
SECTION 11 63 10 - LED DISPLAY AND CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The purpose of this document is to describe the scope of work and options for a complete, turn-key design/build LED display and control systems.
- B. Work under this Contract includes all labor, materials, cabling, tools, transportation services, supervision, coordination, etc., necessary to complete the installation of the LED Display and Control Systems as described in these performance specifications and illustrated on the associated drawings. The systems shall be called the "Display System" and the installer the "Display Installer". Any structural/electrical engineering and construction information provided as part of this specification and/or related documents are provided for design intent information purposes only. The drawings included with this specification convey general system concepts. The drawings may not show complete and accurate building details. The Installer is responsible for making field measurements necessary to establish exact locations, relationships, load capacities necessary for the installation of these systems. All maintenance and warranty work shall recognize the appropriate union jurisdictions.
- C. Work includes a number of separate displays. Drawings should be considered to be conceptual in nature, illustrating the features and appearance of the system. It is intended that the Display Installer shall assume full responsibility for final design and engineering for structural and electrical systems, and installation requirements as well as construction information and design/construction coordination required in accordance with the Installer's final design of elements being provided under this contract. Identify and notify Owner at time of proposal if AC power shown is not sufficient for LED displays. Extension and distribution of AC power and signal raceway from the base project provided point to the displays and within displays is the responsibility of the Display Installer. Any additional raceway/cable management, as required by code or the project general conditions or required for a complete pathway system or to enclose cabling within public view, but not shown on the electrical or AV drawings is to be included the Display Installer's base scope of work.
- D. The systems include the following major items:
 - 1. Removal and proper, in accordance with Owner requirements, disposal of existing south end zone LED video displays, fascia displays, and control components within the DWRRS 4216 video processing center.
 - a. Note: All disposed items shall be disposed in a proper manner conforming with Owner O&M document requirements for the materials in question and an affidavit shall be provided to the Owner that all materials have been properly disposed.
 - b. Remove & return existing server hardware, scalers and associated scoreboard components to owner, unless directed otherwise.
 - 2. New South End Zone LED display within the existing trim/cladding
 - a. Note: cabinets to be aligned to existing structure to allow full rear service of new LED components.
 - 3. New Ribbon Displays at:
 - a. West
 - b. North
 - c. East
 - d. South
 - 4. Active ventilation as required for proper year-round operation.
 - 5. Interface to broadcast services control room via existing control network room in DWRRS West Press Box 4216 room.

6. Central content management and processing system to generate and mix multi-window content for each display. Primary LED rendering, Scaling, Processing & management systems to be installed in existing DWRRS West Press Box 4216 room with operational components installed in DWRRS PA Operations Booth.
 - a. Capability of content rendering, scaling & distribution required to operate existing LED displays at the north end of the stadium is provided.
 - b. Coordination with campus IT & broadcast services engineering is required.
 - c. All computerized systems are connected to an existing owner provided Adder Infinity KVM system. Contractor to provide Transmitters, Receivers & system licenses as required to support final CMS configuration.
 - 1) All operator stations to be provided with dedicated Receiver
 - 2) All computerized hardware that requires User Interface (Monitor, Keyboard & Mouse) for any interaction weather required on game day or for initial set up to be provided with a dedicated KVM transmitter.
 - a) No swapping of signal input cables from one system to the other is allowed. Dedicated devices to be provided.
 - d. Processors & scalers to support 3G-SDI 1080P input from campus video production system. Current system is 720p with plans to upgrade in the future.
 - e. All components based on 3G-SDI 1080P Video standard.
 - f. All video scalers to support external video reference
 7. Video production signal integration
 - a. Connect video sources (confidence cameras, CMS, display processors, etc.) to existing processors.
 8. Interface to existing OES scoring and timing system.
 9. Mounting of displays and secondary structure to existing building structure.
 10. All electrical distribution for displays as required within each system at each installation point.
 11. AV contractor installation drawings to ensure proper conduit provisions for new displays. Extension or addition of conduit to displays is the responsibility of this contractor. Exposed cabling viewable to the public will not be allowed.
 12. CMS System layout development graphical content, video content and user interface development is provided to support a unified LED display management and game day presentation.
 13. Options Pricing
 14. Operations and maintenance training
- E. The Contract also includes:
1. Pre-Installation meeting on site.
 2. Verification of dimensions and conditions at the job site
 3. Provision of final engineering, development of final design drawings and submission to the Owner and Consultant for approval.
 4. Performance and Payment Bond to be provided by the contractor as required by the State of Arkansas
 5. Submission of all information required by public agencies.
 6. Procurement and costs associated with any necessary construction and sign permits.
 7. Registered Engineers' stamp on all structural, attachment and electrical drawings, with calculations required for engineering review by Owner's structure Engineer (review at Owner's expense).
 8. Installation of all anchorages and attachments in accordance with the contract documents, manufacturer's recommendations, and all applicable code requirements.
 9. Minor modifications to rough-in/device location installation during the submittal process or construction without claim for additional expense.
 10. Coordination with other contractors and trades.
 11. Preparation of submittal information.

12. Installation in accordance with the contract documents, manufacturer's recommendations, and all applicable code requirements.
 13. Initial tests and adjustments, written report, and documentation.
 14. Instruction of operating personnel; provision of manuals.
 15. Maintenance services; warranty.
 16. Event attendance as outlined herein.
 17. Field and floor protection when utilizing cranes and/or any other lift mechanism allowed by the project.
 - a. Coordination is required to establish weight load capacity on concourses and field for heavy equipment proposed to be used by installer.
- F. The Contract Documents are complementary and are intended to include or imply all items required for the proper execution and completion of the work. Any item of work required by the Specifications or other portion of the Contract Documents, but not shown on the drawings, or shown on the drawings but not required in the Specification, shall be provided by the Contractor without extra charge as if shown or mentioned in both.
- G. The Owner reserves the right to make reasonable device and equipment location changes prior to rough installation without claim for additional expense.

1.2 WORK EXISTING OR SPECIFIED ELSEWHERE

- A. Display primary structure
- B. Conduit and Raceway
- C. Steel Coatings
- D. Electrical Power Service for Displays

1.3 REFERENCES

- A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations which will apply to Work in this section where cited below:
1. American Iron and Steel Institute (AISI),
 2. American National Safety Institute (ANSI),
 3. American Society of Mechanical Engineers (ASME),
 4. American Society of Testing and Materials (ASTM),
 5. National Electrical Manufacturer's Association (NEMA),
 6. Occupational Safety and Health Administration (OHSA),
 7. Underwriters Laboratories (UL),
 8. United States Institute of Theatre Technology (USITT).
 9. Entertainment Services and Technology Association (ESTA),
 10. Federal Communications Commission Regulation Part 15
 11. National Electric Code (NEC)
 12. Any or all local, governmental, or other applicable codes.

1.4 DESCRIPTION OF WORK

- A. LED displays consist of the following elements:
1. Remove and dispose of existing display components; including but not limited to:
 - a. LED Video and Advertising Displays and related sub-structure as required to fit new displays.

- b. Remove & return existing server hardware, scalers and associated scoreboard components to owner, unless directed otherwise.
 2. LED displays listed above
 - a. AC power distribution and panels
 - b. Secondary structure and attachment to the primary structure
 - c. All new content management and control system. System to be capable of operating existing north main and ribbon LED displays.
 - 1) Provide any signal conversion or signal Up/Down/Cross Scaling as required to feed existing north end zone LED display processors.
 - d. Processors for image scaling.
 - e. Signal cabling, additional conduit required within display assembly or per code but not shown on electrical or low voltage drawings.
 3. Supply all necessary loads, weights, power and other necessary design, construction and coordination. This includes state registered structural engineer stamped calculations for all structural elements. Installer to be responsible for all substructure required to attach displays to primary structure. The Owner will supply necessary structural engineering reports on existing vertical elements.
 4. Installers to verify all dimensions, locations and attachments.
 5. For the main end zone displays work will fit within existing trim/cladding. Any damage or supplemental trim/cladding needed to conform to the installation is required of this installer.
 - B. System to be able to receive data from outside services and update statistical data base in an automated fashion, ready for display within a pre-set graphic format without operator intervention.
 1. Software vendor shall interface to any data service client wishes throughout the warranty period. Vendor may identify any limitations of this service with their response (e.g. XML, 232, or other data interfaces).
 - C. Supply complete assemblies (structure, enclosure, and finish) for Displays included as part of this scope of work as appropriate, including licensed in the jurisdiction of the project registered electrical and/or structural engineer stamped calculations. Attachments to base structure to be reviewed and approved by the Structural Engineer as directed.
 - D. Colors of all exposed structure, enclosures, close-out panels, etc., to be determined during submittal process. Submit color samples to Architect and Owner for approval. Exposed cabling and conduit on enclosures will not be allowed.
 - E. Replacement of Existing Content Management System
 - F. Migrate content and scaler looks from existing CMS system to new CMS system
 - G. Development of new content
 1. Note: All content to be provided as rendered and templates.
 2. Templates provided in the native application that was used to create the content.
 3. Templates should be delivered as fully editable and customizable by Owner.
 - H. Common Requirements for all base and optional displays
 1. All electrical distribution/load centers, etc., within each system at each installation point from isolator or disconnect. Power is provided as noted on electrical drawings. Re-use of remote transformers at displays, if not shown on Electrical drawings to be replaced, is acceptable, provided equipment can be warranted as new. Proposers are responsible for review of site conditions.
 2. Installation of all signal cabling.

3. Any required signal conduit is included in this scope. Re-use of existing conduit, raceway, cable trays, with coordination with the Owner is acceptable. Paint all conduit/raceway installed under this contract as directed by the Owner.
4. Provision of structural support/framing for LED modules, intermediate steel, attachments, etc, required to attach display to existing and new structure provided under this contract.
5. All required louvers in exterior enclosure, forced air ventilation or cooling required for proper summertime operation of display. Location, area and type louvers/ventilation openings to be coordinated with Architect.
6. Painting of all new (and existing, where corrosion or damage is visible) steel, newly welded steel and the like.

I. Early Delivery

1. Type 1 KVM System Upgrade License (KVMLIC₁) – Section 2.4
2. Provide license to ownership prior to installation to allow provision on existing KVM system.
3. All Type 1 KVM System Receivers (EXR₁) – Section 2.4
4. Provide units to Owner prior to installation to allow provision on existing KVM system & installation and existing PA Ops both and control room.

1.5 RESPONSIBILITIES AND RELATED WORK

- A. Coordinate all work so that a complete and functioning display system and interface to existing systems is achieved.
- B. Supply accessories and minor equipment items needed for a complete system, even if not specifically mentioned herein or on the drawings, without claim for additional payment.
- C. Notwithstanding any detailed information in the Contract Documents, it shall be the responsibility of the Display Installer to supply systems in full working order. The Display Installer shall be required to notify the Owner or Owner's Representative of any discrepancies in part numbers or quantities as between the Contract Documents and what would be required to fulfill these performance specifications. Failing to provide such notification, the Display Installer shall nonetheless be expected to supply items and quantities according to the intent of the Specification and Drawings, without claim for additional payment.
- D. Obtain all permits necessary for the execution of any work pertaining to the installation, or any operation by the Owner.
- E. If a conflict develops between the Contract Documents and the appropriate codes, the Display Installer shall refer to General Conditions as described below for a resolution.
- F. Coordinate control area/workstation layout with Owner, Owner's Representative, and other subcontractors installing work in the existing production room.
- G. The drawings associated with this specification convey general system concepts. The plans do not show complete and accurate building details. The Installer is responsible for making field measurements necessary to establish exact locations, relationships, load capacities necessary for the installation of these systems.
- H. The Installer is responsible for providing all components necessary for complete and operational system. Any system changes or revisions necessary to make the system conform to the building, walls, structure/rigging/steel, electrical services etc., shall be included at time of bid and installed without claims for additional compensation.
- I. Coordinate work with other trades and building operating schedule to avoid causing delays in construction schedule.

- J. Fire Alarm Interface. Provide a fire alarm interface to automatically engage emergency evacuation messages on designated displays. Coordinate with Owner and Fire Marshal/Code Authority as to message text.
 - 1. Acceptable products:
 - a. Daktronics
 - b. DNF Controls
 - c. JL Cooper
- K. Preset messages and formatting is required for emergency notification on all displays

1.6 ELECTRICAL

- A. Power is provided as noted on the existing electrical drawings and/or supplemental AV drawings. The Installer shall be responsible for termination and distribution of electrical power from the demarcation point shown on the electrical drawings to the displays. All distribution equipment as required (including load center, breakers, step down transformers, etc.) is to be included in the display installer's scope. This will include necessary distribution boards, conduit and cabling as required for a complete installation.
- B. Sections of the east and west ribbon displays are on emergency back-up power and must be reconnected.
- C. The Installer shall be responsible for connecting ground point to all equipment in accordance with NEC code, local codes and standards specified herein.
- D. Connect each LED assembly to the building's grounding/lightning protection network, if present.
- E. Refer to electrical single line diagrams for minimum short ratings of all required equipment.
- F. Provide complete power and branch circuit distribution within the display/enclosure from the existing demarcation point as shown on electrical drawings.
 - 1. Power Distribution: All panel boards or load centers provided with lighting units for power distribution to displays loads shall incorporate main breakers.
 - 2. Provide utility power distribution in all rear service enclosures.
 - 3. Label each breaker as to its function within the scoreboard assembly (i.e. backlit panel #1, etc.)
- G. Panel boards to be located so as not in public view.
- H. Conceal all distribution equipment, transformers, panels, etc., and conduit within enclosures.
- I. Provide lockable load center, breaker panels, and disconnects. Provide minimum of 8 keys per lock.
- J. Power controls to allow each LED display and theme/letter element illumination to be turned off independently of each other and other displays and done so from the control workstations or racks. Programming of power controls should allow for the following options (Mechanical switches for each option will not be accepted.):
 - 1. Entire system on/off
 - 2. North Fascia on/off
 - 3. South fascia on/off
 - 4. East fascia on/off
 - 5. West fascia on/off
 - 6. North LED on/off

7. South LED on/off

- K. All materials shall fully comply with Underwriters' Laboratories or other acceptable testing agencies acceptable to local authorities with jurisdiction.

1.7 DISPLAY SIGNAL CABLING AND CONDUIT

- A. Install signal in conduit, raceway and cable tray. If additional conduit is required, provide as part of this installation scope. Cabling exposed to public view or the elements is not allowed.
- B. Do not damage any signal cabling that may be co-located with video and scoring cabling. In the event of damage, bring damage to attention of Owner and propose acceptable repair.
- C. Installation shall include all required and operationally necessary low voltage control and/or fiber optic cabling for all scoring displays from Scoreboard Control location to each display assembly as appropriate.
- D. Provide primary and backup connection cabling (separate overall jacket, not diverse pathways) from each display to control system location and other specified control locations.
- E. All cable whether fiber optic or copper will be run in conduit/cable tray from the Scoreboard Control Room to each scoring/matrix element. This does not relieve this contractor from providing fire stop material, armored cable and/or innerduct if project requires it. If additional conduit is required for a complete system, provide.
- F. Patch panels shall be provided at the Control Room and Video Display to facilitate transfer between primary and back-up cables.
- G. Cable shall carry appropriate fire rating (e.g. CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.
- H. Any timing or clock data signal cable located in cable tray with any audio cable shall have appropriate separation between services and appropriate jacket.
- I. Provide any necessary cable management, vertical ladder tray, j-hooks, etc. in areas without pathway.
- J. Provide, under this contract, any D-rings, hooks, etc. required for cable runs above accessible ceilings that cannot be run in raceways provided. Provide any necessary cable management, vertical ladder tray, etc. in communications closets for vertical risers. Provide appropriate cable management, Wiremold, raceways within scoreboard control areas between base building cable tray and control locations.
- K. Available conduit/raceway/cable tray distribution for display signal/data cabling is shown on RFP documents which may be incomplete and not up to date. Site observation will be required to determine full extent of existing raceway and raceway installed by the Owner for this project. If additional conduit, junction/terminal boxes/enclosures will be required notify Owner/Owner's Representative for coordination at time of proposal otherwise provide any conduit required for a complete, working, turn-key systems installation.
- L. Hold conduit tight to structure and conceal behind structure away from public view.
- M. Existing cabling may be re-used provided it is warranted as new and part of the outlined specification warranty requirements.

1.8 QUALITY ASSURANCE

- A. Project Prime Contractor's Qualifications: Firm experienced in the installation of systems similar in complexity to those required for this project; and meet the following requirements. Proposals will be rejected as unresponsive should the following information not be provided with proposal.
1. At least three years of experience with equipment and systems of the specified types.
 2. Experience with at least three NCAA Division 1 stadium projects within the last five years unless the owner waives this requirement.
 3. Maintain a fully staffed and equipped service facility.
 4. With the bid, the potential Installer shall provide documentation that they have:
 - a. Form of corporation.
 - b. Adequate plant capacity and equipment to complete the work.
 - c. Adequate regional service organization in to meet warranty response requirements for the project—4-hour phone call response, with 24-hour repair window during the season.
 - d. Adequate staff to perform work on schedule proposed with commensurate technical experience. Provide key staff resumes.
 - e. Performance and Payment Bond to be provided by the contractor as required by the State of Arkansas to meet the obligations of the work.
 - f. Provide references of three or more users for previously furnished and/or installed LED scoring displays (within the last 24 months for similar scale North American project).
 - 1) References should be for identical display technologies, processors, and most critically graphic user interface used to operate animation and system.
 - 2) If supplier intends to use alternative scoring supplier, references for operations at other facilities for scoring system shall also be supplied.
 - g. List of structural, electrical and other subcontractors intended to do the work. Subcontractors shall be appropriately state licensed in their specialty.
 - h. Listing with appropriate explanation regarding the status of Manufacturer's or Installer's resolved or unresolved legal disputes within the last six calendar years.
 - i. Listing with appropriate explanation regarding any projects within the last 3 years, where the Installer or Manufacturer has failed to meet construction schedules, due Installer or Manufacturer's cause.
 - j. Completed current version of AIA Contractor's Qualification form.
 - k. Name and relevant experience of the proposed project manager and site superintendent.
 - l. Proposed equipment
 - m. Completed display form included in 11 06 60
- B. Display manufacturer's requirements
1. At least 5 years of experience in the production of specified products unless approved by the Owner. Proposals will be rejected as unresponsive should the following information not be provided with proposal.
 - a. Experience with comparable scale projects within the last three years unless the Owner waives this requirement.
 - b. With the bid, the potential manufacturer shall provide documentation that they have:
 - 1) Adequate plant capacity and equipment to complete the work.
 - 2) Suitable financial status (i.e.; bonding and materials purchase capacity) to meet the obligations of the work.
 - 3) Adequate staff to perform work on schedule proposed with commensurate technical experience.
 - 4) Provide references of three or more users for previously furnished and/or installed LED display systems (within the last 36 months for similar scale project).

- C. Contractor shall attend pre-installation meetings to coordinate with other trades as required.

1.9 SUBMITTALS

- A. Submit all shop drawings and submittals in accordance with Project Requirements.
- B. All submittals are to be provided in format as outlined herein.
- C. Any electronic submittal for record shall be a PDF with an active clickable table of contents to sections within. Drawings shall have a TOC page with links to each drawing page with title of page. Product Data submittals shall have a TOC with link to each product, arranged and identified as in the order and identification established in this specification.
- D. Any submittal for content for the Owner to further maintain, such as functional drawings, calculating or tracking spreadsheets, control software configurations, AV software programming, shall be provided in their native editable format (note that for drawings PDF is not an editable format, DWG, RVT and the like are expected and required by this specification).
- E. All submittals are to include a document control page with information relating to the document control number, date information, and requested action, and leaving room for comments or stamps by reviewing parties as appropriate.
- F. Shop drawings and submittal data shall contain sufficient information to fabricate and install the Work to be performed. Drawings shall be executed at an appropriate scale. Submit the quantity of electronic and bond sets of drawings; and catalog data sheets required by the project general conditions, neatly bound in sets. Submit all Shop Drawing information sequentially. Information shall include but not necessarily be limited to:
 - 1. LED lamp order inclusive of part numbers
 - 2. A schedule of all submittals identified with a unique control number as ordered in this specification.
 - 3. Elevation and Sections of all displays.
 - a. Overall assembly weights of displays.
 - b. Power consumption of display assemblies and electronics racks.
 - 4. Finishes of all exposed housings with finish samples.
 - 5. Complete drawings showing the connection of the installer supplied equipment to the structure at each different condition. Drawings to indicate nature of disassembly for storage or portable or demountable items.
 - 6. Complete structural drawings showing member sizes, connections, etc. Submit design calculations, bearing the Registered (licensed in the jurisdiction of the project) structural engineer's stamp for review. Review will be for design intent only and shall not be construed as approving the design analysis.
 - a. Schematic Drawings. Provide drawings detailing inter-component and intra-component.
 - b. Conduit and Electrical Drawings. If the system incorporates an electrical or electronic system of any type, provide detailed drawings depicting wiring routing, termination, and sizing schematic, conduit routing and sizing, etc. These drawings shall be floor plan drawings, including all walls, doors and rooms, showing exact power requirements and conduit routing for each system with the location of all junction boxes. Provide PE stamp, licensed in the jurisdiction of the project, for all AC power drawings for work outside of display enclosures.
 - 1) Indicate location of all access panels. All required access panels are part of this scope of work.
 - 2) Electrical drawings for AC power to include licensed engineer's stamp valid in jurisdiction of the project.

- c. Equipment Drawings. Provide equipment mounting and location (including racks and workstations in plan view within rooms) details including necessary physical dimensions, clearances, load limits, etc. These shall be floor plan drawings, including all walls, doors and rooms, showing exact locations of devices and equipment, including countertop mounted equipment.
 - d. Structural plan and Section Drawings. Provide drawings showing the exact location of all installed equipment on plans and/or sections. Describe attachment methodology for each component that connects to the building structure.
 7. Fabricated Plates, Panels, or Signage Drawings. If plates, panels, or signage is required, provide complete drawings depicting dimensioned locations of components, component types, engraving or printing information, plate material and color, and bill of material
 8. Wiring diagrams. Complete, detailed wiring diagrams for all systems, based on the contract documents but including cable types, identification and color codes, and detailed wiring of connections, both at equipment and between equipment racks and wiring in conduit.
 9. Equipment. Location of all equipment in racks, consoles, mill work, enclosures or on Owner provided countertop/tables with dimensions; wire routing and cabling within housings; AC power outlets, terminal strip and UPS locations. These shall be floor plan drawings, including all walls, doors and rooms, showing exact locations of devices and equipment.
 10. Schematic drawings of any custom circuitry or equipment modifications, including connector pinouts and component lists.
 11. A material list of all equipment to be furnished, arranged in specification order. This list shall be followed by catalog data sheets, arranged in specification order, of all equipment to be furnished. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
 12. Proposed cable labeling technique.
 13. Samples as required in various specification paragraphs.
 14. Power consumption at 50% and 100% illumination levels for each display.
 15. Description of QA/QC procedure.
- G. Content Development Submittal
1. Provide initial and progress reporting submittals of all content development being provided for the LED display system.
 2. Note: This submittal to be an iterative and a working document to support the development of the creative assets involved in the LED display system with the Owner's creative team.
 3. Content development submittal to be submitted electronically and broken down into the following sections:
 - a. Summary
 - 1) Section notes contractual content being provided, a summary of who is providing and an overview of the creative process.
 - b. User Interface
 - 1) Section notes human interface control philosophy and deployment
 - 2) Use cases are provided to support common interactions of game elements to include but not limited to:
 - a) Pregame
 - b) In-Game
 - c) Major sport specific game elements
 - d) Statistic Interface
 - e) Game conclusion
 - c. User interface control panel previews
 - 1) Screenshots and suggested control panel layouts to serve as the base guide for loading of content prior to Owner training.
 - d. Display Layouts

- 1) Section to provide information on various display layouts for the Owner to choose from.
 - e. Pixel dimensions as well as imperial physical dimensions are provided to assist the Owner in 3rd party & advertiser content development and sales.
 - f. Custom Content
 - 1) Section to provide a list of options that could be provided as part of the content inventory.
 - 2) A generic list, relevant to the project-type, with online viewable examples is to be provided as a starting point.
 - 3) Owner to provide direction on final content selection prior to full rendering
 - 4) Due to the nature of content development note any exceptions or estimated pricing per piece of content that would exceed the available carried contractual content allowance. If no such exception is provided it is assumed every item provided in the list will be available to ownership should election occur.
 - g. Owner Deliverables
 - 1) Section to list all items needed by Owner to begin the development of the content.
 - 2) Provide any specific recommendations for deliverables per price as needed such as vector artwork style & recommended color choices based on brand/content piece type.
 - h. Content Development Render Preview Submittal
 - 1) Upon approval of the content development submittal submit render previews of each selected piece of content via an online portal (Box, Dropbox, OneDrive, Vimeo) etc. for progress review by the Owner.
 - i. Iterative reviews to be provided on a bi-weekly basis as required until full acceptance by the Owner.
- H. Final Inspection Notification Report. Organized checkout report for each piece of equipment and the entire system shall be prepared and submitted; it shall include:
 - 1. A complete listing of every piece of equipment including serial number, make, model and manufacturer as well as the date it was tested and by whom, the results and date re-tested (if failure occurred during any previous tests).
 - 2. The final report shall indicate that every device tested successfully.
 - 3. A performance test report indicating that the system meets all of the Installer testing requirements of Part III.
- I. Contract closeout submittals shall be required as follows:
 - 1. Keep a complete set of drawings on the job, note any changes made during installation, and submit copies required by project General Conditions. Electronic files to be in Auto Cad/Revit and PDF format, showing Work as installed.
 - 2. Provide all as-built, close out and testing information, manuals, drawings, test results, etc. in electronic form acceptable to the owner. Specification required as-built drawings, commissioning reports, manuals and electronic files to be submitted prior to acceptance testing and final payment.
 - 3. Submit the following data for review, prepared as indicated, at least one week prior to acceptance testing (exceptions noted):
 - a. System Reference Manual: Furnish electronic files with clickable sections in the table of contents for the following sections:
 - 1) System Operation and Instructions. Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity. This procedure should describe the operation of all system capabilities. Assume the intended reader of the manual to be technically inexperienced and unfamiliar with this facility.

- 2) A list of all equipment, indicating manufacturer, model, serial number, and equipment location (i.e. rack/room number). Update following acceptance testing, if changed.
 - 3) Manufacturer's Instruction Manuals for all items of equipment, incorporating or followed by manufacturer's warranty statements. For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
 - 4) A list of settings, if applicable, of all semi-fixed controls. This shall include a listing of all software settings required in all operating system areas (e.g. control panel, network, etc.) as well as project specific software programs. Update following acceptance testing. Preferred method of displaying "software" settings is with PC-captured "screen shots".
 - 5) Schematic wiring diagrams of the scoreboard and signage display low and high voltage systems, based on the as-built documentation, at a reduced scale easy to handle but fully legible. Blue-line (or similar diazo process) prints are not acceptable.
 - 6) Maintenance Instructions, including Installer's maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
 - 7) A legend of acronyms and abbreviations must accompany all documentation.
 - 8) Any other pertinent data generated during the Project or required for future service.
- b. Manufacturer's Service Manuals and parts lists for all equipment. Photocopies are not acceptable. For custom circuits or modifications, complete schematics and parts lists.
 - c. Photographically reproduced as-built wiring diagrams and overall building wiring diagrams, at a reduced scale easy to handle but fully legible.

1.10 PROJECT CONDITIONS

- A. Verify all conditions on the job site applicable to this work. Notify Owner or Owner's Representative in writing of discrepancies, conflicts, or omissions within three (3) days of discovery.
- B. The drawings are intended to diagrammatically 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, Display Installer shall recommend solutions and/or submit drawings to the Owner or Owner's Representative for approval, showing how the work may be installed.

1.11 ACCEPTANCE TESTING

- A. Upon completion of installation and initial tests and adjustments specified in Part 3, acceptance testing shall be performed by the Owner or Owner's Representative.
- B. Provide one person familiar with all aspects of the system to assist the Owner or Owner's Representative during acceptance testing. Individual must have specialized knowledge of the computer control system operating software and function of the system.
- C. Final Acceptance shall occur after the displays have functioned without failure for two home games.
 1. Failure shall be defined as a failure of the display, or a portion of the display equal to 10% of that display's square footage, to meet the project performance specifications for a

length of time greater than one minute due to electronic, electrical, mechanical, structural, or other failure of the display. Failure due to Owner, spectators, or force majeure will not be considered event failure.

2. Failure shall be defined as a failure of the display processing and control system.

1.12 DISPLAY 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 microprocessor-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, 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 for use only for modifications for this system only.
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 project General Conditions.
6. All hardware supplied shall support software updates for a period of not less than 7 years following substantial completion.

1.13 WARRANTY/MAINTENANCE

- A. Warrant labor and all equipment/materials for twenty-four (24) months following the date of final acceptance or the second, trouble-free, NCAA (as designated by the Owner), regular season game played in the stadium, whichever is later.
- B. 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.
- C. 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.
 1. A defect as it applies to a pixel or LED module shall be at any point that the pixel or module fails to be able to meet the performance requirements of this specification.
 2. While overall system/contract scope warranty is the responsibility of the prime contractor, the LED display manufacturer/reselling sub-contractor is to be the primary warranty service provider for the LED display equipment and content management/control system.
 3. A failure in regard to the content management system is loss of any feature or function that was working during a prior event or rehearsal but does not function properly during a public event. The warranty requirement assumes that the system has been demonstrated to be fully functional and has been accepted as substantially complete by the Owner.
- D. Register all manufacturer's warranties (e.g. software, computers, etc.) in Owner's name.
- E. Maintain spare parts inventory on-site during the warranty period and assure availability of all spare parts required for continued operation of the system, as listed in this specification from end of initial warranty period through year 10 of display life. Within 72 hours of notification that spare part has been used, that part (excluding incandescent or fluorescent lamps) shall be replaced by the service representative/manufacturer.
- F. Unless otherwise noted the following is the requirement for spares throughout the Display system:
 1. Provide 2% (or one if 2% is less than one) spare parts of lighting units, driver cards, power supplies, lamps, modules, fans, and elements, including cables, jigs and the like.

2. Provide one (2) spare printed circuit card and transmit/receive interface of each type used in the system.
 3. Provide 25% spares of any air filters—after final acceptance.
 4. Provide extenders where required for service and maintenance of equipment.
 5. Provide a single spare for each transceiver (line driver) type used by the display system.
- G. During the 50,000 hours nominal board lifetime, the Owner may have certified brightness and color temperature measurements made on screen(s) according to the acceptance procedure to verify that the board is operating within brightness level, uniformity and color uniformity specifications. If the board is not capable of meeting specifications, provide price to perform the necessary repair and component replacement to bring the system to operational parameters.
- H. Within the warranty period, Installer shall be required to answer service calls within 4 hours and mitigate the problem within twenty-four hours.
- I. Preventative inspections shall occur 30 days before the beginning of the second and third seasons (one of the inspections occur prior to the expiration of the 2-year warranty period) by not more than 40 days.
- J. Warranty to include written commitment to maintain an inventory and availability of spare parts required to maintain operation of LED displays (LED modules, screen processors, etc., not content management systems) for a period of not less 10 years after substantial completion.

1.14 PRODUCT STABILITY AND LIFE CYCLE DECLARATION

- A. This system is intended to be used by the Owner for 7-10 years holistically, and some key parts may be used in excess of 10 years. This section addresses this concern and project planning to ensure a stable, serviceable system for the Owner.
- B. The Owner may elect to pursue and maintain extended service contracts, warranties, and/or Service-Level Agreements with the Original Equipment Manufacturer (OEM) as outlined in this specification or offered by the OEM directly. Should the Owner execute these agreements, the OEM agrees that it may not sever or otherwise terminate these agreements due to product life cycle issues without providing an alternate solution at no additional cost at the time of issue for a minimum of 6 years. No language in the agreement shall supersede this requirement. If the Owner should not elect these agreements, the OEM agrees to provide no less than 18 months' notice that a product will be discontinued and offer at least the discount structure provided in the original project to the Owner to replace the obsolescing product/system with products fulfilling the same function.
- C. For all products proposed by the Contractor to meet this design specification and associated drawings, produce a report identifying which stage of product life cycle each product is in:
1. Introduction phase
 - a. This phase is defined as: Any products that are unreleased, newly released at bidding time, or scheduled to be released between the time this specification was originally transmitted and the date of integration in the Owners facility. Expected usable life is 10 years and beyond for products in this phase.
 - b. For any products in this phase:
 - 1) Identify unreleased products regardless of when they are scheduled to be released
 - 2) Identify any products for which the Owner will be the first primary user. Do not account for launch partners, test bed sites and the like.
 2. Growth/Maturity phase:
 - a. This phase is defined as: Products in the primary expansion and stable phase of product life. The product should be stable, past initial launch bugs, and be in a

routine support system not requiring special effort by initial development teams to find and address Owner issues. Expected usable life is 7-10 years for products in this phase.

3. Decline phase:
 - a. This phase is defined as: Any product that is anticipated to be off the market in less than 6 years from the date delivered to the Owner.
 - b. For any products in this phase:
 - 1) Identify products at risk of being obsolesced in 6 years or less. Provide suggestions for alternate solutions deployable at time of specification transmittal which would remove this product list.
 - 2) Provide statement of conformance from the original equipment manufacturer that the product proposed will be supported for a minimum of 6 years from the date of first use as defined in the project manual without claim for additional costs beyond standard service costs or extended warranty costs. One statement from each OEM including a list of applicable products is acceptable.

1.15 OPERATOR OR OWNER FURNISHED; CONTRACTOR INSTALLED EQUIPMENT

- A. Certain Equipment is identified as existing Owner or Tenant Furnished Equipment (OFE).
- B. Inspect the Operator Furnished Equipment and advise the Operator of damage or defect and the extent of repair and/or adjustment required to bring the Operator Furnished Equipment to original operating specifications. Any repair service is beyond the current scope. Service the Operator Furnished Equipment, as directed by the Operator, as change to this contract or under separate agreement.
- C. Incorporate into the system as noted on CMS functional drawings
- D. Existing/Legacy Operator Furnished Equipment reused as part of the system:
 1. Type A Mux (MUX_A)
 - a. Multidyne Fibersaver
 2. Type A HD4 DA(HD5 DA_A)
 - a. AJA HD5 DA
 3. Type A Confidence Multiviewer (CON MIV_A)
 - a. Blackmagic Design Multiview 4
 4. Type A DVI Matrix Switcher (DVI MTX_A)
 - a. Lightware MX16x16DVI-PLUS
 5. Type A Confidence Monitor (CON MON_A)
 - a. Blackmagic Design SmartView Duo
 6. Type A SDI To Audio Disembedder (DBED_A)
 - a. AJA HD10AMA
 7. Type A Analog Video Sync Distribution Amplifier (SYNC DA_A)
 - a. Leitch VDA-16
 8. Type A Crossfire (CROSSFIRE_A)
 - a. Chyron Click Effects Prime Crossfire
 9. Type A Color Picture Monitor (CPXM_A)
 - a. Generic 22" Computer display with DVI Input
 10. Type A Key Mouse (KEY MOUSE_A)
 - a. Generic USB Keyboard & Mouse

1.16 OPTIONS, ALLOWANCES AND UNIT PRICING

- A. See specification section 11 06 60 for options.

PART 2 - PRODUCTS

2.1 SPECIFIED PRODUCTS AND MANUFACTURERS

- A. Model numbers and manufacturers included in this specification are listed solely as a standard of quality and are not meant to exclude other products and manufacturers if the proposer can establish the quality and reliability thereof, in the sole discretion of the Owner, as described below. Regardless of the length or completeness of the descriptive paragraph herein, each device shall meet all of its published manufacturer's specifications. Proposers are required to verify any such products or manufacturers continued performance is as required herein. Where two or more acceptable products are listed, the Installer may use either at his option. Listing of a specific manufacturer does not imply automatic acceptance of that company's product or submission, nor does it certify that vendor is accepted as qualified to perform work under this contract. Listing is to be considered only as an invitation to provide proposal. Where a manufacturer or vendor rather than a specific product model is listed, that manufacturer is required to meet all performance requirements outlined.
- B. Other qualified manufacturers will be considered subject to approval of technical data, samples, demonstrations and/or results of independent testing laboratory or field tests (if necessary, to verify performance) of proposed equipment, submitted in accordance with project requirements.
 - 1. If proposed system includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.
 - 2. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.
- C. All equipment supplied shall be new and meet the latest published specifications of that product. In the event that the product is enhanced, or improved, supply the newer product at no additional cost.
 - 1. If product is discontinued or made obsolete due to continuing product development, replace it with manufacturers' equivalent at time of installation at no additional cost.
 - 2. If product is discontinued or made obsolete due to technology change, substitution will be based on fair market value of accepted and proposed products, upon approval of substitution by Owner or Owner's Representative.
- D. All materials shall fully comply with Underwriter's Laboratories or other acceptable testing agencies acceptable to local authorities with jurisdiction.
- E. Under no circumstances shall the manufacturer's name, logo, or representation be visible to the public.
- F. Suppliers invited to respond to this RFP are done so with no implication or certification that manufacturer's proposed products are approved or meet the technical requirements of this specification. Potential vendors are invited to prepare prices for more than one display/system type meeting these specifications (i.e. different pixel spacing, software provider, etc.). Suppliers invited to respond to this RFP include:
 - 1. Prime Contractors
 - a. ANC
 - b. Daktronics
 - c. Mitsubishi
 - d. Samsung
 - e. SNA
 - f. As approved
 - 2. LED Displays

- a. Absen
 - b. Daktronics
 - c. Lighthouse
 - d. Mitsubishi
 - e. Samsung
 - f. As approved
3. LED Lamp Suppliers
- a. Cree
 - b. Nichia
 - c. Multicolor
 - d. Nationstar
 - e. Osram
 - f. As approved. Additional suppliers are invited propose for the project. Provide appropriate information on the product (white papers, where installed and how long, etc.)
4. Content Management System
- a. Daktronics Show Control with Camino
 - b. Ross Xpression Tessera
 - c. ANC LiveSync
 - d. As Approved

2.2 PHYSICAL DESIGN CRITERIA

- A. General: Engineer systems to the most stringent applicable code.
- B. Seismic Loads: Subject to the Building Official's approval, seismic design shall be under the Building Code in use for this project.
- C. Wind Loads: A minimum design pressure as dictated by IBC code (positive or negative) shall be applied to all signage and display surfaces. This also applies to the entire Scoreboard Enclosure. Corner pressures and attachment loads shall be as determined through local Building Code and by applying the project specific criteria. (All attachments, connections and members shall also be capable of withstanding all seismic forces in accordance with the local Building Code.)
- D. Recommended Minimum thicknesses, gauges and standards:
 1. All sheet metal shall have a minimum thickness of 18 gauge.
 2. Structural steel members shall have a minimum flange, web or wall thickness of 1/4 inch. Aluminum must be of size to achieve same structural capabilities.
 3. Where similar connections and members are used in other areas of the arena, every effort shall be made to detail and furnish members in a consistent and uniform manner.
- E. Enclosure and structure. The structure that is available is existing and should be reviewed, as all additional structure, lighting, power distribution, convenience outlets, and other items for installation, operation, maintenance, and repair is this contractor's responsibility.
 1. Installer to submit complete drawings showing the connection of the Installer supplied equipment to the building structure at each different condition.
 2. Installer to submit design calculations, bearing structural engineer's stamp for review. Review will be for design intent only and shall not be construed as approving the design analysis.
 3. The internal module structure, supports, attachment and anchoring members, mounting hardware shall be provided in accordance with engineering standards and governing codes.
 4. Enclosure.

- a. Enclosure to be shop fabricated, anodized aluminum, style and color as shown on the Owner's scoreboard concept drawings. Construction to comply with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other industry standard practice. Form exposed sheet metal work without excessive "oil-canning", buckling and tool marks with exposed edges folded back to form hem. Finish to comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations. For components which are assembled or welded in factory, apply finish after completion of fabrication.
 - b. Finishes shall match adjacent existing elements (such as building exterior metal panels), unless otherwise indicated.
 - c. All welds shall be cleaned, primed and painted.
 - d. Enclosure design and installation to prevent visible gaps in assembly that allow lights to or other visible items to be viewed through the faces or cabinets of assemblies. This does not include openings through the assembly from directly below the center hung display.
 - e. Electrolytic protection shall be provided wherever differing metals come into contact.
 - f. Trim shall be coordinated to be identical in appearance to adjacent advertising or architectural panels (whether provided herein, or by others).
 - g. Finishes shall match adjacent elements, unless otherwise indicated.
 - h. Cabinet depth of adjacent displays shall be within 1" (+/-). Notify Architect when variance is greater.
 - i. Close out trim panels/bezels are required for all displays to create a unitary appearance to each assembly with no gaps, holes, etc.
 - j. Fascia displays shall not extend out and impede viewing angle of the field from a seated position without prior approval from Owner.
 - k. All display faces exposed to public view to include finished (paint, anodized, trim, etc.) surfaces.
- F. Handrails and Railings: Provide any required handrails and railings in accordance with code requirements.
- G. Provide natural or forced ventilation as required for operation of all components. Provide all necessary dust and dirt filtration for the ventilation system. NC level attributed to this ventilation shall be no more than NC 40 at nearest seat or playing field sound levels from rack mounted electronic equipment in the production room shall be no more than NC 35 at nearest operator location.
- H. Service Requirements
1. Provide front or rear access based on display mounting and access conditions.
 2. Fascia displays to be top access.
 3. All screws and nuts that are required to be removed for access to displays shall incorporate captive screw and nut type designs.
 4. A minimum of one of any specialized or custom tool required for maintenance of the display; including any specialized/custom ladder, bosun's chair, or scaffolding required to service non-center hung displays for maintenance and repair.

2.3 OUTDOOR LED DISPLAYS

A. LED Displays

1. Technical Standards:
 - a. The LED Displays shall incorporate direct view technology, utilizing only the following technologies:
 - 1) SMD Light Emitting Diode (LED)

- b. Brightness: 16 levels of illumination, including 0%, 25%, 75% and 100%.
 - c. Brightness shall not fall below (at 100% white generated by external input):
 - 1) 7500 nits level over 12,000 hours of screen operation after acceptance.
 - d. Exterior displays without overall architectural enclosure to achieve IP 65 minimum rating for all exposed elements of display system.
 - e. Uniformity of brightness:
 - 1) Adjacent pixels 2.5%,
 - 2) 6% total variation across entire display, brightest to darkest pixel/module.
 - 3) Uniformity standards to apply over entire viewing angle specified with no perceptible color shift.
 - f. 140° minimum horizontal angle (defined as 50% brightness) of viewing and 120° (nominal 60° with screen vertical) of vertical. Color temperature to remain constant over 50% brightness viewing angle range.
 - g. Color temperature of display: 7,000-9,300° Kelvin. With a uniformity of 250°K between adjacent pixels and 8% across the entire display. With remote set-up and control to adjustment and balance of any pixel/module in display to match overall display color temperature through 20,000 hours of use.
 - h. Flicker-less display. Must be able to handle a minimum of 1920 60fps of content.
2. Gaps in ribbon displays shall not be larger than 125% of the pixel spacing of the displays (i.e.; 20 mm, 25 mm maximum gap between adjacent sections). Sections spanning expansion joints to feature "slip joints" attachments to minimize or eliminate gaps.
 3. Joints, seams or modules out of plane with the rest of the display, due to mechanical alignment of modules, units, louvers, secondary seals or related artifacts will not be acceptable.
 4. Size: as listed in 11 06 60.
 5. Pixel spacing: as listed in 11 06 60
 6. Compliance
 - a. Entirety of LED displays (not just individual module) must comply with FCC regulations.

B. Display Processors (LED PROC₁)

1. LED Displays
 - a. Provide primary and backup processors.
 - b. The processor shall be configured to support the following inputs:
 - 1) HDMI/AVI/DVI
 - 2) Component Serial Digital input (i.e. ITU-R 601; SMPTE RP-125)
 - 3) 3G-SDI input supporting all common Digital Television (DTV) Production standards (e.g. 480p; 720p, 1080I, 1080P).
 - 4) External Reference - Blackburst
2. Provide connections, cabling and appropriate backups from control room to board to support the following connections:
 - a. DVI
 - b. Serial Digital (601)
 - c. Digital Television Production standard (e.g. 480p; 720p, 1080I, 1080P).
3. Video screen electronics remote control system to provide complete screen control of:
 - a. Brightness level
 - b. Video display power on/off
 - c. Video Input Selection
 - d. Image positioning, sizing, and scaling
 - e. Color level
 - f. Hue
 - g. Contrast
 - h. Sharpness
 - i. Remote lighting unit location testing and color display test. This pattern shall display a map that corresponds to the address of each unit's physical address.

- j. These controls shall be provided for all inputs to control system processor.
- 4. Minimum Computer Processor Configuration
 - a. CPU: as required to meet specified operating performance.
 - b. Cases: Rack mount
 - c. Monitor: 18" flat screen; active matrix, LCD (e.g. Viewsonic, LG, Samsung, Sony, or Philips).
 - d. Rack mount sliding tray keyboard & track pad style mouse Keyboard, Mouse and Monitor extenders. Provide as required to support these devices at some distance from the rack mounted CPUs.
 - e. 1 GB/s Ethernet adapters
- C. Un-interruptible Power Supply (UPS). Provide UPS on screen processor(s), computers and monitors, electronics, etc. that may be disrupted by momentary loss of power. UPS shall be designed to support signal processing path (not display) for 180 seconds. Provide portable UPS devices for remote control stations and scoring consoles without built in battery backups.

2.4 DISPLAY CONTROL/CONTENT MANAGEMENT SYSTEMS

- A. General Configuration
 - 1. Computer based control system hardware shall exhibit sufficient computer processor power and speed to generate images instantly on command without lag, sputter, or stutter during recall, operation, and display.
 - 2. Images must be able to move smoothly through the entire length of the fascia displays and LED assembly in a continuous cycle if programmed to do so. Flicker-less display for both static and moving images. Image control and distribution system to allow the display of smoothly moving images with no flicker, jerking, and "stop motion" around entire display.
 - 3. Software packages and control electronics shall provide specified operational features. Game scoring and clock function data to be provided by Scoreboard control system.
 - 4. System to be capable of:
 - a. Showing Game in Progress (GIP) and stats information on any LED matrix/video display in system including existing display and courtside tables.
 - b. Compositing live video and GIP/Stats/Alphanumeric information on a single, video capable display
 - c. Creation, storage and display of head shots, AVI, JPEG, MOV, MP4, PNG, etc. files on any LED matrix/video display including existing display and courtside tables.
 - 5. All control system software and messages shall be stored in non-volatile (disk) format.
 - 6. Back-up computing and redundancy.
 - a. Network server and centralized file storage shall incorporate fully on-line, completely redundant processing (or mirror masters), including duplicate storage devices (i.e.; RAID arrays).
 - b. All computers, processors, and control panels shall be inter-networked.
 - 7. Computer system shall be fully redundant with back-up, mirror processors on-line.
 - 8. Computer System shall be able to import common computer interchange graphic file formats (e.g. MOV, MP4, PNG, AVI, TIFFs, GIFs, DVI, JPG, MJPG, etc.)
 - 9. All distributed processing computers shall be located in physically accessible spaces (e.g. control room, riser closets). Above ceiling mounting is not acceptable.
 - 10. System to accept trigger/contact closure signal from Venue life safety system to automatically initiate a stored message on the portions of the displays systems on emergency power. Trigger/contact closure to be brought to control system racks by others.
 - 11. Test Pattern Requirement
 - a. Provide button to activate the following content provided by the LED display provider:

- 1) Provide a test pattern program file for viewing on all displays in system and configured for each LED display. Test pattern to contain the following repeating items:
 - a) Full red 10 sec.
 - b) Numerical grid 5 sec (grid to indicate lighting units/modules)
 - c) Full blue 10 sec
 - d) Numerical grid 5 sec
 - e) Full green 10 sec.
 - f) Numerical grid 5 sec
 - g) Full white 10 sec
 - h) Numerical grid 5 sec.

B. Minimum Workstation specifications.

1. Different configurations which meet these standards are acceptable. All computers in this system to be of same manufacturer, with identical specifications and features.
2. Acceptable Manufacturers: Dell, Lenovo, HP, Sony, or approved equal.
3. Processor: as required to meet specified operating performance without noticeable delays or productivity impediments.
4. Cases:
 - a. Rack Mount
5. Memory: 16 gigabytes (minimum), expandable as required; if software requires additional memory to function, provide at no cost to owner. (In other words, we do not expect to have to add memory to get processors to function correctly.)
6. Hard Disk: Multi-media class, fast access speed; capable of storing 2 seasons worth of material, minimum 3 TB
7. Removable media
8. Monitor: 22" flat screen; active matrix, LCD (e.g. Viewsonic, LG, Samsung, Sony or Philips).
9. Mouse: Two button Microsoft Intellimouse mouse with scroll wheel.
10. USB: 2 front and 2 rear panel ports, minimum.
11. Keyboard: full size with separate numeric keypad and cursor control.
12. Keyboard, Mouse and Monitor extenders. Provide as required to support these devices at some distance from the rack mounted CPUs.
13. Computer system shall be completely tested by manufacturer prior to delivery.
14. Audio output
 - a. Connected to existing audio equipment. Provide any necessary cabling and conversion equipment.
15. Ethernet: 10/1000
16. Software:
 - a. Operating system appropriate to needs of application and control software. All updates applied.
 - b. All application and control software necessary to interface this computer to scoring system for configuration and operation.
17. Provide with a 30-minute UPS (Uninterruptible Power Supply) for computer and monitor. Provide rack mount UPS for rack mounted computers.
 - a. Note: UPS systems are existing in DWRRS 4216. Provide expansion if load of new content management system exceeds capacity.

C. Provide the following controllers, at minimum:

1. Main Display Controller; Primary
2. Main Display; Secondary
3. Fascia Controllers; Primary
4. Fascia Controllers; Secondary
5. Primary Control Server

6. Redundant Control Server
 7. Back-up, mirroring Server, including storage, i.e.; RAID arrays.
- D. Display Control Systems configuration to include on-line redundant backup controllers and servers as required.
- E. Networked Functions. The following devices should be configured to be shared on a network between individual workstations should more than one workstation be required to control system:
1. Internet gateway: via network connection to complex or Venue operator's computer system
 2. Internal and exterior data ports to support, at a minimum:
 - a. Sports Ticker feed/League statistical service.
 - b. Feed from sports scoring computer/control system.
 - c. Feed from Venue video production system.
 - d. Captioning device on-site or via telephone/internet based remote service.
 3. Network Back-up Requirements:
 - a. Each machine shall be able to be backed up over the network to shared storage mediums.
 - b. Back-up software
 - 1) Appropriate network and client software to permit system to be backed up to (and restored from) long term storage device.
 - 2) Software shall permit backup of:
 - a) network servers
 - b) individual workstations
 - 3) Software shall be configured to run at user definable intervals.
 - 4) Software shall permit full or incremental backups.
- F. Hardware Control functions
1. Brightness controls: Provide a minimum of three brightness levels for each matrix display. Base brightness levels shall be 50 to 65%, 75% and 100% of full brightness.
 2. Outdoor displays to have automatic brightness adjustment to compensate for time of day and weather conditions.
 3. Emergency message: Provide a special button or "soft" key on keyboard to initiate a minimum of six different stored emergency text messages of Owner's creation, on all displays capable of text.
- G. Software Control Functions and Features:
1. Character and Animation Features: All control system software and messages shall be installed on the internal hard disk drive with backup systems stored on USB or other Owner approved media.
 2. Character, Animation and Symbol Generation: Generation, control and placement of any display pattern in any area of the Display systems. Patterns to include pre-programmed football/lacrosse/soccer/field hockey/track Game-In-Progress (score, game clock, period, time outs left, team fouls, bonus/penalty, possession, game/match score) display formats. Programming should allow the operator to modify the existing display format or store and recall custom formats generated by operator. Information shall be able to be acquired via Sports Ticker or other third-party services as identified by the team. These feeds to be interfaced directly with scoreboard control system, with automatic, real-time update capability. Contractor to coordinate interface with outside information services with the team.
 3. Game in progress information to be able to be displayed on zoned segment of any display as well as zones created within center hung matrix displays. Display of clock must not show any delay from game clock displayed play clocks.

4. Provide interface to the statistics system for out-of-town games to allow update of score, quarter and game clock time. Update of all information on out-of-town scoreboard to be accomplished automatically once day's games are entered into system.
5. Animation: Refresh at a minimum of 60 frames per second. Maximum of a one second response to a control system command.
6. Preview: Preview animations or messages on the control system monitor prior to display on RGB Matrix Displays. Maximum of a one second response to a control system command.
7. Message formatting requirements:
 - a. Zoning: 16 user definable display zones (separate areas for displaying information) within fascia display with the size and location determined by the operator. Zones to be controlled individually, in groups, or totally at the same time, for all matrix boards, including auxiliary boards.
 - b. Character Fonts: Upper and lower case character generation. Include a minimum of ten separate fonts, including double and single characters. In addition, provide the capacity for one additional user definable font for storage and retrieval as a standard character set. Provide modification capabilities to all fonts and characters.
 - c. Symbols: A minimum of 100-line symbols to assist in operator graphics creation. In addition, provide unlimited number of user definable symbols.
 - d. Advanced message composition, including auto centering, left and right justification. Character by character editing with the ability for font changes of existing text without text retyping.
 - e. Bulk deletion of messages or selected deletion of individual messages or groups of messages.
 - f. Messages shall be able to crawl or roll in predefined zones with a minimum of four separate speeds.
 - g. Time of day and date programming.
 - h. Clocks: Provide capability to define location, size, fonts, and format of clocks on any matrix board segment.
8. Effects: Provide the following effects for characters, messages, symbols and animation:
 - a. Operator control of message, including sequencing and timing.
 - b. Continuous, seamless scrolling of selected zones of any matrix board with at least three separate speeds.
 - c. Vertical and horizontal Venetian blind change.
 - d. Horizontal travel with a minimum of three separate speeds.
 - e. Vertical scroll with a minimum of three separate speeds.
 - f. Wipe up/wipe down.
 - g. Wipe left/wipe right.
 - h. Wipe in a random-dot fashion.
 - i. Expand horizontally.
 - j. Expand vertically.
 - k. Transitions inside special effects shall include "dissolve", and "black hole" effects. Black hole and zoom effects to have user definable directions and origins.
9. Control system to allow designation of "soft" keys for rapid display of standard game conditions.
10. Security Code Access: Passwords shall be available to system users to log into and access the control of the display system.
11. Message Display Procedure: User can develop a display "play list" that can include an unlimited number of files (messages) in a specified order, for a specified period of time, at certain times of the day. Individual files can be given time constraints so that a message can be dropped from the displayed after a given number of times.
 - a. Overall display control software to allow scheduled functions to be overridden with content from the Venue control workstations to allow all displays in system to provide integrated content and timing when desired.

12. Offline Programming: New messages, procedures, and displays can be entered and programmed into the system during the display of existing file(s) from any terminal (Network Control Systems).
13. Internet access Message Logging and Recall:
 - a. Control system to allow 24/7 playlist scheduling of exterior display(s) with ability to insert real time video or Venue game-in-progress information upon command.
 - b. All displayed messages or animations shall be recorded into a Message Log. The Message Log shall be tied into the game controller and statistics memory. Any message or selected number of frames of animation can be retrieved from the Message Log and printed on the system printer.
 - 1) All displayed files, messages or animations shall be recorded into traffic database (log).
 - 2) At a minimum every file, message or animation in the traffic database shall provide:
 - a) a description of the event,
 - b) title of the message or animation,
 - c) dates and times of display,
 - (1) date and time of first display.
 - (2) date and time of last display.
 - (3) other dates and times of display.
 - d) duration of display, which display(s) received the message,
 - e) Client (e.g. advertiser, agency or network) associated with message or animation.
 - (1) sub-client information related to the piece (e.g. identifying a specific advertising campaign,
 - (2) Contact information (e.g. name, phone, address, billing codes, etc.)
 - f) Missed display (e.g. scheduled, but did not occur due to being "pre-empted" by live piece or higher priority material).
 - 3) Traffic reports shall be able to be created based upon user definable fields such as:
 - a) client,
 - b) element (e.g. file, message, animation, etc.).
 - c) daily, weekly, monthly, etc.
 - 4) Traffic reports shall be able to be generated in MS Excel.
 - 5) Traffic reports to display if the asset being played was actively visible and on what portion of the content zone.
 - c. Vendor shall provide the ability to host this internet log on a password protected web site specific maintained by vendor for a period of not less than 15 years as part of their base bid proposal.
 - d. Owner shall be responsible for providing internet connection between Venue and vendor's server.
14. Direct Control: Provide direct access and control of game statistics from previously designated remote locations or control room, generated by the operator from both control system locations.
15. Real Time Access: Provide access from any message console to current messages, statistics, game-in-progress and animation.
16. Provide Owner all software updates released by Contractor for other customer use that apply to installed systems for a period of 10 years.

H. Technical LED Content Management Control System

1. Message logging and as played and displayed reports are provided.
2. Quantities of devices are meant for design intent only. Ensure there is adequate quantities to drive every pixel discretely with no visual artifacts for supported boards as noted.

3. Type 1 CMS Management Server (CMS MGR₁)
 - a. Manages all CMS System components, subsystems & projects
 - b. Manager stores and deploys all relevant information to load display system projects to media players and human interfaces to GUI systems as required
 4. Note: System shown on AV drawing as basis of design single server. If multiple systems are required to support above task provide as required.
 5. System is configured as redundant
 6. Vendors with Acceptable solutions
 - a. ANC
 - b. Daktronics
 - c. Ross
 7. Type 1 LED Control System Human Interface (CMS GUI₁)
 - a. Provide control of entirety of LED Control System via network-based commands through a graphical user interface
 - b. System to provide human interface to support the development, playback and addition of display content via standard computer-based interface
 - c. System to support a minimum of 50 layout views
 - d. Hardware is Rack Mountable
 - e. Use same manufacturer as Type 1 CMS Management Server
 - f. Vendors with Acceptable solutions
 - 1) ANC
 - 2) Daktronics
 - 3) Ross
- I. LED Content Management System Digital Media Players & Compositors
1. Type 1 Digital Media Player (DMP₁)
 - a. (2) channels consisting of (1) fill and (1) key
 - b. 3G SDI Outputs
 - c. OES & Daktronics Scoring Data Support
 - d. XML Data Support
 - e. AMP, Ross Talk & GPI Triggers
 - f. Clip Playback
 - g. Graphics Generation Support with Real Time Scoring Data
 - h. External video reference input
 - i. Use same manufacturer as Type 1 CMS Management Server
 - j. Vendors with Acceptable solutions
 - 1) ANC
 - 2) Daktronics
 - 3) Ross
 2. Type 2 Digital Media Player (DMP₂)
 - a. (1) channel consisting of (1) fill output
 - b. 3G SDI Outputs
 - c. OES & Daktronics Scoring Data Support
 - d. XML Data Support
 - e. AMP, Ross Talk & GPI Triggers
 - f. Clip Playback
 - g. Graphics Generation Support with Real Time Scoring Data
 - h. External video reference input
 - i. Use same manufacturer as Type 1 CMS Management Server
 - j. Vendors with Acceptable solutions
 - 1) ANC
 - 2) Daktronics
 - 3) Ross
 3. Type 1 LED Scaling Compositing Engine (SCALER₁)

- a. Provide adequate processing power to address every pixel LED Displays discreetly without any scaling. Verify IO with existing LED display configurations.
 - b. (2) 3G SDI Inputs
 - c. (10) Content Inputs
 - d. (8) Tiled outputs with (3) Layers
 - e. (1) Multiviewer Display Outputs
 - f. AMP, Ross Talk & GPI Triggers
 - g. External video reference input
 - h. Vendors with Acceptable Solutions
 - 1) Analog Way
 - 2) Daktronics
 - 3) Ross
 - 4) TVOne
- J. LED Content Management System Distribution & Interface Components
- 1. Type 1 Distribution Gear Card frame (FRAME₁):
 - a. Frame with cooling fan, network card with 1 power supply
 - b. Connect Frame to network switch
 - c. Acceptable solutions
 - 1) Evertz Solution
 - a) Evertz 500FR with single power supply and 500FC frame controller with
 - b) Evertz 7800QT with power supply and frame controller
 - c) Evertz 3505FR-with power supply and frame controller
 - 2) Imagine Communications Solution
 - a) Imagine Communications 500FR with single power supply and Ethernet resource card
 - (1) Imagine Communications Selenio: SEL-FR3-AC-RR with SELOPT-LCP, (14 slot, 3 RU frame with single controller, single power supply and local control panel)
 - 3) Ross Solution
 - a) Ross OGX-FR-CN
 - b) Spare Power Supply:
 - c) Mounts in selected Distribution Gear Card Frame
 - d. Acceptable Product:
 - 1) Evertz backup/redundant power supply. (Quantity: 3 for every 4 trays, round fractional numbers up)
 - 2) Imagine Communications FR6822+AC power supply,
 - 3) Imagine Communications Selenio Family: SELOPT-PSU-AC (Quantity: One per frame)
 - 4) Ross PS OGX. (Quantity: 1 for every 2 trays, round fractional numbers up)
 - 2. Type 1 Serial Equalizing Amplifier (SDA₁)
 - a. 2 x 4 general distribution amplifier
 - b. 3G-SDI Input
 - c. 3G-SDI Output
 - d. Mounts in selected Distribution Gear Card Frame
 - e. Acceptable Product
 - 1) Evertz Solution
 - a) Evertz 500DA2Q-3G
 - 2) Imagine Communications Solution
 - a) Imagine Communications DA-H6802+S, D (QTY:2)
 - 3) Ross Video Solution
 - a) Ross Video DRS-8804-R2
 - 3. Type 1 Analog Video Distribution Amplifier (VDA₁)
 - a. Mounts in selected Distribution Gear Card Frame

- b. Acceptable Solutions
 - 1) Evertz Solution
 - a) Evertz 501ADA-EQ
 - 2) Imagine Communications Solution
 - a) Imagine communications VEA6800 + S/D
 - 3) Ross Video Solution
 - a) Ross Video UDA-8705A-R2
- 4. Type 1 3G SDI Matrix Switcher (SDI MTX₁)
 - a. (32) 3-G SDI Inputs
 - b. (32) 3G-SDI Outputs
 - c. Route any input to any output
 - d. Network Control
 - e. Router Preset / SALVO support
 - f. Physical Button Panel Interface
 - g. Acceptable Product:
 - 1) AJA KUMO-3232 with
 - a) AJA KUMO CP2
 - 2) Kramer Sierra Video Aspen 3232HD-3G
 - 3) Matrix Switch MSC-XD3232L
 - 4) Ross Video NK-3G34 with
 - a) Ross Video NK-IPS
 - b) Ross Video RCP-QE36
- 5. Type 1 3G-SDI to DVI Converter (DVI₁)
 - a. 3G-SDI Input
 - b. DVI-D Output
 - c. Acceptable Product
 - 1) AJA HDP3 with
 - a) Middle Atlantic UFA-8-F1
(1) Note: (1) UFA-8-F1 per (4) Type 1 3G-SDI to DVI Converter
 - 2) Link Bridge LB-SDI/DH with
 - a) Middle Atlantic UFA-8-F1
(1) Note: (1) UFA-8-F1 per (4) Type 1 3G-SDI to DVI Converter
- 6. Keyboard-Video-Mouse Interfaces
 - a. Type 1 Keyboard, Video, Mouse Manager License Upgrade (KVMLIC₁)
 - b. Provide license to owner
 - c. Upgrades existing management server from (24) unit licenses to (48) unit license
 - d. Quantity: 1
 - e. Acceptable Product
 - 1) Adder AIMLIC-48
- 7. Type 1 Keyboard, Video, Mouse Transmitter (EXT₁)
 - a. Compatible with existing owner KVM system
 - b. DVI Input
 - c. USB-B IO
 - d. Quantity: As required plus (3)
 - e. Acceptable Product
 - 1) Adder ALIF1002-T with
 - a) Adder RMK4D-R2
(1) Note: (1) RMK4D-R2 per (2) Type 1 EXT
- 8. Type 1 Keyboard, Video, Mouse Receiver (EXR₁)
 - a. Compatible with existing owner KVM system
 - b. DVI Output
 - c. (4) USB-A IO
 - d. Quantity: As required plus (5)
 - e. Acceptable Product
 - 1) Adder ALIF1002-R with
 - a) Adder RMK4V

2.5 ANIMATION DISPLAY PACKAGES

- A. As part of the base Display Installer scope of work, provide the following pre-programmed display formats: statistical and timing functions. Include variations of pre-programmed displays for the support of high school and other events as defined by the Owner. Supported Sports:
- B. American Football
 - 1. Installer/programming sub-contractor to work on-site, with Owner's game presentation staff in determining layout and content of pre-programmed displays. Each message shall be capable of being displayed on any matrix board.
 - 2. System to include data interface to allow game in progress information to be provided to broadcasters, without interface to display system control.
 - 3. LED Content Management System Provided Content & Operational Inventory
 - a. Provide each of the following loaded into the provided content management system
 - b. All creative content to be provided as fully rendered and loaded into the CMS as well as templates for modification by ownership
 - c. Content Inventory
 - 1) Graphical User Interface
 - a) Provide (15) user interface windows to support the minimum operations
 - (1) Video Board Operations Functions - Minimum
 - (a) Button Functions:
 - (b) Mute/Unmute each individual display
 - (c) Video Source Selection
 - (d) Layouts
 - (e) Module ID Patterns
 - (f) Video display dimming per display
 - (g) Remote power of displays
 - (h) WJHW Standard test patterns
 - (i) Additional as relevant to operations
 - (2) Pregame Functions
 - (a) Buttons coordinate with owner
 - (3) 1st Quarter Functions
 - (a) Buttons coordinate with owner
 - (4) 2nd Quarter Functions
 - (a) Buttons coordinate with owner
 - (5) Halftime Functions
 - (a) Buttons coordinate with owner
 - (6) 3rd Quarter Functions
 - (a) Buttons coordinate with owner
 - (7) 4th Quarter Functions
 - (a) Buttons coordinate with owner
 - (8) Post-Game Functions
 - (a) Buttons Coordinate with Owner
 - (9) Generic Football Game Stadium Rental
 - (a) Buttons Coordinate with Owner
 - (10) Generic Stadium Rental
 - (a) Buttons Coordinate with Owner
 - (11) (5) Layout screens to coordinate with owner
 - 2) Display Looks & Graphics Templates
 - a) Provide the following minimum LED Display look layouts with graphical templates per display
 - (1) North & South Endzone
 - (a) Game Look with Wings

- (b) Full Screen
 - (c) Game Look with Headshots in the wings
 - (d) Full Screen Headshots
 - (e) Two Box Video
 - (f) Generic Game Look with Wings
 - (g) Generic Football Scoring No live video
 - (h) (5) Owner specified layouts with associated graphical looks
- (2) Fascia
- (a) Full screen
 - (b) GIP & Stat with Advertising Zones
- 3) Custom Animations Package (ANIMATIONPACK₁)
- a) Animations may be both continuous (simultaneously displayed on all displays) as well as local to a specific display.
 - b) Animations shall be able to be displayed on each sign, at appropriate pixel ratio. In the event that animations must be re-rendered or converted to function on different size displays (e.g. fascia and end zone display), provide that as part of this package. Multiple renderings of same animation shall not be construed as more than 1 animation.
 - c) Proofing Process
 - (1) It is anticipated that the development of these animations and graphics will be something of an iterative process, working with the team to arrive at a suitable graphic appearance and look.
 - (2) Where multiple versions are noted, it is likely that some of the additional versions may be sponsored.
 - (3) Some animations will require multiple reviews to arrive at finished, playable product.
 - d) Software Rights
 - (1) Provide each graphic and animation in an editable, layered file format (e.g. Photoshop and after effects, etc.) so that team can make corrections during the season (e.g. add players as the season progresses).
 - e) Delivery
 - (1) Animations to be delivered as both native resolution of the video board and in 1280x720p with correct scaling applied.
 - (2) Animations to be delivered as templates in the native application used to create them with all elements to allow ownership to change elements and re-render.
 - f) Approved Animation Provider
 - (1) V2 Content – Brandon Verzal – brandon@v2content.com - 979-575-0356
 - g) The following animations are considered the initial minimum inventory of animations to be played back on the North Endzone Display, South Endzone Display, All Fascia Displays
 - (1) Welcome to Donald W Reynolds Razorback Stadium
 - (2) Anthem sequence (American flag waving)
 - (3) Get Loud
 - (4) Make Noise
 - (5) Matchups
 - (6) Generic Moving Background 1
 - (7) Generic Moving Background 2
 - (8) Generic Moving Background 3
 - (9) Generic Moving Background 4
 - (10) 1st Down
 - (11) 2nd Down

- (12) 3rd Down
- (13) 4th Down
- (14) Interception
- (15) Fumble
- (16) Touchdown
- (17) Halftime
- (18) Overtime
- (19) Sack
- (20) Field Goal
- (21) Great Play
- (22) Safety
- (23) Delay of Game
- (24) Thank You Fans
- (25) Weather Delay
- (26) Seek Shelter
- (27) Home Team Wins Version 1
- (28) Home Team Wins Version 2
- (29) (10) customizable owner animations

- C. External Data Control System: Provide system software related primarily to game statistics. Software shall interact with outside agency statistics ((i.e.; ESPN Game Cast, Sports Ticker, Elias, Stats.com, Stock ticker, NCAA Live Stats (Genius), via modem, satellite, or internet interface by Scoring system Contractor, or manual entry by operator. Communication connection will be provided to control room under a separate contract. Provide for the system to be interfaced to broadcasters and the Video Replay System's character generator. Subscription costs for outsidess services are the responsibility of Owner and tenant. Implement any of these statistics interfaces at any time during the warranty period at the Owner's request.
- D. Diagnostic Software: Provided to assist the Owner in diagnosing, isolating and repairing deficiencies in the display and control system, including defective lamps.

2.6 GAME IN PROGRESS/STATISTICAL INFORMATION CONTROL

- A. Contractor shall interface with existing OES timing and game in progress system as well as any statistical programs.

2.7 DISPLAY SUPPORT EQUIPMENT

- A. Equipment rack(s)
 - 1. Existing rack may be utilized, if appropriate.
 - 2. Provide any new equipment racks, as needed, to match existing equipment rack make/model numbers to achieve uniform look.
 - 3. Acceptable Product:
 - a. Middle Atlantic Products MRK series
 - b. As approved
 - 4. Rack Drawer:
 - a. Spring loaded latch
 - b. Black textured finish
 - c. Acceptable Product:
 - 1) Middle Atlantic TD series
 - 5. Low Profile Keyboard Shelf:
 - a. Sliding black laminate shelf
 - b. Single rack space
 - c. Acceptable Product:

- 1) Middle Atlantic SSL
6. Computer Shelf:
 - a. Flanged construction
 - b. 16 Gauge steel
 - c. Black powder coat finish
 - d. Acceptable Product:
 - 1) Middle Atlantic U4
7. Universal Rack Shelf:
 - a. Black textured powder coat finish
 - b. Acceptable Product:
 - 1) Middle Atlantic RSU-129
8. Universal Mounting Trays:
 - a. Multiple Devices
 - b. Acceptable Product:
 - 1) Extron RSU 126
9. Single Device
 - a. Acceptable Product:
 - 1) Extron RSB 126
10. Blank Rack Panels:
 - a. Flanged construction
 - b. 16 Gauge steel
 - c. Black powder coat finish
 - d. Acceptable Product:
 - 1) Middle Atlantic SB series
11. Vent Rack Panels:
 - a. Flanged construction
 - b. 16 Gauge steel
 - c. Black powder coat finish
 - d. Acceptable Product:
 - 1) Middle Atlantic VTF series
12. Rack Fan:
 - a. 10" or 4.5" (x4), 115V
 - b. Include cord and hardware
 - c. Acceptable Product:
 - 1) Middle Atlantic FAN10 with GUARD-10
 - 2) Middle Atlantic FAN with GUARD
13. Fan Thermostat Control:
 - a. Switched 15A duplex outlet
 - b. Temperature Range: 50 – 90 Degrees
 - c. On and Stand-by LED indicators
 - d. Integral mounting ears
 - e. Provide for each rack fan assembly
 - f. Acceptable Product:
 - 1) Middle Atlantic FC-4-1C
14. Rack Temperature Display:
 - a. Provide one display in top front panel space of each rack
 - b. Decora mount in 1-RU rack panel
 - c. Digital readout in Fahrenheit or Celsius
 - d. Connect to DAP GPIO for high temperature alarm to the Audio Control Booth
 - e. Acceptable Products:
 - 1) Middle Atlantic TEMP-DEC with DECP-1X1 Panel.
15. Rack Light:
 - a. Provide 60W incandescent or 13W fluorescent work light
 - b. Located in all equipment racks over 36 RU's high
 - c. Acceptable Product:
 - 1) Middle Atlantic WL-60

- 2) Lowell RL-1
 16. Copper Bus Bars:
 - a. Material: Solid copper, 1/8 thick and 2-inches wide with threaded 10/32 holes
 - b. Height: 70-inch for 40-RU or larger racks and 21-inch for racks under 40-RU
 - c. Wire each circuit ground to bus bar and isolated outlet ground
 - d. Terminate two #6 wires between rack and buss bar
 - e. Provide with nylon isolation mounts
 - f. Provide one bus bar in each rack
 - g. Acceptable Product:
 - 1) Middle Atlantic BB-40
 - 2) Middle Atlantic BB-12
 17. Equipment Rack Screws:
 - a. Install rack mounted equipment with black 10-32 star post security screws with flat nylon washers
 - b. Quantity as required
 - c. Provide one spare bit located in a clear plastic bag attached to the inside of each equipment rack in plain view
 - d. Acceptable Product:
 - 1) Middle Atlantic HTX
 - 2) Raxxess PNTX
 18. Wire Duct:
 - a. Purpose: signal wire routing in rack
 - b. Acceptable Product:
 - 1) Panduit Type E Slotted
 19. Surface Mount Wire Duct:
 - a. Signal level cabling, loudspeaker level cabling, electrical
 - b. Acceptable Product:
 - 1) Wiremold 4000 Series
- B. Ethernet Network Switch. 10/1000 with a gigabit uplink port.
1. Connect to existing switch.

PART 3 - EXECUTION

3.1 GENERAL

- A. All equipment and materials shall be new. Take care during installation to prevent scratches, dents, chips, etc.
- B. Mount equipment and enclosures plumb and square. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least three. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.
- C. Cover edges of cable pass-through holes in chassis, racks, boxes, etc., with rubber grommets or Brady GRNY nylon grommets.
- D. Provide event, portable cabling from courtside AV junction boxes to court/ice control operating positions for interconnection and operation of scoring systems.
- E. AC Power and Grounding
 1. Adhere to all local and national electrical codes and standards.

- F. All engraving shall be 1/8" block sans serif characters unless noted otherwise. On dark panels or push buttons, letters shall be white; on stainless steel or brushed natural aluminum plates, or light-colored push buttons, letters shall be black.
- G. Equipment and Cable Labeling
 - 1. Provide engraved Lamacoid labels on the front and rear of active equipment mounted in racks. Mount labels in a neat, plumb and permanent manner. Embossed labels are not acceptable. Equipment labels to have at least three lines of engraving with the first line listing the general name of the device. The second line to include the schematic reference of the device. The bottom line to indicate what other devices or areas this equipment controls.
 - 2. Provide an engraved label over each user-operated control that describes the function or purpose of the control. Label size to be adjusted to fit available space.
 - 3. Engraved labels to have 1/8" high characters minimum. Labels to be black with white characters except where indicated.
 - 4. Cables and wiring to be logically, legibly and permanently labeled for easy identification. Labels on cables to 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 label. Hand-written or self-laminating type labels are not acceptable.
 - 5. Wiring designations to be an alpha-numeric code that is unique for each cable. Locate the cable designation at the start and end of each cable run and within 3" of the point of termination or connection. For cable runs that have intermediate splice points, the cable shall have the same designation throughout with an additional suffix to indicate each segment of the run. Actual cable designation assignments to be determined by Installer. Add cable designation codes to system schematic drawings included with Project Record Drawings.
 - 6. Label each terminal strip with a unique identification code in addition to a numerical label for each terminal. Show terminal strip codes on system schematic drawings included with Project Record Drawings.
 - 7. Provide adhesive labels on the rear of equipment where cables attach to indicate the designation of the cable connected at that point.

3.2 DEMONSTRATIONS

- A. LED Display System
 - 1. Provide 16 hours instruction to Owner or Operator designated personnel/facility staff on the use, operation and maintenance of the System, scheduled as a minimum of eight separate sessions, by an instructor fully knowledgeable and qualified in system operation. The System Reference Manuals should be complete and on site at the time of this instruction. Coordinate schedule of demonstration with Owner or Owner's Representative.
 - 2. Training Schedules
 - a. Training should be assumed to take place on the project site, unless agreed to by the Owner.
 - b. Training should be scheduled to be non-overlapping, unless agreed to by the Owner.
 - c. Actual training schedule shall be by agreement with Owner. Do not assume that training will occur over 8-hour days. It is more likely that training will be scheduled in 4-to-6-hour increments; perhaps over a period of weeks (or even months).
 - d. In the event that a portion of the training time is occupied in troubleshooting the equipment installation, then the training time shall be extended an equal amount of time at a time mutually agreed to with owner.
 - 3. The following is a general idea of the training "curriculum":
 - a. A general familiarization of each major device.

- b. An explanation of how the device interfaces to the rest of the system (including remote controls, data connections; timing requirements and the like).
 - c. General training on operating the device.
 - d. Saving information; backing information up (including a review of the proper procedures for backing up).
 - e. Basic troubleshooting
 - f. Specific troubleshooting (this information may be conveyed to personnel other than the device's "operators").
 - g. How to upgrade software; precautions taken while doing (e.g. backing-up existing software, don't be the first one to try the new software on game day).
4. Content Management System
 5. Content management implementation specialist (60 hours, minimum). Submit resume on implementation specialist on this device for approval.
 - a. Provide an experienced CMS Owner to assist in development and implementation of CMS templates user panels, content loading and system management tasks. This will include consultation on: creative content, programming of content, interfacing to graphic and statistical systems, etc.
 - b. CMS implementation is specifically to be experienced in game entertainment production (not just broadcast production), preferably in a sporting facility with unique aspect ratio displays.
 - c. CMS Owner is specifically to be experienced with database interfacing to Statcrew, OES, Stats LLC, RTD and summary database or other scoring systems (e.g. XML, JSON, RSS, etc.).
 - d. CMS Owner is specifically to be experienced interfacing the system with external devices such as the Ross Carbonite production switcher.
 - e. It is expected that some of this involvement and time will be in advance to actual on site time and work.
 6. The following is a general idea of the training "curriculum":
 - a. An explanation of how the device interfaces to the rest of the system (including remote controls, data connections; timing requirements and the like).
 - b. Specific training on device operation (e.g. entering statistics; how to access data retrieval sources; how to create repeatable formats and layouts, changing fonts, loading new fonts).
 - c. Loading media, Creating Buttons, Creating Layouts, Creating Templates
 - d. Generating run log reports
 - e. Display dimming
 - f. Changing layouts
 - g. Saving information; backing information up (including a review of the proper procedures for backing up).
 - h. Basic troubleshooting
 - i. Redundancy Failover

3.3 EVENT ATTENDANCE

A. LED Display System

1. In addition to training and warranty requirements, this installer shall provide event support services to facilitate troubleshooting and effect repair of the specified systems (hardware and software) during every game during the first season of operation, as designated by Owner. Event support shall begin in a period 24 hours prior to the opening of gates and shall extend to 48 hours for a weekend game.
 - a. Two days prior to the event; test and review all displays, processors and supporting computers to confirm proper operation; repair and address issues as required.
 - b. Be available on call after testing.

- c. Be present on game day from at least 4 hours before gates open, until the time released by the Owner.
- B. At the beginning of each warranty season, provide one (1) full day with Owner reviewing display configurations, operational questions and performance at a time designated by Owner by a manufacturer authorized trainer/Owner/commissioning agent.
- C. Provide sufficient manpower to effect repairs as expeditiously as possible. It is expected that both a display technician as well as a control room/control system specialist are present.
- D. Content Management System
 - 1. In addition to the CMS training noted above, the software/template trainer shall be present at four games and two other events as designated by the Owner.

3.4 LED INSTALLER TESTS AND ADJUSTMENTS

- A. Verify the following before beginning actual tests and adjustments on the system:
 - 1. Electronic devices are properly grounded.
 - 2. Powered devices have AC power from the proper circuit and hot, neutral, and ground conductors are connected correctly.
 - 3. Insulation and shrink tubing are present where required.
 - 4. Dust, debris, solder splatter, etc. is removed.
 - 5. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
- B. Preparation for Acceptance, prior to final inspection:
 - 1. Temporary facilities and utilities shall be properly disconnected, removed and disposed of off-site.
 - 2. All systems, equipment and devices shall be in full and proper adjustment and operation, and properly labeled and identified.
 - 3. All materials shall be neat, clean and unmarred and parts securely attached.
 - 4. All broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. shall be replaced or properly repaired, and debris cleaned up and discarded.
 - 5. All extra materials, portable equipment, and spares shall be delivered and stored at the premises as directed.
- C. RGB LED testing requirements
 - 1. In the event that owner believes that a display does not comply with the performance criteria of the specification, the Installer shall contract with a mutually agreed on independent testing agency/consultancy to verify performance of the display or displays. Cost of this testing will be solely born by the installer. At a minimum the following must be tested:
 - a. Overall screen brightness (peak)
 - b. Uniformity testing
 - 1) Separate measurements (brightness and color temperature) shall be made to verify uniformity at:
 - a) Peak/maximum brightness (recommended direct sunlight operating brightness).
 - b) Typical operating brightness
 - c) Evening/nighttime operating brightness
 - 2) Brightness uniformity
 - a) pixel to pixel
 - (1) intra-module

- (2) between modules
 - (3) Sampling techniques are acceptable, provided:
 - (a) number of samples is not less than 20% of the total display's pixels.
 - (b) samples are spread throughout the screen
 - (c) Samples run width of screen
 - b) module to module
 - c) best case to worst case
 - 3) Color temperature uniformity
 - a) pixel to pixel
 - (1) intra-module
 - (2) between modules
 - (3) Sampling techniques are acceptable, provided:
 - (a) number of samples is not less than 20% of the total display's pixels.
 - (b) sample is spread throughout the screen
 - b) module to module
 - c) best case to worst case
- c. Viewing angles:
 - 1) Horizontal
 - 2) Vertical
 - 3) Defined as 50% of peak brightness, or at the point a noticeable color shift occurs.
- d. Tests to be performed in accordance with manufacturer's installation and service manual on displays installed at the site, with a "normal" video signal that is injected at the control room, or at the board. Tests on display elements or modules prior to installation are not acceptable.
- e. Test report shall include full documentation on test procedure, instruments employed (including model number and serial number) and copy of instrument calibration certification.
- f. Meets FCC compliancy. Testing might be required, if requested by Owner, adjacent property owner or government agency.

3.5 TEST EQUIPMENT

- A. The Contract shall require the Installer to provide test equipment for final acceptance testing. Test equipment to be available for the entire period through final system acceptance. Prior to start of testing, provide a list to the Owner or Owner's Representative of test equipment make and model numbers that will be used.
 - 1. Dual-trace oscilloscope: 100 MHz bandwidth, 1 mV/cm sensitivity, TV trigger.
 - 2. Multimeter: Measurement range, DC to 20,000 Hz, 100 mV to 300 V, 10 ma to 10A.
 - 3. Television signal generator: Tektronics.

3.6 ACCEPTANCE

- A. Upon completion of installation and initial tests and report specified in Part 3, acceptance testing shall be performed by the Owner or Owner's Representative.
- B. Acceptance testing will include operation of each major system and any other components deemed necessary. Installer will assist in this testing and provide any test equipment required specified herein. Installer shall provide at least 1 technician available for the entire testing period (day and night), to assist in tests, adjustments, and final modifications. Tools and material required to make any necessary repairs, corrections, or adjustments shall be furnished by the Installer. Testing process is estimated to take a minimum of 3 days.

- C. The following procedures will be performed on each System:
1. Assessment of all display images.
 2. Provide test pattern on all color matrix and video displays for Owner's Representative to review. Pattern to include:
 - a. A rotation of red, grid, blue, grid, green, grid, white, grid, repeat
 - b. Grids to have letter and/or number or combination of both within each grid box representing module.
 - c. Rotation to be able to be easily accessed and automatic.
 3. Physical inspection of displays
 4. Review of animations
 5. Review of scoring and clock functions.
 6. Review of system operation on redundant cabling.
 7. Control functions shall be checked for proper operation, from controlling devices to controlled devices.
 8. Adjust, balance, and align equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each adjustable control with small white, adhesive dots, and record these settings, in the "System Operation and Maintenance Manual."
 9. Provided and loose equipment will be inventoried for correct quantity.
 10. Testing to include demonstration of Stenograph and Sports Ticker data input capability. Provision of stenograph equipment and operator as required, is the responsibility of the Installer.
 11. Any other test on any piece of equipment or system deemed appropriate.
- D. In the event the need for further adjustment or work becomes evident during equalization and/or acceptance testing, the Installer will 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 Installer will pay for additional time and expenses of the Owner or Owner's Representative.
- E. The Owner's fees and costs involved in acceptance testing are not the responsibility of the Scoring and Matrix Display System Installer, except as described in Part 3 of this specification.
- F. Final acceptance will follow the successful control system operation all first season pre-season games and first two regular season games. Should play at the stadium begin mid-season this period shall be a minimum of four games.
- G. In the event that the system is used prior to final acceptance, attendance in support of system usage shall not be construed as acceptance, or as event attendance.

END OF SECTION 11 63 10