and model that the contractor intends to provide as part of the project. Equipment matching make and model called out in the specification need not be submitted.
 2. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
 3. Mark each copy to show applicable choices and options. Where printed Product Data includes

information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

- a. Manufacturer's printed recommendations.
- b. Compliance with recognized trade association standards.
- c. Compliance with recognized testing agency standards.
- d. Application of testing agency labels and seals.
- e. Notation of dimensions verified by field measurement.
- f. Notation of coordination requirements.
- g. Material Safety Data Sheets (MSDS) for each product.
- h. Catalog or data sheets indicating all component manufacturer's names, model numbers and performance data, where applicable.

B. Shop Drawings:

1. Provide submittals in accordance with Division 1.
2. Submit shop drawings within 90 days of award of contract unless otherwise indicated in Division 1.
3. Show information necessary to explain fully the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation. Include the following drawings as a minimum:
 - a. Signal, control and power sequencing Block Diagrams detailing:
 1. Equipment
 2. Faceplates
 3. Interconnecting wires with unique labels
 4. Terminating devices (Connectors or terminal strips)
 5. Where custom wiring is necessary detail each component (Switches, indicators, resistors, power supplies, relays, etc)
 6. Multiconductor wiring
 7. User configurable signal flow internal to components such as DSPs.
 - b. Faceplate & Rack Panel Fabrication Drawings detailing:
 1. Finishes
 2. Devices
 3. Engraving
 - c. Mounting Details - where custom mounting systems are employed and as required by the specifications
 - d. Patch Panel Layouts detailing:
 1. Layout
 2. Labeling
 3. Normalling
 - e. Rack Elevations detailing:
 1. Equipment location
 2. Equipment labeling
 3. Security covers
 4. Vent panels
 5. Fans
 - f. LCD Control Screen images intended to be used for the LCD control panels.
 - g. Speaker and Device Suspension and Connection Details
 1. Suspension connections at the devices
 2. Suspension connections at structure. Indicate additional structure as required.
 3. Shop Drawings noting suspension of equipment overhead are to be signed and sealed by a licensed Professional Engineer experienced in work of similar nature and scope and licensed in the State of fabrication.
4. Do not commence fabrication, installation, and erection until shop drawings have been approved by the Consultant and Architect.
5. Provide uniformly sized sheets in the submittal.
6. Include a title sheet listing sheets in the submittal.
7. Include manufacturer's information sheets of proposed equipment to be provided as part of the project.
8. Do NOT produce floorplans reiterating information already in the set, such as box layout and low voltage conduit. These have been issued and form part of scope of work by others.
9. DO review box layout and low voltage conduit drawings and note any areas of concern in a

Request for Information.

- C. As Built Drawings:
 - 1. Include:
 - a. All information submitted in the shop drawings.
 - b. Initial settings
 - 2. Provide two sets (2) complete hard copy.
 - 3. Provide one (1) electronic set of as built drawings in DWG format
 - 4. Provide (1) electronic set of as built drawings in PDF format
- D. Test Documentation:
 - 1. Provide two sets (2) hard copy
 - 2. Provide one (1) electronic set
- E. Maintenance Manuals
 - 1. Include:
 - a. A summary section detailing actions required and the intervals at which they are to be performed.
 - b. Detailed maintenance procedures.
 - c. Equipment inventory with a listing for every item furnished or provided that includes the following information:
 - 1. Item: ie: DSP
 - 2. Make
 - 3. Model
 - 4. Serial Number
 - 5. Firmware Version (where applicable)
 - 6. Quantity (>1 if there is no SN, IP, or MAC address)
 - 7. MAC Address (If IP Addressable)
 - 8. IP Address or "DHCP" (If IP Addressable)
 - 2. Provide two sets (2) hard copy
 - 3. Provide one (1) electronic set of maintenance manuals in PDF format
- F. Operation Manuals
 - 1. Include:
 - a. Custom devices and programming..
 - b. Manufacturer's Manuals.
 - 2. Provide two sets (2) hard copy
 - 3. Provide one (1) electronic set of maintenance manuals in PDF format

1.6 QUALITY ASSURANCE

- A. Supplementary Standards:
 - 1. Secure equipment, except portable equipment, firmly in place. This includes loudspeakers, conduit, cables, control equipment, rack equipment, etc. Mount components rigidly, except where resilient isolation is required, such as with loudspeaker clusters / arrays. Design and provide fastenings and supports adequate to support their loads with a safety factor of at least three.

1.7 WARRANTY

- A. Special Warranty:
 - 1. In addition to the manufacturer's warranties, warrant systems and equipment to be free of defective components, faulty workmanship or improper adjustment for a period of two years from the date of Final Acceptance. Paint and exterior finishes are excluded. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within 30 days after notification. Rectify conditions that might present a hazard to human life, well-being and or property within 48 hours of notification. In the case of individual component failure rectify the situation within 48 hours of notification. In the case of catastrophic system failure, rectify the situation within 24 hours of notification. Make replacements without cost to

- the Owner.
2. Designate warranties on equipment to the Owner on the date of Final Acceptance.

1.8 MAINTENANCE

- A. Provide maintenance service for a period of one year after final acceptance. This service shall include two semi-annual visits to the site for testing and adjusting of equipment. The first visit occurring six months after the system has been accepted. Arrange visit to be at a time mutually acceptable to the Owner and Contractor.
- B. As part of the semi-annual visits, provide programming updates to both the control systems and DSPs based on owner requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The components shown on the Drawings and in the Equipment Schedule (make and model) form the basis of design of the system.
 1. Where other manufacturers are known to be capable of providing equipment that meets the functional requirements specified products they are listed.
- B. Substitutions may not be made without prior written approval by the owner.
 1. Other models by listed or alternate manufacturers will be considered for acceptance providing they meet or exceed the requirements and functional qualities specified.
 2. Requests for Architect's approval and complete technical data for evaluation must be received at least 14 days prior to bid due date. These requests must include:
 - a. Complete data on the proposed substitute.
 - b. A listing of deviations from specified quantities required/enabled by the proposed substitution or a statement that no deviations in quantities are proposed.
 - c. A detailed listing of deviations from specified connected components required/enabled by the proposed substitution or a statement that no deviations in connected equipment will be required.
 - d. A detailed listing of changes to the architecture, electrical, conduit, mechanical or structural system required by the substitution or a statement that the substitution will require no adjustments to the building or infrastructure.
 - e. The architect may require a sample to be provided as a condition for approval.
 3. Substitutions accepted will be issued by Addendum.

2.2 EQUIPMENT AND SYSTEMS

- A. General:
 1. Provide Systems described herein and on the Drawings.
 2. Regardless of the length or completeness of the descriptive paragraphs herein, each device shall meet its published manufacturer's specifications. Certify performance as required. Where two or more acceptable products are listed, the Contractor may use either at his option. Equipment other than that listed shall not be substituted without specific written approval of the Consultant.
 3. See Equipment and Component Schedule for manufacturer, model and quantities
 4. Quantities of primary components, if not specifically called out in a schedule, shall be as indicated on the Drawings.
 5. The Contractor shall provide the higher quantity should a discrepancy between the Drawings, the Schedules and this Section exist.
 6. Items are to be provided with necessary modules, components, cables, connectors, and accessories to make them fully functional and interface them with adjacent units as indicated in the contract documents.

- B. Connectors:
 - 1. Provide captive moisture / dust covers in moist locations.
- C. Portable Equipment and Cabling:
 - 1. See complete schedule for equipment types and quantities
 - 2. Portable Cable Labeling
 - a. Each cable shall be color coded by length using a heat-shrink polyolifin sleeve near the male end of the cable. This sleeve shall be hot-stamped with the name of the facility, or as directed by the Owner.
 - b. The following is a recommended color-coding scheme.
 - 1. One to three bands of color code with the most significant digit closest to the connector. Color coding is as follows:
 - a. white = 9
 - b. gray = 8
 - c. violet = 7
 - d. blue = 6
 - e. green = 5
 - f. yellow = 4
 - g. orange = 3
 - h. red = 2
 - i. brown = 1
 - j. black = 0
 - 2. For example a 50' would be Green / Black with Green closest to the connector and 25' would be Red /Green with Red closest to the connector.

2.3 SPARE PARTS

- A. Spare Parts Package:
 - 1. Provide a package of spare parts for user-serviceable portions of the Systems.
 - 2. Label spare parts with manufacturer's part number, designation and description, and location(s) where used.
 - 3. The spare parts shall be delivered to the Owner during training.
 - 4. Quantities:
 - a. Provide the listed percentage or a minimum of 1, in addition to any spare parts specifically listed in individual product specifications.
 - b. Lamps: 10% of the installed components
 - c. Fuses: 10% of the installed components
 - d. Knobs: 10% of the installed components
 - e. Switches: 10% of the installed components
 - f. Cable and Wiring:
 - 1. Runs of 3 - 5 circuits provide 1 spare.
 - 2. Runs of 5 - 10 circuits provide 2 spares.
 - 3. Runs of 11 or more circuits provide 15% spares.
 - g. Patch Points: Provide 10% spares per bay type (Video, Mic Level, Line Level, Speaker).
 - h. Connectors: Provide 10% spares.
 - i. Removable Labels: Provide 200% spares.
 - j. Rack Mounting Hardware: Provide Screws and Clips for 25% of mounting holes.
 - k. Other miscellaneous parts: 10% of the installed components

2.4 SUPPLEMENTARY

- A. Furnish equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

- A. Sequence delivery and installation of components to protect their long term viability. Of particular concern is protecting electronic contacts from abrasive construction dust and grit and protecting devices from the accumulation of dust which can lead to early component failure.
- B. If devices must be installed prior to the room being clean, dry and dust free protect connectors and internal components from the infiltration of dust and thoroughly clean the components of all dust and grit before beginning testing. Devices with evidence of abrasion on the contacts will be rejected.

3.2 INSTALLATION

- A. Provide racks, furniture, consoles, devices, etc., required for the installation and needed to provide completed working systems. Only to the extent that such ancillary equipment is specified elsewhere is it excluded from these system Specifications.
- B. Interface:
 - 1. Contract documents are diagrammatic and indicate general arrangement of systems and work included.
 - 2. Follow drawings in laying out work and check drawings of other trades relating to Work to verify spaces in which work is installed.
 - 3. Maintain headroom and space conditions at all points.
- C. Provide factory trained personnel to perform the installation, tests and adjustments as required.

3.3 SYSTEM TESTS AND ADJUSTMENTS

- A. Perform initial tests and adjustments; include the costs of the testing in the initial bid submittal. Furnish equipment necessary and perform work required to determine or modify the performance of the sound system in accordance with the intent of the Contract Documents.
 - 1. Initial Tests:

Prior to initial settings perform the following inspections and submit to the Consultant the written detailed results at each inspection for inclusion on the permanent records of the sound system.

 - a. Verify proper termination of analog and digital wiring.
 - b. Certify signal flow through systems.
 - c. Verify function of each device in the system.
 - d. Analog Circuits:
 - 1. Measure and record polarity, distortion, and parasitic oscillation. Begin by applying signal to the system's input and observe the devices output. Once the first circuit has been tested and is operating correctly, continue with the next circuit down the line, proceed with each circuit until all have been checked.
 - 2. Measure and record the frequency response of each mixer / preamp in the system.
 - 3. Measure and record the impedance of each loudspeaker line before connecting it to the output of its respective amplifier, confirm that it is equal to or above the rated impedance.
 - 4. Measure and record the output of each power amplifier. Employ a sine-wave oscillator with less than 0.5% frequency accuracy and adjusted to 10 dB less than full power output of the amplifier as the input source to each amplifier being measured. Ascertain that full voltage for rated power can be reached without noticeable deformation of the wave form. Inspect the output sine-wave appearing on distortion analyzer for complete freedom from spurious oscillation, hum, noise, radio frequency interference, or other unexpected additional outputs.
 - 5. Measure and record Z(in), Z(load), E(in), and E(out) for each of the power amplifiers.

6. Measure and record input Z(in) and output Z(out) circuit voltage impedance, open circuit voltage E(o), and input E(in) of speech or music equipment, line amplifiers and signal processors.
 7. Measure and record the polarity of all loudspeakers.
 8. Measure and record the polarity of the microphones used in the system.
 - e. Digital Circuits
 1. Certify as compliant with applicable standard.
 2. Measure and record packet loss, and latency.
 - f. Test any remote controls for specified operational requirements. "Remotes" shall include functions between equipment racks and consoles, power sequencing, etc.
 - B. Test Documentation:
 1. Provide the following documents a minimum of one week prior to the consultant's checkout and testing visit:
 - a. List of personnel and certified test equipment used.
 - b. Documentation of all of the previously mentioned tests.
 - c. System specific tests from the subsystems.
 - C. Equipment Tests:
 1. If any system does not appear to be functioning properly, further tests may be performed on any item of equipment to determine whether it meets the pertinent specifications.
 2. Measurements as deemed necessary by the Architect's Consultant
 - D. Adjustments:
 1. In case the need for further adjustments becomes evident during the demonstration and testing, continue the Work until the systems operate properly.
 2. If final acceptance is delayed beyond three test days because the system does not fulfill this specification, pay for time and expenses of the Architect's Consultant during any extensions of the acceptance testing period.
 3. If more than one (1) visit is required by the Architect's Consultant because the system does not fulfill this specification, pay for time and expenses of the Architect's Consultant during any extensions of the acceptance testing period.
 - E. Additional Programming
 1. Provide additional programming time as noted in the equipment and component schedule to adjust and add to touch screen, dsp, and video programs in order to accommodate exhibit installations within the first year of operation.
 2. Additional programming will be coordinated directly with the owner / exhibit consultant.
- 3.4 DEMONSTRATION AND INSTRUCTION
 - A. Create an initial configuration for test purposes which demonstrates the full capabilities of the system, demonstrates how it meets specification, and demonstrates areas in which it exceeds specification.
 - B. Provide training to the Owner at times and dates and of durations to be mutually agreed upon by the contractor and the owner.
 - C. Training will include detailed instruction in the operation of the equipment provided under this section by persons knowledgeable in the operation of the subject components.
 - D. Training hours are to be divided between multiple sessions.
 1. An introductory session that includes an overview of how components work and significant elements / processes.
 2. A detailed training session that reviews items in the first session and continues into the minutia of the equipment operation and maintenance.
 3. Attendance at one or more cueing sessions to provide support, real time training, review and reinforcement of earlier concepts.
 4. Follow-up training sessions at 3 and 6 months following Final Acceptance.

- E. Total training hours are listed in the equipment and component schedule. Hours listed in the equipment and components schedule may be re-allocated between columns at the owner's discretion.

3.5 PROJECT CREDIT

- A. In publications where this project is mentioned give credit to:
 - 1. Theatre Consultant: Theatre Consultants Collaborative, Inc

3.6 ADDITIONAL INFORMATION

- A. Equipment and component schedule.
- B. TPS System Drawings.

END OF SECTION

SECTION 11 61 70 10 - PERFORMANCE AUDIO, VIDEO AND COMMUNICATIONS
RACKS AND WIRING INFRASTRUCTURE

PART 1 - GENERAL

1.1 SUMMARY

- A. Work in this section includes the engineering, manufacture, furnishing, coordination and installation of the wiring infrastructure for the Sound Video and Communications systems.
- B. Section Includes:
 - 1. Wire and Cable
 - 2. Terminations
 - 3. Wiring devices
 - 4. Racks and rack accessories
 - 5. Racks, Cabinets and Cases.
 - 6. Wiring and Wiring Devices Including:
 - a. Signal wire and cable.
 - b. Power distribution from sound system power supply into equipment racks including circuit protection and power sequencing.
 - 7. Patch panels.

1.2 SYSTEM DESCRIPTION

- A. Design Requirements: Provide integrated sound, video, and intercommunications systems. These systems are capable of providing the characteristics specified herein.
 - 1. Ethernet Cabling System: Provide the facility with a Category 6E compliant Ethernet cabling system.

1.3 QUALITY ASSURANCE

- A. Supplementary Standards:
 - 1. Insulate microphone and 600-ohm lines from the conduit within which they run, and from each other for the entire conduit length.
 - 2. Ground microphone shields only at the microphone frame and to the control console input connectors.
 - 3. Connect audio grounds in the equipment racks to a common point in the rack; ground the racks to the isolated ground bus located in the electrical control panel servicing the sound system equipment. Ground racks to a single point. As stated above, ground audio shields to ground at a common point.
 - 4. Clearly mark switches, jacks, outlets, cables, connectors, etc. logically and permanently during fabrication and installation to match marking indicated on the shop drawings and as-built drawings.
 - 5. Where many cables are run in close proximity color code by level and function in a logical manner.
 - 6. Take necessary precautions to prevent and guard against electromagnetic, electrostatic and radio frequency interference.
 - 7. Provide audio system wiring which is continuous from the faceplates to the racks. Employ no splices for entire cable length.
 - 8. Exercise care in wiring, so as to avoid damage to the cables and to the equipment. Between racks, cabinets, consoles or modules ensure cables are well-supported, neatly laced and dressed. Make joints and connections with rosin-core solder or mechanical connectors approved by the Consultant. Between racks, cabinets, consoles or modules, terminate cable in WAGO Cage Clamp or QCP terminal blocks. Execute audio wiring in adherence to standard broadcast practices.
 - 9. When cable is surface mounted and crossing through fire walls, use the equivalent fire rated plenum cable to the specified cable type.

10. Run power and high level circuits on one side of the racks or cabinets. Run other circuits on the other side.
11. Ground other shields only at the outputs of the associated device and terminate at the "floating" end with "wedge on" collars or plastic tape. Preserve continuity of shields at connecting points.
12. Connect audio grounds in the equipment racks to a common point in the rack; ground the racks to the isolated ground bus located in the electrical control panel servicing the sound system equipment. Ground racks to a single point. As stated above, ground audio shields to ground at a common point.
13. Dedicate a terminal block for use with each audio patch panel. Interface audio circuits terminating in a patch panel through a terminal block. Terminate microphone and line level signals with a QCP punch block or WAGO Cage Clamp terminal blocks. Terminate high level (amplifier output) at a WAGO Cage Clamp terminal block. Wire patch panels so signal sources, inputs and outputs from equipment, are connected in a logical and efficient combination of top and bottom rows.
14. Label terminal strips, punch blocks, wire and cables in a permanent and logical manner
15. Interconnect racks to equipment using multiconductor cables.
 - a. In cases where 6 or more channels from a source are terminated, fan from source in to a multiconductor cable, out to a VEAM CIR Series, ELCO/EDAC multipin or Whirlwind MASS connector. Place a panel in the rack to which equipment is terminated. Install an appropriate VEAM CIR Series, ELCO/EDAC multipin or Whirlwind MASS receptacle in panel labeled to indicate equipment terminated.
 - b. In cases where 6 or less channels from a source are terminated, fan from source in to multiconductor cable, out to XLR connectors. Place a panel in the rack to which equipment is terminated. Install appropriate XLR receptacles in panel labeled to indicate equipment and channels terminated. Signal from devices flow into receptacles through multiconductor cable out to plugs, connecting to panel mounted receptacles.
 - c. Where VEAM CIR Series, ELCO/EDAC multipin or Whirlwind MASS connectors are used, shields may not be combined.
 - d. Multiple wiring levels may not be combined in one conductor nor in one connector. For example low level wiring from a microphone may not be bussed in the same conductor as medium level wiring from a tape deck.
 - e. Where an individual piece of equipment is being connected employ a dedicated multiconductor and connector.
 - f. Where 2 racks are located apart and are being interconnected, signals from many pieces of equipment may be connected over a single multiconductor and connector.
16. Provide a minimum 6" service loop on all rack terminations.
17. Provide a minimum 12" service loop on all other terminations.
18. Cable inside rack is run on an orthogonal grid with radiused turns.
19. Run cables to the side of the rack before running cable vertically.
20. Provide Lacer Bars to support cables when crossing open rack areas or when strain relief is required.
21. Follow recommended practices in infoComm International AV Installation Handbook (current edition).
22. Final location of equipment is as shown on the Drawings, located in the field by the Architect or as shown on supplementary drawings prepared by the Consultant.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Racks, Cabinets and Cases:
 1. Anvil Cases
 2. Calzone Case Co.
 3. Crenlo, Inc., Emcor Products
 4. Hamond Manufacturing Company, Inc.
 5. Middle Atlantic Products

- B. Patch Panels
 - 1. ADC Products,
 - 2. Bittree.

- C. Wire
 - 1. Belden Wire and Cable / Cooper Industries
 - 2. Canare Cable, Inc.
 - 3. ProCo Sound, Inc.
 - 4. West Penn
 - 5. Whirlwind
 - 6. Wireworks

- D. Specialty Wiring Devices:
 - 1. Hubbell Wiring Devices
 - 2. Mystery Electronics
 - 3. Neutrik USA. Inc.
 - 4. Siemon Electronics Company
 - 5. SSRC, Inc
 - 6. WAGO Corporation

- E. Trade Wiring Devices:
 - 1. See Division 26

2.2 EQUIPMENT AND SYSTEMS

- A. Equipment racks
 - 1. EIA 19" standard modular rack frames providing rack units of panel space as noted in the contract documents, 21" of width, and 26" of depth, minimum.
 - 2. Provide side panels, one pair per rack group.
 - 3. Provide interior switched work lamp for each individual rack.
 - 4. Provide matching ventilation panels as needed.
 - 5. Provide matching blank or vent panels in spare rack spaces.
 - 6. Provide two patch cord holders for each rack group containing mic/line level or loudspeaker patch panels (suitable holders are by Trompeter Electronics, model no. CH50, with 10 cable slots for 1/4" diameter and smaller cables, holding up to 50 cables).
 - 7. Provide internal power distribution sufficient to power devices contained in the rack providing the sequencing noted in the contract documents.
 - 8. Floor standing rack groups shall be mounted on wooden frames made from 1" x 3" dimensional oak, laid flat. Frames shall support the entire rack group perimeter, as well as provide center supports for remaining exposed edges of rack bases, as required to isolate rack from building ground.
 - 9. Approved pan or truss head type panel mounting screws with non-metallic flat washers shall be used to secure rack-mounted equipment.
 - 10. Provide shoulder washers for isolating rack mounted video equipment from the equipment rack rails.

- B. AC Power Switching System and Receptacle Strips:
 - 1. AC Power Control Panel
 - a. Custom fabrication
 - 1. A 1U EIA switch panel providing simple on-off control of the Sound System AC power switcher, including separate switches for the SVC rack room equipment rack. Panel to be mounted on front of SVC rack room equipment rack. Switch shall be low voltage momentary push button type with integral LED. AC line switching shall occur in a separate relay-based device which is controlled by this panel.
 - 2. Fabrication per general guidelines for custom panels outlined in the panel specification section.
 - 2. AC Receptacle Strip
 - a. Wiremold 20GB Series Plugmold Strip

1. A painted steel, 3-wire, 1-circuit, prewired outlet receptacle strip with insulated grounding conductor. Unit is available in three (3), five (5), or six (6) foot lengths containing 5 to 12 receptacles.
 2. Receptacle strips shall be permanently mounted inside equipment racks.
 3. Wiring to AC power switcher and intermediate junction boxes shall be in flexible conduit (greenfield).
 4. Provide a sufficient quantity and configuration of AC receptacle strips to support the specified equipment in each equipment rack group, plus a minimum of 50% spare outlets.
3. Provide heavy copper busbar in each rack for connection of isolated ground circuits. Bond busbars together with 3/0 AWG cable in a "star" Wire and Cable:

C. Cable Installation

1. Where the following table and the manufacturer's recommendations conflict follow manufacturer's recommendations.
2. Where the following table does not indicate a cable type follow manufacturer's recommendations.
3. Where installation conditions require plenum rated cable use closest plenum rated equivalent.
4. Cable Manufacturer is Belden unless otherwise noted.

Index	System	Level	Cable	Notes
A	Assistive Listening	High	8219	
AN	Wireless Mic Antenna	Low	9913	
B	Entry Button	Med	9444	
E	Ethernet	Other	7851A	
I	Intercom - Analog	Med	8760	
L	Line Level Audio	Med	8451	
LV	Low Voltage Control	Med	9444	
M	Microphone	Low	8451	
MD	Midi	Other	8102	
MMF	Multimode Fiber	Other	M9A037	Use M9A038 for Quad Fiber Installations
P	70V	High	8719	
PV	70V w/ Volume Override	High High	8718 2 @ #16 THHN	
Q	Cue Light	Med	9444	
S	Speaker	High	WestPenn C207	Use WestPenn C210 for 100'+ runs and subwoofer runs
SMF	Single Mode Fiber	Other	General Cable AP0061PNU	

SN	AV Network	Other	10GX62F	
SR	Show Relay	High	8719	
VS	SDI Video	Other	4694R	
VTP	Video over Twisted Pair	Other	10GX62F	

D. Racks And Rack Installation

1. Racks shall have the same color finish (Textured Black).
2. Vent and Blank Panels
 - a. 16-gauge perforated steel
 - b. In 1U through 3U rack heights with black baked enamel finish.
 - c. Vent Panel: 5/32" diameter holes.
3. Interior to exterior cable paths are to employ grommets or brush grommets.

E. AV Boxes: Faceplates.

1. Termination: Refer to general termination guidelines in "Part 3- Execution: Installation- Wiring-Termination" for further explanation of the following methods. Exceptions as noted.
 - a. XLR-type connectors: Solder wire directly to connector in the field. Or, for ease of field installation, pre-wire with properly sized compression-type butt splices on short "pig tails" of appropriate wire (same type as specified for installation in conduit).
 - b. F-type and UHF-type connectors: Attach double crimp-type (crimp-crimp) straight plug to end of coaxial cable for connection directly to the feed-through jack. Ensure integrity of coaxial cable shield isolation from back box by insulating connectors (and/or any adapters) with a shroud or hood of shrink tubing, or similar material. Plastic "electrical" tape is not acceptable.
 - c. BNC-type connector: Attach double crimp-type (crimp-crimp) straight plug to end of coaxial cable for connection directly to the feed-through jack. Ensure integrity of coaxial cable shield isolation from back box by insulating connectors (and/or any adapters) with a shroud or hood of shrink tubing, or similar material. Plastic "electrical" tape is not acceptable.
 - d. Neutrik NL4 and NL8 series connectors: Attach properly sized crimp type female disconnect terminals to large gauge loudspeaker wire and mate with male disconnect terminals on the Neutrik connectors. Securely strain relief loudspeaker wires to connector body or wall plate to ensure integrity of the electrical/mechanical disconnect termination.
 - e. Ethernet
 1. Category 6A compliant cables.
 2. In patchbays provide standard shielded connectors.
 3. In extension cables provide shielded Ethercon Connectors with silver shells.
 - f. Fiber
 1. Provide dual fiber PVC jacketed cables (quad fiber where specified.)
 2. Patchbays use Neutrik OpticalCon connectors.
 3. Patch and extension cables use Nutrik OpticalCon cable assemblies.
 - g. Video over Twister Pair: Per manufacturer's requirements.

2.3 MANUFACTURED UNITS

A. Equipment Cabinets and Racks:

1. Construct permanent racks of black 16 gauge steel with square front vertical corners. Provide panel mounting channels with holes on E.I.A. spacing. Rack dimensions: 22" wide x 24" deep by the height necessary to accommodate the specified equipment or as shown on the drawings.
2. Fill unused panel space with blank black solid panels and/or black ventilating panels. Provide a variety of panel sizes including 1 rack unit, 2 rack unit, and 3 rack unit panels to facilitate the addition of equipment at a later date.
3. Provide mounting rails, clips, and screws on front and rear of rack.

4. Enclose side and rear of rack assemblies with removable panels.
 5. Racks and panels are to be black in color.
 6. Provide security covers for Show Relay, Assisted Listening, Logic Control, and Paging, Video Processing, and CATV equipment when mixed in racks with other equipment.
 7. Provide hard rubber casters on racks which are not permanently located or require movement to attain rear access.
 8. Build racks, fill and wire and test circuits in the shop before transporting the racks to site.
- B. Installed Wire and Cable:
1. Wire and Cable is to be that specified on the Drawings and/or as described herein.
 2. Multiconductor wire shall exhibit the same characteristics of the single conductor wire specified herein.
 - a. Pairs in a multiconductor are to be individually shielded
 - b. Exception: sound system speaker wire.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Employ continuous runs of cable without splices.
- B. Terminate and install low voltage faceplates.

END OF SECTION

SECTION 11 61 70 15 - PERFORMANCE AUDIO, VIDEO AND COMMUNICATIONS
FACEPLATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work in this section includes the engineering, manufacture, providing, and coordination of the control faceplates.
- B. Section Includes
 - 1. Faceplates
 - 2. Custom Rack Panels
 - 3. Verification of field conditions prior to faceplate manufacturing and installation so as to confirm that faceplates will match properly. Modify faceplates as necessary to conform to existing conditions.

1.2 SYSTEM DESCRIPTIONS

- A. Design Requirements
 - 1. Faceplates are fabricated to match their mounting conditions.
 - 2. Faceplates have labels with circuit numbers that match their termination points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following are accepted faceplate manufacturers:
 - 1. ProCo Sound, Inc.
 - 2. RCI
 - 3. Whirlwind
 - 4. Wireworks
- B. The following are accepted data communications cable manufacturers:
 - 1. Alpha Wire & Cable
 - 2. Belden
 - 3. Carol Wire and Cable
 - 4. West Penn
- C. The following are accepted connector manufacturers:
 - 1. Neutrik
 - 2. Switchcraft
- D. Backboxes:
 - 1. Ace Backstage
 - 2. Cub Systems
 - 3. FSR
 - 4. Hubbell Wiring Devices
 - 5. Mystery Electronics
 - 6. ProCo Sound, Inc.
 - 7. RCI Custom products
 - 8. Steel City
 - 9. Whirlwind
 - 10. Wireworks

2.2 MANUFACTURED UNITS

- A. Faceplates, backboxes and junction boxes:
1. Furnish faceplates, backboxes and junction boxes as specified in the Contract Documents.
 2. Backboxes
 - a. Clearly mark backboxes with box number on the rear "INTERIOR" of the backbox.
 - b. Protect this marking from destruction by other trades subsequent work.
 3. Cable on Faceplates:
 - a. In boxes with pigtails or multiconductor cable is type SO sized to accommodate the maximum load of the terminating connector.
 - b. Cable is to be black in color.
 - c. For multicables factory terminate one end.
 4. For surface mounted conditions faceplate and back box dimensions are equal.
 5. Where faceplates are installed in flush mount conditions the edges of the faceplate are to extend a minimum of 3/8" beyond the edges of the back boxes.
 6. Where line level power and low voltage co-exist in a given box provide internal separators keeping line voltage in a separate compartment.
 7. Remove sharp edges and burrs on faceplates.
 8. Faceplate Finishes
 - a. Unless otherwise noted the finish is flat.
 - b. Where no finish color is noted a custom color is required, which will be selected by the architect.
 9. Provide cover screws with slotted holes to accommodate back boxes mounted out of vertical. The slots will be fabricated such that the horizontal clearance is equal to twice the vertical clearance.
 10. Material: 1/8" aluminum.
 11. Finish: 120 Grit, horizontally brushed anodized aluminum color as noted.
 12. Reinforce faceplate as needed to minimize deflection.
 13. Directly engrave into pre anodized aluminum.
 14. Label Color: Natural (silver) or white fill.
 - a. Legends shown on detail drawings are typical. Refer to drawings and submit proposed circuit numbers to Consultant for review. Faceplate title is typically labeled with the appropriate signal. Individual connectors are labeled with the corresponding circuit number.
 - b. Legend size shall be 0.125" high characters of medium weight unless otherwise noted.
 15. Floor Pocket:
 - a. Consists of a backbox, basket, faceplates, and coverplate with trim ring.
 - b. Exterior finish: per drawings.
 - c. Provide cover plate designed for specific mounting conditions.
 16. Faceplates and Back Boxes Located In Exterior Areas:
 - a. Furnish enclosures for faceplates located in areas exposed to weather in weather proof boxes.
 - b. Provide weather proof enclosures to close while receptacles are filled with temporary cables.
 - c. Provide temporary cable exitways designed to accommodate the full capacity of the faceplate.
 - d. Locate exitways on the bottom of the enclosure.
 - e. Provide attachments for strain relief and drip loop on the enclosure.
- B. Rack Panels, and Other Permanent Equipment:
1. General
 - a. Where line level power and low voltage co-exist in a given panel provide an enclosure to keep line voltage in a separate compartment.
 - b. Standard 19" rack panel format.
 - c. 1U through 6U heights
 - d. Material: 1/8" aluminum.
 - e. Finish: 120 Grit, horizontally brushed anodized aluminum color as noted.
 - f. Reinforce faceplate as needed to minimize deflection.
 2. Connector: Panel or chassis types, as indicated below. Mount on faceplate as shown on detail drawings and fasten with stainless steel machine screws, hex nuts, and lock washers

(screw head style, color, and thread size to match connector body; slot or phillips drive to match wall plate screws).

- a. XLR Type
 1. XLR-3 (Microphone, Line, Communication): Neutrik NC3MD-L-1-B (male) and NC3FD-L-1-B (female) panel mount connectors; Neutrik NC3MX-B (male) and NC3FX-B (female) cable connectors. Gold contacts and black chrome shells throughout.
 2. Note wiring:
 - a. Balanced mic/line: pin 1 = shield (screen), pin 2 = high (hot), pin 3 = low.
 - b. Unbalanced mic/line: pin 1 = shield/common, pin 2 = high, pin 3 = tie to pin 1.
 - c. Production intercom: pin 1 = shield/common, pin 2 = +30VDC, pin 3 = audio/signal.
 - d. In no case shall pin 1 be tied to case of connector.
 3. XLR-4 (Production Intercom Headset/Handset): Neutrik NC4MC-B (male) and NC4FC-B (female) cable connectors. Gold contacts and black chrome shells throughout.
- b. NL4 Type (Loudspeaker)
 1. Neutrik Speakon NL4MP panel mount connector; NL4MPR sealed loudspeaker cabinet chassis connector; and NL4FC cable connector.
 2. Wiring notes: In addition to standard single (ch 1) and dual (ch 1 /ch 2) mode, note the following wiring methods:
 - a. Biamp: ch 1: LF ch 2:HF
 - b. 70.7 volt lines: single-channel only, pin "1+" = high (hot), pin "2-" = low (common).
 3. 1/4" Phone Plugs and Jacks
 1. Plug: Neutrik NP2C-BAG 2-pole and NP3C-BAG 3-pole cable plugs. Nickel contacts and black nickel shells.
 2. Jack: Neutrik NJ3FC6C-BAG latching 2- or 3-pole cable jack. Silver contacts and black chrome shells.
 3. Note wiring:
 - 3-pole: Sleeve = ground/shield, ring = low, tip = high (hot).
 - 2-pole: Sleeve = common/ground/shield, tip = high.
 - d. 1/4" / XLR Combo
 1. Combines the features of an XLR and the 1/4" TRS as noted above.
 2. Jack: Neutrik Combo Series latching 2- or 3-pole cable jack. Silver contacts and black chrome shells.
 3. Wire both jacks in parallel.
 - e. 1/8" Mini Plug
 1. 1/8" T/R/S "Walkman-type" stereo mini plug. Metal shell required.
 - f. Phono (RCA) plugs and jacks
 1. Plug: Neutrik ProFi NF2C/2 RCA plug (available in pairs of black and red). Gold plated nickel contacts and brass shell.
 2. Jack: Switchcraft 3503 RCA cable jack. Nickel plated brass contacts and shell.
3. Video/RF connectors
 - a. UHF Type (Wireless Microphone System Antenna)
 1. Amphenol 31-105 insulated panel 50ohm BNC receptacle (female) for RG-8/U type coaxial cable. Beryllium copper center contact and TR-5 tarnish resistant alloy finish on body and fittings.
 - b. 75-ohm BNC Type (Video)
 1. Canare BCJ-JRU insulated double female (feedthru) recessed panel mount connector; BCP-C7 double crimp-type straight plug (with long body sleeve for 75-ohm precision coaxial cable). Gold plated center contact and beryllium copper external contact.
 - c. 75-ohm F-Type (Video Receiver)
 - d. Trompeter BJ139 bulkhead feedthru jack: PL130-N wrench crimp-type straight plug. Gold plated center contact and beryllium copper external contact. Connector shall be electrically insulated from the mounting plate.
4. Isolated ground receptacles

- a. Duplex isolated ground receptacles shall be Hospital Grade, NEMA 5-20R configuration. 2-pole, 3-wire, 20-amp, 125 volt, orange color.
- b. Provide Pass&Seymour IG 8300, or approved equal.
- c. Provide labels: "SOUND SYSTEM ISOLATED GROUND".
5. Miscellaneous Connectors
 - a. RJ-45
 1. Neutrik Ethercon Series with ACRF Color coding rings as follows (unless otherwise noted.)
 - a. AV Net – Black – No Ring
 - b. Mixer – Red
 - c. Cobranet – Yellow
 - d. Digital Media (STP) - Green.
 - e. Control System - Blue
 2. T568B Pairing
 3. Panel mount receptacles utilize 110 terminations.
 - b. Fiber LC
 1. Neutrick OpticalCon Duo Series
- C. Patch Cable
 1. Analog Audio
 - a. Terminate in longframe TRS connectors.
 2. Analog Video
 - a. Employ 75 Ohm SJ2000 series jacks for signals 360Mbps and below.
 - b. Employ 75 Ohm SVJ-2 series jacks for data rates above 360Mbps.
 3. Ethernet Cables
 - a. Terminate in RJ-45 connectors.

PART 3 - EXECUTION

3.1 (UNUSED)

END OF SECTION

SECTION 11 61 70 20 - PERFORMANCE AUDIO, VIDEO AND COMMUNICATIONS
SOUND SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work in this section includes the engineering, manufacture, furnishing, coordination and installation of Sound Recording, Playback, Reinforcement and Effects Systems.
- B. Section Includes:
 - 1. Amplifiers.
 - 2. Loudspeakers.
 - 3. Loudspeaker Support Frames
 - 4. Dead hung speaker mounting systems where speakers mounted by means of a manufactured pre-engineered mounting system.
 - 5. Microphones.
 - 6. Audio Mixing Consoles.
 - 7. Media Players.
 - 8. Solid State Audio Players
 - 9. Racks, Cabinets and Cases.
 - 10. Digital Signal Processing.
 - 11. Accessories.

1.2 SYSTEM DESCRIPTION

- A. Design Requirements
 - 1. Provide wire, cable and terminations to support portable sound equipment.
 - 2. Auditorium System
 - a. Reinforcement will come from microphones and direct feeds.
 - b. Playback will be from a variety of sources including digital media players.
 - c. Effects will be from an effects mixer or computer.
 - d. Provide digital signal processing effects devices.
 - e. Provide with this system, the capacity to route an alternate signal other than the show relay monitor microphone feed to the Show Relay for the performance space.
 - f. Provide at the patch panels at the racks, a bay for external feeds (feed to Show Relay, feeds to other halls), connection points on equipment, microphone locations and feeds to microphone and line level audio lines.
 - g. Install a left / center / right / surround system.
 - 1. Center is an array hung above the forestage.
 - 2. Left and right are digitally steerable column speakers.
 - 3. Surround speakers are mounted to the side and rear walls.
 - 4. Subwoofers are recessed behind the proscenium.
 - h. Provide additional speaker positions at stage level for stage monitors and throughout the theatre for effects speakers.
 - 3. Cafeteria.
 - a. Reinforcement will come from microphones and direct feeds.
 - b. Playback will be from a variety of sources.
 - c. Provide digital signal processing effects devices.
 - d. Provide at the patch panels at the racks, a bay for external feeds (feed to Show Relay, feeds to other halls), connection points on equipment, microphone locations and feeds to microphone and line level audio lines.
 - e. Install a left / right system.
 - 1. Left, right are digitally steerable column speakers mounted adjacent to the large video displays.
 - 4. Planetarium
 - a. Reinforcement will come from microphones and direct feeds from the existing Projection System.

- b. Playback will be from a variety of sources.
 - c. Provide digital signal processing effects devices.
 - d. Install a 5.1 Surround system.
 1. Main speakers are mounted behind the projection dome utilizing custom mounting hardware.
 2. Subwoofers are mounted behind the dome on a custom shelf.
 3. Use speakers designed for use in humid environments.
 5. Exhibit and Support Spaces
 - a. Playback will be from a variety of sources including digital media players.
 - b. Additional playback will come from a portable mixing console that can tie into the installed system.
 - c. Provide digital signal processing effects devices.
 - d. Test and reuse the distributed speakers system. Upgrade all head end equipment.
 1. Speaker placement and models per drawings. Provide even coverage of spaces.
 6. Video Studio
 - a. Provide the studio with the ability to mix audio signals over the AV network via DANTE.
 7. Portable Recording and Playback
 - a. Provide portable equipment in road cases for use throughout the facility.
 - b. Interface with new and existing spaces.
- B. Standards and Regulations
1. Speakers used for overhead suspension are to comply with ANSI E1.8-2005.
- C. Performance Requirements:
1. Provide audio transformers used in the system which are of appropriate impedance ratio and power handling capacity for the function intended, and unless otherwise noted herein, have a frequency response within +/- 1 dB from 20-20,000 Hz.
 2. Ensure that components are pin 2 hot (XLR) and tip hot ¼" TRS.
 3. Microphone System and Accessories:
 - a. Ensure outputs of microphones are 150-250 ohms, balanced with respect to ground.
 4. Sound System:
 - a. Ensure overall performance requirements of the sound amplification system are checked by measurement. Provide each system as designed which meets the following requirements as well as the manufacturer's published specifications. This Contractor is responsible for use of the equipment specified in the manner specified and each component's conformance with its manufacturer's specifications.
 - b. Ensure overall system frequency response is +/-2 dB, 250-4,000 Hz, and +/- 4 dB 50-16,000 Hz when measured in 1/3 octave bands at any seat in the space. Measure frequency response using Time Delay Spectrometry or 1/3 Octave Real Time Analyzer.
 - c. Ensure residual noise and hum are below the ambient noise levels produced by the air conditioning system and other mechanical systems within the auditorium, for an overall signal-to-noise ratio of 70 dB for the entire system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following is a list of approved manufacturers of Sound System components. See main section for additional terms.
- B. Media Players:
1. Denon Professional
 2. Sony
 3. Tascam
 4. Yamaha
- C. Solid State Audio Playback:
1. Denon Professional
 2. Sony

3. Tascam
 4. Yamaha
- D. Microphones:
1. AKG Acoustics, Inc.
 2. Audio-Technica US, Inc.,
 3. Beyer Dynamic, Inc.
 4. Crown
 5. Countryman
 6. DPA
 7. Earthworks
 8. Electro-Voice
 9. Neumann
 10. Rode
 11. Royer
 12. Sennheiser
 13. Shure Brothers, Inc.
 14. Shure Brothers, Inc.
- E. Audio Mixers – Reinforcement / Playback Consoles:
1. Allen and Heath
 2. Avid / Protocols
 3. Soundcraft
 4. DiGiCo
 5. Yamaha International Corp.
- F. Amplifiers:
1. Crest Audio
 2. Crown, Inc
 3. Lab.Gruppen
 4. QSC Audio Products
 5. Electro-Voice Inc.
 6. Yamaha International Corp..
- G. Loudspeaker Systems - Playback:
1. d&b
 2. Eastern Acoustic Works, Inc.
 3. Electro-Voice Inc.
 4. JBL, Inc.,
 5. L'Acoustics
 6. Meyer Sound
 7. One Systems
 8. Renkus-Heinz
- H. Loudspeaker Systems – 70V:
1. Tannoy, Inc.
 2. JBL
 3. Atlas Sound
- I. Configurable Digital Signal Processors
1. Bi Amp
 2. BSS By Harmon
 3. QSC Q-SYS
 4. Yamaha
- J. Portable Cables
1. Canare
 2. Proco
 3. Whirlwind
 4. Wireworks

2.2 EQUIPMENT AND SYSTEMS

- A. Performance Sound System:
1. Audio Mixing Console
 - a. Provide with Dante network cards.
 - b. Provide LED consoles lights one for each receptacle..
 - c. Provide multicables and fanouts for interfacing the console to the portable rack and microphone lines for use in the control booth and house mix positions.
 2. Media Player: Provide with RS232 interface
 3. Permanent & Demountable Loudspeakers
 - a. Speaker Support Frame
 1. Design a support frame from which the speakers are suspended.
 2. Hang the speakers from a support frame in such a fashion that allows their focusing over the full range of the interior areas.
 3. Provide a locking mechanism on the focus system to prohibit the slipping of focus.
 4. Provide a permanent marking system that will indicate the correct focus of the speakers allowing quick remounting of the system.
 5. Systems lacking horizontal or vertical adjustability are not acceptable.
 - b. Vibration Isolation
 1. Provide vibration isolators in mounting system to minimize transmission of vibration through the hanging system to the surrounding building elements.
 - c. The following establishes minimum safety requirements for the system. Where Federal, State and Local Legislation address these topics, the more stringent requirements take precedence. Factors listed below in no way relieve this Contractor from the sole responsibility of providing safe systems.
 1. Minimum factor of safety for lifted loads: 10 or a 75% impact factor, whichever is greater.
 2. Minimum factor of safety for static loads: 6.
 - d. Provide systems designed to reflect safeguards and precautions related not only to normal use of the equipment under ideal operating and loading conditions but, additionally, to anticipate equipment misuse, human error, and misjudgment. Design and intent parameters set forth herein in no way relieve this Contractor from responsibility or liability arising from the Work.
 - e. Demountable features.
 1. Provide speakers with handles.
 2. Permanently label components for quick and easy reinstallation.
 4. Portable Loudspeaker: Provide with handles.
- B. Portable Equipment and Cabling:
1. Loudspeaker Cables
 - a. Fabricate with Light weight, heavy duty, abrasion resistant, synthetic rubber insulated (similar to STE and SJTE) cable.
 1. Single circuit - 14/2 loudspeaker cable with Neutrik NL4FC connector at each end.
 2. Two (2)-circuit - 14/4 loudspeaker cable with Neutrik NL4FC connector at each end.
 2. Standard Microphone / Production Intercom Cables
 - a. 20-gauge, two-conductor shielded female XLR-3 to male XLR-3 rubber jacket cables.
 3. Miniature Microphone Cables
 - a. 24-gauge, two-conductor shielded female XLR-3 to male XLR-3 rubber jacket cables.
 4. Microphone / Line Level Patch Cords
 - a. Three-conductor patch cord with single male 1/4" T/R/S connector (military plug type PJ-051R) at each end. Shielded cable is grounded to each connector. Connector handles are red.
 - b. Each patch cord shall have a black heat-shrink polyolifin sleeve near one end of the cable. This sleeve shall be hot-stamped with the name of the facility, or as directed by the Owner.
 5. Audio Adapters and Interface Components (as per the Equipment and Component Schedule)

2.3 MANUFACTURED UNITS

- A. Microphone and Line Level Audio System Installation and Accessories:
1. Provide a multi-conductor microphone and line level audio system as indicated on the Drawings and described herein. Employ VEAM CIR Series ELCO/EDAC or Whirlwind MASS multi-conductor plugs and receptacles with gold contacts or an approved substitute. Employ single line XLR connectors with Neutrik NC3_X-B series or an approved alternate with gold contacts.
 2. Cable types are as shown on the drawings and as indicated herein.
 3. In addition to portable cables specified elsewhere, provide one (1) 25' flexible extension cable for each microphone. Fit each flexible extension cable at one end with a Neutrik NC3MX-B connector and a Neutrik NC3FX-B connector at the opposite end.
 4. Provide combining networks and pads as required. They are to be 1/2w 1% composition resistors soldered fixed connection points at each end. Values for pads may vary slightly depending upon signal levels encountered.
 5. Switching and connection facilities required are indicated on the functional diagram. The drawings do not necessarily indicate switches and connectors included in this system. Switches and connectors used in this system whether or not mentioned or shown in this Specification, shall have sufficient voltage and amperage rating to cover the use for which they are required with a safety factor of at least 2. Switches and connectors handling audio circuits shall use gold contacts and unless toggle switches cannot fulfill the function required, shall meet JAN-S-23 or MIL-S-3950A specifications.
- B. Portable Racks
1. Meet or exceed A.T.A. Specification 300 Category 1 requirements.
 2. Are Black in color
 3. Interlock when stacked.
- C. Loudspeakers and Associated Equipment:
1. Layout and mounting arrangements of Loudspeakers are as shown on the Drawings and as described herein.
 2. Fabricate and design each loudspeaker to be held rigid and not vibrate loose during operation.
 3. Securely mount the loudspeakers in a manner that will exclude the possibility of falling.
 4. Provide loudspeakers that are easily movable and replaceable in the same position.
 5. Provide each portable loudspeaker with two male connectors, wired in parallel and mounted in the rear.
 6. For passive speakers employ Neutrik NL4MP Connectors for single and bi-amped speakers.
 7. For powered speakers provide XLR input.
 8. For digital speakers provide Ethercon input.
 9. Provide each portable loudspeaker with a portable cable. These are standard multi conductor loudspeaker cables, 25'-0" long. Fabricate cables from jacketed #12 AWG wire with phasing code. For single and bi-amped applications fabricate using 2 pair cables. Terminating at each end in Neutrik NL4FC Connectors. For tri and quad-amped applications fabricate using 2 pair cables. Terminating at each end in Neutrik NL8FC Connectors.
 10. Receptacles for Portable Loudspeakers: Flush mount loudspeaker receptacles at the locations and in the quantities shown on the Drawings. Employ Neutrik NL4MP Connectors for single and bi-amped configurations.

PART 3 - EXECUTION

3.1 SYSTEM TESTS AND ADJUSTMENTS

- A. Initial Settings
1. Set gain structure to maximize dynamic range using the optimized method. Do this by setting gain structure so all devices in the system clip simultaneously with the mixer.
 2. Balance the levels of the loudspeaker units driven by different amplifiers in the same system to ensure adequate coverage and level of sound from loudspeakers.
 3. Establish the normal settings for level controls. Adjust level controls on rack-mounted

- equipment for optimum signal to noise ratio and signal balance; then install security covers to prevent tampering.
4. Aim speakers to maximize even coverage and minimize spill on unoccupied areas, such as walls.
 5. Prior to equalization of the system use a sweeping sine wave at the systems input to check the permanent loudspeakers for extraneous noise. Confirm even coverage of system by use of pink noise and 1/3 octave real time analyzer. Observe variations in both level and spectrum shape while walking the seating area. If coverage problems are evident, attempt to improve coverage by re-aiming the loudspeakers.
 6. Response shall not vary more than +/- 3 dB at any given seat.
 7. Set delay to minimize the quantity of apparent arrivals of direct sound at any one location. A properly adjusted system will create the impression that the main speakers are providing the coverage.
- B. Equalization:
1. Provide the required testing apparatus specified herein to complete successfully the equalization and tests. The purpose of the equalization is to adjust the acoustical amplitude response of the sound system to a specified uniformity measured throughout the seating area. This adjustment is made to realize maximum acoustics gain and optimum tonal balance from the sound system.
 2. Using a calibrated measuring microphone located in the seating area at twice the critical distance (at which direct sound from the source and reverberant sound are in a ratio of 1:1), establish the unequalized acoustic amplitude response to a pink noise source. Bring the observed acoustic amplitude to within +/- 2 dB uniformity (flat) from 40 to 2,000 Hz. Initially set the roll off at the low frequency end at 24 dB/octave below 20 Hz. Initially set the roll off at the high frequency end at 3 dB/octave above 2 kHz. Adjustments to these settings may be required following initial listening tests.
 3. Adjust the sound system gain until it reaches regeneration (feedback). Determine the frequency of regeneration. Adjust the appropriate filter until the observed regeneration ceases.
 4. At the conclusion of the tuning of the house curve and the feedback corrections, the electrical amplitude response of the equalizers, record first the house-curve filters alone and then the combined house-curve filters and feedback correction filters.
- C. Test Documentation:
1. Provide the following documents prior to the consultants checkout and testing visit:
 - a. The output impedance of active devices used to terminate passive devices and the value of any termination resistor used.
 - b. The input impedance of active devices used to terminate passive devices and the value of any termination resistor used.
 - c. The variation of acoustic distribution throughout the seating area above and below a reference level at each 1/3 octave center frequency from 80 - 12,500 Hz.
 - d. Impulse response graphs of all installed wiring.

END OF SECTION

SECTION 11 61 70 30 - PERFORMANCE AUDIO VIDEO AND COMMUNICATIONS
PAGING SUBSYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Work in this section includes the engineering, manufacture, furnishing, coordination and installation of a performance audio relay / paging subsystem.
- B. Section Includes:
 - 1. Paging System.
 - 2. Amplifiers.
 - 3. Microphones.
 - 4. 70V Speakers including appropriate mounting, plaster rings / T-grid bridges, back-cans, and baffles as required.

1.2 SYSTEM DESCRIPTION

- A. Design Requirements: Provide integrated audio, video, and intercommunications systems. These systems are capable of providing the characteristics specified herein.
 - 1. Show Monitor System:
 - a. Provide an interconnected Show Monitor System, for the Auditorium. This system accepts the common show relay feed.
 - 2. Paging System:
 - a. Provide an interconnected zoned Paging System, for the building. This system accepts the common show relay feed and inputs from portable digital paging microphones. Additionally this system is controlled through the central control system.
- B. Performance Requirements:
 - 1. Ensure overall performance requirements of the sound amplification system are checked by measurement. Provide each system as designed which meets the following requirements as well as the manufacturer's published specifications. This Contractor is responsible for use of the equipment specified in the manner specified and each component's conformance with its manufacturer's specifications.
 - 2. Ensure overall system frequency response is +/-3 dB, 250-4,000 Hz, and +/- 5 dB 150-16,000 Hz when measured in 1/3 octave bands at any covered location. Measure frequency response using Time Delay Spectrometry or 1/3 Octave Real Time Analyzer.
 - 3. Ensure residual noise and hum are below the ambient noise levels produced by the air conditioning system and other mechanical systems for an overall signal-to-noise ratio of 70 dB for the entire system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following are approved manufacturers of Sound and Communications System components. Refer to schedule for specific products. Substitutions may not be made without prior written approval by the owner.
- B. Amplifiers:
 - 1. Crest Audio
 - 2. Crown, Inc
 - 3. Electro-Voice Inc.
 - 4. QSC Audio Products
- C. Paging (70.7v) Equipment:

1. Atlas Soundolier Inc.
2. Mortronics
3. Tannoy
4. JBL, Inc.,

D. Configurable Digital Signal Processors & Paging Devices

1. Atlas IED
2. Bi-Amp
3. Crestron
4. QSC Q-SYS
5. Yamaha
6. Shure Brothers, Inc.

2.2 EQUIPMENT AND SYSTEMS

A. Relay system:

1. Monitor Microphone
 - a. Test and reuse existing microphones. Provide mounting hardware, as required to provide the microphone an uninterrupted pick up pattern of the stage.

B. Show Monitor / Paging System:

1. Loudspeakers – Test and reuse existing distributed loudspeakers.
 - a. Finish enclosure to match wall color.
 - b. Apply speaker grilles to match wall or ceiling color
 - c. For surface mounted speakers, paint enclosure to match adjacent architecture.

2.3 MANUFACTURED UNITS

- A. Layout and mounting arrangements are as shown on the Drawings and as described herein.
- B. Provide paging loudspeakers and transformers that are easily removable and replaceable in the same position.
- C. Fabricate and design each loudspeaker to be held rigid and not vibrate loose during operation.
- D. Securely mount the show relay microphone to the ceiling in a manner that will exclude the possibility of falling.
- E. Supply the show relay microphone in a color to match the surrounding architecture.

PART 3 - EXECUTION

3.1 SYSTEM TESTS AND ADJUSTMENTS

A. Initial Settings

1. Adjust equalization to maximize intelligibility.
2. Adjust compression to minimize dynamic range.
3. Set gain to have a normal listening level at volume control setting of 80%.
4. Set gain to have page match program setting.
5. Set automatic gain compensator to lift program over ambient noise.

B. Test Documentation:

1. Provide the following documents prior to the consultants checkout and testing visit:
 - a. Documentation of function of all volume overrides.
 - b. Documentation of polarity checks on all speakers.

END OF SECTION

SECTION 11 61 70 40 - PERFORMANCE AUDIO, VIDEO, AND COMMUNICATIONS
INTERCOM SUBSYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Work in this section includes the engineering, manufacture, furnishing, coordination and installation of a Performance Communication System
- B. Section Includes:
 - 1. Power Supply
 - 2. Headsets
 - 3. Beltpacks

1.2 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Provide Communication System integrated into the Performance Audio, Video, and Communications system.
 - 2. Provide main station units which include talk and listen capacities for all channels.
 - 3. Provide the intercom system with single channel headsets.
- B. Performance Requirements:
 - 1. Frequency response is +/- 2 dB from 150 to 18 kHz. Main station/power supply impedance is 200 ohms, nominal (adjustable to 1000 ohms). Audio voltage level is -15 dB, nominal. System shall operate from a 28 volt power supply, nominal.
 - 2. System shall operate in temperature range of 0-50 degrees C. It shall have short circuit protection against both the main power feed and the intercom line.
 - 3. Stations are interconnectable by 2 conductor shielded microphone cable per channel. Station signal-to-noise ratio should be 70 dB or better, channel separation better than 45 dB, equivalent input noise 110 dB or better.
 - 4. By connecting a line level feed from the sound system into the master station, it is possible to feed a channel with audio from those systems to serve as program monitor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following are approved manufacturers of Intercommunications System components. Refer to schedule for specific products. Substitutions may not be made without prior written approval by the owner.
- B. Party Line Intercom:
 - 1. Clear-Com
- C. Cable: See Portable Cable Specification for Microphone Cable

2.2 EQUIPMENT AND SYSTEMS

- A. Portable Main Station
 - 1. Refer also to show monitor / paging system section for required components, configuration and interface.
- B. Belt-Pack Stations
 - 1. Provide one 25' cable for each Belt-Pack provided.

PART 3 - EXECUTION

3.1 SYSTEM TESTS AND ADJUSTMENTS

- A. Initial Settings
 - 1. Set channel volumes equal across all channels.
 - 2. Set microphone levels to be equal across all stations.
 - 3. Set program level to be 6 dB below communications level.
- B. Test Documentation:
 - 1. Provide the following documents prior to the consultants checkout and testing visit:
 - a. Verification of setting on each station
 - b. Verification of function of each receptacle.
 - c. Verification of function of stage manager's station.

END OF SECTION

SECTION 11 61 70 50 - PERFORMANCE AUDIO, VIDEO, AND COMMUNICATIONS SYSTEM
ASSISTIVE LISTENING SUBSYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Work in this section includes the engineering, manufacture, furnishing, coordination and installation of a multi-channel personal guidance system that will also be used as a radio broadcast assistive listening system for the hearing impaired.
- B. Section Includes:
 - 1. Transmitter
 - 2. Emitters
 - 3. Receivers
 - 4. Headphones
 - 5. Charging Units
 - 6. System Software

1.2 SYSTEM DESCRIPTION

- A. The system shall function as both a personal guide system, as well as an assisted listening system for primary spaces. Receivers shall be configurable through the receiver's keypad for its intended function.
- B. Design Requirements – Assisted Listening
 - 1. Provide an Assistive Listening System integrated into the overall Audio, Video, and Communications system.
 - 2. Provide each primary space with a unique channel for the Assistive Listening System.
 - 3. Provide an Assistive Listening System that meets or exceeds the criteria outlined for the Americans with Disabilities Act and other applicable legislation and regulations.
 - 4. Where two or more requirements from this document or regulations conflict follow the more stringent requirements thereby ensuring that the system provided meets or exceeds all requirements.
 - 5. Transmission frequencies shall conform to industry standards.
 - 6. The Assistive Listening System shall accept its input from the Common Audio Relay Feed, or as determined via the control system.
 - 7. Provide receivers with rechargeable batteries.
 - 8. Provide storage cases for storing all receivers.
 - a. Mark each case with the international symbol of access for hearing loss prominently displayed on surfaces exposed to the public during headset distribution and collection. A picture of this symbol may be found in ADAAG, and the Federal Register Vol. 56 No. 144 page 54 figure 43 (D).
 - b. Provide 5 additional signs to be located by the user.
 - c. Provide 5 spare batteries and battery recharging units sufficient to accommodate the quantity of receivers specified.
- C. Performance Requirements:
 - 1. The systems shall provide a clear, undistorted signal to every part of the building.
 - 2. Frequency response is 50 - 15,000 Hz \pm 3dB with less than 2% total harmonic distortion at 800 Hz, 1% at 1600Hz.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following are approved manufacturers of Sound and Intercommunications System components. Refer to schedule for specific products. Substitutions may not be made without prior written approval by the owner.
 - 1. Wi-Fi / Bluetooth Assistive Listening Systems
 - a. Listen
 - b. Williams Sound.
 - c. Sennheiser

2.2 EQUIPMENT AND SYSTEMS

- A. Transmitter: Provide rack mount for transmitters
- B. Accessories
 - 1. Carrying Case: Include charging positions for all receivers
 - 2. Provide neck loops compatible with T-coil hearing aids.
 - 3. Software and connection hardware.
 - 4. Headphones per the equipment and component schedule.

PART 3 - EXECUTION

(unused)

END OF SECTION

SECTION 11 61 70 60 - PERFORMANCE AUDIO, VIDEO AND COMMUNICATIONS SYSTEMS
VIDEO SOURCES, OUTPUTS AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work in this section includes the engineering, manufacture, furnishing, coordination and installation of Performance Video System
- B. Section Includes:
 - 1. Blue Ray / DVD / Media players.
 - 2. Video Displays.
 - 3. Video Projectors.
 - 4. Projector Mounts
 - 5. Projection screens.

1.2 DEFINITIONS

- A. EDID - Extended Display Identification Data. Most recent revision of specification.
- B. HDCP - High-bandwidth Digital Content Protection. Most recent revision of specification.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements
 - 1. Provide Video Systems integrated into the Performance Audio, Video, and Communications Systems.
 - 2. Video Distribution
 - a. Scale the image using interpolated values for the derived pixels.
 - 3. Digital Media Content Creation / Distribution system.
 - a. Provide scheduling software that will allow the creation and playback of multiple programs in multiple spaces.
 - 1. Morning
 - 2. Afternoon
 - 3. Evening
 - 4. Preshow
 - 5. Intermission
 - 6. Post show
 - 7. Test Program
 - b. Provide a logic control system that will allow the scheduled operation of the system, and the interface with the Digital Media Content control system.
 - c. Provide composing software that will allow:
 - 1. The positioning of multiple video streams in one overall image
 - 2. Localization of the sound within the image.
 - 3. Control of video sources.
 - 4. Provide rudimentary effects for each embedded image:
 - a. Fade
 - b. Dissolve
 - c. Wipe
 - d. Accept video streams from:
 - 1. Live 1080P Video
 - 2. Compressed digital video on hard disk.
 - 3. DVD players.
 - e. Provide a minimum of 8 output streams:
 - 1. Planetarium Prefunction First Floor (3 streams)
 - 2. Planetarium Prefunction Second Floor (1 stream)

3. Lobby First Floor (3 streams)
4. Lobby Second Floor (1 stream)
5. One (1) spare

B. Performance Requirements:

1. Video projection
 - a. Receives and displays HDMI 1.3 with Deep Color.
 - b. Accommodates Video resolutions up to 4K/60P.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following are approved manufacturers of Sound and Intercommunications System components. Refer to schedule for specific products. Substitutions may not be made without prior written approval by the owner.
- B. Cameras
1. Canon
 2. Panasonic, Inc
 3. QSC Q-SYS
 4. Sony, Inc
 5. Sanyo, Inc
- C. Video Projector
1. Barco
 2. Christie
 3. Digital Projection
 4. Epson
 5. NEC
 6. Panasonic
 7. Sony
- D. Video Displays
1. NEC
 2. Panasonic
 3. Planar
 4. Samsung
 5. SHARP
 6. Sony
- E. Video Walls
1. Barco
 2. Christie
 3. NEC
 4. Panasonic
 5. Samsung
 6. SHARP
 7. Planar
- F. Routing Switchers
1. Autopatch
 2. Crestron
 3. Extron
 4. QSX Q-SYS
- G. Signal Processing
1. Sony
 2. Extron

3. Crestron
4. Panasonic
5. QSC Q-SYS

H. Messaging / Content Management System:

1. Brightsign
2. Optisign
3. Pixilab
4. Scala
5. Visix

2.2 EQUIPMENT AND SYSTEMS

A. Video Camera

1. High definition PTZ camera capable of simultaneous NDI and SDI outputs. Provide cameras that are POE capable.
2. Provide mounting bracket for mounting in the position indicated on the drawings.
3. Provide zoom lens with focal length range to ensure a full-stage picture from typical camera positions.
4. Provide security cable.
5. Pan/Tilt/Zoom capable mount

B. Video Monitor

1. Provide mounting brackets.

C. Video Displays

1. Provide with integrated mounting hardware.
2. Provide displays with minimal bezel thickness
3. Provide all hardware and wiring required for a functional system.
4. Displays will have discrete signal potential as indicated on the riser drawings.

D. Auditorium Projection

1. Provide a Video Projection system integrated into the Performance Audio, Video, and Communications Systems in the Auditorium, consisting of:
 - a. Video projector.
 - b. Motorized projection screen. – Test and Reuse existing projection screen.
 - c. Input connectors for computers, high definition video signals, or as indicated on the drawings.
 - d. Video distribution from sources to projector.
 - e. Switching devices to select sources.
 - f. Integration of control into PAV Control system.
2. Video Projector
 - a. Brightness: Minimum 12,000 ANSI Lumens at 90% uniformity.
 - b. Contrast Ratio: Minimum 2000:1.
 - c. Provide 16:9 video format, in all standard PC and MAC resolutions. Native resolution to be 1920 x 1080.
 - d. Lens
 1. Provide projector with interchangeable lens.
 2. Provide lens with powered zoom and focus, programmable to formats as described herein.
 3. See drawings for projector and screen placement, and lens throw requirements.
 - e. Provide video inputs for DP / HDMI Compatible signals up to 4K.
 - f. Provide projector with Serial interface for control via installed control devices. Provide also a separate IR type remote control.
 - g. Provide projector with integrated keystone compensation up to off-axis angles indicated on the drawings. Provide system that automatically provides compensation, even when projector is powered off.
 - h. Provide a laser light engine.
3. Motorized Projection Screen – Reuse existing projection screen

- a. Screen
 1. Provide a projection screen with the image size indicated on the drawings.
 2. Screen material should be designed for front projection. Provide a matte-white surface
 3. Light loss should be no greater than 8.5%. Material to be viewable from the distances based on the architectural drawings.
 4. Screen material should be seamless within the image zone both horizontally and vertically.
 5. Screen material should be inherently flame retardant.
 6. Provide blackout as required to achieve the dimensions and elevations indicated on the drawings.
- b. Housing
 1. Provide projection screen housing that completely encloses the screen when not deployed.
 2. Provide a screen roller tube capable of spanning the required width without sag.
 3. Provide mounting and rigging hardware as required to support housing either from the adjacent wall or from structure above. Provide support assemblies, cable components, connections, equipment, hardware and linkages employed in supporting, in whole or in part, overhead loads that are rated and designed for that application.
- c. Control
 1. Provide control via the AVC System Control Touchpanels.
 2. Provide motor and control designed for 120vAC, 20A max service. Coordinate installation of conduit and wire with Electrical Contractor.
 3. Provide pre-set, adjustable limit switches for the up and down positions.

PART 3 - EXECUTION

3.1 SYSTEM TESTS AND ADJUSTMENTS

- A. Perform initial tests and adjustments; include the costs of the testing in the initial bid submittal. Furnish equipment necessary and perform work required to determine or modify the performance of the sound system in accordance with the intent of the Contract Documents.
 1. Initial Tests:
 - a. Verify proper termination of analog and digital wiring.
 - b. Certify signal flow through systems.
 - c. Verify function of each device in the system.
 2. Demonstrate functionality of the system with the following video tests:
 - a. Circles
 - b. Alternating Pixel Pattern
 - c. Crosshatch
 - d. Extreme Grayscale / Plunge
 - e. Grayscale
 - f. Transient response.
 - g. Color Bars
 3. Demonstrate Specification Compliance:
 - a. EDID
 - b. HDCP
 - c. Each signal type at source and receiver
 4. Demonstrate Audio Transport
 - a. Perform transfer function tests on each channel.

END OF SECTION

SECTION 11 61 70 70 - PERFORMANCE AUDIO VIDEO AND COMMUNICATIONS
CONTROL SUBSYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Work in this section includes the engineering, manufacture, furnishing, coordination and installation of the control system.
- B. Section Includes:
 - 1. Logic Controller
 - 2. Paging Microphones & Control Touch Panels
 - 3. Interface to adjacent systems.

1.2 SYSTEM DESCRIPTION

- A. Design Requirements: Provide integrated Audio, Video, and Intercommunications systems. These systems are capable of providing the characteristics specified herein.
 - 1. This system provides control of the sound, video, and communications system:
 - 2. Controls include:
 - a. Distribution of audio signals throughout the building.
 - b. Distribution and routing of video signals.
 - c. Sound system controls for the auditorium
 - d. Automixer controls for all spaces.
 - e. Audio / visual transport controls.
 - f. Central building control from main touch panel, iPad devices, or web interface.
 - g. Projection and Display controls
 - h. Links from the Fire Alarm system for output muting.
 - i. Links to the lighting system in the Auditorium and Prefunction spaces
 - j. Routes signal for personal audio / assisted listening devices.
 - k. Routes pages from portable paging stations to building zones.
 - l. Stream video content to touch panels.
 - m. Creates and allows for master presets of rooms and building.
 - n. Power control for Audio Video components.
 - 3. All hardware switches and inputs are momentary contacts.
- B. Performance Requirements
 - 1. The system exhibits no perceptible lag between button push and response.

1.3 QUALITY ASSURANCE

- A. Supplementary Standards:
 - 1. Thoroughly comment code to assist in troubleshooting.
 - a. Include descriptions of the use of each variable.
 - b. Include descriptions of processes in each section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following are approved manufacturers of Sound and Intercommunications System components. Refer to schedule for specific products. Substitutions may not be made without prior written approval by the owner.
- B. Logic Controller

1. AMX
2. Crestron
3. QSC Q-SYS

PART 3 - EXECUTION

3.1 PROGRAMMING

- A. Serial communications may require a pause between commands, the shortest possible pause should be provided.
- B. Controlled Devices include:
 1. Input closures
 2. Output closures
 3. Digital Signal Processor Interface
 4. Media Players
 5. Video Players
 6. Surround Sound Decoder
 7. Solid State Players
 8. Video Projector
 9. Video Displays
 10. Digital Media Content Manager
 11. Fire Alarm
 12. Portable Control Panels
 13. Projection Screen
 14. Portable Devices.
 15. Power sequencing panelboards
 16. Architectural Lighting Controller
 17. Native devices
 - a. Contact Closures
 - b. Touchscreens
 18. Web Browser – Serving the same pages found on native touch screens.
 19. Ipad – Serving the same pages found on native touch screens.
- C. Logic Outline:
 1. General
 - a. When a portable device is plugged in: All synchronized I/O points will be set to mirror the state of the current room as determined by the controller, non-synchronized I/O points will be set to their off state.
 - b. All indicators regarding all devices are to be synchronized between stations.
 2. Paging
 - a. Calls to the Router are executed based on priorities programmed into the paging microphones.
 - b. When Page To House Cutoff is on, pages to the Auditorium from outside the performance space will be logically inhibited. Pages from the stage manager on stage or in the control booth will not be inhibited.
 - c. Paging is initiated through portable paging microphone stations located:
 1. In the control booth
 2. At the reception desk.
 3. In the office.
 4. All paging stations are patched through the AV Net patch panel
 - d. Every paging station is independent. Paging stations may access many zones.
 - e. Availability of the paging circuit is indicated through an "Avail" indicator. When a station may successfully page, or is successfully paging, this indicator is illuminated.
 - f. All paging stations are informed of zone status through "In Use" indicators. When a zone is being paged the IN USE indicator is illuminated on all stations.
 - g. Paging Zones
 1. All speakers

2. Lobby
 3. Public as defined in the touch panel
 4. Auditorium Support as defined in the touch panel
 5. Auditorium
 6. Cafeteria
 7. Exhibit 141
 8. Exhibit 229
 9. Planetarium Prefunction
 10. Individual exhibit rooms and offices
 11. Emergency
 - h. Access to zones is prioritized by station location.
 - i. Paging to the Auditorium Support areas is prioritized in the following order:
 1. Auditorium Paging Station
 2. Office Paging Station
 3. Reception Paging Station
 - j. Paging to all other areas is prioritized in the following order:
 1. Office Paging Station
 2. Reception Paging Station
 3. Auditorium Paging Station
 - k. Paging to the Auditorium is routed to the sound system's central cluster.
 - l. The Auditorium system's central cluster is turned on, if it is off, and remains on for a preset time after the last page. During the cluster power up sequence the person paging receives notification that they must wait.
 - m. Paging to the Cafeteria and Prefunction areas are routed through the main speakers.
 - n. The Cafeteria system's main speakers are turned on, if they are off, and remain on for a preset time after the last page. During the cluster power up sequence the person paging receives notification that they must wait.
 - o. Paging to other zones are routed through overhead speakers.
 - p. If a particular zone's speakers or amplifiers are turned off, then a page will not occur in that space. A notification shall be provided to the paging station noting such.
 - q. Emergency pages will page the entire building, and override all page disable zones.
3. Presets
- a. Selecting a preset will recall all signal routing, muting, video routing, video playback, lighting, power, and any other device conditions for the particular room being affected.
 - b. 4 programmable presets are provided for each room. Night preset may also be re-programmed.
 - c. Presets shall be re-nameable by the owner.
 - d. Presets may be recalled by a user.
 - e. Presets may be stored and renamed by an administrator.
 - f. Controllable devices, such as Media players, Blu-Ray players, Solid State Audio Players, etc. will be available to the user on the control screen if use of that specific device is stored in the preset.
 - g. "Manual" will allow a technician or administrator to manually configure inputs and outputs for that room.
 - h. Night
 1. Powers off main sound system for room.
 2. Powers off displays
 3. Stops all devices and shuts them down.
 4. Turns off lighting if appropriate for that room.
 5. Mutes all zones in a room.
 6. Returns to welcome screen.
 - i. Master Presets
 1. Master presets will allow control of all presets in building.
 2. Master presets may be programmed to recall any 1 of 4 individual room presets.
 3. Night will recall the night preset of each room.
 4. Master presets require confirmation before executing.
 - j. Preset Setup
 1. Recall requires confirmation to recall a preset.

2. Store snapshots levels, device states, routing, and any other audio and video configurations for a particular room to the selected preset. Storing requires confirmation screen.
4. Level Controls
 - a. Automixer
 1. When a device is set on it is highlighted on device selection screens.
 2. To control a level, select the item to control and use the Vol+ and Vol- controls.
 - b. The system queries the DSP and then the screen displays it's current level
 - c. UP/+ increases the level
 - d. DN/- decreases the level
 - e. Levels increment and decrement in steps adjusted to give the user an immediate sense of feedback.
 - f. The upward range of adjustment is limited by the system to prevent accidental overloading of the system.
 - g. When the up or down button is pushed the level bar indicates the progress of the adjustment.
 - h. Mute
 1. On Muting
 - a. Stores the current level
 - b. Mutes the input.
 2. On UnMuting
 - a. Restores the stored setting.
 - i. When the SSD, Media Player or Wireless Mics are selected the location selection buttons are visible and display the current status.
 1. These buttons illuminate when the signal is routed to the associated area.
 2. The area selection is not mutually exclusive.
5. Projection Screen Controls
 - a. Deploy or store the screen
6. Audio Routing
 - a. Sources are routed by selecting the source and adjusting the volume. Volume controls follow the selected source. Multiple sources may provide program at the same time.
 - b. Where there are multiple speaker zones, sources are routed by selecting the source and then selecting the zone(s).
 - c. For devices with control screens (Blu-Ray, Media, SSD, etc.), pressing the device will open the control screen for that device.
 - d. Where input plates are routed, an input plate pop-up window will open and allow selection of input plate(s) to route to the speakers.
 - e. Mic/Line affects the input of the input plates.
 - f. Link makes volume for the two plate inputs to match. Pressing link will default to the lower of the two volumes.
 - g. Lobby accepts the currently routed source to the lobby speakers.
 - h. Reset all resets volumes and routing to initial state
 1. Volume at nominal 30% level on all devices.
 2. All devices muted.
7. Assistive Listening System (ALS)
 - a. Source is selected from room or lobby source, or specific devices in the room.
 - b. Volume control for ALS affects output volume of ALS, and not device volume
 - c. ALS feed is for particular room's transmitter.
 - d. ALS also passes paging for the particular zone regardless of feed
8. Video Routing
 - a. For single displays and projector or basic function, source selection routes that source to the display device.
 - b. Video mute defaults to true. Mute is toggled for the display device.
 - c. Selection of video source brings up control for that source.
 - d. Preview will show a preview of that source on the screen, as well as on the rack mounted display device (if applicable.)
 - e. Advanced video matrix
 1. Sources are routed to display by pressing the desired display icon, then selecting the source.

2. By default, all displays are muted.
3. Selecting a source will automatically preview that device. Selecting a display will preview that display.
4. Audio will route the audio from that source to the speakers in the room.
5. For multiple displays, Link All will route single source to all displays..
9. Preview Monitors
 - a. Routes the associated device to the noted preview monitor in the sound rack.
 - b. Audio routes audio from device to speaker in sound rack.
 - c. Control brings up device control screen for that device.
10. Lectern Controls
 - a. Reset Levels returns all levels and mutes to startup condition.
 - b. Lectern cable connection notes to control system where lectern is plugged. Select my location forces the control system to re-confirm plug-in location.
 - c. End Session returns to the Welcome screen.
11. Auditorium Controls
 - a. Presentation Mode
 1. Routes relay to backstage and selected public zones
 2. Routes console sends to main speakers
 - b. Film Mode
 1. Routes media surround sound inputs to speakers
 2. Routes relay to backstage and selected public zones
 - c. Rehearsal
 1. Routes console sends to main speakers
 2. Routes relay to backstage zone only.
 - d. Night
 1. Mutes all relays
 2. Brings up Night lighting preset
 3. Turns off main sound system.
12. Sound System Controls
 - a. Relay Feed From:
Switches the source of signals between the choices in a mutually exclusive manner.
The default source on power up is all off – relay microphones
 - b. Enable Relay
Sends relay to selected zone.
 - c. Subwoofer Feed From:
The default source on power-up is left/right from AV system.
 - d. Signal Mute
 1. Mutes the feed from the associated device to the system.
 2. All Mute mutes all inputs. This may be activated by a contact closure from the fire alarm system or by a user. If activated by the fire alarm system, only the fire alarm system may un mute the signal.
 - e. Surround Config
 1. 3.1 Has no effect
 2. 5.1 Routes left side to left rear and right side to right rear.
 3. 6.1 Sums Left Rear and Right Rear and routes them to both rear channels.
 4. 7.1 Left Rear and Right Rear channels are fed from their individual feeds.
 5. Configuration is mimicked on media and console inputs
 - f. Speaker Test
 1. Toggles Pink Noise or 1k tone on and off.
 2. Speaker select turns signal on and off at that particular speaker.
13. Other
 - a. Page Enable passes or inhibits pages to a particular room.
 - b. Set Date/Time allows a user to set the system date and time, or download from internet time server. Date time update affects all controllers.
 - c. When a Mute is on: all audio show relay signals which feed the area will be unrouted and logically inhibited.
 - d. Screen Up/Down raises and lowers the projection screen.
 - e. Reset Levels

1. Requests a confirmation by displaying the warning box: "Are you sure you want to reset the levels?"
 - a. If the user responds by clicking NO - the system returns to its pervious state.
 - b. If the user responds YES the system resets all level to the default levels recorded by recalling a preset in the DSP.
 - f. Clean Screen holds the screen in a static state for 30 seconds to allow cleaning.
 - g. Back takes the screen back one level
14. Power Controls:
 - a. Power controls exist on the screen.
 - b. Device Power
 1. Toggles power to that device on and off.
 2. In the case of the Projector the warming process is displayed on the screen.
 - c. System Power
 1. If the power is currently on - Requests a confirmation by displaying the warning box: "Are you sure you want to power the system off"
 - a. If the user responds by clicking NO - the system returns to its pervious state.
 - b. If the user responds YES the system opens the power output and adjusts it's status accordingly.
 2. If the system is powered off, the system closes the power output and adjusts it's status accordingly.
 3. Sequences power on in a stepped fashion to avoid unnecessary surges in the system.
 4. Sequencing on starts from the signal source and follows the signal path to the amplifier or powered speakers with the those devices being the last to turn on.
 5. The amplifiers may be brought on in groups to minimize the current in-rush on the building electrical system.
 6. The off sequence is the reverse of the on sequence
 7. The logic controller is not included in the sequencing system
 8. Sound System Power
 - a. Powers on the reinforcement and effects system.
 9. Ancillary System Power
 - a. Powers on the paging, intercom, and assistive listening systems.
 10. Master Power
 - a. Powers on or off all rooms' devices from single location.
15. Devices.
 - a. The automixer output is pile on (mixed with) the output from other AV devices. When a device is chosen it is queried and the appropriate transport control status is displayed.
 - b. When a Video device is selected and Unmuted any active video device is automatically muted (video and audio)
 - c. Time and track data are constantly updated when the applicable display is active.
 - d. Video mutes and unmutes the video output and audio output from the device.
 - e. Track selection and status is also displayed where applicable.
 - f. Level control and level mute operate as outlined above.
16. Automix / Manual Mixer buttons are mutually exclusive
 - a. When Auto Mix is pushed the system unmutes the input from the auto mixer and mutes signal from the manual mixer in the DSP.
 - b. When Manual Mix is pushed the system mutes the input from the auto mixer and unmutes signal from the manual mixer in the DSP.
17. Zone Mute buttons function independently.
 - a. When a zone is muted the corresponding DSP outputs are muted.
 - b. When a zone is unmuted the corresponding DSP outputs are unmuted.
18. Device Selection
 - a. Indicates the active device by high lighting its button.
19. Volume adjusts the Audio output level of the device, except for the ALS screen.
20. Login
 - a. This button indicates if controls are available (unlocked) or not.
 - b. If pressed when system is unlocked the system locks, making none of the controls operative.
 - c. If pressed when locked displays the Unlock Screen.

- d. The Login Screen allows the entry of a code to activate the system.
 1. Entering the correct code and pressing enter unlocks the system.
 2. Entering the an inaccurate code and pressing enter results in a message: "Incorrect Code, Try Again" after the first 3 attempts in a 2 minute period. On the 4th unsuccessful attempt the system displays "Incorrect Code, Too Many Attempts" for 45 seconds and then returns to the main menu.
 3. A successful logon allows passage to the screen based on the access level:
 - a. User: Presenter Screen
 - b. Technician: Technician Screen
 - c. Manager: Technician Screen
 - e. The code may be changed using the password maintenance screen.
 1. On selecting the change code button the Unlock screen is presented.
 2. The user is first prompted for the current code.
 3. Next the user is prompted for a new 6-9 digit code.
 4. The user is prompted to reenter the new code.
 5. If the 2 entry attempts match the user is informed that the code has been change and then returns to the setup screen.
 6. If the 2 attempts do not match the user is informed that the code has not been changed and returned to the setup screen.
 - f. The backup code 134376846 always unlocks the system and cannot be changed.
21. Factory Reset
- a. Resets all levels, presets, and configurations to the starting setup (or as changed during technicians' visits for system updates.)
 - b. Factory reset requires specific password from installing contractor.
 - c. Provide two confirmation screen requests prior to reset.

D. Screens

1. After a period of 3 minutes of inactivity the active screen is dimmed.
2. After a period of 15 minutes of inactivity, the current user is logged out.
3. Back returns to the previous screen
4. End Session logs the user out and displays the help screen.
5. Welcome is displayed when no one is logged in.
 - a. When touched anywhere, either the Login Screen or Home Screen is displayed.
6. Login Allows entry of an access code.
 - a. The code is processed when the user clicks Enter.
 - b. The next screen displayed is based on the user access level – see menu map.
7. Technician Control
 - a. Functions are as noted above.
 - b. Date & time functions are self explanatory.
8. Sound System
 - a. Allows setting of sound system parameters as noted above.
9. Password Maintenance
 - a. Allows the adding and deletion of users.
 - b. Clicking on a name field pulls up the alphanumeric keyboard displaying the existing user name for editing.
 - c. Clicking on the Password field pulls up the numeric keypad for password entry – the existing password is not displayed.
 - d. Access level defaults to User. Pressing another level switches to that level of access. Access levels are mutually exclusive.
 - e. Exiting the line or closing the screen updates the record.
10. Device Screens
 - a. Functions as noted above.

3.2 SYSTEM TESTS AND ADJUSTMENTS

- A. Test permutations and combinations of logic inputs to ensure predictable system outputs (reactions).
- B. Latency - measure time between button push and response.

- C. Test locator function at boot-up and when moving devices between locations.

3.3 ADDITIONAL PROGRAMMING

- A. Provide additional programming hours as stipulated in the equipment and component schedule based on owner's exhibit requirements.
- B. At the 6 month and 12 month visit, provide an on-site programming service to make adjustments to the configuration. This service is considered base project, and is outside of the additional programming hours noted above.

3.4 DOCUMENTATION

- A. Provide two (2) hard copies of all system programming.
- B. Provide two (2) electronic copies of all system programming.

3.5 ADDITIONAL INFORMATION

- A. See logic controller screen layouts.

END OF SECTION

Item #	Make	Model	Description	Unit	Auditorium	Cafeteria
	Assistive Listening System					
	Power Supply/Transmitters					
1	Williams	BA-CT1	Infinium Auracast Bluetooth Controller and Transmitter Provide Transmitters as indicated on the Drawings	Each	1	1
	Receivers					
2	Williams	BA-R1	Infinium Auracast Bluetooth Receiver with stereo headset.	Each	4	8
	Cases and Accessories					
3	Williams	CHG 408 WF	8 Slot Charger For Wavecast	Each	1	1
	Audio Sources					
	Media Players					
4	Tascam	CD-400U	CD/SD/USB Player with Bluetooth and FM/AM Tuner	Each		1
	Solid State Playback					
5	Denon	DN-F400. Reuse.	Test and Reuse existing Solid State player Solid State Audio Player w/ RS232	Each		1
	Audio Microphones & Direct Boxes					
	Microphones - Wireless					
6	Shure	UA845-SWB	UHF Antenna DA	Each	1	
7	Shure	ULXD4D	UHF Digital Wireless Two Channel Receiver Coordinate	Each	1	1
8	Shure	ULXD4Q	UHF Digital Wireless Four Channel Receiver Coordinate	Each		
9	Shure	UA830USTV	UHF In Line Amplifier	Each	2	2
10	Shure	ULXD2/B58	Wireless Handheld Beta 58	Each	2	2
11	Shure	ULXD1	UHF Digital Wireless BodyPack Transmitter Coordinate	Each	2	2

Item #	Make	Model	Description	Unit	Auditorium	Cafeteria
12	Shure	MX150	Subminiature Lavalier Microphone	Each	2	2
13	Shure	MX153	Earset Headworn Microphone	Each	2	2
	Signal Processing and Control					
	Digital Signal Processing					
14	QSC	Core 24f	Unified Core with 24 local audio I/O channels, 160x160	Each		1
15	QSC	Core 8 Flex	Unified Core with 8 local audio I/O channel 64x64 total	Each		
16	QSC	X20r	Core Server	Each		
17	QSC	QIO-24f	Q-SYS I/O Expander with 8 Mic/Line inputs, 8 Line Outputs, 8 Flex Channels	Each	1	
18	QSC	QIO-ML4i	Q-SYS I/O Expander with 4 Mic/Line Input	Each		
19	QSC	QIO-ML24i	Q-SYS I/O Expander with 24 Mic/Line Inputs	Each		
20	QSC	QIO-LVR4	Low Voltage Relay Interface	Each	1	
21	QSC	QIO-GP8x8	Q-SYS I/O Expander with 8x8 GPIO	Each		1
22	QSC	QIO-S4	RS232/485 Interface	Each		1
23	QSC	unD10-BT	Atterro Tech Bluetooth Interface	Each		
24	QSC	PS-TSCG3-G	Q-SYS Networked paging Station with Touchscreen and	Each	1	
25	QSC	TSC-101-G3	10" Touch Screen Controller	Each		1
26	QSC	TSC-101-G3	10" Touch Screen Controller Provide with TSC-710T-	Each		1
27	Apple	iPad	iPad 11, WIFI only, 256GB Storage. Engraved with	Each		
28	QSC	Q-SYS Programming	Provide all necessary programming. Include licences for all relevant software.	Each	1	1
	Signal Processors - Surround					
29	Extron	SSP 7.1	Surround Sound Processor	Each	1	
	Audio Mixing Consoles					
	Mixers					

Item #	Make	Model	Description	Unit	Auditorium	Cafeteria
30	Yamaha	CL1. Reuse.	Reuse existing digital mixing console. Update to current firmware and software. Test functionality. Provide with Dante Network Card.	Each		
31	Yamaha	CL3. Reuse.	Reuse existing digital mixing console. Update to current firmware and software. Test functionality. Provide with Dante Network Card.	Each	1	
32	Yamaha	DM3-D	Digital Mixing Console with 22 Channels, 16 analog inputs, 8 analog outputs and Dante	Each		
Audio - Amplifiers						
Power Amplifiers - Fan Cooled						
33	QSC	CX-Q 2K4	4-Channel 500W/CH Q-SYS Network Amplifier -	Each	1	
34	QSC	CX-Q 4K8	8-Channel 500W/CH Q-SYS Network Amplifier	Each	1	
35	QSC	CX-Q 8K8	8-Channel 1000W/CH Q-SYS Network Amplifier	Each		
36	QSC	SPA-Qf 60x2	2 channels, 60 watts 70V Amplifier	Each		1
Audio - Speakers						
Speakers - Booth Monitor						
37	Genelec	8030C	Powered 5" Studio monitor	Each		
Speakers - Fullrange, Mid/High						
38	JBL	8340A. Reuse.	Test and reuse existing 8340A	Each	10	
39	One Systems	112-HTH	All weather 12" outdoor rated speaker. Provide with	Each		
40	Renkus-Heinz	UBX8	Passive Assymetrical Column Speaker	Each		
Speakers - Digitally Steerable Columns						
41	Renkus-Heinz	ICLX-RD	Iconyx Live X Line Array Module	Each	4	
42	Renkus-Heinz	ICLLX-RD	Iconyx Live X Line Array Module	Each	2	
43	Renkus-Heinz	ICL-F-DUAL-RD. Reuse	Test and Reuse Existing Iconyx ICL DUAL-RD	Each		2

Item #		Make	Model	Description	Unit	Auditorium	Cafeteria
44		Renkus-Heinz	VA101-22/69-RD	22 Degree Line Array with 60-90 Deg Waveguide Rhaon & Dante	Each	3	
	Speakers - Subwoofers						
45		Renkus-Heinz	DR18-2R. Reuse.	Test and reuse existing Dual 18" Self Powered	Each	2	
46		One Systems	118-HSB	All weather 18" outdoor rated subwoofer. Provide with mounting bracket. with Custom Mount	Each		
	Audio Accessories						
	Headphones						
47		Sennheiser	HD280 Pro	Closed Headphones-8-25kHz response	Each		
	Intercom						
	Main/Remote Stations						
48		ClearCom	MS-702	Two-Channel Main Station	Each	1	
49		ClearCom	KB-702	Two Channel Flush-Mount Headset/Speaker Station Provide with CC-26K Headset	Each		
	Belt Packs and Headsets						
50		ClearCom	RS-701	Single-Channel Standard Beltpack: Encore Single-Channel Standard Beltpack. Four-Pin Male Headset Connector And Three-Pin Female/Male Loop Through Intercom Line Connectors. Provide with 25' WLR Cable	Each	6	
51		ClearCom	CC-300-X4	Single Enclosed Ear Headset with Switched Gooseneck Microphone and standard Clear-Com Connection.	Each	6	
	AV Network Components						
52		NetGear	M4350-MSM4310-100NES	8x2.5G, 2x25G SFP28 Managed AV Switch POE++	Each		

Item #		Make	Model	Description	Unit	Auditorium	Cafeteria
53		Netgear	M4350-MSM4332-100NES	24x2.5G, 4x10G Managed AV Switch POE++	Each		
54		Netgear	M4350-MSM4352-100NES	44x2.5G, 4x10G Managed AV Switch POE++	Each	1	1
55		Netgear	M4350-MSM4332-TAANES	24x2.5G, 4x10G Managed AV Switch with 4 25GBASE-	Each		
56		Netgear	Edge Router	Interface with Building Network	Each		
57		Netgear	WAP	Wireless Access Point	Each	1	1
	Video System						
	Digital Content Manager						
58		Pixilab	Blocks Server	Core i7 CPU - 8 Cores / 16 Threads. 16G System RAM,	Each		
59		Pixilab	Blocks License Key	Blocks Base Key	Each		
60		Pixilab	Blocks Display Spot License	Blocks License Add-on Includes 1 spare	Each		
61		Pixilab	Blocks Content Caching License	Blocks License Add-on	Each		
62		Pixilab	Blocks Player Single	Core i5 CPU - 12 Cores / 16 Threads. 32G System RAM, 500 GB NVMe Storage, 2.5G Network Port and WiFi. 2 HDMI outputs.	Each		
	Cameras						
63		Canon	CR-N300	1/2.3" CMOS sensor 4K PTZ Camera with 20x optical	Each		
64		Canon	RC-IP1000	PTZ Camera Remote Control with 7" touch panel.	Each		
65		QSC	NC-12X80 PTZ	Network PTZ camera, 12x optical zoom and 80 degrees	Each		
66		QSC	NC-Pro15x	Network PTZ camera, 15x optical zoom (20x digital) and 73 degrees horizontal FoV	Each		1
	Mixing / Processing						
67		Blackmagic Design	HDMI to SDI 12G	Mini Converter SDI to HDMI with Power Supply	Each		
68		Blackmagic Design	Streaming Encoder 4K	Multi-format Streaming Encoder	Each		
69		Blackmagic Design	Hyperdeck Studio Mini	Video Recorder - SDI	Each		

Item #	Make	Model	Description	Unit	Auditorium	Cafeteria
70	Vizrt	Tricaster Mini X/NDI Base Bundle	TriCaster Mini 4K/NDI Base. Provide with Control Surface	Each		
	Digital Video Displays					
71	NEC	EA271Q-BK	27" WQHD Desktop Monitor	Each		
72	NEC	MA491	49" Full HD LED Monitor with Wall Mount	Each		
73	NEC	M551-2	55" Ultra High Definition Video Display. Provide with	Each		
74	NEC	M981	98" Ultra High Definition Video Display. Provide with	Each		
75	NEC	LED-EO15i-135	135" E Series FHD LED Display with Wall Mount	Each		2
76	Generic	Wall Mount	Wall Mount For Flatscreen TV Custom tilt to fit in windows	Each		
77	Generic	Wall Mount	Wall Mount For Flatscreen TV Tilting	Each		
78	Generic	Wall Mount	Wall Mount For Flatscreen TV for large displays.	Each		2
	Video over Ethernet					
79	QSC	NV-21-HU	Q-SYS Video Encoder / Decoder	Each	2	
80	Visionary	E5100 Encoder	Gigabit Ethernet 4K60 4:4:4 Video, and Control. HDMI, Stereo Audio Inputs	Each	3	1
81	Visionary	DuetE-5 Decoder	Gigabit Ethernet 4K60 4:4:4 UHD Video, AES67/Dante	Each	1	2
82	Visionary	D5000 Decoder	Gigabit Ethernet 4K60 4:4:4 Video, and Control. HDMI	Each	2	2
83	Visionary	E5-WP-H Encoder	Gigabit Ethernet 4K60 4:4:4 Video, and Control. HDMI Input	Each		1
	Video Projectors					
84	Panasonic	PT-REQ15BU	15,000 Lumen Laser DLP Projector. Provide with lens and mounting hardware.	Each	1	
	Racks / Cases					
	Accessories					

Item #		Make	Model	Description	Unit	Auditorium	Cafeteria
85		Extreme	P80-2200	2000W 120V, Uninterruptable Power Supply For DSP	Each	3	1
	Training						
86		Custom	Training	Total training hours to be scheduled at times and on days to be mutually agreed upon with the owner. Provided over 1 year period	Hour	8	1
	Sub-Totals						
		Materials					
		Labor					
		Design Contingency					
	Total						
End Of Section							

Item #		Make	Model	Food Science Lab	Planetarium	Prefunction	Exhibit Halls	Lobby / Support	Video Studio	Building Shared Equipment	Total	
		Assistive Listening System									-	
		Power Supply/Transmitters									-	
1		Williams	BA-CT1		1			2	1		6	
		Receivers									-	
2		Williams	BA-R1		4			4			20	
		Cases and Accessories									-	
3		Williams	CHG 408 WF		1			1			4	
		Audio Sources									-	
		Media Players									-	
4		Tascam	CD-400U		1	1		4	1	1	3	12
		Solid State Playback									-	
5		Denon	DN-F400. Reuse.		1	1		8	1		12	
		Audio Microphones & Direct Boxes									-	
		Microphones - Wireless									-	
6		Shure	UA845-SWB								1	
7		Shure	ULXD4D		1					1	4	
8		Shure	ULXD4Q							2	2	
9		Shure	UA830USTV								4	
10		Shure	ULXD2/B58		2					8	14	
11		Shure	ULXD1		2					8	14	

Item #		Make	Model	Food Science Lab	Planetarium	Prefunction	Exhibit Halls	Lobby / Support	Video Studio	Building Shared Equipment	Total
12		Shure	MX150		2					8	14
13		Shure	MX153		2					8	14
	Signal Processing and Control										-
	Digital Signal Processing										-
14		QSC	Core 24f					1			2
15		QSC	Core 8 Flex	1	1						2
16		QSC	X20r							2	2
17		QSC	QIO-24f				1	2	1		5
18		QSC	QIO-ML4i		1					1	2
19		QSC	QIO-ML24i				1	2			3
20		QSC	QIO-LVR4								1
21		QSC	QIO-GP8x8				1	1	1		4
22		QSC	QIO-S4			1	1	4	1		8
23		QSC	unD10-BT					2			2
24		QSC	PS-TSCG3-G						1	1	3
25		QSC	TSC-101-G3				1	2			4
26		QSC	TSC-101-G3			1				1	2
27		Apple	iPad							4	4
28		QSC	Q-SYS Programming	1	1	1		1	1	1	9
	Signal Processors - Surround										-
29		Extron	SSP 7.1			1					2
	Audio Mixing Consoles										-
	Mixers										-

Item #	Make	Model	Food Science Lab	Planetarium	Prefunction	Exhibit Halls	Lobby / Support	Video Studio	Building Shared Equipment	Total
30	Yamaha	CL1. Reuse.							1	1
31	Yamaha	CL3. Reuse.								1
32	Yamaha	DM3-D						1		1
	Audio - Amplifiers									-
	Power Amplifiers - Fan Cooled									-
33	QSC	CX-Q 2K4			1		1			3
34	QSC	CX-Q 4K8				3	1			5
35	QSC	CX-Q 8K8		1						1
36	QSC	SPA-Qf 60x2								1
	Audio - Speakers									-
	Speakers - Booth Monitor									-
37	Genelec	8030C						2		2
	Speakers - Fullrange, Mid/High									-
38	JBL	8340A. Reuse.								10
39	One Systems	112-HTH		5						5
40	Renkus-Heinz	UBX8			2					2
	Speakers - Digitally Steerable Columns									-
41	Renkus-Heinz	ICLX-RD								4
42	Renkus-Heinz	ICLLX-RD								2
43	Renkus-Heinz	ICL-F-DUAL-RD. Reuse								2

Item #		Make	Model	Food Science Lab	Planetarium	Prefunction	Exhibit Halls	Lobby / Support	Video Studio	Building Shared Equipment	Total
44		Renkus-Heinz	VA101-22/69-RD								3
	Speakers - Subwoofers										-
45		Renkus-Heinz	DR18-2R. Reuse.								2
46		One Systems	118-HSB		2						2
	Audio Accessories										-
	Headphones										-
47		Sennheiser	HD280 Pro						2		2
	Intercom										-
	Main/Remote Stations										-
48		ClearCom	MS-702								1
49		ClearCom	KB-702						2		2
	Belt Packs and Headsets										-
50		ClearCom	RS-701								6
51		ClearCom	CC-300-X4								6
	AV Network Components										-
52		NetGear	M4350-MSM4310-100NES							1	1

Item #	Make	Model	Food Science Lab	Planetarium	Prefunction	Exhibit Halls	Lobby / Support	Video Studio	Building Shared Equipment	Total
53	Netgear	M4350-MSM4332-100NES			1	3		1		5
54	Netgear	M4350-MSM4352-100NES							2	4
55	Netgear	M4350-MSM4332-TAANES							1	1
56	Netgear	Edge Router							1	1
57	Netgear	WAP		1		2			4	9
	Video System									-
	Digital Conten Manager									-
58	Pixilab	Blocks Server							1	1
59	Pixilab	Blocks License Key							1	1
60	Pixilab	Blocks Display Spot License							9	9
61	Pixilab	Blocks Content Caching License							1	1
62	Pixilab	Blocks Player Single							8	8
	Cameras									-
63	Canon	CR-N300						4		4
64	Canon	RC-IP1000						1		1
65	QSC	NC-12X80 PTZ	2							2
66	QSC	NC-Pro15x								1
	Mixing / Processing									-
67	Blackmagic Design	HDMI to SDI 12G						1		1
68	Blackmagic Design	Streaming Encoder 4K						1		1
69	Blackmagic Design	Hyperdeck Studio Mini						1		1

Item #	Make	Model	Food Science Lab	Planetarium	Prefunction	Exhibit Halls	Lobby / Support	Video Studio	Building Shared Equipment	Total
70	Vizrt	Tricaster Mini X/NDI Base Bundle						1		1
	Digital Video Displays									-
71	NEC	EA271Q-BK						3		3
72	NEC	MA491	2				3			5
73	NEC	M551-2			2		2			4
74	NEC	M981			1					1
75	NEC	LED-EO15i-135								2
76	Generic	Wall Mount						3		3
77	Generic	Wall Mount			3		2			5
78	Generic	Wall Mount								2
	Video over Ethernet									-
79	QSC	NV-21-HU							3	5
80	Visionary	E5100 Encoder			1			1	10	16
81	Visionary	DuetE-5 Decoder	2		1					6
82	Visionary	D5000 Decoder			2		5			11
83	Visionary	E5-WP-H Encoder	2							3
	Video Projectors									-
84	Panasonic	PT-REQ15BU								1
	Racks / Cases									-
	Accessories									-

Item #		Make	Model	Food Science Lab	Planetarium	Prefunction	Exhibit Halls	Lobby / Support	Video Studio	Building Shared Equipment	Total
85		Extreme	P80-2200		1		2		1		8
	Training										-
86		Custom	Training	0.5	1	0.5	1	1	4	8	25
	Sub-Totals										
		Materials									
		Labor									
		Design Contingency									
	Total										
End											