Stadium Boards Equipment Replacement RFP
Scoreboards and Replay Systems
University Project No CP151739

University of Colorado
Boulder, Colorado

Design/Build Criteria

February 7, 2012
SCD Project Number 1127
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University of Colorado at Boulder
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Building Committee

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Wrightson, Johnson, Haddon & Williams, Inc (WJHW)
M-E Engineers, Inc.
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Introduction and Overview

This project is a Scoreboard equipment renewal and replacement for the aging and non-functional video boards at Folsom Stadium as well as relocation of the existing Buff Vision offices and editing bays into a new state of the art facility located on the service level of the Coors Event Center. This new editing and control room suite will consolidate the Athletic department’s existing video production operations into one location.

The Folsom Stadium scoreboard replacement will generally include the following:

- Replace the existing 34’x52’ scoreboard located on the north end of Folsom Stadium on the roof of the Dal-Ward building with a new HD LED video display. See technical criteria for base bid LED matrix spacing and resolutions as well as alternative bids for option resolutions.

- Replace the existing 5’x87’ scoreboard located on the north end of Folsom Stadium on the roof of the Dal-Ward building and static advertising panels with new HD LED ribbon boards. See technical criteria for base bid LED matrix spacing and resolutions as well as alternative bids for optional resolutions.

- Replace the existing 28’-4.5”x29’ scoreboard located on the south end of Folsom Stadium with a new larger 28’-4.5”x34’ HD LED video display. See technical criteria for base bid LED matrix spacing and resolutions as well as alternative bids for option resolutions.

- Replace the existing 5’x130’ static advertising panels located on the south end of Folsom Stadium, just below the existing scoreboard with a new HD LED ribbon boards. See technical criteria for base bid LED matrix spacing and resolutions as well as alternative bids for optional resolutions.

- Replace the existing field level 6’x36’ scoreboard and advertising panels with a new HD LED video display. See technical criteria for base bid LED matrix spacing and resolutions as well as alternative bids for optional resolutions.

- HD cameras and associated equipment and infrastructure upgrades required for the new HD video boards

The Replay Equipment Replacement / Control Room Facility will generally include the following:

- Construction of a new Buff Vision Office Suite on the service level of the Coors Event Center. This work include complete design and construction of the facility based upon the conceptual layouts include within the technical documents and specifications.

- Construction of a new Control Room suite on the service level of the Coors Event Center. This work include complete design and construction of the facility based upon the conceptual layouts include within the technical documents and specifications.

- Complete replay system package as specified within technical documents.
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- Mechanical, Electrical and Special Systems upgrades to the existing services within Coors Events Center to support the new spaces. See technical criteria for a complete description of this scope of work.

Refer to the Technical Criteria for more detail specifications and descriptions of the scope of work.

Project has several additive alternates contained within the technical documents.
Existing Conditions at Folsom Stadium

Image of the existing scoreboard and video display mounted on the roof of Dal-Ward on the north end of Folsom Stadium:
Images of the existing scoreboard and video display on the south end of Folsom Stadium looking from the exterior of the stadium:
Images of the existing scoreboard and video display on the south end of Folsom Stadium looking from the interior of the stadium:
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Images of the existing scoreboard and static add panels on the south end of Folsom Stadium at the field level:
Image of the press box building on the west side of Folsom Stadium sandwiched between Balch Field House and Folsom Stadium:

Images of the existing interior press box room 505:
Images of existing Buff Vision truck bay on the northwest corner of Folsom Stadium:
Existing Conditions at Coors Events Center (CEC)

Image of existing area with the service level of Coors Event Center where the new Buff Vision editing suite will be located:
Images of existing north wall of the new control area showing the electric panel and existing cooler:
Images of existing coolers in north area of service level where the new control suite will be located:
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Image of existing high ceilings (arena seating risers above) where new control suite will be located. The CMU wall above the concrete beam is the south wall of the Women’s BB Offices located on the street level above:
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Images of existing area where new control suite will be located:
Architectural Scope of Work Summary

**Folsom Stadium Scoreboard Replacement:**
Scoreboard control infrastructure upgrades as described in the WJHW specifications.

Improvements to Pressbox Room 505 as required to facilitate the new scoreboard control equipment.

The existing south stadium scoreboard has ventilation problems that need to be corrected as part of this project. The existing scoreboard has an existing maintenance cavity with the shell of the structure with a man door and ladder accessible from the top row of the stadium seating. The existing structure has a large wide flange steel beam on the bottom with several holes for ventilation that have proofed to be ineffective for proper ventilation. The Design-Build team shall upgrade the cavity ventilation with adequate ventilation to serve the new video board. Possible solutions are a cooling system or a louvers or screens on the east and west side of the cavity for cross flow ventilations.

Modifications to the existing structural steel design of the south stadium scoreboard shall be stamped and signed by a registered Colorado structural engineer.

It anticipated that CU Design Review Board approval will not be required for this project, Facilities Planning will seek administrative approval of the design modifications included in the this technical Document.

**Coors Event Center Control Room and Buff Vision Area:**

**Buff Vision Area:**
Interior remodel work includes building out office and editing space as shown on attached concept plans including: modification of existing door to be access control, addition of sound rated partitions and ceilings, power distribution to and within the suite, modification of existing HVAC ductwork and unit heaters and inclusion of special systems connecting the suite with the control room area.

**Control Room Area:**
Interior remodel work includes building out control room area as shown on attached concept plans including: Moving and reconfiguring the existing cooler and freezer, addition of sound rated partitions and ceilings, raised access flooring, power distribution to and within the suite, modification of existing unit heaters and piping, addition of a new HVAC system, inclusion of special systems connecting the suite with the buff vision area, special system connecting to the Folsom Stadiums scoreboards and replay equipment package.

**Accessibility**
The project shall comply with accessibility standards ANSI/ICC A117.1 – 2003 as well as any local and state amendments.
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Architectural Outline Specifications

All work shall be performed in accordance with the University of Colorado at Boulder, Facilities Management, Building and Construction Standards, Version 2011-2012. The Standards can be obtained on the universities website at: www.colorado.edu/facilitiesmanagement/pdc/construction/standards

DIVISION 1: GENERAL REQUIREMENTS

Project Summary 01000 Construction of a new Buff Vision Office Suite on the service level of the Coors Event Center. This work include complete design and construction of the facility based upon the conceptual layouts include within the technical documents and specifications.

Construction of a new Control Room suite on the service level of the Coors Event Center. This work include complete design and construction of the facility based upon the conceptual layouts include within the technical documents and specifications

Mechanical, Electrical and Special Systems upgrades to the existing services within Coors Events Center to supports the new spaces. See technical criteria for a complete description of this scope of work.

Regulatory Requirements 01410 2009 International Building Code
2009 IMC International Mechanical Code
2009 IPC International Plumbing Code
2009 NEC (NFPA-70) National Electric Code
2009 IFC International Fire Code
State of Colorado Energy Code
University of Colorado,

DIVISION 2: SITE WORK

None in project

DIVISION 3: CONCRETE
Concrete 03300 Refer to CU Standards:
- 03100 Concrete Formwork
- 03200 Concrete Reinforcement
- 03300 Cast in Place Concrete

Reference Standards: Comply with following standards except where more stringent requirements are shown or specified:

1. ACI 301, "Specification for Structural Concrete for Buildings."
   Contractor shall make a copy of ACI 301 available at the project field office for the duration of the project.

2. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."

3. ACI SP-66, "ACI Detailing Manual"

4. ACI SP-15, "ACI Field Reference Manual"

REINFORCING MATERIALS

A. General: Sizes, types, grade or yield strengths as indicated on the drawings. Use 60,000 psi yield strength if not otherwise indicated. Use reinforcing conforming to ASTM A706 where welding of reinforcing is required unless otherwise indicated. Provide uncoated finish unless otherwise indicated.

B. Deformed Bars: ASTM A615 plus supplementary requirement (SI), Deformed Billet Steel Bars or ASTM A706, Low-Alloy Steel Deformed Bars unless otherwise indicated.

C. Welded Wire Fabric: Mesh size and gauge as indicated on the drawings. Conform to ASTM A185, plain in flat sheets or coiled rolls.

D. Tie Wire: Tie wire shall be No. 16 American Wire Gage or heavier, black annealed.

CONCRETE

A. 3000 PSI Concrete
DIVISION 4: MASONRY

Unit Masonry 04200 Refer to CU Standards: -04200 Reinforced Masonry

Modular Brick, Standard Concrete block.

Mortar: Type S for masonry below grade or in contact with earth. Type S at all other reinforced masonry locations.

Accessories: Primary Reinforcing: ASTM A615, 60 ksi.

Reinforced and Grouted Work: Bond beams, lintels
F‘m = 1800 psi Unit Masonry
Fy = 60 Ks : steel reinforcing

DIVISION 5: METALS

Structural Steel 05120 Refer to CU Standards: -05120 Structural Steel

Structural designs must be stamp by a licensed Colorado engineer.

Existing structural steel frame on south end of Folsom Stadium that supports the scoreboard must be modified and upgraded to accept the wider display board. The bigger loads must be transferred to the two large ground mounted columns, the building mounted columns cannot accept any additional loads.

STRUCTURAL STEEL:
A. Structural steel rolled shapes shall conform to ASTM A36 and pipes shall conform to ASTM A53, Grade B.
B. Shop connections shall be welded and field connections shall be welded and field connections shall be bolted with A325 bolts.
C. Fabrication, detailing and erection shall conform to AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings".
D. All material and workmanship shall meet applicable requirements of AISC.

Shapes and Plates: ASTM A36 or A572 Grade 50.
Welding: All welding shall comply with AWS code using E70XX electrodes.
Steel Tubes: ASTM A500, Grade B (Fy = 46 ksi).
Steel Pipes: ASTM A53, Grade B.
High Strength Bolts: ASTM A325
Anchor Bolts: A307.
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Metal Fabrications  05500  Refer to CU Standards:
-05500 Metal Fabrications
  Miscellaneous supports, anchors, rough hardware: Steel.
  Lintels: Steel
  Shelf Angles: Steel
  Counter top supports
  Rooftop mechanical equipment supports

DIVISION 6: WOOD AND PLASTICS

Rough Carpentry  06100  Refer to CU Standards:
-06100 Rough Carpentry
  Lumber Standards: PS20
  Plywood Standards: PS1
  Materials: Gypsum sheathing, furring, blocking
  Preservative Treatment: Roof associated curbs, blocking.
  Fire-Retardant Treatment: per code.
  No added urea formaldehyde in composite wood products.

Architectural Woodwork  06400  Refer to CU Standards:
-06400 Architectural Woodwork
  Standards: AWI Custom Quality
  Plastic laminate countertops, faced casework, cubbies
  Melamine interior cabinets and shelving
  Solid surface counter tops: Corian or equal.
  No added urea formaldehyde in composite wood products.
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### DIVISION 7: THERMAL AND MOISTURE PROTECTION

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<thead>
<tr>
<th>Material Type</th>
<th>Code</th>
<th>Work Description</th>
</tr>
</thead>
</table>
| Building Insulation               | 07210 | Refer to CU Standards:  
                                 |                                                | -07210 Building Insulation  
                                 |                                                | Work includes acoustic batt insulation as required for sound insulation at the interior walls of the Buff Vision and Control Room areas.  
                                 |                                                | Insulation materials include: fiberglass batt |
| Preformed Metal Wall Panels       | 07414 | Refer to CU Standards:  
                                 |                                                | -07600 Flashing and Sheet Metal  
                                 |                                                | Roof Panels: Class A, Standing Seam, 22 gauge, concealed fastening system, gold color to match the existing panels on the south end scoreboard of Folsom Stadium.  
                                 |                                                | Finish: Kynar |
| Built-Up Bituminous Roofing       | 07510 | Refer to CU Standards:  
                                 |                                                | -07510 Built-Up Bituminous Roofing  
                                 |                                                | Provide 3 ply built up roof system, including substrate preparation for new mechanical equipment installations at the older area on the north end the Coors Event Center.  
                                 |                                                | Insulation, roofing membrane, membrane flashing, preformed Flashing accessories, adhesives and sealants. |
| Single-ply Membrane Roof          | 07530 | Refer to CU Standards:  
                                 |                                                | -07530 Single Ply membrane Roofing  
                                 |                                                | Provide fully adhered, single-ply TPO membrane roof system, white in color, including substrate preparation for new ductwork installations at the newer addition area on the north end the Coors Event Center.  
                                 |                                                | Insulation, roofing membrane, membrane flashing, preformed Flashing accessories, adhesives and sealants. |
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Flashing and Sheet Metal 07600 Refer to CU Standards:
-07600 Flashing and Sheet Metal

Materials:
2. Flashing provided by Metal Panel manufacturer for metal panel components to match finish.
   Include: flashing and counter flashing, copings, expansion joints.

Joint Sealers 07900 Refer to CU Standards:
-07900 Joint Sealers

Type 1 Sealant: (For joints in horizontal planes) Two-component, self-leveling urethane/polyurethane sealant.
Type 2 Sealant: (For joints in vertical planes) Two-component, non-sagging urethane/polyurethane sealant with a movement capability of 50% of the joint width in extension and 24% of the joint width in compression.
Type 3 Sealant: (For interior static joints) General purpose, gun grade, paintable, acrylic latex caulk.
Type 4 Sealant (For joints in restrooms, janitor's closets, and other areas subject to continued moisture exposure or high humidity)
Type 5 Sealant: (For fire-rated joints) One component, low-modulus silicone sealant complying.
Backer rod as approved by manufacturer.

DIVISION 8: DOORS AND WINDOWS

Steel Doors and Frames and Windows 08110 Refer to CU Standards:
-08100 Metal Doors and Frames

Provide hollow metal doors and frames, including hollow and metal frames for wood doors and borrowed lights where indicated, and associated louvers, glazing, moldings, labels, anchors, reinforcements, and accessory items.

Provide acoustic rated doors and windows per the acoustic report where indicated on the plans in the acoustic report.
Wood Doors  08210  Refer to CU Standards:
-08210 Wood Doors

Solid Core: Pre-fit and pre-matched.
Natural Finish: Prefinished Natural Oak, plain paw, slip matched.

Provide acoustic rated doors and windows per the acoustic report where indicated on the plans in the acoustic report.

Access Doors  08305  Refer to CU Standards:
-08305 Access Doors

1. Flush wall access doors for installation in masonry, tile, or drywall construction.
2. Rated flush wall access doors to match rating in masonry, tile, or drywall construction.
3. Drywall/ceiling tile type access doors to be 1” deep recessed panel access door for installation in acoustical ceiling or drywall construction.

Door Hardware  08710  Refer to CU Standards:
-08710 Finish Hardware
-08740 Electro-Mechanical Hardware

Hinges: Ball bearing type, 3 knuckle.

Locksets: Heavy duty mortise type with lever handles.

Closures: Standard type

Miscellaneous items as required for conditions including door stops, push and pull sets, locksets, kick plates, weather stripping, silencers, etc.

Finish: Satin Brass to match existing service level of Coors Event Center, unless noted otherwise.
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**DIVISION 9: FINISHES**

<table>
<thead>
<tr>
<th>Material</th>
<th>Code</th>
<th>Details</th>
</tr>
</thead>
</table>
| Gypsum Board Assemblies   | 09260 | Refer to CU Standards:  
  - 09260 Gypsum Board Systems  
  Furnish and install all gypsum drywall construction as shown in the Drawings. Work includes gypsum wallboard, light-gauge metal stud framing, trim and accessories, taping and finishing.  
  Metal Stud Framing System: Nonbearing interior partitions.  
  Ceiling Furring: DWC hat channels, Runner channel main framing.  
  Wall furring: 1.625" "C" members.  
  Gypsum Board: Wall and ceilings: 0.625" Type 'X'  
  Provide wall with acoustic system STC rating per the acoustic report, detailed at floor and head conditions as indicated in the report. |
| Acoustical Ceilings       | 09510 | Refer to CU Standards:  
  - 09510 Acoustic Ceilings  
  Acoustical panel: 2'x4' exposed grid, Armstrong Ultima or equal, standard color, non-fire rated, acoustic rating per acoustic report. |
| Carpeting                 | 09680 | Refer to CU Standards:  
  - 09680 Carpet  
  All carpet to meet the Green Label requirements of the Carpet and Rug Institute Indoor Air Quality Program.  
  Sheet Carpet: Furnish and install commercial broadloom carpet in direct glue-down installation as shown in the Drawings.  
  Materials: Solution dyed nylon, textured loop, 36 oz./yd with woven polypropylene backing.  
  Carpet Tiles: Furnish and install commercial carpet tiles as shown in the Drawings.  
  Materials: Modular 50cm x 50cm Solution dyed nylon, anti-microbial, PVC backing. |
Painting 09900 Refer to CU Standards:
-09900 Painting

Work Included: Paint and finish all interior surfaces unless specifically designed to be unfinished or unpainted.

General Paint Schedule:
1. Hollow metal work (interior): Prime + 2 coats enamel.
2. Other ferrous metals, Exterior: Prime + 2 coats Tnemec or equal, gloss.
3. Other ferrous metals, Interior: Prime + 2 coats enamel, semi-gloss.
7. Interior Wood, Transparent finish: Vinyl sealer + 2 coats pre-catalyzed lacquer (AWI System #2), finished off site
8. Interior Gypsum Drywall: Prime + 2 coats latex enamel, eggshell.
**INTERIOR ROOM FINISHES:**

**Coors Event Center**  
**Buff Vision Area (Edit Bay Suite)**

<table>
<thead>
<tr>
<th>Office</th>
<th>Floors</th>
<th>Base</th>
<th>Walls</th>
<th>Ceiling</th>
<th>Specialties</th>
<th>Casework</th>
<th>Door Types</th>
<th>Lighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offices</td>
<td>Carpet tile</td>
<td>Resilient base</td>
<td>Painted gyp-board</td>
<td>2x4 acoustic ceiling plus acoustic rated lid below structure as indicated in the acoustic report</td>
<td>N/A</td>
<td>N/A</td>
<td>HM Frame, solid core wood.</td>
<td>Indirect</td>
</tr>
<tr>
<td>Edit Bays</td>
<td>Carpet tile</td>
<td>Resilient base</td>
<td>Painted gyp-board, plus 50 sf Tectum panels</td>
<td>2x4 acoustic ceiling plus acoustic rated lid below structure as indicated in the acoustic report</td>
<td>N/A</td>
<td>Plastic laminate surface, hardwood face edge</td>
<td>HM Frame, solid core wood.</td>
<td>Indirect</td>
</tr>
</tbody>
</table>

**Coors Event Center**  
**Replay Control Area**

<table>
<thead>
<tr>
<th>Office</th>
<th>Floors</th>
<th>Base</th>
<th>Walls</th>
<th>Ceiling</th>
<th>Specialties</th>
<th>Casework</th>
<th>Door Types</th>
<th>Lighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Room</td>
<td>Carpet tile over 6” raised access floor</td>
<td>Resilient base</td>
<td>Painted gyp-board, plus 100 sf Tectum panels</td>
<td>2x4 acoustic ceiling plus acoustic rated lid below structure as indicated in the acoustic report</td>
<td>N/A</td>
<td>N/A</td>
<td>HM Frame, solid core wood.</td>
<td>Indirect</td>
</tr>
</tbody>
</table>
Audio/EIC
Floors: Resilient flooring over 6" raised access floor
Base: Resilient base
Walls: Gyp-board, covered with sound absorbing wall covering, plus 5 sf Tectum panels
Ceiling: 2x4 acoustic ceiling plus acoustic rated lid below structure as indicated in the acoustic report.
Specialties: Acoustic rated windows with non-parallel glass
Casework: Plastic laminate surface, hardwood face edge
Door Types: HM Frame, solid core wood.
Lighting: Indirect

Studio
Note: The studio is a future build out space, interior build out is not included in the project except for wall separating studio from the corridor and shell type lighting.
Floors: exposed concrete (existing)
Base: none
Walls: unfinished
Ceiling: none
Specialties: none
Casework: none
Door Types: HM Frame, solid core wood.
Lighting: shell type strip lighting

Studio Prop Storage
Note: The prop storage is a future build out space, interior build out is not included in the project.
Floors: exposed concrete (existing)
Base: none
Walls: unfinished
Ceiling: none
Specialties: none
Casework: none
Door Types: none
Lighting: none

DIVISION 10: SPECIALTIES
Raised Access Flooring 10270
Concrete filled steel pan type raised access flooring. 6" high.
Design Requirements:
Static Loads: 1500lbs.
Uniform Loads: 375 lbs.
Ultimate Loads: 5100 lbs.
Rolling Loads: 1250 lbs.
Impact Loads: 150 lbs.
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Identifying Devices  10400  Refer to CU Standards:
-10400 Identifying Devices
        Room Identification.
        Life safety (code) Signage
        Plastic Signage with ADA compliant engraving.

DIVISION 11: EQUIPMENT

Walk-In Cooler  11400  Walk-in cooler and freezer at Coors Event Center.
The new control area layout includes moving and re-configuring the plan
layout of the existing walk-in cooler and freezer.

At D-B team’s option, the walk-in cooler and freezer shall be moved to the
new location shown on the plans and re-configured for size and door
location as shown or a new walk-in cooler and freezer shall be installed.

A. All refrigeration condensing units shall include pre-wiring, pre-piping,
crankcase regulator, head pressure regulator, factory-installed suction
line accumulator, phased loss protection, five year warranty, main fuse
disconnect, structural steel frame and weather-proof carbon steel
body panel with epoxy paint finish, and refrigerant detective alarm.

B. Compressors and related components must be fully accessible for
service and maintenance.

DIVISION 12: FURNISHINGS

None in project

DIVISION 13: SPECIAL SYSTEMS

None in project

DIVISION 14: CONVEYING SYSTEMS

None in project

DIVISION 15: MECHANICAL SYSTEMS
See mechanical narrative

Note: Fire sprinkler system are existing in both the Buff Vision suite and the Control room area. Sprinkler lines must be re-configured from exiting exposed ceiling conditions to 2x4 acoustic ceilings in both areas.

DIVISION 14: ELECTRICAL SYSTEMS

See electrical narrative.
Coors Event Center Code Information

2009 International Building Code

Coors Event Center
Occupancy Type: Arena A-4, Offices B
Construction Type: Type I-B, fully sprinklered.
Accessibility: ADA compliance and accessible means of egress are required.
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work under this Contract Includes all installation labor, materials, tools, transportation services, supervision, coordination, etc., necessary to complete the design/build installation of the Scoring and Matrix Display Systems, at Folsom Field as described in these specifications and illustrated on the associated drawings. The systems shall be called the “Scoring System” and the installer the “Scoring System Installer”.

B. Substantial completion dates for scope of work is August 1, 2012:

C. The work described in this specification is performance based. This requires the Installer to provide all subsequent/final design and engineering, not included within the Contract Documents, but necessary to meet the requirements of this Performance Specification. The drawings included with this specification convey system concepts only. The plans do not necessarily 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.

D. The Scoring Systems include the following major items:
   1. Main scoreboard/video display assembly North and South
   2. Addition of structure and enclosure for the expanded width South display.
   3. “Ribbon” displays, North and South
   4. Field Level Auxiliary Display
   5. Locker room clocks, if required
   6. Game clocks, if required
   7. Delay of game/play clocks, if required
   8. Scoring, Scoreboard, Statistics and Matrix Control components, including software.
   9. Low voltage control system for all displays, and illumination for advertising panels, etc. to be included in stadium scoreboard control rooms as part of this contract to allow control of lighting and displays from that location.
  10. Time of Day and Temperature Sensor/Display Capability,
  11. Automated statistic update capability from in-house and third party services (i.e.; Pac 12 conference sites, sports ticker, ESPN Gamecast, Stat Crew) along with automatic statistical updates during event from event scoring controller.
  12. All electrical distribution/load centers, etc., within each display system at each installation point from isolator per existing conditions.
  13. All display structure, enclosures, secondary/attachment steel, rigging, hoists, etc. required for a complete installation with the exception of the primary vertical display support structure at the stadium.
  14. Data (player/game statistics and game-in-progress information) output compatible with video character generator for use by broadcasters and stadium TV/video production system.
  15. Provision of an SD video output module within scoring computer system(s) to provide a video signal of scoring/text/animation data.
  16. Option pricing.
  17. Operations and maintenance training.
18. Development of animations and graphics as listed below, including training in programming and loading animations.

E. The Contract also includes:
   1. Demolition and disposal of:
      a. Existing Stadium scoreboards/displays.
         1) Structure to remain as necessary for re-use. Modifications to existing structure are required to complete the work are included in this scope for work.
   2. Provision of final engineering, development of final design drawings. Submission to the Owner and Architect for approval.
   3. Registered Engineers’ stamp on structural and electrical drawings along with calculations as requested by Owner.
   4. Verification of dimensions and conditions at the job site.
   5. Coordination with other contractors and trades.
   6. Preparation of submittal information.
   7. Installation and all anchorages and attachments in accordance with the contract documents, manufacturer’s recommendations, and all applicable code requirements.
   8. Initial tests and adjustments, written report, and documentation.
   9. Instruction of operating personnel; provision of manuals.
  10. Creation and documentation for all software required to achieve specified capabilities of system.
  11. As built documents.
  12. Maintenance services; warranty.
  13. Pre-installation on-site meeting.

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 without extra charge as if shown or mentioned in both.

G. The Owner will consider subjective assessment of image quality, brightness/uniformity and scoring and control-animation software along with user interface as part of the overall evaluation process. As operation of the partitioning software is integral to the owner’s process and operations, a hands-on demonstration of the software allowing the owner’s staff to test essential functions and operating flow is required. The Owner reserves the right to make product selection based on this subjective comparison among vendors providing responsive proposals meeting all technical performance requirements.

H. The owner’s structural engineer will provide the following services:
   1. Review the calculations and drawings prepared by the scoreboard supplier to confirm that the existing structure can support the proposed installation. The scoreboard supplier is responsible for evaluating and reinforcing the existing structure as required.

1.2 DESCRIPTION OF WORK

A. Connect (provide all required cabling and transmission electronics) display to Scoreboard Control Room/location for each venue. Existing cabling and conduit may be reused, if technically appropriate and reusable. If existing cable is re-used, warranty as new equipment.

B. Work includes a number of separate scoring/matrix/LED displays and necessary computer controlled scoring systems. Scoring Systems consist of:
   1. Stadium, Main end zone display assemblies, including:
a. All structure, catwalks, access panels, ladders/stairs, speaker support attachment structure as required for a complete assembly.

b. Additional display enclosure/closes out panels, etc., added as part of this contract, consistent with existing metal panel systems in use for the current enclosure.

c. Total enclosure to be consistent with the general appearance to the existing scoreboard enclosure in place at Stadium. As the assembly is not required to be fully water tight, identical materials are not required. Roof and enclosure design and construction should prevent free running of water, dripping, etc. over rear of displays, signal and electrical equipment/junction boxes.

1) It is not a requirement of the specification that the display enclosure be water tight, however the back side of display (IP 54 rating minimum), electrical equipment (NEMA 4 rating minimum), etc., are to be rated for use in the projected environment. If no representations are made as to water resistance of the enclosure, all equipment to be rated for fully exposed, outdoor operation.

d. All colors of equipment, enclosure and structure subject to written approval by Owner.

e. Video display

f. Delay of Game/Play clocks.

g. Game clocks

h. Confidence camera located on each end zone assembly to view opposite end with dedicated 32” class monitor in video production room. Camera to be equal Sony BRCZ700. Scope includes installation, all cabling, fiber electronics, system set-up, etc. Coordinate mounting location of monitor with Owner and video production system installer.

2. LED ribbon displays:
   a. As shown on drawings, at both ends of stadium

   1) Re-use of existing cabling is acceptable, provided it is warranted as new.

   b. Displays to be fully integrated with new display control system.

3. Game and Delay of Game/Play clocks; if necessary or as an option
   a. Total of (2) play clocks in existing clock locations< Plus one back up unit.

   1) Re-use of existing cabling is acceptable, provided it is warranted as new

4. Field Level Auxiliary Display
   a. As shown on drawing

   1) Re-use of existing cabling is acceptable, provided it is warranted as new.

   b. Displays to be fully integrated with new display control system.

5. Locker Room Clocks, as required.
   a. There are a total of (6) existing locker room clocks. Current game clock locations are in the Dal Ward Center: Coaches Locker Room (1B30), Equipment Room (1B33), Officials Locker Room (1B15), Visitors’ Locker Room (1B23), Home Locker Room (1B70), and Auditorium (1B50).

   1) Re-use of existing cabling is acceptable, provided it is warranted as new

C. Low voltage, signal raceway/conduit to, or near, each existing display locations may be re-used. Additional conduit/raceway required to complete the work is to be included in this scope.

D. Power currently exists at each display location. Extension/distribution of power from these locations to the displays is included in this scope of work.

E. Notify owner should power service in these locations not be sufficient for proposed new displays.

F. Supply complete dimensions, clearance requirements, mounting locations and requirements, and total and point load structural loading data for all displays.
G. Provide all required ventilation and climate control equipment, including shop drawings, dimensions, clearance requirements, unit weights and noise data. Installer’s structural information to include State of Colorado registered structural engineer stamped calculations for all structural elements within display assembly and attachments to Owner supplied structure and overall enclosure.

H. Catwalks and Stairs
1. Any new catwalks and platform assemblies within display enclosures are to be capable of the stresses of materials, members and connections equal to the existing structure. Where University codes require a higher level of performance, adherence to those codes is required (A minimum uniform design load of 60 PSF shall be used for all catwalks, platforms and access ways.

I. Design, document, furnish and install all required structure and enclosures; Coordination with base building structure and structural engineer is required. a Contractor shall submit drawings and calculations showing all structural attachments between display structures and existing stadium structure for review by the Owner’s Structural Engineer and approval by the Owner. Submittals shall be in accordance with the provisions in this specification as well as related specification sections.

J. Supply complete assemblies (structure, enclosure, roof and finish) for displays as appropriate, including State of Colorado registered structural engineer stamped calculations. Calculations for integral safety railing as part of fascia displays to include all Code mandated safety loads.

K. Control Equipment
1. All control equipment to operate displays shall be located in the stadium Scoreboard Control Room 505 and coordinated with Owner to work with existing equipment and space plan.
2. Connections between displays and control equipment and any physically separate control position locations shall be included in this installer’s scope of work. Anticipated control locations are scoreboard control room as is existing and field level for clock and score.
3. Displays to be able to be independently turned on/off from the scoreboard control room. Displays to have individual on/off control include:
   a. Stadium
      1) Main Video Display
      2) Ribbon Displays
      3) Field Level Aux Display
      4) Play clocks

L. New display fiber runs to be composed of a minimum of 2 discrete fiber bundles. This does not imply separate raceways, except where existing.

M. If scoring/clocks system is replaced, provide game in progress data feed, distributed via fiber optic cabling and fiber modems to:
1. Stadium TV truck parking location. Locate connector panel in or adjacent to broadcast cabling termination racks or enclosure(s).
2. Data output to support a minimum of two broadcast crews.

N. One channel of statistics keying must be provided to both the Stadium television/RF distribution system. System to provide a standard definition digital video output of statistics information, formatted per Athletics’ direction.

O. Coordinate with Owner’s Testing and Inspection Agency to provide access for testing of welds and attachments in accordance with the project General Conditions and overall project
requirements and specifications. All testing criteria shall be as indicated in the project General Conditions and overall project requirements and specifications.

P. Contractor is responsible for touch up and repair of welds, paint and finishes where work attaches to structure. Coordinate with Owner to maintain all product warranties where attaching to other trades such as Paint, Roofing, Expansion Joints, etc.

1.3 GOVERNING CODES AND STANDARDS
1. American Iron and Steel Institute (AISI)
2. American National Safety Institute (ANSI)
3. American Society of Mechanical Engineers (ASME)
5. National Electrical Manufacturer’s Association (NEMA)
6. Occupational Safety and Health Administration (OHSA)
7. Underwriters Laboratories (UL)
8. Any or all local, governmental, or other applicable codes

1.4 RESPONSIBILITY AND RELATED WORK
A. Supply accessories and minor equipment items needed for complete systems, even if not specifically mentioned herein or on the drawings, without claim for additional payment.

B. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Scoring System Installer to supply systems in full working order. Notify the Owner's Representative of any discrepancies in part numbers or quantities before bid. Failing to provide such notification, supply items and quantities according to the intent of the Specification and Drawings, without claim for additional payment.

C. Obtain all approvals necessary for the execution of any work pertaining to the installation, or any operation by the Owner.

D. If a conflict develops between the contract documents and the appropriate codes and is reported to the Owner's Representative prior to bid opening, the Owner's Representative will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

E. Electrical
1. Power is provided at locations as described, or as existing on-site. Inspection of existing conditions to determine requirements is included in this scope of work. The Installer shall be responsible for termination and distribution electrical power from the transformers and panel boards to the equipment as required (including load center, breakers, step down transformers, etc.). This will include necessary distribution boards, conduit and cabling as required for a complete installation.

2. Ground points are provided as existing for each display. The Installer shall be responsible for connecting existing ground point to all equipment in accordance with codes and standards specified herein.

4. Provide lighting protection for Stadium enclosures if required by the applicable codes

5. Provide surge suppression for all displays should examination/measurement of base building power service indicate that damage is likely to occur were protection not in place.

F. Coordinate work with other trades to avoid causing delays in construction schedule.
G. Contractor is responsible for touch up and repair of welds, paint and finishes where work attaches to existing structure. Coordinate with Construction Manager to maintain all product warranties where attaching to other trades such as Paint, Roofing, Expansion Joints, etc.

H. Signal Cabling and Conduit
1. Conduit is as existing. Re-use of existing conduit is acceptable. New conduit to new displays as required, is included in this scope of work.
2. Remove and dispose of cabling that is abandoned as part of the project.
3. Do not damage any existing signal cabling that is to be re-used and 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.

1.5 REQUIRED PROPOSAL TECHNICAL DOCUMENTATION

A. In addition to the information and document requirements of the RFP, technical submissions are to include the following. Organize the documents with one section per building, with all documents pertaining to that system in that section.
1. Proposed project (design, approval, construction, testing and training) schedule for each facility
2. Concept drawing of new scoreboard structures and enclosures
3. Elevation drawings of all displays proposed
4. Equipment list, organized by major equipment items including displays, processors, computer control equipment, etc. identifying manufacturer.
5. One line drawing of signal flow for each building
6. Completed display form included in 11 06 60.63 for each display
7. Estimated weight, power load, and required service for each display assembly (including hoist and rigging, where appropriate).
8. List of any and all electrical components/equipment which is not UL, CSE, etc, approved.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: At least 5 years experience in the production of specified products or as approved by the Owner.

B. Installer’s Qualifications information to be provided with Bid Response. Firm experienced in the installation of systems similar in complexity to those required for this project; and meet the following:
1. At least five years experience with equipment and systems of the specified types.
2. Experience with at least two comparable scale football stadium renovations or new construction projects within the last three years.
3. Maintain a fully staffed and equipped service facility.
4. With the bid return, the potential Installer shall demonstrate that he has:
   a. Adequate plant and equipment to complete the work.
   b. Scoring software appropriate for NCAA Div 1 football games, and automated statistical record keeping for football and basketball. Provide print outs of representative software screens and identify third party services (e.g. Stat Crew, Pac 12 network, CBS, ESPN etc.) that have been successfully integrated in past projects. Provide locations where electronic captioning equipment has been successfully integrated in past projects.
   c. Adequate staff with commensurate technical experience.
   d. Suitable financial status to meet the obligations of the work.
   e. Hourly fee for software-animation programming.
f. References from three (3) or more users of stadium similar display and software control systems provided by Installer.

1.7 SUBMITTALS

A. Submit all shop drawings and submittals in accordance with project requirements. Quantities listed herein are the minimum required of this contractor.

B. Shop drawings and submittal data shall contain sufficient information to describe the Work to be performed. Drawings shall be executed at an appropriate scale. Submit 3 bond sets of drawings; submit 3 copies of catalog data sheets neatly bound in sets. Submit all Shop Drawing information at one time. Information shall include but not necessarily be limited to:
   1. Elevation and Sections of all displays along with enclosure/structure fabrication drawings.
   2. Internally Illuminated Advertising Panel detailed drawings.
   3. Finishes of all exposed housings.
   4. 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.
   5. Equipment. Location of all equipment in racks, consoles, mill work, enclosures or on Owner provided counter top/tables with dimensions; wire routing and cabling within housings; AC power outlets, terminal strip and UPS locations.
   6. Listing of features/functions of interface to existing scoring/timing systems.
   7. Schematic drawings of any custom circuitry or equipment modifications, including connector pinouts and component lists.
   8. 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. This submittal must be submitted in its entirety.
   9. Floor Plan drawings, including all walls, doors and rooms, showing exact locations of devices and equipment located in control room/equipment rack locations. Include Owner's existing equipment and operator locations in drawings.
  10. 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.
  11. Floor Plan showing location of all operator and rack mounted equipment in control rooms.
  12. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories. Indicate welded connections using standard AWS welding symbols.
  13. Submit a letter of certification prepared by a professional Structural Engineer(s) (registered in the State of Colorado) employed by the fabricator certifying the following:
      a. The aforementioned Engineer is fully experienced in the design of structural steel, signage, catwalks and railings.
      b. All shop drawings (including all supports, connections and components) shall be prepared under the direction of the aforementioned engineer(s), in compliance with the Contract Document requirements and applicable building codes. His seal and signature shall appear on all shop drawings. The aforementioned shop drawings shall include sufficient information to enable the Architect to confirm that design loads, support points and tie backs are in compliance with the Architect's design criteria.
      c. This certification letter must be received by the Architect and Owner prior to the submission of the Shop Drawings for the metal stairs and railings, and shall bear the seal and signature of the aforementioned engineer.
14. Indicate unit locations, unit identification marks, fabrication details, reinforcement, connection details, pertinent dimensions, design loads, support points and tie backs.

15. The design shall be in accordance with the aesthetic design intent of the project with the Architect having final authority in reference to aesthetic matters.

16. All design calculations (which shall bear the seal and signature of the aforementioned engineer), indicating compliance with the requirements of the design criteria and appropriate codes shall be provided to the Architect prior to fabrication for record purposes.

17. The calculations provided to the Owner at project completion shall be forwarded to the Owner as part of “Project Closeout”.

18. Proposed cable labeling technique.

19. Samples as required in various specification paragraphs.

20. Power consumption at 50%, 75% and 100% illumination levels (all lighting elements energized) for each display.

21. Drawings of initial proposal for pre-programmed football displays

C. Design Criteria

1. General: Engineer systems to the most stringent applicable code. Standards listed below are to be considered minimums.
   a. Applicable University of Colorado Codes and Standards

2. Wind Loads: Provide signage and display systems that conform to the wind load requirements of the Local Building Code and/or the wind pressure included with the General Notes on the Structural Drawings, or 50 psf, whichever is most stringent. All attachments, connections and members shall also be capable of withstanding all seismic forces in accordance with the local Building Code.

3. Handrails and Railings: As required to be part of scoreboard enclosures, assemblies, displays, etc., provide handrails and railings capable of withstanding the following minimum structural loads without exceeding allowable design working stresses of materials for handrails, railings, anchors and connections:
   a. Handrails: Capable of withstanding the following loads applied as indicated:
      1) Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
      2) Uniform load of 50 lbf/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf/ft. (q460 N/m) applied vertically downward.
      3) Concentrated and uniform loads above need not be assumed to act concurrently.

4. Catwalks and Platforms: As required to complete the work, provide catwalks and platform assemblies capable of withstanding the following structural loads without exceeding allowable design working stresses of materials, members and connections: A minimum uniform design load of 60 PSF shall be used for all catwalks, platforms and accessways.

5. Minimum thicknesses, gauges and standards
   a. All sheet metal shall have a minimum thickness of 18 gauge.
   b. Structural steel members shall have a minimum flange, web or wall thickness of 1/4 inch.
   c. All welds exposed to weather shall be 1/4 inch minimum, and shall be continuous for the entire surface of the connection.
   d. All steel grating shall be serrated and galvanized.
   e. Where similar connections and members are used in other areas of the stadium, every effort shall be made to detail and furnish members in a consistent and uniform manner.

D. Training and Event Attendance Submittals:

1. All Operations and Maintenance manuals, as well as as-built drawings must be on site for all sessions of training.
2. Following discussions with Owner, formally submit a Training and Event Attendance submittal 2-4 weeks prior to first training. Submittal shall:
   a. Include a separate page/entry for every training session.
   b. Indicate date, time, and approximate length of training session.
   c. Indicate person(s) conducting training.
   d. Indicate whether training will be video taped.
   e. Intended curriculum and most appropriate attendees (e.g. engineer, operations, IT, etc.)
   f. Include signature and title lines for
      1) Owner acknowledging and accepting training schedule. Include both an accepted and rejected box. An alternate schedule time should be suggested by the Owner in the event the schedule is rejected.
      2) Countersigning by trainer indicating that training actually occurred.
      3) All persons attending training. Where attendees do not stay for the entire session, this should be noted on the form and initialed by Owner’s representative attending training.
      4) Owner’s representative attending training at the end of the session shall initial that:
         a) Training Occurred.
         b) Training Materials were provided and left with owner
         c) Training was not interrupted or shortened by equipment or system troubleshooting. If it is, then there should be a line where Owner and Contractor can indicate when make-up training will be provided and how long it should be.
         d) Training was generally sufficient for the proposed curriculum.
   g. Include Notes section for Owner and Contractor to note any issues during training (areas requiring further development, etc.)

3. Following training occurrence, submit completed training records no later than 5 days following end of training. When training is conducted over a period of weeks, completed training submittals shall be consolidated into a single submittal and submitted every 2 weeks.

E. Final Inspection Notification Report. Two copies of a typed, neatly prepared 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, 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.

F. Contract closeout submittals:
   1. Keep a complete set of drawings on the job, note any changes made during installation, and submit 1 corrected set of reproducible drawings showing Work as installed.
   2. Submit the following data for review, prepared as indicated, at least one week prior to acceptance testing (exceptions noted):
      a. System Reference Manual: Furnish 3 copies, in 3 ring binders, sized to hold the material plus 50% excess, with clear vinyl pockets on cover and spine for project title. Provide tabular dividers with permanent legends 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.
   a) Where manufacturer registration is required, register warranty in Owner’s name, and at an address determined by Owner. Provide copy of registration.
   b) 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. Update following acceptance testing.

5) Photographically reproduced schematic wiring diagrams of the scoreboard and advertising display low and high voltage systems, based on the as-built documentation, at a reduced scale easy to handle but fully legible. Blueline (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. Instructions shall include recommendations for products and cleaning, washing and painting of all matrix, auxiliary, and advertising boards for a period of 10 years as deemed necessary by the Owner or tenant.

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. In titled ring binders sized for material below, plus 50% excess; 3 copies:
   1) Manufacturer’s Service Manuals and parts lists for all equipment. Photocopies are not acceptable. For custom circuits or modifications, complete schematics and parts lists.
   2) As-built wiring diagrams and system block diagrams showing nominal input and output levels. (Submit within two weeks after Acceptance Testing.)
   3) Duplicate copies of reduced-scale wiring diagrams.
   c. Photographically reproduced as-built wiring diagrams and overall building wiring diagrams, at a reduced scale easy to handle but fully legible. Blueline (or similar diazo process) prints are not acceptable. Mounted behind clear acetate and located with the equipment racks.

G. Submittal format:
   1. Provide a unique control number in consecutive order (e.g. 11 63 10-001)
   2. Provide a complete table of contents with the following information:
      a. Project title and number
      b. Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix “R” immediately followed by a unique number and be numbered in consecutive order.
   3. Date of submission.
   4. Referenced addendum or change order number as applicable.
   5. Referenced specification Section, Part, Article, Paragraph and page number or drawing reference as applicable.
   6. Index by manufacturer and model or part number unless specified otherwise herein.
   7. Each submission page stamped with Contractor’s certification stamp, initialed or signed certifying:
      a. Review, approval and acceptance of submission.
      b. Certification of product compliance to specification.
      c. Verification product may be incorporated within the work.
8. Arrange product data list in specification order when applicable followed by unspecified product arrange by manufacturer and model or part number. Follow list by manufacturer’s data sheets, arranged in the same order. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.

9. Drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1’-0”. Provide one reproducible transparency and two bound blueline prints of which the processed transparency will be returned to Contractor, additional prints will not be reviewed or returned.

10. Bind Project Record Manual in titled three ring D style binders sized for 150 per cent of the required material. Maximum size: three inch spline. Use multiple volumes if necessary.

H. Resubmission Requirements:
1. Make any requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
2. Indicate any changes that have been made other than those requested.

1.8 PROJECT CONDITIONS

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

B. The drawings 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, recommend solutions and/or submit drawings to the Owner’s Representative for approval, showing how the work may be installed.

C. This installer is responsible for all additional electrical (high and low voltage), structural, mechanical and plumbing work for completed systems.

1.9 ACCEPTANCE TESTING

A. Upon completion of installation and initial tests and adjustments specified in Part 3, acceptance testing shall be performed by the Owner’s Representative or Owner’s Consultant.

B. Provide two persons familiar with all aspects of the system to assist the Owner’s Representative or Owner during acceptance testing. One of the available individuals must have specialized knowledge of the computer control system operating software and function of the system.

C. The process of acceptance testing the System may necessitate moving and adjusting certain component parts; perform such adjustments without claim for additional payment.

D. Final Acceptance shall occur after the displays have functioned without failure for two games/events (as defined by the Owner) in each facility.
   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’s operators, spectators, or force majeur will not be considered event failure; failure due to installer’s operators will be considered a failure.
1.10 DISPLAY AND SCORING SYSTEMS SOFTWARE LICENSE

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

B. LICENSE GRANT AND OWNERSHIP
1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer’s use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software shall mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the owner.
2. Except as expressly set forth in this paragraph, 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 for software developed for this project or not readily available from sources other than the installer, shall be available to owner for a period of not less than 15 years. Alternatively the Owner may consider a software escrow.
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.

1.11 WARRANTY/MAINTENANCE

A. Warrant labor and materials for two years following the date of the first conference game/event, in each facility or Final Acceptance by Owner, whichever is later. This is to be from the date of acceptance of the equipment.

B. System to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or materials within the Warranty period without charge.
   1. A defect as it applies to a pixel shall be at any point that the pixel fails to be able to meet the performance requirements of this specification.

C. 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.

D. Within the warranty period, answer service calls within 8 hours, and correct the problem within twenty four hours. Provide local representation with service personnel available upon call within 3 hours prior to an event and throughout the time of the event.

E. During warranty period, provide pre-event services to occur two days prior to the event to check out and verify proper operation of Stadium systems. This works includes complete power up of all display and control systems, performance of diagnostic checks and display of Owner content, and game in progress/clock functions.

F. During warranty period, provide one, on-site, display hardware technician and phone operating/computer system support for:
   1. Up to eight (8) Stadium events

G. Register all manufacturers’ warranties (e.g. software, computers, etc.) in Owner’s name.

H. Maintain spare parts inventory on-site as listed in this specification from end of initial warranty period through year 5 of display life. Within 72 hours of notification that spare part has been used, that part (excluding bulbs) shall be replaced by the service representative/manufacturer.

I. During the 20,000 hour nominal LED display 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 specifications. If the board is not capable of meeting specifications, provide price perform the necessary repair and component replacement to bring the system to operational parameters. This new work shall be warranted for 20,000 hours effective from the original Owner acceptance date.

J. Preventative inspections and cleaning:
   1. Clean or wash displays prior to first use.
2. Preventative inspections shall occur 30 days before the beginning of the second and third seasons (one of the inspections will be occurring immediately preceding the expiration of the 2 year warranty period).
3. As part of the inspection, clean or wash outdoor LED displays.

1.12 OPTIONS AND UNIT COSTS

A. As listed in section 11 06 60.63.

PART 2 - PRODUCTS

2.1 SPECIFIED PRODUCTS AND MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed as a standard of quality. Regardless of the length or completeness of the descriptive paragraph herein, each device shall meet all of its published manufacturer’s specifications. Verify performance as required. Where two or more acceptable products are listed, the Installer may use either at his option.

B. Suppliers invited to Bid are done so with no implication or certification that their proposed products meet the technical requirements of this specification. Potential vendors are invited to prepare prices for more than one display type meeting these specifications (i.e. different pixel spacing). Suppliers invited to bid include:

1. Prime Contractors
   a. ANC
   b. CBS/Viacom
   c. Daktronics
   d. Mitsubishi
   e. Panasonic
   f. Texas Star Sports
   g. Yesco

2. Scoring Fixed Digit Displays:
   a. Daktronics
   b. OES

3. Video Displays
   a. ANC
   b. Daktronics
   c. Lightouse
   d. Mitsubishi
   e. Optotech
   f. Panasonic
   g. Yesco

4. Animation creation/display control software.
   a. ANC Vision Soft
   b. Sound Creations Crossfire and Blaze
   c. Daktronics Venus w/Show Control
   d. As approved by Owner

C. Any voluntary, Owner option substitutions will be considered subject to approval of technical data, samples, and results of independent testing laboratory tests (if necessary to verify performance) of proposed equipment, submitted in accordance with project requirements.
1. Equipment other than specified model numbers are to be voluntary Owner alternates. Submit a list of major items and their quantities, with a one-line schematic diagram for review with proposal.

2. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.

D. 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 becomes obsolete due to continuing product development, replace it with manufacturers’ current equivalent at time of installation at no additional cost.

2. If product is discontinued or becomes obsolete due to technology change, substitution will be based on fair market value of accepted and proposed products, upon approval of substitution by Owner’s Representative.

E. Under no circumstances shall the manufacturer’s name, logo, or representation be visible to the public.

2.2 PHYSICAL DESIGN CRITERIA

A. General:

1. Engineer systems to the most stringent applicable code.

2. The following requirements apply to new construction included as part of this scope of work, or code required improvements only. It is not the intention of this specification that existing structure be renovated to achieve the standards listed below.

B. Seismic Loads: Subject to the Owner’s approval, seismic design shall be under the Building Code in use at the time of the construction of the display.

C. Minimum thicknesses, gauges and standards:

1. All enclosure surfaces subject to fan abuse shall have a minimum thickness of 16 gauge.

2. All sheet metal shall have a minimum thickness of 18 gauge.

3. Structural steel members shall have a minimum flange, web or wall thickness of 1/4 inch.

4. All welds exposed to weather shall be 1/4 inch minimum, and shall be continuous for the entire surface of the connection.

5. All steel grating shall be serrated and galvanized.

6. Where similar connections and members are used in other areas of the stadium, every effort shall be made to detail and furnish members in a consistent and uniform manner.

D. Enclosure and structure. All display enclosures, 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 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. Steel exposed to weather to be galvanized. Metal components in public view that not part of a manufactured system (ie; enclosure panels) to be powder coated, per Owner direction on color.
5. **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 "oil-canning", buckling and tool marks with exposed edges folded back to form hem. This may require code rated plywood or other substrate to provide a uniform surface for the metal work.
   b. 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.
   c. Electrolytic protection shall be provided wherever differing metals come into contact.
   d. Trim shall be coordinated to be identical in appearance to adjacent panels (whether provided herein, or by others).
   e. Close out trim panels/bezels are required for all displays to create a unitary appearance to each assembly with no gaps, holes, etc.
   f. Finishes shall match adjacent existing elements, unless otherwise indicated.
   g. All welds shall be cleaned, primed and painted.
   h. Rivets and sheet metal screws penetrating the interior to be capped or cut to prevent injury.
   i. Cabinet depth of adjacent scoring, matrix and/or video displays shall be within 1” (+/-). Notify Owner when variance is greater.

E. **Handrails and Railings:** Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stresses of materials for handrails, railings, anchors and connections:
   1. **Handrails:** Capable of withstanding the following loads applied as indicated:
      a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
      b. Uniform load of 50 lbf/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf/ft. (q460 NB/m) applied vertically downward.
      c. Concentrated and uniform loads above need not be assumed to act concurrently.
      d. Provide safety tie-off point in all locations where fall protection is required by OSHA for each display

F. **Catwalks Stairs.**
   1. Provide catwalks and platform assemblies capable of withstanding the following structural loads without exceeding allowable design working stresses of materials, members and connections: A minimum uniform design load of 60 PSF shall be used for all catwalks, platforms and accessways.
   2. Catwalks shall be provided the full width of all rear-service electronic and advertising displays.
   3. Internal circulation between catwalks shall be by ships ladders or stairs; vertical ladders are generally not acceptable.
   4. Ladders shall extend beyond each catwalk level.
   5. Provide self-closing access gate for openings in railing

G. **Electrical**
   1. Provide complete power and branch circuit distribution within the enclosure from the existing demarcation point as listed above Power Distribution: All panel boards or load centers provided with lighting units for power distribution to displays loads shall incorporate main breakers.
      a. Provide utility power distribution in all rear service enclosures.
   2. Conceal conduit and distribution within enclosures.
   3. Provide lockable load center, breaker panels, and disconnects. Provide minimum of 8 keys per lock.
4. Label each breaker as to its function.
5. All materials shall fully comply with Underwriters’s Laboratories or other acceptable testing agencies acceptable to local authorities with jurisdiction.

H. Ventilation
1. Provide natural or forced ventilation as required for operation of all components.
2. Provide all necessary dust and dirt filtration for the ventilation system.
3. Filters shall be easily removable and changeable.
4. NC level attributed to this ventilation shall be no more than NC 45 at nearest seat.

I. Unless otherwise noted the following is the requirement for spares throughout the Scoring and Matrix system:
1. Provide 2% (or two (2) if 2% is less than two (2)) spare parts of lighting units, lamps, modules, fans, and elements, including cables, jigs and the like.
2. Provide two (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. A freestanding testing unit to test and/or adjust individual lighting components

J. Service Requirements
1. All screws and nuts that are required to be removed for access to displays shall incorporate captive screw and nut type designs.
2. Provide 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 auxiliary displays for maintenance and repair.

K. Provide primary and backup connection from each display to control system in each venue’s Scoreboard Control Room/location and other specified control locations. The Primary and Backup connections shall be routed separately around the Stadium and be run in separate cable riser pathways.

L. The contractor shall furnish all labor, materials, equipment and services to provide a complete lightning protection system for the exterior scoreboard structure(s) included in this contract. The system(s) shall include strike termination devices, interconnecting conductors, a proper grounding system, interconnection with other building grounded systems, and surge suppression at service entrances. The system design shall comply with the National Fire Protection Association (NFPA) Standard # 780, the Lightning Protection Institute (LPI) Standard # 175, and Underwriters’ Laboratories, Inc. (UL) Standard # 96A. The manufacturer of the material components shall be a manufacturer member of the Lightning Protection Institute, and all materials shall be listed and labeled in accordance with the requirements of UL Standard # 96. The system installation shall be made under the supervision of an LPI Certified Master Installer. Upon completion the contractor will deliver to the owner an as-built drawing and the appropriate system Certification documents under the UL & LPI programs.

2.3 OUTDOOR COLOR LED DISPLAYS

A. Technical Requirements
1. Color LED displays shall incorporate direct view technology; currently recognized technologies:
   a. “Full Color” Light Emitting Diode (LED)
2. Brightness: 16 levels of illumination, including 0%, 25%, 75% and 100%.
a. These illumination levels shall be able to be preset to simultaneously switch brightness and gamma correction to accommodate the following common game conditions:
   1) with field lighting
   2) without field lighting
b. A method of accommodating automatic brightness control shall be supported at each display location.

3. Brightness shall not fall below (at 100% white generated at external input):
   a. 6,000 nits within first 20,000 hours of operation after acceptance.

4. Uniformity of brightness:
   a. Adjacent pixels 2%,
   b. 8% total variation across display, brightest to darkest pixel/module.
   c. Uniformity standards to apply over entire viewing angle as specified without perceptible color shift.

5. 140° minimum horizontal angle (defined as 50% brightness) of viewing and 50° (nominal +20/-30° with screen vertical) of vertical. Color temperature to remain constant over 50% brightness viewing angle range.

6. Color temperature of display: 7,000-9,300° Kelvin. With a uniformity of 250°K between adjacent pixel 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.

7. Pixel spacing: as noted in the schedule of displays.

8. Provide top, front or rear access as required by mounting conditions and available service access.

9. Display shall be flicker less, and free of all image processing artifacts such as image stuttering, frame dropping or skipping of any portion of the image display.

   a. Ribbon and Aux displays are not required to display live video images
      1) The display processors shall be redundant for these displays
   b. Video input processors shall be redundant for the LED video displays.
      1) The video processor shall be configured to support the following inputs without external processing:
         a) Component Serial Digital input (i.e. ITU-R 601; SMPTE RP-125)
         b) Digital Television (DTV) Production standard (e.g. 480p; 720p, 1080I).
      2) Shall be capable of supporting not less than (3) simultaneous inputs.
      3) If computers are employed as part of the LED Video display system, they shall meet these specification requirements as well as:
         a) Provide with a 15 minute UPS (Uninterruptible Power Supply).
      4) If a computer is used as part of the processor—or used for remote control or any other functions of the video board—provide a complete backup computing system running in a full-time, on-line backup mode with appropriate disk mirroring.

11. Provide connections, cabling and appropriate backups from control room to board to support the following connections:
    a. SMPTE 259, Serial Digital (601)
    b. SMPTE 292, HD-SDI (e.g. 480p; 720p, 1080I).
    c. DVI

12. Display electronics remote control system to provide complete screen remote control of:
    a. Brightness level
    b. DISPLAY POWER ON/OFF
    c. Input Selection
    d. (Including remote activation and deactivation by a contract closure from the video replay system production switcher)
    e. Image positioning, sizing, and scaling
    f. Color level
g. **Hue**

h. **Contrast**

i. **Sharpness**

a. Color display test, and address location. This pattern shall include a numerically identified grid that corresponds to the address of each unit’s physical address as well as a red, green, blue and white color scroll for all inputs over the entire display. Typical pattern:


b. Remote lighting unit location, testing, color display test, and address location.

c. These controls shall be provided for all inputs to control system processor.

13. Provide connections, cabling and appropriate backups from control room to board to support the following connections:

### 2.4 DISPLAY CONTROL COMPONENTS

**A.** Computer based control system hardware shall exhibit sufficient computer processor power and speed to generate images instantly on command. Software packages and control electronics shall provide specified operational features. All control system software and messages shall be stored on non-volatile disk. Function of each workstation used for a particular display shall be able to be accessed and operated in the event of computer failure with workstation in the same functional group.

**B.** Minimum Computer Processor Configuration for each CPU

1. CPU: as required by system operation.
2. Case: rack mount, with mounting rails for servicing while installed in racks.
3. Monitor: 19” flat screen; active matrix, LCD (e.g. Viewsonic, Dell, Sony or HP).
5. Mouse: Two button Microsoft Intellimouse with IntelliEye.
6. Keyboard: full size with separate numeric keypad and cursor control.
7. Serial ports: two.
8. Computer system shall be completely tested by manufacturer prior to delivery.
9. Intel PCI, 10/100/1000 Mbps Fast Ethernet adapter.
11. Animation computers to include sound card and audio storage system to allow sound effects to accompany animation sequences.
12. Each CPU/workstation assembly to include dedicated, on-line UPS with sufficient capacity to operate CPU/workstation (includes video monitor, not printers) for 15 minutes. Locate switch on UPS.
13. Software:
   a. All software necessary to interface this computer to scoring system for configuration and operation.
   b. Provide latest version of Windows® software on computer that is compatible with scoring system.
   c. Provide MS Office XP Professional or 2007 Professional or other, depending upon Owner’s office standard or preference on at least two (2) workstations.
   d. Provide with Microsoft Internet Explorer, Mozilla or Apple Safari, depending upon the Owner’s office standard or preference.
      1) All necessary software to synchronize, with appropriate timing offset, computer clocks
14. Control System configuration to include on-line, redundant server/master for all statistics and game-in-progress information.
15. Control computers for each venue to consist, at a minimum, of the following workstations:
   a. Scoring/timing interface
   b. LED Control/Animation Display
c. Sportsticker/captioning-steno input/Statistics feed.
d. Caption computer if this function is not included in other workstation.
   1) Coordination location of on-site captioning station with Owner, provide
cabling/interface at that location
   2) Coordinate location of access to off-site captioning service (ie; phone or IP
based data delivery) integrate outside service access into complete system.
e. Main Server
   1) Provide sufficient network storage for all message and animations in RAID
protected format for 2 seasons worth of material
f. Back-up Server—configured to run in a “hot-standby” configuration.
   1) Provide sufficient network storage for all message and animations in RAID
protected format for 2 seasons worth of material
g. Video Keying computers—see networked functions for further information
h. Two (2) workstations at stadium, dedicated for animation creation (e.g. full 1080
HD animations). In addition standard configurations, provide:
   1) Minimum of 4gig memory of animations.
   2) Integral BluRay re-writable recorder
   3) Extension of USB port from rack mount workstation to workstation rooms via
patch panel and USB/Cat5 extender (e.g. Intellix).

C. Networked Functions. The following devices should be configured to be shared on a network
between individual workstations:
1. Network switch: 32 port, 10/100/1000 Base T. Acceptable: Cisco
   a. Connect to Video Replay Network Switch
2. Network Back-up Requirements:
   a. Each machine shall be able to be backed up over the network to shared storage
      mediums.
   b. storage mediums:
      1) Short Term
         a) BluRay re-writable recorder
      2) Long Term
         a) SAIT-1 or LTO-3
         b) 300gb capacity (uncompressed)
         c) Integral tape changer to permit a minimum 6 slots.
   c. 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.
3. 32 bit color scanner; Epson perfection V700 Photo, football only (Quantity: 1)
4. Each CPU/workstation assembly to include dedicated, on-line UPS with sufficient capacity
to operate CPU/workstation (includes video monitor, not printers) for 15 minutes. Locate
switch on UPS.
5. Internet gateway: via network connection to team’s computer system
6. Internal and exterior data ports to support, at a minimum:
   a. Elias
   b. Sportsticker feed
   c. Access to Pac 12 stats system.
   d. Feeds to multiple network display interfaces (e.g. Fox Box) located at broadcast
truck parking area.
   e. Statistics SQL database access by Memorial stadium Video Replay System
character generator (e.g. Chyron Duet, or Pinnacle Systems Deko series)
   f. Standard Definition Digital video output of data in text form.
All Venues - Data input standard stenography (ie; Stenograph, Eclipse, Cheetah Systems) equipment. Coordinate exact system and interface requirements with Owner after award of contract.

Statistics Video keying system

For Football, provide a programmable quarter by quarter information that will allow changing of character generator pages (including “intelligent interface” remote recall of pages) based upon programmable triggers for:

1) pre game
2) time before game start
3) specific quarter
4) game ended (team won)
5) game ended (team lost)
6) post game
7) As certain situations happen in the game. For example, stats should automatically change from team to team, based on possession. Graphical templates and the stats shown should be allowed to be triggered by different variables (team/individual passing or rushing, etc.) These are examples and automation of the system should not be limited to these examples.

Statistics Video keying system

Provide the ability to key certain statistics for stadium

Keys over Video. Example of football, hockey and basketball statistics are:

1) Score
2) Quarter/half/period
3) Team
4) Team or individual stats, such as:
   a) Total rushing/passing, attempts/completions, percentages, etc.
   b) First downs
   c) Time of possession
5) Out of Town Scores

Video keying module standard:

1) System
   a) Digital video inputs
   b) Ability to take graphic pages from Video Replay System’s Character Generator.
   c) Ability to provide “squeeze-back”, automation based CG keying, and aspect ratio conversion.
   d) Ability to playback clips stored on the unit.
2) Acceptable Product
   a) Sound Creations Crossfire HD
   b) Daktronics Venus/V-Link
      i) As Approved
3) Keying module requirements:
   a) Provide two video channels in scoreboard room.
4) Installation:
   a) These units should be located in the equipment room racks.
   b) Coordinate the IO with the team’s Video Replay System installer.
5) Connect unit(s) to KVM Matrix.
6) Provide user station one KVM Matrix.
   a) 19" flat screen monitor
   b) MS Intellimouse with IntelliEye
   c) Keyboard.
7) Software configuration: As noted in the training portion of the specification, it is essential that team personnel be trained on the creation and operation of this system. Individuals performing training must be experienced in sports statistics, automation, and ability to generate templates and files.

Approved:
1) As above with 4.5TB of external storage for this function.

D. Hardware Control functions
1. Brightness controls: Provide a minimum of three brightness levels for each matrix display. Brightness levels shall be 50 to 65%, 75% and 100% of full brightness for matrix displays. Provide separate ON/OFF controls for advertising panels, video displays and fixed digit displays.
2. Clear (“oops”) Button: Provide a special clear button in addition to the keyboard control that will immediately clear each matrix board. This will override any display in progress, and allow the operators to immediately remove any messages or animation.
3. Main Scoring and matrix display Graphic Animation for Signage: Provide switch for activating the animation sequence.
4. 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.
5. Rotation (groups or individually) rotating advertising panels

E. Scoring and Animation 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 floppy diskettes, or CD ROM. Provide the following software features for all displays.
   a. Character, Animation and Symbol Generation: Generation, control and placement of any display pattern in any area of the video or scoring displays. Patterns to include pre-programmed football display formats. Programming should allow the operator to modify the existing display format or store and recall custom formats generated by operator.
   b. Character Fonts: Upper and lower case character generation. Include a minimum of 100 separate fonts, including double and single characters. In addition provide the capacity for ten 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.
2. Game in progress scoring requirements:
   a. Provide a graphical user interface capable of game statistics.
   b. Ability to keep a full football and basketball stats database which keeps game in progress statistics, season statistics, lifetime statistics, and updates stats via the Pac 12 statistics system every morning. System to import rosters, visiting team statistics, and league leaders as well. This database shall include the ability to store pitch speed and type.
      1) Must be able to download from outside source (Pac 12, Elias, etc.)
      2) Must be able to manually override or add to rosters or stats if an error occurs in downloaded data
      3) Stats and roster must include, but not limited to:
         a) Full Name
         b) Number
         c) Biographical Information (Age, Birth date, etc.)
         d) Season Stats
         e) Career Stats
         f) Situational Stats
   c. Allow for scoring of all football/basketball situations.
d. System must allow for a safe/manual mode that allows the operator to continue scoring the game if a previous play(s) has/have not yet been recorded into system

e. Software must allow for the input of detailed scoring information; e.g.:
   1) Scoring sequence
   2) Who threw/received pass
   3) Distance covered by play
   4) User designated notes fields

f. Control system to allow designation of keyboard “soft” keys for rapid display of standard game conditions, such as first down, interception, fumble, etc., player name/number, team name, etc.

3. Statistics database:
   a. Game In progress information
   b. League leaders and standings
   c. Sportsticker/Conference information
   d. Situational/Expanded Stats
      1) System must be able to generate game, season, career and situational stats (by quarter or down, etc.) for any player involved in the game
      2) These stats must be easily identified, formatted and displayed at the operator’s discretion using compatible displaying software as well as character generators
   e. Standings & League Leaders
      1) Categories for leaders should include but not limited to:
      2) Offensive,
      3) Defensive,
      4) Team Leaders
      5) Rookie Leaders
   f. This game in progress information shall be stored in a SQL database that shall be made available to:
      1) Video character Generator
      2) Video Display System (in the event that the matrix scoring displays are replaced by a larger video display).
      3) Other resources as designated by Owner
   g. Unique display requirements:
      1) Chart indicating location of completed passes/made shots.
   h. Note Creation, Storing & Editing
      1) System must allow for the creation, editing, storing and displaying of player and team notes
      2) System must allow for easy viewing, selection and displaying of notes
      3) System must allow for notes to be edited during the game
      4) System must allow for the creations of notes on the fly

4. Provide interface to the statistics system for out of town games to allow up date of score, quarter and time remaining for each out of town game displayed. Update of all information on out of town scoreboard to be accomplished automatically once day’s games are entered into system.
   a. Pac 12 Scores
      1) System must download and provide updated schedules, rosters and scores for all games from the league or other source of out of town scores
      2) System must allow for scoring updates to happen frequently (Several times a minute)
      3) Updates should include, but not limited to:
         a) Rosters
         b) Game Start Time
         c) Current Score
         d) Quarter/Half
         e) Time remaining in quarter/half
4) System must allow for an user override function when software does not provide current information (specifically the addition of players to rosters and the changing of scores as needed).

5) System should allow user full control of how scores are displayed  
   a) Number of games displayed  
   b) Information displayed for games  
   c) Displaying of scores on multiple boards at one time.

6) System should allow for the generation of game notes provided by the Pac-12 or other source of out of town scores.  
   a) Total team stats, individual scoring, etc.  
   b) System should allow user to edit and display notes at their discretion  
   c) System should hold all notes generated until user displays or deletes the note.

7) System must allow for an user override function when software does not provide current information.

8) System should allow user full control of how scores are displayed  
   a) Number of games displayed  
   b) Information displayed for games  
   c) Displaying of scores on multiple boards at one time.

9) System should allow for the generation of game notes provided by the Conference, Elias or other source of out of town scores.

5. External Feeds  
   a. Information on out-of-town statistics, standings, league, team and individual statistics shall be acquired via the Pac 12 Conference, SportsTicker data feeds or other third party services as identified by Athletics. These feeds to be interfaced directly with scoreboard control system, with automatic, real-time update capability.

   b. Installer to coordinate interface with outside information services with the Team. Software vendor shall interface to any data service client wishes throughout the warranty period. Vendor shall identify any limitations of this service with their bid proposal (e.g. XML, 232, or other data interfaces).

   c. System to allow input of electronic stenographer data for text display on scoreboards. Coordinate location of stenographer with Owner’s Representative and Team. Provide data link to this location from control system.

6. Animations: Refresh at a minimum of 30 frames per second. Maximum of a one second response to a control system command. System shall be capable of importing AVI files for system playback.

7. Control and Interface requirements  
   a. Preview: Preview animations or messages on the user system monitor(s) prior to display on spectator displays.

   b. Maximum of a one second response to a control system command.

   c. Security Code Access: Passwords shall be available to system users to log into and access the control of the display system.

   d. 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 being displayed after a given number of times.

   e. Off Line 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).

   f. Message Logging and Recall: 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. A summary of the Message Log shall provide a description of the event.
title of the message or animation, date and time of display, duration of display, which board(s) received the message, and which particular quarter (or other moment of the event) the message occurred. A similar log shall exist for the rotating signs.

g. 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.

h. Real Time Access: Provide access from any message console to current messages, statistics, game-in-progress and animation.

8. Message formatting requirements each venue:
   a. Zoning: 8 user definable display zones (separate areas for displaying information) within both color and monochrome displays for the matrix boards with the size and location determined by the operator. Zones to be controlled individually, in groups, or totally at the same time. Zone capability to simultaneously include text captioning or game in progress information at location of displays.
   b. Messages shall be able to crawl or roll in predefined zones with a minimum of four separate speeds.
   c. Temperature, time of day and date programming.
   d. Clocks: Provide capability to define location, size, fonts, and format of clocks on any addressed display.
   e. Assignable Z-order priority

9. Effects: Provide the following effects for characters, messages, symbols and animation:
   a. Operator control of message, including sequencing and timing.
   b. Repetitious rotating of selected zones of any display zone 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.

10. Inherent system backup: Each computer-based workstation shall be capable of operating the software of any other workstation.

11. Control system to allow designation of “soft” keys for rapid display of standard game conditions.

12. Security Code Access: Passwords shall be available to system users to log into and access the control of the display system.

13. 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.

14. Off Line 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).

15. Internet access Message Logging and Recall:
   a. 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,
      i) date and time of first display.
      ii) date and time of last display.
      iii) 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.
      i) sub-client information related to the piece (e.g. identifying a specific advertising campaign,
      ii) 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.

16. 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.


F. Provide the following pre-programmed display formats: statistical and timing functions. Include variations of pre-programmed displays for the support of high school and Pac 12 events:
   1. NCAA football (four different templates)
   2. Soccer
   3. Lacrosse
   4. Installer to work with Owner and Team staff, on site, in determining layout and content of pre-programmed displays. Each message shall be capable of being displayed on any matrix board.
   5. System to include data interface to allow game in progress information to be provided to broadcasters, without interface to display system control.

G. External Data Control System: Provide system software related primarily to game statistics. Software shall interact with outside agency statistics (i.e.; Elias, Sports Ticker; Pac 12, Stat Crew for each sport) via modem or satellite interface by Scoring system installer, or manual entry by operator. Communication (campus IT/telecom services) connection will be provided to control room under a separate contract. Provide for the system to be interfaced to broadcasters and the stadium video Replay System’s character generator.

H. Diagnostic Software: Provided to assist the Owner in diagnosing, isolating and repairing deficiencies in the display and control system, including defective lamps.

I. Spares: Provide one set of back-up disks of all software and first game configurations.
2.5 LED ANIMATION

A. Graphics and Animation packages.
   1. Graphic images
      a. Provide three full color animations with rotating CU logo for each display.
      b. Create static logo for each available Colorado athletics and building identification logos, as well as logos for up to 20 sponsors/advertisers for each system (which may be different for each venue).
      c. Create templates, working with Owner, of at least three different video/stats/game-in-progress/alpha numeric information “screens” for each of the displays (video and matrix) for each venue.
      d. Create templates, working with Owner, of at least three different video/stats/game-in-progress/alpha numeric information “screens” in addition to an emergency message scenario.

B. Content Management/Creation Software to be provided as part of this contract:
   1. Adobe Video Collection, Professional (Mac; latest shipping)
      a. Quantity: two
   2. Stock Graphics
      a. Digital Juice Swipes
         1) Quantity: 10 Volumes
      b. Digital Juice Jump Backs HD
         1) Quantity: 25 Volumes
      c. Digital Juice Editor’s Toolkits:
         1) Quantity: 8 Volumes
   3. Plugins. Provide five (5) licenses and software for the following plug-ins
      a. GenArts, Inc Sapphire
      b. Trapcode Particular
      c. Trapcode Shine
      d. Trapcode Starglow
      e. Trapcode 3D Stroke
      f. Zaxwerks ProAnimator,
      g. Zaxwerks Invigorator Pro
      h. Zaxwerks 3D Flag
      i. Digital Anarchy Anarchy Toolbox
      j. Digital Anarchy Data Animator
      k. Digital Anarchy Geomancy Shapes
      l. Digital Anarchy PlasmaFX
      m. Digital Anarchy Text Anarchy
      n. Digital Anarchy ToonIt! Video

2.6 SCORING DISPLAY SUPPORT EQUIPMENT

A. RS 232/485 Fiber Modems
   1. Required as necessary to provide data at remote locations such as TV truck dock, video coaching, clubhouses, etc.
      a. Teleybyte Model 277
      b. Approved equal

B. Equipment rack(s)
   1. Equipment Rack to be frame and panel type with a minimum of 77" high by 36" deep panel space constructed of 16-gauge cold-rolled steel. Racks to have locking rear door mounted on the frame (not the rails). Empty mounting panel spaces to be filled with blank or vent panels, in a finish to match rack. Provide end panels and top panels as required.
Provide shelving as required for equipment mounting within racks. Provide rack supports as required. Provide seven rack keys of each type. Rack color to be gloss or flat black.

Provide a 60-watt “rough service” lamp in a locally switchable fixture mounted in the top rear of each rack. Include extra set of mounting rails in each rack for rear support of panels or equipment. Verify exact rack space required.

a. Support Equipment
   1) Blank Panels
   2) Vent Panels
   3) miscellaneous equipment shelving
   4) rack screws
   5) power distribution
   6) rack light

b. Scoring System Racks to be:
   1) Middle Atlantic MRK4436 racks, doors, sides, and top panels. (Quantity: 1 or 2 when combined with video displays)
   2) Other manufacturers should be submitted for approval. (Quantity: As required)

C. Keyboard, Video, Mouse Matrix Switcher
   1. Unit to provide up to 8 Users to access each of the systems computer(s) without the need for re-booting or re-configuration of cabling (excepting clubhouse keying computer).
   2. Frame (KVM MATRIX)
      a. Avocent AMX5010-AM KVM Switch
      b. Note: this unit shall be interconnected to other computers and workstations provided by Video Display, Video Replay and Rotational Sign installers.
   3. User Stations (EXR).
      a. Avocent AMX5131. (Quantity: As required plus 1).
   4. Computer Interface (EXT)
      a. Avocent AMIQ-PS2. (Quantity: As Required plus 1)
      b. Avocent AMIQ-USB. (Quantity: As Required plus 1)
   5. Type 1 Data Monitor (GPXM1)—Rack mount keyboard, video and mouse.
      a. 19" flat screen, rack mountable, with integral keyboard and touchpad.
      b. Acceptable Suppliers
         1) Rose RV2-CKVT19

D. Ethernet Network Switch. 10/100 with a gigabit uplink port. Provide 50% unused ports.
   a. Acceptable suppliers: HP, Dell, Cisco, IBM, As Approved

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

2.7 DELAY OF GAME/PLAY CLOCKS, LOCKER ROOM CLOCKS AND CONTROLLERS

A. If existing controllers and clocks can be interfaced to new display system control, then existing system is to be reused. In the event that systems are incompatible, new clocks and controllers are to be provided as part of this scope of work.

B. Delay of Game/Play Clocks (Stadium)
   1. Play clock to be freestanding unit with white LED, fixed digit display and enclosure meeting requirements of main scoreboard scoring and enclosure systems. Location of clocks is shown on drawings. Coordinate exact location with Architect and Owner prior to installation.
      a. Character heights to be not less than 30”.
      b. LED lamps to have matte lens, exposed lamps are not acceptable.
      c. Display to have 6” wide white border around digits.
d. Clock controller to be able to be operated from sideline and press level scoreboard control room.
   1) Cables, connector are part of this scope of work.
   2) Clocks to be same type and size as permanent units
   3) Quantity: Two (2), permanently installed plus one spare set of digit “packs.

2. Control Console.
   a. Control Console Quantity (2) play clock controllers and (2) scoring controllers with multi-sport scoring overlays. Provide carrying case for each.
   b. Standard of quality for Control Console:
      1) Daktronics All Sport 5000

C. Locker Room Game/Time of Day Clocks.
   1. Technical Standards
      a. Displays provided in locker rooms and select other locations as listed above to allow team members and officials to view game clock at all times. **Clock enclosure to allow flush mounting (rather than surface mount) of new clocks in wall, where architectural conditions allow.** New clocks in existing clock locations so mounting should match the existing condition. Should site conditions prevent flush mounting, provide surface mount enclosures at direction of Owners Representative.
      b. Display to be LED, or other approved, directly illuminated source. LCD displays are not acceptable.
      c. Digit sizes to be no less than 4 inches high
      d. 100% Solid state drivers.
      e. A minimum of two levels of brightness: 50% to 65% and 100%.
      f. Electrical and control cabling connections to be hidden behind display enclosure.
      g. Enclosure to allow flush mounting in wall where possible. Flush mounting is expected in gypsum board walls. Coordinate electrical and signal rough-in to facilitate flush mounting.
   2. Quantity: 6
   3. The Standard for locker room/time of day clocks shall be:
      a. Daktronics TI2028/TI2013
      b. OES

2.8 CONTROL CABLELING

A. Installation shall include all required and operationally necessary low voltage control and/or fiber optic cabling for all scoring displays from Scoreboard Control Room to each display assembly as appropriate.

B. All cable whether fiber optic or copper will be run in conduit/cable tray from the Scoreboard Control Room to each scoring/matrix element. Provide a single spare for each transceiver (line driver) type used by the scoring/matrix system.

C. Provide back-up to any cabling sufficient to maintain game in progress clock functions/displays. Provide one spare cable of each type to each display. It is not acceptable to use spare pairs within the same cable.

D. Cable shall carry appropriate fire rating (e.g. CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.
PART 3 - EXECUTION

3.1 GENERAL

A. All equipment and materials shall be new with the exception of any existing conduit/raceway and signal cabling that is being reused. 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. AC Power and Grounding
   1. Adhere to all local and national electrical codes and standards.
   2. Label power distribution equipment (e.g. breaker panels, disconnects, and load centers) as to what portion of what module is being served by that device (e.g. breaker).

E. 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.

F. Equipment and Cable Labeling
   1. Provide engraved laminoid 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 alphanumeric 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 INSTALLER TESTS AND ADJUSTMENTS

A. Verify the following before 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. Installer to perform the following testing of displays. Owner, at Owner’s expense, may contract with independent testing agency/consultancy to verify LED Video display performance:
   1. Overall screen brightness (peak)
   2. Uniformity testing
      a. Separate measurements (brightness and color temperature) shall be shall be made to verify uniformity at:
         1) Peak/maximum brightness (recommended direct sunlight operating brightness).
         2) Typical operating brightness
         3) Evening/nighttime operating brightness
      b. Brightness uniformity
         1) pixel to pixel
            a) intra-module
            b) between modules
            c) Sampling techniques are acceptable, provided:
               i) number of samples is not less than 20% of the total display’s pixels.
               ii) samples are spread throughout the screen
               iii) Samples run width of screen
         2) module to module
         3) best case to worst case
      c. Color temperature uniformity
         1) pixel to pixel
            a) intra-module
            b) between modules
            c) Sampling techniques are acceptable, provided:
               i) number of samples is not less than 20% of the total display’s pixels.
               ii) sample is spread throughout the screen
         2) module to module
         3) best case to worst case
   3. Viewing angles:
      a. Horizontal
      b. Vertical
      c. Defined as 50% of peak brightness, or at the point a noticeable color shift occurs.

C. 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.
6. All as built documentation, record drawings, operations and maintenance manuals, and test data must be presented prior to or during acceptance as determined by Owner’s representative.

3.3 TEST EQUIPMENT

A. Provide test equipment if requested, and complete, installed control system 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’s Consultant 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. Spot photometer: equal to Minolta CS100
4. The following equipment will be needed in the process of acceptance testing. Some of this equipment may exist in the video replay system. The use of the video replay system’s components should be confirmed with the Owner and Owner’s Consultant. In the event that this equipment is not available, then it shall be provided by installer.
   a. Television test signal generator: Tektronik, Leitch; composite or component depending upon actual connections to display.
   b. Waveform monitor and vectorscope: Tektronik or Videotek; composite or component depending upon actual connections to display. Unit should be portable.
   c. Portable 13” color video monitor: Panasonic BT-H1390Y or Sony PVM-14L2.

3.4 ACCEPTANCE

A. Upon completion of installation and initial tests and report specified in Part 3, acceptance testing shall be performed by the Owner’s Consultant.

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 2 technicians 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 4 days for all three venues. Testing to include demonstration of Stenograph and Conference stats/Sports Ticker data input capability. Provision of stenograph equipment and operator as required, is the responsibility of the Installer.

C. The following procedures will be performed on each System:
   1. Assessment of display images
   2. Physical inspection of displays
   3. Review of animations
   4. Review of scoring and clock functions
   5. Review of system operation on redundant cabling
6. Control functions shall be checked for proper operation, from controlling devices to controlled devices.

7. 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.”
   a. For physical controls, normal settings shall be marked with small white, adhesive dots.
   b. For software controls, “screen shots” of the relevant menus, pages or dialog boxes shall be made. Additionally software presets shall be recorded to “disc” permitting full recall.

8. Installed and loose equipment will be inventoried for correct quantity.

9. Any other test on any piece of equipment or system deemed appropriate.

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.

D. Video Brightness testing procedure:
1. Screen(s) shall be set at the appropriate brightness level with a standard NTSC 100% white video signal at input to screen/processor. Screen(s) will be allowed to stabilize, and screen controls shall be adjusted for a uniform brightness across each screen's face.
2. Screen(s) shall be adjusted to the specified color temperature.
3. Brightness level shall be measured using a spot photometer of certified calibration with trained technicians according to the following procedure:
   a. All measurements shall be made in the lowest ambient light attainable. This will necessitate measurement during late hours due to the construction process.
   b. A grid of one vertical and one horizontal line, equally spaced, shall be placed on each video screen to provide for four equivalent rectangular screen areas.
   c. Spot light intensity readings measured in NITS (1 NIT = 1 candela/m^2) shall be taken with a spot photometer set to a 1° measurement circle at a distance of 500 feet normal to screen(s).
   d. Screen(s) will be turned off and four readings shall be taken with an average light established to determine the “black” level.
   e. The difference between the white screen light measurement and the black screen measurement shall establish the brightness in each area and the average of each screen shall establish the overall brightness of each screen.
   f. Horizontal and vertical viewing angles will be measured.

E. In the event the need for further adjustment or work becomes evident during setup 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’s Representative.

F. The Owner’s Consultant’s fees and costs involved in acceptance testing are not the responsibility of the Scoring System Installer, except as described in Part 3 of this specification.

G. Final acceptance will follow the successful control system operation at the completion of the two three? regular season Pac 12 games at each venue or other events as defined by Owner.

3.5 DEMONSTRATIONS

A. Provide 20 hours total instruction to Owner designated personnel on the use and operation of the systems, scheduled as a minimum of 5 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’s Representative and Owner. At direction of Owner, a portion of training time may be deferred to end of first regular season as follow-up sessions to enhance operator’s ability to maximize performance of system. Due to compressed schedule Owner may request control/animation computers prior to installation for training and content production. If this is the case, start training sessions on this equipment shortly after delivery of the equipment, as directed by Owner.

B. Training Schedules
1. Training should be assumed to take place on the project site, unless agreed to by the Owner.
2. Training should be scheduled to be non-overlapping, unless agreed to by the Owner.
3. 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).
4. 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.

C. The following is a general idea of the training “curriculum”:
1. A general familiarization of the Owner’s Representative of the device.
2. An explanation of how the device interfaces to the rest of the system (including data connections; timing requirements and the like).
3. General training on operating the device.
4. 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).
5. Saving information; backing information up (including a review of the proper procedures for backing up.
6. Basic troubleshooting
7. Specific troubleshooting (this information may be conveyed to personnel other than the device’s “operators”).
8. 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).

D. In addition to training noted above, owner training on the video keying devices. This training shall be conducted by manufacturer’s personnel agreed upon by Owner’s representative and Installer. This Training shall consist of no more than 6 hour days over not less than two (2) separate weeks. Initial training should take place 2-3 weeks before the first games; second session will be at a later time agreed upon with Athletics. Training cannot occur until statistics database is fully operational. Any training occurring while statistics database is not functional will not be considered to fulfill this requirement.

E. In addition to training noted above, be present at three football, four basketball and three hockey events, as selected by the Athletic Department, following final acceptance, to assist with operation of system.

F. In the event that any of the Scoring and Matrix Display systems are used prior to final acceptance, attendance in support of said usage shall not be construed as acceptance, or as event attendance.

END OF SECTION 11 63 10
PART 1 - GENERAL

1.1 TERMS

A. Unique Identification
   1. Facility name
   2. SUB—subordinate identification of an element in overall display.

B. Dimensions
   1. HT—Height of Active Display area (excluding, trim, etc.), in feet or pixels
   2. WD—Width of Active Display area (excluding, trim, etc.), in feet or pixels
   3. TOL—Tolerance, expressed as a percentage of Height or Width (or pixels). Allowable variation to base size.
   4. MAX HT—Maximum height of display, including all cabinet, trim, etc. This dimension is generally set by sight lines and cannot be exceeded within base proposal.

C. TYPE—Technology Type

D. MIN RES—Absolute Minimum Physical Pixel Resolution expressed in mm (higher resolution products are implicitly allowed; within the available power limitations).

E. USE—Purpose of display

F. Position Information; physical location of display.

G. Drawing
   1. Architectural drawing reference (for elevation, section and/or location in plan).

H. Lighting
   1. Lighting Technology type.

I. Section—Specification Section for this scope of work.

J. Notes—Special notes
## 1.2 SCHEDULE OF DISPLAYS

<table>
<thead>
<tr>
<th>LVL</th>
<th>SUB</th>
<th>HT X WD</th>
<th>TOL</th>
<th>MAX HT</th>
<th>TYPE</th>
<th>MIN RES</th>
<th>Use</th>
<th>Position Information</th>
<th>Drawing</th>
<th>Lighting</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stadium End Zone Video Display</td>
<td>South</td>
<td>33'-4.5 x 34'</td>
<td>2%; 608 pixel minimum</td>
<td>34'</td>
<td>Color LED</td>
<td>16mm</td>
<td>Video, Ads, text, animation</td>
<td>Center of assembly</td>
<td>SB-002</td>
<td>Internal</td>
<td></td>
</tr>
<tr>
<td>Stadium End Zone Video Display</td>
<td>North</td>
<td>34' x 52'</td>
<td>2%; 608 pixel minimum</td>
<td>34'-6''</td>
<td>Color LED</td>
<td>16mm</td>
<td>Video, Ads, text, animation</td>
<td>Center of assembly</td>
<td>SB-001</td>
<td>Internal</td>
<td></td>
</tr>
<tr>
<td>Stadium Play clocks</td>
<td>Football south and north</td>
<td>30'' high digits</td>
<td>36''</td>
<td>Monochrome LED</td>
<td>Fixed digit</td>
<td>Delay of game/Play Clock</td>
<td>In existing clock location</td>
<td>Internal</td>
<td></td>
<td>Includes 4'' white border around digits at end of display</td>
<td></td>
</tr>
<tr>
<td>Stadium End Zone Ribbon Display</td>
<td>South</td>
<td>2 sections 5' x 48'</td>
<td>2''-64 pixel minimum at 20 mm.</td>
<td>60''</td>
<td>Color LED</td>
<td>20mm</td>
<td>Stats, GIP, Text, ads, logos, animation</td>
<td>Either side at the bottom of video display</td>
<td>SB-002</td>
<td>Internal</td>
<td></td>
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<tr>
<td>Stadium End Zone Ribbon Display</td>
<td>North</td>
<td>5' x 87'</td>
<td>2''-64 pixel minimum at 20 mm.</td>
<td>60''</td>
<td>Color LED</td>
<td>20mm</td>
<td>Stats, GIP, Text, ads, logos, animation</td>
<td>Centered under bottom of video display</td>
<td>SB-001</td>
<td>Internal</td>
<td></td>
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<tr>
<td>Stadium Field Aux Display</td>
<td>Field Wall</td>
<td>6' x 36'</td>
<td>2''</td>
<td>72''</td>
<td>Color LED</td>
<td>16mm</td>
<td>Stats, GIP, Text, ads, logos, animation</td>
<td>In existing display location</td>
<td>SB-003</td>
<td>Internal</td>
<td></td>
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</table>
1.3 **ADDITIVE ALTERNATE OPTIONS**

A. Options 11 06 60.63—A. Service Contract for parts only for Years 3 through 10 for the scope of work covered under 11 63 10. Pricing shall remain in effect until the end of the warranty period or until the Owner accepts or declines this service contract whichever occurs first.

1. Requirements of service contract.
   a. All costs for US factory parts repair or replacement shall be included.
   b. Following expiration of warranty period, owner will remove failed components from display (scoring or video) and ship, at owner’s expense, to US repair depot.
   c. Installer (or installer’s Supplier) shall repair or replace components and ship to owner, at installer’s expense using next-day delivery for Tuesday to Saturday deliveries (at project site). Installer shall ship repair parts, within 24 hours of request of owner, prior to their receipt of failed part.
   d. Repair and return shipment shall be in a timely fashion to maintain display operation.
   e. In the event of parts failure of more than 5% of the display(s), the installer shall dispatch to the site, at installer’s cost, factory technicians to assess cause, and means of returning to operation. Site visit timing shall be coordinated with owner, and in the event that adequate notice is provided (36-48 hours), shall be provided prior to stadium events where more than 50% of the facilities seating capacity is expected.

B. Options 11 06 60.63—B. Service Contract for parts and labor for Years 3 through 10 for the scope of work covered under 11 63 10. Pricing shall remain in effect until the end of the warranty period or until the Owner accepts or declines this service contract whichever occurs first.

1. Requirements of service contract.
   a. In-season response time for each venue to be the same as for the base warranty
   b. All costs for US factory parts repair or replacement shall be included.
   c. Following expiration of warranty period, owner will remove failed components from display (scoring or video) and ship, at owner’s expense, to US repair depot.
   d. Installer (or installer’s Supplier) shall repair or replace components and ship to owner, at installer’s expense using next-day delivery for Tuesday to Saturday deliveries (at project site). Installer shall ship repair parts, within 24 hours of request of owner, prior to their receipt of failed part.
   e. Repair and return shipment shall be in a timely fashion to maintain display operation.
   f. In the event of parts failure of more than 5% of the display(s), the installer shall dispatch to the site, at installer’s cost, factory technicians to assess cause, and means of returning to operation. Site visit timing shall be coordinated with owner, and in the event that adequate notice is provided (36-48 hours), shall be provided prior to stadium events where more than 50% of the facilities seating capacity is expected.

C. Option 11 06 60.63-C. Cost for annual pre-season “health check” for each display. Service to include updating of all software, verification of all control and display functions, repair (from owner spare inventory) of all displays and control equipment. The intent is, to the extent possible, bring the system up to as new operating condition and performance. Provide annual cost for each venue, guaranteed for years 3 through 10.

D. Option 11 06 60.63-D. Cost to provide, on an annual basis for years 3 through 10, event standby technician, and pre-event check out per the base warranty requirements for up to eight (8) events per year.
E. Option 11 06 60.63-E. Cost to replace existing play/delay of game and locker room clocks, if not included in base bid. Note if included in proposal and bid form.

1.4 DEDUCTIVE ALTERNATE OPTIONS

A. Option 11 06 60.63-F. Deduct cost to delete content creation software listed in 11 63 10, section 2.5 B.

B. Option 11 06 60.63-G. Deduct Cost to change resolution of south and north video displays to alternate physical pixel pitch for base configuration video display size.
   1. Option G1 –15/16mm Virtual
   2. Option G2 - 20 mm

C. Option 11 06 60.63-H. Deduct Cost for reduced size south end zone video display (to match existing width of 29 ft) and extended ribbons to fill gaps on both sides of the display
   1. Option H1 –16 mm
   2. Option H2 - 15/16mm Virtual
   3. Option H3 - 20 mm

D. Option 11 06 60.63-I. Deduct Cost to change north and south ribbon displays to 22-25 mm physical pixel pitch.

E. Option 11 06 60.63-J. Deduct Cost to delete base bid Field Level Aux Display and control existing display.

F. Option 11 06 60.63-K. Deduct Cost to change Field Level Aux Display to alternate physical pixel pitch for base configuration video display size.
   1. Option K1 – 15/16mm Virtual
   2. Option K2 - 20 mm

G. Option 11 06 60.63-L. Deduct Cost to delete confidence camera on each display assembly listed in 11 63 10, section 1.2 B.

H. Option 11 06 60.63-M. Deduct Cost to delete south video display lower section and incorporate into ribbon display to create a single ribbon 130’ wide. Cost to include credit for video display section deletion.
   1. Option M1 – For 34’ wide main display 20mm
   2. Option M2 – For 34’ wide main display 22-25mm
   3. Option M3 – For 29’ wide main display 20mm (in the event Option 10 06 60.63H is selected)
   4. Option M4 – For 29’ wide main display 22-25mm (in the event Option 10 06 60.63H is selected)

1.5 UNIT COSTS

A. Unit Costs – Provide cost of one locker room clock (flush or surface mount), installed, exclusive of signal conduit and AC power to display.
## PART 2 - PERFORMANCE STANDARDS (provide for each display)

<table>
<thead>
<tr>
<th>Base Proposal or Alternate Number:</th>
<th>Location:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer:</td>
<td>Model:</td>
</tr>
<tr>
<td>Fractional Units (e.g. 18.5')</td>
<td></td>
</tr>
<tr>
<td>Overall Display Size (measured from physical pixel to physical pixel; not including cabinet)</td>
<td></td>
</tr>
<tr>
<td>Vertical Feet Pixels</td>
<td>Horizontal Feet Pixels</td>
</tr>
<tr>
<td>Physical Display Size (including cabinet)</td>
<td></td>
</tr>
<tr>
<td>Vertical Feet</td>
<td>Horizontal Feet</td>
</tr>
<tr>
<td><strong>Physical</strong> Pixel Pitch (not “lines”)</td>
<td></td>
</tr>
<tr>
<td>Vertical/Vertical</td>
<td>Horizontal/Horizontal</td>
</tr>
<tr>
<td>Physical Pixel Density (not “lines”)</td>
<td></td>
</tr>
<tr>
<td>Virtual Pixel Pitch</td>
<td>“claimed” pixel pitch</td>
</tr>
<tr>
<td>Green LED Supplier</td>
<td>Red LED</td>
</tr>
<tr>
<td>Brightness</td>
<td>Nits</td>
</tr>
<tr>
<td>Brightness Level adjustment</td>
<td></td>
</tr>
<tr>
<td>Gradation Method</td>
<td></td>
</tr>
<tr>
<td>Tonal Gradation</td>
<td></td>
</tr>
<tr>
<td>Color Temperature</td>
<td>°K</td>
</tr>
<tr>
<td>Color Temperature adjustability</td>
<td></td>
</tr>
<tr>
<td>Viewing Angles</td>
<td>Vertical degrees</td>
</tr>
<tr>
<td>Horizontal degrees</td>
<td>Up</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>Average (entire display)</td>
</tr>
<tr>
<td>Maximum (entire display)</td>
<td></td>
</tr>
<tr>
<td>Normal Power requirements (Voltage, Service, Ø)</td>
<td>Include any air conditioning requirements for entire Display</td>
</tr>
<tr>
<td>Entire Display Weight</td>
<td>(Include internal structure)</td>
</tr>
</tbody>
</table>

**END OF SECTION**
PROPOSAL FORM

Proposal for the Purchase and Installation of Video, Scoring and Matrix Display Systems for Folsom Field at the University of Colorado.

To:

The undersigned Offeror, in response to the Request for Proposal (RFP), proposes to furnish all labor and material, and to perform all work necessary for completion of the work required for the above referenced proposal for Section 11 63 10—Video, Scoring and Matrix Display Systems at Folsom Field in strict accordance with the Contract Documents for the base proposal sum of: ________________________________________________ Dollars ($________________), inclusive of taxes and if this proposal is accepted, will execute a formal contract equal in form to that bound in the Contract Documents to this effect.

The following is a breakdown of the proposal:

Video and Scoring Systems

| Base Proposal Equipment costs | __________________________ |
| Project Management, Engineering, non-labor issues | __________________________ |
| Off Site Labor | __________________________ |
| On Site Labor (own forces) | __________________________ |
| On Site Labor (subcontractors) | __________________________ |
| Taxes | __________________________ |
| Shipping, Transportation, handling, insurance | __________________________ |

Base Proposal Total

Overhead for change orders

Profit for change orders

The undersigned Offeror further acknowledges receipt of the following addenda as listed below and represents that any additions or modifications to, or deletions from the work called for in these addenda, have been taken into consideration and included in the base proposal sum.

ADDENDA (mark “None” if no addendum issued):

__________ No. 1 ____________ No. 2 ____________ No. 3
__________ No. 4 ____________ No. 5 ____________ No. 6

All proposals must include the following properly completed documents; please verify that you have included the following. See Instructions to Offerors for explanation of the required documents.

_____ Proposal Form
_____ Display System Technical Performance Parameters
_____ Design Build Contractor’s qualifications, as outlined within specification
_____ Display Manufacturer’s qualifications, as outlined within specification

_____ Statement outlining resolved or unresolved legal issues involving Design Build Contractor and Display Manufacturer within last 6 calendar years.

_____ Construction schedule adherence statement for both Design Build Contractor and Display manufacturer for the last 3 years.

_____ Letter from surety, indicating ability of Offeror to receive a payment and performance bond in the full proposal amount.

_____ Proposed project schedule and manpower loading.

_____ Identification of key subcontractors and their responsibilities.

_____ Proposed Project Management Staff and Organization Chart

1.01 All options shall be inclusive of taxes, insurance, escalation, etc. and shall be expressed as a net add or deduct to the base bid.

1.02 Voluntary Savings. This is an area where a vendor may suggest alternate resolutions, sizes, or deviation from technical specifications. Attach a separate enumeration of items

1.03 Unit Costs. Option Service Pricing is only required for base bid at time of initial proposal. Final BAFO will need to include service costs based upon final BAFO. Service Options shall represent sum of multiple years; actual annual costs will need to be submitted in final BAFO. Include any and all escalation.

<table>
<thead>
<tr>
<th>Option 11 06 60.63-A</th>
<th>Parts Only Service Contract for displays proposed, sum of years 3 through 10</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 06 60.63-A1</td>
<td>Service contract—year 3; parts and labor                                     $</td>
<td></td>
</tr>
<tr>
<td>11 06 60.63-A2</td>
<td>Service contract—year 4; parts and labor                                     $</td>
<td></td>
</tr>
<tr>
<td>11 06 60.63-A3</td>
<td>Service contract—year 5; parts and labor                                     $</td>
<td></td>
</tr>
<tr>
<td>11 06 60.63-A4</td>
<td>Service contract—year 6; parts and labor                                     $</td>
<td></td>
</tr>
<tr>
<td>11 06 60.63-A5</td>
<td>Service contract—year 7; parts and labor                                     $</td>
<td></td>
</tr>
<tr>
<td>11 06 60.63-A6</td>
<td>Service contract—year 8; parts and labor                                     $</td>
<td></td>
</tr>
<tr>
<td>11 06 60.63-A7</td>
<td>Service contract—year 9; parts and labor                                     $</td>
<td></td>
</tr>
<tr>
<td>11 06 60.63-A8</td>
<td>Service contract—year 10; parts and labor                                    $</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option 11 06 60.63-B</th>
<th>Parts and Labor Service Contract for displays proposed, sum of years 3 through 10.</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 06 60.63-B1</td>
<td>Service contract—year 3; parts only                                             $</td>
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</tr>
<tr>
<td>11 06 60.63-B2</td>
<td>Service contract—year 4; parts only                                             $</td>
<td></td>
</tr>
<tr>
<td>11 06 60.63-B3</td>
<td>Service contract—year 5; parts only                                             $</td>
<td></td>
</tr>
<tr>
<td>11 06 60.63-B4</td>
<td>Service contract—year 6; parts only                                             $</td>
<td></td>
</tr>
<tr>
<td>Option 11 06 60.63-B5</td>
<td>Service contract—year 7; parts only</td>
<td>$</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------------------------------</td>
<td>----</td>
</tr>
<tr>
<td>11 06 60.63-B6</td>
<td>Service contract—year 8; parts only</td>
<td>$</td>
</tr>
<tr>
<td>11 06 60.63-B7</td>
<td>Service contract—year 9; parts only</td>
<td>$</td>
</tr>
<tr>
<td>11 06 60.63-B8</td>
<td>Service contract—year 10; parts only</td>
<td>$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option 11 06 60.63-C</th>
<th>Cost for annual pre-season “health check” for each display.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 06 60.63-C1</td>
<td>Annual maintenance Trip—year 3</td>
</tr>
<tr>
<td>11 06 60.63-C2</td>
<td>Annual maintenance Trip—year 4</td>
</tr>
<tr>
<td>11 06 60.63-C3</td>
<td>Annual maintenance Trip—year 5</td>
</tr>
<tr>
<td>11 06 60.63-C4</td>
<td>Annual maintenance Trip—year 6</td>
</tr>
<tr>
<td>11 06 60.63-C5</td>
<td>Annual maintenance Trip—year 7</td>
</tr>
<tr>
<td>11 06 60.63-C6</td>
<td>Annual maintenance Trip—year 8</td>
</tr>
<tr>
<td>11 06 60.63-C7</td>
<td>Annual maintenance Trip—year 9</td>
</tr>
<tr>
<td>1106 60.63-C8</td>
<td>Annual maintenance Trip—year 10</td>
</tr>
</tbody>
</table>

| Option 11 06 60.63-D   | Cost to provide, on an annual basis For years 3-10, event standby technician and pre-event Check out per the base warranty requirements for up to eight Events per year. | $ |

| Option 11 06 60.63 – E | Cost to replace existing play/delay of game and Locker room clocks, if not included in base bid. | $ |

| Option 11 06 60.63-F   | Deductive Cost to delete Content Creation Software listed in 11 63 10, Section 2.5B. | $ |

<table>
<thead>
<tr>
<th>Option 11 06 60.63-G</th>
<th>Deductive Cost to change resolution of South and North video displays to alternate physical pitch for base configuration video display size.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 06 60.63-G1</td>
<td>15/16mm virtual</td>
</tr>
<tr>
<td>11 06 60.63-G2</td>
<td>20 mm</td>
</tr>
<tr>
<td>Option 11 06 60.63-H</td>
<td>Deductive Cost to reduce size of South end zone video display to match existing width of 29ft and extension of ribbons to fill gaps on both sides of the display</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>11 06 60.63-H1</td>
<td>16mm</td>
</tr>
<tr>
<td>11 06 60 63-H2</td>
<td>15/16mm virtual</td>
</tr>
<tr>
<td>11 06 60.63-H3</td>
<td>20mm</td>
</tr>
<tr>
<td>Option 11 06 60.63-I</td>
<td>Deductive cost to change North and South ribbon displays to 22-25mm physical pixel pitch</td>
</tr>
<tr>
<td>Option 11 06 60.63-J</td>
<td>Deduct cost to delete base bid Field Level Aux Display and control existing display</td>
</tr>
<tr>
<td>Option 11 06 60.63-K</td>
<td>Deductive Cost to change Field Level Aux Display to alternate physical pitch for base configuration video display size.</td>
</tr>
<tr>
<td>11 06 60.63-K1</td>
<td>15/16 virtual</td>
</tr>
<tr>
<td>11 06 60.63-K2</td>
<td>20 mm</td>
</tr>
<tr>
<td>Option 11 06 60.63-L</td>
<td>Deductive Cost to delete confidence camera on each display assembly listed in 11 63 10, Section 1.2B.</td>
</tr>
<tr>
<td>Option 11 06 60.63-M</td>
<td>Deductive Cost delete south video display lower section and incorporate into ribbon display to create a single ribbon 130’ wide. Cost to include credit for video display section deletion.</td>
</tr>
<tr>
<td>11 06 60.63-M1</td>
<td>34’ wide main display 20mm</td>
</tr>
<tr>
<td>11 06 60.63-M2</td>
<td>34’ wide main display 22-25mm</td>
</tr>
<tr>
<td>11 06 60.63-M3</td>
<td>29’ wide main display 20mm</td>
</tr>
<tr>
<td>11 06 60.63-M4</td>
<td>29’ wide main display 22-25mm</td>
</tr>
<tr>
<td>Unit Costs</td>
<td>Cost of one locker room clock, installed Exclusive of conduit and power.</td>
</tr>
</tbody>
</table>
1.04 NON-COLLUSION AFFIDAVIT

The undersigned Offeror or agent, being duly sworn on oath, says that he has not, nor has any other member, representative, or agent of the firm, company, corporation or partnership represented by him entered into any combination, collusion or agreement with any person relative to the price to be paid by anyone at such letting nor to prevent any person from offering nor to induce anyone to refrain from offering, and that this offer is made without reference to any other offer and without any agreement, understanding or combination with any other person in reference to such offering.

He further says that no person or persons, firms, or corporations has, have or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.

1.05 SCHEDULE

The undersigned Offeror has received and reviewed the Project/Milestone Schedule.

OATH AND AFFIRMATION
I_______________, an officer of the Company, with the duly prescribed signing rights, hereby affirm under the penalties of perjury, that the foregoing facts and information are true and correct to the best of my knowledge and belief.
Dated at ________________ this ______ day of ________________, 20____.

______________________________________________
(Name of Organization)

By: ______________________________
(Signature)

______________________________________________
(Title of Person Signing)

STATE OF ________________

) SS:

COUNTY OF ________________

On this ______ day of ________________, 2012, ________________ personally appeared before me, ________________, who, being by me duly sworn, did say that he/she is duly authorized to execute, acknowledge and deliver the foregoing instrument in the name of and for and on behalf of ________________, and acknowledged that he/she did in the name of ________________, execute and acknowledge said instrument for the uses and purposes set forth therein.

(seal)
Notary Public

______________________________________________
Printed Signature

My commission expires: ___________ County of Residence: ___________
UNIVERSITY OF COLORADO
FOLSOM FIELD
SOUTH END LED DISPLAYS

OPTION: REDUCE WIDTH OF VIDEO DISPLAY TO THAT OF EXISTING STRUCTURE.

OPTION: DELETE SECTION FROM VIDEO DISPLAY AND INCLUDE AS PART OF RIBBON DISPLAY.
FOLSOM FIELD
FIELD LEVEL AUX DISPLAY

UNIVERSITY OF COLORADO
FOLSOM FIELD
FIELD LEVEL AUX DISPLAY

36'-0" x 6'-0"
LED AD PANEL

35'-0"
PART 1  GENERAL

1.1  SCOPE OF WORK

A. Work under this Contract includes all labor, materials, tools, transportation services, supervision, coordination, etc., necessary to complete the installation of the Video Scoreboard Control Rooms, as described in these specifications and illustrated on the associated drawings. The systems shall be called the “Video Scoreboard Control Room” and the installer the “Systems Integrator”. The systems include the following major items:
1. Video Scoreboard Control Room
2. Remote equipment connections and cabling at fiber inter-connected facilities.
3. All electrical distribution within each system at each installation point.
4. Technical Millwork and Furniture Consoles

B. The Contract also includes:
1. Verification of dimensions and conditions at the job site.
2. Preparation of submittal information.
3. Coordination with other trades.
4. Installation in accordance with the contract documents, manufacturer’s recommendations, and all applicable code requirements.
5. Manufacturer’s commissioning for all major items of equipment.
6. Initial tests and adjustments, written report, and documentation.
7. Instruction of operating; provision of manuals.
8. Maintenance services; warranty.

C. The Installer is responsible for all subsequent design and engineering not included within the RFP documents. 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, steel, electrical services etc, shall be included at time of proposal and installed without claims for additional compensation.

D. 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.

1.2  SYSTEM DESCRIPTION

A. The Video Control Room is the central video production and control room located at the Event Level of Coors Event Center to support video scoreboard and broadcast video production. It is connected via dedicated single mode fiber connections provided outside this contract to multiple campus facilities. Connection locations are:
1. Folsom Field
2. Kittredge Field
3. Prentup/Potts

B. The Video Control Room is the system that will generate
1. Video signals to be displayed on each Facility’s Main Seating Bowl Video Display(s), to the distributed TV network, to edit stations and to an internet stream.
2. Video, audio, intercom, data and control signals will be provided with fiber multiplexing components over existing fiber cable to various athletic facilities on campus.
3. One channel of HD and SD content will be created by the Video Scoreboard Control Room and sent to Folsom Field’s existing RF distribution Headend. Coordination with the University is required.
C. A number of existing video cameras are dedicated to the Video Scoreboard Control Room.
   1. Each camera may be connected at a number of locations throughout each facility via
      SMPTE camera cables where they will be connected back to the Camera Control
      Base Stations in the video control room.
   2. Video sources (camera "isos") are introduced to the system from the Outside
      Broadcast Television (OB) Trucks parked in the Video Truck Areas or Folsom Field
      and the Coors Event Center.

D. In addition to the existing cameras the following equipment is provided for video replay use:
   1. Character generator
      a. A data feed will be made available from the existing scoring computer system;
         this scoring computer system shall be interfaced to the Character Generators and
         text/stat capable Clip and Still Store Devices to allow automatic extraction and
         CG display of scoring and statistics information from the scoreboard system.
   2. Multi-channel file server used for multi-camera slow motion playback
   3. Existing Apple Edit computers
   4. Video Recorders/Servers are provided to:
      a. Make archival video recordings of game and truck program
      b. Playback individual plays in the event of a failure of a file server
      c. Make archival video recordings of the individual camera iso angles.
      d. Create “dubs” and duplications of footage for common distribution.
   5. A separate audio mix room for mixing separate shows (in-stadium entertainment,
      campus TV, internet stream).
   6. A routing switcher (video with audio) is used to route sources throughout the Video
      Scoreboard Control Room, Video Board Processor(s) and other devices within the
      Video Scoreboard Control Room.
   7. Miscellaneous distribution, conversion and equalization components.
   8. Preview, program and confidence monitoring.
  10. The entire Video Scoreboard Control Room is fully equipped with intercom
      (communication) interconnected to the "house" PA/intercom system at both facilities.
      a. Multi-channel circuits are connected to a "source-assignment" panel for ease of
         configuration.
      b. The Video Scoreboard Control Room contractor is responsible for coordinating
         terminations, supplying equipment, and assisting in balancing and configuring the
         system.

E. The installation of the Video Scoreboard Control Room Production System shall be
   coordinated with the Owner as several pieces of existing and Owner furnished equipment
   will be utilized within this system and are detailed within these specifications and on the AV
   drawings.
   1. Coordinate delivery of existing components.
   2. Inspect components for functionality and notify the Owner and Owner’s representative
      if existing pieces are missing and/or non-functional.

F. The installation of the Video Scoreboard Control Room should be coordinated with the
   existing Broadcast Cabling, Structured Cabling, large direct view LED display systems and
   facility Sound Systems (among others).
   1. The actual camera cabling and audio, video and intercom lines from each position to
      the fiber transmit location are provided by this installer. The University’s IT department
      will supply the fiber tie lines from each facility to the Video Scoreboard Control Room.

G. Work to be performed outside the immediate area of the control and audio rooms:
   1. Supply and Mounting Fiber Optic Transmitters and interconnecting cables at Folsom
      Field.
   2. Installation of fiber optic camera cabling and tie lines.
   3. Installation of new wireless intercom system and most importantly antennas; location
      is assumed to be in front of the existing Scoreboard/PA Control Room at Folsom Field.
   4. Installation of permanent optical to electrical connections for video feeds at Folsom
      Field.
5. Testing of remote production at:
   a. Folsom Field

1.3 RESPONSIBILITY AND RELATED WORK

A. 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.

B. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Systems Integrator to supply systems in full working order. Notify the Technical Consultant of any discrepancies in part numbers or quantities before bid. Failing to provide such notification, supply items and quantities according to the intent of the Specification and Drawings, without claim for additional payment.

C. Obtain all permits necessary for the execution of any work pertaining to the installation, or any operation by the Owner.

D. The drawings included 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.

E. If a conflict develops between the contract documents and the appropriate codes and is reported to the Technical Consultant prior to proposal opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

F. All structural support, design, and engineering for installation of all system components.

G. Power shall be provided within the space at a breaker panel. Refer to General Contractor drawings for reference. The Installer shall be responsible for distributing electrical power from the isolator to the equipment as required. This will include necessary distribution boards and cabling for a complete installation.

H. The Installer shall be responsible for connecting appropriate grounds to all equipment in accordance with applicable codes and standards.

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

J. Paint any/all POV camera housings to a color selected by Owner.

1.4 QUALITY ASSURANCE

A. Installer’s Qualifications: Firm experienced in the installation of systems similar in complexity to those required for this project. Specific proposal submission requirements are:
   1. Experience with at least three (3) comparable scale projects within the last three years. At least one (1) shall be a renovation project.
      a. Provide reference information and contact information for each project.
      b. In the event sport specific projects are not available, other projects may be considered.
   2. Maintain a fully staffed and equipped service facility. In the event the integrator is outside a one (1) hour support time for the project, identify local resource(s) to be developed and assigned to support the project during the warranty duration.
   3. Installer authorized to sell all equipment specified within this system.
   4. The Installer shall demonstrate that he has:
      a. Adequate plant, equipment bonding and insurance capabilities to complete the work.
UNIVERSITY OF COLORADO VIDEO SCOREBOARD CONTROL ROOM

b. Adequate staff with commensurate technical experience. Identify the following roles for the project and provide appropriate resumes:
   1. Senior Project Engineer(s).
   2. IT Project Engineer
   3. Project/Site Supervisor (aka lead installer).
   4. Project/Off-site project manager.
   5. Purchasing and expediting staff
   6. Vice President/Owner for escalation contact in the event of difficulties
   7. Other staff and their experience that may assist in evaluating the installer’s proposed deployment team

c. Suitable financial status to meet the obligations of the work.

5. State of Colorado licensed electrician

6. A proposed project schedule with manpower loading diagram (based on a system of this complexity).

7. Sample submittals are encouraged as part of the proposal submittal. This is including but not limited to:
   a. One-line diagrams
   b. As-built documentation
   c. Photographs of work (showing the rear of equipment racks, not the fronts).
   d. Commissioning procedure(s)
   e. Training documentation
   f. Other information that may assist in evaluating the vendor’s past performance.

1.5 SUBMITTALS

A. Submit all shop drawings and submittals in accordance with Project Requirements.

B. Shop drawings and submittal data shall contain sufficient information to describe the Work to be performed. Drawings shall be executed at an appropriate scale. Submit all Shop Drawing information at one time.

C. The following outlines expected submittal packages:
   1. Project and Submittal schedule.
   2. Product Data
      a. 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.
      b. Proposed cable labeling technique.
   3. Equipment layout and Millwork details (with console elevations)
      a. Location of all equipment in racks, consoles, or on tables, with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
   4. One Line diagrams for all signals (without cable numbering or patch points)
      a. 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.
      b. Schematic drawings of any custom circuitry or equipment modifications, including connector pinouts and component lists.
      c. Stamped electrical drawings
   5. Detail Submittal
      a. Patch panel layouts and designation (labeling) strips.
      b. Custom Plates. Provide complete shop drawings on custom fabricated plates or panels. Drawings to include dimensioned locations of components, component types, engraving information and plate material and color.
      c. Representative equipment labeling sizes, styles, and numbering.
      d. Any structural mounting details (including structural engineers seal as appropriate)
1. POV cameras
2. Wireless antennae
e. Samples as required in various specification paragraphs.
6. User Interface (UI) Submittal. This submittal is to provide sufficient information to indicate that the Installer has appropriately configured software and user interfaces in accordance with user requests, as well as in common scoreboard/video replay configuration. The submittal can be in PDF, Excel, or as configuration files as appropriate. In some cases this submittal may need to be incremental, with multiple deliveries. Items covered by this submittal shall include, but not be limited to:
   a. Routing Switcher, inputs, outputs, virtual naming, intercom panel configuration, alphanumerics and the like. A “dummy” version of the configuration file is preferred for review.
   b. Production Switcher
   c. Intercom
d. Tally
e. Control System (e.g. Crestron, AMX, etc.) if any
7. Commissioning Plan and Training Resume Submittal
   a. Provide integrators commissioning plan, if it differs from the plan in Part 3.
   b. Part 3 lists training that is to occur on the system. Provide resumes where required for training on specific device(s).
   c. If Installer desires to utilize own forces for specified manufacturers commissioning, submit resume and relevant references for approval.
8. Commissioning Completion Submittal. At the conclusion of the commissioning process provide a written submittal indicating the completion of each commissioning task.
9. Training and Event Attendance Submittals:
   a. All Operations and Maintenance manuals, as well as as-built drawings must be on site for all sessions of training.
   b. Following discussions with Owner, formally submit a Training and Event Attendance submittal 2-4 weeks prior to first training. Submittal shall:
      1. Include a separate page/entry for every training session.
      2. Indicate date, time, and approximate length of training session.
      3. Indicate person(s) conducting training.
      4. Indicate whether training will be video recorded.
      5. Intended curriculum and most appropriate attendees (e.g. engineer, operations, IT, etc.)
   6. Include signature and title lines for:
      a) Owner acknowledgement and acceptance of training schedule. Include both an accepted and rejected box. An alternate schedule time should be suggested by the Owner in the event the schedule is rejected.
      b) Countersigning by trainer indicating that training actually occurred.
      c) All persons attending training. Where attendees do not stay for the entire session, this should be noted on the form and initialed by Technical Consultant attending training.
      d) Technical Consultant attending training at the end of the session shall initial that:
         (1) Training Occurred.
         (2) Training Materials were provided and left with owner
         (3) Training was not interrupted or shortened by equipment or system troubleshooting. If it is, then there should be a line where Owner and Contractor can indicate when make-up training will be provided and how long it should be.
         (4) Training was generally sufficient for the proposed curriculum.
   7. Include Notes section for Owner and Contractor to note any issues during training (areas requiring further development, etc.).
   c. Following training occurrence, submit completed training records no later than 5 days following end of training. When training is conducted over a period of weeks, completed training submittals shall be consolidated into a single submittal and submitted every 2 weeks.
10. Final Inspection Notification Report. Two copies of a typed, neatly prepared checkout report for each piece of equipment and the entire system shall be prepared and submitted; it shall include:
   a. A complete listing of every piece of equipment, the date it was tested and by whom, the results and date re-tested (if failure occurred during any previous tests).
   b. The final report shall indicate that every device tested successfully.
   c. A performance test report indicating that the system meets all of the Installer testing requirements of Part III.

11. Contract close-out submittals:
   a. Keep a complete set of drawings on the job, note any changes made during installation, and submit 1 corrected set of reproducible drawings showing Work as installed.
   b. Submit the following data for review, prepared as indicated, at least one week prior to acceptance testing (exceptions noted):
      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. Final Documents:
         a) A list of all equipment, indicating manufacturer, model, serial number, power consumption, warranty terms if greater than the specified warranty and equipment rack location. Update following acceptance testing, if changed.
         b) Manufacturer’s Instruction Manuals for all items of equipment, incorporating or followed by manufacturer's warranty statements.
            (1) Where manufacturer registration is required, register warranty in Owner’s name, and at an address determined by Owner. Provide copy of registration.
            (2) For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
         c) A list of settings of all semi-fixed controls. Update following acceptance testing. (This shall specifically include all computer based software settings, e.g. IP addresses, gateways, drive mapping, backup procedures etc.)
         d) Schematic wiring diagrams of the video replay sub-system, based on the as-built documentation, at a reduced scale easy to handle but fully legible.
         e) 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.
         f) A legend of acronyms and abbreviations must accompany all documentation.
         g) Any other pertinent data generated during the Project or required for future service.
         h) System Reference Manual: Furnish multiple copies as required by Project Requirements, in 3 ring binders, sized to hold the material plus 50% excess, with clear vinyl pockets on cover and spine for project title.
   c. Electronically editable files for all project work:
      1. Autocad DWG
      2. Excel
      3. Word
      4. PDF is not considered an editable file.

1.6 PROJECT CONDITIONS

A. Verify all conditions on the job-site applicable to this work. Notify Technical Consultant in writing of discrepancies, conflicts, or omissions promptly upon discovery.
B. The drawings 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, recommend solutions and/or submit drawings to the Technical Consultant for approval, showing how the work may be installed.

1.7 ACCEPTANCE TESTING

A. Upon completion of installation and initial tests and adjustments specified in Part 3, acceptance testing shall be performed by the Technical Consultant.

B. Provide two persons familiar with all aspects of the system to assist the Technical Consultant during acceptance testing.

C. The process of acceptance testing the System may necessitate moving and adjusting certain component parts; perform such adjustments without claim for additional payment.

1.8 WARRANTY

A. Warrant labor and materials provided under this agreement for one year following the date of substantial completion.

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

C. 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.

D. Within the warranty period, answer service calls within 8 hours, and correct the problem within twenty-four hours.

E. Register all manufacturers’ warranties (e.g. software, computers, etc.) in Owner’s name.

1.9 SPECIFIED PRODUCTS AND MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed as a standard of quality. Regardless of the length or completeness of the descriptive paragraph herein, each device shall meet all of its published manufacturer’s specifications. Verify performance as required. Where two or more acceptable products are listed, the Installer may use either at his option.

B. Other qualified manufacturers will be considered subject to approval of complete technical data, samples, and results of independent testing laboratory tests of proposed equipment, submitted in accordance with project requirements.

C. 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.

D. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.

E. 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.
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1.10 OPTIONS. OPTIONS SHOULD REFLECT THE NET COST (ADD OR DEDUCT) FOR THE OPTION AND ALL IMPACTED ELEMENTS.

A. Option 11 63 50-A. Cost to remove fiber camera cabling, SB/PA booth tie lines and TV truck tie lines from Folsom Field scope of work.

B. Option 11 63 50 – B. Cost to remove fiber camera cabling and SB/PA booth tie lines from CEC scope of work.

C. Option 11 63 50 C. Character Generator. Provide incremental cost to replace specified base bid production character generator.
   1. Type 1 Character Generator (CG1)
      a. Type 2 Character Generator consisting of the following parts:
         b. Harris Inscriber
            1. Harris G5 XT
            2. Harris Dual Channel G5 Upgrade
            3. Harris 3D DVE per channel
            4. Dual Channel Clip Option
            5. Harris Remote Playback
            6. Offline Licenses
            7. Quantity: 1

D. Option 11 63 50 D. Slow Motion Device. Provide incremental cost to replace specified base bid Slow Mo device.
   1. Type 1 Production SLOW MO (SLOW MO1):
   2. Abekas Mira-IR-8-02: 100 hours of storage at 100 Mbits (Quantity: 1)
   3. Abekas Mira-DABP-8CH: AES I/O for 8-channel Mira (Quantity: 1)
   4. DNF Controls DMAT-AB (CLIPS RCP) control panel specifically for the Mira (Quantity: 2)
   5. AES unbalanced audio distribution amplifiers to distribute four (4) Stereo pair (unbalanced) to each channel of the Slow Motion unit. Note that this distribution is not shown on the drawings.
      a. Amplifiers
         1. Evertz 500DA2Q-AESU (Quantity: 4)
         2. Harris AES6800+BS (Quantity: 8)
         3. Ross ADA-8401-A (Quantity: 8)
         4. GVG 8912RDA-D (Quantity: 4) or GVG 8911. (Quantity: 8)
         5. Snell or Probel as approved.
      b. Power Supply and Frame. As required.

E. Option 11 63 50 – E. Cost to provide image stabilizer to Type 2 lens configuration

F. Option 11 63 50 – F. Cost to provide HD Hard Disc Record/Playback (HD-DVR)
   1. Front panel control
   2. Single Channel
   3. Up to 18 hours record time
   4. Acceptable product:
      a. Fast Forward Video Omega HD Essential
      b. With analog audio option
      c. With 320GB storage drives
      d. With Genlock option

G. Option 11 63 50 – G. Cost to replace base bid Routing Switcher and Multi-image viewer with Harris option.
   a. Harris Platinum
      1. Harris PM-FR-9 9RU Frame with power supply and controller
      2. Harris PM-128x128-3G9 Crosspoint Module
      3. Harris PM-HS-IB+ 8-input HD/SDI module (Quantity: 8)
      4. Harris PM-HSR-OBG+ 8 output HD/SDI module (Quantity: 8)
      5. Harris PM-ADCT-IB 16 input analog stereo module (Quantity: 4)
6. Harris PM-DACT-OB 16 output analog stereo module (Quantity: 4)
7. Harris HV-SXH-32x2 Multi-viewer module
8. Harris EDGE-SMS7000 protocol converter

H. Option 11 63 50 – H. Cost to provide POV camera at Folsom Field
   1. POV Camera (POV)
      a. Remote operated 16x9
      b. Acceptable Product:
         1. Sony BRCH700
         2. Sony BRUH700 optical mux unit (POV CCU_A)
         3. Sony BRBKH700 HD optical mux card
         4. Sony BRCSDP16 Outdoor dome housing (for outdoor locations)
         5. Custom wall/ceiling mount
   2. POV Controller (POV CNTL)
      a. Acceptable Product
         1. Sony RM-BR300

I. Option 11 63 50 – I. Cost to replace base bid Character Generator (CG) with Chyron solution.
   1. Chyron Micro X3.1 HD/SDI single channel
      a. Lyric Pro Offline creation software
      b. Full function keyboard
      c. 2D DVE
      d. Lyric Pro software + premium bundle package
      e. Intelligent interface

J. Option 11 63 50 – J. Cost to provide wireless camera transmitter, receiver and fiber optic multiplexing equipment.
   1. Support Configuration:
   2. Type 1 Wireless transmitter (WT₁) and Type 1 Wireless Receiver (WR₁)
      a. MicroLite HD-MLS-Elite Kit:
         1. (1) RF Central 58MLT – MicroLite transmitter (Quantity: 1)
         2. (1) RF Central 58MLR – MicroLite receiver (Quantity: 1) NOTE: Base station will be utilized in a temporary fashion so one unit can be used between the different facilities, i.e. in the control room rack for football, in the CEC scoreboard control room.
         3. (1) RF Central CO580-6 – 6dB Omni Antenna (for 58MLT) Quantity: 2
         4. (2) RF Central SCR580-12 – 12dB Compact Sector Antenna (for 58MLR) Quantity: 2
         5. (1) RF Central VFA-10 – Magic Arm (to mount the 58MLR) Quantity: 2
         6. (1) RF Central TDSC-10 – “C” Clamp Mount (for Magic Arm) Quantity: 2
         7. The kit also includes all power cables for both 58MLT and 58MLR, wall wart power supply for 58MLR, camera mounting hardware bracket for 58MLT, antenna mounting brackets for 58MLR and Pelican hard carrying case.
         8. Tripod for mounting 2nd set of antennae in a temporary/portable fashion for use at ancillary athletic facilities

K. Option 11 63 50-K. Cost to provide closed caption encoder and decoder
   1. Closed Caption Encoder (CCE)
      a. EEG EN530
   2. Closed Caption Decoder (CCD)
      a. EEG DE280 WITH SOFTWARE DECODE TO SCORING SYSTEM

L. Option 11 63 50-L. HD Encoders and Modulators. Provide cost to replace existing distributed TV encoding headend at Folsom Field.
   1. Type 1 HD Encoder (ENC₁; HD ENC₁)
      a. Evertz Solution
         1. Evertz 7880ENC-MP2HD-1+3RU
         2. Evertz 7721AE4-HD+3RU
         3. Evertz 7780M4-ASI+3RU

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4. Blonder Tongue AQM
   b. Harris Solution
5. Harris HALRENC-H11-ATSC MPEG-2
6. Harris HALRTMX-M12-TNL1
7. Blonder Tongue AQM

2. Type 1 HD Encoder (ENC1, HD ENC1) Frame
   a. Evertz Solution
      1. Frame
         a) Evertz 7800FR-QT with power supply
      2. Frame Controller
         a) Evertz 7800FC (Quantity: 1 overall)
   b. Harris Solution
      3. Frame
         a) Harris HALRSYS-1700AC-A22
      4. Frame Controller
         a) Harris HALRSYS-A22-CTL (Quantity: 1 overall)
      5. Power Supply
         a) Harris HALRPWR-SUP-AC (Quantity: 2; for redundancy)
   c. Quantity: 1

3. Type 1 Encoder Multiplexer (MUX2)
   a. Blonder Tongue DQMx-20

4. Type 1 SD Modulator (MOD1)
   a. Blonder Tongue AV10E-QAM with SmartVM.com DVI-D to VGA converter (CON-DVI-ANA). (Quantity: 1)

5. RF Combiner (COMBINER):
   a. Blonder Tongue OC8

6. RF Amplifier (RFA)
   a. Blonder Tongue RMDA 86A-30

M. Option 11 63 50 – M. Cost to replace base bid production switcher with Ross Vision
   1. Ross Vision 2M
      a. Ross V2MP-001 2M Control Panel
      b. Ross V2MP-076 Redundant Power
      c. Ross V2MP-005 Mnemonics for Custom Control Macro Panels
      d. Ross V2MP-105 Mnemonics for MLE1 Sources
      e. Ross V2MP-205 Mnemonics for MLE2 Sources
      f. Ross V1MP-001 Vision 1M Control Panel
      g. Ross V1MP-005 Mnemonics for Custom Control Macro Panels
      h. Ross V1MP-076 Redundant Power
      i. Ross V1MP-501 Vision End Blocks
      j. Ross QMD-002 Live Production Engine (2MLE) Rack Frame
      k. Ross QMD-020-16 MD Inputs, 16 additional
      l. Ross QMD-020-10 MD Inputs, 10 additional
      m. Ross QMD-021 MD Outputs, 16 Timed Outputs
      n. Ross QMD-140 Squeeze and Tease MD Carrier for MLE1, 2
      o. Ross QMD-141A Migrating Squeeze and Tease MD Channels 1 & 2 for MLE1
      p. Ross QMD-241A Migrating Squeeze and Tease MD Channels 1 & 2 for MLE2
      q. Ross QMD-903 Video Server Control
      r. Ross QMD-905 Routing Switcher Interface
      s. Ross QMD-012 Proc Amps
      t. Ross QMD-013 RGB Color Corrector
      u. Ross QMD-055 Aux Keys
      v. Ross QMD-090 On-Site Operational Training
      w. Ross QMD-091 On-Site Operational Training
      x. Ross QMD-093 On-Site Commissioning
      y. Ross QMD-096 Serial Tally Interface

1.11 UNIT Costs; SUPPLY AND INSTALL

A. Unit Costs 11 63 50-A. Cost to provide fiber optic test equipment
1. Meeting TIA/EIA-526-14A and TIA/EOA-526-7 standards
2. Able to test SM and MM cable
3. Acceptable manufacturer
   a. Fluke Networks

B. Unit Costs 11 63 50-B. Extended support options. Annual support costs shall be following
   the warranty period. They shall be exercised 30 days before the expiration of the warranty
   or preceding annual support period whichever is later.
1. Unit Costs 11 63 50-B1. Provide annual costs for all software and hardware support
   for full Production Switcher Systems specified as Base Bid following the expiration of
   the warranty period. Annual costs shall be for nine years following expiration of the
   warranty period.
2. Unit Costs 11 63 50-B2. Provide annual costs for all software and hardware support
   for full Routing Switcher and Multi-image viewing Systems provided as base bid.
   Annual costs shall be for nine years following expiration of the warranty period.

Part 2 . PRODUCTS

2.1 GENERAL

A. All equipment and materials shall carry original manufacturer's warranty. B-stock or floor
demonstration equipment is allowed and encouraged for all equipment, other than video
and audio monitors and patch panels. Given the construction cycle NAB or IBC or
intervening trade shows may be accounted for. Take care during installation to prevent
scratches, dents, chips, etc.

B. Regardless of the length or completeness of the descriptive paragraph herein, each device
shall meet all of its published manufacturer’s specifications. Verify performance as
required. Where two or more acceptable products are listed, the Installer may use either at
his option.

C. Provide engraved laminoid labels at the front and rear of all signal processing equipment
mounted in racks. Mount labels on the equipment and attach in a neat, plumb, and
permanent manner. Embossed labels will not be accepted. Provide engraved labels at the
rear only of equipment mounted in furniture consoles.

D. Custom rack panels shall be 1/8” thick aluminum, standard rack sizes, brushed black
anodized finish unless otherwise noted. (Brush in direction of aluminum grain only.)
Custom connector plate (speaker, microphone, etc.) finishes shall be selected from
manufacturer’s full range of standard finishes. Plastic plates will not be accepted, even if
they are building standard in other areas.

E. All engraving shall be 1/8” high 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.

F. In accordance with IEC-268 standard, all XLR connectors shall be wired pin 2 hot (high),
pin 3 low, and pin 1 screen (shield).

G. All patch panels shall be wired so signal “sources” (outputs from devices) appear on the
upper row of a row pair; all “loads” (inputs to devices) appear on the lower row of a row pair.
All patch panel designation strips shall utilize alphanumeric and descriptive labels. The jack
positions in each horizontal row shall be numbered sequentially from left to right. The
horizontal jack rows shall be lettered sequentially from top to bottom. The alphanumeric
identification of each jack shall be included on the functional block drawings.

2.2 OWNER FURNISHED EQUIPMENT

A. Coordinate delivery, connectivity and functionality with owner.
B. Provide inventoried equipment list of existing components prior to installation.

C. Verify all components and existing cabling from control room to camera locations are operational. If a certain existing component is deemed not functional, notify Owner of defect and method to either replace or repair. If existing camera cabling is damaged or not operational, provide appropriately rated cable.

D. Components
   1. Panasonic AGHPX500 (CAM₁)
      a. (Qty: 4)
   2. Fujinon 17x7
      a. (Qty: 4)
   3. Telecast Copperhead G3200 Camera Unit (MUX₁)
      a. (Qty: 4)
   4. Telecast Copperhead G3200 Base Station (MUX₂)
      a. (Qty: 4)
   5. Telecast Telethon (FOT)
      a. (Qty: 2)
   6. Telecast Adder II (MUX₃)
      a. (Qty: 2)
   7. Telecast Wafer power supply
      a. (Qty: 2)
   8. Telecast OpticalConn SMPTE hybrid cable (XXX ft)
   9. Apple Edit Stations (EDIT)
      a. (Qty: 3)
   10. Kona Cards (EDIT)

2.3 VIDEO SCOREBOARD CONTROL ROOM CAMERA AND SUPPORT EQUIPMENT

A. For use with existing Panasonic cameras:
   1. Lens Type 1
      a. 2x extender
      1. Fujinon ZA22x7.6BERM (Qty: 3)
   2. Lens Remote Type 1 (focus)
      a. Fujinon MS-11 (Qty: 3)
   3. Lens Type 2
      a. Without image stabilizer
      1. Fujinon HA42x9.7BERD (Qty: 1)
   4. Lens Remote Type 2 (focus)
      a. Fujinon MS-11D/3 (Qty: 1)
   5. Microphone Kit
      a. Panasonic AJ-MC700 (Qty: 4)
   6. EFP Tripod with mid level spreader and zoom control built into second pan arm
      a. Libec LS-60M (Qty: 4)
   7. Tripod adapter plate (Qty: 4)
   8. Camera monitor
      a. Panasonic BTLH90W (Qty: 4)
      1. With monitor mount and cabling
      2. With viewfinder hood
   9. Recordable Media
      a. (4) 32GB cards
      1. Panasonic AJ-P2EO32XG
   10. Camera Control Unit
      a. With remote control panel
      1. Panasonic AG-RC10G to Telecast interface cables (Qty: 4)
         a) Provide with Panasonic RC050M extension cables
      2. Mount into millwork
   11. Battery charger
      a. Anton Bauer Quad 2702 each with an Anton Bauer XLR-4 (Quantity: 4)
12. Power supply (Qty: 4)
13. Mounting plate (Qty: 4)
14. Lithium Ion batteries
   a. Anton Bauer AB Dionic (Qty: 4)
15. Appropriate rain slicker sized for camera, lens and adapters
   a. Porta Brace (Qty: 4)
16. Castered, hard camera case to support camera, lens, camera adapter, etc.
   a. As configured above (Qty: 4)
   b. NOTE: based on finished hallways/corridors, expansion joints, outdoor terrain and
      pathways, determine if casters or inflatable tires will be needed to cushion the
      transport of cameras and lenses.
17. Camera Cables
   a. Camera adapter interface cables
   b. Reel assembly
   c. Tactical fiber
   d. Optical Con Fiber Connector
      1. Telecast MX TAC fiber CASM-BC-1T2S-MX
         a) XXX feet
   a. Viking
   b. As Approved

2.4 FIBER OPTIC TRANSPORT

A. Fiber Transmitter (FOT)
   1. Four (4) bi-directional HD/SDI
   2. Four SM fiber inputs
   3. Two SM fiber outputs
   4. Acceptable product:
      a. Telecast Teleport

B. Audio/Intercom Transmitter (MUX₃)
   1. Four Channels intercom
   2. Two Channel intercom
   3. Eight bi-directional analog audio feeds
   4. Acceptable product:
      a. Telecast Adder II

C. Type 1 Frame Synchronizers (FS₁). Note that single and multi-path units are specified
   herein. Verify exact quantity against the functional drawings and adjust rack elevations
   accordingly.
   1. Acceptable product:
      a. AJA FS2 with fiber input. NOTE THIS IS A DUAL PATH UNIT. Not audio dual
         channel
      b. Evertz 2012+2PS+CF2G+2RX. NOTE THIS IS A DUAL PATH UNIT.
      c. Harris X50-AV-2PS with OP+SFP+TR13P. NOTE THIS IS A SINGLE PATH
         UNIT.
      d. Ross Solution
         1. Ross UDC-8625. NOTE THIS IS A SINGLE PATH UNIT
         2. Ross FDR-6603. NOTE THIS IS A DUAL PATH UNIT; provide 1 unit for
            every two UDC-8625
         3. Ross DFR-8321-CN. Note this is a multiple card frame; provide quantity as
            appropriate.

2.5 VIDEO SYSTEM MONITORING AND MEASUREMENT COMPONENTS

A. Color Picture Monitors (CPXM):
   1. Type 1 Color Video Monitor (CPXM₁)
      a. 15”-17” camera monitor with HD/SDI
      b. Multi-format
c. Acceptable product:
   1. Ikegami HTM1517R with DKH-501A/B
   2. Sony PVM1741
      a) With rack mount
      b) As Approved

2. Type 2 Color Video Monitor (CPXM₂):
   a. 7" LCD with tally
   b. SDI, DVI and analog video inputs
   c. Analog audio inputs
   d. Acceptable Product
      1. TV logic LVM071W
      2. With rack mount
      3. As Approved

3. Type 3 Color Video Monitor (CPXM₃):
   a. 17" LCD with HD/SDI
   b. Acceptable product:
      1. Ikegami 1704WR
      2. Sony LMD1751WHD
      3. As Approved

4. Type 4 Color Video Monitor (CPXM₄):
   a. (3) 6" LCD monitors
   b. Composite inputs
   c. Rack mounted
   d. Acceptable product:
      1. Marshall V-R563P
      2. As Approved

5. Type 5 Color Video Monitor (CPXM₅):
   a. Dual 10" HD/SDI with tally
   b. Acceptable product:
      1. Marshall Electronics V-R1042-IMD-TE4U
      2. As Approved

6. Type 6 Color Video Monitor (CPXM₆):
   a. Acceptable product:
   b. Performance requirements:
      1. 47 Inch diagonal
      2. 1920x1080 minimum resolution
      3. Acceptable Product:
         a) Sony FWD-S47H1 LCD Monitor with BKM-FW16
         b) With Chief mounting bracket
         c) As Approved

7. Type 7 Color Video Monitor (CPXM₇):
   a. 22", 1920x1080
   b. Acceptable product:
      1. Samsung S22A200B
      2. As Approved

8. Type 8 Color Video/Data Monitor (CPXM₈):
   a. 32" LCD
   b. Acceptable Product:
      1. Samsung
      2. As Approved

B. Waveform Monitor/Vectorscope (WVS)
   1. Multi-format signal analyzer
   2. Integrated video and audio monitoring
   3. Acceptable product:
      a. Harris CVM-306
      b. Other Acceptable Manufacturers: Tektronix

C. Test, Sync Generator
   1. Sync Generator (SYNC)
a. Integral test generator; digital black, and two independently adjustable black burst outputs.
b. Acceptable Product:
   1. Evertz 5600MSC+GP+T+STG+HTG+WC
   2. Other Acceptable Manufacturers: Tektronix, Harris

2.6 PLAYBACK AND SOURCE DEVICES

A. DVD Blu-Ray Disc Device (DVD):
   1. Blue Ray Recorder
   2. Acceptable product:
      a. JVC SR-HD1500US with a Roland VC-50HD with Middle Atlantic RSH4S2R
         JVCXXX –C rack mount shelf with shelf clamp

B. DVI/VGA input Scaler (SCALER):
   1. HD/SDI output
   2. Analog and AES output
   3. Audio and delay level control
   4. Acceptable product:
      a. Ensemble Designs BrightEye Mitto HD ME2
         b. With rack mount

C. Tuner (TUNER)
   1. Acceptable Product:
      a. Contemporary Research 232+ ATSC (Quantity: 1)

2.7 ROUTING SWITCHER

A. Serial digital level and analog audio (RS):
   1. Sized at 64x64 HD/SDI, analog audio
   2. Serves the (MIV) with ability to expand in same frame to 128x128. Please note that the physical frame and size is the ultimate requirement, expansion is expected to be accommodated with the addition of additional input, output and cross point cards.
   3. Capable of passing alphanumeric information between production switcher and multi-image viewers
   4. Allow control panels to intercommunicate. In the event that Ethernet protocol is used for the communication and it requires a separate physical network, then this supplier shall provide the network hardware required.
   5. Provide base bid configuration without any options. If options require additional expansion, indicate this on option pricing not within base bid.
   6. Acceptable Product:
      a. Evertz Magnum
         1. Evertz XE8-3232HX-Xlink video frame
         2. Evertz XE-IP32HX HD/SDI input card
         3. Evertz XE-OP32HX HD/SDI output card
         4. Evertz XE8-323-AA audio frame
         5. Evertz XE-IP32-AA analog audio input card
         6. Evertz XE-OP32-AA analog audio output card
         7. Evertz 7867VIPX-32x2 Multiviewer (MIV)
            a) (Quantity: 2)
         8. Evertz 8967VIPX-RP2 rear plate
         9. Evertz Xlink-BHP-5 5M cable
         10. Evertz 7800FR+78P frame
         11. Evertz PTX protocol converter
         12. With control and configuration software for router, multi-viewer and hardware
      b. Alternate suppliers available for consideration: Sony

B. RS422 matrix (CNTL MATRIX)
   1. Normalled RS422 patch panel.
a. ADC PPB3-5R422D9NS (Quantity: As required with 25% growth)

C. Routing Switcher Control Panels:
   1. Type 1 Button per source control panel (RS BPS₁)
      a. Full X-Y 8 levels of breakaway
         1. Evertz CP-6400E control panel
         2. Alternate suppliers:
            a) Sony
         3. Locations:
            a) As indicated on drawings
   2. Type 2 Button per source Control Panels (RS BPS₂)
      a. X-Y 4 levels of breakaway
         1. Evertz CP-3200E control panel
         2. Alternate suppliers:
            a) Sony
         3. Locations:
            a) As indicated on drawings

2.8 PRODUCTION SWITCHER

A. Production Switcher (PS) and Production Switcher Control Panel (PS CP):
   1. Ross Video Carbonite 2M (PS₁) (Quantity: 1)
      a. Ross C2M-224-001
      b. Ross CF-224
      c. Ross C2M-REDPSU-EXT
      d. Ross C2M-Panel (PS CP₁)
        1. In desk mounting
   2. Ross Video Carbonite 1M (PS₂) (Quantity: 1)
      a. Ross C1M-124-001
      b. Ross CF-124
      c. Ross C1M-REDPSU-EXT
      d. Ross C1M-Panel (PS CP₂)
   3. Switcher Commissioning
      a. Ross: As required

2.9 CHARACTER GENERATORS, CLIP SERVERS, SLOW MO AND EDITING

A. Character Generator (CG):
   1. Ross Expression Prime
   2. DataLinq Server Option

B. Computer Type 1 (COMPUTER₁):
   1. Ethernet: 10/100/1000
   2. USB 2.0 minimum of 2 ports
   3. RS232 Serial Ports: minimum of two (2)
   4. 3 year warranty; 24 hour replacement with on site replacement
   5. Provide 1 spare hard drive of each type.
   6. Provide Hard Drive Image Ghost software and configuration for each type.
   7. Basis of Design Hardware Configuration
      a. Dell PowerEdge R710
      b. Two (2) Quad-Core Intel® Xeon® processor (similar to: X3220 (2.4GHz, 8MB L2 cache, 95 Watts, 1066MHz FSB)
      c. 4GB Memory
      d. 4 x 100GB SATA 7,200/10000 rpm
      e. Hard Drive: RAID 5 drive set (requires above matching 4 hard drives)
      f. Smart Array Controller that supports RAID5
      g. Dual Gigabit NIC Adapters
      h. Optical Drive (CD/DVD-ROM)
      i. Serial port
j. Redundant PSU desktop computer mounted on sliding shelf or rack mount

C. Computer Type 2 (COMPUTER$_2$).
   1. Stealth Computer SR-2501 – with the following configuration:
      a. Processor: Intel Core i5-2500 (4C/4T), 3.3GHz, 32/64-Bit - Upgrade
      b. Memory: 8GB DDR3 Upgrade
      c. Hard Drive - 1: 500GB SATA Included
      d. Removable Hard Drive Kit (Available for Hard Drive 1 only): No Removable Kit included (standard)
      e. Optical Drive: DVD+/-RW/Blu-ray Burner, SATA - Upgrade
      f. Operating System: Microsoft Windows 7 Professional, 64-Bit (installed)
      g. Power Supply: 90-264VAC, 400 Watt ATX (standard)
      h. Side Rails: 30” chassis slide rails
      i. Adjustable Slide Rail Extensions: 6” Adjustable Extensions
      j. Extended Warranty: 1 Year Warranty Extension - 3 Years Total
      k. Software as required to operate:
         1. Routing switcher and multi-viewer
         2. Slo Motion Device
         3. Intercom
         4. Distribution gear

D. Apple Editing Computer (APPLE)
   1. Basis of Design Hardware Configuration is currently Mac Pro Configured:
      a. (2) 2.4GHZ Quad-cores Intel Xeon
      b. 1 TB 7200-rpm serial ATA 3Gb/s hard drive
      c. 48GB memory
      d. Apple Dual Channel 4Gb fiber-channel PCI Express Card
      e. Two ATI Radeon HD 5870 1GB graphics cards
      f. Mac Pro Raid card
      g. Blu Ray Drives; MCE BD10XMPE2009
      h. Apple Magic Mouse and Trackpad
      i. Apple Keyboard with numeric keypad
         1. Quantity: 2
      j. Apple Dual Channel 4Gb fiber-channel PCI Express Card (Quantity: 4)
      k. AJA Kona LHi capture card (Quantity: 3)
      l. Aja Xena KHIi-Box (Quantity: 6)
      m. Western Digital Caviar Black 1 TB 7200 RPM, 32MB Cache SATA 3 Gb/s 3.5” internal hard drive (Quantity: 6)
      n. 12GB kit, 240-pin DIMM, DDR3 PC3-8500 memory module (Quantity: 2)
   2. Software: OFE Final Cut
      a. Coordinate installation

E. Slow Motion Device (SLOW MO):
   1. 4 in/4 out
   2. Multi-viewer output
   3. Tightrope ZPlay HD
      a. With control panel

2.10 DISTRIBUTION GEAR

A. Configuration and Control Software
   1. Provide all manufacturers distribution/interface software available for controlling and monitoring distribution gear (EMAIL NOTIFICATION NOT REQUIRED). (Quantity: lot, as required).
      a. Ross
      b. Evertz
      c. Harris
      d. Grass Valley
      e. Snell, Pesa meeting these performance requirements
B. Distribution Gear Card frame (FR):
   1. Frame with cooling fan, network card with 1 power supply
      a. Ross FBK-8321-CN
      b. Evertz 500FR with single power supply and 500FC frame controller
      c. Harris 6800 + with single power supply and Ethernet resource card,
      d. Grass Valley 8900FFN: GeckoFlex 2RU Frame w/single power supply, 10 8900B-G, fans Ethernet network interface.
      e. Snell, PESA meeting these performance requirements
   2. Spare Power Supply:
      a. Mounts in selected Distribution Gear Card Frame
      b. Acceptable product:
         1. Ross PS 8300. (Quantity: 1 for every 4 trays, round fractional numbers up)
         2. Evertz backup/redundant power supply (Quantity: 1 for every 4 trays, round fractional numbers up)
         3. Harris second power supply,
         4. Grass Valley 8900U#PSX: Redundant 125W Power Supply for GeckoFlex frames (90-240VAC)
         5. Snell, Pesa, meeting these performance requirements

C. Type 1 Serial Equalizing Amplifier (SDA1):
   2. Acceptable product:
      a. Ross DEA-8205-R2 (NOTE THIS MODEL NUMBER IS A DUAL PATH DISTRIBUTION AMPLIFIER.)
      b. Evertz 500DAQ-3G (NOTE THIS MODEL NUMBER IS A DUAL PATH DISTRIBUTION AMPLIFIER)
      c. Harris DA-DHR6802+D (NOTE THIS MODEL NUMBER IS A DUAL PATH DISTRIBUTION AMPLIFIER)
      d. Grass Valley 8945EDA (NOTE THIS MODEL NUMBER IS A DUAL PATH DISTRIBUTION AMPLIFIER)
      e. Snell, Pesa, meeting these performance requirements.

D. Type 2 Serial Equalizing Amplifier (SDA2):
   1. 1 x 8 General distribution amplifier
   2. Mounts in selected Distribution Gear Card Frame
      a. Ross SEA 8203A-R2
      b. Evertz 500DA-3G
      c. Harris DA-HR6802+D
      d. Grass Valley 8943RDA
      e. Snell, Pesa, meeting these performance requirements.

E. Type 3 Serial Equalizing Amplifier (SDA3):
   1. 1 x 2 General distribution amplifier
   2. Mounts in selected Distribution Gear Card Frame
      a. Ross TEA 8207-R2. (NOTE THIS MODEL NUMBER IS A TRIPLE PATH DISTRIBUTION AMPLIFIER.)
      b. Evertz 500DAQ-3G (NOTE THIS MODEL NUMBER IS A DUAL PATH DISTRIBUTION AMPLIFIER)
      c. Harris DA-DHR6802+D (NOTE THIS MODEL NUMBER IS A DUAL PATH DISTRIBUTION AMPLIFIER)
      d. Grass Valley 8945EDA (NOTE THIS MODEL NUMBER IS A DUAL PATH DISTRIBUTION AMPLIFIER)
      e. Snell, Pesa, Grass Valley meeting these performance requirements.

F. Type 1 Analog Video Distribution Amplifier (VDA1):
   1. Mounts in selected Distribution Gear Card Frame
   2. Acceptable product:
      a. Ross UDA-8705A-R2
      b. Evertz 501ADA-EQ
      c. Harris VDA6800+S/D
d. Grass Valley 8902-EQ-1694A

e. Snell, Pesa, meeting these performance requirements.

G. Digital to Analog Composite (DAC). Note that single and multi-path units are specified herein. Verify exact quantity against the functional drawings and adjust rack elevations accordingly.

1. Acceptable product:
   a. Single Path
      1. Evertz 510DCDA-HD
      2. Ross HDC 8222-R2
      3. Harris HDC6800+AD
      4. Grass Valley 8995DNC
      5. Snell, Pesa, meeting these performance requirements.
   b. Dual Path
      6. Evertz 7812DCDA-HD+3RU
      7. Harris, Pesa, Ross, Grass Valley meeting these performance requirements.

H. Down Converter (DC). Note that single and multi-path units are specified herein. Verify exact quantity against the functional drawings and adjust rack elevations accordingly.

1. Acceptable product:
   a. Single Path
      1. Evertz 510DCDA-HD
      2. Ross HDC 8222-R2
      3. Harris HDC6800+AD
      4. Harris X50
      5. Grass Valley 8995DNC
      6. Snell, Pesa, meeting these performance requirements.
   b. Dual Path
      7. AJA FS2
      8. Evertz 7812DCDA-HD+3RU
      9. Evertz 2012
      10. Harris, Pesa, Ross, Grass Valley meeting these performance requirements.
   c. Note: Evertz 2014 is also acceptable

I. Up Converter (UC)

1. Acceptable product:
   a. Single Path:
      1. Harris X50
      2. Ross UDC-8625
   b. Dual Path:
      3. AJA FS2
      4. Evertz 2012
   c. Note: Evertz 2014 is also acceptable

J. Component to Serial Digital Converter (ADC): Note that single and multi-path units are specified herein. Verify exact quantity against the functional drawings and adjust rack elevations accordingly.

1. Acceptable product:
   a. Evertz Solution (NOTE THIS IS A DUAL PATH UNIT)
      1. Evertz HD2012+FR-HIO+FL-ADC-HD+AA+WPAES8-BNCM-6F
      2. Evertz BHP-BNICIU-48 (Quantity: 1 for EVERY 4 Type 1 ADC or Type 2 FS)
   b. Harris X50-AV-2PS with X50OPTCAB-AES NOTE THIS IS A SINGLE PATH UNIT
   c. AJA FS2 with Winford Engineering BRK25X-R-DIN or other approved analog breakout cable. NOTE THIS IS A SINGLE PATH COMPONENT INPUT UNIT.

K. Component to Serial Digital Converter Type 2 (ADC2):

1. Acceptable product:
   a. Evertz 7730ADC+3RU
   b. Harris ADV6800+D
c. Ross Video ADC-8733A  
d. Grass Valley 8950ADC  
e. As approved  

L. SDI TO DVI converter (DVI)  
   1. AJA HDP2 with appropriate power supply  

M. Type 2 HD Encoder (ENC₂)  
   1. Streaming Encoder  
   2. HD/SDI and analog audio inputs  
      a. Elemental Technologies Live Stream  

2.11 STORAGE AND PLAYBACK SERVER  

A. Shared Storage Interface  
   1. 45 TB shared storage interface with edit and play out  
   2. Fully redundant  
   3. Fiber connectivity XSan/StorNext  
   4. Serves up to XXXX clients  
   5. Provide with fiber switch  
   6. Acceptable supplier:  
      a. Active Storage  
      b. PROVIDE $65,000 ALLOWANCE for client configuration needs  

2.12 AUDIO AND TIME CODE  

A. Audio Mixer (MIXER)  
   1. 16 analog channels  
   2. Acceptable product:  
      a. Soundcraft GB2R  

B. Audio Amplifier (AMP):  
   1. Crown D45  

C. Speakers  
   1. Type 1 Speakers (SPKR₁):  
      a. Tannoy i7 (BLACK) with i7 MAB mounting bracket i7 yoke; orient as shown on drawings  
   2. Type 2 Speakers (SPKR₂):  
      a. Genelec 8020B (1 Pair)  

D. Audio Monitor (AM)  
   1. 8 channel analog/2 channel AES  
   2. Rack mount  
   3. Acceptable product:  
      a. Wohler VMDA-4  

E. Time Code Distribution Amplifier:  
   1. Time Code Distribution Amplifier (TDA)  
      a. Ross  
   2. Distribution amplifier Frame and Power supply (DO NOT MIX WITH AUDIO DA’s).  
      a. Ross AFR-7814  

F. Word Clock Synthesizer and Distribution Amplifier (ADA₁):  
   1. Drawmer D-Clock  

G. Audio Interfacing, Matching, and Line Driving Devices:  
   1. Analog Audio to AES (AADC)
a. Evertz 7720ADC-A4+3RU—note this is a multi-channel unit (two pair channels 1 way).
b. Ross ADC-8432—note this is a SINGLE channel unit.
c. Harris ADC6800+A4BCD—note this is a multi-channel unit (two pair channels 1 way).

2. AES to Analog Audio (ADAC)
   a. Evertz 7720DAC-A4+3RU—note this is a multi-channel unit (two pair channels 1 way).
   b. Ross DAC-8416
   c. Harris DAC6800+BCA4D—note this is a multi-channel unit (two pair channels 1 way).

3. Balancing Amplifier (BA; UBA)
   a. RDL STA-1

4. Type 2 Audio Distribution Amplifier (ADA)
   a. RDL RU-DA4D

5. Microphone to Line Level interface (MIC).  NOTE DEPENDING ON MANUFACTURER OF CCU, MAY NOT BE REQUIRED.
   a. RDL STM-2 (Quantity:  2 per stereo connection)

6. Support
   a. RDL-STR-19 (Quantity:  As required)
   b. RDL Power supply (Quantity:  As required)

7. Rackmount Balun; 20 channels (BALUN)
   a. Acceptable Product
      1. Ward Beck IMP20A

8. Type 1 Balun: Individual Devices (BL₁)
   a. Acceptable Product
      1. Ward Beck IMP1
      2. Canare BJC-XS-TRB

9. Type 2 Balun Rack mount (BL₂). Pair of Baluns
   a. Acceptable Product: For each device provide two (2) of the following:
      1. Ward Beck IMP1
      2. Canare BJC-XS-TRB

10. Note: it is acceptable to use the Rackmount Balun system (BALUN) for all AES impedance conversions.
    a. RDL RU-BL2 Adjustable Stereo Line Amplifier

H. 232 Transceiver. Units used to connect 232 connections over Cat 5/6 connections.
   1. Minicom Cat 5 232 Extender Local and Remote Unit with local power supplies. Provide as required.
      a. Onkyo T4555 with rack shelf

2.13 INTERCOM

A. Matrix Station (MATRIX):  
   1. Riedel Artist 64.
      a. Riedel Artist 32 64 Frame MFR-032 G2 (Quantity:  1)
      b. Riedel Artist 32 Power Supply PSU-032 G2 (Quantity:  1)
      c. Riedel Artist Node Controller, Standalone.  (Quantity:  1)
      d. Riedel Transformer balanced analog 4W interface AIO-108 G2.  (Quantity:  2)
      e. Riedel Matrix client card CAT5-108 G2.  (Quantity:  2)
      f. Riedel Director Artist/Performer Configuration Software (Quantity:  1)

B. Intercom Source Assignment Panel (SAP):  
   1. Acceptable Product:  
      a. RTS SAP 612

C. Intercom Power Supply (ICOM PS):  
   1. Acceptable Product:  
      a. RTS PS20
D. Intercom Interface (ICOM IF):
   1. Acceptable Product:
      a. Studio Technologies Model 45

E. Intercom Stations (ICOM). Note: coordinate sex of headset connector to correlate with headphones and camera connections:
   1. Matrix Intercom Station Type 1 (ICOM₁)
      a. 12 key rack mount control panel
      b. Acceptable Product:
         1. Riedel RCP-1012E/O with Riedel MIC-30 Microphone
   2. Matrix Intercom Station Type 2 (ICOM₂)
      a. 16 key desktop control panel
      b. Acceptable Product:
         1. Riedel DCP-1016E/O
   3. Intercom Station Type 3 (ICOM₃).
      a. 8 push button, 16 key operation rack mount panel
      b. Acceptable Product:
         1. Riedel DCP-5108 LCD with DCP RA
   4. Intercom Station Type 4 (ICOM₄)
      a. Belt pack
      b. Acceptable Product:
         1. RTS BP-325

F. Wireless intercom system.
   1. Wireless Receiver and base station:
      a. Type 1 Wireless Receiver Base station (WR₁)
         1. Clearcom Four Channel System Base Station CM-944 and CCT-9RT
   2. Wireless Transceivers (WT):
      a. Type 2 Wireless Transceivers (WT₂).
         1. Clearcom CP942 belt packs.
   3. Spare Battery Pack:
      a. Clearcom Spare Battery (Quantity: 2)
   4. 5-bay Battery Charger:
      a. Clearcom CT-BC5A Charger (Quantity: 1) mounted to Middle Atlantic sliding shelves
      b. Clearcom T-LP1Spare Battery (Quantity: 4)
   5. Remote Wireless antennae; connects to base station via CAT-5 cable.
      a. Clearcom CCT-9RT. (Quantity: 1)

G. Headsets: PROVIDE APPROPRIATE XLR CONNECTOR AT THE END OF EACH UNIT.
   1. Lightweight
      a. Clearcom CC-26K-XX (Quantity: 10)
   2. Single Muff
      a. David Clark 8592 (Quantity: 5)
   3. Dual Muff
      a. David Clark 8392 (Quantity: 8)
   4. Note: coordinate sex of headset connector to correlate with headphones and camera connections.
   5. Headphone
      a. Sony MDR-NC500D (Quantity: 2)
      b. @Provide adapter to go from Intercom station to headset. (Quantity: 2)

H. Telephone Hybrid (HYBRID):
   1. For transmission of game program audio to a remote captioner.
      a. Comrex DH20. (Quantity: 1)

I. Keyboard, Video, Mouse Matrix Switcher:
   1. Unit to provide up to 8 Users access to each of the systems computer(s) without the need for re-booting or re-configuration of cabling.
   2. Frame (KVM MATRIX) :
a. Avocent AMX5000AM KVM Switch. (Quantity: 1)
b. Note: this unit shall be interconnected to other computers and workstations provided by Video Display, Video Control and Scoring installers.

3. User Stations (EXR₁):
   a. Avocent AMX5130. (Quantity: As shown on drawings plus 1).

4. Type 1 Computer Interface (EXT₁):
   a. Avocent AMIQDM-PS2. (Quantity: As shown on drawings plus 1)
   b. Avocent AMIQDM-USB. (Quantity: As shown on drawings plus 1)

2.14 VIDEO REPLAY EQUIPMENT REQUIREMENTS

A. Equipment Rack to be frame and panel type constructed of 16-gauge cold-rolled steel. Racks to have locking rear door mounted on the frame (not the rails). Empty mounting panel spaces to be filled with blank or vent panels, in a finish to match rack. Provide end panels and top panels as required. Provide shelving as required for equipment mounting within racks. Provide rack supports as required. Provide seven rack keys of each type. Rack color to be gloss or flat black. Provide a 60-watt “rough service” lamp in a locally switchable fixture mounted in the top rear of each rack. Include extra set of mounting rails in each rack for rear support of panels or equipment. Verify exact rack space required.

1. Video Scoreboard Control Room Racks to be:
   a. Middle Atlantic MRK 4436
   b. Top
      1. Middle Atlantic MW-4QFT-FC
   c. Side Panels at ends of racks (Only need where exposed; at walls; leave exposed)
      2. Middle Atlantic

2. Support Equipment
   a. Blank Panels
   b. Vent Panels
   c. Rack screws—Middle Atlantic HS
   d. Power distribution
   e. Rack light
   f. Seismic bracing and bases for attachment of racks to structure
   g. Cable lacing bars
   h. Rack Shelves:
      1. Heavy Duty pull out shelf. (SLIDING SHELF)
         a) Middle Atlantic SS
      2. General shelf standard
         a) Middle Atlantic RSH with escutcheon
      i. Horizontal Cable Management (for CAT5/6 cable management)
      3. Middle Atlantic HHCM-2
      j. Vertical Cable Management
      4. Middle Atlantic PCD-4-4-44GRK

B. Rack sensor (SENSOR).
   1. Rackmount controller
      a. American Power Corporation (APC) NBPD0150. (Quantity: 1)
   2. Temperature and Humidity sensor
      a. APC AP9335TH (Quantity: 2)
   3. Moisture Sensor
      a. APC NBES0301 (Quantity: 2)

C. UPS (UPS):
   1. Rack Mount UPS
      a. APC SURT20KRMXLT-TF5 with APC APTF20KW01-20KVa (Quantity: 1)
   2. Additional Battery
      a. APC SURT192RMXLBP2U (Quantity: 3)
   3. Power Distribution Unit (PDU)
      a. As required
   4. Replacement Battery Cartridge
a. APC RBC44 (Quantity: 1)
5. Main Breaker as required to feed UPS.

D. Furniture Console:
1. Console shall be constructed to house audio, video, control and other equipment as shown on drawings. Console shall be constructed by expert craftsmen in a fully qualified cabinet shop regularly in business for furniture work. AWI quality grade: Premium.
2. The term “console” includes actual consoles housing equipment for work while seated; console desks housing little or no equipment; and other millwork or furniture housing monitors, timing or cueing devices, etc.
3. The primary structural material shall be 7- or 9-ply birch veneered hardwood plywood, A-2 grade, ¾” thick; surfaces shall be covered with matte plastic laminate selected by architect from manufacturer’s full range of standard colors and finishes. Hidden surfaces shall be covered with “liner” to equalize stress.
   a. Note: Particleboard may be suggested as a cost savings alternate. Freestanding units must be manufactured with plywood to allow their occasional movement.
   b. Provide a metal sub-frame to support millwork.
4. All exposed edges of horizontal work surfaces shall be treated with a solid wood bull-nose edge in a stain compatible with laminate finish. Submit suggested profiles and finishes to owner for review and acceptance.
5. All shelves, counters and edges to be designed to support 250 pound point load at edge of counter in addition to equipment mounted in or on shelf.
6. Equipment rack frames with drilled and tapped mounting holes shall be included as shown on drawings (reference EIA standards). Unused rack space shall be filled with black blank panels, brushed anodized aluminum.
7. AC power distribution and other requirements shall be as in Section 3.01; for routing between sections of cabinet, metal conduit and/or wireway shall be used for shielding and protection of circuits or as required by applicable codes.
8. Cabling access is required at each and every counter location. Preferred cabling system is a slot or reveal in the millwork that allows user a great deal of flexibility in locating cabling. Where slot exists in a flat millwork piece, then slot should be equipped with a brush cover or other suitable filler material that allows cables to be easily connected and dressed through openings (e.g. www.mockett.com; brush wire manager series).
   a. Circular grommets are not acceptable.
   b. A slot or cable reveal at the intersection of counter with vertical “rack” elements is preferred wherever possible.
9. Certain equipment shall be mounted into the millwork (e.g. console mount intercom stations, camera control shading joysticks, etc.); do not cut into millwork, until on site and user can evaluate operating configuration.
10. Seismic bracing and bases for millwork as required.
11. Field verify all site conditions prior to final shop drawing submittal to Technical Consultant
12. Millwork Locations:
   a. Bays 20-27
   b. Bays 30-37
   c. Rack counter 13-14
      1. Castered Edit Station shown with motorized lift as well side CPU mount
      2. Bays 40-41
13. Acceptable Suppliers:
   a. TBC Consoles
      1. LCD mounts as detailed
      2. Counter Finish: Verify with Owner

E. Video Tally connections are to be provided to indicate when a particular source is “on-air”. Connections shall be provided between the video switcher and:
1. All control console monitors,
2. All shading and tape machine monitors
3. Producer’s monitors multi-viewer
4. Camera control units

F. Patch Panels:
   1. Video and AES (unbalanced) patch panel with normal through patch jacks.
      a. ADC PPE4632-MVJ-BK. (Quantity: As required with 10% excess capacity)
   2. Audio and Intercom Patch Panels
      a. Identification strips to be printed labels of different color for each major connector
         grouping. Use a combination of colored fonts on white background and black
         fonts on colored backgrounds.
      b. Non-terminated inputs to be shorted through normalising contacts on rear panel.
      c. Provide one punch down tool and one replacement tip.
      d. Acceptable product:
         1. ADC PPA3-14MKIVSNO
      e. Provide additional panels for termination of Broadcast Audio cabling (refer to AV
         series drawings for cable distribution); terminations at patch panels by video
         replay contractor.
   3. General Purpose Interface contact closures available on the DVE, Still Store,
      Character Generator, Editor, and any other devices shall be brought to a patch panel
      (normals out) for wiring purposes.
      a. CAT5. (Quantity: As required)
      a. ADC PPI4632-RS-CJMID-BK. (Quantity: As required with 10% excess capacity)
      b. Other Acceptable Suppliers: As Approved

G. Patch Cables:
   1. Video Patch Cables. Standard Video Patch Cords; each length in a different color
      a. 2’ in length
         1. ADC R2V-STM (Quantity: 24)
      b. 3’ in length.
         2. ADC G3V-STM (Quantity: 24)
      c. 4’ in length.
         3. ADC B4V-STM (Quantity: 4)
      d. 6’ patch to male BNC
         4. ADC 06V-STM-B (Quantity: 4)
      e. Conversion adapter
         5. ADC MBNC-3 (Quantity: 6)
   2. Machine Control Patch Cables
      a. ADC R2B (Quantity: 10)
      1. Other Acceptable Suppliers: ADC meeting same performance
   3. GPI Patch Cables
      a. CAT5 (Quantity: 20)
   4. Patch Cord Holder
      a. Quantity: 1
      b. Acceptable suppliers:
         1. Pomona 4408
         2. Trompeter CH50
         3. ADC PPH
      a. ADC QB 4 with QB 4T spare tip. (Quantity: 1)
      a. AES and Analog@@@Standard audio patch cord:
      b. XLR Adapters:
      c. RCA Adapters:

H. Camera, Video and Audio Cables:
   1. Broadcast truck umbilical:
      a. Length: 150 feet
      b. Overall Jacket
      c. Individually numbered cables
      d. Video Umbilical:
         1. 5 BNC—provide 2 foot breakout at the rack end and 4 foot breakout at the
            truck end.
         2. Gepco VS102000
3. Install on Hannay C3218-25-26-F with slotted divider disc to allow appropriate tail to connect between truck connects
4. Quantity: 1
e. Audio Umbilical:
5. End 1
   a) 6 Male XLRs
   b) 4 Female XLRs
6. End 2
   a) 6 Female XLRs
   b) 4 Male XLRs
7. Install on Hannay C3218-25-26-F with slotted divider disc to allow appropriate tail to connect between truck connects.
8. Quantity: 1

2. Video Cables:
a. Assembly:
   1. Gepco GVC11-BLUE-##
b. Quantity and Lengths (note: lengths are in meters):
   2. 3 meter (Quantity: 4)
   3. 7 meter (Quantity: 4)
   4. 15 meter (Quantity: 2)
   5. 30 meter (Quantity: 2)
   6. 100 meter (Quantity: 3) install on Canare R3805 w/casters
   7. 150 meter (Quantity: 1) install on Canare R3805 w/casters

3. Audio Cables:
a. Assembly:
   1. Gepco GMC-5-BLUE-xx-MF-NBG
b. Quantity and Lengths (note: lengths are in meters):
   2. 3 meter (Quantity: 4)
   3. 7 meter (Quantity: 4)
   4. 15 meter (Quantity: 2)
   5. 30 meter (Quantity: 2)
   6. 100 meter (Quantity: 1) install on Canare R3005.

2.15 CABLE INTERFACE BOX PLATES

A. JBT Interface Plates:
   1. Mounts in junction boxes
   2. Panels to be black anodized 16 gauge aluminum flanged design (Middle Atlantic ‘BL’ series).
   3. XLR, Fiber and BNC connectors are offset to the bottom of the panel and engraving is to the side of the connector as shown on typical panel details.
   4. BNC connectors are to be crimp bulkhead cable jack with isolation washers.

B. Rack Mount Screws:
   1. Provide stainless steel flanged button cap screw fully threaded.
   2. Drive type: Hex socket.
      a. McMaster-Carr
      b. Or Equivalent

C. Camera JBT connector
   1. Neutrik NO2-4FDW panel connector

D. JBT Discrete fiber terminations
   1. Rack mounted enclosure.
   2. Provide for internal fusion splicing and cable management.
   3. Provide external strain relief for cables.
      a. Gepco GJBTFB-1RU3-12ST
      b. Or Equivalent
2.16 FIBER, GENERAL PURPOSE CABLE AND CONTROL WIRING

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

1. Video (under 100') and AES-U Cable.
   a. Precision video cable, PVC jacketed.
   b. Solid center conductor.
   c. Color: cable to be ordered in 6 colors (other than black) for each separate cabling system:
      1. Gepco VDM-260
      2. CommScope as approved
      3. Belden as approved

2. Intra Control Room Video cable.
   a. Precision video cable, PVC jacketed.
   b. Solid center conductor.
   c. Color: cable to be ordered in 6 colors (other than black) for each separate cabling system:
      1. Gepco VSD-2001
      2. CommScope as approved
      3. Belden 1694A

3. Outside Control Room video cable.
   a. Precision video cable, PVC jacketed.
   b. Solid center conductor.
   c. Color: cable to be ordered in 6 colors (other than black) for each separate cabling system:
      1. Gepco VHD7000
      2. CommScope as approved
      3. Belden 7855A

4. Analog Audio Cable:
   a. Color: cable to be ordered in 6 colors (other than black) for each separate cabling system:
      1. Gepco 61801EZ
      2. CommScope 4201EZ
      3. Belden 9451

5. AES-B Audio Cable
   a. Gepco DS401

6. Horizontal UTP Cable: Provide compliant with NEC type CMP, CMR and CM rating as applicable:
   a. Impedance: 100 ohms, plus or minus 15 ohms.
   b. Velocity of propagation: at least 70 per cent nominal.
   c. Frequency attenuation at 60° F less than 6.5 dB per 100 ft at 100 MHz.
   d. Acceptable product:
      1. CommScope 5504M
      2. Belden 1585A
      3. Mohawk M54998

7. Single Mode Fiber Optic Cabling
   a. Acceptable products:
      1. Belden M9W231
      2. CommScope R-006-0Z-8W-F-SU-YL
      3. Corning 006E8F-31131-A1

8. SMPTE Cable
   a. Mohawk

9. Other control cables to be 20 gauge with overall shield and appropriate number of conductors.
   a. Riser Rated

B. Connectors: All audio, video, and control equipment not a part of manufactured equipment shall have gold plated contacts excepting phone and patch jacks and plugs.

1. Fiber Optic Connector
a. Provide commercial style FC/APC/FC/SC and ST connections compatible with fiber equipment and where indicated on plans.
b. Provide connectors recommended by the manufacturer for compatibility with equipment and mounting panels and sub plates.
c. Acceptable product:
   1. Corning
   2. Panduit
   3. Siemon

2. XLR type connectors:
   a. Shall incorporate metal shells and bodies and employ a non-hydroscopic dielectric.
   b. Panel connectors to be removable from panel front for solder and repair work. Male and Female panel connectors to fit in the same cutout.
c. Acceptable supplier:
   1. Neutrik

3. F Connector:
   b. Provide seal ring in all moisture intensive environments.
   c. Install with manufacturer recommended compression tool.
   d. Provide weatherized boots and seal covers for all antenna connections.
   e. Verify connector cable type, size and construction with manufacturer.
   f. Acceptable product:

4. BNC Bulkhead Connections:
   a. Utilize gold plated center contacts
   b. Insulated from panel feed-through connection
   1. ADC BHFT-1

5. BNC cable connections:
   a. Utilize gold plated center contact, dual crimp connections:
      1. ADC BNC

6. SMPTE Connector
   a. Neutrik

2.17 FIBER OPTIC CABLING AND TERMINATIONS

A. Fiber Optic Termination Panels
   1. Optical Fiber Rack Mount Patch Panel
      a. 2U Panel, 24 – 48 Port
         1. Acceptable Product;
            a) ADC PN# RMG-2000-000B
      2. Fiber Pigtails Single Mode (3m long) APC (PN determines Connector Type)
         a. Pigtail Adapter
            1. Acceptable Product;
               a) ADC PN# FPT9-APSC-S-003M
      3. Termination Panel Inserts
         a. Single Density, Loaded with 3-SC single mode
            1. Duplex Adapters
               a) Acceptable Product;
                  (1) ADC PN# RMG-06ADPC3
         b. Double Density, Loaded with 6-SC single mode
            2. Duplex Adapters
               a) Acceptable Product;
                  (1) ADC PN# RMG-12ADPC3
         c. Single Density, Loaded with 6-SC single mode
            3. Simplex Adapters
               a) Acceptable Product;
                  (1) ADC PN# RMG-06ADPC1
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d. Double Density, Loaded with 8-SC single mode
4. Simplex Adapters
   a) Acceptable Product;
      (1) ADC PN# RMG-12ADPC3

e. Double Density, Loaded with 12-SC single mode
5. Simplex Adapters
   a) Acceptable Product;
      (1) ADC PN# RMG-12ADPC3

f. Blank Strip
6. Acceptable Product;
   a) ADC PN# RMG-00ADP00

B. Fiber Optic Connectors
1. Single Mode Pigtails
   a. ST Pigtail (12 Fiber Strands)
      1. Acceptable Product;
         a) ADC PN# FPM-04/0-M003M

   b. SC Pigtail (12 Fiber Strands)
      2. Acceptable Product;
         a) ADC PN# FPM-074/0-M003M

   c. SC Angle Polish (APC)
      3. Acceptable Product;
         a) ADC PN# FPM-0E/0-M003M

2. Single Mode fiber optic patch cords
   a. Simplex single mode patch cords
      1. SC to LC patch cords
      2. Provide in 2 and 3 meter and as appropriate
      3. Acceptable product;
         a) ADC FTL-7 series

   4. SC Patch Cord 568SC – 568SC
      a) SC Patch Cord 568SC – 568SC provide in 2 and 3 meter (6 and 10 feet) length as appropriate; “X” is equal to the length in meters
         (1) Acceptable Product;
            (a) ADC PN# FPC-SPSC-S-XM

   5. ST Patch Cord 568ST – 568ST
      a) ST Patch Cord 568ST – 568ST provide in 2 and 3 meter (6 and 10 feet) length as appropriate; “X” is equal to the length in meters
         (1) Acceptable Product;
            (a) ADC PN# FPC-SPST-S-XM

   b. Angle Polished (APC) SC single mode Patch Cord 568SC – 568SC provide in 2 and 3 meter (6 and 10 feet) length as appropriate; “X” is equal to the length in meters

6. Acceptable Product;
   a) ADC PN# FPC-ADSC-S-XM

C. Fiber Optic Patch Panel Cord Management
1. 19" Manager, Front, 1 RU Strain Relief
   a. Acceptable product;
      1. Hellermann Tyton PN# WMBN1
      2. Panduit PN# WMPFSE
      3. Belden PN# AX102032
      4. ADC PN# 6652 2 153-00

2.18 MANUFACTURERS COMMISSIONING

A. Provide manufacturers commissioning and setup for all systems provided as part of the Video Scoreboard Control Room including any selected options. This shall include, but not be limited to:
1. Production Switcher; including interface to 3rd party devices such as file servers, audio mixers, routing switchers, cameras, etc.
2. Routing Switcher and multi-image viewers
3. Clip Server(s); including interface to other devices such as production switcher and data networks
4. Character Generator; including interface to other devices such as production switcher and router system
5. Tally System
6. Intercom Systems
7. Edit Systems including shared storage, archive management, and media asset management system
8. Slow Motion Systems; including interface to other devices such as production switcher, Edit system and data networks

B. If Installer shall be using their own forces for commissioning then they need to submit qualifications of persons performing commissioning and three references for similarly commissioned projects.

C. Unless otherwise noted, Installer is not responsible for providing commissioning of Owner Provided equipment.

PART 3 EXECUTION

3.1 GENERAL

A. All equipment and materials shall be new, unless B-Stock equipment is chosen as indicated in 2.1. 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 grommeting.

3.2 AC POWER AND GROUNDING

A. Coordinate and make final connection of power and ground wiring to racks. Hard wire power wiring directly to internal AC receptacles to ensure uninterrupted operation.

B. Install 3-conductor, isolated ground outlets in each rack. Label each outlet as to which AC circuit is feeding it and provide the same information in the circuit breaker panel.

C. Install a copper ground buss bar top to bottom in each rack, insulated from the rack. Ground equipment chassis not having a three wire power cord to these busses using nuts, bolts and lock washers with No. 12 wire. Connect each rack buss bar to main ground wire in local power panel with properly sized insulated cable.

3.3 EQUIPMENT RACKS AND CONSOLES
A. Mount equipment in racks and consoles and fully wire and test before delivery to job site. If field conditions prevent prior assembly of racks, notify Technical Consultant in writing that racks will be fabricated on site and the reasons for the change.

B. Provide adequate whisper type ventilation.

C. Looking at the rack from the rear, locate AC power wiring on the left; line level audio, video, and RF wiring on the right. Panels or equipment mounted on the rear rack rails shall not block access to any front mounted components.

3.4 SYSTEM WIRING

A. Take precautions to prevent and guard against electromagnetic and electrostatic hum. For line level audio signals, float cable shields at the output of source device. Shields not connected to be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shields.

B. Exercise care in wiring; damaged cables or equipment will not be accepted. Isolate cables of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation in any amplifier section. Keep wiring separated into groups for microphone level circuits, line level circuits, loudspeaker circuits, and power circuits.

C. Make joints and connections with rosin-core solder or with mechanical connectors approved by the Technical Consultant; where spade lugs are used, crimp properly with ratchet type tool. Spade lugs mounted on 22 gauge or smaller cable to be soldered after crimping.

D. Execute wiring in strict adherence to:
   4. In accordance with standard professional practice.

E. Neatly lace vertical and horizontal wiring inside rack with lacing bars. Horizontal wiring in rack to be neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag. Neatly bundle excess AC power cable from rack mounted equipment with velcro cable ties. Rack wiring to be bundled with velcro cable ties or lacing twine. Electrical tape and adhesive backed cable tie anchors are not acceptable.

F. Provide adequate service loops so that equipment mounted on rack slides may be pulled fully out, to their locked position without straining cable.

G. All mini-BNC, mini-DIN and RCA/phono connections shall be made directly to the cable in question; whips and adapters are not acceptable.

H. Wiring and connections shall be completely visible and labeled in rack. Termination resistors shall be 1% tolerance; fully visible and not concealed within equipment or connectors.

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I. Custom rack panels shall be 1/8" thick aluminum, standard rack sizes, brushed black anodized finish unless otherwise noted. (Brush in direction of aluminum grain only.) Custom connector plate (speaker, microphone, etc.) finishes shall be selected from manufacturer’s full range of standard finishes. Plastic plates will not be accepted, even if building standard in other areas.

1. 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.

J. All patch panels shall be wired so signal “sources” (outputs from devices) appear on the upper row of a row pair; all “loads” (inputs to devices) appear on the lower row of a row pair. All patch panel designation strips shall utilize alphanumeric and descriptive labels. The jack positions in each horizontal row shall be numbered sequentially from left to right. The horizontal jack rows shall be lettered sequentially from top to bottom. The alphanumeric identification of each jack shall be included on the functional block drawings.

K. General Equipment and Cable Labeling:

1. Provide engraved laminoid 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, i.e., COMB GENERATOR, or RF SWITCHER. The second line to include the schematic reference of the device, i.e., COMB GEN, or RF SWITCH. The bottom line to indicate what other devices or areas this equipment controls, i.e., FEEDS SPLITTER or MONITOR/RECEIVER.

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.

L. Device labeling shall consist of two types: functional drawing reference and operational naming convention. Device physical labeling shall apply to functional drawings and physical labels on devices, operational naming convention shall allow user to provide flexible labeling between devices and their function (e.g. camera naming/numbering, file server labels).

3.5 INSTALLER TESTS AND ADJUSTMENTS

A. Verify the following before beginning actual tests and adjustments on the system:

1. All products are installed in proper and safe manner according to manufacturer’s instructions.

2. Insulation and shrink tubing are present where required.

3. All Dust, debris, solder splatter, etc. is removed.
4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
5. All labeling has been provided.
6. Temporary facilities and utilities have been properly disconnected, removed and disposed of off-site.
7. All products are neat, clean and unmarred and parts securely attached.
8. All broken work, including glass, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded.
9. All extra materials, portable equipment and spares shall be delivered and stored at the premises as directed.

B. Prior to energizing the System verify and perform the following tests and adjustments in compliance with applicable EIA standards. Record the results of each test in the Project Record Manual.
1. Electronic devices are properly grounded.
2. Test each AC power receptacle with a circuit checker for proper hot, neutral and ground connections.
3. Powered devices have AC power from the proper circuit.
4. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.

C. Preparation for Acceptance, prior to final inspection:
1. Verify each individual component is operating properly
2. Verify each individual component’s performance meets the manufacturer’s published performance for this unit.
3. Verify proper operation from controlling devices to controlled devices.
4. Verify proper adjustment, balance and alignment of equipment for optimum quality and to meet the manufacturer’s published specifications.
5. Establish and mark normal settings for each level control, and appropriately record these settings within the “System Operation and Maintenance Manual.”
6. Verify that all communications and networking services are installed and in proper working condition (Ethernet, IP addressing)
7. Other tests on equipment or systems as deemed appropriate, such as, but not limited to:
   a. Cameras:
      1. Verify Camera power on
      2. Verify all indicators on Camera reflect no short circuit or open circuit conditions
      3. Verify Pan-Tilt arms function smoothly
      4. Verify Focus control is connected and working
      5. Verify Zoom control is connected and working
      6. Verify Camera Head is balanced in front, back and center
      7. Verify Intercom headset is working
      8. Verify Return Video is functional
      9. Verify the Video mode is set proper mode (HD/SD)
     10. Verify Aspect Ratio is set to proper mode (16:9/4:3)
     11. Verify audio is functional and at appropriate levels
   b. Camera Base Stations:
      12. Verify all connectors from base stations to cameras fit snugly into each other and are secure.
      13. Verify that there is no interruption in cable by checking communication link indicator between camera and base station is OK.
      14. Verify On-Air/Tally and ISO indicators function as per manufacturer’s specifications.
      15. Verify cable lengths do not exceed standard maximum recommended lengths for respective cable.
   c. CCUs/OCPs:
      16. Verify relevant cameras are assigned and connected to respective CCU/OCP.
17. Verify assigned IP addresses and subnet mask are configured correctly
18. Verify iris control sensitivity, mode, range and center is setup and joystick is calibrated
19. Verify shading control is turned on
20. Verify White Balance is set and parameters stored.
21. Verify control of camera iris
d. Video Production Switcher
22. Verify assigned IP address and subnet mask is configured correctly
23. Verify all sources are defined, labeled and routed accurately
24. Verify all output assignments are accurate and labeled (program vs. preview)
25. Verify all external devices (DDRs, VTRs, etc) are routed accurately
26. Verify source to button mapping and labeling is to end user preferences
e. Monitors
27. Verify all camera preview cameras have picture from assigned cameras and are labeled as such
28. Verify program and preview monitors have the correct picture routed to them from production switcher
29. Verify DDRs, VTRs monitors have picture
30. Verify aspect ratio is set to 16:9 for native HD signal
31. Verify monitors are calibrated and color matched

D. Commissioning. Commissioning shall be performed by a combination of the integrator, the manufacturer or a separate commissioning agent retained by the integrator. The following identifies some, but not all, of the commissioning tasks expected of the commissioning team. This list is not intended to be comprehensive, and should be considered a general guideline for the integrator without a defined commissioning process statement.

1. Cameras and tripods.
   a. Setup camera in accordance with Manufacturer’s procedure
   b. Balance camera and lens on tripod
c. Confirm presence and proper operation of:
   1. Lens controllers
   2. Tripod feet, spreaders
   3. All cases and carts
   4. Rain slicker(s), if any
   5. Viewfinders and attachments
   6. Batteries and battery chargers
   7. Specified microphones
   8. Specified wireless hardware
   9. Specified camera lighting
d. Set lens back-focus
e. Exercise full zoom/focus control on lens
f. Confirm Remote control panel properly interacts with camera
g. Confirm tallies function as expected at each CCU and Camera. Provide/plan on green and red tally.
h. Confirm Intercom connections are balanced and functional; including CCU front panel connections
i. Confirm program audio connections are properly functioning
j. Confirm return video functions as appropriate.

2. Time Code
   a. Confirm time code is set to appropriate clock and offset for team/league requirements
   b. Confirm time code is distributed to all devices with time code inputs (including file servers, tape machines, multi-viewers, etc.)
c. Confirm time code records properly at all devices
d. Confirm time code does not cross talk into audio or video circuits

3. Computers, Networking, IP and Data
   a. Coordinate IP address for any equipment supplied herein.
   1. Program Gateways
   2. Program subnets
3. Coordinate subnets and V-lans with other systems including, but not limited to AV, scoring and video displays, and league statistics.

b. Coordinate firewall and routing configuration if needed between Video Replay and house system
c. Set all clocks, software and hardware, to listen to local or network NTP server.
d. If appropriate create auto-logon scripts
e. Establish logical share names, including, but not limited to, AV, scoring and video displays, and league statistics.
f. Set startup process to include logging into appropriate services and servers (e.g. establish SQL connection between Character Generator and data service)
g. Establish a defined back up process and train user

h. Install all relevant software including, but not limited to:
   1. Clients preference for browser(s)
   2. Word processing, spreadsheet, presentation and general office software
   3. Adobe Acrobat
   4. Software used to control, monitor and troubleshoot any hardware provided herein
   5. Creative/Graphic suites as appropriate

i. Ghost all boot and configuration hard drives after setup and acceptance, but before the users begin training.
j. Ghost all boot and configuration hard drives 1 month after acceptance.

k. KVM Systems
   1. Label all source and destinations with meaningful labels (e.g. COMP 15-01 is not acceptable; C15-01; Riedel Director is).
   2. As all sources appear on two separately provided KVMs (one by Video Replay and one by Video Scoring Displays) be sure to:
      a) Coordinate labeling
      b) Determine the extent that certain users should be locked out (e.g. not all users should have access to CG keyboard).
      c) Setup a default user environment as to which users can share or just monitor

3. Setup KVM in a training mode, to allow a single user to operate the software, while multiple users can Monitor only the trainer.

l. Connect all data interlinked devices (e.g. CGs, protocol translators, robotic cameras, etc) with their sources using appropriate control routing switcher, patches, distribution devices and the like, Confirm
   1. Baud rate, programming speed
   2. Desired operations are functional and reliable
   3. Interconnection with other systems including, but not limited to, AV, scoring and video displays, and league statistics.

m. Rack and UPS sensors (SENSOR).
   1. Setup all rack and room temperature, humidity and moisture sensors with appropriate alarming, notification, and SNMP alarms.
   2. Setup all UPS alarms with appropriate alarming, notification, and SNMP alarms

4. Intercom
   a. Setup each matrix station with labels as coordinated with the Owner.
   b. Setup each party line circuit with labels as coordinate with owner
   c. Program each matrix user station in accordance with Owner direction for sources and destinations. Unless otherwise noted, user stations of same type and functional use shall be initially programmed identically.
   d. Test each user station to every other station.
   e. Stress test the system under event standards so that users are located at each station and attempt to communicate as they would for the event.
   f. Setup all wireless communication so that talk/listen is available throughout the covered area. Test with high ambient noise conditions.
   g. Balance all users, user station, and intercom sources.
   h. Null all party line circuits
   i. Test Audio Monitoring Paths using the intercom system; verify appropriate gain structure, adjust as required.
5. Audio Phase and Stereo imaging.
   a. Check audio phase from each device to each destination, through routing switcher and direct patch. Correct any anomalies.
   b. Check Left/Right pairing from each device to each destination, through routing switcher and direct patch. Correct any anomalies.
   c. Set audio levels through each device to each destination, through routing switcher and direct patch for unity gain. Adjust interfacing devices to accommodate level differences that occur. Correct any anomalies.
   d. Use appropriate test tapes and signals and tones to verify playback level of file servers, tape machines and any device with audio playback capability.

6. SMATV, IPTV, Broadcast cabling and Sound System interconnections.
   a. Check audio phase from each device to each destination, through routing switcher and direct patch. Correct any anomalies.
   b. Check Left/Right pairing from each device to each destination, through routing switcher and direct patch. Correct any anomalies.
   c. Set audio levels through each device to each destination, through routing switcher and direct patch for unity gain. Adjust interfacing devices to accommodate level differences that occur. Correct any anomalies.

7. Coordinate proper naming and labeling between video and audio sources and destinations that originate elsewhere including, but not limited to Sound, Broadcast, MATV, IPTV, Video Display and LED Scoring devices which may be related work. This shall include but not be limited to: common device labels and nomenclature at each end, rack numbering, all routing interfaces.
   d. After cables are landed and coordinate verify proper connection with each supplier.
   e. Confirm that physical labels correspond to drawing labels and most importantly any alphanumeric control system labels (e.g. Tuner 1 should also be called SAT RX 5 and DIRECTV 7)

8. Production and Routing switcher configurations to Owner/Operator preferences this shall include, but not be limited to:
   a. All equipment settings
   b. Configurations
   c. Software setup
   d. All hardware, button, and software labeling on devices into groups as requested by Owner/Operator.
   e. Routing switcher programming including real and virtual naming configurations, salvo setup and programming and the like.
   f. Audio Routing
      1. Provide appropriate virtual labels for audio sources; building mono, left right pairs as directed by the owner for recording multiple audio sources and/or routing to external locations.
      2. Set gain between exterior ties and the routing system
      3. Verify gain of feeds to and from the PA system, adjust as necessary
      4. Configure MADI routing paths to exterior devices, if MADI interface is present.
      5. Assist user in setting up routing to VCRs and File servers for appropriate game and non-game audio configurations.
   g. Proper Alphanumeric transfer of sources to destinations including under-monitor tally designations, tally and between production and routing switchers. This shall include, but not be limited to:
      1. Multi-viewers
      2. In-monitor tally/under monitor displays whether connected via router or direct to auxiliary bus
   h. Salvos
      1. Establish pre-game and game salvos for all video and audio sources and destinations.
      2. Modify salvos after all event attendance.
      3. Archive each salvo.
i. Interfaces to other devices for proper operation (e.g. machine and file server control from the production switcher, through a control routing layer, to the end devices).

j. Tally programming

k. GPI and/or switcher peripheral setup and control of:
   1. Character Generator(s)
   2. File server(s)
   3. Video Display Processors (which are likely supplied by others)
   4. Routing Switcher
   5. Audio playback devices
   6. Audio Mixers
   7. Cameras and robotics

l. Setup and configure all protocol converters that may be used between devices including but not limited to:
   1. Different switching systems
   2. Scoring and Video Display systems controllers

9. Video Routing and Multi-image viewing
   a. Using a SMPTE pattern test each check video path from each device to each destination, through routing switcher and direct patch. Correct any anomalies.
   b. With user, determine initial multi-image viewer configuration and layout.
   c. Assign both functional drawing reference and operational naming convention.
   d. Video board processors
   e. Setup of video processing returns

10. Distribution Gear and Signal Processing. Setup all software remote interface and operation software including but not limited to:
    a. Device labeling corresponding to drawings as well as functional use
    b. Signal path processing and/or interconnection paths as allowable
    c. Set alarm and notifications screens as allowed.

11. Closed Captioning
    a. Setup video and audio routing into and out of the device.
    b. Coordinate connection of the captioning steno machine to the encoder
    c. Set priority on encoder based upon user preference (e.g. local steno override, or is ignored).
    d. Coordinate addressing inputs/outputs from the decoder to scoring and video display.
    e. Setup intercom station to receive a headset only on the 2nd output of the intercom station
    f. Setup listening mix

12. Setup graticule generator, if provided, for proper alignment of video display and sources.

13. Record all software settings and creating appropriate back up records (paper and electronic as appropriate).

14. Confirm all equipment, loose or fixed is on site. Provide written list and confirmation of such. Note that this list may be the same as the serial number list required for closeout submittals.

3.6 TEST EQUIPMENT

A. Provide the following equipment on site 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 Technical Consultant 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: Tektronix
4. 25 75 ohm, 1 percent resistors.
5. Video Test Tape for each format VCR. As supplied or recommended by manufacturer.
6. Provide two portable VHF or UHF business band radios for use during acceptance testing. Radios should have a transmission range sufficient to cover entire project. Radios to include rechargeable batteries and recharger along with “holster” for wearing
3.7 ACCEPTANCE

A. Upon completion of installation and initial tests and report specified in Part 3, acceptance testing shall be performed by the Technical Consultant.

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. Video Signal: From all source inputs (for cameras, character generators, video tape units, etc.) through all VDAs, processors, switchers, etc., to all signal destinations. Verification of correct signal timing for each source, via each path will be made using standard test patterns. Each processing device will be checked such that the signal passes through the device in the no processing mode such that unity luminance, chrominance, and signal timing and phasing conditions are achieved.
   2. Control functions shall be checked for proper operation, from controlling devices to controlled devices.
   3. The audio fidelity test shall consist of driving the system with pink noise and measuring the response in each 1/3 octave band from 40 to 16,000 Hz. Octave, 1/3 octave, or notch filters as specified shall be used to adjust the response as necessary to fit the requirements of the space.
   4. Adjust, balance, and align equipment for optimum quality and to meet the manufacturer’s published specifications. Establish and mark normal settings for each level control and record these settings, in the “System Operation and Maintenance Manual.”
   5. Installed and loose equipment will be inventoried for correct quantity.
   6. 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 Technical Consultant.

E. The Technical Consultant’s fees and costs involved in acceptance testing are not the responsibility of the Systems Integrator, except as described in Part 3 of this specification.

F. In the event that the Video Scoreboard Control Room is used prior to final acceptance, attendance in support of that usage shall not be construed as acceptance, or as event attendance.

3.8 DEMONSTRATIONS AND TRAINING

A. Manufacturer’s trainers or manufacturer’s authorized or approved trainers to provide operations and service training on the following major equipment components and subject matter to the owner (this is not commissioning):
   1. Production Switcher (96 hours; minimum). Submit resume on trainer on this device for approval.
      a. Provide an experienced switcher TD to program macros, custom controls, DVE moves, etc. for first events. This will include consultation on: creative content, programming of content, interfacing to file servers, etc.
b. Switcher TD is specifically to be experienced in game entertainment production (not just broadcast production), preferably in a sporting facility with unique aspect ratio displays.

c. It is expected that some of this involvement and time will be in advance to actual on site time and work.

d. It is expected that trainer will need to attend two (2) games.

e. Curriculum:
   1. Internal timing adjustments
   2. Normal switcher operations
   3. Use of aux busses with DVE
   4. Programming switcher effects memory
   5. Software configuration for:
      a) DVE
      b) Editor
      c) GPIs
      d) Automation System
      e) Routing Switcher
      f) Camera/robotic interfaces,
      g) Other interfaced devices

f. Trainers Daily reports shall be emailed to those being trained, the Technical Consultant, the manufacturer’s training department, the systems integrator and as appropriate. The reports should include information required as part of the submittal; as well as detailed information on setup and operational training specific to the project installation. The Daily reports should be cumulative and edited as appropriate during the training duration.

2. Character Generator implementation specialist (60 hours, minimum). Submit resume on implementation specialist on this device for approval.

a. Provide an experienced CG operator to assist in development and implementation of CG templates. This will include consultation on: creative content, programming of content, interfacing to graphic and statistical systems, etc. Operator shall be experienced with creating IDS based stats templates.

b. CG 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. CG Operator is specifically to be experienced with database interfacing to IDS Stats, Daktronics DakStats, Statvision, RTD and summary database or other scoring systems (e.g. MLBAM XML; Scorepad, Status Pro, etc.).

d. It is expected that some of this involvement and time will be in advance to actual on site time and work.

e. It is expected that trainer will need to attend two (2) games.

f. No more than 10 hours of this time shall be as traditional CG training; the bulk of the time shall be in assistance of building templates, transitions, 3D effects, clip playout and the like.

3. Clips and Graphic Server(s) (24 hours ON EACH TYPE): Submit resume on trainer on the device(s) for approval.

a. Trainers Daily reports shall be emailed to those being trained, the technical consultant the manufacturer’s training department, the systems integrator and as appropriate. The reports should include information required as part of the submittal; as well as detailed information on setup and operational training specific to the project installation. The Daily reports should be cumulative and edited as appropriate during the training duration.

4. Routing Switcher Training (24 hours)

a. Include all costs for trainer and commissioning.

b. See part 3 of this specification regarding other training considerations.
c. Specific Issues:
1. Programming switcher
2. Programming and using salvos
3. Interfacing routing switcher to the Tally Interface system with appropriate programming
4. This training shall be distinct from any time that switcher manufacturer may spend commissioning switcher.
d. Commissioning will be separate from training.
e. Trainers Daily reports shall be emailed to those being trained, the technical consultant, the manufacturer’s training department, the systems integrator and as appropriate. The reports should include information required as part of the submittal; as well as detailed information on setup and operational training specific to the project installation. The Daily reports should be cumulative and edited as appropriate during the training duration.

5. Slow Motion training (24 hours; scheduled in at least two (2) separate sessions separated by 3-6 weeks as determined by owner). Training shall be separate from commissioning.
a. Trainers Daily reports shall be emailed to those being trained, the technical consultant, the manufacturer’s training department, the systems integrator and as appropriate. The reports should include information required as part of the submittal; as well as detailed information on setup and operational training specific to the project installation. The Daily reports should be cumulative and edited as appropriate during the training duration.

6. Manufacturer’s training should be assumed to take place on the project site, unless agreed to by the owner.

7. Training should be scheduled to be non-overlapping, unless agreed to by the Owner.

8. 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 2-4 hour increments; perhaps over a period of weeks (or even months).

9. In the event that a portion of the training time is occupied in troubleshooting the equipment installation, commissioning the equipment, then the training time shall be extended an equal amount of time.

10. The following is a general idea of the training “curriculum”:
   a. A general familiarization of the architecture of the device.
   b. An explanation of how the device interfaces to the rest of the Video Scoreboard Control Room (including data connections; timing requirements and the like).
   c. General training on operating the device.
   d. Specific training on device operation (e.g. on the CG, entering statistics; how to access data retrieval sources; how to create repeatable formats and layouts).
   e. Saving information; backing information up.
   f. Basic troubleshooting
   g. Specific troubleshooting (this information may be conveyed to personnel other than the device’s "operators").
   h. How to upgrade software; precautions taken while doing (e.g. backing-up existing software).

B. Provide not less than 24 hours of “systems operation and maintenance” instruction to Owner designated personnel on the use and operation of the System. This instruction will consist of two portions:
1. A minimum of five 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.

2. Event Attendance within the following requirements:
a. Be present at three home games or other events as designated by the owner.
b. During these events, attendance shall begin at the first crew call and conclude when the crew is released. During these events perform such tasks (e.g. assistance with timing, patching, routing, shading, troubleshooting cabling problems, etc.) as requested by user. Tasks shall be strictly assistance, not operation.
c. 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.
d. Schedule 2 days with team during mid-season to review systems and equipment operation.
3. Coordinate these schedules with the Owner.

- End of Section -
PROPOSAL FORM

Proposal for the Purchase and Installation of Video Scoreboard Control Room Systems for BuffVision at the University of Colorado.

To:

The undersigned Offeror, in response to the Request for Proposal (RFP), proposes to furnish all labor and material, and to perform all work necessary for completion of the work required for the above referenced proposal for Section 11 63 50—Video Scoreboard Control Room Systems for the University of Colorado in strict accordance with the Contract Documents for the base proposal sum of:

_____________________________ Dollars ($_____________), inclusive of taxes and if this proposal is accepted, will execute a formal contract equal in form to that bound in the Contract Documents to this effect.

The following is a breakdown of the proposal:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Proposal Equipment costs</td>
<td></td>
</tr>
<tr>
<td>Project Management, Engineering, non-labor issues</td>
<td></td>
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<tr>
<td>Off Site Labor</td>
<td></td>
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<tr>
<td>On Site Labor (own forces)</td>
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<tr>
<td>On Site Labor (subcontractors)</td>
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<tr>
<td>Taxes</td>
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<td>Bond</td>
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<tr>
<td>Shipping, Transportation, handling, insurance</td>
<td></td>
</tr>
<tr>
<td>Storage Allowance</td>
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</tbody>
</table>

**Base Proposal Total**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overhead for change orders</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit for change orders</td>
<td></td>
</tr>
</tbody>
</table>

The undersigned Offeror further acknowledges receipt of the following addenda as listed below and represents that any additions or modifications to, or deletions from the work called for in these addenda, have been taken into consideration and included in the base proposal sum.

**ADDENDA** *(mark “None” if no addendum issued):*

No. 1
No. 2
No. 3
No. 4
No. 5
No. 6

All proposals must include the following properly completed documents; please verify that you have included the following. See Instructions to Offerors for explanation of the required documents.

- Proposal Form;
- Construction schedule adherence statement for Design Build Contractor for the last 3 years.
Letter from surety, indicating ability of Offeror to receive a payment and performance bond in the full proposal amount.

Proposed project schedule and manpower loading.

Identification of key subcontractors and their responsibilities.

Proposed Project Management Staff and Organization Chart

1.01 All options shall be inclusive of taxes, insurance, escalation, etc. and shall be expressed as a net add or deduct to the base bid.

### OPTIONS

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Unit Cost</th>
<th>Add/Deduct</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 63 50-A</td>
<td>Cost to remove fiber camera cabling and tie lines from Folsom Field scope of work</td>
<td>$</td>
<td>Add/Deduct</td>
</tr>
<tr>
<td>11 63 50-B</td>
<td>Provide incremental cost to replace specified base bid production character generator</td>
<td>$</td>
<td>Add/Deduct</td>
</tr>
<tr>
<td>11 63 50-C</td>
<td>Provide incremental cost to replace specified base bid Slow Mo device</td>
<td>$</td>
<td>Add/Deduct</td>
</tr>
<tr>
<td>11 63 50-D</td>
<td>Cost to provide image stabilizer to Type 2 lens configuration</td>
<td>$</td>
<td>Add/Deduct</td>
</tr>
<tr>
<td>11 63 50-E</td>
<td>Cost to provide HD hard disc record/playback device</td>
<td>$</td>
<td>Add/Deduct</td>
</tr>
<tr>
<td>11 63 50-F</td>
<td>Cost to replace base bid routing switcher and MIV with Harris option</td>
<td>$</td>
<td>Add/Deduct</td>
</tr>
<tr>
<td>11 63 50-H</td>
<td>Cost to provide POV camera at Folsom Field</td>
<td>$</td>
<td>Add/Deduct</td>
</tr>
<tr>
<td>11 63 50-I</td>
<td>Cost to replace base bid Character Generator with Chyron</td>
<td>$</td>
<td>Add/Deduct</td>
</tr>
<tr>
<td>11 63 50-J</td>
<td>Cost to provide wireless camera transmitter, receiver and frame sync to OFE camera</td>
<td>$</td>
<td>Add/Deduct</td>
</tr>
<tr>
<td>11 63 50-K</td>
<td>Cost to provide closed caption encoder and decoder</td>
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<td>Add/Deduct</td>
</tr>
<tr>
<td>11 63 50-L</td>
<td>Cost to replace existing distributed TV encoding headend at Folsom Field</td>
<td>$</td>
<td>Add/Deduct</td>
</tr>
<tr>
<td>11 63 50-M</td>
<td>Provide incremental cost to replace base bid production switcher with Ross Vision</td>
<td>$</td>
<td>Add/Deduct</td>
</tr>
</tbody>
</table>

1.02 Voluntary Savings. This is an area where a vendor may suggest alternate resolutions, sizes, or deviation from technical specifications. Attach a separate enumeration of items.

1.03 Unit Costs. Option Service Pricing is only required for base bid at time of initial proposal. Final BAFO will need to include service costs based upon final BAFO. Service Options shall represent sum of multiple years; actual annual costs will need to be submitted in final BAFO. Include any and all escalation.

### Unit Cost

| Unit Cost 11 63 50-A1 | Cost to provide fiber optic test equipment | $          |
Unit Cost

Unit Costs 11 63 50-B1. Provide annual costs for all software and hardware support for full Production Switcher Systems specified as Base Bid. Annual costs shall be for ten years following expiration of the project warranty period. $ 

Unit Costs 11 63 50-B2. Provide annual costs for all software and hardware support for full Routing Switcher and Multi-image viewing Systems provided as base bid. Annual costs shall be for ten years following expiration of the project warranty period. $ 

Unit Costs 11 63 50-B3. Provide annual costs for all software and hardware support for full Production Switcher Systems specified as Option 11 63 50-M. Annual costs shall be for ten years following expiration of the project warranty period. $ 

Unit Costs 11 63 50-B4. Provide annual costs for all software and hardware support for all type 1 CGs (CG1). Annual costs shall be for seven years following expiration of the project warranty period. $ 

1.04 NON-COLLUSION AFFIDAVIT

The undersigned Offeror or agent, being duly sworn on oath, says that he has not, nor has any other member, representative, or agent of the firm, company, corporation or partnership represented by him entered into any combination, collusion or agreement with any person relative to the price to be paid by anyone at such letting nor to prevent any person from offering nor to induce anyone to refrain from offering, and that this offer is made without reference to any other offer and without any agreement, understanding or combination with any other person in reference to such offering.

He further says that no person or persons, firms, or corporations has, have or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.
1.05 SCHEDULE

The undersigned Offeror has received and reviewed the Project/Milestone Schedule.

OATH AND AFFIRMATION

I________________, an officer of the Company, with the duly prescribed signing rights, hereby affirm under the penalties of perjury, that the foregoing facts and information are true and correct to the best of my knowledge and belief.

Dated at____________________ this _____ day of __________________, 20____.

______________________________________________________________

(Name of Organization)

By: __________________________________________________________

(Signature)

______________________________________________________________

(Title of Person Signing)

STATE OF__________________________ )

) SS:

COUNTY OF__________________________

On this ________ day of ____________________, 2012, _____________personally appeared before me, ________________, who, being by me duly sworn, did say that he/she is duly authorized to execute, acknowledge and deliver the foregoing instrument in the name of and for and on behalf of ________________ , and acknowledged that he/she did in the name of ________________, execute and acknowledge said instrument for the uses and purposed set forth therein.

(seal)

Notary Public

______________________________________________________________

Printed Signature

My commission expires: ________ County of Residence: ____________

END OF PROPOSAL FORM
Existing Conditions at Coors Events Center (CEC)

Mechanical

The existing Buff Vision area is open to the service corridor and is served by a dedicated VAV box from AHU-3 which was installed in 2010. AHU-3 provides direct & indirect evaporative cooling, hot water preheat, air-side economizer, and filtration. The dedicated VAV box serving the Buff Vision area is not provided with a reheat coil.

The existing Control Room area is heated via existing heating and ventilation unit C-40a located in the Conference level mechanical room which was installed in approximately 1980. Heated outside air is delivered to the service corridor which is open to the Control Room area. Hot water unit heaters are provided in the existing Control Room area and are expected to remain in the plenum above the new Control Room area. No cooling is provided in the Control Room area.

Existing heating hot water supply/return, domestic cold water, domestic hot water supply, domestic hot water return, and vent lines run above the Control Room area and are expected to remain.
Scope of Work Summary

Mechanical General Criteria

Applicable Criteria

- All HVAC and plumbing systems shall be designed in accordance with the following:
  - Plans prepared by Sink Combs Dethlefs
  - Other ASHRAE Standards as are reasonably applicable to the project.
  - Applicable plumbing, gas, energy, building, and other codes.
  - National Fire Protection Association criteria latest version.
  - SMACNA Sheet Metal Contractors Association Standards for Duct Construction.
  - ASME - American Society of Mechanical Engineers.
  - AWWA - American Water Works Association.
  - ULC - Underwriters Laboratories.

Design Conditions

- Elevation: 5280 ft.
- Summer:
  - Outdoor Design Temperature: 94.3 dB/60.3 wB
  - Outdoor Evaporation Design Temperature: 64.9 wB/81.1 dB
  - Indoor Design Temperature:
    - Buff Vision: 75°F
    - Control Room: 75°F
    - Audio Room: 75°F
    - Server Room: 75°F
- Winter:
  - Outdoor Design Temperature: 0.7 dB
  - Indoor Design Temperature:
    - Buff Vision: 70°F
    - Control Room: 70°F
    - Server Room: 70°F
- Relative Humidity Control:
  - Server Room: 45% +/- 5%
  - Buff Vision, Control Room, and Audio Room: No low humidity control
Stadium Boards Equipment Replacement

DESIGN-BUILD CRITERIA

Department of Intercollegiate Athletics
University of Colorado at Boulder
2/07/2012

Mechanical System Summary

General

All scope areas including Buff Vision, Control Room, Audio Room, and Server Room shall include drain pans under existing piping to prevent leakage onto sensitive equipment.

All piping and ductwork systems shall be re-balanced upon completion.

All piping shall be isolated and separately flushed prior to startup.

Buff Vision – Option 1 and Option 2

The existing 10" VAV box and associated low pressure ductwork serving the Buff Vision area will be removed and replaced with a new 8" VAV box and new low pressure distribution. The new VAV box shall be located to minimize noise within the Buff Suite editing rooms, and new low pressure ductwork shall be routed to each Buff Vision room with minimum 3 ft. flexible ductwork connections to supply diffusers. The new VAV box will not be provided with a reheat coil.

One branch return duct serving the Buff Vision area shall be removed and the return main shall be capped. The remaining branch return duct will serve as an open plenum return within the Buff Vision area. Return grilles shall be provided in each Buff Vision room with lined boots for sound control. The return ductwork main within the Buff Vision area shall remain.

The existing unit heater located within the Buff Vision area will be removed and relocated within the adjacent service corridor. The unit heater shall be located between existing columns to prevent a potential obstruction in the service corridor path.

The Buff Vision area will be served by existing AHU-3 which does not provide low end humidity control.

Due to the dependency of direct/indirect air handling systems on outside air conditions (AHU-3), high temperature excursions in the space may occur when outside air enthalpy exceeds design conditions.

Control Room, Audio Room, and Server Room – Option 1 - Water-source Heat Pump and DX CRAC Unit

The new Control Room and Audio Room shall be zoned together and shall be provided with a new 3.5 ton water-source heat pump with cooling water piped from existing mains within the Practice Facility service corridor. Outside air shall be ducted to heat pump return ductwork from existing heating and ventilation unit C-40a located in the Conference level mechanical room.

A new 1,420 CFM transfer fan shall be provided with supply and return ductwork interconnected with heat pump supply and return ductwork. Control dampers shall be provided on the transfer fan supply and return as well as the heat pump supply duct for transfer fan mode operation, and the transfer fan shall be provided with an ECM motor for variable speed control.
The Control Room and Audio Room will not be provided with humidification under Option 1.

The Server Room shall be provided with a new 5 ton air-cooled DX CRAC unit with split condensing unit located on the concourse level roof. The CRAC unit shall be provided with low-ambient control, humidification, and electric reheat. Outside air shall be ducted to the CRAC unit return ductwork from existing heating and ventilation unit C-40a located in the Conference level mechanical room.

The transfer fan will be utilized during winter months to cool the Control Room and Audio Room and will operate only when adjacent service corridor temperature is 65°F or less and the transfer fan can adequately cool the zone. As zone temperature increases or if the service corridor temperature is higher than 65°F, the interior cooling water loop pumps shall be enabled, and the zone heat pump shall be enabled.

During winter months, the heat pump system may operate with the interior cooling water loop pumps enabled and the exterior tower water loop disabled due to low outside air temperatures. During these conditions, the interior cooling water loop temperature will be allowed to rise above interior ambient temperature and will rely on piping losses in the system to cool the loop.

The existing BMS shall be reconfigured to allow the interior cooling water loop to be enabled during shoulder seasons without enabling the exterior tower water loop. Additional BMS controls shall be provided to determine heat pump mode and enable/disable equipment.

In the event the interior loop temperature rises above 85°F, the outside air temperature is too low for cooling tower loop operation, and service corridor temperature is too high for transfer fan cooling, space temperature in the Control Room and Audio Room may rise above design cooling setpoint. Further study of the interior cooling water loop is required to determine if temperature in the loop will be expected to rise out of range during winter months.

The existing cooling water loop and tower water loop arrangement in the Practice Facility is designed for indirect cooling at main air handlers and currently operates only when indirect cooling is enabled. The addition of a water-source heat pump as part of Option 1 will require indoor cooling water loop pumps to operate during more hours throughout the year.

Option 1 Pros:
- Smaller equipment and less ductwork
- Server room temperature reliability with DX cooling
- Smaller equipment mounted on roof
- Less work on Street and Concourse levels

Option 1 Cons:
- DX cooling for server room (less efficient than indirect/direct evap cooling)
- Compressor cooling in control room/audio room (less efficient than indirect/direct evap cooling)
- High temperature excursions possible for Control Room and Audio Room
Option 1 Alternate – Control Room and Audio Room DX Split System

The new Control Room and Audio Room shall be zoned together and shall be provided with a new 3.5 ton air-cooled DX split system with condensing unit located on the concourse level roof. The DX split system shall be provided with low-ambient control, and outside air shall be ducted to return ductwork from existing heating and ventilation unit C-40a located in the Conference level mechanical room.

A new 1,420 CFM transfer fan shall be provided with supply and return ductwork interconnected with split system supply and return ductwork. Control dampers shall be provided on the transfer fan supply and return as well as the split system supply duct for transfer fan mode operation, and the transfer fan shall be provided with an ECM motor for variable speed control.

This alternate provides consistent temperature control in the Control Room and Audio Room under all internal loading and outside air conditions.

Control Room, Audio Room, and Server Room – Option 2 – Rooftop Direct/Indirect VAV Air Handler

The Control Room area shall be provided with a packaged direct/indirect cooled VAV air handling unit sized to accommodate the Control Room, Audio Room, Server Room, and expected loads for the future studio area. The new unit shall be mounted on the concourse level roof and shall include hot water preheat, humidification, an indirect evaporative cooling section with dedicated fan, a direct evaporative cooling section, return fan with VFD, and supply fan with VFD. New supply and return mains shall be routed from the roof to the space, and heating hot water and domestic cold water shall be routed from the service level mains to the new roof mounted air handling unit.

The server room shall be provided with an opposed blade control damper for airflow modulation, and the Control Room/Audio Room zone shall be provided with a VAV box with hot water reheat. The server room will not be provided with a reheat coil. Future studio and storage zones will be provided with VAV boxes with hot water reheat under separate project.

A new BMS control panel shall be provided for the new unit and shall be integrated into the existing BMS system.

Heat tracing shall be provided for all heating hot water and domestic cold water piping routed on the exterior of the building.

During summer months, the new air handling unit will provide direct/indirect cooling with 100% outside air. The supply fan VFD and return fan VFD shall modulate airflow to maintain all spaces at design setpoint. During winter months, the unit will incorporate air-side economizer to provide cooling with hot water reheat for zone level temperature control.
Stadium Boards Equipment Replacement

DESIGN-BUILD CRITERIA

Department of Intercollegiate Athletics
University of Colorado at Boulder
2/07/2012

Air handler size and location to be coordinated with structural engineer. Unit shall be located such that hot water coils may be pulled out of the unit without obstruction.

Due to the dependency of direct/indirect air handling systems on outside air conditions, high temperature excursions in spaces served by the system (including Control Room, Audio Room, Server Room, and future studio area) may occur when outside air enthalpy exceeds design conditions.

Option 2 Pros:
- High efficiency (direct/indirect cooling)
- Air-side economizer available
- Flexibility for future studio area
- Less re-work of existing BMS

Option 2 Cons:
- Larger rooftop equipment
- Larger ductwork
- More work on Street and Concourse levels
- High temperature excursions possible for Control Room, Audio Room, and Server Room

Option 2 Alternate – DX CRAC Unit in Server Room

The Server Room shall be provided with a new 5 ton air-cooled DX CRAC unit with split condensing unit located on the concourse level roof. The CRAC unit shall be provided with low-ambient control, humidification, and electric reheat. Outside air shall be ducted to the CRAC unit return ductwork from the new rooftop mounted VAV air handling unit.

This alternate provides consistent temperature and humidity control in the server room under all internal loading and outside air conditions.

Mechanical Specifications

A. Hydronic Piping

1. Pipe Work
   a. Piping:
      1) Piping to be Schedule 40 black steel with screwed joints on sizes 2” and smaller and welded on sizes 2½” and larger.
      2) Grade and valve all heating water piping with 3/4 inch hose end valves to permit complete drainage of the system. Vent all high points and equipment rooms as necessary with automatic air vents piped to convenient drain. All high points in system outside of equipment rooms with combination automatic/manual air vents as required to relieve air in the system.
      3) For non-buried piping use Type "L" copper, wrought copper fittings, and 95-5 solder.
4) For drain pan piping, not buried, use Type "M" copper, wrought copper fittings and 95-5 solder.

5) Provide isolation valves in all pressurized piping at each riser and each piece of equipment. Provide balancing valves at each piece of equipment.

B. Air Distribution

1. Materials and Equipment
   a. General:
      1) Sizes shown on the drawings are inside (sheet metal) duct dimensions. All ductwork shall be constructed of sheet-metal, furnished and installed in accordance with SMACNA.

2. Low Velocity Flexible Ducts Acoustically insulated flexible duct, consisting of inner core of perforated one-ply corrugated duct, one inch thick insulation and vapor barrier cover.

3. Round duct connectors to be factory fabricated galvanized for insulated ducts, steel adapter plate on glass fiber ducts, butterfly damper and quadrant operator on all applications (except variable air volume systems upstream of variable air volume box).

4. Flexible connections to be 24 oz. per yard, UL approved material.

5. Provide turning vanes on all rectangular elbows.

6. Opposed blade dampers for duct splits and where shown to be:
   a. Steel or aluminum construction with worm drive operator. Screwdriver slotted shaft, factory assembled.

7. Fire dampers, UL label, to have 1-1/2 hour fire rating, with sleeve where construction fire rating requires. To meet NFPA 90 A requirements. Shutter, curtain type blades and replaceable fusible link. Use type "B" dampers at all locations where space permits or type "C" dampers for round or oval ducts. Use type "A" dampers only where space will not allow type "B".

8. Smoke dampers, UL label UL555S class II and meet pressure requirements for the smoke exhaust systems.

9. Duct liner inside the duct.
   a. Insulate all supply ducts, return ducts, outside air intake ducts, and any other ducts called for on the plans with one inch thick, two pound density, monolithic, long glass fiber duct liner.

C. Insulation

All insulation thicknesses shall at least meet the minimum ASHRAE Standards.

1. Piping and Equipment
   a. Domestic Cold Water Pipe, Valves, and Fittings:
      1) Insulate with UL approved, flame resistant, white, vapor barrier jacketed, glass fiber Snap-On Insulation ½ inch thick. Insulate valves and fittings with glass fiber blanket insulation and premolded PVC cover.
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b. Heating Piping, Pipe, Valves, and Fittings:
   1) Insulate with UL approved, flame resistant, white, all service jacketed, glass fiber blanket, insulation and pre-molded PVC covers (covers to be UL 25/50 rated).

D. Plumbing Piping

1. Water Piping Materials
   a. Water Service:
      1) Provide in accordance with Water Department.
      2) All pipe outside the building four inches and larger to be Class 250, cement-lined, cast iron or ductile iron of manufacturer’s recommended thickness class, mechanical joint or push-on joint; three inches and smaller to be Type "K" copper with wrought copper fittings and hard solder with a minimum melting point of 1,100 F.

b. Piping (Inside Building):
   1) Non-buried lines, type "L" copper water tube, wrought copper fittings, and 95-5 solder.

2. Soil, Waste, Vent, and Storm Piping Materials
      1) Lines buried below ground to be standard weight, C.I. soil pipe and fittings, Class 50 ductile iron pipe and fittings, or hubless C.I. with C.I. couplings for below grade.
      2) Waste lines above ground to be standard weight C.I. soil pipe and fittings or hubless C.I. soil pipe and fittings. Up through 2-1/2 inches may be standard weight galvanized steel pipe with black C.I. drainage fittings.
      3) Vent lines above ground to be standard weight C.I. soil pipe and fittings or standard weight galvanized steel pipe with 150 pound galvanized malleable iron fittings for lines two inches and over and black C.I. 125 pound SWP fittings for lines 1-1/2 inches and less.
      4) Waste lines at concessions maybe PVC with plenum rated insulation for corrosion control.
      5) Provide trap primers at each floor drain and floor sink. Primers may be connected to flush fixtures or be stand alone.

E. Fire Protection

1. Outside Alarm
   a. Alarms shall be connected to every fire sprinkler system.

2. Draw-Offs and Drains
   a. Install sprinkler branches and piping to drain to the main rise or to drains in the building. Provide a two inch drain and test line on supply rise with two inch valved discharge pipe running to floor drain.
3. Pipe, Fittings, and Hangers
   a. Pipe and fittings shall be listed in NFPA Pamphlet No. 13 and designated to withstand a working pressure of not less than 175 psi. Hangers shall be UL approved.

4. Wet Sprinkler System
   a. Design: The sprinkler system shall be hydraulically calculated by the Contractor to meet NFPA Light Hazard. Provide ordinary hazard coverage where required per NFPA. Ordinary hazard areas include mechanical rooms, server rooms, and storage.

F. Test And Balance
   1. Testing
      a. Test all drain and waste lines with standing water test of twelve feet of head, held long enough to inspect each joint.
      b. Test all water piping, before connecting to units, at 150 psig hydrostatic pressure.
      c. All tests required by code must be done before covering to the satisfaction of the local authorities having jurisdiction.

   2. Balancing
      a. At the completion of the installation, the mechanical systems shall be adjusted and balanced by an independent balancing firm specializing in this work, with a Registered Professional Engineer in charge of the work.
      b. Furnish and install such items as thermometer wells, pressure test clocks, access doors, etc., as required to allow tests and adjustments to be made.
      c. Adjust and balance all air and water systems. Check, adjust, and balance all systems to meet the design conditions, and tabulate all information on acceptable forms. All systems shall be checked for proper performance during design conditions, both heating and cooling.

G. Building Management System/Temperature Controls
   1. Provide all controllers, panels, wiring/conduit, and accessories required for integration of new equipment with existing DDC system. Modules for new equipment within the existing BMS shall be programmable and shall be modifiable at the PC computer front end. Modules shall be easily programmable to provide flexibility for intermittent use of the facility. Programming shall be incorporated to maximize energy efficiency within the facility.
   2. Individual rooms shall have local thermostats connected to control valves or packaged equipment. The server room shall have a dedicated humidity sensor connected to the humidity control valve or packaged equipment serving the room. Zone level thermostats will not be connected to the DDC system.
   3. Provide “gateways” as necessary for communication with the fire alarm system.
   4. Provide smoke detectors downstream of the air filters and ahead of any branch connections in supply air systems with a design capacity of 2,000 CFM or more.
   5. Provide smoke dampers in air handling systems with a design capacity 15,000 CFM or more to isolate air-handling equipment.
Existing Conditions at Folsom Stadium

Electrical

The south scoreboard is fed from panelboards SSDPA and SSDPB located on the catwalks in the existing scoreboard enclosure. These panelboards feed the scoreboard load centers and other miscellaneous loads. The panelboards are fed from distribution board MDC2 via a 300kva transformer located in the electrical room adjacent to Gate 3. The transformer and distribution board appear to be original equipment but in good working condition.

The north scoreboard is fed from distribution board H5B via a 500kva transformer located in the Dal Ward Facility. Distribution board H5B appears new and in good condition, it serves multiple load centers, circuits and panelboards NSDPA and NSDPB located at the scoreboard catwalk.

Existing Conditions at Coors Events Center (CEC)

Electrical

The exiting storage area is served by existing panelboard located in the general area. The existing panelboard(s) have little to no spare capacity. The facility is fed from a 1600A distribution board MDS1 located in electrical room NW 191. The equipment appears to be original but looks to be in good working condition. New low voltage transformer and panelboard will be required to serve the new space as described herein. Refer to one-line and plan drawings for reference.

The existing equipment storage room 113 is open with minimal services. The existing lighting consists of two lamp 4' strip lights. Control for the strip lights is accomplished via manual toggle switches in multiple zones. The light fixtures will be replaced with new fixture types as described herein.
Scope of Work Summary

Scope of Work to be Included

Electrical

Applicable Criteria

- The latest editions of the following standards are a minimum requirement.
  - Underwriters’ Laboratory, Inc. (UL)
  - National Electrical Manufacture’s Assoc. (NEMA)
  - American National Standards Institute (ANSI)
  - Institute of Electrical and Electronic Engineers (IEEE)
  - International Electrical Testing Association (NETA)
  - Insulated Cable Engineer’s Association (ICEA)
- All work and materials shall comply with latest rules, codes and regulations including, but not limited to the following:
  - OSHA
  - National Fire Codes of National Fire Protection Assoc. (NFPA)
  - National Electrical Safety Codes (NESC, ANSI C2)
  - Americans with Disabilities Act (ADA)
  - University of Colorado Design Criteria.
- Code compliance is mandatory. Nothing in these drawings and specifications permits work not conforming to these codes.

Electrical System Summary

General

This electrical scope narrative and outline specifications are intended to provide general direction for the electrical design of the new Buff Vision Suite (server room, control room and editing bay).

Refer to the architectural, mechanical and A/V narratives for additional electrical requirement.

All existing distribution in which new loads will be added shall have existing loads justified.

Buff Vision

Provide a new 75kva 480-120/208V, 3-phase, 4-wire isolation transformer and new 2-section, 42-pole 250A, 120/208V panelboard to serve the Buff Vision suite. Transformer shall be fed from the existing power panel “H1B” located in the electrical room NW191. Provide new feeder breaker, conduit and wire as
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needed to transformer location as indicated on the drawings. Maintain minimum clear heights as required per UCB.

The server room shall be provided with dedicated 120V, 20A circuit per equipment rack. Refer to drawings for quantities and locations. Provide recessed 2x4 troffers coordinated with the equipment layout. Ceiling mounted vacancy sensors shall be provided with local switch for Manual ON/ Auto OFF controls.

Control room shall be provided with (1) IG four-plex receptacle per console. Maximum (2) consoles per 120V, 20A circuit. Provide recessed 2x4 troffers for general lighting and LED track over each console row. The general lighting shall be controlled via 4-way switching with switches located at the door and at each console row. The LED track lights shall be controlled via local dimmers located at the associated console row. Ceiling mounted vacancy sensors shall be provided with local switch for Manual ON/ Auto OFF controls.

Editing bay shall be provided with surface mounted plugmold as indicated on the drawings. Each plugmold shall be provided with minimum of (2) 120V, 20A circuits. Provide recessed 2x4 indirect fixture for general lighting and LED wall sconces with upright components for lower light level. Provide dimming controls for wall sconce. Ceiling mounted vacancy sensors shall be provided with local switch for Manual ON/ Auto OFF controls.

The existing panelboard L1C shall be relocated on the opposite side of the wall it is currently installed. Relocate existing electrical connections for the relocated walk-in freezer and cooler.

The existing lighting in the future studio shall be maintained, provide new ceiling mounted vacancy sensors with local switch for Manual ON/ Auto OFF controls.

Folsom Field – South Scoreboard

The existing scoreboard panelboards SSDPA, SSDPB and load centers shall be demolished. New panelboards shall be provided as indicated on the drawings. Existing feeder breakers, feeders shall be replaced with increased sizes as indicated on the drawings. Panelboards shall be located in the new scoreboard catwalk enclosure. Provide connections to all the remote load centers; refer to A/V narrative for additional information. Provide remote control capabilities for energizing/de-energizing the scoreboard from the electrical room.

Folsom Field – North Scoreboard

The existing scoreboard panelboards NSDPA and NSDPB shall remain in existing. Demo all existing scoreboard load centers. New feeders shall be provided to new scoreboard load centers as require per electrical drawings and the A/V narrative. Provide remote control capabilities for energizing/de-energizing the scoreboard from the electrical room.
Electrical Specifications

A. RACEWAYS

1. Conduits to be of size and be installed according to NEC unless noted otherwise herein.

2. The minimum conduit size for branch circuits is ¾” and 1” for feeders.

3. Rigid conduit, intermediate metal conduit or electrical metallic tubing as permitted by NEC. Flexible metal conduit to be used only for final connection to equipment with maximum length 6 feet.

4. Conduit systems shall be concealed in areas (other than mechanical/electrical rooms) where studs and drywall are provided. Public spaces using concrete as the finish shall, where practical, have all conduit concealed within the concrete. All exposed conduits to the public must be painted and be coordinated and approved by architect prior to installation.

5. Branch circuit conduits will not be permitted in the slab unless approved by the structural engineer.

6. All medium voltage ductbanks shall be encased in red concrete and be a minimum of 36” below finish grade. The conduit shall be schedule 40 PVC with PVC coated galvanized rigid steel elbows. A 6” wide red warning tape shall be installed 18” above all duct banks.

7. Schedule 80 PVC shall be used where conduit penetrates the concrete slab.

B. WIRE AND CABLES (600 VOLT AND LESS)

1. All conductors to be copper, solid for #12 AWG and smaller, stranded for # 10 AWG and larger.

2. Minimum conductor size No. 12 AWG.

3. All conductors shall be Type THWN/THHN insulation unless otherwise noted.

4. Factory color coding to be utilized for appropriate system voltages and phase identification.

5. All fire alarm wiring shall be in conduit.
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C. OUTLET BOXES

1. Four-inch square or octagonal, zinc coated sheet steel boxes. All boxes for Tele/Data communications shall be 2 1/8” deep.


3. Provide covers set to come flush with finished walls.

4. Utility or sectional switch boxes shall not be used.

5. Verify mounting heights of all outlets prior to installation. Locate outlets to clear counters, benches, baseboards or fin tube heaters, etc., or as required to service equipment.

6. All outlet boxes and exposed conduit shall be corrosion protected.

D. WIRING DEVICES

1. Specification grade receptacles. Hubbell HBL 5362 or equivalent. Ivory color. Telephone room receptacles shall be Hubbel IG HBL 5362. (Orange color).

2. A.C. quiet operating type switches, Hubbell HBL-1121, 20 amp or equivalent.

3. Cover plates to be determined by Architect.

4. All wiring will be installed in conduit.

5. Connections in #8 wire and smaller to be made with Scotchlock Type, UL approved, pressure connectors. Connections in #6 wire and larger to be made with approved lugs and/or connectors. NO splices are to be made within conduit.

6. Wall switch outlets at door locations are to be installed on the latch side of doors and are to be mounted 4 feet above finished floor. Receptacles and telephone outlets are to be mounted at +18” unless noted otherwise.

E. LIGHTING POWER PANELBOARDS

1. Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types and arrangements shown. Equipped with anti-turn solderless pressure type lug connectors approved for use with copper conductors; construct unit for connecting feeders at top of panel; equip with copper buss bars, full-sized neutral bar, with bolt-in type heavy duty, quick-make, quick-break circuit breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral buss for each outgoing feeder required; and provide bare uninsulated grounding
bars suitable for bolting to enclosures. Select galvanized sheet steel cabinet enclosures fabricated by same manufacturers as panelboards, which mate and match properly with panelboards. Employ breakers that are fully rated for available short-circuit condition but not less than 10,000 sym AIC at 120/208 volts; and 14,000 sym AIC at 277/480 volts.

2. Provide factory-assembled, molded-case circuit breakers of frame sizes, characteristics, and ratings including RMS symmetrical interrupting ratings sized for available short circuit. Select breakers with permanent thermal and instantaneous magnetic trip. Construct with overcenter, trip-free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle trip indication. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

F. MECHANICAL EQUIPMENT WIRING AND CONNECTIONS

1. Provide all line voltage power for mechanical equipment motors and motor starters furnished under Division 23.

2. Provide feeder circuits to mechanical equipment and motor starter, and make all connections.

3. Provide disconnect switches (heavy duty, HP rated, quick-make, quick-break, fusible or non-fusible) and/or thermal overload switches as required. Disconnects for equipment located on the roof, or where exposed to weather are to be NEMA 3R.

4. Flexible metallic conduit is to be used for connections to motors and other equipment where vibration is encountered or as required. All flexible connections exposed to the weather are to be made with liquid tight flexible metal conduit.

G. GROUNDING

1. All service equipment, conduit systems, supports, cabinets, equipment, fixtures, etc., and the grounded circuit conductor shall be properly grounded in accordance with the latest issue of NEC and local electrical code. Provide bonding jumpers, grounding bushings, clamps, etc., for complete grounding.

2. Provide a separate grounding conductor in all raceways. The conduit shall not be acceptable as an equipment ground. Securely ground each side of all raceways containing sections of plastic, fiber, or flexible raceway. Size conductor in accordance with NEC.

3. Provide a green grounding jumper from the ground screw to a box grounding screw or clip for all grounding type devices. Use insulated wire.
4. Provide a main building ground riser (12” x 3” x 1/4” copper bus bar on stand-offs) in electrical rooms and a communication ground system riser in the MC and all IC’s rooms. A building ground riser (#250KCMIL) shall be provided and connect each of the electrical rooms and tied into the building ground loop.

5. Provide a building ground loop around the perimeter of the arena. A counterpoise grounding system shall be used around the building to obtain 5 Ohms or less on the system.

H. TESTING

1. Acceptance and startup testing requirements for electrical power distribution equipment and systems. Contractor shall retain and pay for the services of a recognized independent testing firm for purpose of performing inspections and tests as herein specified.

2. The Contractor shall perform routine insulation resistance, continuity, infrared scans, and rotation tests for all distribution and utilization equipment prior to and in addition to any acceptance testing.

3. The Contractor shall perform a 1000-volt DC insulation resistance test (Megger) on all 600 Volt and less conductors.

4. The Contractor shall test all lighting, low voltage relays and circuits to ensure proper operating conditions prior to acceptance testing.

5. The Contractor shall perform visual and mechanical inspections, verifying that the equipment nameplate information meets the intent of the drawings and specification.

6. The Contractor shall be responsible for all final settings and adjustments on protective devices and tap changes.

7. Provide a complete short-circuit study, equipment interrupting/witness evaluation, and a protective device coordination study for the electrical distribution system described below. This study shall be submitted with electrical equipment submission and electrical room layouts.

The studies shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the low-voltage distribution system. Normal system operating method, alternate operation, and operations which could result in maximum fault conditions shall be thoroughly covered in the study.

The study shall be calculated from the utility meter to the unit substation to the lowest overcurrent device or equipment on the electrical distribution system. The utility conductors shall not be used for calculations.
8. The Contractor shall engage the services of a recognized corporate and financially independent testing firm for the purpose of performing inspections and tests as herein specified.

9. The firm shall provide all material, equipment, labor and technical supervision to perform such tests and inspections.

10. It is the purpose of these tests to assure that all tested electrical equipment is operational and within industry and manufacturer’s tolerances and is installed in accordance with design specifications.
3 February 2012

Mr. Steve King
Sink Comb Dethlefs
474 Lincoln Street, Suite 100
Denver, CO 80203

VIA Email: king@sinkcombs.com

RE: University of Colorado Folsom Field Renovations
Room Acoustics and Sound Isolation Recommendations

Dear Mr. King,

This letter provides recommendations for the room acoustics of the control room, edit bays, and offices for the renovations at the University of Colorado athletic facilities. Also included are updated sound isolation recommendations including door recommendations and construction details for a sound isolating ceiling. These recommendations are based on the drawings sent 1 February 2012.

Revised Sound Isolation Recommendations
Partitions
The following table provides revised partition recommendations for the edit bays and control room based on the most recent floor plans. Additionally, a sketch showing these partition recommendations is attached.

<table>
<thead>
<tr>
<th>Partition</th>
<th>STC Rating</th>
<th>Partition Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Room to EIC Room</td>
<td>55</td>
<td>B1</td>
</tr>
<tr>
<td>Offices to Edit Bay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offices to Offices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edit Bay to Hallway</td>
<td>55</td>
<td>B2</td>
</tr>
<tr>
<td>Offices to Hallway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Room to Studio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Room to Hallway</td>
<td>60</td>
<td>C</td>
</tr>
<tr>
<td>Control Room to Server Room</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Room to Coolers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIC Room to Server Room</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Studio to Hallway</td>
<td>65</td>
<td>D1 or D2</td>
</tr>
</tbody>
</table>

As a reminder, all partitions should continue to the structure above where they should be sealed with non-hardening acoustical sealant (gypsum board) or compressible filler (CMU). Vertical perimeter joints should also be sealed appropriately to create an airtight construction.
Door and Windows

Door and windows are typically considered the weakest sound isolating elements in a wall construction, often causing issues with noise reduction between adjoining spaces. Sound rated doors should be used at entries into noise sensitive areas. The following table provides a summary of sound ratings required at the control room and edit bays to meet the recommended noise isolation criteria. The table includes both minimum STC ratings and sample products; cut sheets of those manufacturers are attached. The locations of the sound rated doors and windows are also shown in the partition STC sketch.

<table>
<thead>
<tr>
<th>Door or Window Location</th>
<th>Minimum STC</th>
<th>Sample Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Window between Control Room and EIC Room</td>
<td>47</td>
<td>Single Glazed IAC STC 47</td>
</tr>
<tr>
<td>- Door between Control Room and EIC Room</td>
<td></td>
<td>IAC Swinging Door STC 53</td>
</tr>
<tr>
<td>- Entry to Edit Bay</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>- Entry to Offices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Door between Control Room and Studio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Entry to Control Room from Hallway</td>
<td>55</td>
<td>IAC Swinging Door STC 55</td>
</tr>
<tr>
<td>- Entry to Studio from Hallway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Door between Rack Room and Control Room</td>
<td>61</td>
<td>IAC Swinging Door STC 61</td>
</tr>
</tbody>
</table>

Sound rated doors should be specified as complete assemblies including door leaves, hinges, thresholds, and appropriate frame and bottom seals. Center astragals or mullions should be provided at double door configurations. Door and window frames for the STC rated assemblies should be grouted prior to installation to reduce sound transmission through the frames. Where installed in gypsum board construction, we recommend that acoustical sealant be applied around the entire perimeter on both sides of the frame.

It should be noted that the STC rated doors are 2-1/2 to 3-1/2 in. thick and require deeper frames. Additionally, if a lower STC rated door is desired for the entry to the studio, a vestibule configuration can be used.

Floor/Ceiling Assembly

Given the existing functions of the building, including a basketball practice court and arena seating bowl above the noise sensitive spaces, airborne and impact noise isolation at the floor/ceiling assembly separating these spaces is critical to prevent disturbances in the control room and edit bays.
The sound isolating ceiling should consist of two layers of 5/8 in. gypsum board suspended from the existing concrete slab using spring and neoprene hangers similar to Mason Industries’ 30N hangers. The isolators should be positioned as close to the slab as allowable, especially above the edit bays, to optimize impact isolation of the assembly. Minimum 6 in. thick unfaced fiberglass batt insulation should be positioned above the gypsum board to improve airborne sound isolation. The gypsum board should be sealed to the perimeter walls with non-hardening acoustical sealant.

The gypsum board should not be in direct contact with the existing concrete beams, but should be hung high enough to allow mechanical ductwork, piping, and other building systems components, especially those serving the noise sensitive spaces, to be routed below it with the intent to avoid penetrations in the sound isolating ceiling. However, we recommend providing minimum ½ in. air gap between the gypsum board and the concrete beams to ensure the ceiling is properly isolated.

Where there is enough vertical clearance, such as the edit bays and offices, a separate lay-in ceiling grid should be hung from the sound isolating ceiling, below the building systems components. The grid can be supported from the sound isolating ceiling, but support points should be sealed with acoustical sealant. Where there is not enough vertical clearance, as may be the case at the control room and audio room where the raised floor is employed, absorptive acoustic materials as recommended in the following section may be applied directly to the gypsum board.

**Penetrations**
Ducts, pipes, conduit, cabling, structural, and similar penetrations through sound isolating walls and ceilings should be fully sealed around their perimeters with non-hardening acoustical sealant. Penetrating elements should be centered in the cutouts so they do not touch the partition of ceiling assembly; we recommend allowing a maximum ¼ in. gap around the penetrating element as shown in the attached details. Electrical boxes located in gypsum board construction should also be sealed to their drywall cutouts and should include putty pads on the back of the boxes.

**Room Acoustics Recommendations**
In the control rooms and edit bays, we recommend that the spaces be acoustically dry to promote appropriate listening conditions and good speech intelligibility, even if there are many conversations occurring at one time. One of the key characteristics of room acoustics, as well as our primary metric for describing speech intelligibility, is reverberation time. Reverberation time (RT) describes how long, in seconds, sound persists in a room before it is no longer audible. RTs are directly proportional to the geometric volume of the space and inversely proportional to
the amount of absorptive material in the room. That is, larger spaces with less absorption have longer RTs and speech is less intelligible.

For the spaces listed below, we recommend an RT of 0.6-0.8 seconds. Appropriate materials for the space are given along with approximate amounts needed to achieve these acoustic goals. Where specific products are mentioned as a basis of design, cut sheets are attached at the end of this letter.

**Offices**

**Walls:** Painted CMU and/or gypsum board; no applied acoustic material is needed.

**Ceiling:** Absorptive materials such as acoustic ceiling tile or pin-fixed insulation should be applied either directly to the underside of the sound isolating ceiling or hanging on a grid below it. The material should be specified to have a minimum Noise Reduction Coefficient (NRC) of 0.70 and should cover minimum 80% of the gross ceiling area. Acceptable products include Armstrong’s Ultima ceiling tile or Johns Manville Insul-Shield 1 in. thick pin-fixed insulation.

**Floor:** VCT or carpeting

**Edit Bay**

**Walls:** Approximately 50 sq. ft. of absorptive wall panels with minimum NRC 0.50, such as Tectum FabriTough panels, should be applied where space is available along the west and south walls.

**Ceiling:** Absorptive materials such as acoustic ceiling tile or pin-fixed insulation should be applied either directly to the underside of the sound isolating ceiling or hanging on a grid below it. The material should be specified to have minimum NRC 0.70 and should cover minimum 80% of the gross ceiling area. Acceptable products include Armstrong’s Ultima ceiling tile or Johns Manville Insul-Shield 1 in. thick pin-fixed insulation.

**Floor:** VCT or carpeting

**Control Room**

**Walls:** Approximately 100 sq. ft. of absorptive wall panels with minimum NRC 0.50, such as Tectum FabriTough panels, should be applied where space is available along the west and south walls. As the panels will be below door head height, they should be specified to be impact resistant.

**Ceiling:** Absorptive materials such as acoustic ceiling tile or pin-fixed insulation should be applied either directly to the underside of the sound isolating ceiling or hanging on a grid below it. The material should be specified to
have minimum NRC 0.70 and should cover minimum 80% of the gross ceiling area. Acceptable products include Armstrong’s Ultima ceiling tile or Johns Manville Insul-Shield 1 in. thick pin-fixed insulation.

Floor: VCT or carpeting on the raised floor surface

Audio / EIC Room

Walls: Approximately 5 sq. ft. of absorptive wall panels with minimum NRC 0.50, such as Tectum FabriTough panels, should be applied to the east and south walls. As the panels will be below door head height, they should be specified to be impact resistant.

Ceiling: Absorptive materials such as acoustic ceiling tile or pin-fixed insulation should be applied either directly to the underside of the sound isolating ceiling or hanging on a grid below it. The material should be specified to have minimum NRC 0.70 and should cover minimum 80% of the gross ceiling area. Acceptable products include Armstrong’s Ultima ceiling tile or Johns Manville Insul-Shield 1 in. thick pin-fixed insulation.

Floor: VCT or carpeting on the raised floor surface

I trust you will find this information helpful. If you have any questions, please do not hesitate to contact us.

Sincerely,

Wrightson, Johnson, Haddon, & Williams, Inc.

Emily Piersol
Designer

Cc: Tom Falgien WJHW, Inc.
SETTING THE STANDARD FOR SOUND-CONTROL DOOR SYSTEMS

ENGINEERED AND FACTORY ASSEMBLED ADVANTAGES

IAC doors are produced as engineered systems. Each complete system, including leaf, split-frame, seals, hinges, and latching hardware, is factory assembled and laboratory tested for performance in our NVLAP (National Voluntary Laboratory Accreditation Program) accredited aero / acoustic laboratory. All design changes or material substitutions are fully tested in the laboratory prior to incorporation.

Every door is factory assembled and functionally tested for alignment, fit, and ease of operation prior to shipment. This reduces installation costs and virtually eliminates in-field construction errors that can affect performance. IAC guarantees the in-field performance of the specification and, if necessary, will dispatch engineers to field-test and troubleshoot the situation.

PERFORMANCE AND FLEXIBILITY

IAC offers a wide range of products designed for architectural, industrial, and security applications. IAC’s Noise-Lock® Doors feature:

- Performance ratings from STC 43 to more than STC 70
- Unlimited door opening sizes
- Design flexibility. All doors available in standard and custom designs.
- Full-vision and wood veneer products
- High-performance doors for both architectural and industrial applications
- UL fire-ratings of 20 min.; 45 min.; 60 min.; 90 min., and 3 hours
- Blast-resistance ratings to 3psi
- Radio Frequency Shielding of 50 dB and 100 dB
- DCID approval for SCIF
- ADA compliance
- Quick-Ship programs
### High-Performance Features

- Self-aligning magnetic seals assure long life and high field performance even under constant use.
- Cam-lift hinges lower and seal the door to the floor eliminating high-maintenance, automatic drop seals.
- No-sill condition facilitates wheelchair access; doors conform to Americans with Disabilities Act (ADA).
- Split frames eliminate in-field grouting to achieve the specified acoustic performance and provide time-saving installation.
- Construction damage to system is minimized because the door assembly is installed during the finish-phase of construction.

### Security and RF Shielding

IAC’s security doors are constructed from 14-gauge welded steel and feature security hinges. Options include on / off duty tumblers and cipher access control. They can be blast resistant to 3psi and may be ordered with or without RF shielding at either 100 dB or 50 dB construction options.

IAC security doors meet the following US Government specifications:
- DIAM 50-3, all sound groups
- DCID 1/21.1
- AFP 88-26
- NSA 65-6, 65-5, or NSA 73-2a
- NTISSI 7000

### Function and Form

Sound control doors from IAC are designed to both work hard and look good. Optional finishes include choices from among 62 different wood veneers along with paint and metal. Doors may also be specified with full or partial vision glass options.

### Door Configurations

<table>
<thead>
<tr>
<th>Single / Double / Multi-leaf</th>
<th>Flush Architectural</th>
<th>Sliding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood Veneer</td>
<td>Swinging / Pivoting</td>
<td>Hatch</td>
</tr>
<tr>
<td>Full-Vision</td>
<td>High Performance</td>
<td>Tandem</td>
</tr>
<tr>
<td></td>
<td>Vertical Lift</td>
<td>Security / RF</td>
</tr>
</tbody>
</table>

IAC offers the widest range of sound-control doors in the industry
### ACOUSTIC PERFORMANCE SELECTION DATA - IAC NOISE-LOCK DOORS

<table>
<thead>
<tr>
<th>Glazing Type and Thickness</th>
<th>1/3 OCTAVE BAND CENTER FREQUENCY, Hz</th>
<th>Sound Transmission Loss, DB</th>
<th>Test Report</th>
<th>WT, lb/ft² (kg/m²)</th>
<th>Min. Frame Depth in (mm)</th>
<th>Glazing Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>28 30 34 29 34 36 36 38 30 37 40 41 46 50</td>
<td>54-1-83 (1983)</td>
<td>8 (39)</td>
<td>4 (102)</td>
<td>b</td>
<td></td>
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<tr>
<td>41</td>
<td>30 29 32 35 35 37 38 38 37 41 64 48 50 53 51</td>
<td>9 (44)</td>
<td>4 (102)</td>
<td>c</td>
<td></td>
<td></td>
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<tr>
<td>47</td>
<td>28 26 34 33 36 46 49 51 53 56 60 63 58 57 61 65</td>
<td>453-82-1 (1983)</td>
<td>10 (49)</td>
<td>4 (102)</td>
<td>d</td>
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</tr>
</tbody>
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### ACOUSTIC PERFORMANCE SELECTION DATA - IAC NOISE-LOCK WINDOWS

<table>
<thead>
<tr>
<th>Glazing Type and Thickness</th>
<th>1/3 OCTAVE BAND CENTER FREQUENCY, Hz</th>
<th>Sound Transmission Loss, DB</th>
<th>Test Report</th>
<th>WT, lb/ft² (kg/m²)</th>
<th>Min. Frame Depth in (mm)</th>
<th>Glazing Type</th>
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</thead>
<tbody>
<tr>
<td>57</td>
<td>40 41 46 47 47 50 53 57 56 60 63 66 67 75 79 81</td>
<td>VW-847-2-86 (1986)</td>
<td>18 (88)</td>
<td>10 (254)</td>
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<tr>
<td>58</td>
<td>40 39 44 43 50 54 55 58 60 64 66 64 63 62 63 64</td>
<td>AC-454-89 (1989)</td>
<td>27 (132)</td>
<td>18 (457)</td>
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<tr>
<td>59</td>
<td>42 45 50 48 49 53 57 58 58 59 63 67 72 79 81 82</td>
<td>VW-586-2-95 (1985)</td>
<td>30 (190)</td>
<td>10 (254)</td>
<td>h</td>
<td></td>
</tr>
</tbody>
</table>

### Notes
- a) single magnetic; b) double magnetic; c) magnetic tri-seal; d) magnetic compression tri-seal; e) manual labyrinth wiper; f) automatic pneumatic; g) automatic labyrinth compression.

---

**European Countries**
- **Denmark**
  - IAC Nordic A/S
  - Tel: +45 36 77 88 00
- **France**
  - IAC Boët Stopson SA
  - Tel: +33 (0) 3 20 05 88 88
- **Germany**
  - IAC GmbH
  - Tel: +49 (0) 2163 99910
- **Italy**
  - IAC Stopson Italiana SpA
  - Tel: +39 02 48 44 22 1
- **Spain**
  - IAC Stopson Española SA
  - Tel: +34 (0) 3 20 05 88 88
- **United Kingdom**
  - IAC Ltd.
  - Tel: +44 (0) 1962-873000
EXISTING CONCRETE STRUCTURE

APPROXIMATELY 1/2 IN. GAP SEPARATING GYPSUM BOARD FROM EXISTING CONCRETE BEAM

SUPPORT GYPSUM BOARD CEILING WITH SPRING AND NEOPRENE ISOLATION HANGERS SIMILAR TO MASON INDUSTRIES’ 30N HANGERS. ISOLATORS SHOULD BE LOCATED AS CLOSE TO CONCRETE STRUCTURE AS POSSIBLE.

TWO LAYERS 5/8 IN. TYPE X GYPSUM BOARD SEALED TO PERIMETER WALLS WITH NON-HARDENING ACOUSTICAL SEALANT.

MINIMUM 6 IN. THICK UNFACED BATT FIBERGLASS INSULATION

PARTITION AS SCHEDULED
Acoustical Sealing of Penetrations Through Sound Isolating Ceiling

UNIVERSITY OF COLORADO
CONTROL ROOM & EDIT BAYS

- Insert resilient filler around penetration: mineral or glass wool insulation, Illbruck Will-Seal compressible foam tape, or 12mm (1/2-inch) thick Neoprene sponge rubber.

- Use acoustical drywall sealant (acrylic latex) to seal the gap airtight all the way around the penetration, on both sides.

- Sound isolating ceiling as scheduled.
UNIVERSITY OF COLORADO
CONTROL ROOM & EDIT BAYS

- Insert resilient filler inside pipe sleeve: mineral or glass wool insulation, Illbruck Will-Seal compressible foam tape, or 12mm (1/2-inch) thick Neoprene sponge rubber.

- Use acoustical drywall sealant (acrylic latex) to seal the gap airtight all the way around the penetration, on both sides.

- Metal pipe sleeve grouted into wall with 1/2-inch to 3/4-inch clearance around penetrating element.

- Partition as scheduled.

**NOTE:** Support pipe or duct on both sides of the wall so the pipe/duct is centered in sleeve. Do not allow pipe or duct to bear on or touch wall.

Wrightson, Johnson, Haddon, & Williams, Inc.  Dallas, TX  (972) 934-3700 / Fax: (972) 934-3720
Acoustical Sealing of Penetrations Through Drywall Partitions

UNIVERSITY OF COLORADO
CONTROL ROOM & EDIT BAYS

- Insert resilient filler between studs and penetrating element: mineral or glass wool insulation, Illbruck Will-Seal compressible foam tape, or 12mm (1/2-inch) thick Neoprene sponge rubber.

- Use acoustical drywall sealant (acrylic latex) to seal the gap airtight all the way around the penetration, on both sides.

- Frame or case around the penetration with studs. Hold both the studs and the drywall 6mm (1/4-inch) clear of the penetrating element to avoid transmitting vibration into the drywall structure.

- Partition as scheduled.

NOTE: Ducts are typically hung prior to erection of drywall. This makes it easier to frame around the ductwork without letting anything touch. Ducts shall neither touch nor bear upon the wall they pass through.

Wrightson, Johnson, Haddon, & Williams, Inc. Dallas, TX (972) 934-3700 / Fax: (972) 934-3720
Abuse-resistant Tectum Fabri-Tough acoustical panels set a new standard for durability in fabric wrap wall panel systems.

Control noise efficiently, economically and attractively in open plan, closed or mixed-use space with the Fabri-Tough wall panel system. Efficiently because Tectum panels are known for sound absorption. Economically because these panels are competitively priced and will last longer than ordinary, soft-base panels. Attractively because they come in your choice of fabric colors that coordinate with popular contract furnishings.

Tackability is another feature of all Tectum Fabri-Tough panels. They can be used repeatedly as bulletin or display boards without visible effect, making them ideal for work areas, conference rooms and classrooms.

Depending on mounting, the Fabri-Tough wall panel system can provide NRC’s from .50 to .90. They are available 1” thick, 2′x4′ up to 10′. Fabri-Tough wall panels can be field cut to desired size. Mounting is quick and easy via the internal spline system. The wall panel fabric is wrapped around the edges of the long sides to the kerf. Panels are installed by inserting the furnished vinyl splines into the kerf, then fastening the splines to the wall or other structure.

DÉCOR FABRI-TOUGH PANELS
Tectum Décor Fabri-Tough Panels have fully wrapped edges and are attached using 20” Z-Clips allowing for panels to be strategically placed in a space as opposed to consecutive attachment.

Tectum Fabri-Tough and Décor Panels have a flame spread of 25 or less under the ASTM E84 test method. Both panels meet the requirements of the room corner fire test (UBC 8-2 or equivalent) for use in areas not protected by automatic sprinklers.

For panels to be used in recessed areas, some field adjusting may be necessary.
TECTUM ACOUSTICAL PERFORMANCE

FABRI-TOUGH WALL PANEL SYSTEM

<table>
<thead>
<tr>
<th>Panel Type</th>
<th>Nominal Thickness (inches)</th>
<th>Actual Size (inches)</th>
<th>Edge Detail</th>
<th>Factory Finish</th>
<th>Light Reflectance</th>
<th>Flame Spread</th>
<th>Weight LBS/SF</th>
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<tr>
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SOUND ABSORPTION COEFFICIENTS

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<tr>
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<th>1000</th>
<th>2000</th>
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<th>MOUNTING</th>
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<td>.80</td>
<td>.84</td>
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TECTUM PRODUCT

<table>
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<tr>
<th>Panel Type</th>
<th>Nominal Thickness (inches)</th>
<th>Actual Size (inches)</th>
<th>Edge Detail</th>
<th>Factory Finish</th>
<th>Light Reflectance</th>
<th>Flame Spread</th>
<th>Weight LBS/SF</th>
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<tbody>
<tr>
<td>Fabric Wrapped Tectum Panel</td>
<td>1</td>
<td>24 x 24 to 120 in 12” increments</td>
<td>Long Edges, Fabric Wrapped to Kerf</td>
<td>Fabric Selection</td>
<td>N/A</td>
<td>0-25</td>
<td>1.63</td>
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<tr>
<td>Fabric Wrapped Tectum Panel</td>
<td>1, 2</td>
<td>24 x 48, 72, 96</td>
<td>Fabric returned at edges to back</td>
<td>Fabric Selection</td>
<td>N/A</td>
<td>0-25</td>
<td>1.63</td>
</tr>
</tbody>
</table>

FABRI-TOUGH DECOR PANELS

ENVIRONMENTAL STATEMENT

Tectum panels are made from sustainable domestic, renewable raw materials. The wood excelsior is harvested from new forest growth that reaches maturity in 25-30 years. Tectum Inc. only purchases excelsior from companies that are part of the Sustainable Forestry Initiatives (SFI) Program. This program is a comprehensive system of objectives and performance measures that integrates the perpetual growing and harvesting of trees with the protection of wildlife, plants, soil, and water quality.

The primary source of magnesium oxide used in the binder is seawater. The silicate used is made from sand. Tectum Inc. recovers waste magnesium and recycles water during the manufacturing process. The recovered magnesium waste is used in the manufacturing of magnesium sulfate, a primary ingredient in the binder.

These recovery programs have been successful in reducing the water consumed and in reducing the magnesium requirement for the manufacture of magnesium sulfate. Tectum products continue to meet the needs of owners, architects, and engineers that require “green” building products.

TECTUM PRODUCTS AND LEED

The Leadership in Energy and Environmental Design (LEED®) Green Building Rating System represents the U.S. Green Building Council’s effort to provide a national standard for what constitutes a “green building.” Through its use as a design guideline and third-party certification tool, it aims to improve occupant well-being, environmental performance and economic returns of buildings using established and innovative practices, standards and technologies.

The LEED building rating system has been established to evaluate every aspect of the construction process and building components used in new and existing buildings.

While the main emphasis is on energy efficiency, conservation and the overall “health” of the building, the use of “green” products contributes favorably to the overall rating of a building. Six rating categories make up the project checklist. Four of the six categories are not applicable to Tectum products. Categories four and five, Materials and Resources and Indoor Environmental Quality, consist of 10 elements applicable to the use of Tectum products. Tectum products contribute favorably in all ten areas to the overall positive rating of the building.

For more information, see Marketing Bulletin M-81, available on our website. Tectum is proud to have its products listed in the GreenSpec Directory® published by Building Green from the editors of Environmental Building News. Tectum Roof Deck is noted on page 69, section 3511 and Tectum Interior products are listed on page 230, section 9512.
ULTIMA®
Square Lay-in
fine texture

Key Selection Attributes
- Smooth, clean, durable finish
- Washable, impact-resistant
- Scratch-resistant, Stain-resistant
- Scrubbable and water-repellent (Ultima High Washability)
- Excellent sound absorption
- Ceiling-to-Ceiling® Post-consumer Recycled Content options: Items 1910HRC, 1913HRC, 65% Post-consumer; 15% Post-consumer
- Now available with AirGuard™ Coating - reduces formaldehyde in the air. Refer to CS-4311 Ultima with AirGuard Coating data page.
- Visual coordinates with Optima® for mixed (open/closed plan) applications
- Now available with Ultima® Cre8te® custom colors and images
- Non-directional visual reduces installation time and scrap
- Compatible with TechZone™ Ceiling Systems
- Smaller size panels available (1 carton min. order). Info: armstrong.com/specials
- Plank sizes available (search: Ultima Plank)
- Meets USDA/FSIS guidelines for use in food processing areas (items 1935 and 1936)
- 30-Year Limited System Warranty against visible sag, mold/mildew, and bacterial growth

Typical Applications
- Office
- Healthcare - acetics in addressing HIPAA and FGI acoustical requirements
- Classrooms
- Corridors
- Lobbies/reception areas
- Department stores/retail
- Kitchens, dining rooms, and food preparation areas (items 1935, 1936)

Detail (Other Suspension Systems compatible. Refer to listing on page 186.)

Color
- White (000)

183
TechLine® 877 ARMSTRONG
armstrong.com/ceilings (search: ultima)
### Visual Selection

<table>
<thead>
<tr>
<th>Edge Profile</th>
<th>Grid Drawings</th>
<th>Item No.</th>
<th>Dimensions</th>
<th>UL Listed</th>
<th>Acoustics</th>
<th>Fire Rating</th>
<th>Light Reflect</th>
<th>Sag Resistance</th>
<th>Anti-Microbial</th>
<th>Durability</th>
<th>Recycle Program</th>
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<tbody>
<tr>
<td>ULTIMA</td>
<td></td>
<td>1910</td>
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<td>HumiGuard Plus Block+</td>
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**ULTIMA Health Zone™**

<table>
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<th>Item No.</th>
<th>Dimensions</th>
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<th>Acoustics</th>
<th>Fire Rating</th>
<th>Light Reflect</th>
<th>Sag Resistance</th>
<th>Anti-Microbial</th>
<th>Durability</th>
<th>Recycle Program</th>
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<tbody>
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<td>Block+</td>
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<td>Impact Scratch</td>
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</table>

### ULTIMA High Washability

<table>
<thead>
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<th>Item No.</th>
<th>Dimensions</th>
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<th>Fire Rating</th>
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<th>Sag Resistance</th>
<th>Anti-Microbial</th>
<th>Durability</th>
<th>Recycle Program</th>
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<tbody>
<tr>
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<td>1835</td>
<td>2' x 2' x 3/4&quot;</td>
<td>0.70</td>
<td>35</td>
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<td>Block+</td>
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<td>35</td>
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<td>0.60</td>
<td>Block+</td>
<td>Wash Scrub</td>
<td>Impact Scratch</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Physical Data

- **Material**: Wet-formed mineral fiber with Durabrite® acoustically transient membrane
- **1835, 1836**: Wet-formed mineral fiber with Durabrite® acoustically transient water-repellent membrane
- **Surface Finish**: Durabrite with factory-applied latex paint
- **Fire Performance**:
  - ASTM E84 and CAN/ULC-S102 Surface Burning Characterization: Flame Spread Index 25 or less, Smoke Developed Index 50 or less (UL labeled)
  - FDM F1354: Class A, Type IV, Form 2, Pattern E, Fire Class A

### Performance Selection

- **Durability**
  - 30-Year Performance Guarantee & Warranty Information: Details in back of catalog or at armstrong.com/warranty
  - Cleaning Recommendations: (Rooms 1835, 1836)
    - To clean panel, use a clean, white cloth with water or a mild detergent and wipe surface. To disinfect panel, lightly spray surface and wipe clean with a clean, white cloth. Acceptable disinfectants include:
    - Sodium Hypochlorite
    - Isopropyl alcohol
    - Hydrogen peroxide
    - Quaternary ammonium
  - Weight: 29 lbs/ctn
  - 100% Non-Combustible
  - 1.28 lbs/ft²; 48 fl/ctn
PRODUCT DESCRIPTION

Insul-SHIELD is a series of semi-rigid or rigid thermal and acoustical fiber glass insulating boards for custom curtain wall applications. They are made from inorganic glass fibers bonded with a thermosetting binder. The insulating boards are typically used where framing is not present.

Note: Insul-SHIELD may be manufactured either with or without a formaldehyde-based binder. Check with your sales representative for availability of Formaldehyde-free™ Insul-SHIELD in your area.

APPLICATIONS

- **New and Retrofit Construction** – Insul-SHIELD insulation provides thermal and acoustical insulating values for exterior curtain wall cavities, parking structures, mechanical rooms, theaters, casinos and other commercial construction applications. The insulating boards are typically used where framing is not present. (I/S 100 is often used in shaft wall applications.)

- **Custom Curtain Wall Construction** – Exterior curtain wall cavities – Insul-SHIELD is exceptionally well suited to curtain wall construction in terms of both installation and performance. When used in the exterior envelope of steel-framed buildings, it helps reduce heat loss in the winter and heat gain in the summer. The result is an attractive, efficient thermal enclosure that significantly reduces the cost of air treatment, cuts long-term energy expenses and improves life-cycle costs. The insulation, in sizes up to 56" x 84" (1.42 m x 2.14 m), is easily installed by one person. Insul-SHIELD is available in a variety of densities, thicknesses and facings for custom curtain wall applications. It can be custom-manufactured to precise dimensions to fit specific spandrel panel designs.

- **Standard Metal Panel Construction** – Insul-SHIELD offers a variety of sizes, densities and facings for on-the-job or in-the-shop insulation of metal panel buildings such as power plants, assembly buildings, sports facilities and other commercial facilities.

- **General Construction** – A versatile insulation, Insul-SHIELD is also an ideal thermal barrier for masonry or concrete structures such as shopping centers, banks and many other types of low-rise commercial or institutional buildings. It is also ideal for use in parking garage ceilings. In masonry applications, semi-rigid and rigid Insul-SHIELD boards faced with an FSK vapor retarder are installed between "Z" or hat channels applied directly to the masonry surface. Normally, gypsum board and/or architectural panels are then used as interior surfaces.

- **Theaters** – With a state-of-the-art acrylic-coated surface, Insul-SHIELD Coated Black is an ideal backdrop for theater screens. The opaque surface absorbs both sound and light, eliminating concern about back-scatter into the viewing arena.

PERFORMANCE ADVANTAGES

- **Cost-effective** – ease of handling and fabrication plus light weight make for easy, fast installation and low total applied cost.

- **Thermally Efficient** – provides effective resistance to heat transfer with R-values up to R-17.4 (RSI-3.06).

- **Acoustically Efficient** – reduces transmission of sound through roofs and walls.

- **Fire-resistant and Noncombustible** – (see Specification Compliance).

- **Moisture-resistant** – vapor-retarder facings resist water vapor transmission (see Specification Compliance).

- **Noncorrosive** – does not accelerate corrosion of pipes, wiring or metal studs.

- **Durable** – unaffected by moisture, oil, grease and most acids. It will not rot, mildew or otherwise deteriorate, preventing slumping and uninsulated voids.

- **Easy to Handle** – unlike some products that are friable, fiber glass maintains its physical integrity during handling.

- **Self-supporting** – because of its rigidity, Insul-SHIELD 300 and 600 can often be attached without framing.
AVAILABLE FORMS

Insul-SHIELD is available unfaced or with FSK-25, PSK, black mat or coated black facing.

<table>
<thead>
<tr>
<th>Unfaced Boards</th>
<th>FSK-25 or PSK-Faced Boards</th>
<th>Black Mat Boards</th>
<th>Coated Black Rolls</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Standard board size – 24&quot; x 48&quot; (610 mm x 1219 mm) available for all densities.</td>
<td>• Standard board size – 24&quot; x 48&quot; (610 mm x 1219 mm) available for all densities.</td>
<td>• Standard board size – 24&quot; x 48&quot; (610 mm x 1219 mm) available for all densities.</td>
<td>• Roll form – I/S 100 and 150 available in 16&quot;, 24&quot; and 48&quot; (406 mm, 610 mm, and 1219 mm) widths.</td>
</tr>
<tr>
<td>• Nonstandard sizes – furnished upon request in many nonstandard lengths and widths pre-cut to meet specific dimensions.</td>
<td>• Nonstandard sizes – furnished upon request in many nonstandard lengths and widths pre-cut to meet specific dimensions.</td>
<td>• Nonstandard sizes – furnished upon request in many nonstandard lengths and widths pre-cut to meet specific dimensions.</td>
<td>• Available in 1&quot; (25 mm) and 2&quot; (51 mm) thicknesses.</td>
</tr>
<tr>
<td>Insul-SHIELD boards are designed for custom curtain wall applications.</td>
<td>Faced Insul-SHIELD boards can be used where a vapor barrier is needed. FSK facing has the best fire performance characteristics and helps maximize lighting efficiency.</td>
<td>Insul-SHIELD Black provides a semi-rigid substrate beneath the fabric treatment used on theater side walls. The black, mat-faced insulation provides adequate shadowing behind any surface treatment.</td>
<td>Insul-SHIELD Coated Black is ideal for theater applications. Product shown was specified with both face and edge coating.</td>
</tr>
</tbody>
</table>

INSTALLATION

Insul-SHIELD can be easily cut and friction-fit between vertical or Z-shaped framing or hat channels applied directly to a masonry surface. The insulation can also be installed with impaling pins or with suitable adhesives.

In standard metal panel construction applications, Insul-SHIELD is field-installed between an interior liner and the outer metal panel. Normally, gypsum board and/or architectural panels are then used as interior surfaces. Some trimming may be necessary if used in ceiling grids, as this product is a commercial-use board.

Note: In colder climate areas, vapor retarders (whether attached to the insulation or applied separately) are often placed toward the heated or conditioned side of the wall. This is done to reduce water vapor penetration into the wall from the building interior. Conversely, in predominantly hot, humid climates local practices often call for placing the vapor retarder toward the outside of the wall cavity. Check your local building codes for vapor retarder requirements.

Recommended Pin Patterns

I/S 100, 150, 225, 300 and 600: pins should be placed approximately 3"–5" (76 mm–127 mm) from the edges of the product.
**SOUND ABSORPTION DATA**

<table>
<thead>
<tr>
<th>Type</th>
<th>&quot;k&quot;- Values</th>
<th>Thickness</th>
<th>Thickness</th>
<th>Facing**</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/S 100</td>
<td>0.27</td>
<td>0.039</td>
<td>1½</td>
<td>38</td>
</tr>
<tr>
<td>I/S 150</td>
<td>0.24</td>
<td>0.035</td>
<td>1, 1½, 2½, 3, 3½, 4</td>
<td>Unfaced</td>
</tr>
<tr>
<td>I/S 225</td>
<td>0.23</td>
<td>0.033</td>
<td>1, 1½, 2½, 3, 3½, 4</td>
<td>Unfaced</td>
</tr>
<tr>
<td>I/S 300</td>
<td>0.23</td>
<td>0.033</td>
<td>1, 1½, 2½, 3, 3½, 4</td>
<td>Unfaced</td>
</tr>
<tr>
<td>I/S 600</td>
<td>0.22</td>
<td>0.032</td>
<td>1, 2</td>
<td>Unfaced, FSK-25, PSK</td>
</tr>
<tr>
<td>I/S Coated Black</td>
<td>0.25</td>
<td>0.036</td>
<td>25, 51</td>
<td>Durable black-coated surface</td>
</tr>
</tbody>
</table>

**STANDARD DIMENSIONAL DATA AND FACINGS**

<table>
<thead>
<tr>
<th>Type</th>
<th>&quot;k&quot;- Values</th>
<th>Thickness</th>
<th>Thickness</th>
<th>Facing**</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/S 100</td>
<td>0.27</td>
<td>0.039</td>
<td>1½</td>
<td>Unfaced</td>
</tr>
<tr>
<td>I/S 150</td>
<td>0.24</td>
<td>0.035</td>
<td>1, 1½, 2½, 3, 3½, 4</td>
<td>Unfaced</td>
</tr>
<tr>
<td>I/S 225</td>
<td>0.23</td>
<td>0.033</td>
<td>1, 1½, 2½, 3, 3½, 4</td>
<td>Unfaced</td>
</tr>
<tr>
<td>I/S 300</td>
<td>0.23</td>
<td>0.033</td>
<td>1, 1½, 2½, 3, 3½, 4</td>
<td>Unfaced</td>
</tr>
<tr>
<td>I/S 600</td>
<td>0.22</td>
<td>0.032</td>
<td>1, 2</td>
<td>Unfaced, FSK-25, PSK</td>
</tr>
<tr>
<td>I/S Coated Black</td>
<td>0.25</td>
<td>0.036</td>
<td>25, 51</td>
<td>Durable black-coated surface</td>
</tr>
</tbody>
</table>

**SOUND ABSORPTION DATA**

1" (25 mm) Thickness Unfaced (Type “A” Mounting)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Density</th>
<th>Typical Coefficients by Frequency (Hz)</th>
<th>&quot;R&quot;</th>
<th>&quot;RSI&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/S 150</td>
<td>1.5</td>
<td>24.0</td>
<td>0.63</td>
<td>0.87</td>
</tr>
<tr>
<td>I/S 225</td>
<td>2.25</td>
<td>36.1</td>
<td>0.69</td>
<td>0.95</td>
</tr>
<tr>
<td>I/S 300</td>
<td>3.0</td>
<td>48.1</td>
<td>0.75</td>
<td>0.99</td>
</tr>
<tr>
<td>I/S 600</td>
<td>6.0</td>
<td>96.1</td>
<td>0.85</td>
<td>1.04</td>
</tr>
</tbody>
</table>

2" (51 mm) Thickness Unfaced (Type “A” Mounting)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Density</th>
<th>Typical Coefficients by Frequency (Hz)</th>
<th>&quot;R&quot;</th>
<th>&quot;RSI&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/S 150</td>
<td>1.5</td>
<td>24.0</td>
<td>1.10</td>
<td>1.11</td>
</tr>
<tr>
<td>I/S 225</td>
<td>2.25</td>
<td>36.1</td>
<td>1.15</td>
<td>1.14</td>
</tr>
<tr>
<td>I/S 300</td>
<td>3.0</td>
<td>48.1</td>
<td>1.11</td>
<td>1.08</td>
</tr>
<tr>
<td>I/S 600</td>
<td>6.0</td>
<td>96.1</td>
<td>1.10</td>
<td>1.07</td>
</tr>
</tbody>
</table>

2" (51 mm) Thickness FSK-25/PSK Faced (Type “A” Mounting)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Density</th>
<th>Typical Coefficients by Frequency (Hz)</th>
<th>&quot;R&quot;</th>
<th>&quot;RSI&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/S 150</td>
<td>1.5</td>
<td>24.0</td>
<td>1.11</td>
<td>0.58</td>
</tr>
<tr>
<td>I/S 225</td>
<td>2.25</td>
<td>36.1</td>
<td>1.00</td>
<td>0.75</td>
</tr>
<tr>
<td>I/S 300</td>
<td>3.0</td>
<td>48.1</td>
<td>0.85</td>
<td>0.73</td>
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<tr>
<td>I/S 600</td>
<td>6.0</td>
<td>96.1</td>
<td>0.68</td>
<td>0.47</td>
</tr>
</tbody>
</table>

I/S Coated Black; 1.5 pcf (24.0 kg/m³) Density (Type “A” Mounting)**

<table>
<thead>
<tr>
<th>Thickness</th>
<th>&quot;k&quot;- Values</th>
<th>Thickness</th>
<th>&quot;R&quot;</th>
<th>&quot;RSI&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.09</td>
<td>0.29</td>
<td>0.89</td>
<td>0.79</td>
</tr>
<tr>
<td>2</td>
<td>0.23</td>
<td>0.73</td>
<td>1.05</td>
<td>1.07</td>
</tr>
</tbody>
</table>

* Product sizes vary by plant locations; consult your Johns Manville sales representative for other available sizes.
** Meets HH-B-100 B, Type I and II specifications.
*** Noise Reduction Coefficient.
RECOMMENDED STORAGE AND TRANSPORT

Store insulation indoors. Keep insulation clean and dry at all times. When transporting, cover completely with a waterproof tarpaulin as necessary.

SPECIFICATION COMPLIANCE*

Insul-SHIELD complies with applicable ASTM and federal specifications and the standards of ICBO, BOCA and SBCCI building codes. It meets air erosion standards up to 1,800 fpm (9.14 m/s) per UL 181.

<table>
<thead>
<tr>
<th>Type</th>
<th>I/S 100</th>
<th>I/S 150</th>
<th>I/S 225</th>
<th>I/S 300</th>
<th>I/S 600</th>
<th>Coated I/S Black</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM C 612, Type IA, Category 1**</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tr>
<tr>
<td>ASTM C 612, Type IB, Category 1**</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ASTM C 612, Type IB, Category 2**</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ASTM C 653, Type I and II**</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ASTM C 685, Type I**</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ASTM C 685, Type III, ** Class A, Category 1 or 2</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ASTM E 136 (Noncombustible)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ASTM E 84 (Flame/Smoke 25/50 or less)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

* When ordering material to comply with any government specification (or any other listed specification), a statement of that fact must appear on the purchase order.

** Exceptions to ASTM standards: Not tested for compression resistance. Not tested for use at elevated temperatures. Corrosiveness is tested in galvanized steel instead of plain low-carbon steel. Type 100 has k value of 0.27 Btu-in./(hr.-sq. ft.-F) at 75˚ F mean temperature.

SHORT FORM SPECIFICATION

All insulation shown on drawings or specified herein shall be “Johns Manville Insul-SHIELD Thermal and Acoustical Insulation.” Thermal resistance “R” (RSI) values of the insulation shall be R (RSI) _______ in ceilings, R (RSI) _______ in walls, and R (RSI) _______ in floors over unheated spaces. The product shall have an FHC rating of 25/50 or less.

LIMITATIONS OF USE

Check applicable building codes.

Properly insulating a structure using Johns Manville building insulation helps preserve our environment by reducing energy consumption for heating and cooling, reducing the pollution resulting from fuel burning, reducing the emission of hazardous air pollutants during manufacturing and reducing waste through the utilization of recycled materials.

Technical specifications as shown in this literature are intended to be used as general guidelines only. The physical and chemical properties of Insul-SHIELD thermal and acoustical fiber glass insulation listed herein represent typical, average values obtained in accordance with accepted test methods and are subject to normal manufacturing variations. They are supplied as a technical service and are subject to change without notice. Any references to numerical flame spread or smoke developed ratings are not intended to reflect hazards presented by these or any other materials under actual fire conditions. Check with the sales office nearest you for current information. All Johns Manville products are sold subject to Johns Manville’s Limited Warranty and Limitation of Remedy. For a copy of the Johns Manville Limited Warranty and Limitation of Remedy or for information on other Johns Manville thermal and acoustical insulation and systems, call or write to the 800 number or address listed below.