

ILLINIOS SPORTS FACILITIES AUTHORITY (ISFA)
GUARANTEED RATE FIELD

TECHNICAL SPECIFICATIONS
FY27 Scoreboard Control Room – Video Upgrades

SECTION 27 41 16.76

BROADCAST TECHNICAL SPECIFICATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. The disciplines included in this section are:
 - 1. Camera RF Upgrade Receiver
 - 2. Replay System Upgrade
 - 3. Intercom System Upgrade
 - 4. Storage Archive System Upgrade

1.02 DESCRIPTION

- A. The Contractor shall be responsible for providing all equipment as described for a complete and turnkey system upgrades.
- B. Contractor shall grant a license to use all proprietary software provided with this RFP for the life of the system.
- C. All equipment and materials shall be new (latest version at time of bid) and shall conform to applicable UL, CSA, or ANSI provisions. Remanufactured or "B" stock equipment will not be accepted without prior written consent from the Owner. Evidence of unauthorized re-manufactured or "B" stock equipment on the project site will be deemed evidence of the Contractor's Failure to Perform the Work. Take care during installation to prevent scratches, dents, chips or disfiguration.

1.03 VENDOR QUALIFICATIONS

- A. Vendor shall provide a list of a minimum of three (3) facilities (facility, contact name, title, address and current phone number) where the vendor has provided equipment and services of equivalent size and scope within the last five (5) years.
- B. Vendor shall provide a minimum of one (1) facility (facility, contact name, title, address and current phone number) where the vendor has provided equipment and services of equivalent size and scope that is at least five (5) years old.
- C. Vendor shall be required to provide a Letter of Surety from its bonding agent, stating their ability to provide a 100% payment and performance bond if they are the successful bidder.
- D. Vendor shall have a direct service employee or certified contractor capable of providing maintenance response within 2 hours of a call for service via remote session and have the ability to be onsite within 48 hours when required.

1.04 SUBMITTAL REQUIREMENTS

- A. Initial Submittals and Shop Drawings
 - 1. Contractor shall be required to provide submittals and shop drawings within thirty (30) calendar days of the date shown on award notice. Contractor shall be responsible for ensuring that the dimensions and specifications of each component and all systems fit within the building allowances. Contractor shall advise of any discrepancy that could affect installation. If Contractor fails to report any discrepancies, Contractor shall assume responsibility for providing the required equipment or correcting such discrepancies at no additional cost. The following required submittals will be defined by the guidelines established and shall include but not be limited to:

- a. Digital sets of shop drawings and product data, compiled together in one cloud folder within thirty (30) calendar days of the date shown on Award Notice to Contract and prior to ordering equipment.
- b. Point-to-point wiring diagrams and typed wire lists identifying every connection. Include electronic devices such as switches, transformers and terminal blocks. Indicate locations of all components. Identify cables by types, colors and wire numbers. Complete, detailed wiring diagrams for the 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 conduit, connector types, expansion loops and cable lengths. Drawings shall comply with ANSI and International Electrotechnical Commission recommendations and standards as appropriate. Provide drawing set cover sheet clearly dimensioning all cable preparation details for each cable type and connector utilized in the system.
- c. Rack layouts indicating the proposed arrangement of mounted equipment including power junction box location and locations of conduit penetrations. Rack layouts shall include front and rear views. BTU loads for each piece of equipment should also be included on the rack layout drawing.
- d. Detail drawings of all custom fabricated items and approved equipment modifications. Include complete parts lists, schematic diagrams, and all dimensions required for proper assembly.
- e. A list of all lower-tier subcontractors and suppliers. The list shall include lower-tier subcontractor's qualifications indicating performance of similar work on past projects of this type and scope. Use of any subcontractor does not relieve the prime Contractor of responsibility for engineering and project management.
- f. A project schedule in Gantt Chart format outlining equipment delivery dates and installation start and finish dates. Project schedule shall be broken down into sufficient detail (work task and duration).
- g. Copies of all required business and contractor licenses.
- h. Copies of proof of insurance.
- i. Approval of submitted items indicates only the acceptance of the manufacturer and quality. Specific requirements, arrangements, and quantities shall comply with the intent of the Contract Documents unless specifically approved in writing.
- j. Submittals that are incomplete, deviate significantly from the requirements of the Contract Documents, or contain numerous errors will be returned without review for rework and re-submittal, and may result in back charges to the Contractor.

B. Contract Closeout Submittal:

- 1. When the installation is substantially complete, including the Testing Reports in Part 3 of this Section, Contractor shall submit a complete initial electronic set of contract closeout submittals for review. After review and approval of the initial set, return markup to Contractor with comments for updating. Contractor shall provide the final set of closeout submittals in electronic format. Closeout submittals shall include, but not be limited to:
 - a. Project Record Drawings (As-Built Drawings) including final secondary steel structural drawings, electrical drawings, and system block diagrams, rack layout drawings and wiring schedule. This shall be a digital copy as well as installed on the EIC computer.
 - b. An Operation & Maintenance Manual. This shall be a digital copy as well as installed on the EIC computer.
 - c. A list of all equipment provided and its location within the facility. List shall include manufacturer name, model identifier, serial number, and any other pertinent information needed to obtain service, maintenance, and/or replacement.

- d. A list of all Subcontractors who performed work for Contractor during installation. List shall include company name, physical company address, phone number, and contact person(s).
 - e. Copies of all software, settings and programs used in the control and operation of this system.
 - f. Copies of all equipment registration documentation.
 - g. Test reports from an independent testing and inspection agency certifying that bolted and/or welded connections for primary secondary structural steel meet the minimum requirements of the engineered structural drawings, the governing building code, or as required by the building official; whichever is more restrictive.
 - h. All testing reports as specified in Section 3.1.9 – Testing and Acceptance.
 - i. Test reports for all new fiber optic cables installed under this scope of work. Test reports shall indicate end-to-end signal loss does not exceed a maximum dB loss per Section 3.1.5.j and/or 3.1.5.k.
- C. Operation & Maintenance Manual
- 1. Upon substantial completion but prior to onsite training, Contractor shall provide digital copies of the Operation & Maintenance Manuals (O&M Manuals). O&M Manuals shall have folders and shall be logically organized to provide easy access to information without the need to research through the entire manual. All documents provided in the O&M Manual shall be written in English and shall provide sufficient detail as to be understood by an individual with no knowledge of audio components or the associated control equipment and/or operating systems. Contents of the O&M Manual shall include, but not be limited to:
 - a. Table of Contents
 - b. Description / overview of system(s) including key features and operational procedures.
 - c. Full startup procedure for all control room rack equipment and any additional audio components written under the assumption that all equipment was in full powered off mode.
 - d. Full shutdown procedure for all control room rack equipment and any additional audio components written under the assumption that the facility is in an extended power failure situation.
 - e. Owner's Manuals for all third-party and/or "off the shelf" type equipment provided by Contractor; e.g., KVM's, fiber modems, network switches/routers, and UPS battery backups.
 - f. Single-line block diagrams showing all major components of the systems.
 - g. All third-party equipment and/or "off the shelf" equipment warranties and a notarized System Warranty.

1.05 EQUIPMENT GENERAL SPECIFICATIONS

- A. All equipment and materials shall be new and the latest version at the time of bid and shall conform to applicable UL, ULC, CSA or ANSI provisions. Remanufactured or "B" stock equipment will not be accepted without prior written consent. Evidence of unauthorized re-manufactured or "B" stock equipment on the project site will be deemed evidence of the contractor's failure to perform the work. Contractor shall take care during installation to prevent scratches, dents, chips or disfiguration of equipment and materials supplied. All damaged equipment and/or materials shall be repaired or replaced.
- B. All cabling, excluding equipment power, is to be labeled at each end of the cable with a description in English OR with a reference to a wire designation on a wiring diagram. These diagrams must be part of the Project documentation submitted at time of acceptance.

- C. Each device shall meet all its published manufacturer's specifications. Verify performance as required.
- D. Install all rack-mounted equipment with Middle Atlantic Products HP Series truss head screws or approved equal.
- E. Provide 2.0 mil gloss white polyester face stock; over-laminated with a 1.0 mil clear polyester film; 1.0 mil high-performance permanent pressure-sensitive adhesive. Mount labels on the equipment chassis and attach in a neat and permanent manner. Label equipment with schematic enumeration reference, and with descriptive information regarding its function or area it is serving.
- F. All labels shall be 1/8" block lettering unless noted otherwise. On dark panels or pushbuttons, letters shall be white. Letters shall be black on stainless steel, brushed natural aluminum plates or light-colored pushbuttons.
- G. Per IEC-268 standard, all XLR connectors not mounted on equipment shall be wired pin 2 hot (high), pin 3 low, and pin 1 screen (shield).
- H. Mounting Hardware exposed to the weather shall be aluminum, brass, epoxy-painted galvanized steel, or stainless steel. Apply corrosion inhibitor to all threaded fittings.
- I. Any rear mounted rack equipment shall be placed so the equipment does not block access to the back of front mounted equipment.
- J. Contractor shall exercise care when wiring racks to avoid damaging cables and equipment. Contractor shall install grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
- K. Power wiring and signal/data wiring shall be installed on opposite sides of rack. Contractor may determine which side is used for power and which side for signal. Method shall be kept the same for entire installation, if multiple racks are required. Contractor shall exercise care when wiring racks to avoid damaging cables and equipment.

1.06 QUALITY ASSURANCE

- A. All requirements of the latest published editions of the following standards shall apply, unless otherwise noted. In the event of conflict between cited or referenced standards, the more stringent shall govern.
 - 1. National Electric Code (NEC)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. American National Standards Institute (ANSI)
 - 4. Occupational Safety and Health Administration (OSHA)
 - 5. American Iron and Steel Institute (AISI)
 - 6. Underwriters Laboratories (UL)
 - 7. Federal Communications Commission (FCC) Rules and Regulations, Part 76
 - 8. Society of Cable Telecommunications Engineers (SCTE)
 - 9. Society of Motion Picture and Television Engineers (SMPTE)
 - 10. ASTM International (ASTM)
 - 11. The Internet & Television Association (NCTA)
 - 12. Electronic Industries Alliance (EIA)
 - 13. Telecommunications Industries Association (TIA)
- B. Review all architectural, civil, structural, mechanical, electrical, and other project documents related to this work.
- C. Verify all dimensions, cable lengths and site conditions prior to starting work.
- D. Coordinate the specified work with all other trades.

- E. Maintain a competent supervisor and supporting technical personnel, acceptable to the Project during the entire installation. Change of supervisor during the project shall not be permitted without prior written approval from the Project.
- F. Provide all items not indicated on the drawings or mentioned in the specifications that are necessary, required or appropriate for this work to realize a complete and fully operational system that performs in a stable and safe manner.
- G. Review project documentation and continuously make known any conflicts discovered and provide all items necessary to complete this work to the satisfaction of the Project without additional expense. In all cases where a device or item or equipment is referred to in singular number or without quantity, each such reference shall apply to as many such devices or items as are required to complete the work.
- H. Provide additional support or positioning members as required for the proper installation and operation of equipment, materials and devices provided as part of this work without additional cost.
- I. Regularly examine all construction, and the work of others, which may affect the Contractor's work to ensure proper conditions exist at the site for the equipment and devices before their manufacture, fabrication or installation.
- J. Contractor shall be responsible for the proper fitting of the systems, equipment, materials, and devices provided as part of this work.
- K. Promptly notify in writing of any difficulties that may prevent proper coordination or timely completion of this work. Failure to do so shall constitute acceptance of construction as suitable in all ways to receive this work, except for defects that may develop in the work of others after its execution.
- L. After installation, submit photographs showing cable entries and terminations within equipment racks, enclosures and pedestals at the job site.

1.07 WARRANTY AND SERVICE

- A. Contractor shall warrant labor and materials for twelve (12) months following the date of SUBSTANTIAL COMPLETION.
- B. In the event that the contractor does not meet Substantial Completion before the first event, the contractor will be responsible for event support for all events that use the system until substantial completion is reached. The three (3) required events will not start until after substantial completion is reached.
- C. During the warranty period the system shall be free of defects and deficiencies and conform to the drawings and specifications with respect to the quality, function, and characteristics stated.
- D. Contractor shall repair or replace defects that occur in labor or materials within the warranty period.
- E. On-site labor shall be included during the warranty period for any work beyond simple component replacement. Simple component replacement shall be defined as all equipment that does not require tools to perform the equipment replacement.
- F. Failed parts shall be returned to the Contractor for repair at a service facility located in the United States. Contractor shall identify the location of its service facility in the documentation provided when submitting a bid for this work.
- G. The Contractor shall replace failed parts that cannot be repaired.
- H. Upon receipt of a failed part, Contractor shall return a repaired or replacement part within fifteen (15) business days from receipt of failed part.
- I. Contractor shall supply at least one local service employee or local authorized service agent for service and repair of all equipment during the warranty period. Local service employee or local authorized service agent shall be located within 75 miles of the facility.
- J. The local service employee or local authorized service agent shall be the entity responsible for providing the following emergency response availability:

- K. Telephone service assistance and technical support from 8:00 a.m. to 11:00 p.m. local time, seven days per week.
 - 1. Answer all service calls and requests for information within one (1) hour during the warranty period.
 - 2. The advance replacement should contain all the shipping information and packaging necessary to return the defective part or assembly back to Contractor at no cost.
- L. Warranty shall cover all equipment, including processors, controllers, operating systems, and software.
- M. Warranty shall include one annual on-site system check-up by a qualified technician who is a full-time employee of the Contractor. Visit to occur approximately 2-3 weeks prior to the start of the second season.
- N. Check-up shall include all regular maintenance; including filter cleaning, a complete inspection of all systems, parts replacement where required and a complete written report of all findings.

END OF PART 1 GENERAL

PART 2 - PRODUCTS

2.01 BROADCAST CABLE

- A. See bid form for equipment requirements. Bid Form supersedes the specification for design intent.
- B. The Base Bid is required. A vendor alternate tab is provided in the bid form for use to recommend alternatives to the equipment. All vendor alternates will meet the same minimum specifications as the equipment in the main equipment list.

END OF PART 2 PRODUCTS

PART 3 - EXECUTION

3.01 VIDEO REPLAY

A. Scope of Work

1. The following outlines the turnkey delivery and installation responsibilities that define the project scope of work. All work outlined in this section is the responsibility of the Contractor unless otherwise noted. Contractors are required to provide all labor, materials, tools, supervision and equipment to perform the following:
 - a. Replay System Upgrade
 - (1) Replace and upgrade the existing Evertz DreamCatcher/Live Media production system by furnishing, delivering, installing, integrating, configuring, and commissioning three LM-CORE-HC7T 1RU high-compute processing cores with 7TB hot-swappable storage, three DC-IO-MX12-12G-SDI I/O modules, one LM-CORE-HC 1RU high-compute processing core with 1.9TB hot-swappable storage, eight SFP10G-TR13-M 10Gbps single-mode optical transceivers, 45 LM-IXXS-16 JPEG XS 60fps encoding/decoding feature keys, 30 DC-CONTINUOUS-REC continuous ingest channels, six DC-OUTPUT live production playout channels, three DC-REPLAY-UI user interface instances, one DC-MEDIA-FLEX application, one DC-MEDIA-BRIDGE application, one DC-MEDIA-DIRECTOR application, and the applicable transferred software licenses. The work shall include installation and interconnection of all processing cores, I/O modules, optical transceivers, storage, network connections, video inputs and outputs, and associated system components; configuration of the DreamCatcher and Evertz Live Media applications, JPEG XS encoding and decoding, continuous recording, playout, replay, media management, media bridging, transcoding, external network access, and related operational parameters; transfer and activation of all applicable software licenses; and system testing to verify proper functionality, signal flow, recording, playback, processing, networking, redundancy, storage access, and integration with the existing production environment. The scope shall also include three eight-hour days of on-site live production commissioning, three eight-hours of on-site live production training, applicable software support and annual licensing, and reasonable travel, accommodation, and out-of-pocket expenses associated with the services. Any remote-control panel, including the listed DC-RCP-10 item with a quantity of zero, is OFE for this scope, and all software functions, application licenses, license transfers, support terms, and subscription periods shall be provided in accordance with the final quotation and Evertz licensing requirements.
 - b. Intercom System Upgrade
 - (1) Furnish, deliver, install, configure, test, and commission a complete Riedel Artist digital intercom and Bolero wireless communication system, including the following equipment and services:
 - (a) One Artist-1024 frame with two power supply units and fan assembly.
 - (b) Five VAE-16 Plus Virtual Artist Expansion licenses, providing 16 ports each.
 - (c) Seven Artist 1024 Universal Interface Card 128-II cards, including six primary cards and one shelf spare/backup card.
 - (d) Four 1G RJ45 SFP fiber accessories for Artist and MediorNet systems.
 - (e) Four single-mode 1310 nm, 1.25 Gbps SFP CPU modules for the Artist system.
 - (f) One SFP MADI module with BNC connectivity and one single-mode LC duplex fiber cable.

- (g) Sixteen RSP-2318 2300 Series rackmount SmartPanels with 18 keys.
 - (h) Three 2300 Series 24-key expansion SmartPanels.
 - (i) Two DSP-2312 2300 Series desktop SmartPanels with 12 keys.
 - (j) Two 2300 Series Intercom App PLUS licenses and sixteen Intercom App PRO licenses.
 - (k) Three DSP-1216HL 1200 Series desktop SmartPanels with 16 lever keys.
 - (l) Three CCA_1200_PLUS Commentary Control Application PLUS licenses and three 1200 Series commentary headset adapters.
 - (m) Four BL-ANT-1010-19G-US G2F Bolero wireless antennas, including three standard units and one owner-furnished-equipment unit associated with PO68836.
 - (n) Three NSA-008A StageLink audio interfaces, each providing six audio inputs and six audio outputs.
 - (o) Thirty-two AIR-D1 XLR4F lightweight headsets and seventeen PRO-D1 XLR4F medium-weight headsets.
 - (p) Two 50-port Netgear GSM4352PA managed 1G/10G PoE+ network switch with SFP+ connectivity for the primary and backup network infrastructure.
- (2) The work shall include rack installation, equipment mounting, power and network connectivity, fiber and audio interconnections, system software and license activation, configuration of Artist resources, interfaces, panels, applications, StageLink devices, MAD1 connectivity, Bolero antennas, and associated network services. The contractor shall coordinate the installation with the existing facility infrastructure and verify compatibility with the primary and backup network paths.
 - (3) Following installation, the contractor shall perform system programming, endpoint registration, signal-flow verification, panel and key assignment, headset and commentary-function testing, Bolero wireless coverage and registration testing, audio input/output testing, network and PoE verification, primary/backup path testing, and operational acceptance testing. Any deficiencies identified during testing shall be corrected before turnover.
 - (4) The scope shall include three units of commissioning services, one technical training service, applicable travel and expenses, and one year of Riedel Care Standard service-level support. Commissioning shall include final system configuration, operational verification, basic troubleshooting, and turnover documentation. Technical training shall cover system operation, user-panel functions, commentary and headset operation, Bolero wireless units, routine administration, and basic fault isolation.
 - (5) The applicable U.S. tariff surcharge shall be included as identified in the equipment schedule. One Bolero antenna is identified as owner-furnished equipment associated with PO68836 and shall be coordinated for installation and integration. Pricing, licensing, annual service coverage, and travel shall be provided in accordance with the final Riedel quotation and applicable manufacturer terms.
- c. Storage Archive System Upgrade
- (1) Furnish, deliver, install, configure, integrate, test, and commission complete EditShare EFS media storage, metadata management, nearline storage, and network infrastructure solution, including the following equipment, licenses, services, and associated accessories:
 - (a) One EditShare Ultimate EFS Metadata Controller (MDC) 2U server with platform license.

- (b) One dual-port 10GbE Base-T network interface card for the EditShare server or workstation.
 - (c) One dedicated dual 480GB SSD file-auditing expansion for the existing EFS MDC.
 - (d) One memory upgrade increasing the EFS MDC system memory to 256GB.
 - (e) Four 3U 16-drive, 6TB storage nodes with platform and storage licenses, including onboard dual 10Gb network controllers.
 - (f) Four 6TB spare drives.
 - (g) One 4U EditShare Parking Node configured as 480TB raw nearline storage using 30 × 16TB drives, half-populated, with EFS nearline storage and platform functionality.
 - (h) One quality-tested 16TB 3.5-inch RAID hard drive.
 - (i) One Netgear M4500-48XF8C managed network switch with 48 × 10G/25G SFP28 ports and 8 × 100G QSFP28 ports.
 - (j) Thirty-six Netgear AXM765-20000S 10GBASE-T SFP+ transceivers.
 - (k) Twelve 10GE LR-LITE SFP+ modules.
- (2) The work shall include rack installation, equipment mounting, power distribution, network connectivity, fiber and copper interconnections, installation of storage and metadata components, system initialization, platform and storage license activation, configuration of the MDC, storage nodes, nearline Parking Node, file-auditing storage, network interfaces, and associated EditShare services.
 - (3) The contractor shall configure the EditShare environment to provide centralized metadata management, media storage, file auditing, nearline storage, and connectivity to the facility's production and post-production systems. The storage nodes shall be configured and presented as an integrated EFS storage environment, with the Parking Node configured for nearline or extended-capacity storage as applicable. The network switch and transceivers shall be installed and configured to support the required 10GbE, 25GbE, and 100GbE infrastructure, including applicable VLANs, port assignments, link aggregation, management access, and connectivity to the EditShare system and attached workstations or production devices.
 - (4) The scope shall include migration of media and data to the new EditShare solution for three 32TB increments, or approximately 96TB total, subject to confirmation of the source environment, media organization, network capacity, and available destination storage. Migration services shall include planning, transfer, verification, and coordination with the customer to minimize disruption to ongoing operations. Any incompatible, corrupt, unsupported, or otherwise inaccessible source media shall be identified and reported.
 - (5) Following installation and migration, the contractor shall perform system testing and validation, including storage availability, metadata services, file auditing, media access, nearline storage operation, network throughput, redundancy where applicable, drive and spare-drive recognition, client connectivity, and representative media ingest, playback, editing, and retrieval workflows. Configuration deficiencies identified during testing shall be corrected before turnover.
 - (6) The scope shall include five days of remote commissioning, three remote training sessions for a maximum of five participants, and five years of EditShare Standard Annual Support. Support shall provide 9×5 regional business-hours coverage, telephone support, portal access, and email support in accordance with the applicable EditShare support terms.

- (7) Two customer loyalty/trade-up promotional credits for four EFS 300 96TB MDC systems shall be applied as identified in the equipment schedule. The trade-up eligibility, credited equipment, and final commercial treatment shall be subject to EditShare approval and the terms of the applicable promotion.
- (8) All equipment, licenses, support, commissioning, training, migration services, network components, transceivers, storage media, and promotional credits shall be provided in accordance with the final EditShare and Netgear quotations. Exact manufacturer part numbers are identified as TBD and shall be confirmed before procurement.
- d. Provide and install all equipment listed in Part 2 – Products, including any and all equipment not specifically listed that is required to provide a completely functional system.
- e. All equipment listed in Part 2 and bid form should be considered the base bid. All alternative equipment will be considered as long as it meets the same specs as the base system. Please provide cut sheets for any alternative equipment you are presenting.
- f. Decommissioning of an existing system/cables is deemed to be in this scope.
- 2. Ensure that levels and impedances are properly matched between components.
- 3. Provide all required permits and licenses.
- 4. Provide on-site installation supervisor per Section 1.6.5.
- 5. Coordinate work with other trades and coordinate scheduling with the construction supervisor to minimize delays.
- 6. Deliver all Equipment to site and convey to appropriate locations within site as directed by the project.
- 7. Store all Equipment in a safe and secure manner until installed, or as otherwise directed by the project.

3.02 GROUNDING AND SHIELDING

- A. Mount and enclose all electrical and electronic equipment in metal enclosures, pedestals or equipment racks.
- B. Use EMT type conduit for all wiring outside of equipment racks except plenum rated wiring above a lay-in ceiling, and outdoor conduits and raceways, where separate insulated ground wiring shall be supplied.
- C. Use flexible conduits and PVC fittings to provide insulated connections of the building's electrical raceways to equipment racks. Mount all equipment racks at the job site in a manner which provides electrical isolation from the building structure and electrical raceways.

3.03 WIRING PRACTICES/INSTALLATION

- A. Where specific instructions are not given, perform all wiring in strict adherence to standard video engineering practices in accordance with the references listed in Section 1.5.
- B. Group all wiring into the following classifications by power level or signal type:
 - 1. Microphone Level
 - 2. Line Level Audio and DC Control Circuits
 - 3. Video Level
 - 4. Copper Data
 - 5. Fiber Data
 - 6. AC Power Circuits
- C. Separate wiring of differing classifications by at least six (6) inches, wherever possible. Wherever lines of differing classification must come closer together than six (6) inches, cross them perpendicular to each other.

- D. Neatly harness wires together within racks by power level classification using horizontal and vertical wiring supports as required. Rigidly support all wires with fixed connection points. Leave service loops of sufficient lengths to allow rack hinges or slides to fully extend to facilitate access to rear panel connectors from the front of each rack. Do not use self-adhesive tie-wrap pads for support of cables unless fastened with screws.
- E. Observe consistent polarity throughout the audio components as follows:
 - 1. Use only balanced differential inputs throughout the audio system:
 - 2. Use approved transformers where directed to reduce objectionable system noise to acceptable levels.
- F. Exercise care in wiring to avoid damaging the cables and equipment. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
- G. Cut off unused wire ends approximately one-half inch (1/2") past the wire jacket. Fold them back over the jacket, and secure in place with heat-shrink tubing. In multi-conductor cables, preserve all unused conductors for future use. Failure to do so may result in replacement of cables at the Contractor's expense.
- H. Make video connections using approved mechanical connectors. All connectors shall be insulated from mounting plates or panels. Label each connection point with a unique number.
- I. Make audio connections using rosin-core solder or approved mechanical connectors. Connect microphone, control, and line level wiring through approved connectors. Mount all terminal devices on a non-conductive (electrically) rigid surface. Provide 10% spare terminals at each location. Label each terminal with a unique number.
- J. All fiber splicing shall utilize the fusion splice method. The maximum allowable loss per fusion splice shall be .05 dB.
- K. Pull mandrel one size smaller than the conduit, through entire length of all underground conduits.
- L. Cable pulling lubrication shall be utilized when pulling cable in conduits.
- M. A dynamometer shall be used to measure pulling tension during long or difficult runs. The dynamometer is to be placed between the cable puller and the pull line to monitor pulling tension. The manufacturer's pulling tension maximum range shall not be exceeded.
- N. Pulling grips suitable for use with fiber cables shall be applied to the ends of the cable. Consult cable manufacturer to determine appropriate pulling grip and method of attachment. Breakaway or fuse links shall be used at the pulling grip. Ensure that the correct fuse pin is installed in the fuse link.
- O. The bend radius for all cables shall conform to manufacturer's specifications.
- P. All electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper and shall be Anaconda, Triangle, General or approved equal for power, and Belden, Clark or Gepco for low voltage. Cable shall adhere to the following standards:
 - 1. Analog Video – Black
 - 2. Digital Video – Blue (or approved, agreed upon alternate color)
 - 3. RGB – Magenta
 - 4. Sync – Green
 - 5. Data – Light Blue
 - 6. Control – White
 - 7. Speaker – Grey
 - 8. Analog Audio – Red
 - 9. AES Audio – Red
 - 10. Mic Level - Brown

3.04 LABELING

- A. Label products in a logical, legible, and permanent manner corresponding to the Drawings. Wording, format, style, color and arrangement of text will be subject to the Contractor's approval. Submit samples and labeling schedule for approval. Labeling will be verified at final system commissioning.
- B. Label all wall plates for input, output, and control receptacles as well as connector mounting plates in all boxes using 1/8" engraved lettering filled with black or contrasting paint, as approved.
- C. Use 2.0 mil gloss white polyester face stock; over-laminated with a 1.0 mil clear polyester film; 1.0 mil high-performance permanent pressure-sensitive adhesive labels, squarely and permanently attached, to label the following:
 - 1. Front of all rack-mounted equipment including controls.
 - 2. Barrier strips, terminals, transformers, switches, relays and similar devices.
- D. Label pushbutton switches with lettering filled with contrasting color paint.
- E. Label all permanently installed wires on both ends with approved permanent sleeve type markers. Wrap-around adhesive labels will not be accepted unless completely covered with clear heat shrink tubing.
- F. Label all portable equipment using initials and/or words. Label all portable cables similarly with printed heat-shrinkable tags located 12 inches from the male connector end. Verify lettering through the Contractor prior to printing.

3.05 ELECTRICAL AND DATA WIRING

- A. The Contractor will be responsible for power distribution from the demarcation points noted on the included electrical drawings. Any additional electrical components required for a complete and fully operational system but not shown on the electrical drawings shall be the responsibility of the Contractor.
- B. Contractor shall not use wire nuts or electrical tape for any power or signal connection or any part of the work. All connections shall use a proper terminal block and spade terminal or terminal block and direct connection as required. Covers shall be provided over all high power terminal blocks to prevent electrical shock.
- C. Any equipment not certified as required in Section 1.5 shall require on-site certification by a listed testing agency. All costs associated with obtaining on-site certification shall be the responsibility of the Contractor. Written proof of certification or equivalent will be required prior to any work being performed on site.
- D. Contractor shall provide six (6) spare strands of fiber in addition to the total amount of fiber that is required to provide video signal and/or data communication to all video components installed by Contractor. All fiber shall be terminated and landed in an appropriate fiber patch panel. All new fiber supplied by Contractor shall be tested and shall not exceed maximum allowable dB loss per Section 3.1.5.j and/or Section 3.1.5.k.
- E. Multimode fiber tested shall not have a signal dB loss greater than 0.1dB per 100 feet (30m) for 850nm fiber or a loss greater than 0.1 dB per 300 feet (100m) for 1300nm fiber.
- F. Single-mode fiber tested shall not have a signal dB loss greater than 0.1dB per 600 feet (200m) for 1310nm fiber or a loss greater than 0.1 dB per 750 feet (250m) for 1550nm fiber.
- G. Contractor to provide all required fiber transmitters and receivers (including amplifiers where required). Contractor will be responsible to terminate and perform final connection of all cables. Cables will be routed from the specified control locations to the video components per Contractor's diagram once diagram has been approved.

3.06 AESTHETIC CONSIDERATIONS

- A. The Contractor shall not visibly display its trademarks or insignia on any of the Equipment or structural elements within public view.

3.07 FINAL ADJUSTMENT AND COMMISSIONING

- A. Schedule a time to perform the Final Adjustment and Commissioning. Notify the Project at least seven (7) days in advance.
- B. Furnish a technician who is familiar with the system to assist the Contractor during the Final Adjustment and Commissioning.
- C. Record final settings on all equipment and submit with contract closeout documents.

3.08 TRAINING

- A. The Contractor, at its own expense, will provide training for designated operators and maintenance personnel.
- B. Training will be performed at the site by a qualified technician and shall occur either during installation of the equipment or immediately thereafter. O&M Manuals per Section 1.4.3.a shall be provided to Owner prior to training.
- C. The training shall cover the operation, routine maintenance and troubleshooting of the video replay system and control equipment.
- D. Training shall consist of at least 8 hours of instruction.
- E. Warranty period will commence at the conclusion of the third consecutive successful event.

3.09 TESTING AND ACCEPTANCE

- A. Contractor must demonstrate the full capabilities of the provided systems and prove performance meets contractual specifications.
- B. Confirmation will be required of, but not limited to, the following functions: operation of each system component, including back-up systems, control functionality and integration with existing systems.
- C. Contractor must provide all necessary testing equipment for acceptance.
- D. Upon notice from the Contractor of substantial completion and at a time to be mutually agreed upon, the Contractor will arrange for the testing of all operations of the systems comprised in scope of work at the time of substantial completion.
- E. The following items must be completed and signed off by an appropriate official before the Project will deem the system "Accepted":
 - 1. Three completed events with no equipment or system failures.
 - 2. The Project will not be responsible for any added costs as a result of an unsuccessful acceptance test.
 - 3. Acceptance of the system includes, but is not limited to, the completed installation of all physical components as well as proper system functionality. Tests of the system shall not occur until after the system has been installed, and all work has been completed.
- F. Document all acceptance testing, calibration and correction procedures described herein. Include the following information:
 - 1. Date of performance of the given procedure.
 - 2. Conditions under which the procedure was performed.
 - 3. Type of procedure, and description.
 - 4. Parameters measured and their values, including values measured prior to calibration or correction, as applicable.
 - 5. The names of personnel conducting the procedure.
 - 6. The equipment used to conduct the procedure.
- G. Upon completion of initial tests and adjustments, submit written report of tests to the Project along with all documents, diagrams, and recorded drawings required herein.
- H. Final Procedures.

1. Perform any and all "punch-list" work to correct inadequate performance or unacceptable conditions, as determined by the Project, at no additional expense.
2. Furnish all portable equipment to the Project along with complete inventory documentation. All portable equipment shall be presented in the original manufacturer's packing, complete with all included instructions, miscellaneous manuals, and additional documents.
3. Provide new acceptance testing in the same format as initial test reports.
4. Check, inspect, and if necessary, adjust all systems, equipment, devices and components specified, approximately thirty (30) days after the Project's acceptance.
5. Upon completion of the Work, the Project may elect to verify test data as part of acceptance procedure. Provide personnel and equipment, at the convenience of the Project, to reasonably demonstrate system performance and to assist with such tests without additional cost.

END OF PART 3 EXECUTION