# ADDENDUM NO. 2

**PROJECT NAME:** **UNL North Stadium Sound System/Wi-Fi Enhancement**
**UNL PROJECT NUMBER:** **10420**
**BID INVITATION NUMBER:** **2332-14-7200**

CONSULTANT: The Clark Enersen Partners, Inc.
ADDRESS: 1010 Lincoln, Suite 200
Lincoln, NE 68508
DATE OF ISSUANCE: March 21, 2014
DATE OF BID OPENING: March 27, 2014

The bid documents dated March 3rd, 2014 for the above referenced project are amended by this addendum.

NOTICE: This Addendum is issued to all interested prospective bidders as an amendment to the project manual or other parts of the bidding (contract) documents for the above named project. Reference to this Addendum must be included in the Bid proposal. The information contained herein shall be fully incorporated into the contract documents as though originally included therein.

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## QUESTIONS REGARDING THE A/V DRAWINGS AND SPECIFICATIONS:

### Item #2-1 – QUESTIONS.

1. QUESTION: Where will UNL provide the Meyer Speakers to (i.e.: Roof Top, truck Dock, or top level of speaker cluster)?

   RESPONSE: At the truck Dock

2. QUESTION: In the East Stadium there is speakers in the restroom of the suites in a hard drywall, are those to be removed as part of this project or what is the intent (would need to patch and paint if removed)?

   RESPONSE: Speakers in the suite itself are to be replaced. Existing suite restroom speakers, where applicable, will remain and be reconnected into the new amplifier zone of that particular suite.

3. QUESTION: There are 2 gang plates with a volume control and switch at/near the same location as the CP for these suites; is the existing rough in acceptable to be reused for this project?

   RESPONSE: Yes, acceptable.

4. QUESTION: On the AV Sheet AV6.21 and AV6.22 are the Audio and Control cables intended to be run free air from the enclosure to each speaker?

   RESPONSE: Yes, with the proper supports that meet NEC codes. They must be supported and may not just lay on the floor. Conduit for routing of low-voltage cabling from the center speaker enclosure and side array enclosures are be detailed in this Addendum.

5. QUESTION: The Following is from 1.4 Item C on page 3 of spec:
   *C. As noted throughout this specification section the Meyer Sound products will be owner furnished as previously bid as section 27 41 16.10. Engineering and the installation of this equipment is the responsibility of this contractor. This includes all loudspeakers, structural rigging design, DSP software configuration and its deployment, and testing and commissioning*

*of the system.*
I believe it is the intent for the Meyer DSP Configuration and its deployment and testing and commissioning is to be performed by the Meyer Speaker Supplier and the contractor as part of this bid is preforming the same for all non-Meyer equipment and the physical installation of the Meyer (Owner Supplied Equipment). Can you please verify/clarify?

RESPONSE: This is incorrect. The installing contractor of this section 27 41 16 is responsible for installation of the Meyer loudspeakers, structural rigging design, DSP software configuration (including Meyer) and its deployment, and testing and commissioning of the Meyer system components. The equipment purchase, section 27 41 16.10, does require the provider of the Meyer Sound products to review the rigging and installation documentation, to assist with the testing and commissioning, and handle warranty of the Meyer products, but the final responsibility for system operation rests on the contractor for section 27 41 16. The Meyer Sound equipment provider will have nothing to do with the systems or installation other than as applies directly to the Meyer Sound products.

**MODIFICATIONS TO THE PROJECT MANUAL:**

**Item #2-2 – SECTION 27 14 16 AUDIO SYSTEMS**

Section 27 14 16 is re-issued its entirety, see attached.

**MODIFICATIONS TO THE DRAWINGS:**

**Item #2-3 – DRAWING NO. AV0.00 – General Notes and Legends**

Sheet AV0.00 is re-issued in its entirety, see attached.

**Item #2-4 – DRAWING NO. AV1.W6B – West Level 600 Floor Plan – Section B**

Sheet AV1.W6B is re-issued in its entirety, see attached.

**Item #2-5 – DRAWING NO. AV5.02 – Scoreboard Plan Views**

Sheet AV5.02 is re-issued in its entirety, see attached.

**Item #2-6 – DRAWING NO. AV6.10 – Control Room Functional**

Sheet AV6.10 is re-issued in its entirety, see attached.

**Item #2-7 – DRAWING NO. AV6.40 – Network Functional**

Sheet AV6.40 is re-issued in its entirety, see attached.

**Item #2-8 – DRAWING NO. AV6.41 – DSP Concept Functional**

Sheet AV6.41 is re-issued in its entirety, see attached.

**ATTACHMENTS:** **SPECIFICATIONS: 27 14 16 AUDIO SYSTEMS**
**DRAWINGS: AV0.00, AV1.W6B, AV5.02, AV6.10, AV6.40, AV6.41**

END OF ADDENDUM NO. 2

UNL Project No.: 10420
TCEP Project No.: 018-210-14
HNTB Project No.: 61274

## SECTION 27 41 16 – AUDIO SYSTEMS

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Coordination, provision, installation, observation, testing, instruction, and warranties of a high quality Sound System.

B. All materials, equipment, transport and labor necessary to accomplish this and have a complete and working system.

C. Each of the following:
1. Required licenses and permits including payment of charges and fees.
2. Verification of dimensions and conditions at the job site.
3. Provision of submittal information.
4. Installation in accordance with the contract documents, manufacturer's recommendations, applicable codes and authority having jurisdiction.
5. Documented sound system tests and adjustments.
6. Instruction of operating personnel.
7. Provision of manuals.
8. Maintenance services and warranty.

### 1.2 REFERENCES

A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:
1. National Electric Code (NEC).
2. National Electrical Manufacturer’s Association (NEMA).
3. American National Safety Institute (ANSI).
4. Underwriters Laboratories (UL).
5. American Society of Testing and Materials (ASTM).
6. Electronics Industries Association (E.I.A).
7. Davis and Davis, Sound System Engineering (3rd Edition), Howard W. Sams, 2006.
8. Giddings, Audio System - Design and Installation, (ASDI) Howard W. Sams, 1990.
9. ANSI/TIA/EIA-568-A-Commercial Building Telecommunications Cabling Standard. (October 1995).
10. Building Industry Consulting Service International (BICSI).
11. ANSI S4.48-1992.
12. Airline Transportation Association (ATA).

### 1.3 RESPONSIBILITY AND RELATED WORK

A. Electrical



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1. Power is provided for this work at locations shown on the electrical riser diagram and or other drawings/information in electrical drawings and specifications. Power will be terminated to an outlet near the equipment enclosure or above each powered loudspeaker or array. Reference the electrical drawings and documents for additional information. The audio contractor shall be responsible for distribution of each electrical circuit from these outlets to the equipment devices or powered loudspeakers as required. Each circuit is to have separate neutral and ground conductors. The power for this equipment is served from the emergency power system to support emergency messaging in the event of a power failure.
2. A ground point will be provided in each equipment room or enclosure electrical panel. The contractor shall be responsible for connecting ground point to all equipment in accordance with NEC Code, local codes and standards specified herein. Isolated ground system is not required for this work.
3. The contractor shall be responsible for all conduit and raceway required for the installation of the system. All conduits and raceway to be installed in accordance with NEC, local codes and standards specified herein.
4. The contractor shall be responsible for fire-stopping building penetrations associated with this Work. Fire-stopping to be installed in accordance with NEC, local codes and standards specified herein.
5. Existing electrical service within the audio control room and existing amplifier rooms is to be reused and routed into new equipment locations as required. New circuits required to support additional load of any new equipment will be provided.
6. Any existing power sequencing system will be abandoned. Existing panel boards may be reused if size is adequate for new system and quantity of breakers required with new breakers being provided by this contractor. All low-voltage control boards and activation switches are to be removed.
7. Paint newly installed conduit that is exposed to public view. Color to match surrounding surfaces.

B. Structural
1. The contractor shall be responsible for design and structural engineering for all loudspeaker bracketing and attachment points required to attach the loudspeakers to the building or scoreboard structure at position shown within the drawings. Reference structural design documents for addition information regarding scoreboard structure. This contractor is responsible for reviewing field conditions affecting this work for the portions of the building and scoreboard that currently exist.
2. Where required, the contractor shall be responsible for the use of x-ray, ground penetrating radar, or metal detectors as appropriate for identifying concrete reinforcing elements and tensioning tendons within the concrete prior to any required core drilling. Any penetration into the concrete for attachment of loudspeaker bracketing is to be as shallow as possible and must avoid reinforcing elements or tensioning tendons.

## 1.4 SYSTEM DESCRIPTION AND REQUIREMENTS

A. The following is intended to provide an overview of the design concepts and is not an exhaustive description of the Sound System. Contractor to verify field conditions as they pertain to the renovation of the audio system. Cabling that is planned to be reused throughout the



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facility has been noted as existing in the design documents. Any cable not listed as existing in the documents is assumed to be new and part of this Work.

B. The removal of all existing equipment is part of this Work. This includes all loudspeakers associated with the existing scoreboard loudspeaker system; including the North scoreboard speakers, amplification equipment and processing, abandoned cabling, and control room equipment not being reused. Disposal of equipment is to be part of this work and documentation to certify that this equipment was disposed of properly is required. Where applicable, the existing equipment racks may be reused if desired in their current location or removed if not needed. Any rack not being reused is to be removed or filled with blank panels to facilitate proper cooling of adjacent racks.

C. As noted throughout this specification section the Meyer Sound products will be owner furnished as previously bid as section 27 41 16.10. Engineering and the installation of this Meyer Sound equipment is the responsibility of this contractor under section 27 41 16. This includes installation of all loudspeakers, structural rigging design, DSP software configuration and its deployment, and testing and commissioning of the Meyer Sound products and system. Reference 27 41 16.10 for additional information on the involvement of the Meyer Sound product provider during installation and commissioning of the Meyer Sound products.

D. Proposal price is to include the removal, storage and reinstallation of all ceiling tiles affected by this Work. For this work, plan for a minimum of 25% of the ceiling tiles being removed, stored and re-installed. Replacement tiles for those broken or damaged by this work must be approved for use by the Owner and procurement is the responsibility of this contractor.

E. The Audio System components will communicate electronically by means of an IEEE 802.3 Ethernet compliant Local Area Network (“LAN”). An IEEE 802.3 Ethernet compliant LAN for audio system communication will be integrated as part of building network. The LAN will consist of managed network edge and core switches provided by the owner to the audio contractor for installation. Coordination of VLAN’s, IP Addresses, and other network protocol requirements with the owner and network contractor is part of this work.

F. The LAN cabling infrastructure (“Structured Cabling”) horizontal cabling is provided to each edge device, such as amplifiers, digital audio signal processors, computers, and other intelligent remote devices by cabling specified as part of this Work. The backbone fiber optic cabling from the audio equipment room and each amplifier rack location not currently existing is also part of this work.

G. The audio control room is located in the press box on level 6 and will house the mixing console along with program sources and patch panels. In addition, other signal processing units, a portion of the digital audio processing system and the system control computer user station will be operated from the audio control room. The control computer CPU’s and associated network switches will be located in the equipment room and operated from the audio control position through a KVM switching system. A new AES compatible patch panel system will be installed for connection of field cabling and all other control room interconnects. Existing connection panels and cabling at the playing field are to be reused and will provide for direct connection to the system through multiple input receptacles and tielines. Existing connection panels and cabling throughout the press box area and feeds to other destinations such as clubs, ticket



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offices, and elsewhere are intended to be reused with the current functionality being maintained. Any new and existing audio tielines from the playing field, video replay room, broadcast connections in the truck dock, and other areas will terminate to the new patch panel system in the audio control room racks. The console will be configured to send and receive multiple stereo pairs of digital AES audio signals routed to and from the video replay system in the HuskerVision control room. All newly installed microphone and line level cabling will meet AES/EBU digital audio performance standards.

H. The digital audio processing system provides audio signal processing and signal routing and then feeds AES digital audio signals and/or network digital audio to the audio system equipment throughout the facility. The system will take analog audio signals from various source equipment and auxiliary inputs on the patch panels and convert them to digital audio for distribution throughout the building. An analog backup signal will simultaneously be routed over separate cabling to the equipment feeding loudspeakers in the main seating bowl and in the event of a catastrophic network failure this backup signal will be automatically activated by digital audio processers in each amplifier room.

I. Crowd noise and band microphones will be implemented as part of the work and distributed throughout the stadium by the digital audio processor and provide crowd noise and band signals to interior spaces within the stadium. New microphones will be provided for this purpose and will be temporary being setup for each game. Dedicated inputs to the DSP system will route these signals to interior spaces and also will feed the band signal to the East Upper Deck array only.

J. Existing amplifier racks are located throughout the stadium. These amplifier racks house existing QSC CX series amplifiers which will be reused and remain connected to the Q-sys system as currently configured. They will also be used to house the new amplifiers and signal processing for the primary bowl loudspeaker system and other various loudspeakers throughout the stadium. Each room is intended to provide the amplification for the speakers in that portion of the facility. Signals for the digital audio processors will be supplied from the QSC Q-sys network QLAN digital feed and will then connect directly to each amplifier as QSC dataport audio feed. Each amplifier will have control interface built in and will provide control and monitoring of each amplifier from the audio control room as noted above. For additional inputs or outputs needed within a given amplifier room, the networked digital audio processing system may be used for signal distribution in conjunction with the appropriate input/output expansion device.

K. An analog backup signal from the audio control room will be distributed to both the main and redundant digital audio processor feeding all stadium loudspeaker zones. Each backup input will be setup to automatically switch to the analog backup signal in the event of failure or interruption of the digital feed or if the digital feed loses sync.

L. As an aid to the fire alarm system, the main seating bowl will receive warning signals and announcements from the main fire command center. Security page stations also exist around the stadium and will be connected into the renovated system maintaining their current functionality. Field verify current conditions as these connections exist and are intended to be reused upon testing. If existing cabling is found faulty, the contractor is to notify the general contractor immediately and provide a price to install new cabling and any electronic components



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needed to implement the connections into the new processing system. The audio signal for this emergency override condition will insert into both the digital audio processing system and provide signal to the digital audio distribution and analog backup feeds. The emergency audio signal will be automatically routed to the system whether the standard digital audio transport or the analog backup is engaged. The switch over to the fire alarm signal will be by a contact closure received from the fire system connected to the digital audio processing system. During an emergency with the fire alarm, all systems shall play the emergency messaging. Assign interior zones to mute in emergency mode or play the notification audio as directed by the owner.

M. The seating bowl loudspeaker system will be an endzone style system with self-powered loudspeakers located in the renovated scoreboard. A variety of smaller loudspeakers will mount to the underside of the scoreboard and along the North railing above the suites to provide additional coverage to areas that may be shadowed from the main loudspeakers. New delay speakers will be added to the far North end of both the East and West mid-level deck to replace the existing speaker at this location. The delay speakers located under this mid-level deck will be reused along with the amplifier currently powering these circuits. All rigging and attachment hardware, structural engineering, conduit and cabling to installed these loudspeakers will be part of this work.

N. Assistive Listening System: A new wireless RF hearing assistance system will be provided for the seating bowl. The system is to operate on a coordinated frequency to provide interference free operation with other existing systems and will operate on an FCC approved frequency. The transmitter will be mounted in a weather-tight enclosure located on the west roof and remotely powered for the West amplifier room. Line level audio will also be fed from the West amplifier room.

O. Press Announcer System: This system is currently in place and operative. New digital signal processing for this area will be implemented as part of this work. Existing QSC I/O devices are to be reused. Any feeds to or from this system must be maintained.

P. Concourse Concessions Systems: This system is currently in place and operative. New digital signal processing for this area will be implemented as part of this work. Existing QSC I/O devices are to be reused. Any feeds to this system must be maintained.

Q. Restroom Speakers: This system is currently in place and operative. New digital signal processing for this area will be implemented as part of this work. Existing QSC I/O devices are to be reused. Any feeds to this system must be maintained.

R. Entrance Gate Speakers: This system is currently in place and operative. This system is currently standalone and any feeds to this system must be maintained.

S. Private Suites: Some existing suites currently have dedicated ceiling speakers that carry signal as selected from the audio control room. This system renovation will include new processing, amplification and speakers for each of the 101 suites. Existing speakers and volume controls are to be removed. Each suite will also have a local audio input feeding the DSP system to allow use of portable audio devices such as on iPod or iPad. Each suite will be controlled by a newly installed QSC wall-mounted touchscreen panel. This panel will control both the audio

system and the TV's in each suite through network communication with the Cisco StadiumVision system provided under separate contract. Coordination with the Cisco StadiumVision contractor and the owner is a requirement of this contract. Installation of the network cable feeding data and power to each suite touch panel will be installed by the University's IT contractor and will be routed to the nearest IDF. When PA is selected the signal must be delayed to synchronize with the sound from the main bowl loudspeakers. Audio source program selections will be PA, Aux for control room patch panel, radio, local audio input and Cisco StadiumVision audio specific for that suite. The StadiumVision audio program when selected in to match the channel selection of only one of the TV's in each suite as directed by the owner. An engraved lamacoid label to identify which TV is provide the TV audio for each suite is part of this work. This label must be sized to allow it to be read from the touchscreen control panel and color to be coordinated with the owner.

T. Club Systems: This system is currently in place and operative. New digital signal processing for this area will be implemented as part of this work. Existing QSC I/O devices are to be reused. Any feeds to or from this system must be maintained.

U. Interview Rooms: This system is currently in place and operative. This system is currently standalone and any feeds to this system must be maintained.

V. Players Entrance: New processing, amplification, and loudspeakers will be added under the North stands for cover the players tunnel walk from the locker room exit to the field. Audio program source for this new zone will be selected in the audio control room. Amplification will be located in the existing North amplifier room on the 400 level.

## 1.5 QUALITY ASSURANCE

A. The Sound System Contractor shall be experienced in the provision of systems similar in complexity to those required for this project and meet the following requirements:
   1. The primary business of contractor shall be the installation of sound and video systems.
   2. No less than five years experience with equipment and systems of the specified types.
   3. Demonstrate experience with at least two projects of this type comparable scale within the last three years involving large scale reinforcement audio systems.
   4. Be a franchised dealer and service facility for the major products furnished.
   5. Maintain a fully staffed and equipped service facility with full time field technicians. It is recommended that the installation team members have following NICET or National Systems Contractors Association (NSCA) certifications.
      a. Project Manager: NICET Level III or R-ESI Integrator Certification.
      b. Field Supervisor: NICET Level II or C-EST Technician Certification.
      c. Crew Lead: NICET Level I or C-SI Installer Certification.
   6. At the request of the Owner, the Contractor shall demonstrate that he has:
      a. Adequate plant and equipment to complete the work.
      b. Adequate staff with commensurate technical experience.

B. Any other contractor who intends to bid this work as the prime contractor and does not meet the required qualifications shall employ the services of a single "Sound System Contractor" who

does meet the requirements noted above and is approved by the Owner. This "Sound System Contractor" shall:

1. Furnish the equipment.
2. Shop fabricate the equipment racks and subassemblies.
3. Make audio, speaker and control connections to equipment racks, each piece of equipment, and connection panels.
4. Continuously supervise the installation and connections of cable and equipment.

C. Work shall be in compliance with the applicable standards listed above and all governing codes and regulations of the authorities having jurisdiction and the Contract Documents.
   1. Drawings and specification requirements shall govern where they exceed Code and Regulation requirements.
   2. Where requirements between governing Codes and Regulations vary, the more restrictive provision shall apply.
   3. Nothing in the Contract Documents shall be construed as authority or permission to disregard or violate legal requirements.

D. Contractor to maintain a local office in Lincoln, Nebraska to provide warranty service and presence at games as noted elsewhere in this specification. It is acceptable to sub-contact this portion of the work given the sub-contractor is involved in the installation and has adequate knowledge of the systems involved to make repairs or programming edits as needed.

E. Coordinate exact location and installation of equipment, power, conduit, and raceway systems with the Owner.

## 1.6 SUBMITTALS

A. Comply with the general terms and conditions–Project Submittal Procedures.

B. Supplementary submittal requirements:
   1. Complete schedule of submittals.
   2. Chronological schedule of Work in bar chart form.
   3. Provide a list of and manufacturer’s data sheet on product to be incorporated within the Work. Organize data sheets in specification order.
      a. Upload to project FTP site in PDF format.
      b. Separate major product or specification grouping within separate folders. Each group to be bound as a single or packaged PDF file.
   4. Functional diagrams and description of all parts of the system installation.
   5. Shop Drawings:
      a. Schematic: Detailed wiring diagrams showing interconnection of components and products, wiring and cabling diagrams depicting cable types and cable designators, and device designators. Provide connector designations and terminal strip identification, along with color codes for cables connecting to these devices. Give each component a unique designator and use this designator consistently throughout the project.
   6. Coordination Drawings:



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a. Prepare and submit a set of coordination drawings showing major elements, components, and devices of the sound system in relationship with other building components. Prepare drawings to an accurate scale of 1/8”=1’-0” or larger on suitable sized media.
b. Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all equipment. Indicate locations where space is limited, and where sequencing and coordination of installations is of importance to the efficient flow of the work including but not necessarily limited to the following:
    1) Equipment housings
    2) Ceiling and wall mounted devices
    3) Raceways
    4) Cabling

7. Equipment housing: Location of equipment in racks, consoles position on tables or counters. Details to include dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
8. Patch panel layouts and labeling strips, including color schemes.
9. Full fabrication details of custom enclosure and millwork indicating size, material, finish and openings required for equipment and enclosures.
10. Structural rigging and mounting details:
    a. Structural rigging and mounting details of all loudspeakers suspended from or mounted to the building structure: These drawings will identify all types of hardware, fittings and materials to be used. Detail the product manufacture, part numbers and load capacity of the hardware, fittings and materials selected. All loudspeaker structural rigging and mounting detail drawings shall be signed and sealed by a professional engineer licensed to practice in the State of Nebraska and will include a copy of the design calculations.
    b. The signed and sealed drawings noted above to include the following:
        1) Attachment method to building structure for suspended loudspeakers or mounting brackets.
        2) Any secondary steel required for attachment to the building structure.
        3) All fittings, hardware, materials, and cable used for suspended loudspeakers.
        4) All custom brackets, mounts, suspension grids or trusses and loudspeaker cabinet frames or brackets not supplied by the manufacturer of the specific loudspeaker to be mounted or suspended.
11. Fabricated Plates and Panels: Provide complete drawings on custom fabricated plates or panels. Drawings shall include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.
12. Labeling: Equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and designator schedule.
13. Schedules: Wiring schedule showing source and destination of wiring and indicating which wiring is in conduit. Junction box schedule showing type of box, size, mounting and location. Include this information with remainder of wiring diagrams.

C. Submittal format:
1. Floor plan drawings executed at an appropriate scale, not less than 1/8” = 1’-0”.
2. Detail drawings executed at an appropriate scale, not less than 3/8” = 1’-0”.



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3. Plate and panel drawings executed at an appropriate scale, not less than 1/2" = 1".
4. Rack, enclosure, and millwork detail drawings executed at an appropriate scale, not less than 1" = 1'-0".
5. Separate major grouping with labeled binder tabs.
6. Bind contents in titled three ring D style binders sized for 150 per cent of the material. Maximum size: three-inch spine. Use multiple volumes if necessary.
7. Additionally provide all submittal drawing and binder contents on finalized DVD media, FTP upload, or hardcopy as directly. Any electronic documents to be in non-proprietary Adobe PDF format.

## 1.7 PROJECT CLOSEOUT

A. Comply with the general terms and conditions–Project Closeout Procedures.

B. Supplementary Project Closeout Procedures
1. Provide all close-out documents on a finalized DVD media as well as hard copy. The DVD documents to be in non-proprietary "PDF" format.
2. Product Data: Product actually incorporated within the Work:
   a. Manufacturer's data for each type of product conforming to the submission format specified herein. Include manufacturer's serial numbers within the list of product.
   b. For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
   c. Each products Owner/Instruction Manual. Provide high quality copies where necessary, with all text legible and illustrations of equal resolution and sharpness as the original manual. Faxed copies or copies with portions of the information missing or smeared not acceptable.
   d. Manufacturer's maintenance and care instructions.
   e. Separately bound list by manufacturer and model or part number of product incorporated within the Work arranged in alphanumeric order. when applicable Manufacturer's warranty statements bound separately
3. Record drawings: Final rendition of Shop Drawings depicting what is actually incorporated within the Work.
4. Test Reports: Recorded findings of Contractor's Commissioning.
5. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
   a. Describe the operation of system capabilities.
   b. Assume the intended reader of the manual to be technically inexperienced and unfamiliar with this facility.
6. Service & Maintenance Manual:
   a. Provide an original manufacturer's copy of the service manual on every piece of equipment for which the manufacturer offers a service manual. On equipment where there is no service manual, provide statement from company indicating manual is not available. Arrange manuals in the same order as the operations manual.
   b. Manufacturer's maintenance and care instructions.



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c. Maintenance Instructions, including maintenance phone numbers and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.

7. Provide copies of all current versions of the software programs of the various system components on CDR. Include all site files for the system configuration and internal device settings.
8. Any other pertinent data generated during the Project or required for future service.
9. Segregate documents into separate bindings containing data relevant to operational, maintenance and warranty issues. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. To prevent damage or entrance of foreign matter, ship product in its original container.

B. Ship in accordance with manufacturer's recommendations.

C. Provide protective covering during construction.

D. At no expense to Owner, replace product damaged during storage or handling.

E. At no time may materials be stored in stadium rooms or on stadium concourses without prior approval of the owner. Concourses may be used for staging of materials and tools for scheduled Work in the area, but under no circumstances will materials and tools be allowed on the concourses during an Event.

## 1.9 PROJECT CONDITIONS

A. Verify conditions on the job site applicable to this work. Notify Owner's Representative in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings show cables, conduit, wiring, and arrangements of equipment fitting the space available without interference. If conditions exist at the job site which make it impossible to install work as shown, recommend solutions and submit drawings to the Owner for approval, showing how the work may be installed.

## 1.10 FINAL OBSERVATION AND TESTING

A. Upon completion of the installation and contractor commissioning as specified in Part 3, observation and testing shall be performed by the Owner and their consultant.

B. To assist the Owner, provide a minimum of one person for observation and two persons for testing who are familiar with all aspects of the system.

C. The process of testing the System may necessitate moving and adjusting certain components such as speaker aiming or transformer taps.

D. Testing includes operation of each major system and any other components deemed necessary. Provide required test equipment, tools and materials required to make necessary repairs, corrections or adjustments.

E. The following procedures will be performed on each System by the Owner and there consultant:
   1. Observation of the methods provided to incorporate the System within the facility.
   2. Verification of proper operation of all devices.
   3. Verification that the equipment has been properly adjusted, balanced, and aligned for optimum quality and meets the manufacturer's published specifications.
   4. In the event further adjustment or work becomes evident during testing, the Contractor shall continue his work until the system is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications, the Contractor shall pay for additional time and expenses of the Owner and or his representatives at the standard hourly rates in effect at that time.

1.11 WARRANTY:

A. Contractor shall warrant equipment to be free of defects in materials and workmanship for two years following the date of the University of Nebraska 2014 football game, trouble free operation, or substantial completion, whichever is later.

B. System to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics; repair or replace defects occurring in labor or materials within the Warranty period without charge.

C. Within the Warranty period, answer service calls within eight hours, and correct the problem within twenty four hours.

D. This warranty shall not void specific warranties issued by manufacturers for greater periods of time, nor shall it void any rights guaranteed to the Owner by law.

E. Installing contractor to provide Owner with the name and telephone number of the person to call for service. This information to be part of Project Record Drawings.

F. Thirty days prior to the end of the warranty period provide a complete checkout of all system components. Repair or replace any defective equipment or transducers discovered during the testing. Correct any defects in wiring or other functional problems reported by Owner. Warranty replacement and service of equipment shall not apply to Owner furnished equipment. Coordinate inspection visit with the Owner.

G. Outdoor mounted speakers shall be warranted by the manufacturer or contractor to withstand the rigors of the environment and perform to the published specifications for at least three years after date of Substantial Completion.

## 1.12 INSTRUCTION OF OWNER PERSONNEL

A. After final completion, provide sixteen (16) hours of instruction to Owner designated personnel on the operation and maintenance of the System. If any component is not operational at the time of testing or training, the vendor shall return to complete the testing or training on the component.

B. Develop instructional course based on the use of the system and manufacturer's recommendations. Arrange course so that operational and maintenance training seminars are separate.

C. Training Submittals:
   1. All Operations and Maintenance manuals, as well as as-built drawings must be on site for all sessions of training.
   2. Following discussions with Owner, formally submit a Training and Event Attendance submittal two weeks prior to first training. Submittal shall:
      a. Include a separate page/entry for every training session.
      b. Indicate date, time, and approximate length of training session.
      c. Indicate person(s) conducting training.
      d. Indicate whether training will be video recorded.
      e. Intended curriculum and most appropriate attendees (e.g. engineer, operations, IT, etc.)
      f. Include signature and title lines for:
         1) Owner acknowledging and accepting training schedule. Include both an accepted and rejected box. An alternate schedule time should be suggested by the Owner in the event the schedule is rejected.
         2) Countersigning by trainer indicating that training actually occurred.
         3) All persons attending training. Where attendees do not stay for the entire session, this should be noted on the form and initialed by Owner's representative attending training.
         4) Owner's representative attending training at the end of the session shall initial that:
            a) Training Occurred.
            b) Training Materials were provided and left with Owner
            c) Training was not interrupted or shortened by equipment or system troubleshooting. If it is, then there should be a line where Owner and Contractor can indicate when make-up training will be provided and how long it should be.
            d) Training was generally sufficient for the proposed curriculum.
      g. Include Notes section for Owner and Contractor to note any issues during training (areas requiring further development, etc.).
      h. Following training occurrence, submit completed training records no later than 5 days following end of training. When training is conducted over a period of weeks, completed training submittals shall be consolidated into a single submittal and submitted every 2 weeks.
      i. Provide all training material on DVD in Adobe PDF format.



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D. Sound system contractor shall have at least two persons present at the first SIX Events held in the bowl following substantial completion. An Event is considered a use of the bowl audio system when paid spectators occupy at least 50% of the bowl seating. The contractor shall be on site the day before the event in addition to the day of the event. These first six events must include the at least the first four University of Nebraska football games of the 2014 schedule. Contractor staff at all events must be able to make adjustments within DSP system as well as being able to troubleshoot system components.

## 1.13 TECHNICAL SYSTEMS SOFTWARE LICENSE

A. Introduction:
   1. All proprietary software provided for the Technical Systems shall be subject to this software license between the Contractor and the Owner as an essential element of the system as defined in the system specification and associated documents, drawings and agreement.
   2. Contractor shall agree that 3rd party (e.g. manufacturer's) proprietary software provided with the system shall be subject to this agreement.
   3. Contractor and owner agree that this software license is deemed to be part of, and subject to, the terms of the Agreement applicable to both parties; and shall supersede any standard manufacturer or Contractor's standard license agreement.
   4. Proprietary software shall be defined to include, but not be limited to, device and system specific software and firmware designed to run on conventional computer based operating platforms as well as all micro-processor based hardware used to program, setup, or operate the system or its components.
   5. For sake of this agreement, MS Windows® shall not be considered "proprietary" software, unless a non-public version of Windows® or any of its components are critical to the operation of the system in which case it shall be deemed proprietary.

B. License Grant and Ownership
   1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer's use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software shall mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the owner.
   2. Except as expressly set forth in this paragraph, the Contractor shall at all times own all intellectual property rights in the software. Any and all licenses, product warranties or service contracts provided by third parties in connection with any software, hardware or other software or services provided in the system shall be delivered to Owner for the sole benefit of owner.
   3. Owner may supply to Contractor or allow the Contractor to use certain proprietary information, including service marks, logos, graphics, software, documents and business information and plans that have been authored or pre-owned by Contractor. All such intellectual property shall remain the exclusive property of Owner and shall not be used by Contractor for any purposes other than those associated with delivery of the system.

C. Copies, Modification and Use
   1. Source code shall be available to owner for a period of not less than 15 years.
   2. Owner may make copies of the software for archival purposes and as required for modifications to the system. All copies and distribution of the software shall remain within the direct control of owner and its representatives.
   3. Owner may make modifications to the source code version of the software, if and only if the results of all such modifications are applied solely to the system. In no way does this Software License confer any right in owner to license, sublicense, sell, or otherwise authorize the use of the software, whether in executable form, source code or otherwise, by any third parties.
   4. All express or implied warranties relating to the software shall be deemed null and void in case of any modification to the software made by any party other than Contractor.
   5. During the life of the system (defined as a period of not less than 10 years and not more than 15 years), the Contractor shall provide software updates in accordance with all necessary support requirements to maintain the system. This shall include a commitment to provide appropriate patches, fixes, and interface updates as necessary to maintain the operability and security of the system at a level commensurate with the original system.
      a. In the event that computer and or processor hardware refinements and updates are necessary to support software updates 7 years after substantial completion, said hardware will be provided to owner at the agreed upon terms for change orders of the original contract.
      b. Labor shall be in accordance with change order rates of the original contract, as adjusted for inflation in accordance with conditions and limitations of the general contractor or U.S. Bureau of Labor Statistics' Consumer Price Index (CPI).
   6. All hardware supplied shall support software updates for a period of not less than 7 years following substantial completion.

D. Warranties and Representations
   1. Contractor represents and warrants to Owner that:
      a. It has all necessary rights and authority to execute and deliver this Software License and perform its obligations hereunder and to grant the rights granted under this Software License to owner.
      b. The goods and services provided by contractor under this Software License, including the software and all intellectual property provided hereunder, are original to Contractor or its subcontractors or partners.
      c. The software, as delivered as part of the system, will not infringe or otherwise violate the rights of any third party, or violate any applicable law, rule or regulation.
   2. Contractor further represents and warrants that, throughout the System Warranty Period, the executable object code of software and the system will perform substantially in accordance with the System Specifications and Agreement. If the software fails to perform as specified and accepted all remedies are pursuant to the policies set forth in the Specification and in the Agreement. No warranty of any type or nature is provided for the source code version of the software which is delivered as is.

E. Except as expressly stated in this Agreement, there are no warranties, express or implied, including, but not limited to, the implied warranties of fitness for a particular purpose, of merchantability, or warranty of no infringement of third party intellectual property rights.

1.14 UNIT PRICING

A. 27 41 16 – A: Provide an individual price for additional assisted listening receivers as specified within this section. Include one (1) Receiver, one (1) Battery Pack, one (1) Ear Speaker, and one (1) Neck Loop.

**PART 2 - EQUIPMENT**

2.1 ACCEPTABLE MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed as a standard of function, performance and quality.

B. Refer to Project General Conditions for equipment substitute procedure.

2.2 GENERAL

A. Product quantity is as required. If a quantity is given, Sound System Contractor shall provide at least the given amount. Some product listed under this section may not be required to fulfill the obligations of the work.

B. Equipment and materials shall be new and conform to applicable UL or ANSI provisions. Take care during installation to prevent scratches, dents, chips, etc.

C. Regardless of the length or completeness of the descriptive paragraph herein, each device shall meet published manufacturer's specifications.

D. Audio XLR type connectors not a part of manufactured equipment shall have gold plated contacts. This includes all cable mounted connectors as well as chassis mounted connectors on custom fabricated panels.

E. Remove all manufacturers' names, logos, or other symbols from speakers or other objects placed in view of the public. If logo badge does not allow for removal paint badge to match the color of the loudspeaker grill or other loudspeaker cabinet finish.

F. All loudspeaker finishes are to be factory applied. Ceiling and wall mounted speaker grilles and enclosures to match the surrounding ceiling or wall color as directed by Owner.

2.3 MICROPHONES AND ACCESSORIES

A. Wireless Microphone Receiver System (WIR):
   1. Reuse existing Telex wireless microphone system.
   2. Relocate antennas to roof.

B. Wireless Microphone Transmitter - Handheld:
   1. Reuse existing Telex wireless microphone system.

C. Wireless Microphone Transmitter for Referee - Bodypack:
   1. Reuse existing Telex wireless microphone system.

D. Crowd Microphones:
   1. Type: Electret condenser.
   2. Frequency Response: 30 Hz to 20 kHz.
   3. Polar Pattern: Cardioid.
   4. Accessories: 5/8"-27 thread-mount stand adapter and foam windscreen.
   5. Quantity: 6.
   6. Acceptable product:
      a. Audio Technica ES935C6.

E. Band Microphones:
   1. Type: Line + gradient condenser.
   2. Frequency Response: 20 Hz to 20 kHz.
   3. Polar Pattern: Shotgun.
   4. Accessories: 5/8"-27 thread-mount stand adapter and foam windscreen.
   5. Quantity: 6.
   6. Acceptable product:
      a. Audio Technica AT897.

F. Announcer Microphone – Headset:
   1. Impedance:
      a. Microphone: 200 Ω.
      b. Headphone: 64 Ω.
   2. Frequency response (microphone): 50 - 13500 Hz.
   3. Frequency response (headphones): 8 - 25000 Hz.
   4. Quantity: 1.
   5. Acceptable product:
      a. Sennheiser HMD 281 PRO.

G. Announcer's Console (ANC-INT):
   1. General Audio (Mic In-to-Main Output):
      a. Frequency Response: 10 Hz-20 kHz, ±0.2 dB.
      b. Distortion (THD+N): 0.008%, measured at 1 kHz.
      c. S/N Ratio: 86 dB, referenced to –42 dBu mic in/–2 dBu main out.
      d. Dynamic Range (A-weighted): 108 dB.
   2. Intercom Interface:
      a. Type: 2-channel, unbalanced (pin 1 common; pin 2 DC with channel 1 audio; pin 3 channel 2 audio).
      b. Compatibility: single- and dual-channel intercom systems such as from RTS™ and Clear-Com.
      c. Impedance: 10 k ohms.
      d. Nominal Receive Level: –10 dBu.
      e. Nominal Talkback Level: –10 dBu.

f. Sidetone: 0 to –18 dB, adjustable..

3. Main Output:
   a. Type: balanced, transformer-coupled.
   b. Nominal Level: –2 dBu.
   c. Maximum Level: +20 dBu into 2 k ohms.
   d. Impedance: 100 ohms.
4. Quantity: 1.
5. Acceptable product:
   a. Studio Technologies Model 230.

H. Microphone Cables
1. Each cable to be provided with heat-shrink label identifying facility name and cable length.
2. Each cable to be provided with a hook and loop tie strip to keep cable coiled. Use a different color of tie for cables of each length.
3. Color: Black.
4. Provide the following quantities:
   a. 25 foot Microphone Cable, (Quantity: 12).
   b. 50 foot Microphone Cable, (Quantity: 6).
   c. 100 foot Microphone Cable, (Quantity: 2).
5. Acceptable product:
   a. Gepco XB201M, Part # GMC20-BLACK-(length)-MFNBG.

I. Press Announcer Microphone:
1. Type: Dynamic Gooseneck.
2. Polar Pattern: Cardioid.
3. Audio Frequency Bandwidth: 150 to 15000 Hz.
4. Audio Output: Integrated Male, Balanced XLR.
5. Acceptable product:
   a. AKG DGN99E.
   b. Audio Technica U855QL.

J. Press Announcer Desk Stand:
1. Construction: Metal Base.
2. Connectors: 3-pin XLR-F in and a 3 or 5-pin XLR-M out.
3. Control: User-Programmable Switch.
4. Power Requirements: 11-52V DC phantom power.
5. Acceptable product:
   a. Audio Technica AT8666RSP.
   b. CAD Audio 40-117.

## 2.4 INPUT SOURCES

A. Compact Disc Player (CDP):
1. Outputs to be XLR type connectors capable of +4 dBm level into 600 Ohm load.
2. Player to include wired remote transport control.
3. Player to be single disc type.

4. AES/EBU Digital output capability.
5. 1-RU Rack mountable.
6. Acceptable product to include the following:
    a. Tascam CD-01U Pro.

B. AM/FM Tuner (AM/FM TUNER):
1. Tuning Range:
    a. FM: 87.5 MHz – 108.0 MHz (100 kHz steps).
    b. AM: 530 kHz – 1,720 kHz (10 kHz steps).
2. Quieting Sensitivity:
    a. Mono: 15 dBf.
    b. Stereo: 20 dBf.
3. Total Harmonic Distortion (1 kHz):
    a. Mono: 0.4%.
    b. Stereo: 0.5%.
4. Frequency Response: 30 Hz – 15 kHz, +1/ –1.5 dB.
5. Stereo Separation (1 kHz): 40 dB.
6. Signal-to-Noise Ratio:
    a. Mono: 72 dB.
    b. Stereo: 70 dB.
7. Acceptable product to include the following:
    a. Tascam TU-690.

C. Digital Playback System (DIGITAL PLAYBACK):
    a. Owner Furnished Equipment.

## 2.5 CONSOLES AND MIXERS

A. Control Booth Mixing Console (DIGITAL CONSOLE):
1. Inputs: 16 mono.
2. Outputs: 8 Mix.
3. Frequency response: +.5/-1.5dB, 20 Hz to 20 kHz with less than 0.05% THD at +4 dBm out.
4. Noise generation: at least -128 dBm (equivalent input).
5. Maximum output level: at least +30 dBu.
6. Input Module: 150 Ohm microphone or 600 Ohm line balanced input.
7. Input attenuator to provide attenuation allowing signal levels from -60 to +10 dBm without overload or distortion.
8. Provide modular input/output cards as shown on drawings.
9. Provide gooseneck console lamps for all lamp ports.
10. Provide with fitted nylon console dust cover.
11. Provide with rack mountable redundant auto-switching power supplies. Locate PSU rack beneath console counter.
12. Acceptable product to include the following:
    a. Yamaha LS9-16 Digital Mixing Console (Quantity: 1).
    b. Yamaha MY16-AE AES I/O Card (Quantity: 1).
    c. Digital Deck Covers Dust Cover, silver nylon (Quantity: 1).

d. Sony MDR7506 Headphones (Quantity: 1).

B. Microphone Preamp (MICPRE):
1. Configuration: Dual channel.
2. Switchable 48 volt phantom power.
3. Variable gain control from 0 dB to 50 dB.
4. Balanced 3-pin (XLR) connectors.
5. 1-RU Rack mountable.
6. Acceptable product to include all of the following:
a. ATI ML200.
b. ATI WA100-1 Power Supply.
c. ATI PH48-1 48VDC Phantom Power Option.
d. ATI 21075-501 Rack Kit.
e. ATI 21097-501 Filler Panel (Quantity: 2).

C. Line Amplifier (LINE AMP):
1. Configuration: Two inputs, two outputs.
2. Input: Electronically balanced with maximum input level of +18 dBv.
3. Output: Transformer balanced with maximum output level of +4 dBv into 600 Ohm load.
4. Include mounting hardware for secure mounting in rear of rack.
5. Acceptable product to include the following:
a. ATI Audio L1000-1.

D. Mono Summing Amplifier (MONO SUM):
1. Configuration: 2 input, 1 outputs with individual level adjustments.
2. Input: electronically balanced with maximum input level of +18 dBv.
3. Output: electronically balanced with maximum output level of +4 dBv into 600 Ohm load.
4. 1-RU Rack mountable.
5. Acceptable product to include:
a. ATI SUM100 for balanced inputs.
b. ATI SUM100-RCA for unbalanced inputs.

## 2.6 ANALOG SIGNAL PROCESSING

A. Equipment Room Modular Distribution Amplifier (DIST AMP):
1. Configuration: 1 input, 6 outputs with individual multi-turn front panel level controls.
2. Input: electronically balanced with maximum input level of + 20dBu.
3. Output: transformer balanced with maximum output level of +22 dBm into 600 W load.
4. Amplifier to be modular type with card frame type housing.
5. Front panel of amplifier to provide LED type meter and headphone output with selector switch to choose which channel is being monitored.
6. Provide redundant power supply.
7. Review existing control room for quantity of modules required.
8. 3-RU Rack mountable.
9. Acceptable product to include (Quantities as required):
a. ATI Audio System 10000:
1) RM100 with dual PS100 power supplies.

2) MIDA100-1 distribution amplifier modules.

B. Digital Delay (DELAY):
1. Type: solid state adjustable type, with minimum delay time of 0 - 680 milliseconds.
2. Input impedance: 600 ohm.
3. Frequency response: ±2 dB, 30 Hz to 12 kHz, less than 0.5 per cent THD, +18 dBm, 600 ohm.
4. Noise: 90 dB below maximum output.
5. Display: five digit LED
6. Acceptable product:
a. Rane AD-22b.

C. Digital Voice Processor (DIG-VOX):
1. Two (2) independently programmable channels of ultra-low latency digital microphone processing.
2. Two (2) Mic/Line inputs, two (2) Mic/Line outputs, two (2) AES3 outputs, Word Clock input.
3. Processing modules include Compression, Equalization, De-Essing, Downward Expansion, Highpass and Lowpass filters, and Voice Symmetry.
4. Configure up to 50 named presets for each announcer personality using included Windows software with control over Ethernet.
5. Recall presets with convenient front panel controls.
6. 1-RU rack mountable.
7. Acceptable product:
a. Airtools Voice Processor 2x.

D. Control Room Aux Input (iGATE-AUX):
1. Inputs:
a. 3.5mm Stereo.
b. RCA (2) Stereo.
c. ¼-inch Line, Instrument.
d. XLR Microphone pass through.
2. 1-RU rack mountable.
3. Acceptable product:
a. ProCo Sound iGate.

## 2.7 DIGITAL AUDIO DISTRIBUTION EQUIPMENT

A. AES Sample Rate Convertor Interface (SRC):
1. Supports 192 kHz with ADAT, TDIF and AES.
2. 8-Channel sample rate conversion up to 192 kHz.
3. Sample Rate Conversion can be selected for AES, TDIF or ADAT.
4. 8-Channel Sample Rate Conversion without phase errors (sub-sample synchronous).
5. SteadyClock for maximum jitter suppression and clock regeneration.
6. Complete triple format converter AES/TDIF/ADAT with added SPDIF TOSLINK I/O.
7. Direct support for Double and Quad Wire, S/MUX and S/MUX4.
8. Word clock input.

9. 1-RU Rack mountable.
10. Acceptable Product:
    a. RME ADI-192 DD.

B. Analog to Digital Converter (AD/DA):
1. Channels: 8.
2. Analog Inputs: 8, Balanced.
3. Analog Outputs: 8, Balanced.
4. Digital Inputs: 8, AES/EBU.
5. Digital Outputs: 8, AES/EBU.
6. Sample Rate: 44.1kHz to 192kHz.
7. Bit Depth: 24-bit.
8. World Clock: 1 Input, 1 Output.
9. 1-RU Rack mountable.
10. Acceptable Product:
    a. RME ADI-8 QS.

C. Work Clock Distribution (WCD):
1. Connect and sync to Word Clock or AES audio (AES pending cable length) from video replay on Level 2 West.
2. Inputs: BNC / AES with zero latency loop-through.
3. Outputs: BNC loop-through / AES loop-through.
4. 10 BNC clock outputs.
5. 3 sample rate measurement LCD modes accurate to 2ppm.
6. Universal voltage filtered mains power input.
7. Acceptable Product:
    a. Drawmer M-Clock Plus.
    b. Antelope Audio Isochrone DA.

D. USD to AES Interface (DIG-INT):
1. Interface with owner furnished Click Effects digital playback system.
2. USB Compliance: USB 1.1 or higher.
3. Sample rates: 48.0 kHz, 44.1 kHz, 32.0 kHz.
4. Bit depth: 16 bit Delta-Sigma DAC.
5. AES I/O: 110 ohms, transformer balanced.
6. S/PDIF I/O: 75 ohms, unbalanced.
7. Analog Output: Stereo, bal, Lo-Z, +24 dBu max.
8. Analog Level: +4 dBu = -15 dBfs nominal.
9. Acceptable Product:
    a. Henry Engineering USD-AES Matchbox.

E. Scoreboard Array Digital Processor (SPKR DSP):
1. Owner furnished equipment.
2. Acceptable product:
    a. Meyer Sound Galileo Callisto 616.

## 2.8 DIGITAL AUDIO SIGNAL PROCESSING COMPUTER

A. The DSP system and control software shall be operational 30 days prior to the first use of the installed system.

B. Signal processing shall be performed by computer based system. The DSP control platform is to incorporate amplifier and loudspeaker control, monitoring and configurable DSP.

C. The system shall have the following capabilities:
   1. CPU: 3.1 GHz Intel® Core i7 processor.
   2. Operating System: Microsoft Windows 7 Professional, 64-bit.
   3. Enclosure/Case: 2-RU Rack Mountable.
   4. Power supply: 400 watt.
   5. Memory: 8 GB, DDR3 1333MHz.
   6. Internal Hard Disk 1: 500 GB. 7200RPM, SATA.
   7. Internal Hard Disk 2: 500 GB. 7200RPM, SATA, fully redundant, mirrored, RAID 1.
   8. Networking: Dual 10/100/1000 Mbps.
   9. DVD+/-RW: Minimum of 16x recording speed. Include disc recording software.
   10. Video: Intel HD Graphics with VGA and DVI outputs.
   11. Keyboard/Mouse: Logitech Internet 350 USB Desktop Keyboard & Optical Mouse.
   12. Monitor: Samsung S27A650D, Matte Black, 27-inch, 1920 x 1080, HD15 and DVI.
   13. Software to be included:
      a. License all software to the Owner.
      b. Norton Antivirus.
      c. Nero 11 Platinum Edition.
   14. Warranty: Three-Year Onsite Warranty with 24/7 Phone and Next Business Day Service.
   15. Computer system shall be completely tested by manufacturer prior to delivery.
   16. Quantity: Provide TWO identically configured computers with the second setup as backup should the main CPU fail.
   17. Acceptable product:
      a. Super Logics SL-2U-LLQ67-DB (custom configured as above).

D. Large-Format Touchscreen Display:
   1. Viewable Size: 31.6-inches diagonal.
   2. Touchscreen type: Projected capacitive.
   3. Touchscreen interface: USB.
   4. Contrast ratio: 5000:1.
   5. Viewing angle: 178° H and V.
   6. Display type: LCD Active Matrix TFT.
   7. Display resolution: 1920 x 1080.
   8. Aspect ratio: 16:9.
   9. Mount: 400x200 VESA.
   10. Mount to rear wall of control room adjacent to audio equipment racks.
   11. Acceptable product to include all of the following:
      a. Planar PT3285PW.

E. Touchscreen Wall Mount:
   1. Color: Black
   2. Minimum depth: 0.79-inches.
   3. Mounting pattern pompatibility (Universal): 100 x 100mm - 445 x 400mm.

4. Orientation: Landscape.
5. Overall Dimensions (H x W x D -inches): 16.5 x 22.0 x 0.8.
6. Screen sizes: 26 - 42"
7. Wall stud compatibility: 16-inches.
8. Weight capacity: 125 lbs.
9. Acceptable product:
    a. Chief Mfg RMF-2.

F. User Station (USER STATION):
1. Monitor:
    a. Size: 24” Widescreen.
    b. Resolution: 1920 x 1200 6ms.
    c. Contrast: DCR 25,000:1 (1000:1).
    d. Inputs: D-Sub, DVI, HDMI, DisplayPort.
    e. Acceptable Product:
        1) NEC Display Solutions EA244WMi-BK.
2. Monitor Mount:
    a. Type: Wall mount.
    b. VESA: 100 x 100.
    c. Mount on side of end control room rack.
    d. Acceptable Product:
        1) Atdec TH-2250-VF Wall Mount.
3. Keyboard:
    a. 106 Normal Keys.
    b. USB Wired.
    c. Acceptable Product:
        1) Logitech 920-000914 Black.
4. Mouse:
    a. USB Wired.
    b. Laser tracking.
    c. Scroll wheel.
    d. Acceptable Product:
        1) Logitech M500.

G. KVM Matrix Frame (KVM Matrix):
1. Note: this unit shall be interconnected to the CPU’s in Rack Room 603 and workstation components and touchscreen panel in the control room.
2. Acceptable product:
    a. Avocent HMXMGR.
3. Type 1 User Stations (EXR):
    a. Avocent HMX2050.
4. Type 1 Computer Interface (EXT):
    a. Avocent HMIQHDD.

## 2.9 DIGITAL AUDIO PROCESSING (DAP) UNIT

A. Signal processing for local rack systems shall be performed by an independent DSP unit.



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B. Primary audio signal processing shall be performed by a networked system of digitally controlled processing units. Each unit shall be capable of operating independently or in groups.

C. The system shall have the following capabilities:
   1. Digital Signal Processing Unit (DAP-CORE):
   2. The audio processing unit shall be an industrial package designed for fixed installation.
   3. The unit shall include an architecture based on an integrated floating point DSP engine with internal DSP processing chips.
   4. The unit shall operate with a common digital audio bus with support for at least 64 simultaneous high-speed digital audio channels. Use this digital buss to route digital audio between DAP Units and DAP Expanders within an amplifier room or other areas.
   5. The unit shall include software-based configuration and control through a Windows-based software application, with additional tools for creating user interface clients and integration with control panel and third party control systems.
   6. Primary internal storage shall be through a solid state memory.
   7. The unit shall include modular input/output expanders for support of individual 4 channel audio cards.
   8. The unit shall be fan cooled with a front-panel exhaust and shall operate with a universal computer-grade modular power supply.
   9. The unit shall include an integrated GPIO breakout system with at least 8 configurable logic ports and 4 configurable high-current ports.
   10. Provide integration of the amplifier software for monitoring the status of each amplifier and controlling simple mute and level functions.
   11. Provide interconnection to building WIFI system to allow remote use with Apple iPad devices.
   12. Provide fully redundant DAP-CORE backup system.
   13. Acceptable product:
      a. QSC Q-Sys Core 4000.

D. DAP IPTV Core Interface (CORE-500):
   1. The unit shall include modular input/output card bay system for support of individual 4 channel audio cards.
   2. The unit shall include an architecture based on an integrated floating point DSP engine with internal DSP processing chips.
   3. The unit shall include a digital audio transport with support for at least 64 32-bit digital audio channels and 16 audio streams.
   4. The unit shall include an integrated GPIO breakout system with at least 8 configurable logic ports and 4 configurable high-current ports.
   5. Unit to support microphone or line level inputs remotely selectable through control system.
   6. Acceptable product:
      a. QSC Core-500i.

E. DAP I/O Expander (DAP-I/O):
   1. The unit shall include modular input/output card bay system for support of individual 4 channel audio cards.
   2. The unit shall include a digital audio transport with support for at least 64 32-bit digital audio channels.

3. The unit shall include an integrated GPIO breakout system with at least 8 configurable logic ports and 4 configurable high-current ports.
4. Unit to support microphone or line level inputs remotely selectable through control system.
5. Acceptable product:
   a. QSC I/O Frame.

F. DAP Digital Input/Output Card:
1. Support for 4 AES/EBU input channels.
2. Support for 4 AES/EBU output channels.
3. Card shall support software control.
4. Provide one spare unit.
5. Acceptable product:
   a. QSC CAES4.

G. DAP Analog Input Card:
1. Support for 4 Analog microphone or line level input channels.
2. Digital to analog converters shall be 24 bit.
3. Card shall support software control of analog functions including sensitivity, gain, and phantom power.
4. Euro style screw terminal connector blocks.
5. Provide one spare unit.
6. Acceptable product:
   a. QSC CIML4.

H. DAP Analog Output Card:
1. Support for 4 Analog line level output channels.
2. Digital to analog converters shall be 24 bit.
3. Card shall support software control of analog functions including gain.
4. Euro style screw terminal connector blocks.
5. Provide one spare unit.
6. Acceptable product:
   a. QSC COL4.

I. DAP Analog Output Card:
1. Support for 4 Analog line level output channels and control of two channels of amplification.
2. Digital to analog converters shall be 24 bit.
3. Card shall support software control of analog functions including gain.
4. DB15HD connector for each pair of outputs.
5. Provide one spare unit.
6. Acceptable product:
   a. QSC CODP4.

J. DSP Touchscreen Control Panel (CP):
1. 3.5-inch, 320x240 LCD with capacitive touch technology.
2. Connection: Dual RJ45, 10/100 Mbps.
3. Host control interfaces created in Q-Sys Designer.

4. Provide control over Q-Sys GPIO ports.
5. Provide control over other Ethernet or IP enabled equipment.
6. Power: IEEE 802.3AF PoE (Power over Ethernet).
7. Mounting: Flush in wall, Standard 2-Gang.
   a. In the East suites with existing 1-Gang volume controls, contractor to remove volume control and backbox, install new backbox and repair drywall. Owner to provide paint that matches wall color to the contractor.
   b. In the North suites with existing 2-Gang volume controls, contractor to remove volume control and reuse existing 2-gang enclosure. Owner to provide paint that matches wall color to the contractor for touchup as needed.
   c. In the West suites will require the installation of a new 2-Gang backbox to support the control panel installation. Owner to provide paint that matches wall color to the contractor for touchup as needed.
8. Acceptable product to include the following:
   a. QSC TSC-3 Controller.

K. Portable Wireless Control Panel:
1. Screen: 2048-by-1536-pixel resolution at 264 pixels per inch (ppi).
2. Fingerprint-resistant coating.
3. Memory: 64GB.
4. Wi-Fi: 802.11a/b/g/n.
5. Battery life: Up to 10 hours.
6. Charging: Power adapter or USB to computer system.
7. Color: Black.
8. Quantity: 1.
9. Acceptable product:
   a. Apple iPad 3rd Generation.

L. Suite DSP Control Software:
1. Provide latest version of interface software to link DSP system user computer control system.
2. Provide network analysis and configuration software to setup and control Network components.
3. Provide 12 months of on-site software upgrades from date of final acceptance.
4. This project requires that the site specific configuration of digital signal processing equipment associated with the QSC Q-sys and Cisco StadiumVision integration shall be provided by a firm specializing in the engineering, programming and commissioning of large-scale DSP systems.
   a. Acceptable Software Development Firms:
      1) K2 Audio, Boulder, Colorado. Contact: Deb Britton.
5. The software development is to be done in four phases.
   a. During the first phase, development of the general configuration and functions are to be established. Participants of the development are the Software Development Firm, this Contractor, the Owner's Representative, and the Owner. This requires multiple meetings with these principles and is an interactive and iterative process.
   b. During the second phase, the Digital Signal Processing (DSP) Software Development Firm produces the initial configuration software fulfilling the requirements developed during the first phase. This also requires multiple

meetings with the Digital Signal Processing Software Development Firm, this Contractor, the Owner's Representative, and the Owner and is an interactive and iterative process.

c. Upon completion of the second phase, install the configuration software within the DSP Systems and inspect the systems for performance compliance. During this process the Manufacturer with the assistance of this Contractor debugs the DSP System software code as required to ensure a properly functioning system. At the end of this phase, the Contractor is to provide written notification that the product is operating properly and that the functions and configurations established in Phase One and Two are working and have been properly implemented.

d. During the fourth phase, the DSP Software Development Firm, this Contractor, the Operator's Consultant, and the Owner inspect the operational aspects of the Systems and develop final software configurations. Upon completion of final configuration, this Contractor and the DSP Software Development Firm installs and debugs the final Control Systems software code as required to ensure a properly functioning system as established during the fourth phase.

6. Provide DSP support personnel on-site during the contractor commissioning and the Owner Representative testing and tuning processes. Personnel to test and observe the functioning of the digital signal processing system. Should problems exist, personnel to remain and assist contractor in correcting the malfunctions until system is functioning properly and be present for final observation and testing.

M. Suite Audio System DSP Software Setup:

1. Provide site specific configuration of the DSP software for all systems as shown within the drawings.
2. Coordinate user interface, software functionality, and menu screens with Operator's Consultant.
3. Provide ongoing software upgrades and maintenance for 12 months from date of final acceptance.
4. Software to be configured for the following systems:
   a. Independent selection if input source program audio:
      1) Local audio input.
      2) Main PA Feed.
      3) Radio.
      4) Aux patch from audio control.
      5) TV audio from IPTV system.
         a) Local TV program audio will be specific to the channel on one TV in each suite. Coordinate which TV will provide the audio in each suite with the owner.
   b. Independent volume control:
      1) Source audio program.
      2) Master volume.
      3) Provide preset volume level for each input at selection of program source.
   c. IPTV Controlled Televisions:
      1) Control each TV independently.
      2) Power On/Off.
      3) Channel Up/Down.
      4) Channel preset selection (ESPN, ESPNU, ABC, NBC, etc.).

5) Provide HDMI input selection for one TV within suite. Coordinate which TV with the owner.

N. Audio System DSP Control Software:
1. Provide latest version of interface software to link DSP system user computer control system.
2. Provide network analysis and configuration software to setup and control Network components.
3. Provide 12 months of on-site software upgrades from date of final acceptance.
4. This project requires that the site specific configuration of digital signal processing equipment and shall be provided by the firm providing the DSP system(s).
5. The software development is to be done in four phases.
   a. During the first phase, development of the general configuration and functions are to be established. Participants of the development are the Software Development Firm, this Contractor, the Owner's Representative, and the Owner. This requires multiple meetings with these principles and is an interactive and iterative process.
   b. During the second phase, the Digital Signal Processing (DSP) Software Development Firm produces the initial configuration software fulfilling the requirements developed during the first phase. This also requires multiple meetings with the Digital Signal Processing Software Development Firm, this Contractor, the Owner's Representative, and the Owner and is an interactive and iterative process.
   c. Upon completion of the second phase, install the configuration software within the DSP Systems and inspect the systems for performance compliance. During this process the Manufacturer with the assistance of this Contractor debugs the DSP System software code as required to ensure a properly functioning system. At the end of this phase, the Contractor is to provide written notification that the product is operating properly and that the functions and configurations established in Phase One and Two are working and have been properly implemented.
   d. During the fourth phase, the DSP Software Development Firm, this Contractor, the Operator's Consultant, and the Owner inspect the operational aspects of the Systems and develop final software configurations. Upon completion of final configuration, this Contractor and the DSP Software Development Firm installs and debugs the final Control Systems software code as required to ensure a properly functioning system as established during the fourth phase.

O. Audio System DSP Software Setup:
1. Provide site specific configuration of the DSP software for all systems as shown within the drawings.
2. Coordinate user interface, software functionality, and menu screens with Operator's Consultant.
3. Provide ongoing software upgrades and maintenance for 12 months from date of final acceptance.
4. System to provide for delivery of football related announcements, music and video accompaniment and associated programming to spectators in the seats.
5. System to permit individual spectral and temporal adjustment of similar speaker groups.
6. Software to be configured for the following systems:
7. Seating Bowl:

a. Main Seating Bowl:
   1) Provide equalization, delay, routing and limiting for main arrays, HF long throw speakers, fill speakers, and underbalcony delay speakers.
   2) Provide loudspeaker processing configuration for testing and tuning as follows:
      a) Individual output control.
      b) Group output by speaker type and stadium quadrant.
      c) Group output by speaker type.
   3) Provide override interface for fire alarm audio announcements to the main bowl. Upon the completion of alarm override, system to revert to previous operating mode and configuration.
   4) Provide for preset system configurations for the various type of events.
b. Concourse System:
   1) Maintain features in current programming.
c. Restroom System:
   1) Maintain features in current programming.
d. Pressbox System:
   1) Maintain features in current programming.
e. Clubs:
   1) Maintain features in current programming.
f. Suites:
   1) Each suite will have an independent audio system control and each will have an integrated touch-screen control panel within the suite for system control and source selection.
   2) Control of audio reinforcement of signals from local inputs.
   3) When the local source(s) are not in use, the system will be able to receive and select other building wide sources including PA, Radio play-by-play, Local TV source, or a patchable feed located within the PA Sound booth.
   4) Control panel will control both the audio system and the TV's in each suite through network communication with the Cisco StadiumVision system provided under separate contract.
g. Players Entrance Tunnel:
   1) System to provide for delivery of pregame football music and associated programming.
   2) System to permit spectral and temporal adjustment.
h. Priority Page:
   1) To supplement the building fire alarm, the seating bowl system shall be able to accept an audio and control signal from the alarm system and other security paging locations.
   2) Upon activation of the control signal, the system shall switch from the normal audio program to the special audio signal provided by the alarm system.
   3) The sound system to remain in this state until the control signal is restored to its normal state by building security or fire personnel.
   4) While in the priority mode, an indicator on the audio control room control screens should provide a distinctive indication that normal programming has been overridden.



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P. Software Control Screens:
1. Provide control screens for both the User Station and the wall mounted 32-inch touch control screen.
2. Each screen to be logically arranged for a minimum of confusion. The basic graphical appearance should remain the same for all screens. Consistent terminology should be employed throughout. Utilize color backgrounds and other techniques to group similar functions. Include bitmap graphical elements where it will provide enhanced clarity. Screen functions described below may be combined when doing so will not create confusion or complexity.
3. Main Seating Bowl System:
   a. Provide GUI floor plan or map style display of the seating for the following:
      1) Muting of main system by areas.
      2) Visual level monitors for each typical speaker type.
   b. Provide for saving and recalling of four stored configurations.
4. Concourse Concessions System:
   a. Maintain control capabilities of current programming.
5. Restroom System:
   a. Maintain control capabilities of current programming.
6. Pressbox System:
   a. Maintain control capabilities of current programming.
7. Security:
   a. Provide supervisor or higher password protection to all configuration screens not intended to be manipulated by regular operators.
   b. Each normal user to have distinct password for logging of system usage.

## 2.10 AMPLIFIERS

A. Power Amplifiers:
1. Two channel power amplifier with the EIA standard RS-490 power rating at 1% THD into 70-Volt and 100-Volt constant voltage load or 8 ohm load as applicable.
2. Provide protection of circuit components in the event of input over-drive, output overload, or short circuits.
3. Frequency response: ±1 dB, 20 Hz to 20 kHz with less than 1 per cent THD at rated output.
4. Input impedance: 10 kohm balanced.
5. Output regulation: 2 dB from no load to full load conditions.
6. Noise generation: at least 85 dB below rated output with input shorted.
7. Provide one spare Type 2 amplifier.
8. Acceptable products:
   a. Type 1:
      1) QSC PL340.
   b. Type 2:
      1) QSC PL380.
   c. Type 3:
      1) QSC CX602V.
   d. Type 4:
      1) QSC CX108V.

## 2.11 AMPLIFIER CONTROL SYSTEM

A. The amplifier system and control software shall be operational 30 days prior to the first use of the installed system.

B. Signal processing shall be performed by computer based system. The amplifier control platform is to incorporate amplifier and loudspeaker control, processing and monitoring.

C. This contractor is responsible for installing and integrating the Meyer Sound RMS remote monitoring system. This includes the physical installation of the equipment as well as the programming and configuration to have a fully operable system.

D. Provide amplifier control screens for both the User Station and the wall mounted 32-inch touch control screen. Allow each to display either the QSC control or the Meyer Sound RMS monitoring screens.

E. Amplifier Control Software:
   1. Provide latest version of interface software to link amplifier control system user computer control system.
   2. Provide network analysis and configuration software to setup and control network components.
   3. Provide 12 months of on-site software upgrades from date of final acceptance.
   4. The software development is to be done in four phases.
      a. During the first phase, development of the general configuration and functions are to be established. Participants of the development are the amplifier manufacturer, this Contractor, the Owner's Representative, and the Owner. This requires multiple meetings with these principles and is an interactive and iterative process.
      b. During the second phase, the amplifier Software Development Firm produces the initial configuration software fulfilling the requirements developed during the first phase. This also requires multiple meetings with this Contractor, the Owner's Representative, and the Owner and is an interactive and iterative process.
      c. Upon completion of the second phase, install the configuration software within the amplifier system and inspect the systems for performance compliance. During this process the Contractor and hardware manufacturer debugs the system software code as required to ensure a properly functioning system. At the end of this phase, the Contractor is to provide written notification that the product is operating properly and that the functions and configurations established in Phase One and Two are working and have been properly implemented.
      d. During the fourth phase, the amplifier manufacturer, this Contractor, the Owner's Representative, and the Owner inspect the operational aspects of the Systems and develop final software configurations. Upon completion of final configuration, this Contractor and the Software Development Firm installs and debugs the final Control Systems software code as required to ensure a properly functioning system as established during the fourth phase.
   5. Provide Software Development Firm personnel on-site for a minimum of five days during the contractor commissioning and the Owner Representative testing and tuning processes. Personnel to test and observe the functioning of the digital signal processing system. Should problems exist, personnel to remain and assist contractor in correcting

the malfunctions until system is functioning properly and be present for final observation and testing.

F. Control System Makeup:
1. Type 1 through Type 4 amplifiers shall be under computer control.
2. Control System shall use a Windows 7 based software system.
3. Graphical displays and menu screens to maintain a consistent user interface.
4. Screen selections shall be implemented by mouse pointer or keyboard.
5. System shall be implemented from control computer described above.
6. Control System shall communicate with other components via non-proprietary communication protocol. Provide all necessary repeaters, signal conditioners, format converters, etc. needed to connect the audio control room with the amplifier rooms. Data cable not to be run with audio cables.
7. Control System software shall include password protection for multiple user levels.

G. Control System Setup Functions:
1. Amplifier setup and adjustment.
2. Each amplifier shall be individually adjustable and adjustable in preprogrammed groups from control screen on computer. When used in groups, amplifiers shall maintain their own relative gain levels.
3. Controls shall include volume up/down in 1/2 dB increments and provide mute on/off, power, signal polarity, and peak voltage limiting.
4. System shall permit both channels to be linked for common operation or separated for individual adjustment.
5. Provide ability to include user provided amplifier labels for identifying which unit is being controlled.
6. System shall provide for power on and power off of amplifiers.
7. Amplifier control screens shall include graphical indications of input and output levels, power status, reserve headroom and thermal conditions of amplifier.
8. System shall have easy access to pre-set amplifier configurations.
9. Each amplifier to be able to retain its current gain settings in the event of power outage or loss of communication with the control computer.

H. Other system Capabilities:
1. Amplifier diagnostics and error reporting.
2. Control system shall monitor operating parameters of each amplifier.
3. System shall alert operator when an amplifier or group of amplifiers is clipping or overheating.
4. System to indicate the relative impedance of the speaker line and alert the operator when the load on the amplifier has changed significantly.
5. Provide user adjustability for amplifier alert by permitting operator to set degree of clipping or overheating before generating an alert.
6. Provide user selection on how alerts and errors are indicated, including any combination of: log file, printer, visual indicator, or audible indicator.

I. Visual system monitoring:
1. Provide for multiple bar graph displays of amplifier outputs on system monitor.
2. Size of graph and quantity displayed to be determined by operator.



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3. Each graph shall indicate amplifier level in dB and include user provided label for describing amplifier function.
4. Graph shall also include information on amplifier clipping, reserve headroom, polarity, and mute status.
5. Provide integration of monitoring into DAP software platform.

J. System shall remain fully operable if one or more amplifiers ceases operation or goes off line.

K. System shall remain fully operable if the control system goes off line.

L. Acceptable product will include:
1. QSC Q-sys Control Software.
2. Owner furnished equipment: Meyer Sound RMS remote monitoring system.

## 2.12 ETHERNET NETWORK AND INTERCONNECT

A. Network Overview:
1. Provision of CISCO Ethernet switch hardware and configuration is by the owner. Installation and initial configuration of network equipment will be by this contractor.
2. This contractor to provide all fiber and copper based patch cords required for the operation of this system.
3. The Ethernet network will be a 1,000 Mb based structured cabling system to link the DSP Computers in the Audio Control Room to the Digital to Analog Converters in the Amplifier Rooms.
4. This Contractor is to employ or retain a Cisco Certified Network Associate (CCNA) to provide for the setup and commissioning of network including, but not limited to, VLAN's, QoS, and layer 3 routing. This Contractor is to employ or retain a Cisco Certified Entry Networking Technician (CCENT) onsite during system commissioning and setup to accommodate adjustments and fine-tuning of the network infrastructure and equipment.

B. Ethernet Network Switch:
1. Owner furnished equipment:
a. Cisco 3850 Series.

C. Rack Mount Fiber Interconnect Center:
1. Provided for termination of all active and spare fiber strands.
2. Unit to have sliding tray for access to adapters and connectors.
3. Unit to rack mount.
4. Unit to have front labeling panel for cable identification.
5. 1-RU rack mountable.
6. Provide quantity as needed for fiber counts in each rack.
7. Acceptable product to include the following:
a. Siemon FCP3-RACK rack frame.
b. Siemon RIC-F-SC6-01 SC Adapter Plates.

D. LC Fiber Patch Cords:
1. Type: Single-mode patch cable.

2. Connector: LC Duplex – LC Duplex - UPC.
3. Fiber: Single-mode.
4. Length: 2m.
5. Acceptable Product:
   a. Belden AX200507.
   b. Wirewerks PC-1ELCBLCB002.

E. RJ-45 Patch Cords:
1. ~~Provided for interconnecting Ethernet segments within equipment racks.~~Provide for all connections between the owner provided switches, RJ-45 patch panels, and equipment within this specification requiring an Ethernet connection.
2. Cables to be factory made with flexible boot over connector.
~~3. Provide an assortment of cable jacket colors to aid in wire tracing. Provide equal quantities of red, green, blue and yellow jacketed cables.~~Provide blue jacketed cables.
~~4.~~3. Cables to be rated Category 6.
~~5.~~4. Acceptable product:
   a. Belden ~~C6F11(XX)(XXX)~~CA211060(XX).
   b. Siemon ~~M6A-(XX)-(XX)~~MC6-(XX)-06.
   c. Uniprise UNC6-BL-(X)FT.

F. RJ-45 Patch Panels:
1. Provide for all AV and audio related Ethernet connections between the owner provided switches and equipment within this specification requiring an Ethernet connection.
2. Ports: 48.
3. ANSI/TIA Category: 6.
4. Current Rating: 1.5A.
5. 2-RU Rack mountable.
6. Acceptable Product:
   a. Uniprise UNP610-48P.

## 2.13 POWER CONDITIONING

A. Power Protection (SURGE):
1. Provide surge protection device to maintain clean power to the following equipment:
   a. DSP analog to digital converters.
   b. Fiber Transport system components.
   c. All UPS systems.
2. Acceptable products:
   a. New Frontier Electronics Surge-X SX-1120RT.

B. Backup Power (UPS):
1. Provide UPS systems to maintain power to all computer CPU's and associated video monitors.
2. Provide UPS system for all Digital Audio Signal Processing (DAP) units.
3. UPS's shall be on-line style with sufficient battery reserve to operate for 15 minutes. Size each UPS unit for 25% additional capacity.
4. 2-RU Rack mountable.

5. Acceptable product:
   a. APC Smart-UPS 2200 Series SUA2200RM2U.
   b. Juice Goose XVRT-2200.
   c. Surge-X UPS-2000-OL (Note: Surge noted above note needed.).

C. Rack Power Strip (POWER DIST):
1. 20 Amp/2400 Watt rating.
2. Front panel AC voltmeter.
3. Spike and surge suppression with over-voltage shutdown
4. 1-U Rack Mountable.
5. Acceptable product:
   a. Furman PM-Pro Series II.

## 2.14 LOUDSPEAKERS

A. Type 1 Speaker – Suite:
1. Configuration: 6-inch coaxial or 2-way.
2. Coverage pattern: 100° conical.
3. Sensitivity: 90 dB at 1W/1M.
4. Frequency operating range: 80 Hz to 20 kHz.
5. Transformer: Internal 60 Watt, 70.7 Volt.
6. Provide all necessary grilles, backcans, mounting hardware, brackets, and tile supports.
7. Paint grille to match surrounding surfaces at the direction of the Owner.
8. Acceptable product:
   a. EAW CIS400.
   b. JBL Control 26CT.
   c. Tannoy CVS6.
   d. Community D6.

B. Type 2 Speaker – Player's Tunnel:
1. Configuration: Two way cabinet with rotatable HF horn.
2. HF: 1.4-inch exit, 3-inch diaphragm compression driver.
3. LF: 12-inch low frequency driver.
4. Coverage pattern: 90° x 90°.
5. Sensitivity: 97 dB at 1W/1M.
6. Frequency operating range: 70 Hz to 20 kHz.
7. Nominal impedance: 8 ohms.
8. Crossover: Internal passive crossover.
9. Provide factory Light Gray finish on speaker and bracket to match RAL7035 color standard.
10. Provide all necessary mounting hardware, brackets, supports and any secondary steel required to attach to concrete structure overhead.
11. Provide with safety cable.
12. Provide liquid-tight gland nut fitting to seal cable entrance to cabinet.
13. Acceptable product:
    a. EAW MK2399-WP.
    b. JBL AM5212/00-WRX.

C. Type 3 Speaker – South Concourse Concessions:
   1. Configuration: Two way cabinet.
   2. HF: 1-inch exit compression driver.
   3. LF: 8-inch low frequency driver.
   4. Coverage pattern, minimum: 90° x 40°.
   5. Sensitivity: 90 dB at 1W/1M.
   6. Frequency operating range: 70 Hz to 15 kHz.
   7. Crossover: Internal passive crossover.
   8. 70V Transformer Tap: 60W.
   9. Provide all necessary mounting hardware, brackets, supports and any secondary steel required to attach to building structure.
   10. Provide with safety cable.
   11. Provide weather resistant fitting to seal cable entrance to cabinet.
   12. Acceptable product:
      a. Community R.25-94TZ.
      b. JBL Control 29AV-1.
      c. QSC AD-S8T.

D. Type A Speaker – Array Module:
   1. Owner furnished equipment.
   2. This contractor is responsible for the installation of this product which includes physical installation, all connections and power cords, software programming, and structural rigging design. Design and provision of any secondary steel needed to attach these speakers to the scoreboard structure is part of this contract.
   3. Acceptable product:
      a. Meyer Sound MILO-60-UWP.

E. Type B Speaker – HF Long Throw:
   1. Owner furnished equipment.
   2. This contractor is responsible for the installation of this product which includes physical installation, all connections and power cords, software programming, and structural rigging design. Design and provision of any secondary steel needed to attach these speakers to the scoreboard structure is part of this contract.
   3. Acceptable product:
      a. Meyer Sound SB3F.

F. Type C Speaker – North Corner Fill:
   1. Owner furnished equipment.
   2. This contractor is responsible for the installation of this product which includes physical installation, all connections and power cords, software programming, and structural rigging design. Design and provision of any secondary steel needed to attach these speakers to the scoreboard structure is part of this contract.
   3. Acceptable product:
      a. Meyer Sound MSL-4-UWP-RMS.

G. Type D Speaker – Under Scoreboard:
   1. Configuration: Two way cabinet with rotatable HF horn.
   2. HF: 1-inch exit, 38mm diaphragm compression driver.

3. LF: 8-inch low frequency driver.
4. Coverage pattern: 90° x 60°.
5. Sensitivity: 95 dB at 1W/1M.
6. Frequency operating range: 70 Hz to 20 kHz.
7. Nominal impedance: 8 ohms.
8. Crossover: Internal passive crossover.
9. Provide factory Light Gray finish on speaker and bracket to match RAL7035 color standard.
10. Mount in horizontal configuration with HF horn rotated to provide 90° horizontal coverage.
11. Provide all necessary mounting hardware, brackets, supports and any secondary steel required to attach to building structure.
12. Provide with safety cable.
13. Provide liquid-tight gland nut fitting to seal cable entrance to cabinet.
14. Acceptable product:
    a. EAW MK8196-PL-WP.
    b. JBL AC18/95-H-WRX.

H. Type E Speaker – North Railing above Suites:
1. Configuration: Two way cabinet with rotatable HF horn.
2. HF: 1-inch exit, 38mm diaphragm compression driver.
3. LF: 8-inch low frequency driver.
4. Coverage pattern: 90° x 60°.
5. Sensitivity: 95 dB at 1W/1M.
6. Frequency operating range: 70 Hz to 20 kHz.
7. Nominal impedance: 8 ohms.
8. Crossover: Internal passive crossover.
9. Provide factory finish on speaker and bracket to match Nebraska Red RAL color as directed by the Owner.
10. Mount in horizontal configuration with HF horn rotated to provide 90° horizontal coverage.
11. Provide all necessary mounting hardware, brackets, supports and any secondary steel required to attach to structural railing.
12. Provide with safety cable.
13. Provide liquid-tight gland nut fitting to seal cable entrance to cabinet.
14. Acceptable product:
    a. EAW MK8196-PL-WP.
    b. JBL AC18/95-H-WRX.

I. Type F Speaker – Balcony Fill:
1. Configuration: Two way cabinet with rotatable HF horn.
2. HF: 1.4-inch exit, 3-inch diaphragm compression driver.
3. LF: 12-inch low frequency driver.
4. Coverage pattern: 90° x 90°.
5. Sensitivity: 97 dB at 1W/1M.
6. Frequency operating range: 70 Hz to 20 kHz.
    a.
7. Impedance: 8 ohms.
8. Crossover: Internal passive crossover.



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9. Provide factory Light Gray finish on speaker and bracket to match RAL7035 color standard.
10. Mount in horizontal configuration with HF horn rotated to provide 90° horizontal coverage.
11. Provide all necessary mounting hardware, brackets, supports and any secondary steel required to attach to building structure.
12. Provide with safety cable.
13. Provide liquid-tight gland nut fitting to seal cable entrance to cabinet.
14. Acceptable product:
    a. EAW MK2399-WP.
    b. JBL CSAW211-GRAY.

## 2.15 SPEAKER HARDWARE AND SUPPORT STRUCTURE

A. Provide a modular loudspeaker hardware system as required to mount and suspend speakers in the arrangement as shown on the Drawings.

B. Attachment system to be supplied by vendor whose primary specialty is fabricating support systems for loudspeakers or similar devices over an audience.

C. Provide safety cable on all bracket mounted loudspeakers.

D. Provide auxiliary support steel and hardware required to attach to building structure and design members to have a minimum safety factor of at least 7:1. Reference architectural and structural documentation for details on structural elements.

E. All wire rope used for loudspeaker suspension to have a minimum safety factor of 10:1.

F. Fabricate all components from powder coated aluminum for maximum resistance to corrosion.

G. Contractor is responsible for painting any welds associated with this Work. This includes bracket attachment points and welds required to attach bracketing to building structure, scoreboards or poles.

H. Acceptable manufacturer:
    1. ATM Flyware / Allen Products.
    2. Whirlwind Metal Fabrication (U-Brackets Only).
    3. Custom Engineered by Contractor (reference submittal requirements for additional information).
    4. Meyer Sound: Owner furnished equipment. Reference specification 27 41 16.10.

I. Shoulder Type Machinery Eye Bolts:
    1. Forged Steel – Shoulder, Quenched and Tempered.
    2. Fatigue rated at 1-1/2 times the Working Load Limit at 20,000 cycles.
    3. Product to meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements.
    4. Select size of product based working load limits required.
    5. Acceptable product:

a. Crosby Group S-279 / M-279 Series.
b. Chicago Hardware Company 261 Series.

J. Forged Eye Nuts:
1. Forged Steel – Quenched and Tempered.
2. Tapped with standard UNC class 2 threads after galvanizing.
3. Product to meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements.
4. Select size of product based working load limits required.
5. Acceptable product:
a. Crosby Group G-400 Series.
b. Chicago Hardware Company 167 Series.

K. Anchor Shackles:
1. Forged - Quenched and Tempered, with alloy pin.
2. Working Load Limit permanently shown on every shackle.
3. Hot Dip galvanized or Self-Colored.
4. Product to meet the performance requirements of Federal Specification RR-C-271D Type IVA, Grade A, Class1.
5. Select size of product based working load limits required.
6. Provide all screw pin type shackles with mouse wire.
7. Acceptable product:
a. Crosby Group G-209 / S-209 Series Screw Pin.
b. Chicago Hardware Company 201 Series.

L. Turnbuckles:
1. Acceptable turnbuckle assembly combinations include: Eye and Eye, Jaw and Jaw, Jaw and Eye.
2. End fittings are Quenched and Tempered, bodies heat treated by normalizing.
3. Hot Dip galvanized.
4. Product to meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements.
5. Product to meet the performance requirements of Federal Specifications FF-T-791b, Type 1 Form 1 - CLASS 4, and ASTM F-1145.
6. Select size of product based working load limits required.
7. All end fittings to be moused to the body with mousing cable.
8. Acceptable product:
a. Eye and Eye:
1) Crosby Group HG-226 Series.
2) Chicago Hardware Company 012/013 Series.
b. Jaw and Eye:
1) Crosby Group HG-227 Series.
2) Chicago Hardware Company 026 Series.
c. Jaw and Jaw:
1) Crosby Group HG-228 Series.
2) Chicago Hardware Company 030/031 Series.

M. Swivel Hoist Ring:

1. All components are Alloy Steel - Quenched and Tempered.
2. Rated at 100% of Working Load Limit at 90° angle.
3. 360 swivel and 180 pivot action.
4. Product to meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements.
5. Bolt specification to be Grade 8 Alloy socket head cap screw to ASTM A 574.
6. Fatigue rated at 1-1/2 times the Working Load Limit at 20,000 cycles.
7. Zinc Plated (Yellow Chromate) finish for increased corrosion protection.
8. Select size of product based working load limits required.
9. Acceptable product:
    a. Crosby Group HR-125.
    b. Chicago Hardware Company 860 Series.

N. Wire Rope Thimble:
1. Product to meet the performance requirements of Federal Specification FF-T-276b Type II.
2. Hot Dip galvanized.
3. Select size of product based wire rope size required for suspended load.
4. Acceptable product:
    a. Crosby Group G-411 Series.
    b. Chicago Hardware Company 224/225 Series

O. Wire Rope:
1. Strands: 7 x 19 Utility Cable.
2. Type: Galvanized.
3. Select size of product based working load limits required.
4. Acceptable product:
    a. Wire Rope Corporation of America (WRCA).

P. Wire Rope Sleeves:
1. Type: Copper Duplex.
2. Select size of product based wire rope size required for suspended load.
3. Acceptable product:
    a. Wire Rope Corporation of America (WRCA) SW-740 Series.

## 2.16 HEARING ASSISTANCE SYSTEM

A. General:
1. Purpose: provide radio frequency transmission of locally selected audio program to patrons in seating bowl and other areas with wireless receiver.
2. Coordinate frequencies of transmitters with other users in the area to avoid conflicts.
3. For seating bowl, mount antenna outside to provide coverage to all seats.

B. Transmitter (ALT):
1. Configuration: Single-channel.
2. Frequency: 216 MHz or 72-76 MHz.
3. Audio Input: Balanced, microphone or line level, 3-pin XLR.

4. Provide power supply.
5. Acceptable product to include the following:
    a. Listen Option:
        1) Listen LT-800-216.
        2) IDEC PSR5-C12 12VDC Power Supply.
    b. Williams Sound Option:
        1) Williams PPA-T45.
        2) IDEC PSR5-C24 24VDC Power Supply.

C. ALT Bowl Antenna:
1. Acceptable product to include:
    a. Listen Option:
        1) Listen LA-107 Ground Plane Antenna Kit.
    b. Williams Sound Option:
        1) Williams ANT-005 Coaxial Antenna.

D. Receivers:
1. Configuration: Single channel.
2. Frequency: 216 MHz.
3. Frequency agile to adjust various systems.
4. Include NiMH rechargeable batteries for each unit.
5. Include 12 spare battery packs.
6. Receivers to be frequency adjustable for use in all venues.
7. Include an individual price for University to purchase additional receivers.
8. Acceptable product to include the following:
    a. Listen Option:
        1) Listen LR-400-216 (Quantity: 24).
        2) Listen LA-362 (Quantity: 24).
    b. Williams Sound Option:
        1) Williams PPA-R38 (Quantity: 24).
        2) Williams BAT-026 (Quantity: 48).

E. Charger/Case:
1. Charger for 8 or 12 receivers.
2. Locking hard-sided case.
3. Acceptable product:
    a. Listen Option:
        1) Listen LA-321 (Quantity: 3).
    b. Williams Sound Option:
        1) Williams CHG-3512-PRO (Quantity: 2).

F. Headsets:
1. Provide the following list of items.
    a. Listen Option:
        1) Listen LA-161 Ear Bud (Quantity: 32).
        2) Listen LA-164 Ear Speaker (Quantity: 8).
        3) Listen LA-165 Headset (Quantity: 8).
        4) Listen LA-166 Neck Loop (Quantity: 8).

b. Williams Sound Option:
   1) Williams EAR-014 Ear Bud (Quantity: 32).
   2) Williams EAR-008 Ear Speaker (Quantity: 8).
   3) Williams HED-021 Headset (Quantity: 8).
   4) Williams NKL-001 Neck Loop (Quantity: 8).

## 2.17 MISCELLANEOUS EQUIPMENT

A. Audio Equipment Racks:
   1. Existing racks may be reused.
   2. Type: Frame and panel with locking rear door.
   3. Size: 32-inches deep with 44 units of vertical space.
   4. Construction: Factory assembled 16-gauge cold-rolled steel frames with all corners welded.
   5. Black enameled finish.
   6. Provide all necessary side panels, trim pieces, tops, and blank panels.
   7. Provide Middle Atlantic VBK-W27-W32 Vent Blocker kit(s) and configure for proper airflow and cooling of rack.
   8. Acceptable product:
      a. Middle Atlantic Products WRK series.

B. Scoreboard Environmental Equipment Rack (EE-SBD):
   1. UL Listed NEMA Certified Type 3R.
   2. Material: .125" thick aluminum alloy type 5052-H32 rigid construction or 304 Stainless Steel.
   3. Size: Minimum 20-inches deep and 24 units of vertical space.
   4. Provide with 19” interior rack mount frame.
   5. Provide with front and rear locking door assemblies.
   6. Provide all necessary side panels, trim pieces, tops, and blank panels for each rack.
   7. Provide with Air Conditioner sized to proper equipment cooling.
   8. Provide with Heater Option sized to maintain minimum temperature required by fiber optic connectors and equipment.
   9. Acceptable product to include:
      a. APX NEMA 3R Rack Mount Enclosure.
      b. Bulloch Fabricating TV-RP Enclosure.

C. Control Room Source Equipment Rack:
   1. Type: Desktop.
   2. Size: 8 units of vertical space.
   3. Construction: Laminate covered MDF.
   4. Finish: Black.
   5. Provide all necessary trim pieces and blank panels.
   6. Locate on front counter to the right of mixing console to house CDP(s), Power Dist., iGate-Aux and (1) 2-RU Drawer.
   7. Acceptable product:
      a. Middle Atlantic Products DT8PS.



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D. Rack Fan(s):
   1. 10” or (4) 4.5”, 115V.
   2. Include mounting panel as required by selected rack configuration.
   3. Include cord and hardware.
   4. Acceptable products:
      a. Middle Atlantic FAN10 with GUARD-10.

E. Fan Thermostat Control:
   1. Switched 15A duplex outlet.
   2. Temperature Range: 50 – 90 Degrees F°.
   3. On and Stand-by LED indicators.
   4. Integral mounting ears.
   5. Provide for each rack and fan assembly.
   6. Acceptable product:
      a. Middle Atlantic FC-4-1C.

F. Rack Temperature Display:
   1. Provide one display in top front panel space of each rack grouping, existing or new.
   2. Connect over temperature contact closure to the DSP GPIO to provide high temperature warnings to the control room DSP control screens.
   3. Decora mount in 1-RU rack panel.
   4. Digital readout in Fehrenheit or Celsius.
   5. Acceptable products:
      a. Middle Atlantic TEMP-DEC with DECP-1X1 Panel.

G. Rack Blanks:
   1. Flanged, aluminum panel.
   2. Blank anodized finish.
   3. Provide where shown on drawings.
   4. Acceptable product:
      a. Middle Atlantic BL series.

H. Cable Entry Rack Blank:
   1. Provide above and below network switches with front cable access.
   2. 1-RU or 2-RU with Brush Cable Entry.
   3. Acceptable products:
      a. Middle Atlantic BR series.

I. Rack Drawer:
   1. Drawer provided where shown on drawings.
   2. Drawer depth to be 14.5 inches.
   3. Acceptable product:
      a. Middle Atlantic D series.

J. Wireless Microphone Drawer:
   1. Provide two drawers in audio control room racks.
   2. Cold rolled 16 gauge steel construction with Black powder coated finish.
   3. Fully enclosed drawer & spring-loaded latches.

4. Heavy-duty smooth glide drawer slides.
5. Lock knock-out, lock and key included.
6. 3-RU size drawer with wireless foam nest.
7. Nest stores 4 wireless microphones, body packs, headsets, and accessories.
8. Body pack and microphone storage area lined with polyethylene foam with tricot covered plywood dividers.
9. Foam storage compartment with cut-outs to hold up to 16 AA batteries.
10. Accessory compartment to hold larger items and head-worn microphones.
11. Acceptable products:
    a. Gator Cases GE-WIRELESSDRWR.

K. Copper Bus Bars:
1. Material: Solid copper, 1/8 thick and 2-inches wide with threaded 10/32 holes.
2. Height: 70-inch for 40-RU or larger racks and 21-inch for racks under 40-RU.
3. Wire each circuit ground to bus bar and isolated outlet ground.
4. Terminate two #6 wires between rack and buss bar.
5. Provide with nylon isolation mounts.
6. Provide one bus bar in each rack.
7. Acceptable product:
    a. Middle Atlantic BB-40.
    b. Middle Atlantic BB-12.

L. Patch Panel – 48 Point:
1. Provide the quantity of patch panels to accommodate all patch points as shown within these documents.
2. Identification strips to be printed labels of different color for each major connector grouping. Use a combination of colored fonts on white background and black fonts on colored backgrounds. Manufacture colored insert markers are also acceptable to identify normalling and signal types.
3. Non-terminated inputs to be shorted through normalling contacts on rear panel.
4. Type: Longframe, two rows of 24 jacks.
5. Termination: 18-28 AWG stranded, oversize split cylinder capable of two wires per terminal.
6. Labeling: Standard label strips and color-coded, numbering required for each terminal.
7. Normals: Sleeve Normals out.
8. Tool: Provide one tool and tip to Arena Operator.
9. Labeling: Circuit designation strip and title block.
10. 2-U Rack Mountable.
11. Quantity: 10.
12. Acceptable product:
    a. AVP AP-A224E2-L-ST-RPT.
    b. Switchcraft MTP48K3SNOX.

M. Patch Cords:
1. Patch Cords to be 2, 3 and 4 feet long.
2. Provide different color cords for each cable length.
3. Provide patch cord holder for unused cords.
4. Provide all patch cords from single manufacturer.

5. Provide the following:
   a. 24” Patchcable; Black (Quantity: 24).
   b. 36” Patchcable; Red (Quantity: 36).
   c. 48” Patchcable; Green (Quantity: 12).
6. Acceptable product:
   a. AVP BPC-(Length)-DAT Series.
   b. Switchcraft TT(Length)-(Color) Series.

N. Patch Cable Holder:
1. Provide in audio control room.
2. Mount to wall or side of rack at direction of Owner.
   a. Pamona 4408 patch cord holder (Quantity: 3).

O. Transformers:
1. Line Input and Bridging: Jensen JT-11SSP-6M.
2. Line Isolation: Jensen JT-11SSP-6M.
3. Microphone Bridging: Jensen JT-MB-C.
4. Microphone Matching: Jensen JT-MB-C.
5. Unbal-Bal: Jensen JT-10KD-B.

P. Speaker to Line Transformer (TX70A):
1. Matches a 100, 70 or 25 volt speaker line to any unbalanced line level audio input.
2. Trimmer adjusts output level for various input voltage/power levels.
3. Frequency response: 20 Hz to 20 kHz (+/- 0.5 dB).
4. THD: < 0.05% (1 kHz).
5. Locate at equipment being driven.
6. Acceptable product:
   a. RDL TX-70A

Q. Wire Duct
1. Purpose: Signal wire routing for interior surface mount applications.
2. Acceptable product:
   a. Wiremold Series 4000.

R. Power Supply:
1. Provided for lamp illumination and relay operation.
2. Type: 24-volt DC regulated.
3. Current rating: 2.5 amps.
4. Acceptable products:
   a. FSR DC-24R-2.5.
   b. Lambda LOS-X-24.
   c. Power-Mate EMA-18/24CC.

S. Receptacles:
1. Accepted product:
   a. Type XLR-3M:
      1) Neutrik NC3MD-L-B-1.
      2) Switchcraft E3MSCBAU.

3) Amphenol AC3MMDZB-AU.

b. Type XLR-3F:
1) Neutrik NC3FD-L-B-1.
2) Switchcraft E3FBAU.
3) Amphenol AC3FDZB-AU.

c. Type XLR-5M:
1) Neutrik NC5MD-L-B-1.
2) Switchcraft E5MSCBAU.
3) Amphenol AC5MDZB-AU.

d. Type 1/4" Phone:
1) Neutrik NJ3FP6-C.
2) Switchcraft E111BL.

e. Type SPEAKON:
1) Neutrik NL4MP.
2) Switchcraft HPCP410F.
3) Amphenol SP-4-MD.

f. Type 1/4" Speaker:
1) Neutrik NJ3FP6-C.
2) Switchcraft E111L.

g. Type BNC:
1) Neutrik NBB75DFI.
2) Switchcraft EHBNC2RB.
3) Amphenol AC-BNC-PJ-75B.

h. Type NCJ:
1) Neutrik NCJ6FI-S.
2) Amphenol ACJC6S.

i. Type RCA:
1) Neutrik NF2D-2 (Right) and NF2D-9 (Left).
2) Switchcraft BPJJ02AUX (Right) and BPJJ04AUX (Left).
3) Amphenol ACJD-RED (Right) and ACJD-WHT (Left).

j. Type Ethernet:
1) Neutrik Ethercon CAT-6 NE8FDY-C6-B.

k. Type Fiber Optic Field Panel:
1) Neutrik OpticalCon NO2-4FD.

T. Plugs:
1. Accepted product:

a. Type XLR-3MP:
1) Neutrik NC3MX-B.
2) Switchcraft AAA3MBAUZ.
3) Amphenol AX3MB-AU.

b. Type XLR-3FP:
1) Neutrik NC3FX-B.
2) Switchcraft AAA3FBAUZ.
3) Amphenol AX3FB-AU.

c. Type XLR-5MP:
1) Neutrik NC5MX-B.
2) Switchcraft AAA5MBAUZ.



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3) Amphenol AX5MB-AU.

d. Type XLR-5FP:
   1) Neutrik NC5FX-B.
   2) Switchcraft AAA5FBAUZ.
   3) Amphenol AX5FB-AU.

e. Type XLR-3MP Right Angle:
   1) Neutrik NC3MRX-B.
   2) Switchcraft R3MBAUZ.
   3) Amphenol AC3MMR.

f. Type XLR-3FP Right Angle:
   1) Neutrik NC3FRX-B.
   2) Switchcraft R3FBAUZ.
   3) Amphenol AC3FR.

g. Type TRS:
   1) Neutrik NP3X-B.
   2) Amphenol TS3P.

h. Type 1/4":
   1) Neutrik NP2X-B.
   2) Amphenol TM2P.

i. Type RCA:
   1) Neutrik NF2C-B/2.
   2) Switchcraft 3502ABAU.
   3) Amphenol ACPR-S(XX).

j. Type Speakon:
   1) Neutrik NL4FC.
   2) Switchcraft HPCC4F.
   3) Amphenol SP-4-F.

k. Type BNC:
   1) Kings. Verify part number with cable selected.
   2) Trompeter. Verify part number with cable selected.
   3) Amphenol. Verify part number with cable selected.

l. Type BNC for Word Clock using VHD2000M cable:
   1) Kings 2065-2-9.
   2) ADC BNC-1.
   3) Gepco BNC-XL-2.

m. Type BNC for Word Clock using VHD1100 cable:
   1) Kings 2065-8-9.
   2) ADC BNC-25.

U. Logic Relay
   1. Configuration: DPDT contacts.
   2. Control from switch, button, or logic circuits.
   3. Operate from 24 VDC
   4. Acceptable product manufacturers:
      a. Magnecraft.
      b. Potter Brumfield.
      c. Radio Design Labs.

V. Solid-State Relay (SSR):
1. Configuration: 2 audio inputs, 1 audio output.
2. Silent audio switching.
3. Control from switch, button, or logic circuits.
4. Operate from 24 VDC.
5. Acceptable product manufacturers:
   a. Line Level: Radio Labs ST-SSR1.
   b. Microphone Level: Audio-Technica AT8684.

W. Relays and Contactors:
1. Relays operating at low voltages to be sealed and include transient suppression devices in parallel with each coil to prevent any relay bounce.
2. Mount contactors and relays for AC power in a NEMA 1 enclosure unless otherwise specified.
3. Number all relay sockets in rack and on the Record Documents.
4. Acceptable products:
   a. Microphone level audio: Potter & Brumfield KHS17D13-24V.
   b. Power contactor for line level equipment: Square D LLO series for 20 A circuits and Square D SMO for 30 A circuits.
   c. Line level & DC routing relay: Potter and Brumfield R10E1-Z2V700.
   d. Speaker level: Soundolier RLM 24 with RPM series chassis modules.

X. Interconnect Panel:
1. Provide one assembly in control room rack.
2. Connectors:
   a. Four XLR Female.
   b. Four XLR Male.
   c. Two TRS Female.
   d. Two RCA.
3. Panel to be isolated from the rack steel.
4. Provide with cable tie bar and label strip.
5. 1-RU rack mountable.
6. Acceptable product to include the following:
   a. AVP
      1) WK-U112E1-Z Panel.
      2) UNX330 XLR-F (Quantity: 4).
      3) UNY330 XLR-M (Quantity: 4).
      4) USPJ TRS (Quantity: 2).
      5) URCA-RD RCA Red (Quantity: 1).
      6) URCA-WH RCA White (Quantity: 1).
   b. Switchcraft
      1) QGPK1B440 Panel.
      2) E3FSCBAUPKG XLR-F (Quantity: 4).
      3) E3MSCBAUPKG XLR-M (Quantity: 4).
      4) E112BLBPKG TRS (Quantity: 2).
      5) EHRCA2BPKG RCA (Quantity: 2).
      6) ECP4PKG Blank (Quantity: 1).



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Y. Truck Dock Panel:
1. Provide one assembly in control room rack.
2. Connectors:
   a. Twelve XLR Female.
   b. Twelve XLR Male.
3. Panel to be isolated from the rack steel.
4. Provide with cable tie bar and label strip.
5. 1-RU rack mountable.
6. Acceptable product to include the following:
   a. AVP
      1) WK-U216E2-Z Panel.
      2) UNX330 XLR-F (Quantity: 12).
      3) UNY330 XLR-M (Quantity: 12).
      4) UCP Blank (Quantity: 8).
   b. Switchcraft
      1) QGPK3B440 Panel.
      2) E3FSCBAUPKG XLR-F (Quantity: 12).
      3) E3MSCBAUPKG XLR-M (Quantity: 12).
      4) ECP4PKG Blank (Quantity: 8).

Z. Home Radio Panel:
1. Provide one assembly in control room rack.
2. Connectors:
   a. Eight XLR Female.
   b. Eight XLR Male.
3. Panel to be isolated from the rack steel.
4. Provide with cable tie bar and label strip.
5. 1-RU rack mountable.
6. Acceptable product to include the following:
   a. AVP
      1) WK-U216E2-Z Panel.
      2) UNX330 XLR-F (Quantity: 8).
      3) UNY330 XLR-M (Quantity: 8).
      4) UCP Blank (Quantity: 16).
   b. Switchcraft
      1) QGPK3B440 Panel.
      2) E3FSCBAUPKG XLR-F (Quantity: 8).
      3) E3MSCBAUPKG XLR-M (Quantity: 8).
      4) ECP4PKG Blank (Quantity: 16).

AA. Suite Input Panel (IP):
1. Input Connectors:
   a. One 3.5mm stereo jack.
   b. Two RCA jacks.
2. Isolated with bridging transformers.
3. 2-Gang Wall Plate.
4. Color: Brushed Silver Aluminum.



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5. Custom wire stereo/mono switch to always it be in mono no matter switch position. Use left output as for mono signal feed to system.
6. Acceptable product:
   a. ProCo Sound iPlate.

## 2.18 PLATES AND PANELS

A. Provide plates and panels and as described in Drawings. Engrave as shown on Drawings. Other Plates and Panels may be required to satisfy the requirements of the Work.

B. Custom panels shall be 1/8 inch thick aluminum, standard EIA sizes, brushed black anodized finish unless otherwise noted. Brush in direction of aluminum grain only.

C. Plate finish shall be coordinated with the Owner. Plastic plates are not acceptable.

D. Panel, plate and label engraving shall be 1/8 inch block sans serif characters unless noted otherwise. On dark panels or pushbuttons, letters shall be white; on stainless steel or brushed natural aluminum pushbuttons, letters shall be black.

E. Acceptable Manufacturers for Plates and Panels:
   1. Proco Sound.
   2. Whirlwind USA.
   3. RCI Custom.

## 2.19 CABLES & WIRING

A. All electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper, and meet appropriate ratings (e.g. CMR, CMP, etc.).

B. Cable shall carry appropriate fire rating (e.g. CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.

C. Where cables are routed through cable tray, provide tray rated cable of equal specification.

D. Where speaker cables are run exposed through a return air plenum, provide plenum rated cable of equal specification.

E. Shielded cables located in raceways shall have aluminum foil shield with drain wire.

F. The Belden cables listed below are approved for use on this project and are listed to set the acceptable standard of performance. Cables from Commscope, Gepco, and West Penn are also acceptable provided they meet the performance specifications of the approved listed cables. If field conditions or actual cable pathway requires tray or plenum cable, provide version of cable that meets required NEC rating. Conduit pathways and raceways shown on the AV drawings have been calculated for appropriate fill based on the diameter and area of the



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cables listed below. Contractor to verify adequate conduit capacity for alternate cables selected from Commscope, Gepco, and West Penn.

G. Install all conduit, raceway and cabling in accordance with NEC code requirements.

H. Provide the following:
1. Bowl Loudspeaker Cables (Type D, E, and F):
   a. Rack Room Terminals to Junction Box Terminals near loudspeaker, non-plenum: Belden 5000UP - 12 gauge twisted pair, jacketed.
   b. Junction box terminals near loudspeaker to loudspeaker: General Cable-Carrol Brand #02724, 12 gauge, 2-conductor, SOOW rubber jacketed, twisted. Distance not to exceed 6 feet.
   c. 70V Zones: Belden 5000UP - 12 gauge twisted pair, jacketed. Provide Belden 6000UE in plenum spaces.
2. 70.7 Volt Loudspeaker Cables:
   a. Rack Room Terminals to Speakers: Belden 5000UP - 12 gauge twisted pair, jacketed. Provide Belden 6000UE in plenum spaces.
   b. Speaker to Speaker Cabling: Belden 5100UE - 14 gauge twisted pair, jacketed. Provide Belden 6100UE in plenum spaces.
3. Other Loudspeaker Cables:
   a. Amplifier to Rack Room Terminals: Belden 5000UP - 12 gauge twisted pair, jacketed.
4. Microphone Level Cable: Belden 1800B - Single Pair twisted, 24 gauge, shielded, jacketed with gray jacket. Conductor to conductor cable capacitance to be less than 12 pF/ft.
5. Line Level Cable: Belden 1800B - Single Pair twisted, 24 gauge, shielded, jacketed with violet jacket. Conductor to conductor cable capacitance to be less than 12 pF/ft.
6. Multipair Audio Cable (Microphone and Line Level): Belden 18(**)F (03)(05)(06)(50)(52)(54) Series – 24 gauge, individually shielded, individually jacketed with overall jacket. Conductor to conductor cable capacitance to be less than 12 pF/ft. Provide with required number of pair for selected application. Note: May be used in lieu of Belden 1800B for microphone and line level applications where multiple cables are routing and terminating to the same destination.
7. Control Cables: Belden 53(**)FE (00)(01)(02)(03)(04)(06)(07) Series - 18 gauge with overall shield and appropriate number of conductors.
8. Ethernet Cable: Category ~~5e~~6, Belden ~~1212F~~DataTwist 4800 non-bonded UTP - 4 pair, ~~enhanced~~ category ~~5e~~6. Provide ~~Belden 1213F~~CMP version in plenum spaces. Provide with blue jacket.
9. Wireless Microphone Antenna Cable: Belden 8214 – RG8/U Type, 11 gauge stranded center conductor, 95% braided shield.
10. Assisted Listening System Cable: Belden 8214 – RG8/U Type, 11 gauge stranded center conductor, 95% braided shield.
11. Precision Video Coax Cable: Belden 1505A – RG59/U, 20 gauge solid center conductor, 100% foil shield and 95% braided shield.
12. Word Clock: Gepco VHD2000M, Extra-flexible Digital Coax. This cable is for use within control room between word clock distribution device and digital audio equipment.



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13. Word Clock: Gepco VHD1100, Digital Coax. This cable is for use between the video replay control room and word clock distribution device in the audio control room. Provide Gepco VHD1100TK if pathway requires plenum cable.

## PART 3 - EXECUTION

### 3.1 GENERAL

A. Coordinate work with other trades to avoid causing delays in construction schedule.

### 3.2 INSTALLATION

A. Electronic audio equipment shall be permanently mounted in equipment racks. This does not include the sound reinforcement console.

B. Equipment and materials shall be new and conform to applicable UL or ANSI provisions. Take care during installation to prevent scratches, dents, chips, etc.

C. Regardless of the length or completeness of the descriptive paragraph herein, each device shall meet published manufacturer's specifications.

D. Install mounted equipment with black number 10 button head machine screws with Hex Allen or Square Robinson drive.

E. Provide shaft locks or security covers on non user operated equipment having front panel controls. Install at the conclusion of Acceptance Testing.

F. Audio XLR type connectors not a part of manufactured electronic device or component shall have gold plated contacts. This includes both cable and chassis mount connectors on all interconnect cables, plate and panels for all audio systems.

G. Install XLR type connector wired pin 2 high, pin 3 low, and pin 1 screen (shield).

H. Provide all ceiling and wall mounted speaker grilles and enclosures with a manufacturer applied finish to match the surrounding ceiling or wall color as directed by Owner.

I. Mount equipment and enclosures plumb and square. Permanently installed equipment to be to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five. Seismic bracing shall be installed on appropriate equipment where State of Nebraska codes require such installation.

### 3.3 LABELING

A. The label nomenclature shall correspond to the Owner's directed signage and wayfinding program.

B. Provide engraved lamicoid label adjacent to the front and rear of equipment mounted in housing. Install in a plumb, level, and permanent manner. Provide rear mounted labels on equipment mounted in furniture console.

C. Provide engraved label over each user-operated control that describes the function or purpose of the control. Adjust label size to fit available space.

D. Provide each terminal strip with a unique descriptor and a numerical designator for each terminal. Show terminal strip descriptor and designator on system schematic drawing.

E. Provide logical and legible cable and wiring label permanently affixed for easy identification.

F. Labels on cables shall be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style.

G. Wiring designator shall be an alpha-numeric code unique for each cable.

H. Locate the cable designator at the origination and destination of each circuit within 75 mm of the point of termination or connection. Circuits that have intermediate splice points shall have the same designator throughout with an additional suffix to indicate each segment.

## 3.4 ENGRAVING

A. Text font shall be 1/8 inch block sans serif characters unless noted otherwise.

B. On dark materials provide white characters. On stainless steel, brushed natural aluminum plates or light-colored materials, provide black characters.

C. Provide at least three lines of text with first line listing the general device name, e.g., POWER AMPLIFIER, EQUALIZER. Second line to include schematic reference of the device, e.g., PA. The bottom line to indicate what other devices or areas this equipment controls, i.e., FEEDS HF-3&4 or FEEDS XOVER-3.

D. Equipment label shall be black with white characters unless otherwise indicated.

## 3.5 EQUIPMENT HOUSING

A. Install equipment and amplifiers in equipment racks according to manufacturer's recommendations.

B. Provide adequate ventilation or fans to maintain a maximum rack temperature of 90 degrees Fahrenheit.

C. Floor racks located in equipment rooms to be mounted on wood riser-minimum of 2 inches high.

D. Provide unused panel space with blank or vent panels, painted to match housing.

E. Provide rear support for housing mounted equipment greater than 15 inches deep.

F. Allow a minimum of 20% open rack space.

G. Locate operator usable equipment and patch panels at a convenient height.

H. Key door locks for each housing type alike.

I. Looking at the housing from the rear, install AC power and ground cabling on the left; audio and video cabling on the right.

J. Provide lights mounted in the top of each rack to illuminate the interior for service or maintenance. Lights to be individually switchable and placed so as to provide maximum illumination throughout the rack. Lamps to be 75 watt PAR style.

K. Do not mount panels or equipment on the rear housing rails. Use rear rack rails for support of any rack equipment over 16-inches in depth.

## 3.6 PATCH PANELS

A. Provide unique colored identification strips for each major connector grouping (i.e., microphone inputs, line inputs, console inputs, console outputs, inserts, etc.).

B. All patch panels shall be in consecutive rack spaces located at a level to comfortably read and use the panels.

C. Patch panels shall be located in Control Room racks.

D. Locate inputs from microphone input plates and floor panels near the top of the patch bay.

E. Locate sends and tielines near the bottom of the patch bay.

F. Locate “Interconnect Panel” adjacent to patchbay.

G. Patch panels shall be normalled at the direction of the Owner following the first two regular events.

## 3.7 SYSTEM CABLING AND WIRING

A. General:
1. Take precaution to prevent and guard against electromagnetic and electrostatic hum. For line-level audio signals, float cable shield at the output of source device. Shields not

connected shall be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shield.

2. Exercise care in cabling and wiring. Damaged cables or wire will not be accepted. Isolate cables and wires of different signal levels. Separate or re-route to reduce channel crosstalk or feedback oscillation in any amplifier section. Keep cabling separated into groups as described in ASDI article 12.3.
3. Make joints and connections with rosin-core solder or with mechanical connectors approved by the Operator's Consultant. Where spade lugs are used, crimp properly with ratchet type tool.
4. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.
5. Provide splice free wiring and cabling from origination to destination.

B. Housing:
1. Cabling entering equipment housings or splices in junction boxes should connect via connector termination or terminal block equal to Cinch 140 -142 series.
2. Install terminal block fully exposed, labeled, and mounted on 19 mm plywood board painted flat black with fire retarding paint.
3. Install cable and wire neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack while allowing for service and testing. Provide horizontal support bars if cable bundles sag.
4. Neatly bundle excess AC power cable from housing mounted equipment with plastic cable ties.
5. Provide plastic cable ties or lacing twine to bundle cabling and wiring. Electrical tape and adhesive backed cable tie anchors are not acceptable.
6. Install cabling with connections completely visible and labeled.
7. Provide termination resistors of 5 per cent tolerance; fully visible and not concealed within equipment or connectors.

## 3.8 AC POWER AND GROUNDING:

A. Coordinate final connection of power and ground wiring to housings. Hard-wire power wiring directly to power contactors or internal AC receptacles to ensure uninterrupted operation.

B. Provide 3-conductor, isolated ground, 120 VAC outlets as required within each housing plus an additional two spare outlets.

C. Provide a copper ground buss in each housing. Ground equipment chassis not having a three wire power cord to these busses using 6/32 nuts, bolts and lock-washers with No. 12 wire. Connect green ground wire from each AC outlet in housing to this buss bar.

## 3.9 LOUDSPEAKER SUSPENSION

A. Loudspeakers shall be suspended at the operating position in a safe, secure and permanent manner.



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B. The aiming direction of all loudspeakers shall be adjustable by ±15 degrees vertically.

C. All speaker enclosures being flown or suspended to have internal mounting brackets to distribute the load to the other faces of the enclosures. Provide internal bracing on cabinets that do not have factory installed bracing.

D. All speaker enclosures to be rigidly mounted to structure with no visible speaker movement during typical wind gusts.

E. All speaker enclosures to have permanently attached grilles with no company logos or names visible without prior approval by the Owner.

F. Structural support members to have a safety factor of at least 5. Mounting hardware and wire rope to have a safety factor of 8. All fasteners to be graded and certified for use in the intended applications. Overhead suspension hardware shall comply with ASME B30.20 standards and all applicable local building and safety codes.

G. Overhead suspension hardware must be of a type that includes product traceability controls.

H. Rigging, mounting and support systems for loudspeakers shall be designed and sealed by a registered professional engineer licensed to practice in the State of Nebraska. Once the systems are installed, the engineer shall physically inspect the methods and means used to verify compliance with the original design.

I. Paint speakers, supports and related hardware as directed by Owner.

J. Unless otherwise noted, speakers mounted to building structure are to be positioned with the long dimension horizontal and the high frequency horn rotated to maintain the wider dispersion in the horizontal plane. Speakers mounted on poles are to be oriented vertically, as shown in the drawings.

## 3.10 OUTDOOR MOUNTING OF EQUIPMENT

A. Objects mounted outdoors and within the building bowl structure shall be properly treated for exposure to moisture and temperature extremes.

B. Mounting hardware shall be non-corrosive or be coated with a corrosion inhibiting layer.

C. Structural supports for speakers or other equipment shall have inherent corrosion resistance or covered with a corrosion inhibiting layer.

D. Speaker components mounted in exterior environments shall be rigidly connected to the structure to prevent movement caused by wind gusts.

E. Speaker and microphone enclosures to include grille capable of breaking up direct water sprays or rain.



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F. Seal all exposed electrical connections on speaker enclosure with waterproof silicone sealant.

G. Treat paper cones of outdoor speakers with silicone based moisture repellent if not factory treated.

H. Provide screened cover over all openings in horn type speakers to keep out birds, insects, or small animals. Screened covering to be stretched with no visible wrinkles.

## 3.11 CONTRACTOR COMMISSIONING

A. Prior to energizing or testing the system, ensure the following:
1. All product is installed in a proper and safe manner per the manufacturer's instructions.
2. Insulation and shrink tubing are present where required.
3. Dust, debris, solder splatter, etc. is removed.
4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
5. All labeling has been provided.
6. Temporary facilities and utilities have been properly disconnected, removed and disposed off-site.
7. All products are neat, clean and unmarred and parts securely attached.
8. All broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded.
9. Electronic devices are properly grounded.

B. Prior to energizing the system, perform the following tests in compliance with applicable EIA standards. Record the results of each test in the Project Record Manual.
1. Test each AC power receptacle with a circuit checker for proper hot, neutral and ground connections.
2. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.
3. Temporarily lift the technical ground from the main electrical ground, measure and record the DC resistance between them. Resistance should be 1000 ohms or greater.

C. Impedance Tests:
1. Prior to energizing the system, perform the following tests in compliance with applicable EIA standards. Record the results of each test in the Project Record Manual.
2. Measure the impedance of each speaker line leaving the equipment racks. For full range devices, use a frequency of 1000 Hz and 100Hz, for band limited devices, use a frequency appropriate for the operating range of the transducer. When documenting the results of these tests, include the calculated impedances based on number of units on a line and the size and distance of the run.
3. Correct any field readings that differ more than 20% from the calculated impedances.
4. Include the results of the tests in the Project Record Manual.

D. Fiber Optic Cable test:
1. Test FO cable in accordance with ANSI/TIA/EIA-568-B.3 and any applicable amendments



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2. Provide two hard copies and CDR of recorded test results IN THE Project Record Manual.

E. Category 5e Cable test:
1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, and opens. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using a level IIe or level III test unit for category 5e or category 6, performance compliance, respectively.
2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-B Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
4. Provide two hard copies and CDR of recorded test results in the Project Record Manual.

F. Speaker Aiming Test:
1. Provide a temporary means by which to wire and power the various loudspeaker types to provide the opportunity for fine cabinet aiming adjustments to be made.
2. Once these fine aiming adjustments are made, other like loudspeakers can be set using the same aiming angles.
3. Notify Owner two weeks prior to test.

G. Speaker Circuit Verification Test:
1. Provide a low level, band limited test signal to each amplifier input.
2. Turn on one channel of Amplifier #1 and verify that the correct speaker or group of speakers is operating. Correct any wiring or other problems found.
3. In a similar manner, check each channel of all remaining amplifiers and their respective speaker circuits.
4. Include the results of the tests in the Project Record Manual.

H. Constant Voltage Speaker Test:
1. Play music, pink noise or other distinctive audio signal through each group of constant voltage speakers. Only one amplifier channel should be on at a time.
2. Walk the area covered by the speakers.
3. Verify that each speaker is operating and that there are no significant changes in volume level from one speaker to the next.
4. Verify that the extent of coverage is consistent with the areas indicated on the drawings.

I. Speaker Polarity Verification Test:

1. Use an electronic polarity checker, TEF-20, SYSID, SIM II, or other similar device to test each reinforcement speaker. All speakers should have the same relative polarity.
2. Follow manufacturer's recommendations in conducting the tests.
3. In a similar manner, check all distributed speakers to ensure they have the same polarity.
4. Include the results of the tests in the Project Record Manual.

J. System Gain Adjustment:
1. Adjust each active device for proper gain from the console output to the input of the amplifier.
2. Record the output levels of each device in the Project Record Manual.

K. Signal Delay Adjustment:
1. Adjust the delay to each subsystem to ensure proper synchronization between the main speakers and delayed speakers.
2. Using a TEF 20, SYSID, Smaart, SIM II, or other acceptable time based measurement system, measure the arrival time of the distant signal and then measure the arrival of the local signal.
3. Based on the arrival times measured, adjust the delay applied to the local speakers to synchronize them with the distant speakers. Repeat the test to verify the delay has been set to within 1 ms of the arrival of the distant signal.
4. Continue to test and adjust each separate subsystem with a dedicated delay channel.
5. Provide hard-copy printout of each delay adjustment showing first the arrival times with no delay set and then the result after the delay has been adjusted. Record the settings of each delay in the Project Record Manual.

L. Active Crossover Network Adjustment:
1. Adjust each active crossover to provide the appropriate bandwidth and slope rate for the speaker system it controls.
2. Multiple crossovers controlling speakers in identical areas should be set identically.
3. Record the settings of all the crossovers in the Project Record Manual.

M. Amplifier Level Adjustment - Main Reinforcement System:
1. Adjust the gain of each amplifier to provide a consistent and appropriate volume level throughout the facility.
2. Begin by connecting a pink noise source to one input of the mixing console. Adjust the console output to -10 dB on the VU meter.
3. Adjust the appropriate amplifiers to achieve 85 dBA in the area covered by one section speakers. Use a calibrated sound level meter to make the measurement.
4. If the test group of speakers employs an active crossover, use a Systune, Smaart or SIM II system to balance the spectrum by adjusting the amplifier for each band.
5. Once the initial speakers have been properly adjusted, begin adding the speakers in each adjacent areas and repeating the same adjustments.
6. When a given area or seating level has been completed, move to the next lower area and repeat the tests and adjustments for that area.
7. Amplifier settings for speakers covering similar seating areas should have the same gain settings. Investigate and correct any occurrences where an amplifier deviates more than 2 dB from the average.

8. Record the setting of each amplifier in the Project Record Manual and keep backup copies of the data file on disk.

N. Amplifier Level Adjustment - 70 Volt Systems:
1. Adjust the level of 70 volt systems to achieve a volume level appropriate for their location and intended use.
2. After setting the amplifier level for each system, play a pink noise signal over the speakers and walk through each area. Using a sound level meter, identify any areas where the SPL changes by more than 3 dB. Identify the cause of the change and where it is due to mounting height or architectural differences, adjust the transformer taps of the affected speakers to bring the sound level within range. Include any changes on the Record Documents.

O. Headroom Verification Test:
1. Once the preceding tests and adjustments have been completed, play a variety of musical programs through the system. Amplifiers should be off for this test.
2. Adjust the console gain to achieve peak output levels of +6 VU on the console meters.
3. Observe if any of the components indicate clipping or less than 3 dB of headroom.
4. Replace the musical program with a steady 1000 Hz sine wave. Connect an oscilloscope or similar device to selected amplifiers in each portion of the reinforcement system.
5. Increase the output level of the console until the signal displayed on the oscilloscope begins to show distortion. Record the dB level of the signal from the console and which component in the chain is creating the distortion in the Project Record Manual.

P. Remote Input Verification Test:
1. Using a microphone or portable signal generator, connect to each microphone receptacle throughout the facility.
2. Verify that the receptacle under test appears at the correct position on the patch bay and is operating properly.
3. In a similar manner, check all remote tielines and media related lines for correct wiring and labeling.

Q. System Equalization:
1. Using a TEF 20, SYSID, SMAART or a spectrum analyzer with both 1/3 band and narrow band display, equalize all loudspeaker systems to provide a suitable frequency response.

R. Verify system gain and amplifier levels:
1. Provide follow-up refinements to the equalization based on requests from the Owner.
2. When all the above tests have been completed and the system is ready for observation, formally notify the Owner at least seven working days prior to Acceptance Testing. Include in this notice copies of all data recorded, date each test was completed and the results of each test. All test data shall be available during the observation process.

## 3.12 TEST EQUIPMENT

A. Furnish the following equipment as requested. Equipment to be available for the entire test period through final system testing.

1. Sound Level Meter : ANSI S1.4-1971 Type SEA with digital or analog display. Meter to provide ranges of 40 to 120 dBA.
2. Impedance Meter - Capable of testing audio lines at three frequencies, minimum, between 250 Hz and 4k Hz. Measurement Range: 1 ohm to 100 kohms.
3. Multimeter-Measurement range, DC to 20kHz, 100 mV to 300V, 10 ma to 10 A.
4. Audio Oscillator: bandwidth 20 Hz to 20k Hz ±1 dB at 0 dBm output. Output to be balanced. Oscillator to include adjustable output level.
5. Dual trace oscilloscope.
6. Ladders and scaffolding necessary to inspect all speakers.
7. Temporary 1000 foot microphone cable for testing purposes.
8. Provide three portable VHF or UHF business band radios for use during acceptance testing with transmission range sufficient to cover entire project. Include rechargeable batteries and charger along with holster for wearing on belt. Radios to be available for duration of testing process, including any follow-up visits required prior to final acceptance.

END OF SECTION



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## CABLE NUMBERING PLAN

XXXXXXXXX

- Port (Alpha)
- Sequence (00–99)
- Radial Column Line (see note 1)
- Level (see note 2)
- Area (see note 3)
- System (see note 4)

1. Use only whole numbered column designations , do not use fractionally numbered columns (ie; 28.5) outlet is on a whole number column line use between column lines number. If the outlet is between column lines use the lowest number column line. As examples:
   1. Outlet on column line 19 use 19 in number plan.
   2. Outlet on column line 19.5 use 19 in number plan.
   3. Outlet between 19 and 20 use 19 in number plan.

2. Stadium Levels
   Reference Drawings

3. Stadium Areas
   - N North Quadrant
   - S South Quadrant
   - E East Quadrant
   - W West Quadrant

4. Systems
   - A Audio
   - C Control

## DEVICE ROUGH-IN BOX

D1: 1–Gang Die Cast: RACO 5386–0 Die Cast Aluminum 2–5/8" Deep.

M1: 1–Gang Masonry: RACO 5695 Steel Masonry Box, no less than 2–1/2" Deep in 6" CMU, Brick or Concrete and 3–1/2" Deep in 8" CMU. Cover edge to be flush with finished wall.

S1: 1–Gang 4" Square: RACO Steel Box, 2–1/8" Deep with 1–Gang Raised Device Cover. Cover edge to be flush with finished wall.

D2: 2–Gang Die Cast: RACO 5388–0 Die Cast Aluminum 2–5/8" Deep.

M2: 2–Gang Masonry: RACO 696 Steel Masonry Box, no less than 2–1/2" Deep in 6" CMU, Brick or Concrete and 3–1/2" Deep in 8" CMU. Cover edge to be flush with finished wall.

S2: 2–Gang 4" Square: RACO 236 Steel Box, 2–1/8" Deep with 2–Gang Raised Device Cover, unless otherwise noted. Cover edge to be flush with finished wall.

D3: 3–Gang Die Cast: RACO 5390–0 Die Cast Aluminum 2–5/8" Deep.

S3: 3–Gang: RACO 686 Steel Switch Box, 2–1/2" Deep. Cover edge to be flush with finished wall.

M3: 3–Gang Masonry: RACO 697 Steel Masonry Box, no less than 2–1/2" Deep in 6" CMU, Brick or Concrete and 3–1/2" Deep in 8" CMU. Cover edge to be flush with finished wall.

S4: 4–Gang: RACO 687 Steel Switch Box, 2–1/2" Deep with four gang cover. Cover edge to be flush with finished ceiling.

M4: 4–Gang Masonry: RACO 698 Steel Masonry Box, no less than 2–1/2" Deep in 6" CMU, Brick or Concrete and 3–1/2" Deep in 8" CMU. Cover edge to be flush with finished wall.

NOTES:

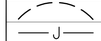
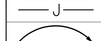
1. Provide masonry rough–in box for concrete embedment.

## GENERAL CONDUIT NOTES

NOTES:

1. Provide as required herein, by Code and as specified in Division 16.
2. Coordinate location of equipment, junction boxes, outlets, wireways, panels, etc.
3. Provide conduit no less than 3/4" in trade size unless noted otherwise.
4. Provide conduit with pull cord and debur, clean, cap and tag.
5. Install conduit maintaining a radius bend of no less than 4 times internal diameter for conduit 2" and smaller and no less than 8 times internal diameter for larger than 2".
6. Route conduit with other building services and conceal whenever possible. Group conduit and run parallel along a single building column line, hold tight to structure, and paint as directed by the Architect.
7. Provide a Pull Box as required in a conduit run so that any segment within the run is less than 100 feet in length, or if the summation of bend radiuses within a segment is greater than 180 degrees.
8. Size Pull Box so that it's length is no less than 8 times the diameter of the largest conduit and the width is no less than 1/4 the length.
9. Provide blank covers for rough–in boxes without plates. Provide temporary labeling on blank covers describing system served.
10. Encase audio system microphone circuits in steel conduit.

## PATHWAY DISTRIBUTION

| | |
|---|---|
|  | Raceway Concealed or Exposed |
|  | Raceway Hidden or Below Floor Slab |
|  | J–hooks on Minimum of 5' centers |
|  | Home Run |
|  | Conduit Stub To Above Accessible Ceiling or Cable Tray |

## AUDIO SYSTEMS

| SYMBOL | DEVICE | ROUGH–IN BOX TYPE: WALL OR CEILING | ROUGH–IN BOX TYPE: MASONRY | ROUGH–IN BOX TYPE: SURFACE | MOUNTING HEIGHT | NOTES |
|---|---|---|---|---|---|---|
| CM | Control Monitor | See Note. | | | Coordinate mounting height with owner. | Provide Arlington TVBS505 and coordinate with electrical. |
| CP | Control Panel | Type S2 | | | Mount at standard building switch height. | |
| HA | Hearing Assist Antenna | | | Type D2 | Mount to roof above control room. | Provide penetration and appropriate weatherhead at roof level. |
| J | Junction Box | REF Note 2 | REF Note 2 | REF Note 2 | | |
| JBL | Line Junction Box | REF Note 1 | REF Note 1 | REF Note 1 | 5'–6" A.F.F. to top of box unless otherwise noted. | |
| JBM | Microphone Junction Box | REF Note 1 | REF Note 1 | REF Note 1 | 5'–6" A.F.F. to top of box unless otherwise noted. | |
| JBS | Speaker Junction Box | REF Note 1 | REF Note 1 | REF Note 1 | 5'–6" A.F.F. to top of box unless otherwise noted. | |
| IP | Input Panel | Type S2 | | | Coordinate location and height with owner. | |
| WA | Wireless Microphone Antenna | | | Type D2 | Mount to roof above control room. | Provide penetration and appropriate weatherhead at roof level. |
| | | | | | | |
| 1 | Speaker Type 1 – Suite Ceiling | | | | Flush in Ceiling | Reference Note 3, 8, and 9. |
| 2 | Speaker Type 2 – North Tunnel | | | Type D2 | Surface Mount | Reference Note 8 and 9. |
| 3 | Speaker Type 3 – South Concessions | | | | | Reference existing pathway and cable. |
| | | | | | | |
| A | Type A Speaker– Main Array | | | | | |
| B | Type B Speaker– HF Long Throw | | | | | |
| C | Type C Speaker– North Short Throw | | | | | |
| D | Type D Speaker– Under Scoreboard | | | | | |
| E | Type E Speaker– North Railing | | | | Mount to north parapet railing | |
| F | Type F Speaker– Shadow East/West | | | Type D2 | | Reuse existing pathway and cable. |

NOTES:

1. Provide Hoffman painted steel Type 1 Screw Cover Pull Box no less than 12"W x 12"H x 6"D unless otherwise noted. Provide 3/4" void free plywood coated with a fire retardent white paint on back wall of junction box from sidewall to sidewall. Increase size of box as required to accommodate conduits terminating at box. Reference 5/ES7–01 for further details. Provide stainless steel enclosure with gasketed cover when enclosure is mounted in an environmentally exposed location.
2. Provide Hoffman POLYPRO Type 4x (#AnnnPHC) enclosure no less than 4" W x 4" H x 4" D unless otherwise noted. Size enclosure as required for conduit entering enclosure.
3. If loudspeaker is located in an inaccessible ceiling, provide 3/4" conduit interconnecting loudspeakers within same service area or zone, unless noted otherwise. If loudspeaker is located in an accessible ceiling, provide hooks and rings to destination.
4. Provide no less than 3/4" conduit home–run to nearest nearest outer (stacked) Comm Room, unless noted otherwise.
5. Provide no less that (2) two 1" conduits stubbed to above accessible ceiling, unless noted otherwise.
6. Provide Raco 4801 or 4803 series liquid–tight aluminum strain relief cord connector for each cable exiting junction box and speaker enclosure.
7. Provide Hoffman stainless steel NEMA Type 4X Hinged Cover Junction Box no less than 12"W x 14"H x 6"D model #A–1412CHNFSS. Provide with Hoffman A–14P12SS panel for interior mounting of devices and terminal strips.
8. Provide no less than 3/4" conduit per loudspeaker zone to local amplifier equipment rack, unless noted otherwise.
9. H is the contractor's responsibility to review all field conditions to determine conduit and cable pathway throughout existing structure.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SHEET HISTORY:

| | | |
|---|---|---|
| ISSUED | 03/03/2014 | CONSTRUCTION DOCUMENTS |
| 1 | 03/21/14 | ADDENDUM #2 |

**UNL Memorial Stadium Sound System Upgrades**

UNL City Campus
Lincoln, Nebraska

TCEP No.: 018-210-14
HNTB No.: 61274
UNL Proj. No.: 10420

March 3, 2014

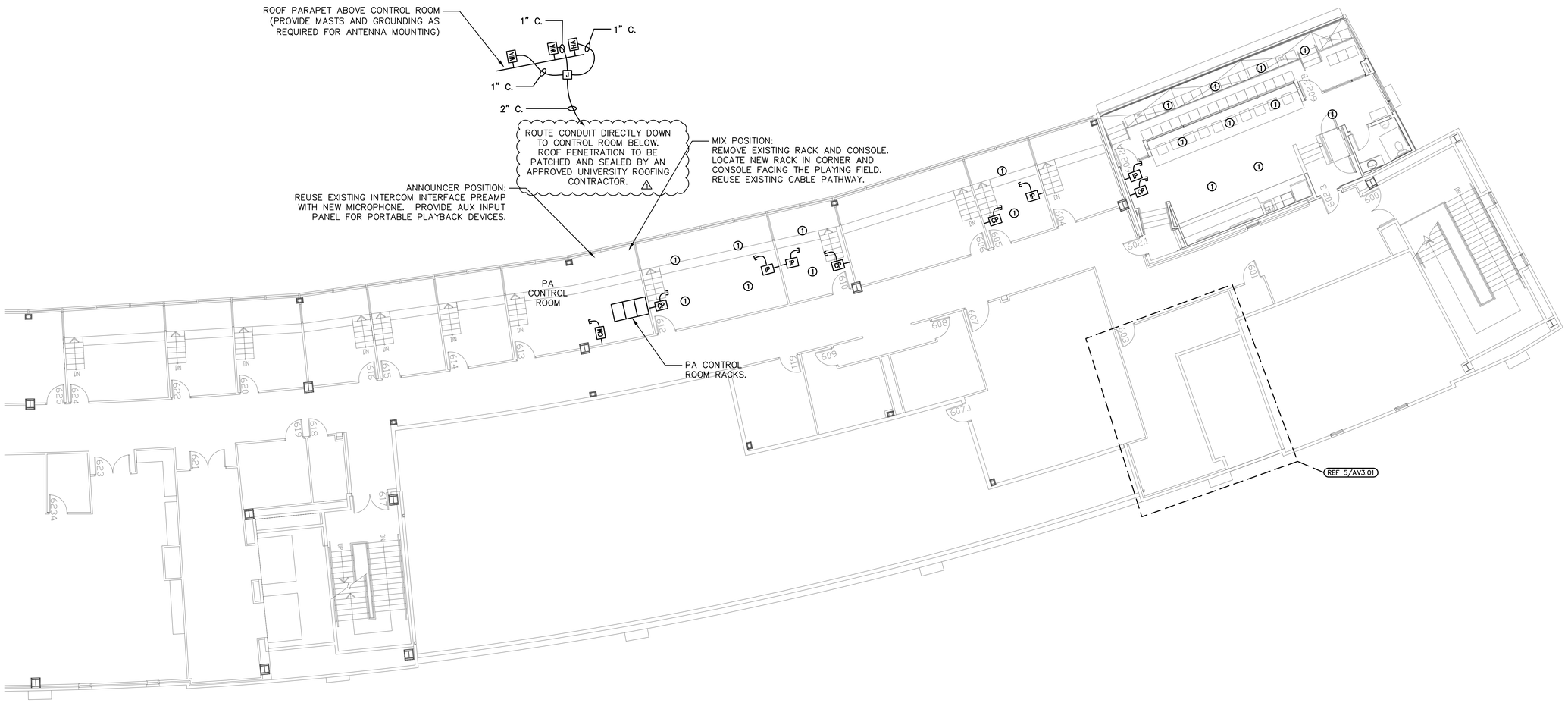
CONTROL ROOM FUNCTIONAL

# AV0.00


Plot Time Stamp: 3 / 21 / 2014 9:50:36 AM
File Location/Name: F:\2013\13055 UI of NE Memorial Stadium Sound Study\CAD\Sheets\AV0.00.dwg

## GENERAL NOTES

1. COORDINATE FINAL LOCATION OF ALL [IP] INPUT PANELS AND [CP] CONTROL PANELS WITH OWNER PRIOR TO INSTALLATION




1 WEST LEVEL 600 FLOOR PLAN - SECTION B
SCALE: 1/8" = 1'-0"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|---|---|---|
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| 1 | 03/21/14 | ADDENDUM #2 |

**UNL Memorial Stadium Sound System Upgrades**

UNL City Campus
Lincoln, Nebraska

TCEP No.: 018-210-14
HNTB No.: 61274
UNL Proj. No.: 10420

March 3, 2014

West Level 600
Floor Plan - Section B

# AV1.W6B


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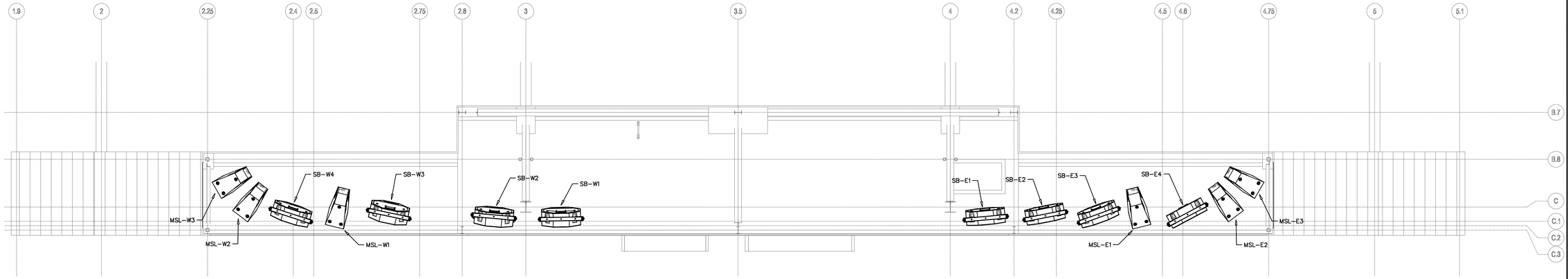
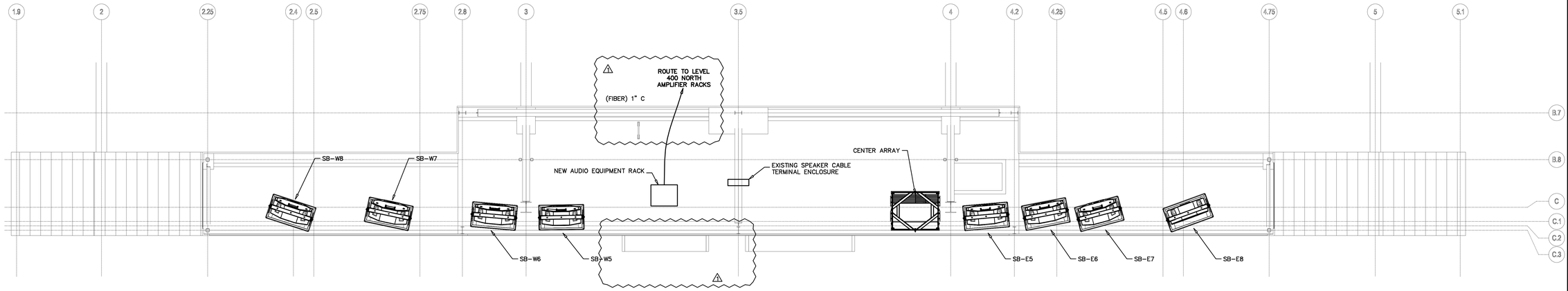
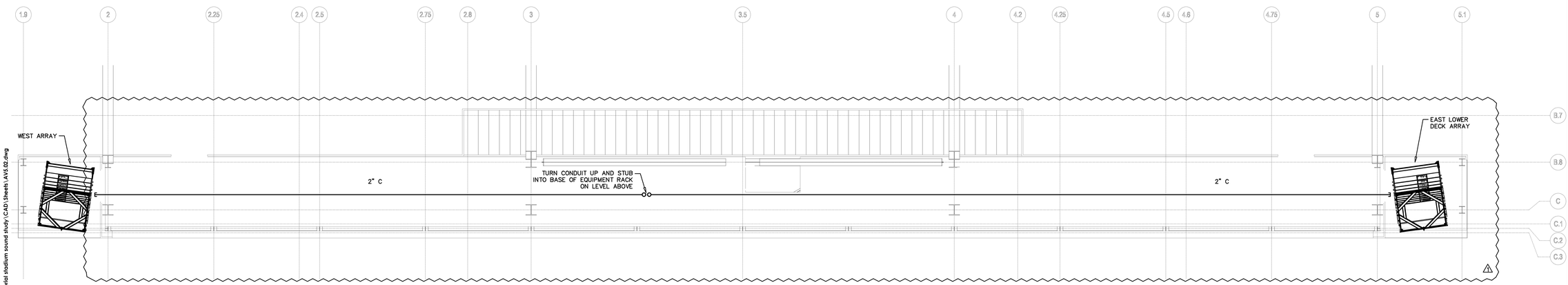



## 3 SCOREBOARD PLAN VIEW
SCALE: 1/4" = 1'-0"




## 2 SCOREBOARD PLAN VIEW
SCALE: 1/4" = 1'-0"




## 1 SCOREBOARD PLAN VIEW
SCALE: 1/4" = 1'-0"

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March 3, 2014

Scoreboard
Plan Views

# AV5.02

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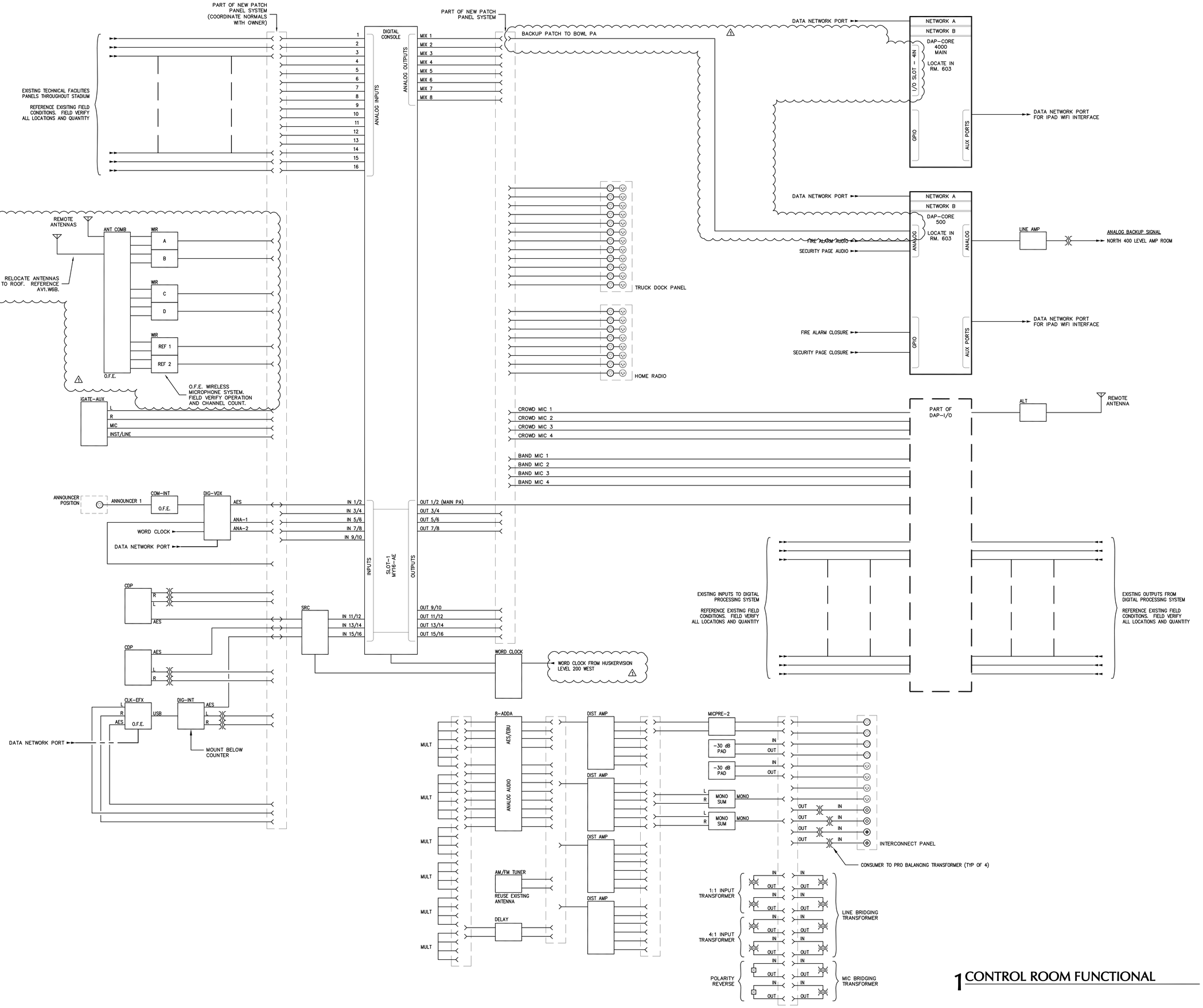


# 1 CONTROL ROOM FUNCTIONAL


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CONTROL ROOM FUNCTIONAL

**AV6.10**


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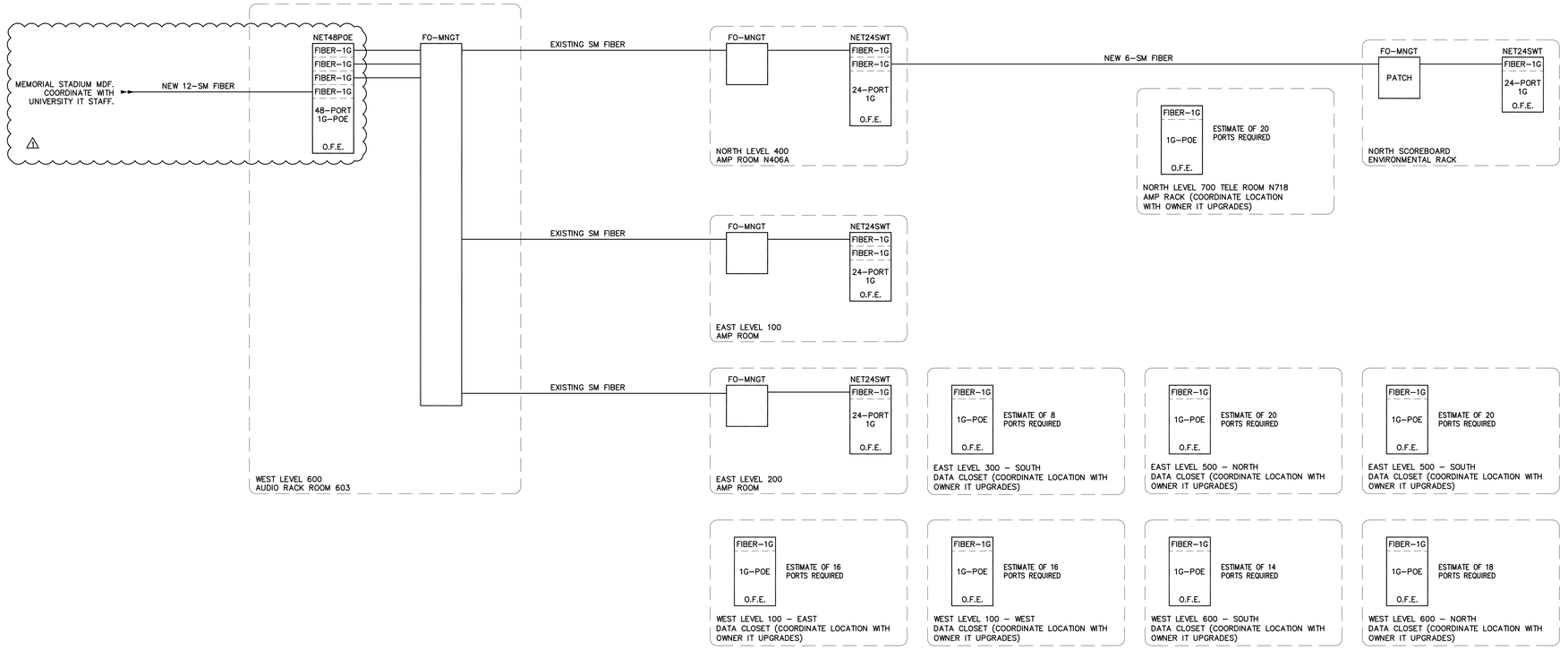
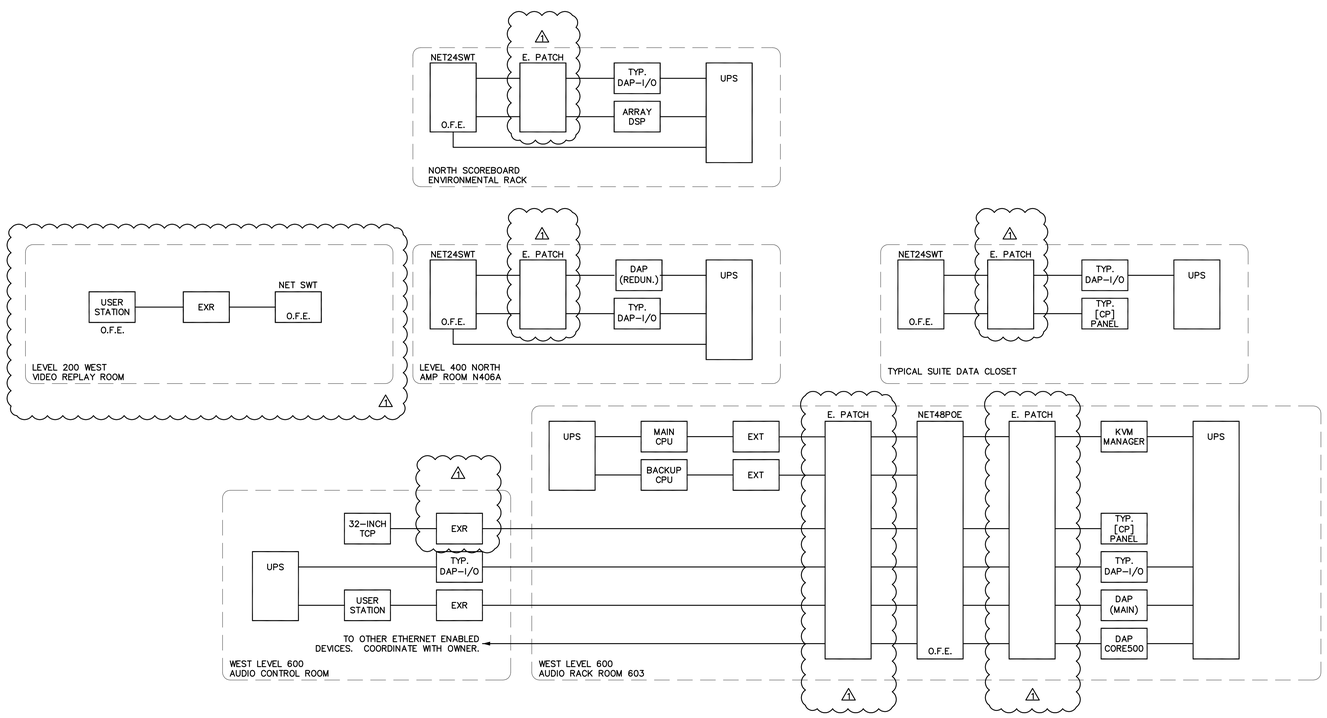



## 2 NETWORK FIBER TOPOLOGY DIAGRAM

**SCALE: N.T.S.**

NOTES:
1. PROVIDE FIBER MANAGEMENT RACK ENCLOSURES AT EACH LOCATION TO ACCOMMODATE REQUIRED FIBER STRANDS AS NOTED WITHIN THE SPECIFICATIONS. SURVEY FIELD CONDITIONS AS SOME ENCLOSURE EXIST BUT WILL NEED ADDITIONAL PATCH MODULES.
2. ROUTE NETWORK DROP FOR SOUTH SIDELINE CLUB TO THE NEAREST EAST DATA ROOM.




## 1 NETWORK TOPOLOGY DIAGRAM

**SCALE: N.T.S.**

NOTES:
1. COORDINATE VLAN REQUIREMENTS FOR EACH TYPE OF DIGITAL AUDIO TRANSPORT AND CONTROL SYSTEMS WITH THE OWNER.
2. PROVIDE PATCH CABLES FOR ALL NETWORK ENABLED DEVICES SPECIFICALLY ASSOCIATED WITH THE AUDIO SYSTEM AND qsc q-SYS CONTROL. ANY EXISTING EQUIPMENT WILL REUSE EXISTING PATCH CABLES.

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March 3, 2014

NETWORK FUNCTIONAL

# AV6.40

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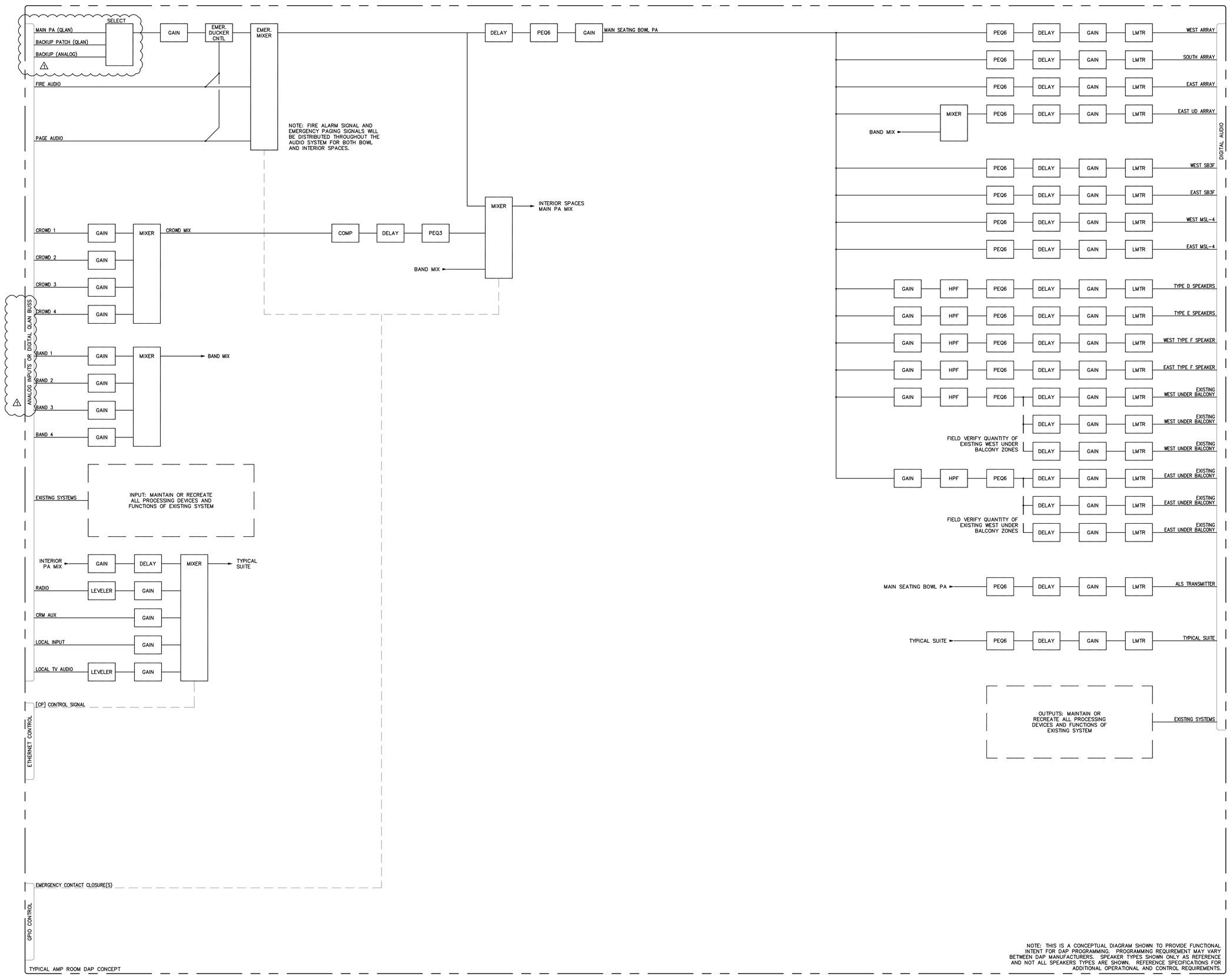


1 DSP CONCEPT FUNCTIONAL

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DSP CONCEPT FUNCTIONAL

**AV6.41**

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