

SECTION 27 41 00 - AUDIO SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Audio System (AV-series) Drawings

1.2 REFERENCES

- A. Building Industry Consulting Services International (BiCSi), "Telecommunications Distributions Methods Manual," Twelfth Edition.
- B. Electronic Industries Association/Telecommunications Industry Association (EIA/TIA) -568-C, "Commercial Building Telecommunications Wiring Standard"
- C. EIA/TIA-569-B, "Commercial Building Standard for Telecommunications Pathways and Spaces"
- D. EIA/TIA-606A, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings"
- E. EIA/TIA-607-A, "Commercial Building Grounding/Bonding Requirements"
- F. National Electrical Code (NEC), 2008 - National Fire Protection Agency (NFPA) 70
- G. Institute of Electrical and Electronic Engineers (IEEE) 802.3 Carrier Sense Multiple Access with Collision Detection (Ethernet 100BASE-T)
- H. Federal Communications Commission (FCC), Title 47, Code of Federal Regulations, Part 68.
- I. National Institution for Certification in Engineering Technologies (NICET)
- J. International Communications Industry Association (ICIA).

1.3 DEFINITIONS

- A. ADA: Americans with Disabilities Act
- B. AUD: Audio
- C. Bid: Herein, used interchangeably with "proposal"
- D. DSP: Digital Signal Processor
- E. IR: Infrared
- F. NIC: material and work which is Not In Contract and for which the Installer is not responsible except as otherwise detailed herein.

- G. OFE: "Owner Furnished Equipment" which will be provided by The Owner. Be responsible for installing and integrating this equipment as detailed herein.
- H. OFCI: "Owner Furnished Contractor Installed" Equipment which will be provided by The Owner. Be responsible for installing and integrating this equipment as detailed herein.
- I. The term "shall" is mandatory.
- J. The term "will" is informative.
- K. The term "should" is advisory.
- L. Term "provide" means furnish and install.
- M. Audio Systems Consultant: Convergent Technologies Design Group, Inc.
- N. Bidder: Qualified firm intending to tender a bid on the systems described herein.
- O. Owner: Chesapeake College

1.4 BID PROPOSALS

A. Itemized Bid Response

1. Each piece of equipment shall be individually priced and submitted with Bid Proposals. Provide itemized bid response to include equipment description, manufacturer, model number, unit price, and quantity on a per room basis. All equipment prices shall reflect required modifications and accessories as needed for a complete and functioning system.
2. Non-equipment charges shall be outlined separately as a single line item on a per room basis. A sum of the audio system total cost shall be provided with the bid proposal.
3. Include a separate line item for post-installation warranty service and maintenance visits specified in this Section, as well as a line item for per-diem cost of any service visits beyond those specified herein.

B. Contractor Qualification

1. Demonstrate at least three (3) years experience in the fabrication, programming, assembly, and installation of audio and remote control systems of similar magnitude and quality as specified for the subject job. Submit documentation to this effect with the bid response. Be an authorized sales and service center for all listed components and offerings in this specification.
2. References: Furnish no less than three (3) references for installations of similar size (dollar amount & quantity of spaces receiving integrated technology) and scope, performed throughout the Wye Mills, Maryland area within the past three (3) years. At a minimum, reference information will include the reference company or institute name, contact person's name and title, telephone number, address, and detailed project description, project manager's name, and contact information of the organization that is responsible for day-to-day operation of the audio installation.

C. Alternate Proposals

1. Any proposed alternate equipment choices should be requested in writing by the contractor prior to the proposal submission for approval. Each item on the alternate equipment list must be accompanied by catalog cut sheets and technical specifications.

D. Non-Equipment Charges, Including but not be limited to:

1. Engineering: Including all required design drawings, run sheets, instruction manuals, console layout, step-by-step user guide, etc.
2. Pre-Installation: Work performed on the Installer's premises including all fabrication, modification, assembly, rack wiring, etc.
3. Installation: Including all on-site installation and wiring, shop drawing, coordination and supervision, testing, checkout, Owner training, etc., performed on the Owner's premises.
4. General and Administrative: Including all shipping, insurance, and guarantees.

E. Owner Furnished Equipment (OFE, OFCI)

1. Identify any Owner Furnished Equipment assumed in the Bid Proposal to be installed and integrated under this contract. Identify all assumed Owner Furnished equipment within each room/space type that will be required to complete the Audio systems installation.

F. State of the Art Development

1. Supply only the manufacturer's latest developed product. In cases where product development surpasses the criteria of the specification, inform the Architect and make the newer product available to the project at no additional cost. In no case shall discontinued or obsolete equipment be acceptable. The same requirement applies to software programs developed/updated during the warranty period.
2. Should a manufacturer discontinue a specified product, provide the manufacturer's recommended replacement at no additional cost to the owner. Should the manufacturer have no direct replacement product, Audio System contractor shall propose a product of equal or greater specification from an alternate manufacturer at no additional cost to the owner.
3. Should a product recall by a specified manufacturer require temporary or permanent replacement of a product specified under this section, notify the Architect at the earliest possible time and arrange to replace the product in question as quickly as possible.
 - a. Equipment found defective or subject to recall prior to scheduled installation shall not be delivered to the jobsite.
 - b. Equipment defect or intended recall shall not relieve the Audio Systems Contractor from any contractual obligations with regard to delivery schedule of product.
 - c. Under no circumstances shall arrangement for alternate product require the Owner to accept superseded equipment except on a temporary basis.

G. Service Contract

1. Submit the costs for a one-year service contract, renewable for up to three years, which shall commence with the completion of the two-year warranty period. These contracts shall be fixed-cost, and can be accepted at the option of the Owner.
2. The service contract shall include all of the services provided during the warranty period, including complete replacement or repair of defective equipment.

1.5 QUALITY ASSURANCE

A. Coordination

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

B. Standards and Codes

1. Comply with
 - a. Local, state and federal codes
 - b. Applicable National Electrical Code
 - c. American National Standards Institute
 - d. Underwriters' Laboratories, Inc. standards.
2. All equipment, material, accessories, and loose items provided by Contractor shall be new and shall conform to applicable requirements of the above-mentioned agencies.
3. If required by local authorities, provide certificates and labels indicating compliance with above-mentioned codes and standards where applicable.

C. Point of Contact

1. Designate to the Owner in writing, the responsible person who shall ensure timely and consistent communication with the Owner on progress of the contract. The designated representative shall have full knowledge of all engineering and production procedures and shall report status of the installation and upcoming work plans to the Owner's Project Manager and Consultant on a weekly basis.
2. Project manager shall have successfully managed not less than two (2) projects of similar size and scope (as defined in previous sections). Bid submission shall detail the percentage of time that the project manager and other key personnel will be involved with the project.

1.6 SCOPE OF WORK

A. Provide the following in accordance with Specifications and Drawings:

1. All bidding firms must attend a Pre-Bid site walk through and meeting at Chesapeake College, date to be announced, in order to qualify for bidding on this scope of work.
2. Submittals delivered in a timely manner as described hereinafter.
3. Verification of dimensions and other conditions at project site. Review existing and specified conduit systems as shown in building construction documents and, where

applicable, as built conditions. Notify Consultant, Architect, GC, and EC within four weeks after award of contract of any deficiencies or inadequacies in conduit system design.

4. Detailed design of Digital Signal Processor system "maps," including remote-control accommodations.
 5. Complete programming of audio processing and remote control system inclusive of graphical layout and source code programming
 6. Power distribution within equipment racks including power connection to electrical outlets as described in electrical section of building construction documents.
 7. Incidentals necessary for a complete working system.
 8. Initial testing and adjustments, demonstration of system for approval, participation in acceptance tests, final adjustments as required.
 9. Record Documents, "As-Built" drawings and Owners Manual.
 10. Training of operating personnel.
 11. Notify appropriate parties of conflicts in a timely manner.
 12. Work cooperatively with other trades to resolve conflicts.
- B. Special Insurance
1. Provide insurance fully covering all equipment against loss and damage during shipment, storage, installation, testing, adjustment and demonstration.

1.7 SYSTEM DESCRIPTION

A. Design Intent

1. Provide a complete and functioning Audio system inclusive of all hardware, software and training to meet or exceed the performance features outlined in this document.

B. Design Standards

1. The Owner's goal is to have available a cohesive and fully functional system. Therefore, part of the development efforts for successfully implementing the Audio systems should include:
 - a. Install the system in a manner that complies with BiCSi and ICIA cable routing standards. Route all audio, point-to-point, and remote control cabling elements in a subtle, unobtrusive manner to maintain the architectural and visual integrity of the building.
 - b. Except where plenum cable is used above finished ceilings, it is required that all cabling be routed inside the comprehensive system of conduit. Floor and wall boxes shall serve as the primary interface points to the Audio system.
 - c. Provide and install cover plates, connectors, and associated cabling to link all floor and/or wall boxes to all affiliated local and remote Audio components. No wiremold or surface-mounted raceway will be permitted, except where specifically identified on

- drawings. The Audio Systems contractor shall coordinate faceplate materials, colors, and finishes with the faceplates used by other trades on the project and the architect to match aesthetics.
- d. Provide and install security covers on any electronics with front panel controls that should not need to be adjusted after initial set-up. All components permanently mounted to rack rail systems shall be installed with industry accepted security screws.
 - e. All ceiling mounted Audio equipment shall be secured to building structure. Any suspended equipment must be mounted with a safety factor of 8. Review existing structure and provide proposed suspension method for line array loudspeakers with licensed structural engineer. Include proposed suspension method in submittal materials.
 - f. Steel cable security systems and padlocks to secure structure shall be provided for all surface mount loudspeakers, and other exposed audio system components. All padlocks provided for security shall be keyed to a single master key.
 - g. Provide intellectual property release and install an editable version of all master source code for all digital signal processing, remote control or microprocessor-based systems included on this project to an owner furnished personal computer. Also provide a hardcopy on portable media.
 - h. Provide necessary analog and/or digital audio and control signal repeaters, extenders, and amplifiers for any run greater than 30 feet and as needed to maintain required signal levels for receipt at destination device. All audio lines shall be balanced at the source, prior to any cable pull longer than 20 feet. There are no exceptions.
 - i. For each input/output point of interface to the system, provide a suitable length patch cord for owner use for every signal type present. Provide umbilical style cable management for any mobile solutions.
2. Performance Standards: Unless restricted by the published specifications of a particular piece of equipment, or unless otherwise required, the following minimum performance standards shall be met by each system:
- a. Analog Audio:
 - 1) S/N (including crosstalk and hum): 75 dB minimum
 - 2) Total Harmonic Distortion: 0.5% maximum from 30 Hz to 15,00Hz.
 - 3) Frequency Response: Flat within +1.0 dB, 30 Hz to 15,000Hz.
 - b. Performance Test Signal Paths: The signal paths for the above Performance Standards shall be as follows:
 - 1) Audio: From any and all source inputs (for microphones, audiotape units, etc.) through all audio processing, audio distribution amplifiers (ADA), mixers, switchers, codec, etc., to all electrical signal destinations.
 - c. Remote Control Standards: As a minimum, the remote control system for each space shall be programmed to include the following:
 - 1) Owner Logo on first page.
 - 2) Automatic System Shutdown.
 - 3) AM/ PM Clock Settings.
 - 4) 50 % audio level default.
 - 5) Separate Program and Microphone Audio Level Control with mute function.
 - 6) Volume/ Mute control for program and speech audio reinforcement on every screen.
 - 7) Panel layout to include user screens, as well as, password protected technician pages.

- 8) Provide remote control room management software and full licensing for each system on the project.
 - 9) Full function control of all source components, processing devices and switching electronics.
 - 10) In sub-dividable spaces, provide both IR and closed contact partition sensor control, and automation of control system scenerios.
 - 11) Touch panel page layouts shall be submitted for approval. Prior to designing touch panel layouts, meet with the Owner and review existing control system standards on campus and determine a basis of design.
 - 12) Follow-up programming and modifications as requested by the Owner shall be provided 6 months after system acceptance. Provide and install updated editable source code to the Owner following these updates.
 - 13) In the event the remote control system programming becomes compromised during the warranty period, provide the necessary effort to make the system fully functional once again.
3. The specified Audio System shall be ADA compliant through connection to the existing Assisted Listening System currently installed in the Auditorium. Provide all required cabling and connections to maintain the current assisted listing system functionality.

1.8 SUBMITTALS

A. Submittal Data

1. Submittal data is to be submitted in a three ring binder, a continuous spiral binder, or plastic binding that allows the booklet to lie flat while open. Submission of the below materials in electronic format is also be acceptable. Each booklet shall contain the below in the following order:
 - a. Cover Sheet.
 - 1) Include name of supplying contractor and project name.
 - b. Detailed Bill of Materials.
 - 1) Include a listing of: component quantities, equipment manufacturers, model numbers, and description of each component being supplied, and the specification paragraph or drawing sheet that corresponds to the product. Failure to provide this information will result in the rejection of submittals.
 - c. Product Data.
 - 1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product. Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures. If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight.
 - d. Authorized Distributor Certificate.
 - 1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is an Authorized Distributor of the product being supplied.

B. Shop Drawings

1. Prior to fabrication submit contractor generated drawings for approval for all supplied systems. These drawings shall include, but are not limited to, the following:
 - a. Title Sheet & Symbols Legend
 - b. All panels, plates, and designation strips, including details relating to terminology, engraving, finish and color.
 - c. All equipment racks, cabinets, consoles, tables, carts, support bases, and shelves.
 - d. Schematic drawings (Audio & Control Signal Flow), system functional block drawings, including those for audio subsystems. Resubmission of contract drawings is unacceptable.
 - e. All unusual equipment modifications.
 - f. Front mechanical drawings of each equipment rack.
 - g. Equipment location drawings.
 - h. Cable labeling plan.
 - i. Floor Plans, RCPs and Elevations: Show planned location for all elements and cable routing. Drawings should be at project standard scale and clearly legible.
 - j. Mounting and Rigging Details: to be reviewed and stamped by a licensed structural engineer. As-built documentation of the current building structure is available upon request.

C. Form

1. Submit all materials for review as described above, specifically referenced to the Specification paragraph number (where applicable).
 - a. Submit all drawings on sheets of one size, preferably the project standard size.
 - b. Where materials are presented on sheets 11" x 17" or smaller, organize into three-ring binder which include:
 - 1) Dividers or tabs between logical sections
 - 2) Project name and binder title labels on face and edge of binders
 - c. On submittal drawings, maintain 3/32" minimum lettering height. Submittals with text less than 1/16" in height may be rejected.
2. Partial Submittals may be rejected. If submitted individually and each in its entirety, the following Submittals shall not be considered partial:
 - a. Personnel
 - b. Milestones
 - c. Conduit Verification Statement and Notifications
 - d. Rigging and Mounting Drawings
 - e. As-Built Documentation
3. Product Data and Shop drawings must be submitted together in order to be reviewed.

D. User Interface

1. In order to develop a user interface which is both functional and useable, provide working "Beta" copies of system software for review and comment by the owner, architect and the Audio System consultant as per the below listed schedule:
 - a. This is anticipated to be an interactive process, requiring at least three submittals prior to first beneficial use. At a minimum, the software development process will have the following milestones:
 - 1) Initial concept Submittal for Review
 - 2) First Beta Review
 - 3) Second Beta Review

- 4) Final Implementation and On-Site Training: Prior to Final Acceptance
- 5) Follow-up programming review and updates; Timing (within sixty-days from final acceptance)

E. Weekly Reporting

1. Commencing with project award, provide weekly status reporting of milestone task status, anticipated completion date, and related memo notes for the following tasks:
 - a. Submittals
 - b. Infrastructure verification
 - c. Pre-wire status
 - d. Equipment Procurement
 - e. Shop fabrication
 - f. Remote control system design
 - g. Installation and Terminations
 - h. Field testing and pre-acceptance testing
 - i. Final acceptance demonstrations
 - j. Owner training
 - k. First owner use
 - l. Open Coordination Items and Questions
2. See below for a partial example of an acceptable weekly reporting list.

Project: <i>Project Name</i>							
Location: <i>Project Location</i>					Date: <i>Form Delivery Date</i>		
Project Manager: <i>Project Manager</i>				Delivered by: <i>Form Delivered By</i>			
		Projected Completion:	Status:	Notes:			
Infrastructure Verification:		<i>6/1/2011</i>	<i>Complete</i>				
Submittals:							
	<i>Product Data</i>	<i>8/1/2011</i>	<i>Complete</i>				
	<i>Drawings</i>	<i>8/1/2011</i>	<i>Complete</i>				
	<i>Personnel (etc.)</i>	<i>8/1/2011</i>	<i>Complete</i>				
RFIs:							
	<i>12</i>	<i>8/25/2011</i>	<i>Received</i>	<i>Implementing</i>			
	<i>178</i>	<i>9/6/2011</i>	<i>Pending</i>	<i>Projector Screen Clearances</i>			
Installation Status by Space							
Room		Equipment					
Name	Number	Pre-Wire	Order	Receive	Install	Test	Notes:
<i>Example 1</i>	<i>105</i>	<i>100%</i>	<i>100%</i>	<i>100%</i>	<i>60%</i>	<i>0%</i>	<i>Re-programming</i>
<i>Example 2</i>	<i>135</i>	<i>100%</i>	<i>100%</i>	<i>100%</i>	<i>90%</i>	<i>0%</i>	<i>Other Notes Here</i>

F. Personnel

1. Provide, in writing, within two weeks after award of Contract, the names, mailing address, phone numbers with extensions, email addresses and paging service numbers (if available) of the following project personnel:
 - a. Project Manager
 - b. Lead Systems Engineer
 - c. Field Foreman
 - d. Remote Control System Programmer

G. Conduit Verification

1. Within four weeks after award of Contract, submit statement confirming that Contractor has reviewed the conduit system as designed in building construction documents and, where applicable, as built.
2. Notify Consultant, General Contractor, Architect or Electrical Contractor of deficiencies or inadequacies, if any, in conduit system design or installation. If none, so indicate.
3. Absent conduit verification by Contractor and after installation of conduit as designed, Contractor shall assume costs of equipment, materials, labor and engineering, including services of owner's representative(s) in designing and/or verifying revised wiring approach(es) as relate to providing a fully functional system using conduit as designed or as revised at the discretion of the owner.

H. Rigging and Mounting Drawings

1. Submit full size drawings outlining mounting and installation details of all Audio equipment requiring integration with cabinetry or architectural elements.
2. Details, stamped and signed by an appropriately licensed engineer, of all equipment mounting methods and materials provided by the Scope of Work, wherein failure of method or materials used for mounting or hanging permanently installed equipment could result in serious personal injury.
 - a. Details provided by or requiring approval by licensed engineer may include: method of attachment to building structure or attachment and/or suspension points; method of attachment to supported equipment; all suspension materials; a materials list including specifications of all suspension materials; calculations used to determine loads and strengths of suspension materials, other as deemed necessary by the engineer.
3. In the absence of submitted approved, stamped and signed mounting and hanging details, the Owner reserves the right to acquire such engineering approval at the expense of the Contractor. Owner will notify Contractor of such intent. Contractor shall remedy within two weeks or Owner may proceed without Contractor approval and without relieving Contractor from any other obligations set forth by Contract.

I. Color Selection

1. Color options for all items as applicable.
2. Wallplate finishes should be coordinated with the Owner.

J. Samples

1. Color and finish samples of any visible components.

1.9 CLOSEOUT SUBMITTALS

- A. At the completion of the installation, but before Final Acceptance, provide for review and approval the following:
 1. Operation and Maintenance Manuals:
 - a. Equipment manufacturer's operation and service manuals for each make and model of equipment.
 - b. System Operation Manual. Produce a manual specifically for the subsystems detailed herein. The manual shall describe all procedures necessary to activate each system to provide for the functional requirements, except as specifically excluded by the Owner. This section shall provide a simple "How-to" users guide for the procedures needed to operate the system. This document shall contain a section on operating the systems equipment in the event of control system failure. Control system touch panel layouts shall be accompanied by narrative text describing "step-by-step" function engagement.
 2. Warranty
 - a. Provide list and dates of activation of equipment warranties
 - b. Provide original manufacturers' certificates.
 3. As-built Drawings
 - a. Include contractor generated (mark-up of contract documents is not acceptable) digital record diagrams for all systems including, but not limited to:
 - 1) Schematic wiring diagrams with cable markings.
 - 2) Internal wiring diagrams of the equipment rack cabinets.
 - 3) Custom equipment modifications.
 - 4) Final test results and nominal settings for all adjustable controls.
 4. Software Passwords
 - a. Software Passwords Schedule (i.e., a spreadsheet listing the manufacturer, model number and location in the Facility, of each piece of audio equipment, the software for which is password-protected).
 - b. Provide to Owner's Representative as a secure document separate from Operating and Maintenance Manuals and As-Built Drawings.
 5. Editable Control System Code
 - a. Provide the final control system code in an editable format.
 6. Laminated Instruction Cards
 - a. Provide 8 ½ x 11 Instruction cards, approved by the Owner. Laminate step-by-step instructions outlining system operations for each room that has an Audio system. Provide editable file of card to Owner.
 7. Existing Equipment
 - a. Provide to Chesapeake College all existing loudspeakers and electronics removed during this scope of work. Provide an itemized spreadsheet identifying each existing piece of equipment provided to Chesapeake College, including quantities, manufacturer, and model number.

1.10 DELIVERY, STORAGE, HANDLING, AND STAGING

- A. Supply, transport, deliver, unload, move to the installation location, unpack, place, assemble, secure, connect, and install all equipment needed to complete the installation. Be responsible for transportation, parking, delivery, and on-site storage of the system's equipment. Be responsible for all transportation of personnel to and from the site.
- B. Reconfirm before delivery that hallways, stairways, passages, doorways, rooms, entries, elevators and foyers are of sufficient size to accommodate the passage and installation of the equipment and systems. Off-site pre-staging of goods is encouraged.
- C. The Owner's acknowledgment of delivery of goods and any payment made on account of such delivery shall not constitute acceptance (partial or otherwise) and shall not diminish obligations as specified.
- D. The actual dates of delivery shall be under the absolute control of the Owner. The dates and times for delivery/installation are critical to the successful completion of the project. Deliveries shall normally be accepted only Monday through Friday 8:00 a.m. to 4:00 p.m. In the event it becomes necessary for goods to be installed outside these hours comply with the instructions of the Owner. Deliveries attempted outside these hours without prior consent of the Owner may be turned away. Comply with all instructions of the Owner and the Contractor concerning time of arrival at the site; which entrance shall be utilized for delivery; routes to be taken to reach the installation location; and other matters relating to the orderly and timely installation of the system.
- E. Installation shall commence immediately upon delivery of materials to the jobsite, except as directed by owner. Time required from delivery date to completion of project shall be in accordance with the approved schedules.

1.11 SYSTEM TRAINING

- A. Training: Provide training in the operation and maintenance of the system for personnel designated by the Owner. Record owner training sessions on DVD or other agreed upon media, and make training videos available to the owner at no charge. The training shall be organized as follows:
 - 1. Two (2) four-hour training classes for system technical operation and maintenance. This class shall cover the following topics:
 - a. Review of signal flow diagrams.
 - b. Review of all equipment functions, relevant to the function in this system.
 - c. Review of initial equipment settings.
 - d. Demonstration of all functional connections from a user perspective.
 - e. Review & demonstration of replacement procedures for consumables.
 - f. Review of manufacturers' recommended routine maintenance procedures.
 - 2. Two (2) four-hour training classes for system engineering concerns. This class shall cover the following topics:
 - a. Review of signal flow diagrams.
 - b. Review of all equipment functions, relevant to the installation.
 - c. Review of initial equipment settings.
 - d. Review of manufacturer's recommended routine maintenance procedures.
 - e. Review & demonstration of replacement procedures for consumables.

- f. Review & demonstration of control system software replacement/upgrade procedures.
- 3. Two (2) four-hour training classes addressing Audio system operations. The classes will demonstrate and describe the following:
 - a. System set-up and operations.
 - b. Control system operation.
 - c. How to attach microphones, record Audio signals, and control the sound system.
 - d. Audio monitoring system operations.
 - e. Provide and coordinate at least two (2) technical visits by Yamaha and Bose separately to assist in tuning the audio system & system training, along with two (2) additional visits from each manufacturer during the first public uses of the system. Dates and times of public uses or performances for which manufacturer representatives must attend are to be determined by and coordinated with Chesapeake College. Total hours in system tuning and training visits must be at a minimum, sixteen hours (16) for Bose representatives, and eight (8) hours for Yamaha representatives.
 - f. Contact Bose directly to David Andrews at 717-738-3828
- 4. Training may take place at any time (chosen by the Owner) after the systems are operational, up to a year following system acceptance.
- 5. Close out submittals shall be provided prior to any training classes.
- 6. Coordinate detailed specifics of the training session(s) time, date & location with the Owner.

1.12 WARRANTY

- A. The system warranty shall be for twenty-four (24) months from the date of final acceptance. Provide all equipment, material, and labor required to uphold a full system warranty at no charge to the Owner. All manufacturers' equipment warranties shall be activated in the Owner's name and shall commence on the date of final acceptance. In the case of modified equipment, the manufacturer's warranty is normally voided. In such cases, provide the Owner with a warranty equivalent to that of the original manufacturer.
- B. Include in overall systems warranty, a service warranty for all existing hardware which is to be re-used in the final installed system.
- C. There shall be no cost to the Owner for maintenance performed during the warranty period beyond the fixed cost of the contract.
- D. Coordinate and provide updates to the control system code & touch panel layouts based on owner feedback of desired functionality during warranty period.
- E. Provide a total of four (4) one-day visits per year, or a total of thirty-two (32) engineering/ service labor hours to conduct preventive maintenance and the Owner directed system adjustments. Include pricing for these maintenance visits as an add-alternate in the submitted bid proposal.
- F. Each visit will include:

1. Checking and repairing microphones and microphone cables.
2. Conducting subjective and objective tests of the audio and control systems of the installed audio systems.
- G. Repair and/or adjust any malfunctioning components located by the technician during this testing. Include control system programming updates and modifications as part of this service contract, providing an updated editable copy of the source code to the Owner.
- H. Provide a service telephone number, staffed by a qualified technician familiar with the equipment installed. Staff this number during normal business hours.
- I. Respond with an on-site technician within 24-hours of a service call (including Saturdays and Sundays) for all equipment and system failures.
- J. Replace or repair, at no cost to the owner, any failed equipment hardware or software installations required to provide full system operations.
- K. During the warranty period, advise the Owner in writing each time any routine software and firmware updates become available, giving the Owner the opportunity to upgrade the software/hardware should they so desire at no additional cost. Provide any necessary system modifications after installation of these updates to maintain a fully functioning system.
- L. Provide updates to firmware during service period. Provide any necessary system modifications after installation of these updates to maintain a fully functioning system.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Equipment Lists: Included below is a list of all equipment and materials required to complete the work of this section, for reference.
 1. Music, Announcement, and Audio Effect Module
 - a. Stereo audio input and output
 - b. 16/24 bit digital audio conversion
 - c. More than 250 hours recording capability
 - d. Provide quantity of one (1)

Product: 360 Systems Instant Replay 2, or approved equal

2. Personal Performance Monitoring System (Add Alternate Only)
 - a. One (1) RJ45 A-Net signal input
 - b. Receives 16 discrete channels of audio over single Category cable
 - c. Headphone output with personal mix controls
 - d. Provide Bose SoundTrue in-ear headphones for ½ of all units
 - e. Provide Sony MDR-V600 headphones for ½ of all units
 - f. Provide stand
 - g. Provide all required patch cabling

Product: Aviom A320, or approved equal.

3. Centralized Audio Signal Distribution Module (Add Alternate Only)
 - a. One (1) RJ45 A-Net signal input
 - b. Eight (8) RJ45 simultaneous split A-Net signal outputs
 - c. Rack mountable
 - d. Provide all required patch cabling

Product: Aviom D800, or approved equal.

4. 16-Channel Monitoring System Input Module (Add Alternate Only)
 - a. 16 balanced inputs – ¼" TRS connectors
 - b. 16 balanced thru connectors TRS
 - c. A-Net Out and A-Net Expansion network connections (RJ45)
 - d. Stereo link switches for each pair
 - e. Four position gain switches
 - f. Signal present and clip LEDs per channel
 - g. 1RU

Product: Aviom AN-16/I v.s, or approved equal.

5. Configurable Audio Power Amplifier
 - a. 20 Hz to 20 kHz Frequency Response
 - b. 102 dBA Signal to Noise Ratio
 - c. Eight (8) audio input channels
 - d. Two to Eight (2 – 8) audio output channels

Product: Bose PM8500.

6. Central DSP Audio Processor
 - a. Rack Mountable, 2 RU
 - b. 20 Hz – 20 kHz frequency response
 - c. 24-bit A/D conversion
 - d. Provide Bose Audio Input Cards EDR4-I
 - e. Provide Bose Audio Output Cards EDR4-O

Product: Bose ESP-00.

7. RoomMatch Dual 15" Subwoofer
 - a. Frequency Range 40 Hz – 280 kHz
 - b. Dual 15" drivers
 - c. 1000 Watt Power Handling
 - d. 2x 8 ohm inputs
 - e. Refer to the attached Bose Room Match Array Rigging Data document. Provide all part numbers identified in this document, and comply with recommended mounting details.
 - f. Reference Bose quote number US112301ChesapeakeCollege

Product: Bose RMSS215.

8. Suspended Loudspeaker Line Array
 - a. Frequency Response: 60 Hz – 16 kHz
 - b. Dispersion Pattern: 120 x 20 degrees
 - c. 4 ohm low frequency input

- d. 8 ohm high frequency input
- e. Provide RMSFLY line array suspension array, RMAFLG Frame, and RMXSRT Extension
- f. Integrate this device, RM120x10, and RMS215 into a single suspended line array system
- g. Refer to the attached Bose Room Match Array Rigging Data document. Provide all part numbers identified in this document, and comply with recommended mounting details.
- h. Provide quantity of one (1)
- i. Reference Bose quote number US112301ChesapeakeCollege

Product: Bose RM 120x20.

9. Suspended Loudspeaker Line Array
- a. Frequency Response: 60 Hz – 16 kHz
 - b. Dispersion Pattern: 120 x 10 degrees
 - c. 4 ohm low frequency input
 - d. 8 ohm high frequency input
 - e. Provide RMSFLY line array suspension array, RMAFLG Frame, and RMXSRT Extension
 - f. Integrate this device, RM120x10, and RMS215 into a single suspended line array system
 - g. Refer to the attached Bose Room Match Array Rigging Data document. Provide all part numbers identified in this document, and comply with recommended mounting details.
 - h. Provide quantity of three (3)
 - i. Reference Bose quote number US112301ChesapeakeCollege

Product: Bose RM 120x10.

10. Stage Fill Loudspeakers (Stage Fill)
- a. Frequency Response 80 Hz – 16 kHz
 - b. 90 x 60 degree dispersion
 - c. 94 dB Sensitivity
 - d. Provide stands for temporary use as stage fill loudspeakers
 - e. Provide all infrastructure required to connect loudspeakers to stage fill output plates at face of stage

Product: Bose RMU-208.

11. Stage Monitor Loudspeaker
- a. Floor-wedge style stage monitor
 - b. 100 watt power handling
 - c. 8 Ohm input

Product: Bose Panaray 310M.

12. Ceiling Mounted Pre-Function Area Loudspeakers
- a. Frequency Response: 60 Hz – 18 kHz
 - b. 200 watt continuous power handling
 - c. 97 dB Sensitivity
 - d. Mount in ceiling above Pre-Function area. Remove all existing loudspeakers, clean, and furnish to Chesapeake College prior to installing specified loudspeakers.
 - e. Provide acoustically transparent grille, white in color

- f. Provide manufacturer recommended rear loudspeaker enclosure

Product: Community Cloud1266, or approved equal.

13. Remote Control Touch Panel Interface (Add Alternate Only)

- a. 8" Color Touch Screen Display
- b. Wireless Communications
- c. Provide Docking Station for use in Control Room

Product: Crestron TPMC-8X-GA, or approved equal.

14. Remote Control Processor

- a. Rack Mountable, 1 RU
- b. Core 3 Operating System, 32-Bit
- c. Transmits Ethernet, RS-232 control signals
- d. Provide programming for Xpanel integration, with iPad tablet.

Product: Crestron CP3, or approved equal.

15. Wireless Intercom Base Station

- a. Frequency Range: 2400 – 2483.5 MHz
- b. Frequency Response 200 Hz to 3.5 kHz
- c. 600 ohm 4-wire input/output
- d. External dual diversity ½-wave dipole antenna
- e. Provide all required batteries and chargers for associated belt packs
- f. Provide Four (4) Clear-Com BP-210 Wireless Beltpacks, with CC-400 headsets

Product: Clear-Com BS-121, or approved equal.

16. Production Intercom Master Station

- a. 4-Channel Master Station
- b. Provide Clear-Com CC-400 headset and faceplate microphone
- c. Provide Clear-Com HB-702 wall plate station at 4-gang existing box backstage
- d. Provide four (4) model RS701 wired beltpacks and associated headsets

Product: Clear-Com MS-704, or approved equal.

17. 8-Port Unmanaged PoE Network Switch

- a. Eight (8) RJ45 10BASE-T / 100BASE-TX ports
- b. 3.2 Gbps Switching Capacity
- c. 2.4 mpps Forwarding Capacity
- d. 2RU
- e. PoE enabled

Product: Cisco SRW208P-K9-NA, or approved equal.

18. 16 Channel Dante Audio Interface

- a. 16 balanced audio inputs on two (2) DSUB 25-pin connectors
- b. 16 balanced audio outputs on two (2) DSUB 25-pin connectors
- c. One (1) Ethernet output on female RJ-45 jack
- d. Distributes multi-channel audio information over LAN connection to dante-enabled devices

- e. 20 Hz – 20 kHz Frequency Response

Product: Focusrite Rednet-2, or approved equal.

- 19. 82" Tall Equipment Rack (2nd floor Equipment Rack)
 - a. 45 RU
 - b. 81 1/8" overall height; 25" overall depth; 22" overall width
 - c. Provide security screws
 - d. Provide quiet exhaust fan top 4"
 - e. Provide RSH series rack mount kits as needed
 - f. Provide Furman PL-Pro D II power distribution

Product: Middle Atlantic BGR-4525, or approved equal.

- 20. 1st Floor Control Room Equipment Rack (Base Option)
 - a. 35 Rack Units
 - b. Wall Mount, Swing-out cabinet
 - c. 15" overall center section depth
 - d. Provide Security Screws
 - e. Provide pricing as Base Option with Marshall Furniture MEQ-70R as Add Alternate

Product: Atlas 335-15, or approved equal.

- 21. Custom Equipment Cabinet (1st floor Control Room, Add Alternate)
 - a. Reference Marshall Furniture Quote number MFI-29505AB
 - b. 36 Total Rack Units, with Front and Rear rack rails
 - c. Two (2) locking wood frame doors with smoked plexi glass windows
 - d. Three (3) 3" grommets in top surface
 - e. Natural maple finish
 - f. Provide Security Screws
 - g. Provide quiet 4" exhaust fan
 - h. Provide Pricing as Add Alternate option

Product: Marshall Furniture MEQ-70R, or approved equal.

- 22. Mobile Equipment Rack (Backstage)
 - a. 18 Rack Units
 - b. Provide Casters and Locking Door
 - c. 500 Lbs load capacity minimum
 - d. Provide Security Screws

Product: Anvil Castered Rack Case, or approved equal.

- 23. Gooseneck Microphone
 - a. 18" gooseneck electret condenser microphone
 - b. Frequency Response: 50Hz to 17kHz
 - c. Cardioid cartridge
 - d. Shock mount, flange mount, windscreen
 - e. Mute switch and LED

Product: Shure MX418S/C, or approved equal.

24. 4-Channel Wireless Microphone System

- a. 1RU Rack Mountable Wireless Receiver
- b. Four discrete output channels, XLR connectors
- c. Switchable mic/line output levels
- d. Removable $\frac{1}{2}$ wave antennas
- e. Provide remote antennas to enable coverage of vestibules 102a and 104a
- f. Provide Shure MX150 lapel microphone
- g. Provide Shure ULXD1 bodypack transmitter

Product: Shure ULXD4Q, or approved equal.

25. 48-Point Audio Patch Panel

- a. 24x24 Line-Level audio patch panel
- b. No normalled connections
- c. $\frac{1}{4}$ " TRS female jacks
- d. Rack mountable, 1 RU
- e. Provide patch cables for all input and output points

Product: Switchcraft MT48K1HN, or approved equal.

26. 32-Point Microphone Audio Patch Panel

- a. 16x16 microphone level audio patch panel
- b. XLR female jacks
- c. Rack mountable, 2 RU
- d. Provide XLR-to-XLR and XLR-to- $\frac{1}{4}$ " patch cords for all input and output points

Product: Switchcraft QGPK3B440, or approved equal.

27. Compact Flash Audio Recorder

- a. Solid State recording to Compact Flash media
- b. 1 RU
- c. Records in WAV or MP3 format to CF Card
- d. Balanced XLR and unbalanced RCA input/output connections
- e. RS232 controllable

Product: Tascam SS-R1, or approved equal.

28. Powered Studio Monitors

- a. Integral amplification circuitry
- b. TRS and XLR line input connectors
- c. Provide quantity of two (2)

Product: Tannoy Reveal 402, or approved equal.

29. 8-Channel Microphone Preamplifier

- a. 8 input microphone level on XLR connectors
- b. 8 line outputs
- c. Rack mountable, 1 RU
- d. 20 Hz – 20 kHz frequency response

Product: True Systems Precision 8, or approved equal.

30. Audio Mixing Console

- a. Thirty-Two (32) microphone inputs
- b. Two (2) YGDAI expansion slots
- c. Provide Yamaha MY8-DA96 input card
- d. Provide Yamaha MY8-AD96 output card
- e. Dante Audio Interface (Primary and Secondary)
- f. Provide programming for remote control via iPad, and provide Apple iPad, quantity of one (1), to be 64GB memory with retina display and grabbit protector case.
- g. Provide iPad Docking Station
- h. Provide Add Alternate Pricing for Yamaha CL5 audio mixer in lieu of the specified QL5, inclusive of all accessories noted here

Product: Yamaha QL5.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. All existing loudspeakers and associated hardware which is removed from the existing facility shall be cleaned, salvaged, and furnished to Chesapeake College for storage and future use. Coordinate delivery of existing hardware with Chesapeake College.
2. All installation work shall be in accordance with, but not limited to, this specification and drawings. Work practices shall be performed in accordance with applicable standards, requirements, and recommendations of Federal and Local authorities having jurisdiction.
3. All discrepancies discovered and any discrepancies which are apparent at the date of submission of bids, shall be immediately corrected without additional charge to the Owner.
4. Clearly label all user controls for intended use and nominal setting. These labels shall be engraved and filled, or equal. Note: "Dymo" labels are not acceptable.
5. All equipment to be rack mounted shall be supplied with the appropriate rack mount kits.
6. Each rack enclosure shall have a single button on/off power distribution panel to include pull out lights and LED voltage indicator (Furman PL-Pro DMC or equal) located in the first available rack unit.
7. All equipment racks to include removable, locking front doors and a 4" diameter, low-noise fan.
8. All rack and instructor stations shall include "security type" screws to secure rack-mounted components.
9. In rooms containing wireless microphones or assisted listening system, provide an antenna distribution system inclusive of remote antennas as needed to support transparent coverage throughout the space(s).

B. Physical Installation:

1. Provide system identification plate as shown below. Plate shall occupy the first available rack unit in all Audio System equipment racks. If more than two (2) racks are positioned together, one (1) plate for every two racks is acceptable. Product: Covid # 1R0001-BA-X-A-CT.



2. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise. Unless granted specific permission by the Owner, install and secure all boxes, equipment, etc., plumb and square.
3. Fastenings, mounting brackets and supports shall be adequate to support their loads with a safety factor of at least eight (8). A safety chain or cable will be tied to all equipment suspended from above.
4. In the installation of equipment and cable, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.

3.2 AUDIO CABLE INSTALLATION

- A. All cables, regardless of length, shall be marked with wraparound cable markers at both ends. There shall be no unmarked cables at any place in the system, inclusive of existing cabling to be re-used. Marking codes used on cables shall correspond to codes shown on "as-built" drawings and/or run sheets. The labeling and numbering system will be coordinated with the Owner.
- B. All wired microphones shall include a 30ft. patch cable with heavy-duty jacket and XLR connectors.
- C. Loudspeakers operating at 8 ohms shall be installed with 12AWG cable as a minimum size/diameter. Confirm existing cabling to be re-used meets this standard.
- D. Wall plate and floor box input/output panels shall be installed with audio line drivers on runs exceeding 35ft.
- E. All cabling shall be neatly strapped, dressed, and adequately supported. Any exposed cabling shall be neatly enclosed in a protective covering.
- F. Terminal blocks, boards, strips, or connectors shall be furnished for all cables, which interface, with racks, cabinets, consoles, or equipment modules.
- G. All audio signal lines shall be balanced at I/O plates. Provide ninety (90) degree connector adapters for all Audio cabling at custom I/O plates.
- H. All cables shall be grouped according to the signals being carried. In order to reduce signal contamination, separate groups shall be formed for the following cables:
 1. Power cables
 2. Control cables

3. Data cables (when applicable)
 4. Audio cables carrying low level signals
 5. Audio cables carrying line and high level signals
- I. Supply cables as required to meet system performance standards. Any cabling installed in walls or ceilings shall be plenum rated. All cables shall be cut to the length dictated by the run plus the required service loop to permit future equipment movement and relocation. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.
- J. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer. Notify the construction manager in the event that a field condition interferes with the proper installation of any cables or equipment.
- K. Grounding Procedures: In order to minimize problems resulting from improper grounding and to achieve maximum signal-to-noise ratios, the following grounding procedures shall be adhered to:
1. General: Because of the great number of possible variations in grounding systems, follow good engineering practice, as specified herein, and to deviate from these practices only when necessary to minimize crosstalk and to maximize signal-to-noise ratios in the audio and control systems. Inform the Consultant in the event that there is a deviation from the standard grounding practices prior to actually performing the work.
 2. System Ground: A single "system ground" shall be established for the system. All grounding conductors shall connect to this system ground. The system ground shall be provided in the equipment rack, and shall consist of a copper bar of sufficient size to accommodate all secondary ground conductors.
 3. A copper conductor, having a maximum of 0.1 Ohms total resistance, shall connect the system ground bar to the nearest grounded, metallic electrical conduit of at least 2 inches in diameter. Be responsible for determining if the metallic conduit is properly electrically bonded to the building ground system, and shall show the grounding path of a document that is provided with the system documentation.
 4. Secondary system grounding conductors shall be provided from all ungrounded equipment in each area, to the primary system grounding point for the area. Each of these grounding conductors shall have a maximum of 0.1 Ohms total resistance.
 5. Under no conditions shall the AC neutral conductor, either in the power panel or in a receptacle outlet, be used for a system ground.
- L. Audio Cable Shields: All balanced audio cable shields shall be grounded at one point only. For ungrounded portable equipment, such as microphones, the shield shall be connected at both ends but grounded at only one end.
- M. Non-continuous cable supports
1. Audio cables shall be supported AFC with adjustable non-continuous cable supports, where not routed through conduit.

2. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of audio cables.
3. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
4. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
5. Do not exceed load ratings specified by manufacturer.
6. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.
7. Non-continuous cable supports shall be ERICO CableCat™ J-hook series or approved equal.

3.3 REPAIR/RESTORATION

- A. Any damage to any installed work or product caused by the unpacking, transporting, assembly, connecting, or configuring of the product shall be repaired at no charge to the Owner.

3.4 FIELD QUALITY CONTROL

- A. Once installed and the System Checkout is complete, the system shall be demonstrated as operational to the Owner.
 1. If the Audio system fails to meet the requirements of this document or those stated by the technical documentation, then the Owner shall reject the installed system and the contractor shall be given notice (either oral or in writing) to correct the failure.
 2. If unable to overcome repeated performance deficiencies within thirty (30) days, and if requested to do so by the Owner, remove the equipment and replace at no expense to the Owner.
 3. No warranties shall begin until the Owner has authorized final acceptance in writing.
 4. Right to Revoke Acceptance: If any equipment and/or goods which have been previously accepted, specifically or by the making of payment, are found to have defects, damage, deficiencies, or fail to conform to the specification, for any cause not attributable to the Owner, the Owner may revoke acceptance.
- B. Conduct pre-acceptance tests
 1. Perform all system performance checks on the installed systems prior to final acceptance testing. The Owner / Audio Consultant, may witness the pre-acceptance tests. The Owner / Architect may inspect and operate system components in order to evaluate installation progress and technical compliance prior to acceptance testing.
- C. Contractor System Checkout

1. Perform system checkout before acceptance tests are scheduled. Furnish all required test equipment. Perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification.
2. During performance testing, all equipment shall be operated under standard conditions as recommended by the manufacture.
3. Test all audio systems for compliance with the Performance Standards using test procedures that follow later in this specification.
4. Maintain documentation of all performance tests for reference by Consultant during the System Acceptance Tests.
5. At the conclusion of the tests, return all equipment settings to previously calibrated positions.
6. Provide written records of all test results in spreadsheet form.
7. Check all control functions, from all controlling devices to all controlled devices, for proper operation.
8. Adjust, balance, and align all equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for all level controls, and record these settings in the "System Operation and Maintenance Manual."
9. Provide testing results and settings for all equipment and systems to the Consultant at least three (3) business days prior to System Acceptance Testing.
10. Provide the Audio Consultant with all test results, manuals, software, as-built documentation, etc. prior to acceptance testing.
11. Inform the Owner and Audio Consultant that the systems are ready for System Acceptance Testing by the Consultant. The system shall be considered ready for acceptance testing when the following conditions are met:
 - a. Audio System Contractor has pre-tested all systems such that all sub-systems, functions, software, and equipment are de-bugged and operational
 - b. Audio System Contractor has supplied the Audio System Consultant with the written test results and documentation as listed above for all rooms and systems
 - c. Audio System Contractor has supplied the Audio System Consultant with close out (manuals, training materials, and other as-built) documentation revised to reflect comments and/or revisions arising from the review cycles listed elsewhere within this document
12. Should the systems not be ready for testing by the Audio System Consultant at the date(s) and time(s) indicated by the Audio Contractor, system acceptance testing may be rescheduled at the sole discretion of the Audio Systems Consultant. Pay for the labor and expenses of the Audio Consultant and other project team members assembled at the project site for the purpose of system acceptance testing for the date(s) of the original scheduled testing plus the labor and expenses of the Audio Consultant and other project team members for the rescheduled testing date(s). The labor rate for the Audio Consultant shall be a flat rate of \$200.00/hour including travel time. Other project team member labor costs shall be at their respective published rates. The PM and/or Owner

shall be entitled to deduct any money owed to the Owner, PM, Audio Consultant, or other project team members under this contract from any sum which may become due or is payable to the Audio Contractor under this Contract for the purposes of satisfying the charges listed above.

D. Final Acceptance Test

1. Testing will be performed with the Owner (or its designees) present to determine that the Audio system equipment satisfies the manufacturers' performance specifications and that the Audio system installed satisfactorily performs the functions required by this specification. Conduct formal pre-acceptance tests prior to the Owner's acceptance testing to ensure that the performance and functional specifications are satisfied by the installed system and the system is ready for the Owner's acceptance. Verify in the owner's presence that the installed audio system satisfies the performance and functional requirements through formal acceptance testing. Be responsible for staging each room to be tested, and shall have sufficient personnel on site to run multiple systems at once (not less than three (3) personnel).

E. Test Equipment

1. Assemble the following test equipment (or equivalent) on site.
 - a. Audio and control cable, terminations, adapters, etc
 - b. Audio Test CD
 - c. DVD
 - d. Programmable Audio Test Generator, Extron VTG-400D

F. Audio System Testing

1. Absolute Impedances
 - a. Set any speaker level controls at zero attenuation. Measure absolute impedance value of each speaker line at 250, 500, 1000, 2000, 4000 Hz without the amplifier connected but with all speakers connected. Impedance must not be below the rated load impedance of respective amplifier and may be any value equal to or above that. Check resistance of lines to all speakers and microphone receptacles with receptacles open and short-circuited.
2. Hum and Noise Level
 - a. Test overall hum and noise, it should be at least 60 dB below rated power output of each amplifier with amplifier controls set for optimum signal to noise and full output and with inputs terminated with proper shielded resistor. (150 and 600 ohms).
3. Parasitic Oscillation and RF Pickup
 - a. Set up system for each specified mode of operation.
 - b. Use 5 MHZ band with oscilloscope and speaker monitoring.
 - c. Check to insure that the system is free of spurious oscillation and RF pickup in the absence of any input signal and also with the system driven momentarily to full output at 160 Hz.
4. Buzzes, Rattles, Distortions
 - a. Apply high quality music signal to the system. Adjust the sound system for frequent peaks at its specified maximum sound pressure level.
 - b. Apply sine-wave sweep from 50 to 5,000 Hz to 6 dB below full amplifier power.

- c. In both cases, listen carefully for buzzes, rattles and objectionable distortion.
- d. Correct all causes of such defects. If cause is not from system, promptly notify the architect indicating cause and suggested corrective procedures.

5. Equalize all audio systems for maximum gain before feedback in all room configurations.

6. Record all systems settings and include into Systems Operation manuals

G. Qualification Methods

1. Three methods will be used to qualify the Audio system for acceptance.
 - a. Inspection - A critical observation of qualifying factors, such as quality of workmanship, equipment placement, routing of cables, adequacy of technical documentation, etc., that do not lend themselves to demonstration or measurement.
 - b. Demonstration - A process of showing by reason or evidence that a given condition clearly satisfies the requirement.
 - c. Measurement - A process of determining the actual dimension, capacity, or amount of something, by measuring using calibrated standards.
2. Acceptance of the Work of this Section shall occur after completion of corrections and adjustments required by "Punch List" (as generated during Demonstration and Acceptance Testing of Completed Installation).
3. Owner reserves the right to use equipment, material and services provided as part of Work of this Section, prior to Acceptance, without incurring any obligation to Accept any equipment or completed systems until Punch List work is complete and systems comply with Contract Documents.

3.5 SCHEDULES

A. Todd Performing Arts Center Auditorium

1. The Todd Performing Arts Center is a marquee facility and a focal component of the Chesapeake College campus. The purpose of the work described in this Section is to modernize, improve, and expand the existing audio system in the Auditorium of the Performing Arts Center (and associated pre-function area) to meet the needs of a contemporary, flexible performance environment. Existing equipment, infrastructure, and some cabling will be utilized where possible, but must be replaced for any connections which do not pass signal tests.
2. The primary program, speech, and instrument audio reinforcement loudspeaker system will consist of one (1) centralized line array suspended from the ceiling above the center of the stage, positioned and angled to provide even audio coverage of the entire audience seating area, including the balcony. Attached to the rear of this line array assembly frame shall be two (2) high-powered subwoofer loudspeakers, to provide full spectrum audio reproduction capability. These loudspeakers will be located in the general location where the current Altec Lansing loudspeakers are mounted, and will utilize existing loudspeaker cabling and infrastructure where possible. Coordinate closely with Bose technical representatives regarding loudspeaker placement and angling, prior to installation. Develop shop drawings with mounting details to reflect this coordinated rigging method.

3. All existing cabling is to be tested for compliance with standards and criteria listed in this Section prior to re-use in the installed system. Replace all cabling that does not comply. In addition, four (4) portable loudspeakers are to be provided as stage fill loudspeakers, which will connect to new output connectors at infrastructure provided by the AV contractor under this contract. The existing Lobby loudspeakers will also be removed and replaced with high-powered directional ceiling loudspeakers to improve speech intelligibility and audibility in this pre-function area. The existing loudspeaker system currently serving the backstage area will remain as installed, and must be operational as a part of the upgraded system upon completion of the work outlined in this Section.
4. All audio signal routing, mixing, and processing will be controlled through two complementary system components. The first of these shall be a multi-channel audio mixer, which will be used for most operator-run mixing applications for performances and rehearsals. The second, parallel device shall be a rack-mounted audio DSP processor, which shall be capable of providing users with access to pre-set audio mix configurations in the event that no operator is present to create a manual mix. All existing audio tie lines from input wall plates in the Auditorium, Orchestra Pit, and Lobby will be maintained, and will be re-terminated at the Control Room end for direct connection into the new audio mixer. Several line level cables will be terminated on TRS-type patch panels for manual patching of various sources and OFE processors. All patch panels will be mounted into the specified equipment rack, to be located in the control room for quick operator access to manual patching.
5. Point-to-point category 6 cabling will be provided between the Control Room location and existing wall boxes back stage, as indicated on the associated floor plan drawings. This cabling will be used to support the distribution of multi-channel digital audio, both through remote input/output modules associated with the primary audio mixer, as well as personal performer monitoring headphone stations. An eight-channel wireless microphone system has also been specified for use in this area – coordinate wireless channel selection with Chesapeake College IT representatives to ensure signals do not interfere with data network wireless communications. A production intercom system will also be provided, with both wired and wireless capability, to support discrete intercommunication between system operators and back stage personnel. On-stage monitors have been specified for use by performers for self-monitoring. Audio mixes and signals will be able to be recorded to a hard-disk recorder appliance, and audio will be able to be played back from this appliance as well. Audio monitoring in the Control Room will be accomplished through the specified powered studio monitors.
6. All amplifiers and related equipment will be mounted in an equipment rack in the 2nd equipment storage area. All equipment requiring manual access will be mounted in the mixing console specified. The below listed Owner Furnished Equipment is to be maintained, and re-installed in these equipment racks as shown in the AV series drawings.
7. System Interconnection: The functional interconnections of the audio, point-to-point data cabling, and control systems shall be as detailed on the “AV” series drawing sheets associated with this space.
8. Equipment Layout: The equipment in this area shall be located as detailed on the “AV” series drawing sheets associated with this space.
9. Owner Furnished Equipment (OFE):

- a. Personal / Laptop Computer
- b. One (1) QSC RMX 2450 audio amplifier
- c. One (1) QSC GX3 audio amplifier
- d. One (1) Altec Lansing model 9444B audio amplifier
- e. One (1) Denon model DN-T625 CD / Cassette combination player
- f. One (1) Denon model DN-740R dual cassette player
- g. One (1) Denon model DN-C550R dual CD deck player
- h. One (1) Altec Lansing model 1715C Mixer / Amplifier (used to power Backstage loudspeakers)
- i. One (1) Blonder Tongue AM series modulator
- j. One (1) Symetrix model 421 expander / limiter
- k. One (1) Atlas Soundolier model SACR-191 sequential power switch system
- l. One (1) Altec Lansing model 1631A Electronic Dividing Network
- m. One (1) RackRider model RR-15 power conditioner

10. System Details

- a. Control System: The primary audio system control surface shall be the audio mixing console located in the Control Room. Interconnection of components and routing of audio signals shall also be accomplished through manual patching of cabled connections at the specified audio patch panels. In addition, a remote control system will be controlled from a hardwired rack mount color LCD touchscreen that shall terminate at the specified equipment rack. From this touchscreen, users shall have full function control of all room source and system functions (including audio system preset configurations) with one button operation. These sources and associated electronics are to be detailed in the signal flow drawing associated with these rooms. Touchscreen layouts to be approved prior to installation. It is intended to have the control system programmed to turn power on/off for all system components with a single function button.
- b. Electrical Boxes and Conduit: Provide electrical boxes and conduit in the walls, and above the ceiling as needed. Be responsible for all custom AV plates and the necessary cabling connecting to the system's equipment. There shall be a custom wallbox and rackplate location for input/output hook-ups of microphones and other specified audio system hardware. Confirm on site conditions prior to ordering.
- c. Program/Speech Reinforcement Loudspeakers: Ceiling-mounted loudspeakers will be installed for program audio signals and performance speech / instrumental audio reinforcement purposes. Take care not to damage the ceiling during installation, and repair or replace any damage caused during the installation. Provide submittal drawings detailing the method of suspending specified loudspeakers, reviewed by a licensed engineer. Audio inputs include, but are not limited to: Cassette and CD players, personal computers, wired and wireless microphones, pre-recorded audio content.
- d. Equipment Rack/Hardware: Provide rack and all equipment rack hardware, including vent panels, slide-out shelves, rack mounts and miscellaneous hardware for a complete and finished system. The equipment rack for this room shall be located as detailed on the AV series drawings. Provide cable management from the rack to associated wall plate.

11. Equipment List: Included in Part 2 of this Section is a comprehensive equipment list for all audio equipment, including items required for this space. Each of these items shall be priced using both the equipment make and model shown, or components with equivalent functionality and of newer make, which meet or exceed the performance characteristics that are outlined for each component in the list. If an item is listed as "Custom," this

Chesapeake College Todd Performing Arts Center Auditorium
Audio System Upgrade
March 20th, 2015

means that the Contractor may use any manufacturer's component appropriate for the function and quality required for that item. Submit a "build" quality shop drawing for approval, on any custom items.

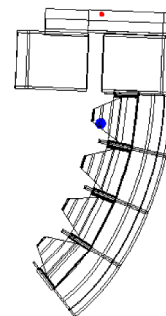
END OF SECTION 274100

RoomMatch Array Rigging Data - Cluster 1

Array Within WLL	Pickup Point	❶ Frame Pitch		Pull Bracket	Extender Bar	
YES	28	Target	Predicted	NA	Type	Position
		-2.3 °	-2.2 °		SHORT	IN

Array Design is Within Acceptable Limits

Calculated Values	Metric	US
Total Array Weight	475.7 kg	1046.5 lb.
❷ Array Hang Height	8.40 m	27.56 ft.
❸ Array Frame Load (per side)	237.8 kg	523.2 lb.
©Array Center of Gravity (X-axis)	-26.8 cm	-10.5 in.
©Array Center of Gravity (Z-axis)	-65.3 cm	-25.7 in.



RoomMatch Array Parts List

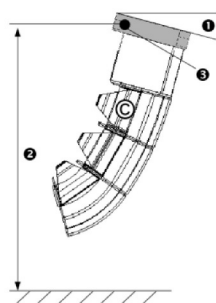
Item	QTY	SKU	Description
Bose RMS215	2	330034-0110	ROOMMATCH DUAL-15 SUBWOOFER LDSPKR BLK
Bose RMSFLY	2	343856-0120	ROOMMATCH RMS215 FLY KIT BLK
Bose RM 120x10	3	343929-2010	ROOMMATCH 120X10 LOUDSPEAKER BLK
Bose RM 120x20	1	343929-2020	ROOMMATCH 120X20 LOUDSPEAKER BLK
Bose RMAFLG	1	330038-0120	ROOMMATCH ARRAY FRAME LARGE
Bose RMXSRT	1	344057-0110	ROOMMATCH ARRAY FRAME EXTENDER SHORT

WARNING: The products referenced herein are intended for installation only by professional installers with knowledge of proper hardware and safe mounting techniques. Unsafe mounting or overhead suspension of any heavy load can result in serious injury and equipment damage. It is the responsibility of the installer to evaluate the reliability of any mounting method used for their application.

WARNING: All Bose® products must be used in accordance with local, state, federal and industry regulations. It is the installer's responsibility to ensure installation of the loudspeakers and mounting system is performed in accordance with all applicable codes, including local building codes and regulations. Consult the local authority having jurisdiction before installing these products.

Please refer to the user and installation manuals of the products for further information. Manuals available at <http://pro.bose.com>

Key Dimensions



- ❶ Frame Pitch
- ❷ Array Hang Height*
- ❸ Array Frame Load (per side)
- © Center of Gravity

* relative to z=0 in room model

Notes

- 1) Allowed pitch is +30° to -45°; depending upon configuration these limits may be reduced
- 2) The design safety factor for all RoomMatch array rigging hardware is 10:1
- 3) The Center of Gravity dimensions are referenced to the side-plate forward-most fastener position of the first (top) module of the array.