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# 27 41 16 Broadcast Systems

Minnesota State Legislature – Phase 2 – State Office Building

**BROADCAST SYSTEM SPECIFICATIONS**

**ADDENDUM 4**
**(LINE IN LEFT MARGIN INDICATES REVISIONS)**

## PART 1 - GENERAL

### 1.01. RELATED DOCUMENTS

A. Refer to drawings related to this section.

B. Refer to the provided contract documents.

C. Refer to the provided Project Milestone Schedule.

D. Refer to the provided Bill of Materials.

E. Refer to the provided Substitution Request Form.

F. Refer to the provided Request for Information Instructions.

G. Refer to the provided Asset Tracking Requirements.

### 1.02. SUMMARY

A. Primary Parties

1. "Project Locations": any or all the following:

a. "SOB": **State Office Building**, location of
Minnesota House of Representatives Public Information Services
100 Rev Dr Martin Luther King Jr Boulevard., St Paul, MN 55155 (map)

b. "COB": **Centennial Office Building**, location of the
Temporary House Production Facilities
658 Cedar St, St Paul, MN 55155 (map)

c. "CAP": **Minnesota State Capitol**
75 Rev Dr Martin Luther King Jr Boulevard., St Paul, MN 55155 (map)

d. "MSB": **Minnesota Senate Building**, location of
Minnesota Senate Media Services
95 University Ave W, St Paul, MN 55103 (map)

2. "Owner": **Minnesota Legislative Coordinating Commission** ("LCC")
Centennial Office Building
658 Cedar St, St Paul, MN 55155

3. "Construction Manager": **JE Dunn Construction**
800 North Washington Avenue Suite 600
Minneapolis, MN 55401

4. "Design Consultant": any or all the following:

a. FinePoint Technology LLC
416 Gateway Blvd, Burnsville, MN 55337

b. SR Productions & Consulting LLC
24 Williamsburg Lane, Dayton, OH 45459

5. "Bidder": any firm receiving this specification and intending to provide a proposal to fulfill this scope of work.

6. "Contractor": the successfully awarded Bidder that, having responded to this request for proposal, has successfully executed all contract documents and shall fulfill this scope of work.

B. System Description

1. The Owner, representing the Minnesota Legislature, is soliciting proposals for the comprehensive design and installation of television broadcast systems. This project involves the Minnesota House of Representatives, the Minnesota Senate, and the Legislative Coordinating Commission. The primary objective is to install new television broadcast systems within the SOB and adjoining spaces, ensuring optimal functionality during live floor sessions, committee hearings, and press conferences.

2. The Owner is seeking a Contractor to design and install a new, modern Broadcast System. "Work" on the Broadcast System will include, but will not be limited to:

a. Control rooms, technical furniture, user stations, monitoring, KVM systems;

b. Production studios, studio camera systems, studio support equipment;

c. Master control operation equipment;

d. IP and baseband routing systems, video switchers, cameras, graphics, playout servers, captioning, test & measurement, frame syncs, utility computers, and video encoding & decoding;

e. Intercom systems, audio processing and mixing;

f. Media-over-IP Network Fabric(s), routers, switches, and infrastructure;

g. Control network routers, switches, and infrastructure;

h. Management network routers, switches, and infrastructure;

i. Transmission and air-chain equipment for fault-tolerant distribution of signals to streaming platforms and local broadcast partners;

j. Installation materials, supplies, cables, connectors, plates, and wiring.

3. The Work will primarily be located within the following buildings:

a. SOB: Renovation, restoration, and additional construction of the SOB is anticipated to be completed by mid-2027. When completed, the new facility will house nine hearing rooms, one press conference room, a black box production studio, six control rooms, an equipment rack room, multiple editing suites, and support offices.

b. CAP: State Capitol building, housing the Senate Chambers, House of Representatives Chambers, Media Hub, press distribution, CATV headend systems, multiple hearing rooms, and support facilities.

4. The Work will integrate with the existing work of others, deemed outside the scope of this engagement:

a. MSB: Senate Media Services facilities, housing multiple hearing & conference rooms, a black box production studio, five control rooms, an equipment rack room, a master control suite, multiple editing suites, and support offices.

b. COB: Temporary House Production Facilities, housing the House of Representatives production facilities until the completion of their new SOB building. This temporary space includes multiple control rooms, an equipment rack room, IDF, multiple editing suites, and support offices.

1. Migration and installation of COB systems was completed under a separate contract, prior to the start of construction of SOB.

2. Contractor shall ensure that the COB systems and existing interconnections remain fully-functional throughout Work, including,

but not limited to, bi-directional baseband video fiber conversion, intercom party-line conversion, and IP networking. See 2.04.B.a.2 below.

a. Coordinate all cutover dates with Owner and Design Consultant at least 30 days in advance.

3. The Work does not include decommissioning, demolition, and removal of existing systems from COB, unless Owner elects the option for demolition of COB equipment. See 2.10 below.

5. The Work will involve several types of rooms, each with distinct requirements:

a. Hearing & Committee Meeting Rooms

1. Small, medium, and large meeting rooms with seating for members, in front of a panel of one or more testifiers.

2. Multiple, robotically-controlled broadcast cameras will capture each hearing. Two video feeds (with one mirroring the local AV presentation), and two return video paths back to the room, will integrate with the broadcast systems.

3. Microphones for each member and the testifier(s) will be auto-mixed by the existing AV systems and then presented to the broadcast systems as two sub-mixes.

b. Press Conference Room

1. A room with a podium and seating for members of the media.

2. Multiple, robotically-controlled broadcast cameras will capture each press conference. Two video feeds (with one mirroring the local AV presentation), and two return video paths back to the room, will integrate with the broadcast systems.

3. The podium microphone(s) and room ambient mic feeds will be auto-mixed by the existing AV systems and then presented to the broadcast systems as two sub-mixes.

c. Production Control Rooms

1. Six production control rooms shall be installed in SOB. Each will accommodate multiple operators and will be capable of operating the equipment in any House Chamber, Hearing Room, Committee Meeting Room, or Press Conference Room, one at a time.

2. The control rooms shall be independent, with a dedicated video switcher, audio mixer control panel, character generator, camera control, monitoring, and utility PC(s).

3. Each operator will have video and audio monitoring, intercom devices, control panels, and/or KVM user stations installed at a dedicated workspace.

4. Any operator shall be able to access and operate the Master Control switcher soft-panels via KVM user station or router control panel.

   a. This operator will be responsible for determining which SOB Production Control Room or playback device is sent to the CAP transmission air chain(s).

   b. This operator will also be responsible for remotely controlling the existing master control switcher at CAP, and to control devices along the CAP transmission air chain(s).

d. Equipment Rack Rooms

   a. The core routing and processing equipment for these systems shall be installed in the Equipment Rack Rooms.

   b. Contractor shall provide all racks, hot/cold aisle containment, equipment, cabling, and support structures not provided by the base building.

   c. Racks shall be installed on owner-furnished raised datacenter flooring, with a plenum space beneath. Owner-furnished cable tray ~~and power receptacles~~ shall be installed above the racks. Owner-furnished power circuits shall be installed below the racks. Multiple in-row computer room air conditioning units (CRAC) shall also be owner-furnished and owner-installed.

e. Studio

   1. The SOB shall have a black-box production studio for live, live-to-tape, and editorial content production. The studio shall have an owner-furnished, owner-installed broadcast lighting grid and control system.

   2. A large LED video wall shall be installed in the Studio for digitally generated background content to be displayed during productions.

   3. Video and audio interface plates will provide signal connectivity to the rest of the spaces.

4. Multiple robotically controlled cameras, with teleprompters and program return monitors, will be able to be positioned throughout the space.

5. The studio will be wired for numerous microphones, IFB beltpacks, and a studio announce speaker system.

f. Offices

1. Equipment within numerous support offices, some with production requirements including video and audio monitoring, intercom, and/or KVM user stations, shall be installed.

2. Offices may include owner-furnished, owner-installed furniture, fixtures, and equipment (FF&E) including desks, furniture, and televisions. Contractor shall coordinate any Work involving FF&E with Owner and Design Consultant.

C. Scope of Work

1. Inclusions

a. The Contractor shall be responsible for:

1. Conforming and complying with all requirements herein;

2. Permits and work authorizations as required;

3. Onsite safety training, compliance, reporting, and incident resolution procedures;

4. Security credentialing;

5. Code compliance;

6. Demolition and disposal of existing equipment where specified, any/all existing cabling, excess Work materials, supplies, byproducts, temporary support structures, dust, debris;

7. Verification of dimensions and conditions at the job site;

8. Adherence to historical protection and preservation requirements;

9. Coordination with SOB Construction Manager, Owner, Design Consultant, and all other trades regarding:

a. master schedule, including but not limited to phasing, work sequencing, room availability;

b. storage and laydown locations;

c. jobsite access;

d. all existing and future construction site requirements, mandatory programs, quality control procedures, safety requirements;

10. Coordinating, leading, and facilitating weekly project status meetings; providing weekly written progress updates, including updated schedule, itemized task status, percentage complete, percentage remaining, dependencies; providing weekly written delay mitigation updates and plans;

11. Preparation of submittal information;

12. Coordination of Owner's production schedule, including but not limited to system outages;

13. Supplemental low voltage pathways, conduit, pull boxes;

14. Supplemental fiber optic riser and horizontal cabling (within a building), terminations, fiber patch panels, patch cables, splice trays;

15. Supplemental high voltage electric panelboards, transformers, circuits, receptacles, and support material;

16. Integration with existing facility broadcast cabling systems;

17. Integration with existing campus CATV distribution systems;

18. Integration with existing campus IP networking and fiber systems;

19. Mobile elevated work platforms (MEWPs), including scaffolding, lifts, and ladders;

20. Permanent installation of equipment, mounting brackets, materials, cabling supports;

21. Inventory tracking & asset tagging per Owner's requirements;

22. Installation of non-penetrating roof mounts, GPS antenna(s), ATSC antennas(s), conduit, conduit penetrations, fiber extension electronics and cabling, and lightning grounding protection;

23. Installation of conductors to telecommunications grounding and bonding systems;

24. System commissioning, configuration, testing, tuning and adjustments;

25. Training, Event Support, Warranty;

26. Procurement and delivery of shelf spare equipment and materials.

2. Exclusions

a. The Owner shall be responsible for:

1. Cable tray and low voltage pathways where designated in the drawings;

2. Electrical circuits, receptacles where designated in the drawings;

3. HVAC modifications and supplemental services where designated in the drawings;

4. Fire protection systems;

5. Telecom grounding and bonding systems where designated in the drawings;

6. Campus fiber optic cabling between buildings to/from designated demarcation locations.

6.7. Lighting grid, rigging, and lighting fixtures within SOB 0G102 Studio.

b. The Contractor shall coordinate with the Owner and Design Consultant to ensure planning and execution of the Owner's scope is adequate, appropriate, sufficient, and necessary.

1.03. RELATED SECTIONS

A. None.

1.04. REFERENCES

A. Refer to the following codes, associations, acts and agencies, as required by law:

1. Federal Communications Commission (FCC).

2. National Fire Protection Association (NFPA 5000 – Building Construction and Safety Code)

3. National Electric Code (NFPA 70, NEC).

4. National Electrical Safety Code (NESC).

5. American Society of Testing Material (ASTM).

6. National Electrical Manufacturers Association (NEMA).

7. Institute of Electrical and Electronics Engineers (IEEE).

8. Underwriters Laboratories (UL).

9. Americans with Disabilities Act (ADA).

10. Uniform Building Code (UBC).

11. All other applicable, national, state, and local codes.

B. Refer to the latest version of the following standards:

1. EIA/TIA 310D – Cabinets, Racks, Panels and Associated Equipment.

2. ASCE 7 – Minimum Design Loads for Buildings and Other Structures.

3. ANSI/AVIXA 1M-2009 – Audio Coverage Uniformity in Enclosed Listening Areas

4. ANSI/AVIXA 2M-2010 – Standard Guide for Audiovisual Systems Design and Coordination Process (Project Management process)

5. ANSI/AVIXA 4: 2012 – Audiovisual Systems Energy Management

6. ANSI/AVIXA V202.01:2016 – Display Image Size for 2D Content in Audiovisual Systems

7. ANSI/BICSI N3-20, Planning and Installation Methods for the Bonding and Grounding of Telecommunication and ICT Systems and Infrastructure

8. AV 9000:2012 – Quality Management System Conduit, pathway, and dedicated equipment room considerations

9. American National Standards Institute/Telecommunications Industries Association (ANSI/TIA)

   a. ANSI/TIA-568.0-D Generic Telecommunications Cabling for Customer Premises

b. ANSI/TIA-568.1D Commercial Building Telecommunications Cabling Standard

c. ANSI/TIA-569-D Commercial Building Standard for Telecommunications Pathways and Spaces

d. ANSI/TIA-606-C Administration Standard for Commercial Telecommunications Infrastructure

e. ANSI-S4.48 - Application of connectors, part 1, XLR-type polarity and gender

10. Institute of Electrical and Electronics Engineers (IEEE)

a. IEEE 1588-2002, 1588-2008, 1588-2019 Precision Time Protocol

11. Society of Motion Picture Experts (SMPTE)

a. ST 274, ST 296 and others related to Image Sample Structures

b. ST 292-1, ST 372 and others related to 1.5 Gb/s Signal/Data Serial Interface

c. ST 425-1, ST 425-3 and others related to 3 Gb/s Signal/Data Serial Interface

d. ST 2081-10, ST 2081-11 and others related to 6 Gb/s Signal/Data Serial Interface

e. ST 2082-1, ST 2082-10 and others related to 12 Gb/s Signal/Data Serial Interface

f. ST 2110 suite and others related to Professional Media Over Managed IP Networks

C. Refer to the latest version of the following industry best practices:

1. Davis, Gary, and Ralph Jones. *The Sound Reinforcement Handbook*. Hal Leonard Corporation, 2000.

2. Davis, Don, et al. *Sound System Engineering*. Focal Press, Taylor & Francis Group, 2013.

3. Giddings, Philip. *Audio Systems: Design and Installation*. Sams, 1990.

4. Horie, Y., editor. Shock Wave Science and Technology Reference Library, Vol. 2: Solids I. 2007th ed., Springer, 2007.

5. Whitaker, Jerry C., editor. *Electronic Systems Maintenance Handbook, Second Edition*. 2nd ed., CRC Press, 2001.

6. Whitaker, Jerry, and Society of Broadcast Engineers. The SBE Broadcast Engineering Handbook: A Hands-on Guide to Station Design and Maintenance. McGraw-Hill Professional, 2016.

7. AV Design Reference Manual – from AVIXA International.

8. Audiovisual System Design and Coordination Components – from AVIXA International.

-- END OF PART 1 --

# PART 2 - PRODUCTS & SERVICES

## 2.01. GENERAL

A. All product, equipment, and material shall be new and shall be covered by the original equipment manufacturer ("OEM") warranty. Product with dents, scratches, chips, or defects (whether significant or cosmetic) shall be rejected and replaced. Contractor agrees to transfer or assign any OEM warranty to the Owner, if necessary, to ensure Owner has beneficial rights to all such warranties.

B. By proposing to provide a product, the Contractor is certifying its ability to legally buy, sell, and return the item. Product may be procured directly from an OEM, through a third-party reseller ("distributor"), or may be manufactured by the Contractor. Regardless of the origin, the Contractor is solely responsible for complying with the specifications described herein.

C. This specification is not intended to completely describe every performance standard, feature, requirement, function, method, criteria, or best practice. All product shall meet the published specifications provided by the OEM. Where the Contractor is the OEM, the Contractor shall provide sufficient published specifications, such as cutsheets, manuals, product and feature descriptions, manufacturing drawings, etc. as appropriate for each product.

D. Where two or more discrete products are specified herein, the Contractor may elect to provide either/any at their option, so long as either/any fulfills the functional requirements described.

E. All documents within or attached to this package, including specifications, drawings, schedules, tables, charts, graphs, photos, functional diagrams, sample code, etc., are intended to be complimentary. Where discrepancies occur, the Contractor shall comply with the most strict, specific, exacting, detailed, expensive and/or onerous requirement. For further clarification, submit a formal Request for Information.

F. The Contractor is responsible for uncovering technical limitations, errors, omissions, conflicts, discrepancies, duplications, inaccuracies, and issues within the documents, drawings, and site conditions. By submitting a bid, the Contractor acknowledges a thorough review has been completed and that the Contractor has included all components, equipment, licenses, software, material, parts, services, labor, overtime, expenses, fees, tax, freight, and costs in order to provide a complete, fully-functional system. Change orders for Contractor omissions will not be approved.

G. Notwithstanding any detailed information in the contract documents, it is the responsibility of the Contractor to supply systems in full working order. Notify the Design Consultant of any discrepancies in part numbers or quantities before

bidding. Failing to provide such notification requires this Contractor to supply items and quantities according to the intent of the specifications and associated drawings without claim for additional payment.

2.02. ACCEPTABLE MANUFACTURERS

A. Specific product manufacturers and model numbers are included in this specification and are listed as a standard of quality. Contractor shall provide product matching the requirements herein.

1. Other product manufacturers and model numbers may be incorporated, if and only if they are individually approved through the formal substitution request process. See 2.09 below for requirements.

2.03. DESIGN PERFORMANCE REQUIREMENTS

A. Video Systems

1. Formats

a. All video systems shall operate in the standard of 1920x1080p59.94, with a color space achieving ITU-R Recommendation BT.2100 (HDR HLG).

1. Provide all conversion, translation, and/or adaptation equipment necessary for each non-compliant source & destination to conform to these signal formats.

2. Baseband video signals shall conform to SMPTE 424M (“3G-SDI”), Level A.

a. Provide Level B to/from Level A conversion, translation, and/or adaptation equipment necessary for each non-compliant source & destination to conform to Level A.

b. Baseband video signaling shall primarily be used for connections within a building.

c. The video/audio router(s) shall serve as the bulk gateway between baseband signaling and the Media-over-IP Network Fabric.

3. Uncompressed packetized video signals (“SMPTE 2110-20 flows”) shall conform to the SMPTE 2110 suite of standards.

a. Provide all conversion, translation, and/or adaptation equipment necessary for each non-compliant source & destination to ensure all signals conform to these signal formats.

b. SMPTE 2110-20 flows shall primarily be used for connections between buildings.

c. SMPTE 2110-20 flows shall only traverse the Media-over-IP Network Fabric. See D.1 below.

4. In addition to baseband and uncompressed IP transport, some devices may also support IP transport of compressed packetized video signals.

a. Compressed SMPTE 2110 flows (“SMPTE 2110-22 flows”, “JPEG-XS”, or similar)

1. Some components are specified herein to support compressed SMPTE 2110 signal formats, including but not limited to JPEG-XS. Where a device performance requirement explicitly states support for compressed SMPTE 2110 signals, connect the device to the Media-over-IP Network Fabric. See D.1 below.

2. If a device supports compressed SMPTE 2110 flows, but does not support uncompressed SMPTE 2110 flows, provide appropriate conversion equipment.

b. Network Device Interface (“NDI”).

1. Some components are specified herein to support NDI signal formats. Where a device performance requirement explicitly states support for NDI signals, connect the device to the Control Network using a port tagged for the appropriate NDI VLAN. See D.2 below.

2. Architecture

a. Each building shall contain a central aggregation video router, capable of interfacing with 3G-SDI Level A, 12G-SDI and SMPTE 2110-20 flows.

1. Signal routing within a building shall be handled by the local video router.

2. The router shall be capable of embedding and de-embedding audio from these video signals, and integrating with the Media-over-IP audio system. The router shall also accommodate non-blocking shuffling of mono audio signals internally from any source to any destination.

3. Patching of all baseband video pathways shall provide local inspection and reconfiguration.

4. Video from meeting rooms

a. Robotic cameras within each room will observe the meeting room proceedings, connecting back to the nearest router via baseband video over fiber.

b. Local room sources from the AV presentation system shall be converted and connected to the nearest router via baseband fiber. Aux send and receive paths will also be provided to/from each room.

b. Each building shall be interconnected with each other building via the Media-over-IP Network Fabric.

1. The router controller shall manage virtual, dynamically-assigned tielines between the router at each building, transporting video, audio, and ancillary data between router frames.

a. The router controller shall orchestrate the delivery of video, audio, and ancillary data signals over tielines, such that:

1. Tielines are “parked” or indicated as “available” when not in use.

2. When a tieline route is established, the tieline is indicated as “in-use” until such time as the destination route is changed to another source.

3. The router controller shall inhibit any route changes to tielines that are “in-use”.

4. The router controller shall determine and use only the shortest (least cost) path using “available” tielines, in order to transport a source to a destination.

a. The path shall be calculated when the initial route is made, and not be recalculated/rerouted upon subsequent parking of other tielines.

2. All video sources in all building routers shall be capable of being sent to all destinations, subject to concurrent bandwidth limitations of the Media-over-IP Network Fabric.

3. Minimal, point-to-point, baseband fiber signals between buildings shall provide fault-tolerant redundancy for transmission air chain paths.

4. The temporary facilities at the COB shall remain connected by point-to-point, baseband fiber conversion equipment at the CAP until Work is complete and a cutover date is coordinated.

    a. At such time, Contractor shall decommission and remove existing equipment within CAP.

c. Devices local to the SOB

    1. Video devices local to the SOB include, but are not limited to: studio cameras, meeting room cameras, teleprompters, monitors, switchers, playback servers, ingest servers, captioning encoders, character generators, encoders, decoders, multi-viewers, frame syncs, color converters, etc.

    2. All local video devices shall be connected to the video router using one of two methods:

        a. Baseband video signals on copper cabling, or

        b. Baseband video signals on fiber optic cabling.

    3. Patching for all copper and fiber pathways shall provide local inspection and reconfiguration.

d. Video processing

    1. Video signals shall be processed, when required, using proc amps, frame synchronizers, HDR <> SDR converters, etc. These functions may be performed by outboard devices, or internally within the router input prior to entering the router crosspoints.

    2. Individual video signals shall be combined into multiview canvases, with audio metering, closed caption decoding, under-monitor displays, and tally indicators.

        a. Multiview canvases shall be generated in three ways:

            1. Internal to the video switcher;

            2. Internal to the video router;

            3. Using existing, owner-furnished, owner-installed external multiview canvas generator software.

        b. Regardless of generation method, all multiview canvases shall be integrated as a router source.

c. Multiview canvas outputs shall operate in the 1080p59.94 HDR/HLG format and shall be free from glitching, strobing, and artifacts.

e. Graphics

1. Each Production Control Room shall have a dedicated character generator.

2. Each character generator shall have the ability to read data from an automation system, which is then incorporated into graphics as a data source. A graphics assistant shall be able to enter data quickly into the automation system.

f. Video switching

1. Each Production Control Room shall have a dedicated video switcher and switcher control panel.

2. Most switcher inputs as well as program, clean, multiview and auxiliary outputs shall be connected to the video router via patch. The remaining will be on patch only.

g. Captioning

1. The switcher program video and audio from each Production Control Room shall be routed through an automated captioning system. The captioning system shall embed the caption text into the ancillary data of the video signal.

2. The master control transmission air chain is re-captioned by a human captioner connected to a separate caption encoder in the CAP.

h. Encoding

1. The final program output and audio mix from each control room shall be encoded and streamed to the Owner's designated content delivery partner. These streams shall be delivered at 1920x1080p59.94 HDR HLG.

B. Audio Systems

1. Formats

a. All audio systems shall operate in stereo, 16-bit Linear PCM with 48 kHz sampling frequency, using an AES67-compliant IP network.

1. Provide all conversion, translation, and/or adaptation equipment necessary for each non-compliant source & destination to conform to these signal formats. Convert and/or translate: Audinate Dante, MADI, AES3, mic- or line- or consumer-level analog audio, and other formats.

2. Uncompressed packetized audio signals shall conform to the SMPTE 2110 suite of standards ("SMPTE 2110-30 flows") and/or the AES67 standard ("AES67 flows").

2. Architecture

a. Audio from meeting rooms

1. Audio to/from devices within hearing rooms, conference rooms, chambers, etc. shall be integrated with the owner-furnished, owner-installed AV systems and transported via the existing, owner-furnished Dante audio network.

2. The Owner's existing Dante network shall be integrated with VLAN(s) on the new Control Network (collectively, "Dante Network").

3. Each meeting room contains one or more existing microphones, signal processors, AV sources, and mixers.

a. In most rooms, individual room microphones are sub-mixed locally by the Owner to one or more feeds and presented to the existing Dante device network. The chairperson's mic is provided separately.

4. Dante Network audio flows shall be converted to/from AES67 through an audio interface connected to the Media-over-IP Network Fabric.

a. Do not reconfigure the Owner's Dante devices for AES67 compatibility mode. Use an active conversion device as a bridge to isolate the network segments.

b. Devices local to the SOB

1. Audio devices local to the SOB include, but are not limited to: hearing room microphones, studio microphones, wireless mics, IFB transmitters, speakers, playback servers, captioning encoders, music players, off-air monitoring, etc.

2. All local audio devices shall be connected to the Media-over-IP Fabric using one of two methods:

a. By audio interfaces, connected to the Media-over-IP Network Fabric; or,

b. Through the embedding or de-embedding function of the video router, using MADI inputs or outputs on the video router connected to an audio interface, with the interface then connected to the Media-over-IP Fabric.

3. Patching for all analog audio pathways shall provide local inspection and reconfiguration.

c. Central audio processing

1. Audio from meeting rooms, and devices local to the MSB, shall enter a central audio mixer's digital signal processor ("DSP").

a. Inputs shall be processed with equalization, compression, gating, and other dynamics.

b. Direct, post-fader outputs from the central audio processing shall be sent to the individual Production Control Room audio mixers, via Media-over-IP Network Fabric, as AES67 flows.

d. Audio mixing

1. A pool of DSP resources shall be divided logically between several virtual audio mixers, each supporting one of the Production Control Rooms.

2. A selection of direct outputs from the central audio mixer shall be routed into the inputs of each, with only basic controls exposed to the novice operator(s).

3. For flexibility, the operator shall be able to use snapshots to quickly switch the mixer inputs, choosing between all meeting rooms, conference rooms, chambers, etc.

4. A small fader bank controller will be installed in each control room, commanding the corresponding virtual mixer.

5. The audio mixer outputs shall be sent to the Media-over-IP Network Fabric, and to the video router via MADI. The video router shall marry the final program audio with video for each control room.

C. Master Control

1. Architecture

a. Live Events

1. The program audio and video outputs, with captioning, from each production control room shall be fed to a master control switcher. The SOB master control switcher shall select among the SOB control rooms.

b. Ingest, Playout, Time Slipping

1. In the SOB, Production Control Room outputs may be ingested live and stored within playout servers, to be recalled by a playout server, and played through the master control switcher later.

2. Production Control Room outputs may also be time-slipped, meaning played from a playout server while still being ingested.

c. MSB master control

1. The MSB also contains an existing master control switcher, which selects among the MSB control rooms, their recorded content, and time-slipped events.

d. CAP master control

1. To switch between the master control outputs from each building, an existing master control switcher is installed at CAP.

a. This switcher can select between MSB master control, SOB/COB master control, exterior POV cameras, and graphics.

b. This switcher does not have an operator local to CAP. An operator at the MSB and an operator at the SOB shall each be able to control the existing CAP master control switcher simultaneously.

1. MSB: An existing switcher control surface is installed the MSB Master Control Room.

2. SOB: Any operator shall be able to access and operate the Master Control switcher soft-panels via KVM user station or router control panel.

2. Though each Production Control Room program feed input to the master control switcher is already automatically captioned, the existing CAP master control output is routed through a dedicated caption encoder to apply human-generated captions.

3. The main output of the existing CAP master control switcher with embedded human-generated captions is routed down the transmission air chain.

e. Transmission Air Chain

1. Together the MSB, SOB/COB and CAP master control equipment form the transmission air chain. As such, the systems and their interconnections shall be fault tolerant, ensuring maximum availability and the resiliency of the signal path.

a. Relays and relay distribution

1. Signal sensing relays and distribution amplifiers shall be used strategically throughout the transmission air chain signal flow to ensure that a failed device can be immediately bypassed without impact.

b. Alternate routes

1. Transmission air chain signals shall be duplicated, with each copy taking geographically diverse routes. For SMPTE 2110 signals traversing the Media-over-IP Network Fabric, this shall be accomplished using the dual ST2022-7 red & blue networks, configured in a ring topology.

c. Baseband backup

1. Backup baseband embedded video-over-fiber signals shall be sent from each master control switcher output to CAP master control switcher inputs.

d. Local control

1. An existing, owner-furnished, owner-installed local touch screen with the CAP Media Hub is available for use in the event of system failures at MSB or SOB/COB.

2. The final output shall feed distribution amplifiers and be handed off to the Owner's designated broadcast partner (currently Twin Cities Public Television). The partner shall provide all encoding and transmission equipment beyond the CAP demarcation point.

D. Networking

1. Media-over-IP Network Fabric

1. SMPTE 2110 and AES67 flows shall be conveyed on a dedicated, high-capacity, fault-tolerant media-over-IP network fabric, consisting of two separate networks (referred to as “red network” and “blue network”) implementing the SMPTE 2022-7 standard for hitless redundancy.

    a. Devices supporting SMPTE 2022-7 shall be connected to both networks, and configured to independently interface with each.

    b. SMPTE 2110-20 flows shall be calculated at approximately 3GBps per video essence, without limiting future migration (outside this Work) of some signals to approximately 12GBps per video essence.

2. Switch topology

    a. Switches shall be interconnected with Layer 3 routed links and arranged in a multiple spine + leaf topology, with a spine pair per building.

    b. Each leaf switch pair shall connect to the closest spine switch pair through multiple inter-switch links, providing increased throughput and fault tolerance.

    c. The fabric shall support deterministic failure handling and move affected flows to alternate links. Switch links shall be of a bandwidth and quantity providing excess available capacity to accommodate link failure.

    d. The fabric shall utilize IGMP to manage multicast traffic and PIM for group membership management.

3. Fabric Controller

    a. The fabric shall be observed and managed by a central fabric controller.

    b. The controller shall provide:

        1. Visibility of the current state of each fabric component;

        2. network telemetry and visualizations of link bandwidth, individual flow bit rates and routes, and warnings of oversubscription;

        3. the ability to centrally manage switch settings, perform configuration backups & restores;

4. the ability to manage multicast flows through policy rules; and,

5. an audit log of actions performed on the fabric.

4. Host access ports

a. Switches shall provide 100Gbps, 40Gbps, 25Gbps, 10Gbps, 5Gbps, 2.5Gbps, and 1Gbps access ports, with POE as needed.

5. Registration and Discovery

a. All media devices connected to the Media-over-IP Network Fabric shall be compatible with AMWA IS-04 NMOS Discovery & Registration Specification and IS-05 Device Connection Management Specification.

b. A central server shall discover all devices, and maintain a registry of all active and inactive device configurations.

6. System Timing

a. PTP master clocks shall provide IEEE 1588 & SMPTE 2059 compatible synchronization services to all devices on the Media-over-IP Network Fabric.

b. A PTP grandmaster clock shall be installed in each building (SOB, MSP, CAP) and referenced to GPS satellites.

c. The clocks shall utilize the best master clock algorithm to elect the grandmaster leader. All follower clocks shall then sync to that clock.

d. Clocks shall perform calculated time slewing to speed up or slow down over a period to match the grandmaster.

e. Each master clock shall then derive PTPv1 services for Dante, NTP services for hosts, and traditional broadcast timing signals (blackburst, tri-level sync, LTC, DARS, wordclock, etc).

2. Control Network

a. The Control Network shall consist of switches and network services, separate from the Media-over-IP Network Fabric.

b. Each main equipment rack room shall contain a stack of several switches. Each hearing room, conference room, and chamber shall contain a switch.

c. The Control Network shall use Layer 2 links capable of link aggregation and VLAN trunking to extend VLANs to each switch.

1. Numerous VLANs shall be used to segment the broadcast domains and traffic on the switches. VLANs may include, but not be limited to:

a. Dante Primary

b. Dante Backup

c. KVM

d. Intercom (OMNEO)

e. Camera Control & NDI

f. iSCSI (if required)

g. General Control

h. Guest Devices

i. Switch Management

d. Switches shall provide 10Gbps, 5Gbps, 2.5Gbps, and 1Gbps access ports, with POE as needed.

e. Equipment Rooms

1. The Control Network within the Equipment Room(s) shall be implemented using one of two methods, either:

a. Using a top-of-rack (TOR) switch topology, with each equipment rack housing a Control Network switch at the top containing sufficient ports to support all equipment within the rack, and future expansion; or,

b. Using an end-of-row (EOR) switch topology, with each equipment rack housing a 24-, 48, or 72-port network patch panel fully populated and connected to a network patch panel within the first/last rack in a row. This first/last rack in a row shall contain a stack of Control Network switches with sufficient ports to support all equipment within the row of racks, and future expansion.

E. Intercom

1. The intercom system servicing the MSB, SOB, and CAP shall consist of multiple matrices interconnected to behave as one frame.

    a. Contractor shall coordinate an intercom outage to disconnect the existing frames at the MSB and CAP, and integrate both with the new frame at the SOB.

2. User station keypanels will connect to the closest intercom matrix using either analog frame connections or audio-over-IP (OMNEO).

3. A dedicated audio interface between the AES67 Media-over-IP Network Fabric and the OMNEO VLAN shall provide audio to/from the intercom matrices. This shall provide for IFB, program audio, paging, and studio talkback feeds.

4. The COB temporary facilities are connected to the CAP intercom frame using an owner-furnished 2-wire partyline-to-fiber converter. The temporary facilities at the COB shall remain connected until Work is complete and a cutover date is coordinated.

    a. At such time, Contractor shall decommission and remove existing equipment within CAP.

F. KVM

1. An IP-based KVM system shall be deployed to connect user station terminals with computer host interfaces.

2. The existing system that spans the MSB and CAP shall be expanded to include the SOB. A redundant pair of controllers are owner-furnished, and owner-installed within the CAP.

3. The KVM system shall support dual monitor, 4K resolution with HDR. Each endpoint shall support 10Gbps network connections.

4. Provide KVM computer interfaces for all devices with a computer monitor output and keyboard/mouse control inputs, even if not required elsewhere.

G. Camera Control

1. A central robotic camera control system shall be used to control all robotic cameras, regardless of make or model.

2. A central camera shading system shall be used to control all cameras, regardless of make or model.

3. Each Production Control Room will contain equipment that interfaces with this system, allowing operators to control the camera position, focus, zoom, iris, and color settings for every camera.

H. Display Control

1. Develop a basic system for turning on and off all video displays within each Control Room.

2.04. OWNER-FURNISHED EQUIPMENT

A. The Owner has established a list of Owner-furnished, Contractor-installed equipment, material, parts, and/or accessories (collectively, "OFCI") that the Contractor shall accept, install, and reintegrate.

1. Existing OFCI equipment to be reused:

a. Within the SOB:

1. Captioning (Production Control Rooms)

a. Link Electronics ACE-2200 Automated Captioning Engine [CC-1] – *Qty: 1*

1. Provide 3G-SDI Level A/B conversion for inputs and outputs.

b. Link Electronics ACE-FLEX4 Automated Captioning Engine [CC-2] – *Qty: 1*

1. Provide 3G-SDI Level A/B conversion for inputs and outputs.

c. Link Electronics AIP-494 3G-SDI CC Encoder with audio captions over IP [CC-3] – *Qty: 4*

1. Provide 3G-SDI Level A/B conversion for inputs and outputs.

d. Link Electronics ACE-2000 Automated Captioning Engine [CC-4] – *Qty: 1*

1. Provide 3G-SDI Level A/B conversion for inputs and outputs.

2. Asset Management

a. Qualstar Q40 LTO Tape Library & Controller [LTO-1] - *Qty: 1*

3. Audio

a. Denon DN-300R MKII Solid State Audio Recorder [MUSIC-1] – *Qty: 1*

4. Studio Camera Support

a. Vinten PTZ-OL Pedestal [PED-1] – *Qty: 3*

B. The Owner has established a list of Owner-furnished, owner-installed equipment, material, parts, and/or accessories (collectively, "OFOI") that the Contractor shall reconfigure and reintegrate.

a. Within the CAP:

1. For integration with new SOB systems:

a. Cisco Nexus Dashboard Fabric Controller [NDFC-1] – Qty: 1

b. Cisco N9K-C9364C-GX Fixed Spine Switch [NETSW-1] – Qty: 2 (MoIP Red, Blue)

c. SonicWall NSa 2700 Security Appliance [NETRTR-1] – Qty: 1

d. Ross Video ULTRIX-FR12 Router [RTR-1] – Qty: 1

1. With ULTRICORE-BCS controller pair.

e. Adder ASP-001-US KVM Manager [KVM-MGR-1] – Qty: 1

f. RTS ODIN Intercom Matrix [ICMTX-1] – Qty: 1

g. Cable TV Distribution System, including:

1. ATX DIGIVU-II QAM Encoder & Modulator [MOD-1] – Qty: 1

2. ATX DIGIVU-II QAM Encoder & Modulator [MOD-2] – Qty: 1

3. Demarcation Plate [PLT-CATV-1] – Qty: 1

h. Air Chain, including:

1. Ross Video MC1 Master Control Switcher [MCSW-1] – Qty: 1

2. Ross Video SRA-8901-R [MCDA-1] – Qty: 2

i. TAG MCS Multiview Processor [MIV-1] – Qty: 1

j. Nagios Networking Monitoring Software [NMS-1] – Qty: 1

k. Ross Video TSI4000 Tally Processor [TALLY-1] – Qty: 1

l. Hitomi XF-AG-3G Signal Generator [TSG-1] – Qty: 1

2. For temporary facilities to the COB until cutover date:

a. Lynx Technik OTX 1712-2 Analog Sync / Video Fiber Optic Transmitter [FOX-5] – *Qty: 1*

1. For sync signal to COB

b. Grass Valley FXC-S201 WDM Intercom to Fiber Converter ICONV-1] – *Qty: 1*

1. For intercom partyline to/from COB

c. Ross Video FDT-6604-xx 2Ch Transmitter [FOX-11] – *Qty: 8*

1. With Ross Video FCM-6846 8 CH CWDM Mux [FOX-12] – *Qty: 2*

2. For 16 ch HD-SDI from CAP to COB

d. Ross Video FDR-6603 2Ch Receiver [FOX-13] – *Qty: 4*

1. With Ross Video FCD-6847 8 CH CWDM Demux [FOX-14] – *Qty: 1*

2. For 8 ch HD-SDI from COB to CAP

e. Kiloview Cradle RU03 [NDI-1] – *Qty: 1*

1. With Kiloview RN-3 3G-SDI to NDI Encoder Card – *Qty: 16*

b. Within the MSB:

1. For integration with new SOB systems:

a. Ross Video ULTRIX-FR12 [RTR-1]

1. With ULTRICORE-BCS controller pair.

b. RTS ODIN Intercom Matrix [ICMTX-1]

~~b.~~c. Cisco N9K-C9364C-GX Fixed Spine Switch [NETSW-1] – Qty: 2 (MoIP Red, Blue)

c. Amongst all buildings:

1. Dante Network Devices

a. Numerous devices exist on the current Dante VLAN that spans the CAP, SOB, COB, and MSB. Devices include microphones, amplifiers, DSPs, mixers, etc.

1. Contractor shall integrate new systems with the existing Dante device network devices as needed for interoperability and sharing of audio signals.

a. Do not reconfigure the Owner's Dante devices for AES67 compatibility mode. Use an active conversion device as a bridge to isolate the network segments.

2. Contractor shall ensure existing DHCP services remain active on the existing Dante device network.

C. Owner shall make reasonable accommodation to provide Owner Furnished Equipment ("OFE") to the Contractor upon request. Coordinate a time and location.

1. Contractor shall be responsible for shipping charges related to receiving OFCI equipment if shipment is deemed necessary by the Contractor.

2. Upon receipt of OFCI equipment, the Contractor shall catalog, document, and inspect all OFCI equipment for any damage, defect, missing parts, or other inadequacy. The Contractor shall ensure proper operation of equipment functions and that OFE meets the requirements within this specification.

a. Should any defects be discovered, notify the Owner within three (3) business days of the date the OFE equipment was received. OFE equipment shall be deemed to be tendered in good, working order unless written notification occurs.

b. Parts, materials, labor, and services to restore defective OFE equipment are beyond the current scope and shall be treated as a change to the contract sum, or as a separate engagement. Use the Change Order process described in 3.02 below.

c. Provide the Owner with a list all received OFE equipment within the Contractor's custody. The list shall include equipment make, model number, serial number, current storage location, and date and time received.

d. Make all reasonable efforts to securely store OFCI equipment in a manner that does not damage, degrade, or shorten the lifespan. Parts, materials, labor, and services to restore OFE equipment that was deemed tendered in good, working order shall be the Contractor's responsibility.

D. Incorporate as much OFCI equipment as is technically and functionally feasible for a complete system design. Supplement OFCI equipment with new when necessary. Return unused OFCI equipment to the Owner prior to closeout.

E. Update OFCI equipment firmware and software to the latest, publicly available version prior to the date of substantial completion. Should a software maintenance agreement be required to access the latest version(s), the cost to extend warranties or software maintenance agreements for the purpose of updating OFCI equipment is beyond the scope of this agreement.

F. Document, install, integrate, test, commission and configure OFCI equipment as if it was provided new by the Contractor.

G. All OFCI equipment shall be exempt from warranty coverage. Delineate OFCI equipment on all submittal documents, including drawings, floorplans, elevations, and signal drawings. Provide warranty coverage only for any Contractor-installed cabling attached to OFCI equipment, and for damages occurring during the Contractor's transport, handling, installation, testing, and commissioning of OFCI equipment.

H. Quantities listed within this specification and related drawings shall be construed as the total quantity of devices required. The total quantity may be fulfilled using either OFE, Contractor-provided equipment, or a combination of both.

## 2.05. EQUIPMENT

A. Audio Control

1. Audio Monitor Volume Control Panel [VCP-2]

a. Desktop form factor, single knob monitor level controller.

b. Balanced stereo XLR inputs and outputs.

c. Range of Off – 0db.

d. Acceptable product:

1. TC Electronic LEVEL PILOT X

B. Audio Interface

1. Audio Interface, Modular [AIF-1]

    a. 3RU I/O box enclosure, 20 I/O card slots.

    b. AES67 aggregation interface, support for ST2022-7 seamless protection switching.

    c. Redundant power supplies.

    d. Remote preamp control support via Calrec Type-R consoles.

    e. Acceptable product:

        1. Calrec EE5833 Modular IO Box

        2. Calrec UJ6429 IP Interface Module

        3. Calrec ZN5835 PSU - Qty: 2

        4. Calrec JM6199 MADI I/O Module - Qty: 2

            a. For interface with [RTR-1], [RTR-2], or [RTR-3]

        5. Calrec BI6192 Dante I/O Module- Qty: 3

            a. For interface with Dante networks and Intercom network

        6. Calrec SFP - Qty: as required

        7. Calrec NN5866 Blank Panel - Qty: 15

2. Audio Interface, 12ch In, 4ch Out [AIF-5]

    a. Analogue mic/line interface with 12 XLR inputs and 4 XLR outputs

    b. Calrec Hydra2 and AES67 IP Interface

    c. Remote preamp control from Calrec consoles

    d. Switchable +48V phantom power per channel

    e. Acceptable Product:

        1. Calrec AD5782 IP Audio Interface

        2. Calrec SFP - Qty: as required

C. Audio Microphone

1. Microphone, Voiceover [MIC-1]
    a. Large diaphragm, dynamic microphone with integrated preamp
    b. Desktop boom mic stand
    c. Acceptable product:
        1. Shure SM7db
        2. Electro-Voice RE20 Dynamic Mic
        3. Rode PSA1+ Boom Arm
2. Microphone, Ceiling Array [MIC-2]
    a. 30’x30’ coverage area, with automatic and steerable coverage options.
    b. Automatic Mixing and Gain Control, Noise Reduction and Echo Cancellation.
    c. Dante, PoE, and Audio via Single Cable.
    d. 8 Pickup Lobes with Individual Outputs.
    e. Acceptable product:
        1. Shure MXA920W-S Microflex Advance 24" Ceiling Mic Array
3. Microphone, Shotgun [MIC-3]
    a. Short cardioid shotgun mic. Built-in preamplifier.
    b. Acceptable product:
        1. Shure VP82
4. Microphone, Lapel [MIC-5]
    a. Omnidirectional lavalier microphone.
    b. XLR preamp adapter.
    c. Acceptable product:
        1. Shure UL4B/C-XLR-A
        2. 50’ starquad XLR mic cable

D. Audio Mixer

1. Audio Control Panel, Large [ACP-1]

a. 12 fader configuration, with dual softpanel touchscreens.

b. Configurable buttons, knobs, and identification screen per channel, including mute, PFL/AFL.

c. Integration note:

1. See 2.03.B.2.c above regarding central audio processing and separate Production Control Room audio mixing.

a. The left softpanel of each [ACP-1] shall be configured to control the Production Control Room audio mixer. The right softpanel of each [ACP-1] shall be configured to control the central audio processing mixer.

d. Acceptable product:

1. Calrec Surface-1 Type R Console

2. Calrec IM6413 Fader Panel - Qty: 2

3. Calrec MU6411 Large Softpanel - Qty: 2

4. Calrec 720-999003 Large Softpanel Desk Kit - Qty: 2

5. Calrec 720-999007 Fader/Fader Linking Kit

6. Calrec 720-999008 Large Softpanel Linking Kit

2. Audio Control Panel, Small [ACP-2]

a. 6 fader configuration, with softpanel touchscreen.

b. Configurable buttons, knobs, and ident screen per channel, including mute, PFL/AFL.

c. Acceptable product:

1. Calrec Surface-1 Type R Console

2. Calrec IM6413 Fader Panel

3. Calrec MU6411 Large Softpanel

4. Calrec 720-999003 Large Softpanel Desk Kit

3. Audio Mixer Cores [AMIX-1]

a. Primary and redundant core pair (1+1).

b. AES67 interface, support for ST2022-7 seamless protection switching.

c. SMPTE 2110 compliant, with NMOS IS-04 and IS-05 compatibility.

d. 166 DSP processing paths, 120 input channels.

e. 3 main outputs, 8 group outputs, 16 aux output buses.

f. 64 definable input, path, and output delays of up to 5.4 seconds each.

g. Logically subdividable up to 3 independent mixers.

h. Integrated 4 AES I/O, 8 Mic/Line, 8 Line out, 2 H/P (per core)

i. Integration note:

1. Bring all audio mic/line inputs and line outputs to patch.

j. Acceptable product:

1. Calrec UR6500 2RU, Type R, Base Core - Qty: 2 (primary + redundant)

2. Calrec US6493 AoIP Interface Card- Qty: 4

3. Calrec SL6517 Type R, R120 DSP Pack

E. Audio Monitor

1. Audio Monitor, 1RU [AMON-1]

a. Monitoring of up to 8 channels from multiple sources

b. Up to 64 presets

c. 3G-SDI de-embed, balanced analog stereo inputs.

d. Support for option cards, Dante, Ravenna, AES67 and ST2110-30 flows.

e. Integrated stereo speakers, with volume, mute, source, and channel selections.

f. Integrated graphics displays of level, loudness, and control parameters.

g. Acceptable product:

1. Wohler iAM1-8 1RU Audio monitor

2. Option card to support 64-ch AES67/ST2110-30 inputs with NMOS compatibility

2. Audio Monitor, 2RU [AMON-2]

a. Monitoring of up to 16 channels from multiple sources

b. Up to 64 presets

c. 3G-SDI de-embed, balanced analog stereo inputs.

d. Support for option cards, Dante, Ravenna, AES67 and ST2110-30 flows.

e. Integrated stereo speakers, with volume, mute, source, and channel selections.

f. Integrated graphics displays of level, loudness, and control parameters.

g. Integration note:

1. Bring all analog, AES, and MADI inputs and outputs to patch.

h. Acceptable product:

1. Wohler iVAM2-2-G 2RU Audio monitor

2. Wohler OPT-AES Software Option

3. Wohler OPT-DANTE Hardware Option

4. Wohler OPT-MADI Software Option

5. Wohler SFP-2110 w/NMOS or Ember+ SFP Option

3. Audio Monitor, 1RU Mixing [AMON-3]

a. Monitoring of up to 128 channels from multiple sources

b. Up to 16 mixing presets

c. 3G-SDI de-embed, balanced analog stereo inputs.

d. Support for ST 2110-30 Level A, B and C (1ms and 125µs packet time, stream size up to 64 channels).

e. ST 2022-7 and NMOS IS-04/05 support.

f. Integrated stereo speakers, with volume, mute, eight source control knobs, and stereo panning.

g. Integrated graphics displays of level, loudness, and control parameters.

h. Web interface for remote control.

i. Acceptable product:

1. TSL MPA1-MIX-NET-V-R Audio monitor

4. Headphones [HP-1]

a. Stereo Headphones. 40mm driver, 63ohm impedance.

b. 1/4” and 1/8” stereo plug.

c. Acceptable product:

1. Sony MDR-7506

2. Sennheiser HD 280 PRO

5. IFB Wired [IFB-1]

a. Mono headphone amp. 9V battery power.

b. Balanced XLR audio input, loop through output.

c. Drive stereo and mono headphones and earpieces from 8 to 2000 Ohms

d. Acceptable product:

1. Glensound GS-HA009 Headphone Amp

2. Westone PRO X10 Earphones

F. Audio Speakers

1. Speakers, 2.1 Nearfield Monitoring [SPK-1]

a. Powered 3/4” (50W) and 5 1/8” (50W) drivers.

b. Active 6.5” (50W) subwoofer.

c. XLR input.

d. Acceptable product:

1. Genelec 8030C Studio Monitor - Qty: 2

2. Genelec 7040A Subwoofer

3. Genelec 8000-402 Wall Mount Bracket- Qty: 2

2. Speakers, 2.0 Nearfield Monitoring [SPK-2]

a. Powered 3/4” (50W) and 5 1/8” (50W) drivers.

b. XLR input.

c. Acceptable product:

1. Genelec 8030C Studio Monitor - Qty: 2

2. Genelec 8000-402 Wall Mount Bracket- Qty: 2

3. Speakers, 2.0 Nearfield Monitoring [SPK-3]

a. Powered .75” (50W) and 3” (50W) drivers.

b. XLR input.

c. Acceptable product:

1. Genelec 8010A Studio Monitor - Qty: 2

2. Genelec 8010-320 / 8010-330 L-shape Table Stand for Vertical Mounting - Qty: 2

G. Audio Wireless

1. IFB Receiver [IFBRX-1]

a. Twin antenna diversity bodypack receiver.

b. Configure for two independent IFB program feeds.

c. IR sync for frequency programming.

d. Acceptable product:

1. Shure ADXR=-A Bodypack Receiver
2. Shure SB910 Rechargeable Battery - Qty: 2
3. Westone PRO X10 Earphones

2. IFB Transmitter [IFBTX-1]
   a. Quad channel wireless 1RU transmitter.
   b. Networked remote control.
   c. Dante network audio interface.
   d. Balanced, ¼" and XLR connectors.
   e. Acceptable product:
      1. Shure ADTQUS=-G57 Rackmount Transmitter
      2. Shure SBC441-PS 4-bay Docking Charger
3. IFB Transmitter Antenna [IFBTX-2]
   a. Architectural IEM/IFB folded helical antenna.
   b. Acceptable product:
      1. RF Venue CP-ARC Antenna
4. Wireless Microphone Receiver and Antenna [WLMICRX-1]
   a. Four-channel, digital wireless receiver with dual diversity tuners.
   b. Dante compatible.
   c. Network control.
   d. XLR outputs.
   e. Architectural diversity antenna, wall mount.
   f. Acceptable product:
      1. Shure AD4QNP 4Ch Receiver
      2. RF Venue D-ARC Antenna

5. Wireless Microphone Bodypack Transmitter [WLMICTX-1]

a. Digital encrypted bodypack transmitter with antenna.

b. TA4 microphone connector.

c. IR sync for frequency programming.

d. Acceptable product:

1. Shure AD1 (TQG) Bodypack Transmitter

2. Shure UL4B/C-MTQG-A Lapel Microphone

3. Shure SB900B Rechargeable Battery - Qty: 2

4. Shure SBC220-US Battery Charger

H. Cameras, PTZ

1. Camera, Box [CAM-1]

a. Compact POV camera. 2/3” CMOS sensor system.

b. Remote network control via web GUI, master setup unit, and remote-control panel.

c. Native support for HDR HLG output. 3G-SDI output. Genlock & TLS input.

d. Integration Note:

1. Provide rackmount DC switching power supply, dedicated one per [CAM-1], in AV Rack to power camera remotely.

2. Ensure DC voltage and power cabling is sufficient to reliably power camera.

e. Acceptable product:

1. Sony HDC-P31 Camera

2. Sony HZCPRV50 Permanent Software License for 1080p59.94 Operation

2. Pan Tilt Head, Type 1 Camera [CAM-1-ROBO]

a. Remote pan & tilt head, with support for payload of up to 15 lbs.

b. All metal (steel) helical gears, with Anti-Backlash mechanism, brushless DC servo motors.

c. Pan range +/-179deg. Tilt range +/-90deg. Repeatability better than +/-0.05deg.

d. 12V DC Auxiliary power output, cascaded Genlock output, built-in ethernet switch for camera connections

e. Support for Canon and Fujinon full servo digital and analog lenses.

f. Ethernet control with web GUI for configuration and control.

g. Furio API control interface.

h. Integration Note:

1. Provide rackmount DC switching power supply, dedicated one per [CAM-1-ROBO], in AV Rack to power camera remotely.

2. Ensure DC voltage and power cabling is sufficient to reliably power camera.

3. Turn off touchscreen and tally lights.

i. Acceptable product:

1. Ross RRB-SYS-X350-PT Head

2. Ross RRB-UNI-DLC Lens Cable for Canon

3. Ross RRB-UNI-WMB Wall Mount Bracket

3. Pan Tilt Head, Type 2 Camera [CAM-2-ROBO]

a. Remote pan & tilt head, with support for payload of up to 70 lbs.

b. All metal (steel) helical gears, with Anti-Backlash mechanism, brushless DC servo motors.

c. Pan range +/-179deg. Tilt range +/-90deg. Repeatability better than +/-0.05deg.

d. Support for Canon and Fujinon full servo digital and analog lenses.

e. Ethernet control with web GUI for configuration and control.

f. Furio API control interface.

g. Integration Note:

1. Provide rackmount DC switching power supply, dedicated one per [CAM-2-ROBO], in AV Rack to power camera remotely.

2. Ensure DC voltage and power cabling is sufficient to reliably power camera.

h. Acceptable product:

1. Ross CAM-520PT-PKG Head

2. Ross RRB-UNI-DLC Lens Cable for Canon

3. Ross RRB-UNI-MA Mitchel Tripod Mount Adapter

4. Ross RRB-UNI-PM8 Pedestal Mount 8in Riser

4. Prompter Display, Type 2 Camera [CAM-2-PRMPT]

a. 17-inch, high brightness teleprompter display for robotic heads.

b. Counterbalance weight set.

c. Acceptable product:

1. Ross RRB-TP-CUE-17LW-BOX Display Kit

5. PTZ Camera, Type 5 [CAM-5]

a. Pan, tilt, zoom camera with 1” 4K MOS sensor. 3840x2160 resolution.

b. 12G-SDI output. SFP slot for baseband fiber and ST2110 native compatibility.

c. Network control via web GUI and remote panels.

d. Support for High Bandwidth NDI and NDI|HX v2. Native SRT streaming integration.

e. Quiet PTZ operation, less than NC35 while moving.

f. Acceptable product:

1. Panasonic AW-UE160 Camera, White

a. Coordinate color prior to ordering.

2. Panasonic FEC-160GMK Wall Mount

3. Coherent FTLF1429P3BNV 12G-SDI Baseband SFP

6. PTZ Camera, Type 7 [CAM-7]

a. Pan, tilt, zoom camera with full-frame 4K CMOS sensor. 4096x2160 max. resolution.

b. Sony E-mount lens, with servo zoom and focus.

c. Support for NDI|HX v2. Native SRT streaming integration.

d. Acceptable product:

1. Sony ILMEFR7K Camera Kit with 28-135mm Zoom Lens

7. Prompter Display, Type 7 Camera [CAM-7-PRMPT]

a. 19-inch high brightness teleprompter display for robotic heads.

b. Counterbalance weight set.

c. 22” Talent monitor and bracket.

d. Acceptable product:

1. CueScript CSV2P19FR7 Display Kit

2. CueScript TM22 Talent Monitor

3. CueScript CSTMML Large Talent Monitor Mount

8. PTZ Camera, Type 8 [CAM-8]

a. Pan, tilt, zoom camera with 1” 4K MOS sensor. 3840x2160 resolution.

b. 12G-SDI output. SFP slot for baseband fiber and ST2110 native compatibility.

c. Network control via web GUI and remote panels.

d. Support for High Bandwidth NDI and NDI|HX v2. Native SRT streaming integration.

e. Quiet PTZ operation, less than NC35 while moving.

f. Acceptable product:

1. Panasonic AW-UE150A Camera, White
    a. Coordinate color prior to ordering.
2. Panasonic WV-Q105AUX Ceiling Mount
3. Coherent FTLF1429P3BNV 12G-SDI Baseband SFP

9. Outdoor Enclosure [CAM-OD]
    a. Exterior enclosure for PTZ cameras.
    b. IP66/NEMA 4X rated. Cable sealing glands.
    c. Integrated heater, blower, and cooler. Internal power conversion to 12VDC.
    d. Integration note:
        1. Mock up and confirm camera viewing angles with Owner prior to final install.
        2. Coordinate installation of lighting protection grounding devices for any structures erected.
    e. Acceptable product:
        1. Dotworkz HD12-CD-HB Enclosure with mounting brackets and hardware, as required
10. Media Converter and POE Injector [CAM-POE-FIBER]
    a. 802.3bt PoE++ Injector (95 W) and ethernet over single-mode fiber media converter.
11. Camera Control Panel [CCP-1]
    a. Universal camera control panel, with support for Panasonic, Sony, and other camera brands. Control of external color correctors.
    b. Joystick iris control. Paint, master black, and user-definable controls.
    c. Camera select buttons for cycling through and controlling multiple cameras.
    d. Integrated touchscreen. Internal and external tally support, with TSLv3.

e. IP control of supported cameras. Integration with central multicamera dashboard GUI.

f. Integration note:

1. Integrate with tally processor [TALLY-1] using TSL protocol for tally display.

2. Configure control of frame syncs [FS-1].

3. Configure control of all cameras, including [CAM-1], [CAM-5], [CAM-7], [CAM-8].

4. Integrate with the router control system [RTR-#].

a. Integrate preview joystick trigger buttons using the native router protocol, routing the selected camera to the appropriate shading preview monitor.

g. Acceptable product:

1. Cyanview CY-RCP-J

12. Camera Control Panel Server [CCP-2]

a. Central control aggregation server, allowing multiple CCPs to connect with multiple cameras. Central multicamera dashboard GUI.

b. Integration note:

1. [CCP-2] shall be installed and configured to control cameras in SOB/House related rooms only.

a. OFOI cameras in MSB/Senate related rooms will continue to be controlled by existing OFOI controllers.

2. Integrate with the router control system [RTR-#].

a. Integrate preview joystick trigger buttons using the native router protocol, routing the selected camera to the appropriate shading preview monitor.

c. Acceptable product:

1. Cyanview CY-RIO

13. Lens, 27x [LENS-1]

a. 27x zoom lens for 2/3" format 3-chip ENG/EFP cameras.

b. Servo control of zoom, focus, and iris. Digital drive with rotary encoder.

c. BT.2020 and HDR/WCG Support, with chromatic aberration correction based on BT.2020 correction data.

d. Acceptable product:

1. Canon CJ27ex7.3B IASE T

14. Camera Pedestal, Studio [PED-1]

a. 2-Stage Steering Pedestal with PTZ Adapter. Rubber dolly wheels with cable guards.

b. Supports up to 77 lb.

c. Manual air pump and inlet valve for balance and quick height adjustment.

d. Acceptable product:

1. Vinten PTZ-OL

15. Prompter Generator [PROMPT-1]

a. OpenGear card for prompter output. Ethernet control and HD-SDI output.

b. Software license for teleprompting software.

c. Integration note:

1. Install and configure software on designated utility PC.

d. Acceptable product:

1. CueScript CSOGP Package, includes one [PROMPT-HAND-1]

16. Prompter Control, Foot [PROMPT-FOOT]

a. Wireless Foot Scroll Control with Receiver

b. Acceptable product:

1. CueScript CSFSCW

17. Prompter Control, Hand [PROMPT-HAND-1]

a. Desktop scroll controller.

b. Acceptable product:

1. CueScript CSSC

18. Prompter Control, Voice Recognition [PROMPT-AI]

a. Automatic script scrolling synchronized with speech.

b. Integration note:

1. Connect a submix of talent mic audio to the utility PC running the software.

c. Acceptable product:

1. CueScript SAYIT Software

19. Robotic Control Panel [CCP-11]

a. 3-Axis Unified Control Panel with Single Joystick control panel for integration in desk, 11 camera selection buttons.

b. Pan, Tilt, Zoom, Focus control.

c. Ethernet interface for direct UDP joystick control of robotic heads.

d. USB interface to GUI PC.

e. Camera control software with visual preset recall.

f. 1RU host Windows PC.

g. Acceptable product:

1. Ross RRB-UCP3-SW Control Panel & Smartshell Software

2. Ross DB-HW-SERVER-G5-W-SE 1RU Workstation

a. Upgrade graphics card to Nvidia T1000 4GB minimum to enable dual screen monitors.

3. Provide USB extension as required.

20. Robotic Control Server [ROBO-SVR-1]

a. 1RU Rack-mounted server for control of all robotic cameras.

b. Integration note:

1. [ROBO-SVR-1] shall be installed and configured to control cameras in SOB/House related rooms only.

a. OFOI cameras in MSB/Senate related rooms will continue to be controlled by existing OFOI controllers.

2. Integrate control of Panasonic and Sony PTZ cameras.

3. Set up automated replication from primary server [ROBO-SVR-1] to backup server [ROBO-SVR-2].

c. Acceptable product:

1. Ross Video RRB-SRV

2. Ross Video RRB-CTL-PTZ

3. With Ross RRB-SRV-BKUP Backup Server [ROBO-SVR-2]

21. Automated Tracking System [TRACK-1]

a. 1RU automated camera tracking system

b. Vision analysis of camera image, automated tracking of people.

c. Adjustable ballistics, trajectory smoothing, and framing preferences.

d. 4 video channels of 3G-SDI ingest and simultaneous operation. Single user.

e. Acceptable product:

1. Ross Video RRB-VAI-SRV VisionAiry Server, with:

a. Ross Video RRB-VAI-FT-ENGINE Facial Tracking License – Qty: 4

b. Ross Video RRB-VAI-BT-ENGINE Body Tracking License – Qty: 4

c. Ross Video RRB-SRV-SW

d. Ross Video RRB-VAI-FT-CLIENT

I. Captioning

1. Caption Generator, Type 1 [CC-1]

    a. Automated Captioning Engine for 1 Live Channel (SDI Only) and Post Production Captioning.

    b. Internal captioning encoding card.

    c. Integration note:

        1. Device is only compatible with 3G-SDI Level B. Provide conversion to/from Level A.

    d. Acceptable product:

        1. Link Electronics ACE-2200 with ENC-102 Bundle

2. Caption Generator, Type 2 [CC-2]

    a. Automated Captioning Engine. Real Time Captioning of up to 4 simultaneous SDI inputs.

    b. Internal captioning encoding.

    c. Integration note:

        1. Device is only compatible with 3G-SDI Level B. Provide conversion to/from Level A.

    d. Acceptable product:

        1. Link Electronics ACE-Flex4 with ENC-101 (QTY 4) Bundle

3. Caption Encoder [CC-3]

    a. External captioning encoder.

    b. OFCI use only, no longer supported.

    c. Integration note:

        1. Device is only compatible with 3G-SDI Level B. Provide conversion to/from Level A.

    d. Acceptable product:

        1. Link Electronics AIP-494

4. Caption Generator, Type 4 [CC-4]

a. Automated Captioning Engine for 1 Live Channel (SDI Only).

b. Internal captioning encoding card.

c. Integration note:

1. Device is only compatible with 3G-SDI Level B. Provide conversion to/from Level A.

d. Acceptable product:

1. Link Electronics ACE-2000 with ENC-102 Bundle

J. Custom Panels – see 2.06.A below.

1. Plate, CATV Feed Demarcation [PLT-CATV-1]

a. Rack-mounted custom plate with:

1. 12x 3G-SDI (Control Room PGM Feeds)

2. 1x 3G-SDI (Senate Master Control Feeds)

3. 1x 3G-SDI (House Master Control Feeds)

4. 1x 3G-SDI (Capitol Master Control Feeds)

5. 6x 3G-SDI (Future Aux)

2. Plate, Office Convenience [PLT-OFF-1]

a. Custom plate with tielines to remain open for future use: 2x ST-UPC SMFO, 2x 3G-SDI, 2x2 XLR, 2x RJ45 Network

3. Plate, Press Feed Demarcation [PLT-PRESS-1]

a. 1RU Rack-mounted custom plate, one for each control room and CAP master control, with:

1. 8x 3G-SDI Multiview DA outputs and 8x 3G-SDI CAP Master Control outputs; OR

2. 8x 3G-SDI (Control Room PGM Feed) and 8x 3G-SDI (Control Room Clean Feed)

a. One for each:

1. Senate PCR 1, PCR 2, PCR 3, PCR 4, PCR 5

2. House PCR 1, PCR 2, PCR 3, PCR 4, PCR 5, PCR 6

4. Plate, Studio Feeds [PLT-STUDIO-1]

a. Custom plate with tielines for future use: 6x ST-UPC SMFO, 6x 3G-SDI, 8x4 XLR, 6x RJ45 Network

5. Plate, Studio Feeds [PLT-STUDIO-2]

a. Custom plate for [LED-x] video wall connections: ST-UPC SMFO, RJ45 Network connections, Qty as required

6. Plate, Transmission Demarcation [PLT-TX-1]

a. Custom rackmount plate with connections for handoff of transmission feeds: 2x 3G-SDI

7. Plate, User Convenience [PLT-USR-1]

a. Custom plate with connections for user convenience: 120VAC, USB-A and USB-C charging, 2x RJ45 Network, USB passthroughs for KVM keyboard and mouse connections

8. Plate, Hearing Room Rack [PLT-USR-4]

a. Custom plate with connections for auxiliary hearing room tielines: 1x 3G-SDI send, 2x 3G-SDI receive.

K. Encoding

1. Encoder/Decoder, Software [EDC-1]

a. 1RU live video and audio transcoding server.

b. Support for 12G-SDI I/O, NDI, SRT, H.265, H.264, H.262, JPEG XS (Optional), JPEG 2000 (Optional), and RTMP.

c. Minimum simultaneous processing of one UHD channel, or four HD channels.

d. Support for SDR & HDR workflows, transfer characteristics.

e. CEA-608/CEA-708 Closed Captioning.

f. Streaming delivery via HLS, RTP, RTMP, RTMPS, SRT, UDP, MPEG-TS, NDI, AVC-TS, and fragmented MP4.

g. Remote WebUI or local GUI.

h. Monitoring, control, and automation via REST API and SNMP.

i. Dual 10 GigE interfaces. Dual power supplies.

j. Acceptable product:

1. AJA Bridge Live

2. Encoder/Decoder, Hardware [EDC-2]

a. 4K HEVC / AVC / MPEG2 Software Defined Broadcast Encoder with Single-Channel 4K or Quad-Channel 2K Video Paths.

b. Support for one 4K encode channel or up to four encode channels up to 1080p60

c. Support for MPEG-2 and MPEG-4 AVC (H.264)

d. Support for 4:2:0 8-bit/10-bit encoding

e. Full ancillary data support

f. Support for 2 stereo pairs per channel (4 audio channels) in any combination of

g. MPEG-1 Layer II, AAC-LC, and HE-AAC (v1/v2) modes

h. All network protocols (RIST and SMPTE-2022 FEC available with corresponding Options)

i. Remote control/monitoring via Dashboard software

j. OpenGear compatible.

k. Acceptable product:

1. Cobalt Digital PACIFIC 9992-ENC-4K-HEVC OpenGear Card

2. Cobalt Digital RM20-9992-ENC-B-HDBNC Rear Module

3. Cobalt Digital +422 4:2:2 Encoding License

4. Cobalt Digital +MP1L2-AAC Audio Encoding License – Qty: 4

5. Cobalt Digital +SMPTE2022 SMPTE 2022 FEC License

6. Cobalt Digital +SRT-ENC SRT License

3. Encoder, NDI [NDI-1]

a. OFE use only.

b. Single channel 3G-SDI to NDI High Bandwidth encoder card. Rackmount chassis.

c. Acceptable product:

1. Kiloview Cradle RU03 [NDI-1] – *Qty: 1*

a. With Kiloview RN-3 3G-SDI to NDI Encoder Card – *Qty: 16*

L. Graphics

1. Character Generator, Type 1 [CG-1]

a. 1 RU server running Windows 11 with graphics creation and playout software.

b. Support for up to 3 Output Channels (fill+key), using HD-SDI hardware or NDI output.

c. Unlimited Output Layers.

d. Support for 2 Video Input signals. Support for virtual preview and rendering channels.

e. Integrated data aggregation server software for remote data feeds, including XML, JSON, RSS, UDP/TCP, Microsoft Access, Microsoft Excel, etc.

f. Acceptable product:

1. Ross Video XPN-1RU-M9

2. Ross Video XST-DLQ

3. Ross Video XST3-0001

2. Character Generator Project Server [CG-SVR-1]

a. 1RU server for centralized graphics project and workflow server.

b. Acceptable product:

1. Ross Video XPN-HW-CORE-V3

2. Ross Video XPN-PS

3. Character Generator Keyboard [KB-11]

a. Custom keyboard with dedicated character generator function keys for recall, clear, commands, macros, fonts, etc.

b. Acceptable product:

1. Ross Video XPN-KBD with wired mouse

M. Handover - Engineering Toolkit

1. Engineering Toolkit [TOOLKIT-1]

a. Provide ALL acceptable product:

1. Handheld Analyzer, Generator, and Monitor

a. Acceptable product:

1. Leader Phabrix PHSXTAGC, with:

a. PHSXO-AVD AV Delay Analysis License

b. PHSXO-3GADV 3G Advanced Formats License

c. PHSXOSD SDI Data Display License

d. PHSFP-RT30-1310 Optical SFP for SDI

e. PHSXWM Wall Mount Bracket

2. Provide one set of all hand tools required for patch panel maintenance and terminations. (cable stripper, crimp tool & dies, insertion & extraction tool, punch down, etc.). Include for audio, video, and network.

3. Provide one set of cleaning & inspection hand tools for all types of fiber optical cabling systems present in the system (cleaning/polishing, visual inspection microscope, visual fault locator, loss meter, etc). This requirement does not include electronic tools like OTDR test equipment, fusion splicer, etc.

N. Ingest & Playout

1. Playout Server [PLAYOUT-1]

a. Dual 8-ch ingest & playout chassis; poolable with central management software

b. Baseband SDI, NDI, and 2110 support.

c. Licensed for 3G-SDI. Support for 1080p59.94 HDR HLG.

d. AVCIntra codec (50, 100, 200 Mbps) with growing file support.

e. Internal RAID-1 system drives.

f. 2x 10GbE network Ports each with support for optional 10/25 GbE networking.

g. Redundant power supplies.

h. Acceptable product:

1. Ross Video Media I/O, with two servers configured for 6 inputs/2 outputs each:

a. Ross Video MIO-SW-CHANNEL License – Qty: 16

b. Ross Video MIO-SW-MGMT License – Qty: 1

c. Ross Video MIO-HW-G6-IO-SDI Video Card– Qty: 2

d. Ross Video MIO-HW-G6-X8-3U-W Server – Qty: 2

e. Ross Video MIO-HW-G6-SFP-25S Network Card – Qty: 4

2. Storage RAID Array [RAID-1]

a. Storage RAID Array designed for high speed editing workflows.

b. Minimum 16 SATA/SSD disks per chassis.

c. Support for at least four 16-bay expansion chassis.

d. 2x10 GbE network ports, with expansion options for 1 GbE, 10 GbE, 25 GbE and 50 GbE.

e. Support for RAID 0, 1, 4, 5, 6, and 10 configuration.

f. Redundant power supplies.

g. Acceptable product:

1. SNS EVO-16B-192TB Array

2. SNS EVO-IO-25G-2-SFP NIC – Qty: 2

3. Transcoding Server [TRANSCODE-1]

a. 1RU Server, minimum dual 16-core, 2.5 GHz enterprise CPU. Dual 800GB OS SSD in RAID 1. Dual 1.92TB Media SSD in RAID 0. Dual NVIDIA GPU. Minimum 256GB RAM.

b. 2x 10GbE networking, with support for optional expansion.

c. Workflow designer software with watch folder support.

d. Analysis and transcode modules supporting all common media formats. Distribution workflow support for common services including FTP/network folder.

e. GPU acceleration support for H.264/5 encoding.

f. Single-file analysis and workflow forking based on video & audio format, deep frame analysis, letterboxing, slate detection, macroblocking, and Loudness measurement.

g. Support for caption processing.

h. Acceptable product:

1. Telestream V-VLS-200

2. Telestream V-XCPRO-SW

3. Telestream V-ANLZ-SW

4. Telestream V-LS-PLTN-MS00

O. Intercom

1. Keypanel, 1RU [ICKP-1]

a. 1RU, 16 keys. IP connection.

b. Wide viewing-angle color screen, ergonomic levers for talk/listen.

c. Expansion panel option available.

d. Built-in speaker. Microphone input for dynamic or electret mics.

e. Acceptable product:

1. Bosch/RTS KP3016 Keypanel
2. Bosch/RTS PH-88R Headset, 4pin Male
3. Bosch/RTS MCP-90-8 Gooseneck Mic

2. Keypanel, 2RU [ICKP-2]

a. 2RU, 32 keys. IP connection.

b. Wide viewing-angle color screen, ergonomic levers for talk/listen.

c. Expansion panel option available.

d. Built-in speaker. Microphone input for dynamic or electret mics. Advanced signal processing and AD/DA.

e. Acceptable product:

1. Bosch/RTS KP5032 Keypanel
2. Bosch/RTS PH-88R Headset, 4pin Male
3. Bosch/RTS MCP-90-8 Gooseneck Mic

3. Keypanel, Desktop 16-key [ICKP-3]

a. Desktop/wall-mount, 16 keys. IP connection.

b. Wide viewing-angle color screen, ergonomic levers for talk/listen.

c. Built-in speaker. Microphone input for dynamic or electret mics.

d. Acceptable product:

1. Bosch/RTS DKP4016
2. Bosch/RTS PH-88R Headset, 4pin Male
3. Bosch/RTS MCP-90-8 Gooseneck Mic

4. Keypanel, Desktop 4-key [ICKP-4]

a. Desktop/wall-mount digital speaker station, 4 keys. IP connection.

b. Wide viewing-angle color screen, ergonomic levers for talk/listen.

c. Built-in speaker. Microphone input for dynamic or electret mics.

d. Acceptable product:

1. Bosch/RTS DSPK4-D

2. Bosch/RTS PH-88R Headset, 4pin Male

3. Bosch/RTS MCP-90-8 Gooseneck Mic

5. Beltpack [ICKP-5]

a. Digital beltpack, 4 keys. POE.

b. Acceptable product:

1. Bosch/RTS DBP

2. Bosch/RTS PH-88R Headset, 4pin Male

6. Intercom Matrix [ICMTX-1]

a. 16 port intercom matrix, licensable up to 128 ports.

b. Up to 8 units can be interconnected, for up to 1024 ports.

c. Front panel user interface.

d. Ports support analog audio, AoIP, VoIP, and analog powered party line connections.

e. Physical connections for up to 16 analog ports, 2 party line ports.

f. Integration note:

1. Integrate inter-frame link connections with existing [ICMTX-1] in CAP and MSB.

g. Acceptable product:

1. Bosch/RTS ODIN64NOCORD

2. Bosch/RTS OM-SM SFP ODIN - Qty: 2

7. Intercom Fiber Converter [ICONV-1]

a. Partyline to fiber converter.

b. OFCI use only, no longer supported.

c. Integration note:

1. Currently in use at CAP for intercom connections to COB. Maintain use until cutover date, then decommission and remove.

d. Acceptable product:

1. Grass Valley FXC-S201

8. Intercom Telephone Interface [TIF-1]

a. Dual SIP IP lines, with minimum 64kbps data rate.

b. Dual POTS analog lines.

c. Separate hybrid for balanced audio transmit and receive, per channel.

d. Acceptable product:

1. Bosch/RTS TIF-PRO2

P. KVM

1. Keyboard & Mouse [KB-1]

a. Wired keyboard and mouse.

b. Acceptable product:

1. Logitech MK120

2. Keyboard & Mouse, Rackmount [KB-2]

a. Wired keyboard and mouse. For rackmount applications.

b. Acceptable product:

1. Logitech MK120

2. Rackmount Solutions RS-RM KEYBOARD

3. Computer Monitor, 32” [KMON-1]

a. 32-inch 4K HDR display with mini-LED backlight with 1,000 cd/m2 peak brightness

b. Support multiple HDR formats (HDR-10, HLG) and DisplayHDR 1000 certified.

c. USB-C supports DisplayPort signal, data transfers and up to 80W Power Delivery to external devices via one cable

d. X-rite i1 Display Pro calibrator (one per building required)

e. HDMI(v2.0) x 3, DisplayPort 1.2, Full Function USB-C and a USB hub

f. Built-in speakers

g. Integration note:

1. Connect speaker to [KVM-RX-#] via USB or mini stereo jack.

h. Acceptable product:

1. ASUS PA32UCRK 32" 4K HDR Monitor

4. Computer Monitor, 27” [KMON-2]

a. 27-inch 4K (3840 x 2160) LED backlight HDR display with 178° wide-view IPS panel.

b. Support HDR (HDR-10) and DisplayHDR 400 certified.

c. USB-C supports DisplayPort signal, data transfers and up to 96W Power Delivery to external devices via one cable

d. HDMI(v2.0) x 2, DisplayPort 1.4, Full Function USB-C and a USB hub

e. Built-in speakers

f. Integration note:

1. Connect speaker to [KVM-RX-#] via USB or mini stereo jack.

g. Acceptable product:

1. ASUS PA279CRV 27" 4K HDR Monitor

5. Computer Monitor, 32” Touch [KMON-3]

a. 32" 16:9 IPS 10-Point Touchscreen, UHD 4K 3840 x 2160 at 60 Hz. 400 nits Peak Brightness.

b. Supports HDR. DisplayHDR 400 certified.

c. USB-C supports DisplayPort signal, data transfers and up to 65W Power Delivery to external devices via one cable

d. HDMI(v2.1) x 2, DisplayPort 1.4, Full Function USB-C and a USB hub

e. Built-in speakers

f. Integration note:

1. Connect speaker to [KVM-RX-#] via USB or mini stereo jack.

g. Acceptable product:

1. ALOGIC 32C4KPDWT 32" 4K HDR Touch Monitor

6. Computer Monitor, 27” Touch [KMON-4]

a. 27" 16:9 IPS 10-Point Touchscreen, UHD 4K 3840 x 2160 at 60 Hz. 400 nits Peak Brightness.

b. USB-C supports DisplayPort signal, data transfers and up to 65W Power Delivery to external devices via one cable

c. HDMI(v2.1) x 2, DisplayPort 1.4, Full Function USB-C and a USB hub

d. Built-in speakers

e. Integration note:

1. Connect speaker to [KVM-RX-#] via USB or mini stereo jack.

f. Acceptable product:

1. ALOGIC 27C4KPDWT 27" 4K HDR Touch Monitor

7. KVM Manager [KVM-MGR-1]

a. IP-based KVM system, with centralized manager.

b. Fault tolerant 1+1 “hot" redundant manager.

c. User Access Rights Management and Audit Trails. LDAP integration for user accounts.

d. Video and control switching <1 sec. Favorite and hotkey switching.

e. Support for private and public one-to-one connections, as well as one-to-many public multicasting.

f. Support for multiple transmitters routed to single dual-monitor receivers.

g. Support for breakaway routing of video, audio, control connections.

h. Web GUI control for remote administration.

i. Integration note:

1. Enroll all KVM devices in OFOI [KVM-MGR-1] at CAP.

j. Acceptable product:

1. Adder ASP-001-US Infinity Manager AdderLink Server - Qty: 2

2. Adder AIMLIC-UNL Unlimited Primary License

3. Adder AIMLIC-UNL-BCK Unlimited Backup License

4. Adder SFP-CATX-RJ45 SFP - Qty: 4

8. KVM Power Supply, Type 1 [KVM-PSU-1]

a. Central power supply for rack-mounted [KVM-RX-#] and [KVM-TX-#].

b. Acceptable product:

1. Adder PSU-REDPR02-16-US

2. Adder VSC48 - Qty: 16

9. KVM Power Supply, Type 2 [KVM-PSU-2]

a. Central power supply for rack-mounted [KVM-RX-#] and [KVM-TX-#].

b. Acceptable product:

1. Adder PSU-REDPR02-8-US

2. Adder VSC48 - Qty: 8

10. KVM Transmitter, Single Display [KVM-TX-1]

a. 0RU KVM transmitter dongle, USB-powered. 1-gigabit ethernet.

b. USB 2.0 with fast switching support. USB HID support. USB Audio support.

c. Internal EDID Management.

d. Max resolution of 2560x1600, 60fps, 8-bit color. Single display.

e. Acceptable product:

~~Adder ALIF101T-DP or -VGA or -DVI or -HDMI~~

1. Adder ALIF102T-HM or -DP; or Adder ALIF101T-DVI; or Adder ALIF100T-VGA

a. Match signal type to device output. Do not provide external conversion if a suitable variation is available.

2. Adder PSU-RPS-5V-3M

11. KVM Transmitter, Dual Head [KVM-TX-2]

a. 1RU, half width transmitter. 10-gigabit ethernet.

b. USB 2.0 with fast switching support. USB HID support. USB Audio support.

c. Internal EDID Management.

d. Up to two 5K video resolutions and ultra-wide video resolutions (5120x1440@60Hz or 5120x2880@30Hz) or higher refresh rates of up to 240Hz (HD@240Hz) over a single IP connection. Up to 10-bit Per Color and HDR10.

e. Integration note:

1. Set devices for dual, UHD HDR10 displays.

f. Acceptable product:

1. Adder ALIF4001T-US Transmitter

2. Adder RMK12 Rack Kit

3. Adder RMK12-BP Rack Blank

4. Adder SFP-CATX-10G-80M SFP

12. KVM Receiver, Dual Head [KVM-RX-2]

a. Simultaneous compatibility with [KVM-TX-1] and [KVM-TX-2]

b. 1RU, half width receiver. 10-gigabit ethernet.

c. USB 2.0 with fast switching support. USB HID support. USB Audio support.

d. Internal EDID Management.

e. Up to two 5K video resolutions and ultra-wide video resolutions (5120x1440@60Hz or 5120x2880@30Hz) or higher refresh rates of up to 240Hz (HD@240Hz) over a single IP connection. Up to 10-bit Per Color and HDR10.

f. Acceptable product:

1. Adder ALIF4001R-US Transmitter

2. Adder RMK12 Rack Kit

3. Adder RMK12-BP Rack Blank

4. Adder SFP-CATX-10G-80M SFP

Q. LED Video Wall

1. Studio LED Video Wall, .93mm [LED-1]

a. Modular LED video wall display, designed for on-camera broadcast use.

b. Cable-less module interconnections. Front service access.

c. 700 nits brightness. Minimum 3840 Hz refresh rate.

d. Trim kit.

e. 8-year warranty. Lifetime >100,000 hrs.

f. 7% spare parts included (minimum of QTY 1 per part)

g. Novastar KU20 HD LED Controller

h. Calibration kit for modular adjustments

i. Display size:

1. Physical dimension: 15’9” wide x 7’9” tall.

2. Pixel dimension: 5120 px x 2520 px

3. Pixel pitch: .93mm

j. Integration note:

1. Integrate display controller with [RTR-1], including full canvas preview output.

2. Configure display to ensure absolutely no on-camera flickering, tearing, moiré, seaming, blocking, or visual artifacts.

k. Acceptable product:

1. NanoLumens Engage P0.93 HDS LED Video Wall

a. Contact Patrick Jackson (pjackson@nanolumens.com)

2. Studio LED Video Wall, 1.25mm [LED-2]

a. Modular LED video wall display, designed for on-camera broadcast use.

b. Cable-less module interconnections. Front service access.

c. 700 nits brightness. Minimum 3840 Hz refresh rate.

d. Trim kit.

e. 8-year warranty. Lifetime >100,000 hrs.

f. 7% spare parts included (minimum of QTY 1 per part)

g. Novastar KU20 HD LED Controller

h. Calibration kit for modular adjustments

i. Display size:

1. Physical dimension: 15’9” wide x 7’9” tall.

2. Pixel dimension: 3840 px x 1890 px

3. Pixel pitch: 1.25mm

j. Integration note:

1. Integrate display controller with [RTR-1], including full canvas preview output.

2. Configure display to ensure absolutely no on-camera flickering, tearing, moiré, seaming, blocking, or visual artifacts.

k. Acceptable product:

1. NanoLumens Engage P1.25 HDS LED Video Wall

a. Contact Patrick Jackson (pjackson@nanolumens.com)

R. Master Control

1. Master Control Relay Distribution Amplifier [MCDA-1]

a. 12 G Bypass Protection Switch with Output Distribution, 1x4.

b. Passive bypass path ensures continuity of signal even in the event of frame power loss.

c. Acceptable product:

1. Ross Video SRA-8901-R-R3S

2. Master Control Switcher [MCSW-1]

a. 6x 3G / 12G-SDI inputs, 6x 3G / 12G-SDI outputs.

b. Support for HD and UHD formats, 59.94p.

c. Ancillary data pass-through and deletion.

d. GPI & tally interface with TSL.

e. A/B mix with clean switching. Cut, cross, and V-Fade transitions. 4 keyers. 2 animated logo generators. Quiet audio switching and transitions.

f. Control integration with [RTR-#]. Dashboard configuration and on-air control GUI.

g. Acceptable product:

1. Ross Video GATOR-MC1-2-R4 Mixer/Keyer

2. Ross Video MC1-DVE-1CH-LICENSE

3. Ross Video MC1-MASTERCTRL-LICENSE

S. Media Asset Management

1. LTO Tape Library [LTO-1]

a. OFCI LTO Tape library and controller

b. Acceptable product:

1. Qualstar Q24 FlexStor II 2RU LTO7 Library

2. HP ProLiant DL360 Gen 9 1RU Server, running Flashnet v6.9

2. Media Asset Management [MAM-1]

a. Media asset management database system including media registration & ingest, organization, metadata management, and access control.

b. Concurrent use of web GUI, creative software plugin, and NRCS plugin.

c. Automatic proxy generation and file tracking.

d. Internal workflow automation engine, with rule-based actions including proxy generation, metadata tagging, and archiving.

e. Integration with file- and online-based archive systems, including LTO, AWS S3, AWS Glacier, Quantum, Archiware, SGL, Atempo, and similar.

f. Optional web GUI video editor with dedicated transcode rendering engine.

g. Acceptable product:

1. Ross Video Streamline Pro, with:

a. MAM-SW-CORE Platform License

b. MAM-EXP-USER User License – Qty: 20

c. MAM-EXP-PROXY Proxy Transcode – Qty: 6

d. MAM-OPT-AUTOMATION Automation Engine

e. MAM-OPT-LDAP LDAP Server Integration

f. MAM-OPT-ARCHIVE Archive Integration

g. MAM-OPT-VIDEO-EDITOR Web Video Editor

h. MIO-SW-CHANNEL Media I/O Flex Channel License – Qty: 2

i. MAM-HW-SERVER-G5-W-HE MAM High Performance Server – Qty: 2

3. Network Attached Storage [NAS-1]

a. 2RU network attached storage array. 12 bays, 3.5” HDD and 2.5” SSD.

b. Minimum Intel Xeon D-1541 8-core/16-thread 64-bit CPU.

c. 8 GB DDR4 ECC UDIMM RAM, upgradable to 64 GB

d. Compatible with expansion chassis, for up to 36 bays.

e. 2x 10GbE and 4x 1GbE LAN ports.

f. 2x Gen3 x8 PCIe Expansion Slots

g. Redundant power supplies

h. Acceptable product:

1. Synology RackStation RS3621xs+, with:

a. Synology HAT5300-16T 16TB SATA III 3.5" Internal Enterprise HDD – Qty: 6

b. Synology SAT5221-1920G 1.92TB SAT5221 SATA III 2.5" Internal SSD – Qty: 2

1. Configure as SSD read/write cache.

T. Monitoring

1. IP Multi-image Viewer Generator [MIV-1]

a. Multiview canvas generator, capable of a variety of IP sources including: ST-2110-10/20/21/30/31/40, ST-2022-6 SDI over IP, JPEG-XS, H.264/H.265, SPTS or MPTS MPEG-TS, MPEG-2, JPEG2000, SCPTE-35/104, MPEG-DASH, HLS, TS/UDP, TS/RTP, RTMP, HD, UHD, HDR/HLG, AAC, AES67, SRT, and NDI.

b. Support for NMOS IS-04 and IS-05.

c. Completely custom, user-definable layouts, with custom layout editor.

d. Round-robin and penalty box layout displays, based on user-defined error monitoring criteria.

e. A minimum of eight (8) HD outputs, delivered as ST 2110-21/30 streams.

f. Tally and UMD integration via TSL protocol.

g. Audio metering, event and error monitoring per PIP window. Subtitle & open captioning displays per PIP window.

h. Customizable clock display, with PTP and/or LTC input.

i. Support for ST 2022-7 input and output seamless redundancy.

j. Integration note:

1. Ensure SOB video signals are accessible on OFOI [MIV-1] installed at CAP, via ST 2110 router tielines.

k. Acceptable product:

1. TAG Video Systems PACKAGE with:

a. TAG Video Systems MCS

b. TAG Video Systems Subscription

c. TAG Video Systems Zero-Friction CAPEX Input License - Qty: 60

2. Dell PowerEdge R650xs

a. Configured per TAG requirements to support MCS software.

b. NVIDIA MCX512A-ACAT SFP28 25GBE x2 - Qty: 1 each

3. Dell PowerEdge R750 - Qty: 3

a. Configured per TAG requirements to support MCM software.

b. NVIDIA MCX512A-ACAT SFP28 25GBE x2- Qty: 1 each

c. NVIDIA MCX516A-CCAT QSFP28 100GBE x2 - Qty: 1 each

4. QSFP and MTP Patch as required

2. Multi-image Viewer Generator [MIV-2]

a. 16-input utility multiviewer. 10-bit up to 6G-SDI.

b. Blackburst input.

c. HDMI and SDI outputs.

d. Acceptable product:

1. Blackmagic Design MultiView 16

U. Music Player

1. Music Player [MUSIC-1]

a. OFCI Music Player.

b. Acceptable product:

1. Denon DN-300R MKII

V. Network - IP Media

1. Fabric Controller [NDFC-1]

a. Fabric controller for IP Media deployments, for automated provisioning, topology and fabric visibility, templated deployment and automatic compliance remediation.

b. Monitor and alert operators to failure conditions.

c. Integration note:

1. Integrate new MoIP fabric switches with existing OFOI [NDFC-1].

d. Acceptable product:

1. Cisco NDFC

2. Dell PowerEdge R7525, configured per software requirements

2. IP Media Switch, Spine [NETSW-1]

a. 2RU spine switch that supports 12.84 Tbps of bandwidth and 4.3 bpps across 64 fixed 40/100G QSFP28 ports and 2 fixed 1/10G SFP+ ports

b. Hot-swappable, dual fan trays with redundant fans.

c. Redundant power supplies.

d. Acceptable product:

1. Cisco N9K-C9364C-GX Fixed Spine Switch

2. Cisco CON-SNC-N9KC93CG

3. Cisco NXOS-CS-10.2.5M

4. Cisco NXK-MEM-16GB
5. Cisco NXA-PAC-2KW-PI - Qty: 2
6. Cisco N9K-C9300-RMK
7. Cisco C1A1TN9300XF2-1Y
8. All required accessories & licenses

3. IP Media Switch, Leaf [NETSW-2] – Qty: as required to support all devices plus at least 20% unused access ports.
   a. 2RU Leaf switch that supports 7.2 Tbps of bandwidth and 2.4 bpps across 96 fixed 10/25G SFP+ ports and 12 fixed 40/100G QSFP28 ports. Downlinks support 1/10/25-Gbps
   b. Hot-swappable, dual fan trays with redundant fans.
   c. Redundant power supplies.
   d. Acceptable product:
      1. Cisco N9K-C93360YC-FX2
      2. Cisco CON-SNC-N9KC933F
      3. Cisco NXOS-CS-10.2.5M
      4. Cisco NXK-MEM-8GB
      5. Cisco NXA-PAC-1200W-PI - Qty: 2
      6. Cisco N9K-C9300-RMK
      7. Cisco C1A1TN9300XF-1Y
      8. All required accessories & licenses
4. IP Media Switch, Leaf [NETSW-5] – Qty: as required to support all devices plus at least 20% unused access ports.
   a. 1.2RU Leaf switch that supports 4.8 Tbps of bandwidth and 2.5 bpps across 48 fixed 10/25G SFP+ ports and 12 fixed 40/100G QSFP28 ports. Downlinks support 1/10/25-Gbps.
   b. Hot-swappable fan trays with redundant fans.

c. Redundant power supplies.

d. Acceptable product:

1. Cisco N9K-C93240YC-FX2
2. Cisco CON-L1NCD-
3. Cisco MODE-NXOS
4. Cisco NXK-AF-PI
5. Cisco NXOS-CS-10.4.3F
6. Cisco NXK-MEM-8GB
7. Cisco NXA-PAC-750W-PI – Qty: 2
8. Cisco NXA-FAN-35CFM-PI – Qty: 5
9. Cisco C1A1TN9300XF-1Y
10. Cisco NXK-ACC-KIT-1RU
11. Cisco NXOS-SLP-INFO-9K
12. All required accessories & licenses

W. Network - Control

1. Control Switch, Stacking [NETSW-3] – Qty: as required to support all devices plus at least 20% unused access ports.

a. 3,000 Gbps switching capacity with stacking. 48 port UPOE+, 48x 10G Multigigabit (10G/5G/2.5G/1G/100M) with 90W UPOE+. Modular uplinks, with support for up to 4x 100G/40G.

b. Redundant power supplies. Stackable power.

c. Acceptable product:

1. Cisco C9300X-48HX-A
2. Cisco CON-L1NCD-C9300XY4
3. Cisco PWR-C1-1100WAC-P
4. Cisco PWR-C1-1100WAC-P/2

5. Cisco STACK-T1-1M – Qty: as req. based on stack member qty.
6. Cisco STACK-T1-50CM – Qty: as req. based on stack member qty.
7. Cisco CAB-SPWR-30CM – Qty: as req. based on stack member qty.
8. Cisco TE-C9K-SW
9. Cisco C9300-DNA-A-48
10. Cisco CON-L1SWT-C93A48
11. Cisco TE-EMBEDDED-T
12. Cisco D-DNAS-EXT-S-T
13. Cisco NETWORK-PNP-LIC
14. All required accessories & licenses

2. Control Switch, Spine [NETSW-4]
   a. 3.2 Tbps switching capacity. 32 port 40G Gigabit Ethernet via QSFP+. 16 port 100G Ethernet.
   b. Redundant power supplies.
   c. Acceptable product:
      1. Cisco C9500-32QC-A
      2. Cisco PWR-650WAC-R
      3. Cisco PWR-650WAC-R/2
      4. Cisco DNA License
      5. Cisco NETWORK-PNP-LIC
      6. All required accessories & licenses
3. Control Switch, Hearing Room [NETSW-11]
   a. 880 Gbps switching capacity. 24-port 10G/mGig copper, UPOE+. Modular uplinks, with support for up to 4x 100G/40G.
   b. 1835W of total POE power.

c. Acceptable product:

1. Cisco C9300X-24HX-A
2. Cisco CON-L1NCD-C9300X3A
3. Cisco PWR-C1-1100WAC-P
4. Cisco PWR-C1-1100WAC-P/2
5. Cisco TE-C9K-SW
6. Cisco C9300-DNA-A-24
7. Cisco CON-L1SWT-C93A24
8. Cisco TE-EMBEDDED-T
9. Cisco D-DNAS-EXT-S-T
10. Cisco NETWORK-PNP-LIC
11. All required accessories & licenses

4. Network Module [NETSW-NM2C]

a. Modular uplink card, supporting 2x 100G/40G.

b. Acceptable product:

1. Cisco C9300x-NM-2C

5. Network Module [NETSW-NM8Y]

a. Modular uplink card, supporting 8x 25G/10G/1G.

b. Acceptable product:

1. Cisco C9300x-NM-8Y

6. Network Router [NETRTR-1]

a. 1RU security appliance.

b. Support for 10G/5G/2.5G/1G ports

c. Multi-gigabit Threat and Malware Analysis Throughput

d. Up to 256 logical VLAN and tunnel interfaces.

e. Up to 5.2Gbps firewall inspection throughput.

f. IPv4/IPv6 support, DNS, DHCP server, DHCP relay, NAT, BGP4, OSPF, RIPv1/2, policy-based routing, QOS.

g. Point to point VPN tunneling, with support for up to 100Mbps throughout.

h. High-availability failover with n+1 mode

i. Integration note:

1. Configure existing OFOI [NETRTR-1] in CAP for all new [NETSW-x].

2. Update DNS, DHCP server(s) for all new devices.

3. Implement firewall, QOS, route, and NAT policies as required to support new SOB systems.

4. Maintain all existing facilities and services unless approved by Owner and Design Consultant.

j. Acceptable product:

1. SonicWall NSa 2700 Security Appliance High Availability Pair

2. SonicWall 02-SSC-8389 Stateful HA Upgrade NSA 2700 V License

3. SonicWall 02-SSC-7370 NSa 2700 Secure Upgrade Plus Essential - 3 YR (valid through 11/2027)

4. All required accessories & licenses

X. Network - Management

1. Management Switch [NETSW-21]

a. 36 Gbps switching capacity. 16x gigabit ethernet ports, with 2x SFP ports.

b. Acceptable product:

1. Cisco C1300-16T-2G

2. Cisco CON-SNC-C13001TG

3. All required accessories & licenses

Y. Network - SFPs

1. SFPs

a. 100G, CWDM4 [SFP-100G-CWDM4]

b. 100G, LR4 [SFP-100G-LR4]

c. 100G, PSM4 [SFP-100G-PSM4]

d. 100G, SR [SFP-100G-SR]

e. 100G, SR4 [SFP-100G-SR4]

f. 10G, LR [SFP-10G-LR]

g. 10G, SR [SFP-10G-SR]

h. 1G, T [SFP-10G-T]

i. 25G, LR [SFP-25G-LR]

j. 25G, SR [SFP-25G-SR]

k. 40G, LR4 [SFP-40G-LR4]

l. Others, as required

m. Acceptable product:

1. Cisco

2. HP

3. SonicWall

4. Fluxlight, compatibility as required

5. Addon, compatibility as required

6. Others, as approved

n. Provide quantity as required, plus 5% spare of each type used throughout the system (minimum of QTY 1).

Z. Network Monitoring

1. Network Monitoring System [NMS-1]

a. Enterprise server and network monitoring software. Centralized view of IT networks, processes, and dashboards. Automated trending and capacity planning. Proactive alerts sent via email, SMS text message, Slack, or Microsoft Teams.

b. Multi-tenant user rights management.

c. Web-based GUI for administration, control, monitoring, and alert configuration.

d. Integration note:

1. Assist Owner with enrolling devices into existing OFOI [NMS-1]. Provide SNMP trap and IP address details for all servers to monitor server health, resource usage, and service availability.

2. Enroll all network devices to track network performance, bandwidth, and connectivity. (Media-over-IP fabric devices will not be monitored with this tool. Use OEM tool.)

3. Enroll all databases for monitoring of performance metrics, query response times, and storge usage.

4. Set up SNMP and SNMP trap monitoring for all devices that support SNMP.

e. Acceptable product:

1. HP 8Z235UT#ABA, configured per software requirements

2. Intel i350-T4

3. Nagios XI:XI-400-MSP-1Y

4. Nagios XI:XI-ENT-1Y

AA. On Air Light

1. On Air Light, Wall Mounted [OAL-1]

a. RGB LED wall mounted sign, with dual GPI inputs and configurable light pattern display.

b. Integration notes:

1. Integrate all GPI with [GPIO-1].

2. For Control Rooms:

a. Configure to light yellow when control room program audio is not silent.

b. Configure to light red when control room program video is “on-air” in the MSB master control switcher.

3. For Studios:

a. Configure to light yellow when a studio camera is “on-air” in any production control room switcher.

b. Configure to light red when a studio camera is “on-air” in any production control room switcher, AND that control room program video is “on-air” in the MSB master control switcher.

c. Acceptable product:

1. Sonifex LD-20F1ONA

a. Confirm text prior to ordering.

2. Sonifex LD-DC

BB. QAM CATV

1. QAM Encoder & Modulator [MOD-1]

a. 2 channel HD-SDI QAM encoder and modulator.

b. For OFOI use only.

c. Acceptable product:

1. ATX Digivu II 2-ch

2. QAM Encoder & Modulator [MOD-2]

a. 8 channel SD-SDI QAM encoder and modulator.

b. For OFOI use only.

c. Acceptable product:

1. ATX Digivu II 8-ch

CC. Router

1. Router Control Panel, 4RU [RCP-1]
    a. 4RU router panel, touch screen.
    b. Configurable profiles for router control & monitoring, Multiview window and preset configuration, switcher aux delegates, master control switcher control, and router breakaway.
    c. Acceptable product:
        1. Ross Video ULTRITOUCH-4
        2. Ross Video ULTRITOUCH-PS - Qty: 2
2. Router Control Panel, 2RU [RCP-2]
    a. 2RU router panel, touch screen.
    b. Configurable profiles for router control & monitoring, Multiview window and preset configuration, switcher aux delegates, master control switcher control, and router breakaway.
    c. Acceptable product:
        1. Ross Video ULTRITOUCH-2-HR
        2. Ross Video ULTRITOUCH-PS - Qty: 2
3. Router Panel, 1RU [RCP-3]
    a. 1RU fixed button hardware panel, 36 keys. Customizable RGB backlit LCD screen per key.
    b. Acceptable product:
        1. Ross Video RCP-QE36
4. Video & Audio Router, Type 1 for CAP [RTR-1]
    a. Existing OFOI at CAP.
    b. Software defined video, audio, and ancillary data routing platform.
    c. Native support for SMPTE ST2110 IP, 12G-SDI, 3G-SDI, HD-SDI, and SDI video. Native support for SMPTE ST2110 IP, AES67, and MADI audio.

d. Card/slot architecture with multiple slots, supporting various signal types. Optional processing cards and/or software for full-featured switching engines, multiview canvas generation, audio mux/demux, framesync, HDR<>SDR color conversion, and video proc amp.

e. Minimum video matrix size of 288x288 at UHDp60 HDR. Minimum audio matrix size of 6144x6144 mono.

f. Router Controller

1. Centralized router controller with redundant hot spare, immediate failover.

2. Controller shall support multiple router frames, managing tielines and namespaces between them.

3. Controller shall manage baseband, IP, and hybrid baseband + IP pathways seamlessly.

4. Switching of timed audio and video sources to all destinations shall be frame-accurate, occurring in the vertical interval without glitch, pause, distortion, hesitation, or interruption. Switching shall be frame accurate regardless of signal type.

g. Input and Output Cards

1. Router frame shall support multiple input and output cards, configurable in blocks of 16-18 inputs and outputs. Cards shall include:

a. Baseband video and audio inputs and outputs, including 12G-SDI, 3G-SDI, and HD-SDI with 16 audio channels per I/O on coax connections.

b. Baseband video and audio inputs and outputs, including 12G-SDI, 3G-SDI, and HD-SDI with 16 audio channels per I/O on fiber connections.

c. IP video and audio inputs and outputs, including compliance with the SMPTE ST 2110 suite (-10 System Timing, -20 Uncompressed Video, -30 PCM Digital Audio, -40 ANC Data).

1. Each flow shall support up to UHDp59.94 resolution.

2. Card shall receive PTP system timing and reference.

3. NMOS IS-04 and IS-05 for AIMS-compliant discovery, registration and connection control.

h. Multiview

1. Router shall be capable of generating multiple Multiview canvas outputs, each with at least 16 window tiles.

2. Each tile shall show full motion video without glitches, stutters, flashes, etc. Each tile shall provide multiple tally indicators, under-monitor display text dynamically updated, configurable audio meters, caption display, and configurable audio/video alarms.

3. Canvases shall be completely customizable. Any source shall be able to be represented in any tile, at any size and position within the canvas.

4. Canvases shall re-enter the router crosspoint fabric to ensure non-blocking routes are available to all destinations.

i. Integration Note:

1. Integrate all [RTR-#] frames with the existing centralized router controller pair installed at CAP.

2. Provide 3G-SDI and SMFO patching for all baseband inputs and outputs, allowing easy inspection of signals.

j. Acceptable product:

1. Centralized Router Controller pair, located at CAP, controlling all [RTR-#] frames at CAP, MSB, and future SOB:

a. Ross Video ULTRICORE-BCS - Qty: 2, with:

1. ULTRICORE-BCS-CLIENT - Qty: 3

2. ULTRICORE-BCS-PS - Qty: 2

3. ULTRICORE-IP

4. ULTRICORE-PRO

5. ULTRICORE-SNMP [RTR-SNMP]

6. ULTRICORE-TLX

7. ULTRICORE-IP+A - Qty: 12

8. ULTRICORE-IP+A3RD - Qty: 6
9. ULTRICORE-IP+V - Qty: 12
10. ULTRICORE-IP+V3RD - Qty: 6

2. Router Frame Hardware
   a. Ross Video ULTRIX-FR12, with:
      1. ULTRIPOWER - Qty: 3
      2. ULTRIPOWER-PS - Qty: 3
      3. ULTRIX-IPX-IO - Qty: 3
      4. ULTRIX-HDX-IO - Qty: minimum 10, more as required to maintain 10% unused input ports and 10% unused output ports
      5. ULTRIX-MODX-IO - Qty: 3
      6. ULTRIX-MOD-SFP - Qty: 12
      7. SFP-FIBER-12G - Qty: 26
      8. SFP-RJ45-1G - Qty: 8
      9. SFP-HDB-IO-12G – Qty: 24
3. Router Licenses
   a. Ross Video ULTRIPROC-16 - Qty: 3
   b. Ross Video ULTRIPROC-3DLUT - Qty: 8
   c. Ross Video ULTRISCAPE - Qty: 24
   d. Ross Video ULTRISCAPE-CA
   e. Ross Video ULTRISPEED-FR12
   f. Ross Video ULTRISTREAM - Qty: 8
   g. Ross Video ULTRISYNC-18 - Qty: 2
   h. Ross Video ULTRISYNC-UHD - Qty: 4

5. Video & Audio Router, Type 2 for SOB [RTR-2]

a. Meet or exceed [RTR-1] specifications, with the following configuration:

b. Acceptable product:

1. Router Frame Hardware

a. Ross Video ULTRIX-FR12, with:

1. ULTRIPOWER - Qty: 3

2. ULTRIPOWER-PS - Qty: 3

3. ULTRIX-IPX-IO - Qty: 3

4. ULTRIX-HDX-IO - Qty: 9

5. ULTRIX-MODX-IO - Qty: 4

6. ULTRIX-MOD-SFP - Qty: 15

7. ULTRIX-MOD-SDI - Qty: 1

8. SFP-FIBER-12G - Qty: 60

9. SFP-MADI-COAX - Qty: 2

10. SFP-HDB-IO-12G – Qty: 2

2. Router Licenses

a. Ross Video ULTRIPROC-16 - Qty: 2

b. Ross Video ULTRIPROC-3DLUT - Qty: 8

c. Ross Video ULTRIFORMAT-16 – Qty: 1

d. Ross Video ULTRISCAPE - Qty: 31

e. Ross Video ULTRISCAPE-CA

f. Ross Video ULTRISYNC-18 - Qty: 1

g. Ross Video ULTRICORE-SNMP [RTR-SNMP] - Qty: 1

h. Ross Video ULTRICORE-IP+V – Qty: 3

i. Ross Video ULTRICORE-IP+A – Qty: 3

j. Ross Video ULTRICORE-BCS-CLIENT – Qty: 3

6. Video & Audio Router, Type 3 for MSB [RTR-3]

a. Existing OFOI at MSB.

b. Meet or exceed [RTR-1] specifications, with the following configuration:

c. Acceptable product:

1. Router Frame Hardware

a. Ross Video ULTRIX-FR12, with:

1. ULTRIPOWER - Qty: 3

2. ULTRIPOWER-PS - Qty: 3

3. ULTRIX-IPX-IO - Qty: 3

4. ULTRIX-HDX-IO - Qty: minimum 7, more as required to maintain 10% unused input ports and 10% unused output ports

5. ULTRIX-MODX-IO - Qty: 2

6. ULTRIX-MOD-SFP - Qty: 8

7. SFP-FIBER-12G - Qty: 18

8. SFP-MADI-COAX - Qty: 2

9. SFP-RJ45-1G - Qty: 8

10. SFP-HDB-IO-12G – Qty: 26

11. SWR-SDPE - Qty: 2

2. Router Licenses

a. Ross Video ULTRIPROC-16 - Qty: 3

b. Ross Video ULTRIPROC-3DLUT - Qty: 8

c. Ross Video ULTRISCAPE - Qty: 26

d. Ross Video ULTRISCAPE-CA

e. Ross Video ULTRISPEED-FR12

f. Ross Video ULTRISTREAM - Qty: 8

g. Ross Video ULTRISYNC-18 - Qty: 2

h. Ross Video ULTRISYNC-UHD - Qty: 4

i. Ross Video CUFR-ADD-FSFC - Qty: 2

j. Ross Video CUFR-ADD-ME1 - Qty: 2

k. Ross Video CUFR-ADD-ME2 - Qty: 2

l. Ross Video CUFR-ADD-PACC - Qty: 2

m. Ross Video CUFR-ADD-UHD - Qty: 2

7. Router SNMP License [RTR-SNMP]

a. Add-on license for existing OFOI router control system.

b. Acceptable product:

1. Ross Video ULTRICORE-SNMP [RTR-SNMP] - Qty: 1

8. Router Spare Kit [RTR-SPAREKIT-1]

a. Additional shelf spare standby of critical components.

b. Acceptable product:

1. Ross Video ULTRIX-FR12-DCPWR

2. Ross Video ULTRIX-FR12-EXFAN

3. Ross Video ULTRIX-FR12-FC

4. Ross Video ULTRIX-FR12-FCBFAN

5. Ross Video ULTRIX-FR12-IOFAN

6. Ross Video ULTRIX-FR12-REF

7. Ross Video ULTRIX-FR12-XPT

8. Ross Video SFP-MADI-COAX

9. Ross Video SFP-FIBER-12G - Qty: 6

DD. Scan Converter

1. Scan Converter, 2K SDR [SCAN-2]

a. OpenGear card form factor.

b. Conversion of signals up to 1920x1200 60 Hz

c. HDMI input, 3G-SDI output.

d. Analog reference input on BNC connector.

e. Dashboard control and monitoring.

f. Acceptable product:

1. AJA OG-ROI-HDMI

EE. Speakers

1. Amplifier [DSP-1]

a. 64 x 64 networked audio channels (Q-LAN / AES67)

b. Up to 32 x 32 Dante audio channels (8 x 8 included)

c. Full-featured Q-SYS Control engine (with optional feature license)

d. Compatible with QSC QLAN

e. Acceptable product:

1. QSC Core Nano

2. Amplifier [AMP-11]

a. 2 Ch, 60W Networked Amplifier

b. Compatible with QSC QLAN

c. Acceptable product:

1. QSC SPA-Qf 60x2

3. Amplifier [AMP-12]

a. 4 Ch, 60W Networked Amplifier

b. Compatible with QSC QLAN

c. Acceptable product:

1. QSC SPA-Qf 60x4

4. Speaker, Pendant [SPK-4]

a. 6.5-inch two-way pendant-mount loudspeaker

b. 70V transformer taps at 30, 15, 7.5, 3.7, 1.9 watts and 8-ohm bypass.

c. Acceptable product:

1. QSC AD-P6T-BK Black

a. Coordinate color prior to ordering.

5. Speaker, Ceiling [SPK-5]

a. 6.5-inch two-way ceiling-mount loudspeaker

b. 70V transformer taps at 30, 15, 7.5, 3.7, 1.9 watts and 8-ohm bypass.

c. Acceptable product:

1. QSC AC-C6T-WH White

a. Coordinate color prior to ordering.

2. Mud ring, as required

FF. Switchers (see [RTR-3] for frame)

1. Switcher Control Panel, 1ME [SWCP-1]

a. Control panel with 15 crosspoint buttons and touch mnemonics

b. 1 mix effects control row

c. Acceptable product:

1. Ross Video TD1-PANEL

2. Ross Video TD-TouchScreen

3. Ross Video CUF-PSU - Qty: 2

2. [SWCP-1C]
    a. Compact control panel with 15 crosspoint buttons and touch mnemonics
    b. 1 mix effects control row
    c. Acceptable product:
        1. Ross Video TD1C-PANEL
        2. Ross Video TD-TouchScreen
        3. Ross Video CUF-PSU - Qty: 2
3. [SWCP-2]
    a. Control panel with 15 crosspoint buttons and touch mnemonics
    b. 2 mix effects control rows
    c. Acceptable product:
        1. Ross Video TD2-PANEL
        2. Ross Video TD-TouchScreen
        3. Ross Video CUF-PSU - Qty: 2
4. [SWCP-2S]
    a. Control panel with 25 crosspoint buttons and touch mnemonics
    b. 2 mix effects control rows
    c. Acceptable product:
        1. Ross Video TD2S-PANEL
        2. Ross Video TD-TouchScreen
        3. Ross Video CUF-PSU - Qty: 2

GG. Sync

1. Automatic Changeover [ACO-1]
    a. 1RU automatic changeover system. Switches analog black burst, HD tri-level sync, AES/DARS, word clock, LTC, and SD/HD/3G-SDI signals.

b. Front panel audible and visual fault indication including power supply status.

c. Electronic Fast Switch function for near glitch-less sync source switching, minimizing disruption in operations

d. Manual override capability.

e. Hot swappable redundant power supplies

f. Web-based interface for configuration and SNMP for status and alert information.

g. Acceptable product:

1. Ross Video ECO8000-ADV with ECO8000-PS

2. Telestream equivalent

2. Sync Generator, Type 1 for CAP & SOB [SYNC-1]

a. Existing OFOI at CAP. New CFCI at SOB.

b. Slot-based clocking system with redundant power supplies, multiple clock modules, seamless switchover, onboard CPU, and up to 10 slots for additional input and output cards.

c. Synchronization of NTP and SNTP compatible clients

d. Web-based status and configuration interface and console-based graphical configuration utility

e. IEEE 1588 PTP Grandmaster / Slave (optional)

f. Up to 10 PTP (IEEE 1588-2008) modules

g. Redundant power and receiver option (eg GPS / GLONASS combination)

h. Replacement or retrofitting of an ACM module (Active Cooling Module) possible during operation

i. Video Sync Generator Module capable of producing Blackburst, Tri-Level Sync, LTC (Linear Time Code), DARS (Digital Audio Reference Signal), Word Clock. Options for balanced and unbalanced LTC generation.

j. Integration note:

1. [SYNC-1] at CAP shall be configured with GPS clock source as the highest priority, followed by PTP. [SYNC-1] at SOB and [SYNC-2] at MSB shall be configured with PTP as the highest priority, followed by the locally connected GPS.

2. GPS antennas shall be mounted on the roof at the specified location in coordination with the Owner and Design Consultant.

    a. Provide and install non-penetrating roof antenna mounting structure. Secure with weights, without damage to existing structures or membranes.

    b. Install a junction box and conduit from the antenna location to the designated interior penetration location. Ensure a weathertight seal.

    c. Install low voltage cabling and power, as required, to connect electronics to the receiving device. Coordinate use of Owner's existing fiber optic cabling.

    d. Minimize publicly-visible components, and mount out of sightlines.

    e. Coordinate installation of lighting protection grounding devices for any structures erected.

3. VSG cards specified in pairs, with one serving as primary and one serving as backup, into [ACO-1].

k. Acceptable product:

1. Meinberg IMS-M3000, with:

    a. IMS-CLK GPS183-HQ GPS Receiver with OCXO HQ oscillator - Qty: 2

        1. Includes GPSANTv2 IF Antenna, hardware, 20 meter antenna RG58 coax cable

    b. IMS-ACM-M3000 Active Cooling Module

    c. IMS-CPU-C15G2 NTP Time Server

        1. For NTP clients

    d. IMS-HPS-100 PL-A PTP / SyncE / Hardware NTP (up to 8 Unicast Clients) – Qty: 2

1. For Media-Over-IP Red & Blue PTP

e. IMS-HPS-100 PL-C PTP / SyncE / Hardware NTP (up to 512 Unicast Clients)

1. For Dante PTPv1

f. IMS-PWR-AD10 Power supply - Qty: 4

g. IMS-RSC-M3000 Switch module

h. IMS-VSG181-HQ Video Sync Generator Module - Qty: 2

1. For primary & backup: blackburst, unbalanced LTC, unbalanced DARS and Wordclock

i. IMS-VSG181H-HQ Video-Sync Generator Module - Qty: 2

1. For primary & backup: tri-level sync, balanced LTC, balanced DARS

j. GOAL-S GPS Optical Antenna Link Pair - Qty: 2

k. MBG S-PRO Surge Suppressor for GPS - Qty: 2

3. Sync Generator, Type 2 for MSB [SYNC-2]

a. Existing OFOI at MSB

b. Meet or exceed [SYNC-1] specifications, with the following configuration:

c. Acceptable product:

1. Meinberg IMS-M3000, with:

a. IMS-CLK GPS-HQ GPS Receiver with OCXO HQ oscillator IMS-ACM-M3000

1. Includes GPSANTv2 IF Antenna, hardware, 20 meter antenna RG58 coax cable

b. IMS-ACM-M3000 Active Cooling Module

c. IMS-CPU-C15G2 NTP Time Server

1. For NTP clients

d. IMS-HPS-100 PL-A PTP / SyncE / Hardware NTP (up to 8 Unicast Clients) – Qty: 2

1. For Media-Over-IP Red & Blue PTP

e. IMS-HPS-100 PL-C PTP / SyncE / Hardware NTP (up to 512 Unicast Clients)

1. For Dante PTPv1

f. IMS-PWR-AD10 Power supply - Qty: 4

g. IMS-SPT-M3000 Signal Path Through Module

h. IMS-VSG181-HQ Video Sync Generator Module - Qty: 2

1. For primary & backup: blackburst, unbalanced LTC, unbalanced DARS and Wordclock

i. IMS-VSG181H-HQ Video-Sync Generator Module - Qty: 2

1. For primary & backup: tri-level sync, balanced LTC, balanced DARS

j. GOAL-S GPS Optical Antenna Link Pair - Qty: 2

k. MBG S-PRO Surge Suppressor for GPS - Qty: 1

HH. Tally

1. Tally Processor [TALLY-1]

a. Collects information from signal routing and processing equipment to operate displays and tallies as directed by its internal configuration information.

b. 1RU server. Support for up to 16 unique control areas.

c. Integration note:

1. Integrate existing OFOI [TALLY-1] at CAP with all new equipment installed at SOB.

2. Integrate with all devices capable of TSL protocol.

3. Maintain integration with [MIV-1].

4. Integrate with all new [RTR-#] and maintain integration with existing [RTR-#].

5. Integrate with all new video switchers and maintain integration with existing.

6. Integrate with [GPIO-1] and [OAL-1].

d. Acceptable product:

1. Ross Video TLY-TSI4000-CP

2. Ross Video TLY-Generic-TSL - Qty: as required

3. Ross Video TLY-TAG License – Qty: as required

II. Technical Furniture

1. Constructed to house video, audio, control, and similar equipment as shown on drawings. Console shall be constructed by an expert craftsman regularly in business as a furniture manufacturer and running a fully qualified cabinetry shop.

2. The term “Technical Furniture” shall include all consoles, operator station furniture, millwork, tables, desks, turrets, or other furniture housing monitors, equipment, etc.

3. Design

a. Verify all site dimensions during design, and again prior to manufacturing.

b. Maintain conformance to ADA requirements.

c. Technical furniture shall incorporate a seated-height work surface with a minimum depth of 10”, but no greater than 30” deep. The work surface shall consist of premium, laminated plywood or medium-density fiberboard, free from scratches, dents, chips, or deformations. Seams shall be flush and smooth.

d. Technical furniture shall accommodate rack-mounted equipment above the worksurface in reconfigurable banks (“turrets”), made of high-quality finished hardwood, laminated plywood, sturdy metal sheeting, or similar. Turrets shall have tapped equipment rack rails meeting EIA standards, adequate ventilation for the equipment housed within, and be free to slide laterally left & right. Cabling to equipment within turrets shall NOT pass through holes within the worksurface, or be constructed in a way that limits movement along the console.

e. Designated area(s) under the worksurface (“bays”) shall accommodate rack-mounted equipment, with tapped equipment rack rails meeting EIA standards. Each bay shall feature vented, removeable doors covering the front and back of the console.

f. All unused equipment rack units shall be fitted with blank or hinged access panels.

g. Power receptacles shall be provided at every user station, and in every turret and bay. Provide additional receptacles for future modifications, beyond what is required for initial equipment installation. Power receptacles shall be easily accessible from each user station position. Do not mount receptacles onto horizonal surfaces, where debris may enter the electrical contacts.

h. Cable management shall be provided at every user station location. The furniture shall incorporate a slot or reveal in the millwork that allows flexibility for installing, connecting, and maintaining cabling. Slots in horizontal surfaces shall be equipped with a brush cover or other suitable filler material that allows cables to be easily connected and dressed through openings, but prevents ingress of dust and debris.

i. Consoles shall include an extruded rail system along the back edge of the worksurface for mounting articulating monitor arms, speaker stands, note stands, etc. Provide all components required to mount equipment, shown on the drawings or listed in the specifications, to the console rail system. Arms and stands shall support the weight of the equipment, with a safety factor of 3:1. Arms and stands shall be able to slide along the rail laterally, and in elevation, for fine adjustment.

j. Consoles shall be customized to accommodate site conditions, and the workspace configuration required by the number of users.

1. Single user console [CONSOLE-1]

2. Two user console [CONSOLE-2]

3. Three user console [CONSOLE-3]

4. Four user console [CONSOLE-4]

5. Five user console [CONSOLE-5]

6. Desktop Turret, 5RU [CONSOLE-T5]

7. Desktop Turret, 10RU [CONSOLE-T10]

8. Rackmount Standing Height Worksurface, 2 Bay [CONSOLE-W2]

k. Consoles shall be designed with the ability to access equipment from all sides. Design dimensions with clearance to allow the console to be slid in and out of position for service. Where not possible, provide permanently-installed furniture sliders.

4. Construction

a. Construction shall use 7- or 9- ply hardwood plywood, with a minimum thickness of ¾"; structural extruded aluminum; metal sheeting and tubing; or a combination thereof.

b. All shelves, counters, and edges shall be designed to support 250 lb. point load at the edge, beyond the weight the equipment professionally mounted within.

c. All exposed edges of horizontal worksurfaces shall be treated with a solid wood bull-nose edge in a stain compatible with the laminate finish.

d. Certain equipment may be mounted into the millwork, where designated on the drawings AND approved by the Owner (e.g. production switcher, intercom stations, router control panels, camera control shading joysticks, etc.). DO NOT CUT into the millwork until on site and approved in writing by the Owner. Provide structural bracing around all worksurface cutouts.

e. Provide seismic bracing as required by local code.

f. Submit all surfaces and finishes for Owner approval prior to ordering.

5. Acceptable product:

a. Forecast – contact Pasquale (Pat) Barbuto (PasqualeB@forecastconsoles.com)

b. TBC Consoles

c. Laguna

d. Winsted

e. Others, as approved.

JJ. Terminal Gear

1. Analog Audio DA [ADA-1]

a. OpenGear Analog Audio and Timecode DA with Remote Gain

b. 1x8 or dual 1x4

c. Acceptable product:

1. Ross Video ADA-8405-C-R2C – Qty: as required

2. Fiber Converter [FOX-1]

a. OpenGear Dual Optical to Electrical Converter, supporting data rates from 143Mb/s to 2.97Gb/s.

b. Acceptable product:

1. Ross Video FDR-6603-R2 – Qty: as required

3. Fiber Converter [FOX-2]

a. OpenGear Dual Electrical to Optical Converter, supporting data rates from 143Mb/s to 2.97Gb/s.

b. Acceptable product:

1. Ross Video FDT-6604-R2

4. Fiber Converter, SFP [FOX-3-SFP-2RX]

a. SFP for receiving 2 Ch 12G-SDI over fiber

b. Acceptable product:

1. Ross Video SFP-FIBER-12G-2R – Qty: as required

5. Fiber Converter, SFP [FOX-3-SFP-2TX]

a. SFP for transmitting 2 Ch 12G-SDI over fiber

b. Acceptable product:

1. Ross Video SFP-FIBER-12G-2T – Qty: as required

6. Fiber Converter, SFP [FOX-3-SFP-TRX]

a. SFP for transmitting and receiving 1 Ch each 12G-SDI over fiber

b. Acceptable product:

1. Ross Video SFP-FIBER-12G – Qty: as required

7. Fiber Converter [FOX-3]

   a. OpenGear fiber transport of SD to 12G-SDI, plus ASI. 4 ch.

   b. Channel configuration based on SFP installed.

   c. Acceptable product:

      1. Ross Video SFC-6901-R3F – Qty: as required

8. Fiber Converter, Sync [FOX-4]

   a. Analog Sync / Video Fiber Optic Receiver

   b. Single-mode fiber SFP

   c. Acceptable product:

      1. Lynx Technik ORX 1702-1 ST or LC – Qty: as required

      2. Lynx Technik RFR1001

9. Fiber Converter, Sync [FOX-5]

   a. Analog Sync / Video Fiber Optic Transmitter

   b. Single-mode fiber SFP

   c. Acceptable product:

      1. Lynx Technik OTX 1712-2 ST – Qty: as required

      2. Lynx Technik RFR1001

10. Fiber Converter [FOX-11]

    a. OpenGear Dual Electrical to Optical Converter, supporting data rates from 143Mb/s to 2.97Gb/s.

    b. Acceptable product:

       1. Ross Video FDT-6604-xx – Qty: as required

11. Fiber Combiner [FOX-12]

    a. Fiber mux combiner, 8 to 1.

b. Acceptable product:

1. Ross Video FCM-6846 – Qty: as required

12. [FOX-13]

a. OpenGear Dual Optical to Electrical Converter, supporting data rates from 143Mb/s to 2.97Gb/s.

b. Acceptable product:

1. Ross Video FDR-6603 – Qty: as required

13. Fiber Splitter [FOX-14]

a. Fiber demux splitter, 1 to 8.

b. Acceptable product:

1. Ross Video FCD-6847 – Qty: as required

14. Card Frame [FRM-1]

a. OpenGear card frame, 2RU, with support for up to 20 cards.

b. Redundant 600W power supplies.

c. Front LCD panel with diagnostics. Advanced networking card with support for SNMP monitoring.

d. Acceptable product:

1. Ross Video OGX-FR-CNS – Qty: as required

2. Ross Video PS-OGX

3. Ross Video FSB-OGX

15. Frame Sync [FS-1]

a. Realtime HDR/WCG conversion for up to 4 HD channels, or 1 UHD channel.

b. 3G-SDI inputs and outputs.

c. Independent frame synchronization, scaling, region of interest, format conversion, frame rate conversion, A/V delay, proc amp controls.

d. SDR <> HDR color transforms. Up, down, and cross conversion. Configurable frame delay. 33-point Tetrahedral 3D LUT Processor with support for standard and custom 3D LUTs. Configurable HDR settings for SDI output VPID.

e. Web-based UI offering control over a LAN or across the web via a REST API.

f. Acceptable product:

1. AJA FS-HDR

16. General Purpose Input & Output [GPIO-1]

a. OpenGear GPIO card, 16x16.

b. Acceptable product:

1. Ross Video GPI-8941-I16-O16-R3 – Qty: as required

17. Optical Splitter [OPT-SPL-8]

a. OpenGear passive optical splitter, non-CWDM.

b. Acceptable product:

1. Ross Video FSS-6808 – Qty: as required

18. SDI DA [SDA-1]

a. OpenGear 2 channel, 3G distribution amplifier. 2x(1x8).

b. Acceptable product:

1. Ross Video DRA-8804-R2H – Qty: as required

19. SDI DA [SDA-2]

a. OpenGear 4 channel, 3G reclocking distribution amplifier. 2x(1x4) + 2x(1x3).

b. Acceptable product:

1. Ross Video QRA-8808-R2H – Qty: as required

20. SDI DA [SDA-3]

a. OpenGear 1 channel, 3G distribution amplifier. 1x(1x8)

b. Acceptable product:

1. Ross Video SRA-8802-R2 – Qty: as required

21. SDI DA [SDA-4]

a. OpenGear 1 channel, 12G distribution amplifier. 1x(1x4)

b. Acceptable product:

1. Ross Video SRA-8901-4-R3S – Qty: as required

22. SDI DA [SDA-5]

a. OpenGear 2-in, 16-out, 12G distribution amplifier with crosspoint. 2x(1x2) + 2x(1x6).

b. Acceptable product:

1. Ross Video DRA-8902-16-R3 – Qty: as required

23. [VDA-1]

a. OpenGear Analog Video Utility Distribution Amplifier. 1x8 with loop.

b. Acceptable product:

1. Ross Video UDA-8705A-R2L – Qty: as required

KK. Test & Measurement

1. Test Signal Generator [TSG-1]

a. 1RU modular test signal generator and reader. 3G-SDI.

b. Support for path analysis of audio + video timing, coherence, transport timing, content timing, levels, inversion, and channel order.

c. Remote control via web GUI.

d. Integration note:

1. Integrate 3G-SDI input, 3G-SDI generator output, and reader character output.

e. Acceptable product:

1. Hitomi XF-AG-3G with:

a. Hitomi GLL-LA-SA Glass Annual License [TSG-1-LIC]

2. Waveform Vectorscope, Engineering Rasterizer [WFVS-1]

a. 1RU rasterizer with SDI / IP connectivity with SDI EYE/Jitter measurement, 8ch Analog Audio output.

b. Integration note:

1. Provide and connect to [KVM-TX-2].

c. Acceptable product:

1. Telestream MPP-300

2. Telestream MP-SFP 25GESR - Qty: 2

3. Telestream MPSDP- EXTNDSP

4. Telestream MPSDP-25GE

5. Telestream MPSDP-AUD

6. Telestream MPSDP-ENG-QC

7. Telestream MPSDP-IP-MEAS

8. Telestream MPSDP-PROD

9. Telestream PWR-CORD-NA- S15

3. Waveform Vectorscope, Shading [WFVS-2]

a. 3RU dual monitor 9” touchscreen waveform & vectorscope.

b. Acceptable product:

1. Telestream MPD-100

2. Telestream MPSDP-MULTI

3. Telestream MPSDP-PROD

4. Telestream PWR-CORD-NA- S15

LL. Tuner

1. Tuner, ATSC [TUNER-1]

a. Tune analog and digital channels in ATSC, clear QAM, and NTSC formats.

b. Decode MPEG2 and H.264 digital channels up to 1080p 60Hz.

c. SDI Output – SD/HD/3G

d. Pass through IPTV stream from received digital channel.

e. Dolby Audio, PCM, or Variable PCM audio formats for SDI, HDMI, and digital audio ports.

f. Front-panel and on-screen menus for tuner setup.

g. Web pages for remote setup and configuration.

h. Decode analog and digital closed captioning.

i. Pass through 608 and 708 closed caption data on SDI output.

j. Acceptable product:

1. Contemporary Research ATSC-SDI 4i

2. ATSC antenna, with fiber extension to and mounted near GPS antenna location.

MM. UPS, Power, Sensing

1. Environmental Sensor [SENS-1]

a. 1RU Sensor pod, support for 6 universal sensor modules.

b. Acceptable product:

1. APC NBPD0150 with temperature & humidity sensor

NN. Utility PC

1. Utility PC, 1RU [UPC-1]

a. 1RU Workstation for general use. Minimum configuration:

1. 2.1 GHz Intel Xeon w3-2423 6-Core

2. 16GB of 4800 MHz DDR4 ECC Registered RAM

3. NVIDIA T400 GPU (4GB GDDR6)

4. 512GB NVMe PCIe 4.0 x4 M.2 SSD
5. 1 x Gigabit Ethernet Port
6. 6 x USB-A 3.2 Gen 1 | 3 x MiniDP 1.4a
7. USB Keyboard & Mouse Included
8. Single 675W Power Supply
9. 1 RU Form Factor with Rail Rack Kit
10. Windows 11 Pro (64-Bit)

b. Acceptable product:

1. HP 8Z235UT#ABA Z4 Rack G5 Workstation

2. Utility PC, 1RU, Network [UPC-2]

a. 1RU Workstation for engineering use. Minimum configuration:

1. 3.0 GHz Intel Xeon w3-2425 6-Core
2. 16GB of 4800 MHz DDR4 ECC Registered RAM
3. NVIDIA RTX A2000 GPU (12GB GDDR6)
4. 512GB NVMe PCIe 4.0 x4 M.2 SSD
5. 1 x Gigabit Ethernet Port
6. 6 x USB-A 3.2 Gen 1 | 4 x MiniDP 1.4a
7. USB Keyboard & Mouse Included
8. Single 675W Power Supply
9. 1 RU Form Factor with Rail Rack Kit
10. Windows 11 Pro (64-Bit)
11. Intel E610-XT4 Quad 10GbE NIC

b. Acceptable product:

1. HP 8Z237UT#ABA

2. Intel E610-XT4 Quad 10GbE NIC

3. Utility PC, Editing [UPC-3]

a. 1RU Workstation for post-production editing. Minimum configuration:

1. 3.0 GHz Intel Xeon w3-2425 6-Core
2. 16GB of 4800 MHz DDR4 ECC Registered RAM
3. NVIDIA RTX A2000 GPU (12GB GDDR6)
4. 512GB NVMe PCIe 4.0 x4 M.2 SSD
5. 1 x Gigabit Ethernet Port
6. 6 x USB-A 3.2 Gen 1 | 4 x MiniDP 1.4a
7. USB Keyboard & Mouse Included
8. Single 675W Power Supply
9. 1 RU Form Factor with Rail Rack Kit, PCI riser card
10. Windows 11 Pro (64-Bit)
11. Intel E610-XT4 Quad 10GbE NIC
11. ~~Intel i350-T4 Quad NIC~~
12. 8 independent 3G-SDI capture and playback channels

b. Acceptable product:

1. HP 8Z237UT#ABA
2. Intel E610-XT4 Quad 10GbE NIC
3. Blackmagic DeckLink Quad 2

c. Integration note:

1. Install and configure owner-furnished editing software.

4. Utility PC, 1RU, Production [UPC-4]

a. 1RU Workstation for production utility, VMIX, OBS, and screen capture use. Minimum configuration:

1. 3.0 GHz Intel Xeon w3-2425 6-Core
2. 16GB of 4800 MHz DDR4 ECC Registered RAM
3. NVIDIA RTX A2000 GPU (12GB GDDR6)
4. 512GB NVMe PCIe 4.0 x4 M.2 SSD
5. 1 x Gigabit Ethernet Port
6. 6 x USB-A 3.2 Gen 1 | 4 x MiniDP 1.4a
7. USB Keyboard & Mouse Included
8. Single 675W Power Supply
9. 1 RU Form Factor with Rail Rack Kit, PCI riser card
10. Windows 11 Pro (64-Bit)
11. Intel E610-XT4 Quad 10GbE NIC
11. ~~Intel i350-T4 Quad NIC~~
12. 8 independent 3G-SDI capture and playback channels

b. Acceptable product:

1. HP 8Z237UT#ABA
2. Intel E610-XT4 Quad 10GbE NIC
3. Blackmagic DeckLink Quad 2

OO. Video Monitoring

1. Video Converter [VCONV-1]

a. 12G-SDI to HDMI 2.0b.

b. HDR signaling metadata pass-through and optional override

c. Single-mode fiber optic input.

d. Acceptable product:

1. AJA Hi5-12G-R

2. Video Converter [VCONV-2]
    a. HDMI 2.0b to 12G-SDI.
    b. HDR signaling metadata pass-through and optional override
    c. Acceptable product:
        1. AJA HA5-12G
3. Video Converter [VCONV-3]
    a. OpenGear Card. 12G-SDI to HDMI 2.0b.
    b. HDR signaling metadata pass-through and optional override
    c. Acceptable product:
        1. AJA OG-HI5-12G
4. Video Converter [VCONV-4]
    a. OpenGear Card. HDMI 2.0b to 12G-SDI.
    b. HDR signaling metadata pass-through and optional override
    c. Acceptable product:
        1. AJA OG-HA5-12G
5. Video Converter [VCONV-5]
    a. HDMI 2.0b to/from 12G-SDI.
    b. HDR signaling metadata pass-through and optional override
    c. 4k scaling engine with genlock input
    d. Framerate, resolution, and format conversion
    e. BT709 to/from BT2020 color translation
    f. Acceptable product:
        1. Decimator Designs 12G-CROSS
6. Video Converter [VCONV-NVX]

a. OFOI Media over IP endpoint, for AV system integration.

b. Configured in decode mode, with HDMI scaled output.

c. Acceptable product:

1. Crestron DM-NVX-363

7. Video Monitor, 75” [VMON-1]

a. 75” UHD 4K (3840 x 2160) Native Resolution Display

b. HDR10, HLG & Dolby Vision Capability

c. VA Direct-Lit LED LCD Panel

d. IP & RS-232 Controllable

e. 4 x HDMI Inputs with HDCP 2.3

f. 1200:1 Static Contrast Ratio

g. 700 nits Brightness, 24/7 Duty Cycle

h. Acceptable product:

1. Sony FW75BZ40L

2. AJA Hi5-12G-R [VCONV-1]

3. Chief AS3LD Mount

8. Video Monitor, 65” [VMON-2]

a. 65” UHD 4K (3840 x 2160) Native Resolution Display

b. HDR10, HLG & Dolby Vision Capability

c. VA Direct-Lit LED LCD Panel

d. IP & RS-232 Controllable

e. 4 x HDMI Inputs with HDCP 2.3

f. 1200:1 Static Contrast Ratio

g. 700 nits Brightness, 24/7 Duty Cycle

h. Acceptable product:

1. Sony FW65BZ40L
2. AJA Hi5-12G-R [VCONV-1]
3. Chief AS3LD Mount

9. Video Monitor, 55” [VMON-3]

a. 55” UHD 4K (3840 x 2160) Native Resolution Display

b. HDR10, HLG & Dolby Vision Capability

c. VA Direct-Lit LED LCD Panel

d. IP & RS-232 Controllable

e. 4 x HDMI Inputs with HDCP 2.3

f. 1200:1 Static Contrast Ratio

g. 700 nits Brightness, 24/7 Duty Cycle

h. Acceptable product:

1. Sony FW55BZ40L
2. AJA Hi5-12G-R [VCONV-1]
3. Chief AS3LD Mount

10. Video Monitor, 43” [VMON-4]

a. 43” UHD 4K (3840 x 2160) Native Resolution Display

b. HDR10, HLG & Dolby Vision Capability

c. VA Direct-Lit LED LCD Panel

d. IP & RS-232 Controllable

e. 4 x HDMI Inputs with HDCP 2.3

f. 1200:1 Static Contrast Ratio

g. 440 nits Brightness, 24/7 Duty Cycle

h. Acceptable product:

1. Sony FW43BZ30L

2. AJA Hi5-12G-R [VCONV-1]

3. Chief AS3LD Mount

11. Video Monitor, 32” [VMON-5]

a. 32” UHD 4K (3840 x 2160) Native Resolution Display

b. HDR10, HLG & Dolby Vision Capability

c. VA Direct-Lit LED LCD Panel

d. IP & RS-232 Controllable

e. 4 x HDMI Inputs with HDCP 2.3

f. 3000:1 Static Contrast Ratio

g. 300 nits Brightness, 24/7 Duty Cycle

h. Acceptable product:

1. Sony FW32BZ30J

2. AJA Hi5-12G-R [VCONV-1]

3. Chief MTM1U/LTM1U/XTM1U Mount

12. Video Monitor Cart [VMON-5-CART]

a. Rolling mobile cart for video monitors.

b. Height adjustable between 3’-4’.

c. Acceptable product:

1. Chief MFM6000B

13. Video Monitor, Grading, 18” Rackmount [VMON-6]

a. 18” Professional UHD 4K Display; 2x 12G-SDI , 2x 3G-SDI, and HDMI inputs.

b. 1000 cd/m²; HDR EOTF & 3D LUT Support.

c. Quad View, Scopes, VPID Support.

d. Acceptable product:

1. Sony PVM-X1800

2. Sony PVMK-RX18 Rackmount Bracket

14. Video Monitor, Grading, 32” [VMON-7]

a. 32” Professional UHD 4K Display; 2x 12G-SDI , 2x 3G-SDI, and HDMI inputs.

b. 1000 cd/m²; HDR EOTF & 3D LUT Support.

c. Quad View, Scopes, VPID Support.

d. Acceptable product:

1. Sony PVM-X3200

2. With mount, where required

15. Video Monitor, Grading, 24” [VMON-8]

a. 24” Professional UHD 4K Display; 2x 12G-SDI , 2x 3G-SDI, and HDMI inputs.

b. 1000 cd/m²; HDR EOTF & 3D LUT Support.

c. Quad View, Scopes, VPID Support.

d. Acceptable product:

1. Sony PVM-X2400

2. With mount, where required

16. Video Monitor, Grading, 18” [VMON-9]

a. 18” Professional UHD 4K Display; 2x 12G-SDI, 2x 3G-SDI, and HDMI inputs.

b. 1000 cd/m²; HDR EOTF & 3D LUT Support.

c. Quad View, Scopes, VPID Support.

d. Acceptable product:

1. Sony PVM-X1800

2. With mount, where required.

17. Video Monitor, 32” [VMON-10]

a. 32-inch 4K HDR display with mini-LED backlight with 1,000 cd/m2 peak brightness

b. Support multiple HDR formats (HDR-10, HLG) and DisplayHDR 1000 certified.

c. USB-C supports DisplayPort signal, data transfers and up to 80W Power Delivery to external devices via one cable

d. X-rite i1 Display Pro calibrator (one per building required)

e. HDMI(v2.0) x 3, DisplayPort 1.2, Full Function USB-C and a USB hub

f. Built-in speakers

g. Acceptable product:

1. ASUS PA32UCRK 32" 4K HDR Monitor

2. AJA Hi5-12G-R [VCONV-1]

PP. Video Switcher

1. Video Switcher [SW-1]

a. 1RU video switcher. Video formats up to 2160p59.94. HDR HLG passthrough.

b. 24 HD inputs, up to 3ME. 12 HD outputs. 5 keyers per ME. 2D DVE. Media wipes.

c. Two dedicated internal multiview generators, with option for up to four.

d. Compatible with external 1/2/3 ME control panel.

e. Acceptable product:

1. Ross Video CUF-124 Carbonite Ultra, with:

a. Ross Video CUF-ADD-ME2

b. Ross Video CUF-ADD-ME3

c. Ross Video CUF-ADD-I/OPLUS

d. Ross Video CUF-ADD-MV2&4

e. Ross Video XDS0-0001-CPS

f. Ross Video CUF-PSU Power Supply – Qty: 2

2. Video Switcher [SW-2]

a. 4RU, All-in-one switcher platform. Video formats up to 1080p59.94. HDR HLG passthrough.

b. 13 inputs, 2ME. 6 outputs. 5 keyers per ME.

c. 2 internal Multiview generators.

d. Support for RossTalk, TSL UMD, and Ross CamBot control.

e. Built-in character generator, with up to 2ch (F+K). Internal clip capture and playout.

f. External audio breakout with support for 8x5 analog audio, 1x1 AES, 24 GPIO, and 16 tallies.

g. Acceptable product:

1. Ross Video GRAPHITE-4RU-2ME-13IN, with:

a. Ross Video GRAPHITE-4RU-ENGINE-M9

b. Ross Video GRAPHITE-5IN-9IN-UPG

c. Ross Video GRAPHITE-9IN-13IN-UPG

d. Ross Video GRAPHITE-1ME-2ME-UPG

e. Ross Video GRAPHITE-PRIME-SCE-UPG

f. Ross Video GRAPHITE-SCE-DUAL-UPG

g. Ross Video XPR-DLQ Datalinq Server

## 2.06. FABRICATED PRODUCTS AND SYSTEMS

A. Plates and Panels

1. Where required, Contractor shall fabricate, or have fabricated, custom plates and panels.

2. Provide complete drawings for custom-fabricated plates or panels before manufacturing. Drawings shall include dimensioned locations of components, component types, engraving information, plate material, color, and bill of material.

3. Install and secure all components rigidly to the panel in a straight, plumb, and level manner. Provide insulating bushings or similar dielectric components to ensure isolated signal grounds where required.

4. Ensure all edges and cuts are smooth, rounded, chamfered, and/or will not cause injury during normal operation or maintenance.

5. Custom rack panels shall be at least 12-gauge thick, powder-coated steel unless otherwise noted.

6. Custom connector wall plates shall be polished or brushed stainless steel, unless otherwise noted.

7. Coordinate materials where existing devices are present.

8. Each plate and each connector shall be uniquely labeled using at least ¼" block, sans-serif text engraved into the plate and accented with a contrasting color.

9. When possible, use components featuring standardized panel cutout dimensions in lieu of custom cutouts to accommodate future modifications (for example, D-series, keystone, decora, etc.).

B. Custom Assemblies, Cables, Breakouts

1. Provide complete drawings on all custom cable assemblies prior to closeout. Drawings shall include cable type, model number, termination components, component model numbers, pinouts, and insulation materials.

2. The following materials shall not be used to manufacture custom assemblies: wire nuts, adhesive tapes, non-UL-rated components, flammable components (paper, commodity plastics, etc), glues, or similar.

3. All conductors must be fully insulated. Absolutely no exposed wiring, terminals, live screws, etc.

2.07. OEM PROFESSIONAL SERVICES

A. The Contractor shall provide onsite commissioning and training by the following OEMs on their respective equipment.

B. OEM Development

1. Ross Video Dashboard Custom Panels

a. Contact Jamie Hall, jamie.hall@rossvideo.com

2. Ross Video Rocket Surgery Creative Services

a. Contact Jamie Hall, jamie.hall@rossvideo.com

C. OEM Commissioning

1. OEM Commissioning shall include, but not be limited to:

a. Audio Mixer(s) (Calrec), minimum of three (3) days onsite, until fully commissioned

b. Media-over-IP Network Fabric (Cisco), minimum of five (5) days onsite, until fully commissioned

c. Routing System(s) (Ross Video), minimum of five (5) days onsite, until fully commissioned

d. Character Generator(s) (Ross Video), minimum of two (2) days onsite, until fully commissioned

e. Video Switcher(s) & Master Control (Ross Video), minimum of two (2) days onsite, until fully commissioned

f. Camera Robotics (Ross Video), minimum of two (2) days onsite, until fully commissioned

g. Tally (Ross Video), minimum of one (1) day remotely, until fully commissioned

h. MAM (Ross Video), minimum of five (5) days onsite, until fully commissioned

i. Edit Storage (SNS), minimum of one (1) day onsite, until fully commissioned

j. Ingest/Playout (Ross Video), minimum of two (2) days onsite, until fully commissioned

k. LED Video Wall (Nanolumens), minimum of one (1) day onsite, until fully commissioned

D. OEM Training

1. OEM Training shall include, but not be limited to:

a. Audio Mixer(s) (Calrec), minimum of two (2) days onsite

b. Media-over-IP Network Fabric Control & Monitoring Software (Cisco), minimum of one (1) day onsite

c. Routing System(s) (Ross Video), minimum of four (4) days onsite

d. Character Generator(s) (Ross Video), minimum of two (2) days onsite, upon completion of commissioning and custom creative content

e. Video Switcher(s) & Master Control (Ross Video), minimum of three (3) days onsite

f. Ross Robotics (Ross Video), minimum of two (2) days onsite

g. Tally (Ross Video), minimum of one (1) day remotely

h. MAM (Ross Video), minimum of five (5) days onsite

1. Minimum one (1) day remotely once system has been in use by all users for at least 90 days.

i. Ingest/Playout (Ross Video), minimum of one (1) day onsite

1. Minimum one (1) day remotely once system has been in use by all users for at least 90 days.

j. LED Video Wall (Nanolumens), minimum of one (1) day onsite

k. HDR Workflow Training online seminar, from Cromorama, one (1) day online

1. Contact:

a. Beata Rakoczy, beata@cromorama.io

E. OEM commissioning and training shall be scheduled prior to substantial completion and shall only take place once the related systems have been completely installed. OEM training shall occur only after related systems have been fully commissioned and are operating without fault.

F. OEM Training that is substantially interrupted by system malfunction, incomplete setup, misconfiguration, or installation error shall not be considered complete.

G. Use a video camera and wireless lavalier or shotgun mic to record each training session. Provide recordings per 3.03.D.7.a.9 below~~3.03.D.6.a.8 below~~.

H. OEM commissioning, OEM training, and system-wide Contractor's training (if required) shall not occur simultaneously, except at the sole discretion of the Owner.

I. OEM training shall be coordinated with the Owner, and broken into 4-hour-maximum sessions.

J. The Contractor may elect to use its own forces, staff, or personnel to perform OEM professional services, provided:

1. The Contractor submits a professional resume with detailed experience and certifications demonstrating previous expert-level experience installing, configuring, and providing end user training for each piece of equipment. Submittals shall be entered no later than 60 days before anticipated date of commissioning/training. Approval of Contractor's professional service representative is at the sole discretion of the Owner.

    a. Should the Owner reject any or all submissions, the Contractor shall subcontract the OEM to provide commissioning and training without request for further reimbursement.

## 2.08. INSTALLATION MATERIALS

A. The Contractor shall develop a method and means for properly integrating all equipment into a complete and fully-functional system. Collectively, any additional equipment, cabling, terminations, hardware, pieces, parts, assemblies, components, adapters, or similar required to meet the specified requirements shall be described as "Installation Materials" and provided.

1. Installation Materials shall comply with all applicable codes, laws, rules, regulations, or similar that dictate their proper use.

2. This specification may not provide requirements for all possible types of Installation Materials. Where there is ambiguity, provide and install Installation Materials in accordance with industry best practices and manufacturer's requirements.

3. Supply Installation Materials and minor equipment items needed for a complete system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.

4. Installation Materials shall be subject to all submittal requirements described herein, including but not limited to data sheet submissions. Provide all required documents and gain submittal approval prior to installation.

5. Where possible, seek to match Installation Materials with material onsite to remain. Coordinate makes, models, termination types, colors, etc. Provide a cable color schedule for approval prior to ordering.

6. Installation Materials shall be procured, stored, installed, and tested per the manufacturer's requirements.

    a. Replace any materials damaged during procurement, storage, or installation, including but not limited to: scuffs, marks, dents, scratches, abrasion, breaks, improper bend radius, discoloration, chipping, corrosion, water/humidity exposure, etc.

    b. Determine pull length prior to installation. Ensure that the installed length of a path does not exceed the manufacturer's specifications for signal loss, when carrying the corresponding signal type.

    c. Maintain the manufacturer's minimum bend radius and pull strength during installation. Inspect each pulled cable for kinks, knots, scuffs, stretch marks, and breaks.

    d. All cables shall be continuous from source device to destination device. Cables shall not be spliced, broken, amplified, extended, stretched, or barreled. Broken or spliced cables shall be replaced immediately.

    e. Assess all code requirements and site conditions prior to purchasing or installing Installation Material. The Contractor is solely responsible for determining plenum/non-plenum requirements, armoring, indoor/outdoor, direct burial, etc.

B. Defined Material

1. The Contractor shall have discretion to specify and submit Installation Material, excepting the following Defined Material.

    a. Equipment Racks

        1. Four Post [RACK-1]

            a. Match existing racks and accessories collocated within the same room (typically Middle Atlantic MRK4436).

            b. Extend existing cable tray and fiber duct, where needed, to access new rack location(s). See drawings.

~~c. Install two additional electrical circuits per rack, where needed, to new rack location(s). See drawings.~~

c. Coordinate the installation of two OFOI electrical circuits per rack.

d. Acceptable product:

1. Middle Atlantic (to match)

2. Chatsworth (to match)

2. Two Post [RACK-2]

a. Match existing racks and accessories collocated within the same room (typically Middle Atlantic MK or RL series or Chatsworth).

b. Provide cable management side ducts.

c. Extend existing cable tray and fiber duct, where needed, to access new rack location(s). See drawings.

~~d. Install two additional electrical circuits per rack, where needed, to new rack location(s). See drawings.~~

d. Coordinate the installation of two OFOI electrical circuits per rack.

e. Acceptable product:

1. Middle Atlantic (to match)

2. Chatsworth (to match)

3. Office [RACK-3]

a. 25RU rolling rack with laminate surface top.

b. Skirted wheelbase, leveling feet, curved plexi front door, cable entry rear door, and front+rear rackrail.

c. Match existing finishes. Provide samples to Owner for color selection.

d. Provide cable management.

e. Acceptable product:

1. Middle Atlantic BGR-25SA27MDK-C8 Rolling Presentation Rack with PDU

2. Others, as approved

4. Two Post [RACK-4]

a. 2-post 19” EIA rack enclosure.

b. 45RU height. 15” depth. 20.3” wide.

c. UL listed in the US and Canada.

d. Rack comes equipped with 2 pairs of 11-gauge steel rack rail with tapped #12-24 mounting holes in universal EIA spacing

e. Support for side-mounted vertical cable manager.

f. Integration notes:

1. Extend existing OFOI cable tray and fiber duct, where needed. See drawings.

2. Coordinate the installation of two OFOI electrical circuits per rack.

3. Integrate with OFOI raised computer flooring. Coordinate work with raised flooring installer, including any flooring modifications required.

~~e.~~

~~f.~~g. Acceptable product:

1. Chatsworth 55053-X03 Rack, Black, with:

a. Chatsworth 30095-X03 6”W Cable Section – Qty: 1 per each end of rack rows

b. Chatsworth 30096-X03 10”W Cable Section – Qty: as required, between racks in a row

5. Four Post [RACK-5]

a. Gangable, 4-post broadcast 19” EIA rack enclosure. 1/8” thick structural steel internal braces.

b. 44RU height. 42” depth. 22” wide.

c. Open top and bottom, with configurable panel options.

d. Optional solid, fully vented, plexi, and vented plexi front doors available.

e. Durable, black textured, powder-coat finish with numbered rack spaces.

f. UL listed in the US and Canada.

g. Rack comes equipped with 2 pairs of 11-gauge steel rack rail with tapped #10-32 mounting holes in universal EIA spacing

h. Integration notes:

1. Extend existing OFOI cable tray and fiber duct, where needed. See drawings.

2. Coordinate the installation of two OFOI electrical circuits per rack.

~~2. Install two electrical circuits per rack. See drawings.~~

3. Integrate with OFOI raised computer flooring. Coordinate work with raised flooring installer, including any flooring modifications required.

4. Install internal LED rack lighting to illuminate entire rack height.

i. Acceptable product:

1. Middle Atlantic VRK-44-42HLRD 19" (482.6mm) Gangable Rack without Rear Door

2. Middle Atlantic SPN-44-423 Side Panels – Qty: as required, one pair per ganged row

3. Middle Atlantic RIB-x-MRK-42 Rack Base

4. Middle Atlantic MV-RR44 Extra Rack Rail (mid-rail)

5. Middle Atlantic BB-44-1 Copper Bus Grounding Bar

6. Middle Atlantic FWD-LT-UTL-44-45-D Lighting Kit

6. Four Post [RACK-6]

a. Owner-furnished, owner-installed AV rack.

b. Extend existing cable tray and fiber duct, if needed, to access rack location. See drawings.

c. Install additional electrical circuits per rack, if needed, to rack location. See drawings.

d. Integration note:

1. Coordinate rackspace with AV systems installer. Ensure adequate power, cable pathways, and ventilation.

2. Coordinate installation with AV systems installer.

e. Acceptable product:

1. Middle Atlantic (to match existing)

7. Rack Hot Aisle Containment [RACK-CONTAIN]

a. Vinyl containment system to separate hot and cold airflow.

b. Mounted aluminum extruded track.

c. Custom length slitted curtain. Field-modifiable.

d. Fire-rated vinyl, with fire suppression link attachments.

e. Integration notes;

1. Coordinate design and installation with fire suppression systems installer.

2. Verify code compliance with Fire Marshall.

f. Acceptable product:

1. Chatsworth BTS Hot Aisle Containment

2. Airseal Softwall Containment System

3. SubZero Engineering Essential Series

4. Others, as approved

8. Power Distribution Unit [RACK-PDU-1]

a. Vertical power distribution.

b. Built-in WebGUI for remote monitoring of circuit power usage.

c. Acceptable product:

1. APC NetShelter Metered Series

2. With one temperature and humidity sensor per rack

9. Power Distribution Unit [RACK-PDU-2]

a. Vertical power distribution.

b. Metered, per circuit.

c. 208V 3-phase 30A input. (36) C13, (6) C19, and (2) NEMA 5-20R outlets.

d. Built-in WebGUI for remote monitoring of circuit power usage.

e. Integration note:

1. Provide additional NEMA 5-20R and -15R distribution as required.

f. Acceptable product:

1. APC AP8865US NetShelter Metered PDU

2. With one temperature and humidity sensor per rack

b. Wiring, Cabling, and Connectors

1. Video Cabling

a. Serial Digital Video (12G-SDI)

1. Belden 4855 (between racks, control rooms), 4505, 4694, 4794, 4731

2. Clark Wire & Cable CD7523UHD (between racks, control rooms) CD7559UHD, CD7506UHD

3. Others, as approved

b. Serial Digital Video (3G-SDI)

1. Belden 1855 (between racks, control rooms), 1505, 1694, 1794, 7731

2. Clark Wire & Cable CD7523, CD7559, CD7506, CD7511DBR

3. Others, as approved

2. Video Patching

a. 3G-SDI

1. Internal fully-normalled jack design, avoiding external looping plugs. Self-terminating.

2. Maximum of 32 Channels of I/O into 2 RU

3. Staggered BNC rear jacks

4. Printed channel designation strip

5. Acceptable product:

a. Canare

b. Bittree

c. AVP

d. Others, as approved

3. Video Patch Cables

a. Provide 50 patch cables of various lengths, per building. Match brand of patch panel.

b. Provide 16 patch-to-BNC adapters per building.

4. Audio Cabling

a. Unbalanced Digital Audio (AES, MADI)

1. Belden 1855, 1505, 1694, 1794, 7731

2. Clark Wire & Cable CD7523, CD7559, CD7506, CD7511DBR

3. Others, as approved

b. Balanced Digital Audio (AES)

1. Belden 1800, 1801

2. Clark Wire & Cable 801, 901

3. Others, as approved

c. Analog Audio (Line level, Consumer level)

1. Belden 9451

2. Clark Wire & Cable SPA22GS

3. Others, as approved

d. Analog Audio (Mic level)

1. Belden 1804

2. Clark Wire & Cable MINK4

3. Others, as approved

e. Speaker

1. Calculate signal loss due to cable resistance / impedance before selecting appropriate cable type for each pull.

2. Ceiling, Pendant, Surface Speaker Cable

a. Minimum 16 gauge stranded, twisted pair

b. Belden 5200UE, 6200UE

c. Clark Wire & Cable CW1602, CW1602P

d. Others, as approved

5. Audio Patching

a. Analog, Balanced AES

1. Internal fully-normalled jack design, avoiding external looping plugs.

2. Maximum of 48 Channels of I/O into 2 RU

3. Printed channel designation strip

4. EDAC/ELCO 3 pin rear interface.

5. Acceptable product:

a. Bittree Micro

b. AVP Micro

c. Others, as approved

6. Audio Patch Cables

a. Provide 10 patch cables of various lengths, per patch panel. Match brand of patch panel.

b. Provide 2 patch-to-XLR adapters per patch panel.

7. Network Cabling

a. CAT6+ (Ethernet, Control)

1. Belden 2412

2. Clark Wire & Cable CN423C6

3. Others, as approved

b. CAT6A (Ethernet, Control)

1. Belden 10GXS

2. Clark Wire & Cable CN423C6A

3. Others, as approved

8. Network Patch Panels

a. 1RU/2RU Panel

1. Keystone-style inserts, 24 position, label strip

2. Belden RVMPPF1U24BK, RVMPPF2U48BK or similar system

3. Clark Wire & Cable RP-K224

9. Network Patch Cables

a. Color code to denote VLAN, signal/service type.

b. Provide patch cables as required.

10. Fiber Cabling

a. Coordinate fiber optic cabling types with existing onsite.

1. Belden

2. Commscope

3. Others, as approved

11. Fiber Patch Panels

a. Coordinate patch panel frames, LIU, inserts, and cable management with existing onsite.

1. Belden

2. Commscope

3. Others, as approved

12. Fiber Patch Cables

a. Provide patch cables as required.

## 2.09. PRODUCT SUBSTITUTIONS

### A. Prebid

1. Bidder must use only the product manufacturers and model numbers listed in this document unless the Bidder submits a Substitution Request form prior to the Request for Information deadline and receives written approval of the Substitution Request.

2. Other qualified manufacturers may be considered, subject to approval of complete technical data, samples, and/or results of independent testing laboratory tests of proposed equipment.

3. Substitute products shall be of similar quality and standard as established by the specified product. Bidder shall ensure that substitute product meets the design requirements and criteria specified herein.

### B. After Notice of Award

1. All product substitutions requested or required after the Contractor has received notice of award shall occur using the Change Order process. See 3.02 below.

2.10. OPTIONS

A. Provide all-inclusive option costs (including equipment, material, labor, services, warranty, etc.) for the following additions and deductions.

1. List of optional equipment and/or scope of work:

a. OPTION 01 – Deduct Studio LED Wall. Detail the change in cost to remove [LED-2] from SOB 0G102 Studio.

b. OPTION 02 – Upgrade Studio LED Wall. Detail the change in cost to upgrade [LED-2] to [LED-1] in SOB 0G102 Studio.

c. OPTION 03 – Increase LED Wall Spares. Detail the change in cost to increase the [LED-2] spares requirement to 10% (up from 7%).

d. OPTION 04 – Reduce Hearing Room. Detail the change in cost to reduce one hearing room.

e. OPTION 05 – Upgrade Hearing Room to Full Robotics. Detail the change in cost to remove all [CAM-5] from one hearing room and replace with [CAM-1] with [CAM-1-ROBO].

f. OPTION 06 – Panasonic Studio Cameras. Detail the change in cost to remove all [CAM-7] from SOB 0G102 Studio and replace with [CAM-5].

g. OPTION 07 – Full Robotic Studio Cameras. Detail the change in cost to remove all [CAM-7] from SOB 0G102 Studio and replace with [CAM-1] with [CAM-2-ROBO].

h. OPTION 08 – Reduce PTZ Camera. Detail the change in cost to remove a single [CAM-5] and replace with [CAM-8].

i. OPTION 09 – Remove PCR 6. Detail the change in cost to remove all equipment associated with PCR 6.

j. OPTION 10 – Remove LTO Allowance. Detail the change in cost to remove [ALLOW-SOB-LTO].

k. OPTION 11 – Remove Aisle Containment. Detail the change in cost to remove [RACK-CONTAIN].

l. OPTION 12 – Add AI Tracking. Detail the change in cost to add [TRACK-1].

m. OPTION 13 – Demo COB Building Equipment. Detail the change in cost to disassemble, remove, and dispose of all broadcast equipment from COB. See 3.06 below.

n. OPTION 14 – Consolidate Hearing Room Rack Equipment. Detail the change in cost to consolidate network switches, sync distribution, frames and rack sensors in rooms where AV racks are collocated.

o. OPTION VA ## – Voluntary Alternate Options. The Contractor, with sole discretion, may provide additional options to reduce cost, reduce integration time, increase system functionality, improve system flexibility, etc. Provide a separate voluntary alternate for each proposed option.

1. Alternates within the base bid will not be accepted, unless approved in an RFI, addenda, or accompanied with an approved substitution request. See 2.09 above.

B. Option pricing shall be held firm for a period of at least ninety (90) calendar days after contract execution, during which any may be elected by the Owner using a change order.

C. Submittals shall reflect the incorporation of all elected Options as of the date submitted. If Options are elected after submittal has been submitted, the Contractor shall revise and resubmit all affected items.

## 2.11. UNIT COSTS

A. Provide all-inclusive unit costs (including equipment, material, labor, services, warranty, etc.) for the following additions and deductions.

1. List of unit costs:

a. UNIT COST 01 – Labor Classifications. Provide a standard hourly rate card for all labor classifications used on this project, including but not limited to engineering, CAD drafting, project management, installation, training, etc. Outline any overtime, weekend, or holiday surcharges.

b. UNIT COST 02 – Warranty, Year 2-5. Provide an annual, per-year cost to extend the Contractor’s system-wide parts, labor, service and support warranty.

## 2.12. ALLOWANCES

A. The following allowances shall be included in the contract amount:

1. [ALLOW-SOB-LTO] Include a $25,0000 allowance for equipment, materials, and labor to cover a future Change Order to add an LTO tape library.

B. The Owner shall have full exclusive right and sole discretion to use allowance funds to offset future contract change orders for equipment, materials, labor, services, or other costs.

C. The Owner shall also reserve the right to execute a contract change order to reduce the contract amount by all or some of the total allowance amount. Should overpayment have occurred, the Owner shall be refunded the difference in the payment form established in the contract documents. “Credits”, “discounts”, “future trade credit” or similar shall not be construed to fulfill this obligation.

# PART 3 - EXECUTION

## 3.01. UPON AWARD

A. Upon receiving notice of award, the successful bidder shall work diligently to execute all required contract documents in a timely manner. Time is of the essence.

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

C. Obtain permits and pay fees necessary for the execution of any work pertaining to the installation.

D. Engage with key project stakeholders, Owner, Design Consultant, and other contractors by setting up regular cadence meetings.

## 3.02. CHANGE ORDERS

A. Owner-Initiated Proposal Requests: To initiate, the Owner and/or Design Consultant will issue a detailed description of proposed changes in the Work that may require adjustment to the contract sum or the contract time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work change requests issued by Owner are not instructions to stop work in progress nor to execute the proposed change.

2. Within time specified in the request or 14 days after receipt of request (when not otherwise specified), submit a quotation estimating cost adjustments to the contract sum and the contract time necessary to execute the change.

a. Include a list of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish additional information to substantiate quantities.

b. Indicate applicable taxes, delivery charges, restocking fees, equipment rental, and amounts of trade-in discounts.

c. Include costs of labor and supervision directly attributable to implementing the proposed change.

1. Labor costs and expenses incurred while responding to Owner-Initiated Proposal Requests are NOT reimbursable, shall not be included in the quotation, nor in future Change Order(s).

d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the contract time.

B. Contractor-Initiated Proposals: If modifications to the Contract are required, Contractor may initiate a claim by submitting a request for a change to the Owner and Design Consultant.

1. Include a statement outlining reasons for the change and the effect of the change. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the contract sum and the contract time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, restocking fees, equipment rental, and amounts of trade discounts.

4. Include costs of labor and supervision directly attributable to implementing the proposed change.

a. Labor costs and expenses incurred by responding to Owner-Initiated Proposal Requests are NOT reimbursable and shall not be included in the quotation or future Change Order(s).

5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the contract time.

## 3.03. SUBMITTALS

A. Contractor shall comply with all submittal procedures of the project, unless otherwise noted.

B. Contractor shall submit, revise, and resubmit each submittal as required to receive approval. Any work commencing prior to respective submittal approval shall be performed at the sole risk and expense of the Contractor.

C. Contractor shall submit the following within thirty (30) calendar days of notice of award, and prior to the commencement of work:

1. Submittal 27 41 16-01: Schedule

a. Contractor shall assemble a chronological Schedule of Work, in Gantt chart format, providing granular detail for duration of design tasks, shop prefabrication, programming, onsite mobilization, demolition, installation, commissioning, testing, training, and event support.

b. Include scheduled submission dates for all remaining submittals.

c. Incorporate key milestones by coordinating schedules from the Architect, Owner, and all other trades. Indicate the date of first system use.

d. Forecast sourcing for equipment and material deliveries. Incorporate any exceptions to lead times for key items. See 3.04.B below.

e. Revise and resubmit weekly, and upon request, to reflect construction progress.

2. Submittal 27 41 16-02: Data Sheets

a. Contractor shall assemble, list, and submit manufacturer's product data sheets for all products and materials to be used, including Installation Materials.

b. Arrange data sheets in order of specification.

c. On each data sheet, highlight or circle the models, configurations, colors, options, licenses, etc. included.

d. For color and material selections, provide real samples of the finishes.

e. Propose a cable color schedule by signal type and submit for approval prior to ordering.

D. Contractor shall submit the following by the corresponding date approved (via "Submittal 27 41 16-01: Schedule"), and prior to the commencement of work:

1. Submittal 27 41 16-03: Network Coordination

a. Contractor shall assemble documentation describing the logical design intent of all network-based systems for preliminary coordination with the Owner's IT representatives, including but not limited to:

1. For each intended VLAN, the VLAN ID, subnet IP addressing schemes, routing requirements, use of DHCP/reservations/statics. Indicate existing VLANs that are to be reused.

2. Coordination with Owner's ISP(s) regarding demarcation location, routing, firewall needs.

3. Interfaces connecting to existing OFOI network systems, uplinks, routers, switches, etc.

b. Upon approval, Contractor shall implement the logical design depicted within the submittal.

2. Submittal 27 41 16-04: Shop Drawings

a. Prepare and submit complete shop drawings in a current version of Autodesk AutoCAD, Autodesk Revit, Vectorworks, and/or other computer-aided drawing software capable of exporting .DWG files.

b. Acceptance of an incomplete or partial phased submittal shall not waive any requirements for submission of complete shop drawings.

c. A complete package of shop drawings shall include, at a minimum:

1. Site Plans, Floor Plans & Reflected Ceiling Plans

a. Prepare to-scale drawings of the project location and buildings, indicating the installed locations of devices, equipment racks, consoles, low voltage pathways, etc.

2. Sections & Elevations

a. Prepare to-scale cross-section views of pertinent locations indicating the installed locations of equipment racks, wall-mounted equipment, cable pathways, consoles, displays, speakers, low voltage pathways, etc.

3. Equipment

a. Show the location of equipment mounted within enclosures, racks, consoles, or on tables, credenzas, lecterns, etc. Show dimensions, wire routing and cabling within housings, AC power, and terminal strip locations.

4. Patch Panels

a. Provide patch panel layouts and label designation strips, including color schemes, for all patch panels.

5. Fabricated Plates and Panels

a. Provide complete drawings of custom-fabricated plates and panels, including dimensioned locations of components, component types,

cutout sizes, engraving information, plate material and color, and bill of materials.

6. Fabricated Millwork and Enclosures

   a. Provide full fabrication details for custom millwork and enclosures, indicating size, materials, finishes, and openings for equipment.

7. Frame Layouts

   a. Provide slot allocation drawings for frame chassis containing multiple cards/devices within.

8. Line Diagrams

   a. Develop detailed, installation-ready wiring diagrams for each system and subsystem. Include all devices with unique Device IDs, all cabling with unique Cable IDs, cable types, identification and color codes, device input and output ports, device make & model, and device location. Indicate OFE, OFCI, and OFOI where applicable. Include a legend that explains the significance of each symbol, linetype, and text block.

9. Installation Details

   a. Depict installation methods and means specific to each product, if differing from that shown in the manufacturer’s data sheet.

   b. Provide drawings for any custom device, bracket, mount, or assembly of off-the-shelf parts.

   c. Illustrate all pinout details for standard and custom assemblies. Illustrate visual representations of cable terminations, assembly procedures, and standard of quality for each termination type.

   d. Submit a proposed cable type and color scheme, by signal type, for approval prior to ordering. Coordinate with existing systems.

10. Mounting & Rigging Details

    a. Retain the services of registered professional structural engineer licensed to practice in state of Minnesota to develop mounting details for any devices suspended overhead. Include hardware types and load capacity. Structural information to include design calculations and copy of engineer's certification.

b. For minor equipment, provide a mounting detail drawing, including brackets, hardware, and the structure to which it will be attached.

11. Cable ID and Device ID Labels

a. Submit 1:1 scaled samples of proposed cable and device labels. Include an explanation of ID schemes and a descriptor schedule.

d. Coordinate a detailed design review meeting with Owner and Design Consultant to review Shop Drawings in person.

3. Submittal 27 41 16-05: User Interface Designs

a. Develop visual aids to convey the final programming intent for all user interface panels, controllers, touch screens, etc. Include a narrative for any depictions of custom controls or buttons. Include:

1. Intercom key panel layouts

2. Router control panel layouts

3. Audio control panel layouts and button mapping

4. Touch panel designs, graphical user interfaces

5. Multiview image processor layouts

b. After submittal, schedule a detailed design review meeting with Owner and Design Consultant to review.

c. Submittal designs shall provide a base configuration that will be further modified, adjusted, changed, adapted, or rebuilt during Acceptance and Event Attendance.

4. Submittal 27 41 16-03: Preliminary Network Information

a. Prior to Owner's first use, Contractor shall assemble preliminary documentation describing the initial IP commissioning settings for all network-based systems, including but not limited to:

1. For each device network interface, intended VLAN, the VLAN ID, IP address, subnet, gateway, routing requirements, use of DHCP/reservations/statics.

2. Provide Owner with initial list of access credentials

b. Update and resubmit periodically until Closeout.

5. Submittal 27 41 16-06: Substantial Completion, Adjustment & Testing Results

a. At the conclusion of system installation and commissioning, submit a consolidated punch list of all remaining incomplete tasks, including those at the request of the Owner and Design Consultant.

1. Prioritize each item on the list, with the most critical/crucial/important at the top, and indicate the date each item will be completed.

b. Submit a completed Adjustment & Testing Results document indicating that all testing procedures have been completed successfully. Include notes on final settings, adjustments made, issues uncovered, and resolutions. See 3.10 below.

6. Submittal 27 41 16-07: Training and Event Attendance

a. In coordination with Owner and Design Consultant, develop a training and event attendance schedule. Formally submit four (4) weeks prior to first scheduled training. Include:

1. Each training session, including the date, time, approximate length. List the instructor and provide a resume indicative of their experience. Describe the curriculum, intended audience, and recommended class size.

2. Provide the training materials and agenda for distribution to attendees at least one week prior to the in-person session.

b. Upon completion of each training, submit a roll call list of all attendees with their signature, the actual date and time of training, duration, and location.

c. Upon completion of each event, submit a statement, signed by the Owner's designee, that the Contractor's technician was present for the entire event. Include the actual date and time of the event, the duration, and the location.

7. Submittal 27 41 16-08: Closeout

a. Prior to contract closeout, submit the following:

1. As-Built Drawings

a. Revise and resubmit all Shop Drawings, indicating all changes and revisions made during installation, and reflecting the final installed state of the system.

b. Indicate the final configuration and calibration settings of all semi-fixed controls for each device. Update following acceptance testing. Include all computer-based software settings, IP addresses, gateways, drive mappings, etc.

c. Provide files in both a common digital document format (PDF) and in native, editable files (DWG, DXF, Revit).

2. As-Built Documentation

a. Provide digital copies of all documentation used to install and configure the system, including but not limited to patch panel labels, IP address lists, label templates, modeling files, databases, etc.

3. Final Programming Code

a. Deliver a digital copy of all software, programming code, user interfaces, components, configurations, custom applications, scripts, etc. used within the system. Provide in the native editable format, and in PDF/JPEG depictions.

4. Final Configuration Files

a. Deliver three (3) digital storage devices containing identical backups of all device configurations, settings, passwords, licenses, keys, etc. Retain an additional copy internally for future reference.

5. Asset List

a. Provide a complete list of all equipment installed, indicating the asset tag number, manufacturer, model, serial number, device ID, and location.

6. Network Information & Credentials

a. Assemble a complete list of all network interfaces and the settings configured, including VLAN, IP address, subnet, gateway, routing requirements, use of DHCP/reservations/statics.

b. Include a list of all inter-VLAN routing rules and ACLs.

c. Submit a list of all configured usernames and passwords. Where devices are managed by an outside identity service, indicate which service is used and the associated configuration parameters.

7. Operations Manual

a. Assemble, organize, list, and deliver the user guide manuals for all equipment and Installation Material contained within the system.

b. Include the manufacturer's warranty statement. Where manufacturer registration is required, register warranty in Owner's name, and at an address determined by Owner. Provide copy of registration.

8. Service & Maintenance Manuals

a. Cleanly assemble, organize, list, and deliver the manufacturer's service & maintenance manuals for all major equipment within the system. A box of random items will not be accepted.

b. Provide a summary recommendation for a preventative maintenance checklist, consolidated across all manufacturer's recommendations, covering the entire system and related components.

9. Training Recordings & Agendas

a. Submit a final agenda, per session, for all System Training and OEM Professional Service Training. Include an attendance roster for each session signed by attendees.

b. Provide a digital storage device containing video and audio recordings of all training sessions, organized by date and topic, and documents containing the agendas for each.

10. Warranty Statement

a. Provide a letter of warranty, following and beginning on the date of the first trouble-free event operation after Acceptance, conforming to the terms of this specification. See 3.14 below.

## 3.04. SOURCING

### A. QUALITY CONTROL

1. Source equipment and material from reputable sources selling only original, new, genuine product. Ensure that all distributors are authorized to sell a manufacturer's product.

B. FORECASTING

1. Upon notice of award, assemble a sourcing forecast for lead times of all equipment and materials and update it throughout the project. If product lead times and availability will impact the dates approved (via "Submittal 27 41 16-01: Schedule"), notify the Owner and Design Consultant immediately.

3.05. DELIVERY, HANDLING, AND STORAGE

A. Deliver products in original, unopened packaging with legible manufacturer's identification. Coordinate secure, onsite storage locations with the Owner.

B. Comply with manufacturer's recommendations for storage and protection.

1. Store all equipment and material in a cool, dry place, out of direct sunlight.

2. Protect from damage, including by other trades, during the construction process.

3. Provide protective covering during installation, where necessary to prevent damage or entrance of foreign material.

3.06. DEMOLITION

A. Coordinate all shutdowns with Owner. Notify the Owner a minimum of 48 hours prior to any shutdown or service interruption regardless of the impact or expected duration.

B. Protect existing facilities to avoid damage. Repair and replace any property unintentionally demolished or damaged.

C. Completely remove all existing devices, equipment, fixtures, supports, brackets, mounting hardware, controls, cabling, screws, and related material.

1. Disconnected cable shall be completely removed and shall NOT be tagged for future use. Do not abandon material.

2. When removing cable from conduit, take extra caution to avoid collateral damage. Confirm the function of other collocated facilities and protect against damage.

D. Disposal of demolished materials shall comply with local, state, and federal regulations. Attempt to recycle demolished materials when possible.

E. Comply with Owner's disposal requirements. Upon request, collect all or limited specified items. Palletize, inventory, and shrink-wrap using Contractor-provided materials. Identify each pallet with a unique identifier matching the inventory list. Submit the list to the Owner. Move pallets to designated location.

## 3.07. INSTALLATION

A. Always maintain a safe and secure work environment.

B. Mount equipment and enclosures securely, accurately, and statically. Ensure that permanently installed equipment is held firmly in place. Design equipment supports to handle loads with a safety factor of at least three-to-one (3:1). Install seismic bracing on applicable equipment as required by local codes.

C. Install equipment to allow proper ventilation, following manufacturer's guidelines. Ensure adequate separation and supply of intake and exhaust air. Take measures to prevent heat buildup. Where additional airflow is deemed necessary, provide adequate whisper-type ventilation.

D. Provide and install all components in a complete and professional fashion. Provide and install blank panels & inserts, courtesy covers, gaskets, seals, etc. without request for reimbursement. Fill all exposed screw holes with appropriate hardware.

E. Maintain consistency throughout installation. Install, mount, and align devices in a repetitive, organized manner for ease of locating and troubleshooting.

F. Install enclosures, consoles, junction boxes, etc. in such a way that all doors, hinges, and access panels can open and close completely, without obstruction.

G. Asset Tagging

1. Install owner-furnished asset tags on all equipment, according to the Owner's asset tracking requirements. Document the asset tag number, manufacturer, model, serial number, device ID, and location. Submit a final list.

a. Tagging requirements may consist of defined criteria such as equipment location, purchase price, equipment type, kitted/packaged systems, or similar. Refer to Asset Tracking Requirements, provided separately.

H. Power & Grounding Systems

1. Retain the services of an electrical contractor licensed in the jurisdiction of the project location.

2. Do not allow any personnel to field modify power cables, circuits, receptacles, plugs, switches, etc. unless they are fully licensed to perform the work at the project location.

3. Coordinate final connection of power and ground wiring to racks. Ensure uninterrupted operation. Where devices plug into a receptacle, Contractor should use twist-lock style plugs when possible.

4. Install 3-conductor, grounded NEMA 5-20 receptacles in each rack & console, and feed with a minimum of two separate 120V 20-amp circuits. Contractor may also provide IEC C13, C19 receptacles and/or 208V/240V circuits, if desired. Provide a minimum of two spare receptacles in each rack. Label each bank of receptacles with the circuit that is feeding it. Update the printed panelboard circuit schedule.

    a. Color-code device power cables to identify circuits within racks.

5. 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 ground wire from each AC outlet in each rack to each buss bar. Connect each rack buss bar to the main telecommunications grounding busbar with properly-sized insulated cable. Refer to ANSI/BICSI N3-20, Planning and Installation Methods for the Bonding and Grounding of Telecommunication and ICT Systems and Infrastructure.

6. When installing new equipment racks, electrically isolate the rack from the flooring system by installing a manufacturer-approved, dielectric pad or isolated raised feet.

7. Replace manufacturer-provided power cables with shorter equivalents, connecting directly to the power strip without bundling. Provide the owner with some of the original length power cables.

8. Upon completion, meter the exact power draw or amperage across each circuit during startup and nominal operation. Ensure at least 10% excess capacity remains.

I. System Wiring

1. When viewing the racks and enclosures from the rear, place alternating current power wiring on the left and audio, video, control, and RF wiring on the right. For ganged racks without separation, flip power and signal every-other-rack, so that signals are adjacent and power is adjacent between racks.

2. Ensure that equipment mounted on the rear rack rails does not obstruct access to any front-mounted components or cabling. Ensure cable bundles do not block access to any equipment, rack rails, or mounting hardware.

3. For devices with power supplies on both sides of the rack, extend both power cords to the appropriate side. Signal cable may occupy both sides of the rack in limited cases (e.g. racks containing only patch panels) if and only if at least 12” of separation is maintained.

4. Organize vertical and horizontal wiring inside each rack using lacing bars. Tie horizontal wiring into manageable bundles with appropriate cable lengths to minimize excess slack while allowing for service and testing. Install horizontal support bars if cable bundles sag. Attach cables to vertical support bars to reduce the weight of cabling on attached equipment. Use hook/loop strips to bundle rack wiring; do not use electrical tape or adhesive-backed cable tie anchors.

5. Neatly bundle excess AC power cables from rack-mounted equipment using hook/loop cable ties when short power cables are not available.

6. Ensure sufficient service loops for equipment mounted on rack slides to be fully pulled out and locked without straining cables.

7. Terminate each cable with the appropriate connector. Avoid use of adapters.

8. Handle wiring with caution; damaged cables or equipment will not be accepted. Keep cables of different signals or signal levels isolated and properly separated, organized, and routed to prevent crosstalk. Specifically, maintain separate groups for microphone level circuits, line level circuits, loudspeaker circuits, and power circuits.

9. Ensure that all terminations are securely fastened using mechanical connectors or solder. Crimp each lug properly using an appropriately-sized tool. Test all connections for loose or frayed conductors.

J. Patch Panels

1. Wire all normal patch panels with signal "sources" (outputs from devices) across the upper row of a row pair and "loads" (inputs to devices) across the lower row of a row pair.

2. Attach designation strips to each row of each patch panel. Use alphanumeric and descriptive labels for all designation strips. Number the jack positions in each horizontal row sequentially from left to right. Letter the horizontal jack rows sequentially from top to bottom. Ensure that the alphanumeric identification of each jack is included on all relevant drawings.

3. Wire patch panels with adequate service loops, allowing panels to be removed for service while still connected.

K. Weatherproofing

1. Objects installed outdoors shall be properly treated for exposure to moisture and temperature extremes.

2. Utilize non-corrosive mounting hardware and ensure that mating metals do not cause electrolytic corrosion.

3. Care must be taken during installation or maintenance to avoid any measures that could compromise weather-protection features.

4. Provide and install all necessary conduit, conduit fittings, glands, seals, gaskets, etc. to maintain weatherproofing.

5. Failure to maintain manufacturer-recommended weatherproofing shall result in the Owner's decision to reject the product and require a new replacement.

3.08. SEQUENCING

A. Develop an installation task schedule that minimizes impact to other contractors. Sequence work to account for, accommodate, and minimize typical construction delays.

B. Should completion of a task be delayed, require unexpected effort, and impact other trades or Contractors contractual obligations, notify the Owner immediately.

3.09. QUALITY ASSURANCE

A. The Contractor shall develop and maintain a quality control and assurance program. This shall include:

1. Review of the specifications and related documents to identify quality requirements above and beyond Contractor's standard operating procedures.

a. Any unique project quality requirement shall be identified, defined, and assigned a designated quality supervisor.

2. Developing and implementing a quality management program.

a. Contractor shall plan to inspect installation and commissioning quality continuously.

3. Initiate and complete a documented quality assurance procedure to ensure that the required quality of the project is achieved.

a. This process shall define inspection requirements, timing of inspections, written reports, and who is to receive and review them, and – if any need for correction arises –how it will be completed.

b. This process shall clearly define escalation procedures for mitigating and responding to issues.

4. The Contractor's quality assurance plan shall be extended to include all subcontracted and assigned work.

## 3.10. ADJUSTMENT AND TESTING

A. Prior to configuring, adjusting, and testing the system, perform and verify the following tests.

1. Visually inspect all equipment and material, insuring it is installed in a proper and safe manner, according to the manufacturer's instructions.

2. Clean the project site, removing all dirt, dust, and debris.

3. Visually inspect all cabling, insuring it is properly dressed, supported, and properly connected. Verify cable and device labels.

4. Remove temporary facilities for power, grounding, networking, low voltage pathways, and the like.

5. Ensure all products are neat, clean, and undamaged.

6. Remove and replace all broken work.

7. Store extra materials in a location designated by the Owner.

8. Inventory and catalog all handover and spare equipment. Provide a list to the Owner, deliver equipment, and obtain signoff.

B. Prior to energizing the system, perform the following tests.

1. Ensure all equipment is properly grounded. Verify that power connections are solid. Test each power receptacle with a digital multimeter to observe the expected voltage and frequency. Confirm the correct polarity of hot, neutral, and ground connections. Confirm that the neutral to ground voltage is no more than +/- 0.25 V.

2. Measure the resistance to ground of each piece of equipment using a digital multimeter. Remedy any resistance higher than 0.15 ohms.

3. Temporarily lift the technical ground from the main electrical ground, measure and record the DC resistance between them. Resistance should be 1000 ohms or greater.

C. Energize the system. Perform the following tests.

1. Verify each component is operating properly, and its performance meets the published specifications as provided by the manufacturer.

2. Balance and adjust each component to ensure optimal operation. Establish the "normal" setting for each adjustable control. Document.

3. Configure network devices and ensure they are in proper working condition.

4. Replace default passwords, login credentials, pins, passcodes, security and encryption keys with unique, secure values. Document and store securely.

5. Inject a unique, distinctive signal into each signal path and verify it is received properly at the destination device. Correct any faults, crossed wires, or issues with signal integrity. Check each channel or port of each device individually. Document that each cable has been tested and verified operational.

6. Adjust each active device in a signal flow to ensure a calibrated signal passes at unity gain. Diagnose and correct any discrepancies. Document each gain adjustment level.

7. Subsystems:

a. Network Systems

1. Verify secure grounding and proper stacking procedures for switches.

2. Ensure proper cable seating and avoid excessive bending.

3. Certify riser and horizontal network cabling by providing time-domain reflectometer (TDR) test results in PDF form for all links terminated onsite (excluding factory-certified patch cables). Run tests for excessive crosstalk, distance, crossed/open pairs, and shield faults. Include the cable number, strand number, optical loss, reflectivity, and a distance/time graph of loss events. Document and submit results digitally in PDF format.

4. Verify all devices connected to the Media-over-IP fabric are locked to PTP on both the Primary and Secondary interfaces.

a. Observe PTP traffic packet timing offsets in the highest queue under extreme congestion.

b. Confirm all boundary clocks are translating cleanly between domains.

c. Ensure no unintended clock leaders across zones.

d. Establish continuous logging of leader changes and offset trends.

5. Verify the proper operation, configuration, and fault tolerance of all link aggregations (LAG).

6. Verify basic functionality through ping tests and device connectivity checks.

7. Deploy Cisco Nexus Dashboard Fabric Controller (NDFC) for fabric management.

a. Management and data networks will have a Round Trip Time (RTT) of less than 50 milliseconds.

b. Ensure that the Management and Data interfaces on the NDFC must reside on different subnets.

c. Confirm stable IGMP querier convergence to the appropriate devices.

d. Confirm link utilization is <70% during staged load.

8. Utilize test generators and analyzers to validate proper formatting and transmission of video, audio, and ancillary data packets, including:

a. Multicast associations

b. SDP parameters

c. Ensure no video artificing and audio pops (crackles).

9. Test network redundancy and failover mechanisms to guarantee uninterrupted operation by physically disconnecting all 2110 devices for ST 2022-07 redundancy.

10. Perform a building isolation test for each location. Disconnect the network systems from all other buildings. Verify that devices continue to operate properly. Document any abnormalities.

a. KVM systems: While changing subscriptions without connection to the manager will not be possible, ensure that existing

connections between user stations and computer interfaces continue to operate as normal.

11. Shutdown all ports that are not in use or for future deployments.

12. Provide and verify detailed documentation of network configuration including:

a. Multicast assignments

b. Media-over-IP fabric port assignments: Network Address, Switch Port IP, Device IP, Broadcast Address, Subnet Mask

c. Network Switches: Switch Name, Make / Model / Location, Management Address, Loopback Address

d. Networks: VLAN assignments, subnets, and descriptions

b. Air Chain

1. Simulate faults in a systematic fashion to test all failure modes and workaround methods, confirming automatic relay engagement and signal continuity. Correct any issues resulting in a disruption to the air chain.

c. Fiber Optic Cabling

1. Certify fiber optic cabling by providing optical time-domain reflectometer (OTDR) test results in PDF form for all fiber terminated onsite (excluding factory-certified patch cables). Include the cable number, strand number, optical loss, reflectivity, and a distance/time graph of loss and reflection events.

d. Video Systems

1. Ensure all devices are operating in the proper resolution and frame rate.

2. Ensure all devices are operating in the proper color space and that HDR<>SDR mapping devices are properly configured.

3. Verify all video signals are free from quality issues, including artifacts, blips, glitches, and dropouts.

4. Verify that switching of router sources is performed in the vertical interval, and in less than 100 ms. of command.

5. Calibrate all monitors.

6. Ensure proper termination of all open loop outputs.

e. Audio Systems

1. Ensure all devices are operating in the proper sample and bit rate.

2. Verify all audio signals are free from quality issues, including artifacts, blips, glitches, extreme or low gain, and dropouts.

D. Once all the tests above are finished and the system is prepared for inspection, formally notify the Owner and Design Consultant. Include copies of all recorded data, indicating the date each test was completed and the corresponding results.

## 3.11. ACCEPTANCE

A. The Owner, Design Consultant, and/or their designated representative(s) will perform a walk-through Acceptance inspection. The Contractor shall assist as required and provide test equipment as needed.

B. The Contractor shall provide at least one technician throughout the entire Acceptance inspection and testing period, available from 7am to 10pm, to solely assist with tests, adjustments, and final modifications. The testing process is expected to take a minimum of 3 days.

C. Provide remote access to control systems for adjustments to be made anywhere throughout the project site.

D. The Owner’s designated representative will:

1. Confirm that all systems meet the Design Performance Requirements outlined in 2.03 above.

2. Take inventory of installed and loose equipment to ensure the correct quantity.

3. Perform any additional tests as desired.

E. If further adjustments or work are needed during Acceptance testing, the Contractor must continue to work diligently until the system meets the required standards. If Acceptance is delayed due to the Contractor’s failure to implement a quality assurance program or meet the specification requirements, the Contractor shall cover the cost of any excess time, travel, and expenses incurred by the Owner’s designated representative.

F. If the systems are used prior to final Acceptance, attendance in support of that usage shall not be construed as Acceptance, or as Event Support.

G. The Contractor acknowledges the importance of the specified systems to the Owner's daily business operations. It is crucial to complete all work on the systems in a timely manner. If the lack of performance significantly disrupts normal business operations, the Owner may, at their discretion, take appropriate actions which may include but are not limited to:

1. Imposing penalties or liquidated damages as specified in the contract.

2. Withholding payments or invoking payment deductions until the issues are resolved.

3. Initiating legal proceedings to seek damages, relief, or specific performance.

4. Terminating the contract and engaging an alternative Contractor to complete the work.

5. Seeking reimbursement for any additional costs incurred because of the delays or non-compliance.

6. Pursuing any other remedies available under applicable laws.

H. The Owner and Design Consultant will issue a letter of Acceptance upon successful completion of testing.

3.12. SYSTEM TRAINING

A. Contractor must provide twenty-four (24) hours of instruction (“System Training”) to designated personnel from the Owner on the use and operation of the Work.

B. System Training shall be conducted onsite by one or more senior commissioning engineer(s) familiar with the project and possessing comprehensive knowledge of the system design and operation. Each session shall have an agenda and defined scope of training. All system documentation must be available on-site during the training sessions.

C. The System Training must include:

1. A tour of all Work locations, installed equipment locations, rooms, enclosures, etc.;

2. An in-depth signal flow review of each subsystem, including detailed discussion of how devices are interconnected;

3. A detailed review of each device in the system, its function, configuration, interconnections, operational best practices, startup/shutdown procedures, and indications of common modes of failure; and,

4. Procedures for requesting Warranty service and escalation processes.

D. System Training shall be in addition to any required OEM Professional Services.

E. Submit the System Training materials and agenda prior for distribution to attendees as required in 3.03.D.6 above3.03.D.5 above.

F. At the Owner's discretion and availability, perform System Training across multiple occasions, days, weeks, or months. The Owner shall reserve the right to determine when the system is ready for training, ensuring training occurs only after the system is operational and at the Owner's request.

G. System Training that is substantially interrupted by system malfunction, incomplete setup, misconfiguration, or installation error shall not be considered complete. System Training shall not occur simultaneously with system Adjustment and Testing.

H. System Training shall be divided into separate sessions consisting of no more than two (2) consecutive hours.

I. Use a video camera and wireless lavalier or shotgun mic to record each session. Provide recordings per 3.03.D.7.a.9 above3.03.D.6.a.8 above.

J. Generate an attendance roster for each session, signed by attendees.

## 3.13. EVENT SUPPORT

A. Coordinate and attend ten (10) daily uses of the system after the date of Acceptance ("Event Support").

B. During the event(s), attendance shall start at the first crew call and end when the crew is released. Contractor shall perform requested tasks, such as assisting with crew questions, minor changes, routing, calibration, troubleshooting, diagnosing installation problems, and more. Tasks will strictly involve helping, not operating the equipment or systems directly.

C. If the system fails to meet the specified performance standards during the attended event(s), the Contractor shall mobilize a service team to address the issue and attend each use of the system until all issues are fully resolved.

D. At the Owner's discretion and availability, perform Event Support across multiple occasions, days, weeks, or months.

D. At the Owner's discretion, perform Event Support consecutively or over multiple occasions.

## 3.14. WARRANTY

A. Contractor shall warrant all equipment, labor, and materials provided under this agreement for a minimum of one (1) calendar year.

1. Contractor shall provide qualified technicians to diagnose defects observed and reported by the Owner.

2. Contractor shall repair or replace all defects occurring in labor, material, or equipment within the warranty period without charge. Replaced products shall be warranted as new.

3. Contractor shall provide multiple methods for submitting a warranty claim, such as an online form, phone call, email, text message, etc. Guarantee that warranty claim service requests, regardless of method, are answered within 2 hours.

a. Provide posters, business cards, rack panels, flyers, or other postings that list all methods for submitting a claim.

4. Maintain standby resources available for the entire warranty period to fully correct any system issue onsite within twenty-four (24) hours of the claim request.

5. Proactively monitor network performance metrics after deployment to identify and remedy any potential issues.

B. The Contractor shall submit a letter of warranty, ~~following and beginning on the date of Acceptance, conforming to the terms of this specification.~~following and beginning on the date of the first trouble-free event operation after Acceptance, conforming to the terms of this specification.

C. The Contractor shall extend any manufacturer's warranty of a shorter term. 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. Register all new product requiring a warranty registration with OEMs on behalf of the owner. Request Owner's appropriate contact information prior to submission. Document and provide copies of all registration submissions.

E. Provide the Owner a notice of the option to renew at least ninety (90) days before the warranty period ends.

F. Thirty (30) days prior to the expiration of the one (1) calendar year period, coordinate with the Owner to provide a service technician onsite to perform a system audit.

1. During the system audit, the Owner, Design Consultant, and service technician will review system functionality, equipment, installation, and commissioning for any outstanding warranty claims.

2. Within thirty (30) days of the system audit, the Contractor must remedy the claims. Upon completion, the Owner shall release any and all retainage.

-- END OF SECTION --