Audio-Video Systems

City of Kalispell
Council Chambers

AV Upgrade Project

TABLE OF CONTENTS

Contents

PART 1 - GENERAL

1.1 SUMMARY

A. General: The scope of this specification is concerned with audio-video (AV) systems in the following presentation spaces within the City of Kalispell City Hall Kalispell, MT (hereafter *facility*) of the City of Kalispell (hereafter *Owner*):

- Existing Council Chambers Room (106)
- Existing A/V Room (108)

1. Scope of Work: Integrate, install, and support the following AV systems at the facility:
    a. AV systems
    b. VTC Systems
    c. Audio conferencing (ATC) systems
    d. Control system for AV system
    e. AV Cabling shall be terminated by AV contractor. The AV contractor shall terminate existing and new wiring in accordance with the requirements of the AV systems.
    f. Cable, wiring, and connection devices for wiring system to be used as signal pathways for AV, production communications and control system
2. Related Documents: The following drawings, as well as the general provisions of the RFP, apply to this Section:
    a. Drawings:
        1) AV0.001 Drawing Index & General Notes
        2) AV1.101 Elevation Legend
        3) AV1.102 Display Elevations & Mounting Details
        4) AV1.201 Cable Pull Plan – Level 1
        5) AV1.202 Council Dais Equipment Layout
        6) AV1.301 Wiring Diagrams
        7) AV1.401 Equipment Rack Elevation

A. Products Supplied, But Not Installed Under this Section

B. Products Installed, But Not Supplied Under This Section

C. Related Requirements

1.2 PRICE AND PAYMENT PROCEDURES

A. Allowances:

1. Supply all necessary parts and components to provide a complete installation, regardless of whether it was specifically identified within this document.
2. See Attachment 1 for AV Equipment Lists.
3. See Attachment 2 for Total System Costs

B. Unit Prices:

1. Provide quantity and unit pricing with the bid for each piece of equipment required for the implementation of this project.

C. Alternatives:

1. The development of the systems within this document is based on the provision, installation, and commissioning of the equipment listed in Attachment 1, AV Equipment List. Alternative equipment shall be considered only if submitted specified equipment has become end-of-life and requires an updated replacement at time of bid.

D. Measurement and Payment:

1. For information or references regarding the measurement and payment procedures and conventions, see the Instruction to Bidders, which can be provided by the Owner's Representative.

1.3 REFERENCES

A. Abbreviations and Acronyms

Term	Description
AES	Audio Engineering Society
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
ATC	audio conferencing (formerly audio teleconferencing)
AV	audio-video
CATV	cable television
codec	coder-decoder
CSI	Construction Specification Institute
DSP	digital signal processing

Term	Description
FCC	Federal Communication Commission
HVAC	heating, ventilation and air conditioning
IEC	International Electro-technical Commission
IEEE	Institution of Electrical Engineers
ISF-C	Image Science Foundation, Commercial Division
LCD	liquid crystal display
LEC	Local Equipment Center
NEC	National Electrical Codes
NFPA	National Fire Protection Association
NIC	not in contract.
OFE	Owner-furnished Equipment
RF	radio frequency
SMPTE	Society of Motion Picture and Television Engineers
VTC	Videoconference(ing) (formerly video teleconference)

B. Definitions:

1. Glossary:

Term	Definition
Article	A subject within a Part consisting of one or more related paragraphs and subparagraphs in a construction document as specified by Construction Specification Institute (CSI) standards:
audio conferencing (ATC)	The live exchange of primarily audio information among several persons and machines remote from one another but linked by a telecommunications system. Also referred to as *teleconferencing*, *audio conferencing*, *telephone conferencing*, and *phone conferencing*.
AV system	Audio-video equipment and infrastructure that is integrated to support various collaboration and presentation functions at or across specific spaces or locations.
bidder	An entity that submits a proposal for a project.
cable tuner (CATV tuner)	Also known as a set-top-box (STB), it is the cable television receiver unit supplied by cable TV provider for the customer.

Term	Definition
chrominance	The signal used in video systems to convey the color information of the picture, separately from the accompanying luma signal (or Y for short). Chrominance is usually represented as two color-difference components: U = B' − Y' (blue − luma) and V = R' − Y' (red − luma). Each of these difference components may have scale factors and offsets applied to it, as specified by the applicable video standard.(Wikipedia; on 3 May 2011 at 20:02)
codec	The electronics that provide the means to communicate via videoconferencing (VTC). This device shall be located in the LEC of a room where this feature is available.
custom	Describes systems or components that shall be fabricated by the Contractor based on these specifications and drawings.
EASE	EASE is Windows-compliant acoustic simulation software that predicts the performance of a sound system in a given venue.
future	Describes equipment that shall be added to the systems by the Owner or Owner representative at a later date. Provisions (TBD) shall be made for this equipment.
High-bandwidth Digital Content Protection (HDCP)	A form of digital copy protection developed by Intel Corporation [1] to prevent copying of digital audio and video content as it travels across DisplayPort, Digital Visual Interface (DVI), High-Definition Multimedia Interface (HDMI), Gigabit Video Interface (GVIF), or Unified Display Interface (UDI) connections.
heating, ventilation, and air-conditioning (HVAC)	The building mechanical systems providing heating, ventilation and air conditioning.
luminance	The total luminous flux incident on a surface, per unit area. It is a measure of the intensity of the incident light, wavelength-weighted by the luminosity function to correlate with human brightness perception.
Key Selection Vector (KSV)	Commonly called an HDCP "key." A unique ID for each HDMI sink that must be sent to HDCP-enabled sources in order for the sinks to receive content.
liquid crystal display (LCD)	Flat panel display device.
local equipment center (LEC)	Refers to the Local Equipment Center or equipment racks, for the AVC capable rooms.
not in contract (NIC)	Work or equipment that is not in contract covered in this section.

Term	Definition
(not applicable)	A documentation convention that refers to a topic deemed not applicable at the time the document is submitted; however, the topic could become relevant subsequent to further knowledge acquisition and developments.
meeting space	Any space where AV systems are available.
Owner-furnished equipment (OFE)	Equipment provided by the Owner for removal, relocation and testing prior to installation. Coordinate the integration of existing components or new components, provided by the Owner into the AVC system. Provide required mounting hardware, rack panels, cable, connectors, etc. to ensure proper operation of the OFE systems as specified.
Paragraph	One or more statements addressing a particular subject in a construction document as specified by Construction Specification Institute (CSI) standards; a component of an Article
Part	One of the three groups of related information that make up one of the following sections in a construction document as specified by Construction Specification Institute (CSI) standards: GENERAL, PRODUCTS, or EXECUTION.
product	Systems, materials, manufactured units, equipment, components, software, special tools, and accessories that are delivered as the result of project work. Includes mixes, shop fabrication, and factory finishing prior to installation or incorporation into the project.
quality check (QC)	The standards and practices by which the performance and integrity of the system is tested and verified.
radio frequency (RF)	The portion of the electromagnetic spectrum with frequencies between 3 KHz and 300 GHz. This corresponds to wavelengths between 30 Km and .3 mm.
shop drawing(s)	A shop drawing is a detailed drawing or set of drawings produced by various building trades that explain the installation of the items to the contractor's installation crews. Shop drawings normally show more detail than the construction documents. They are not produced by the Owner's architects and engineers.
Subparagraph	One or more sentences related to and subordinate to a paragraph or another Subparagraph
use case	A description of steps or actions between a user and a software system which leads the user towards something useful. (*Wikipedia*, 13 June 2011 at 19:14)
videoconferencing (VTC)	Audio conferencing in which video images are transmitted among the various geographically separated participants in a meeting. (Microsoft Computer Dictionary, 5th ed.)

Term	Definition
wireframe	Also known as a page schematic or screen blueprint, a wireframe is a visual guide that represents the skeletal framework of a software application or website. (*Wikipedia*, 20 July 2011 at 13:42)
work	Activity that consists of providing labor, materials, equipment, services, and administration required in conjunction with or properly incidental to project construction.

2. Roles:

Role	Description
Owner	Any person or entity for which the work is being performed.
Owner's Representative	Represents the interests of the Owner for the AV-related objectives, requirements, and work stipulated in this project.
Architect	The entity that is responsible for the entire construction and system design of the work stipulated in this project.
AV Designer	Develops the AV design and associated documentation for the objectives, requirements, and work stipulated in this project.
General Contractor	The entity responsible and accountable to the Owner for the successful completion of the entire construction/modification project.
Bidder	Contractor, supplier, or vendor who responds to an invitation to bid.
AV Contractor	The professional audio-video entity awarded, assigned to, and responsible for the work.
Presenter / End-user	Person offering presentations.
Operator	Person operating facility systems in support of end-user's presentation.

C. Reference Standards: (not applicable)

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate arrangement of the AV system assemblies with adjacent construction and with components occupying ceiling space, including structural members, pipes, air-distribution components, raceways, cable trays, recessed light fixtures, ceiling framing, tight fixtures, HVAC equipment, fire-suppression system, and partitions.
2. Refer to Electrical Drawings, which are not part of the AV submittal, for service-voltage power feed.

3. Coordinate layout and installation of AV system with adjacent construction, including ceiling framing, light fixtures, HVAC equipment, fire-suppression system, and partitions.

B. Pre-installation Meetings:

1. For information or references regarding Pre-installation Meetings, see the Instruction to Bidders, which can be provided by the Owner's Representative.

C. Sequencing:

1. General:

a. Allow adequate time for corrections to be made alter Inspections to maintain the Project Schedule.

b. Allow adequate time for corrections to be made after Submittals to maintain the Project Schedule.

2. Sequence the Project Submittals and Inspection Requests as follows:

a. Qualifications Submittal

b. Shop Fabrication Submittal

c. Shop Observation Inspection Request

d. Shop Observation Inspection

e. Field Installation Submittal

f. Substantial Completion Inspection Request

g. Substantial Completion Inspection

h. As-Built Record Submittal

i. Final Inspection Request

j. Final Inspection

k. Training Request

l. Training

D. Scheduling:

1. For information or references regarding the atypical project work scheduling, see the Instruction to Bidders, which can be provided by the Owner's Representative.

E. Code Compliance:

1. All work and material shall comply with all applicable national, local municipal laws and regulations.

2. Code compliance is mandatory. Nothing in these specifications and/or drawings permits work that does not conform to applicable codes. Where work is shown to exceed minimum code requirements, comply with drawings and applicable codes, and immediately notify the Architect prior to proceeding with

work. Do not proceed with work that is in apparent conflict with applicable codes without first receiving written direction from the Architect.

3. No work shall be concealed until after inspection approval by proper authorities. If work is concealed without inspection and approval, the party that concealed said work shall be responsible for all work that requires exposing the concealed areas in addition to any associated modifications.

F. Licenses and Permits:

1. Each separate trade shall arrange for required inspections and pay all license, permit, and inspection fees pertaining to its respective portion of the work (unless otherwise directed in the Owner's Agreement with AV Contractor.)

G. Safety and Indemnity:

1. The AV Contractor shall be solely and completely responsible for conditions of the job site (as pertaining to the AV equipment and installation of same), including safety of persons and property during performance of work.

2. No act, service, drawing review, or construction observance by the Owner's Representative is intended to include a review of adequacy of the AV Contractor's safety measures, in, on, or near the construction site.

H. Contractor's Insurance:

1. The AV Contractor shall purchase and maintain such insurance as shall protect him from claims set forth below which may arise out of or result from the AV Contractor's operation under the contract, whether such operation by himself or by any subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

2. Coverage and limits shall be as required by the general or supplemental conditions. A certificate of insurance shall be submitted with the bid.

1.5 INFORMATIONAL SUBMITTALS

A. General:

1. Submit the following items in accordance with the Instruction to Bidders, which can be obtained from the Owner's Representative.

2. Submit only complete submittals. Only complete submittals shall be reviewed; incomplete Submittals shall be rejected.

3. AutoCAD electronic, DWG files:

a. All AV Contractor-generated drawings shall be developed using AutoCAD version 2007 or newer.

1) The AV Contractor is solely responsible for developing Shop Drawings as described in this Section.

2) The Contract Drawings shall not satisfy the Shop Drawing requirements.

B. Product Data:
   1. Firmware
   2. Software
   3. Release
   4. Basic instructions
   5. Set-up guide
   6. Advanced tech manual
   7. Product specs

C. Response Submittal:
   1. Installer Qualifications Submittal:
      a. Provide the installer qualification information described in Part 1 Quality Assurance
      b. For firms and persons specified in 'Quality Assurance" Article 10 demonstrate their capabilities and experience, include lists ofcompleted projects with project names and addresses, names and addresses of architects and Owners, and other information specified.
   2. Bill of Quantity:
      a. Provide a Bill of Quantity for each item specified in Part 2 and is incidental material supplied necessary to complete the Work asspecified herein and shown in the Drawings, Tabulate a bill of quantities In the same order as each item appears in Part 201 this Section. Provide the following information for each item listed:
         1) Manufacturer's name
         2) Manufacturer's model number
         3) Product description
         4) Quantity supplied

D. Shop Drawings:
   1. Shop Drawing Submittal Components: Shop drawings (see definition) are detailed drawings used by installation crews. The submittal is comprised of the following:
      a. Shop Drawings
         1) Cover Sheet
         2) Room Index
         3) Device Schedules
         4) Overall Plans
         5) Enlarged Plans

6) Wiring Diagrams ("Wiring diagrams")

7) Elevations—Room, Rack, and Panel

8) Details

b. Test Reports

1) Field Test Report

2) Shop Test Report

c. Product Data

1) Manufacturers Equipment Specification Sheets: For each item Specified in Part 2 submit a Manufacturer's Equipment Specification Sheet listing the product features, specification, and physical characteristics.

2) If more than one product or model option is listed, identify clearly on the sheet which product is being submitted.

d. Samples

2. Shop Drawing Requirements:

a. General Requirements:

1) Shop Drawings shall be clear and legible.

2) Character height shall be $^1/_8$ inch high when plotted at full scale.

3) Title block character height shall be $^1/_4$ inch high when plotted at full scale.

4) High scale of drawings shall be at $^1/_4$ inch, $^3/_4$ inch, 1 inch, 1 $^1/_2$ inches, and 3 inches.

b. Cover Sheet Requirements:

c. Room Index Requirements:

d. Device Schedules Requirements:

e. Overall Plans Requirements:

1) Coordinate the Overall Plan Drawings with the Wiring Diagrams.

2) Detail the infrastructure system. Include the following information for each device:

a) Conduit location, termination, size, type, and quantity

b) Multi-barrier raceway location, termination, size, type and quantity

c) Raceway locations, terminations, size, type and quantity

d) Intermediate pull box location, size, type, quantity and number

e) Terminal block box location, size, type, quantity and number

f) LEC or equipment enclosure type and location

g) Table type and general location, including modular tables and general occupant capacity indication

h) Table top signal connection types and general location(s)

i) Controls type and general location(s)

j) Speaker general locations

k) Projector type and general location

l) Display type and general location

m) Camera type and general location(s)

n) Table microphone type and general locations

o) Lectern type and general location

3) Include the following for each cable in a Cable Schedule:

a) Manufacturer name

b) Manufacturer model number

c) Designation prefix

d) Cable type

e) Cable color

4) Detail the conduit fill. For each conduit run show the cable fill, include:

a) Cable designation

b) Cable quantity

f. Enlarged Plans Requirements

g. Wiring Diagram Requirements

1) Break down Wiring Diagrams as follows: Wire paths shall be depicted for some or all of the following signals:

a) Audio

b) Video

c) Control

d) Audio network

e) Production communications

f) Intercom

g) RF

h) Broadcast

2) Show the interconnection of all devices in the signal path for each system.

3) Include the following information for each device:
    a) Equipment manufacturer name
    b) Equipment manufactures model number
    c) Specialized part number option
    d) All input and output connection information, used or unused
    e) Location
4) No drawing codes shall be permitted.
5) Ensure diagrams are coordinated with the bills of quantities.
6) Demonstrate the calculated estimated signal strength of the RF distribution system, based on the theoretical conduit path.
7) Include the following information for each cable:
    a) Equipment manufacturer name
    b) Equipment manufactures model number
    c) Cable designation number
    d) Termination locations
8) Include the following Information for each field device:
    a) Terminal cabinet number
    b) Intermediate pull box number
    c) Intermediate pull box size
    d) Field panel number
    e) Field panel connector number
    f) Location

h. Elevations Requirements:

1) Room Elevations: Show the elevation view of each patch bay and indicate the following Information:
    a) Patch bay type
    b) Patch bay number
    c) Patch bay “normal” configuration
    d) Connector type
    e) Connector quantity
    f) Connector designation number
2) Rack Elevations: Show the elevation view of all enclosed equipment and indicate the following information:
    a) Manufacturer name
    b) Manufacturer model number

c) Equipment enclosure location

d) Equipment enclosure number

3) Panel Elevations: The Owner shall provide menu layouts for use by AV Contractor.

a) Document the menu logic tree for each control device.

i. Details Requirements:

1) For each contractor-fabricated drawing indicate all components and devices, including:

a) Manufacturer name

b) Manufacturer model number

c) Dimensions

d) Component values

e) Locations

2) Include Structural analysis data signed in blue ink and sealed by the qualified professional engineer responsible for their preparation.

3) Include the Structural Engineers Company Name and phone number.

4) For all devices attached to the building indicate:

a) All loads

b) Location of attachment to building structure

c) Dimensions

d) Method of connection to building structure

e) Details of hardware

f) Manufacturer name

g) Manufacturer model number

h) Design calculations

E. Samples:

1. Finished samples of plates and panels that meet quality standards

2. Coordinate with the architect

F. Delegated Design Submittals:

1. Any assemblies or subassemblies designed by a third party must also conform to the submittal requirements stipulated in sections 1.5 and 1.6.

G. Test and Evaluation Reports:

1. Shop Test Report: Submit a bound volume of test results of the test results from Part 2 of this Section.
2. Field Test Report: Submit a bound volume of test results of the test results from Part 3 of this Section.

H. Manufacturers' Instructions:

1. Any assemblies or subassemblies installed by a third partymust also conform to the submittal requirements stipulated in sections 1.5 and 1.6.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Operations & Maintenance Binder:
   a. Systems E-Binder: System-specific documentation
   b. Product Catalog: Manufacturer documentation by model
2. Operations & Maintenance Manual:
   a. General:
      1) Compose the manual using a single, consistent visual format and writing style.
      2) Describe in the Operation section, typical procedures necessary to activate each system to provide the functional requirements as listed under the System Description. Include normal settings for equalizer, amplifier, signal processing, and user operated controls (as established during system check-out) in tabular or pictorial form.
      3) Portions of the manual may be derived from the equipment manufacturer's instruction manuals and may Include reproductions of artwork and other materials.

4) Provide in the Maintenance section, a recommended maintenance schedule with reference to the applicable pages in the manufacturer's maintenance manuals. Where inadequate information is provided by the manufacturer, provide the information necessary for proper maintenance.

5) List of Replacement Parts: Provide a list of necessary and recommended replacement parts for a normal maintenance period of one year.

6) Assume the reader of this manual to be technically competent, but unfamiliar with this particular facility. It is estimated that this manual should require a minimum of 30 pages.

7) Print the manual using 24lb, bond paper.

8) Electronic Media: On a CD ROM disk or memory stick provide 5 copies of:

   a) The control system un-compiled source code

   b) Digital signal processing (DSP) source code

   c) Adobe Acrobat, PDF files of the Record Set Drawings

   d) Adobe Acrobat, PDF files of the Manufacturers Equipment Specification Sheets

   e) Adobe Acrobat, PDF files of the system Operating & Maintenance Instructions

   f) Adobe Acrobat, PDF files of the Performance Tests

b. Part I-index, includes:

   1) Title page

   2) Project name

   3) Date

   4) Specification reference number

   5) Installers name and address

   6) Installers service phone number

c. Part II - Equipment Operating Instructions index

d. Part III- Equipment Information Index

e. Part IV - Performance Tests Index

f. Part II - Equipment Operating Instructions:

   1) Provide an abbreviated overview of the system description.

   2) Provide comprehensive instructions for the operations of all the systems specified in this section

g. Part III- Equipment Information: For each piece of equipment specified in this Section, include:

1) Reference to manufacturer's installation

2) Reference to manufacturer's operating and service manual

h. Part IV – Performance Tests: Provide comprehensive documentation of all performance verification tests and procedures described in Part 2 and Part 3 of this Section

3. Training Materials: Provide all training materials for review prior to scheduling training sessions.

B. Warranty Documentation:

1. Provide and activate all manufacturer warranties for each component of equipment supplied as a part of this specification.

C. Record Documentation and Files:

1. Record Drawings:

a. Develop and submit the Record Drawings from the final as-built condition of the system. Use same structure as Shop Drawings.

b. Mount one full-scale original on 20-lb, bond paper behind acrylic in the Local Equipment Center Room for each system.

2. Control System Programming Documentation: Develop and submit the following document:

a. Use cases

b. End-user documentation

c. Controls software release notes (including version and release date)

D. Software

1.7 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:

1. Comply with the all national (NBC 2005), regional and local code requirements.

2. Equipment and materials shall be CE, UL listed or ICS where appropriate.

B. Qualifications:

1. Manufacturers:

a. A prime system manufacturer who maintains or sponsors a service center capable of providing training, parts, and emergency replacement and repairs.

b. Minimum of 10 years continuous experience in the design and

manufacture of AV equipment

c. ISO 9001 quality certification for a period of five years or longer.

2. Suppliers: (not applicable)

3. Fabricators: (not applicable)

4. Installers:

a. An experienced installer who is an authorized representative of equipment manufacturer for both installation and maintenance of equipment required for this Section.

b. An experienced installer is an installer that has successfully completed a minimum of three projects of similar scope and size as determined by the Owner's Representative. Provide letters of recommendation from the Owner's Representative from those three projects.

c. The Work specified in this Section shall be accomplished by a single AV Contractor experienced in the design, fabrication, installation, checkout and warranty contract management of systems such as those described in each Section.

1) The Installer shall employ a qualified project engineer meeting the following requirements:

a) BA university graduate engineer in electrical, electronic engineering or physics, and have at least 5 years' experience with similar electronic and optical specialty systems or other equivalel1l educational experience or background.

b) Participation in meetings and conferences. Be present at the Project site for Substantial Completion Inspection, Final Inspection, approve the operating and maintenance manuals, and provide any additional instruction as needed to designated members of the Owner's staff.

c) Be responsible for supervision of all technical work that is part of this Section

d) Supervise preparation of shop drawings and submittals and sign all submittals.

e) Supervise shop fabrication and field installation work to assure conformance with the Contract Drawings, the Specifications, and the reviewed Shop Drawings to assure workmanship at the specified quality.

f) Oversee the testing of all assemblies and sub-assemblies prior to delivery to the Project Site.

g) Lead In the specified testing of the completed installation to assure the Owner that all Contract Requirements are met. Work with and assist the Owner in the final testing for approval and acceptance of the system for the Owner.

d. The bidder shall, prior to the bid, in accordance with the Instruction to

Bidders, submit the following information:

1) A detailed brochure describing its capabilities.
2) Examples of three similar Installations within the past five (5) years
3) Distribution arrangements with manufacturers
    a) Franchise
    b) Dealerships
    c) Distributorships
    d) Evidence of all necessary licenses and certificates to perform the specified work
    e) Financial capability
    f) Bonding capability
    g) Identify all sources of labor
    h) Identify all local agents
    i) Identify all subcontractors
    j) Personnel experience background for the following people who shall be directly responsible for the Work specified herein:
    k) Director of engineering
    l) Project engineer
    m) Project manager
    n) Control system programmer
    o) DSP system programmer
    p) Shop personnel
    q) Field personnel
    r) This submittal must justify, in the judgment of the Owner's Representative, that the AV Contractor has the capability to manage and install a project of this size and scope and that he is capable of the necessary business and technical arrangements for this installation and the pursuant warranty service.

C. Certifications:

1. The AV Contractor shall ensure that workers hold the following certifications prior to the commencement of relevant work:
    a. QSC Level II Certified Programmer
    b. Imaging Science Foundation—Commercial (ISF-C)
    c. Certified Technology Specialist (CTS)

d. Certified Technology Specialist—Design (CTS-D)

e. Certified Technology Specialist —Installation (CTS-I)

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:

1. Deliver portable AV system components, equipment, materials, and accessories to project site in original, unopened packages.
2. Handle components, equipment, materials, and accessories carefully to avoid damaging units in any way.
3. Do not deliver the AV system assemblies until the building is enclosed and other construction within spaces where the AV system assemblies shall be installed is complete and ready for installation.

B. Storage and Handling Requirements:

1. Store received items in a fully enclosed, conditioned space where they shall be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

C. Packaging Waste Management:

1. AV Contractor is responsible for removing and properly recycling and disposing of all waste and packaging from the jobsite.

1.9 SITE CONDITIONS

A. Ambient Conditions:

1. The spaces where AV system assemblies are installed shall meet the following requirements:
   a. Free from dust generated from construction
   b. The room temperature shall be within the specified operating temperature recommended by manufacturer

B. Existing Conditions:

1. Verify all that all existing conduits are suitable for reuse.

1.10 WARRANTY

A. Manufacturer Warranty:

1. The warranty period shall begin only when all of the above listed Substantial Completion Inspection Deficiencies Report has been corrected to the satisfaction of the Owner and the Owner's Representative.
2. Warranty Period: One year from date of the Final Inspection and Acceptance.

B. Specialty Warranty:

1. Written warranty, executed by manufacturer agreeing to repair or replace components of AV system that fail materially or as a result of substandard workmanship within specified warranty period.
2. General Warranty: Special warranty specified in this document shall not deprive Owner of other rights that the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by AV Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 OWNER-SUPPLIED PRODUCTS

A. Existing Audio System Components:
   1. Dias and lectern gooseneck microphones and wiring are existing (see design drawings), but the AV Contractor is responsible for installing existing microphone cabling to new audio Digital Signal Processor.
   2. Two existing speaker circuits (gallery & dais) including a total of 6 Atlas Sound speakers as well as existing Bogen amplifier. Amplifier will be relocated by the AV Contractor to the new equipment rack as well as existing speaker wiring termination.
   3. Assistive Listening transmitter is existing, but the AV Contractor is responsible for relocating the unit to the new equipment rack as well as integrating the audio output from the new audio Digital Signal Processor.

B. Projector and Projection Screen:
   1. The Epson Pro Cinema 1985 projector & Da-Lite 70137LS motorized screen are existing within the room. The AV Contractor is responsible for installing new video transport and control to the projector and new IP to Serial control to the motorized screen for use with the new control system.

C. Broadcast Video Peripherals
   1. Owner's Leightronix Nexus, Leightronix media storage, and GI C6M-II Modulator will be required to be integrated to the new AV upgrade and connected as shown on design drawings. These components will be removed from their existing broadcast rack and moved to the new equipment rack.

2.2 VENDOR-SUPPLIED PRODUCTS

A. Council Chamber Room & A/V Room (106/108):
   1. General: The new AV systems in the Council Chamber Room shall be comprised of a combination of new and Owner-furnished equipment.
   2. Display Systems:
      a. Projector & Screen: AV Contractor will provide AV over IP VSI ethernet decoders at existing projector, at each of the 4 new 75" displays, and at Dais monitors HDMI Distribution amplifier (HDDA-1-1). The AV Contractor will provide new grommet-mounted monitor mounts for these existing Dais monitors.
      b. QSC Control System will provide on/off control functionality to each of

the 4 new displays, and existing projector. A new IP to Serial adapter will be provided to control the existing projection screen. Dais monitors fed by the HDMI distribution will not have on/off control provided.

3. Video Core System: The following are elements that comprise the components of the large meeting room in this project scope.

   a. Video Core:

      1) System Routing Core: Video system shall provide the appropriate connectivity to support the revised system requirements. The system shall transport signals using CAT6 cabling. The new system shall provide the required quantity of connections as indicated below. The heart of the presentation system shall be a QSC Core Control Processor.

   b. Video System Elements:

      1) Laptop/Desktop Display: Video system shall provide the capability to input and display a laptop, corporate desktop, and alternative PC via an auxiliary input at the presentation lectern and a secondary input at Clerk's location.

         a. At Clerk's location, provide QTY 2 HDMI cables for user connection each with accessible length to either end of the Staff/Clerk desk.

      2) Required Connections: The required connections shall include the following sources and destinations for the system (NDI Sources can be routable via control touchscreen to NDI destination locations as indicated below):

Source-Destination Locations— Council Chamber Room

Source Locations		*Destination Locations*	
ENC-1-6	CLERK INPUT	DEC-1-1	FPD-1-1
ENC1-7	LECTURN INPUT	DEC-1-2	FPD-1-2
VPS1-1 [NDI]	TC1 PROGRAM	DEC-1-3	FPD-1-3
CAM-1-1 [NDI]	PTZ 1 SOURCE	DEC-1-4	FPD-1-4
CAM-1-2 [NDI]	PTZ 2 SOURCE	DEC-1-5	PRO-1-1
CAM-1-3 [NDI]	PTZ 3 SOURCE	DEC-1-6	VPS-1-1
CAM-1-4 [NDI]	PTZ 4 SOURCE	DEC-1-7	HDDA-1-1
ENC1-1	TC2 OUTPUT 2	VFC-1-1 [NDI]	CLERK USB
ENC1-2	TC2 OUTPUT 3	VFC-1-2 [NDI]	RECORDER
ENC1-3	TC2 OUTPUT 4		
ENC1-4	TC2 OUTPUT 5		
ENC1-5	TC2 OUTPUT 6		

4. VTC & Broadcast System:

   a. General: New provided Newtek TriCaster TC2 Elite, 2-Stripe control surface, Lumens VS-KB30 PTZ camera control unit, and USB VTC

connection will be utilized for VTC and Broadcast.

b. Four new Lumens PTZ cameras will be provided for use via NDI with VTZ bring-your-own device USB VTC at the Clerk's position as well as being utilized with the Newtek TriCaster TC2 Elite for Broadcasting events.

c. System VTC and Broadcast Modes:

AV system will allow for a BYOD (bring your own device) VTC mode via USB at the Clerk's location or manually operated Broadcast mode via the TriCaster switching system. Mode is selectable via touch-screen at the Clerk's location or at the Production desk.

1) VTC BYOD Mode: In this mode, the owner will be able to utilize the microphones and PTZ cameras in the room via USB to a unified communications soft codec (i.e. Zoom, Teams, WebEX, etc.)on a connected labptop at the Clerk's location. When selected, the touch-screen will allow for in-room volume control, audio output to far-end VTC participants, and control of PTZ camera selection/presets.

2) TriCaster Broadcast Mode: In this mode, the owner will utilize the TriCaster TC2 Elite, 2-Stripe control surface, and Lumens PTZ controller to manually switch cameras to feed OFE Leightronix scheduler/streaming, modulator, and the recording computer near the Clerk's position. QTY 5 additional SDI outputs from the TriCaster will allow for individual Microsoft Teams meeting video feeds to be routed the projector, or 4 new 75" displays. The QSC DSP will allow for Auto-Mixed microphones from the Council Chambers room feed a stereo mix to the TriCaster via Dante for streaming. The touch-screen at the Production Desk in this mode will allow for in-room volume control, and control over audio output volume to the TriCaster system.

5. Audio System:

a. General:

1) The audio system shall be provided with wireless microphones for use in the room as well as utilization of OFE gooseneck microphones at the lectern and on the dais/staff tables.

2) The DSP-based audio system shall support all configurations including reinforcement and echo cancellation for conferencing.

3) OFE existing ceiling-mounted speakers shall be utilized.

b. Audio System Digital Signal Processing Core:

1) The audio system shall provide mixing and echo cancellation.

2) The system shall provide Presenters and Operators control over the audio system when necessary.

3) The system shall allow for automated operation when the system is supporting meetings that do not require Operator support.

c. Audio System Playback:

1) This system includes OFE amplifier and speakers for the playback

of program sources. It shall provide the quality playback of audio from all of the playback sources attached to the system. The system provides playback audio for portable equipment connected to the system.

d. Audio System Voice Reinforcement:

1) The system shall include speech reinforcement from microphones within the room.

2) Included are reinforcement for 2 new wireless microphones and OFE gooseneck microphones.

e. Audio Conferencing (ATC):

1) The audio system shall provide all necessary input, processing, routing, and volume adjustment functions for ATC.

2) The ATC system can be used in conjunction with the VTC system.

3) The audio system shall provide the resources necessary to support a standalone ATC.

2.3 SOURCE QUALITY CONTROL

A. Fabrication Tolerances:

1. General:

a. Each item shall be a product of a firm regularly engaged in the manufacture of electrical, electronic, or optical equipment. The equipment shall be the latest model or type offered that meets the applicable specifications at the time of submittal. Discontinued items replaced by newer models or versions are prohibited and should not be submitted for review.

b. Qualification of workmanship and fabrication of all equipment and components which are custom-fabricated shall be comparable to professional equipment produced by specialized manufacturers of the trade involved and shall be verified by inspection. Only firms having five years of experience in all aspects of the fabrication and installation of similar systems shall be allowed to perform the work.

2. All materials and products shall be new and of professional quality. Unless specifically stated in the drawings or specifications, no existing or used materials shall be installed.

3. Substitutions:

a. Substitutions of equal equipment beyond the alternatives listed shall be permitted only in accordance with the RFP. If a requested substitution requires a change in any of the contract drawings, a revised drawing must be submitted as part of the substitution request. The Owner's Representative shall be the final judge of the acceptability of substitutions.

b. By making requests for substitutions, the AV Contractor accomplishes or

establishes the following:

1) Assesses the proposed substitute product and determines that it is equal to or superior in all respects to the substituted equipment.

2) Provides a warranty equivalent to the substituted equipment's warranty.

3) Certifies that the cost data presented is compete and includes all related costs under this Contract and waives all claims for additional costs related to the substitution, which may later become apparent.

4) Coordinates the installation of the acceptable substitution, ensuring that the outcome equals or exceeds, as appropriate, the original requirements. In the event that the substitution fails to meet performance testing standards, the AV Contractor shall replace the substitution with the original equipment.

B. Shop Observation Inspection:

1. The AV Contractor shall accomplish or establish the following:

a. Notify the Owner's Representative in writing that the system has met all of the requirements for the Shop Observation Inspection and is ready for the Shop Observation Inspection two weeks in advance.

b. Before delivery of the equipment to the project site, demonstrate to the Owner's Representative that all equipment is operating as specified.

c. Verify the achievement of the specifications for each electronic component *in situ*—as assembled in its console; equipment enclosure or other enclosure; powered by the system power supply; and with all other components also activated, powered and interconnected.

d. Record the magnitude and character of the threshold noise for any of the following:

- Hum in excess of that present with individual activation
- High-frequency oscillation

e. Test projection equipment to verify that the manufacturer's specifications are met after it has been incorporated into a complete subassembly.

f. Test the video equipment to verify that the manufacturer's specifications are met after it has been incorporated into a complete subassembly.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Installer List:

1. Installation shall be performed by the parties who meet the qualifications and

criteria stipulated in subparagraphs 1.8B.4.

B. Substitution Limitations:

1. Equipment substitutions per guidelines and performance criteria specified in section 1.2; B, Unit Prices:

3.2 EXAMINATION

A. Verification of Conditions:

1. Examine the as-built and/or the existing condition of the AV system infrastructure to discover all of the field conditions of the AV system infrastructure.

a. Verify that all of the AV system back-boxes shown on the AV drawings match the plate sizes shown on the drawings. If they do not, match the plate with the back box. In the event that the back box that has been installed is too small and does not accommodate the AV receptacles, notify the Owner's Representative.

b. Verify the as-built conduitcapacity. In the event that the conduit that has been installed is too small and does not accommodate the AV cables, notify the Owner's Representative.

c. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting Installation.

d. If the conduit or back-boxes are deficient in any way, notify the Owner's Representative in writing before the shop drawings are submitted.

2. Examine walls, floors, ceilings, roofs, equipment bases, and supports for suitable conditions where AV systems are to be installed.

3. Verify that the isolated ground for AC power circuits has been implemented correctly.

B. Pre-installation Testing:

1. Verify that the AC power has been installed and tested.

C. Evaluation and Assessment:

1. Proceed with AV equipment installation only after the unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Protection of In-place Conditions:

1. Any existing AV system in the project work areas shall be protected by the General Contractor who shall take appropriate preventative and reactive measures as follows:

a. Prevent dust, dirt, paint, moisture, and any other unintended foreign

material from accumulating on or inside of the device.

b. Ensure equipment is properly installed so it cannot be easily dislodged.

c. Ensure equipment is appropriately secure within the framework of the facility's security protocol.

d. Ensure equipment is not operated by anyone other than personnel authorized in writing by the Owner's Representative.

e. Maintain appropriate temperature and humidity levels for the devices.

2. Damaged devices: If damage occurs, the components and entire units shall be replaced as necessary to ensure the provided system is in its original, undamaged condition.

B. Surface Preparation:

1. Complete the following items before the AV equipment components are installed:

a. Painting

b. Walls and partitions

c. Ceilings

d. Windows

e. Millwork:

f. Doors

g. Door Locks

h. Cleaning

i. Floor coverings

j. Electrical Work.

C. Removal:

1. Coordinate with Owner for the removal of legacy equipment prior to installation of new equipment

3.4 INSTALLATION

A. General:

1. Furnish all labor, materials, equipment, programming, and incidental items necessary for construction and completion of the AV system described in the specifications and shown on the drawings.

2. In case of a discrepancy between these overall system standards and the individual equipment item specifications or the manufacturers' recommendations, the most stringent shall take precedence.

B. Cable Installation:

1. General:

a. Pull the cable without damaging the insulation or deforming the cable.

b. Install all cable in provided raceways and conduits.

2. Separation of electrical signal levels:

a. Each conduit shall contain cable of the same signal level or the same type of circuitry only. Install each separate electrical service-level cable designation type shown on the AV Drawings in their respective, separate conduits.

b. Separate all low-voltage signal levels by 12 inches minimum.

c. Separate all low-voltage signal levels running parallel to 120 and 240 Volt AC power by 3' minimum.

d. Separate all low-voltage signal levels running parallel to AC power greater than 240 Volts by a minimum clearance of 6'.

e. Low-voltage signals shall cross AC power perpendicular to each other.

3. Terminations, Splices, and Taps:

a. Splices are not allowed.

b. Wire nuts are not allowed.

c. Pull all cable from device to device directly through terminal, junction, pull and AV back boxes without splices or terminations.

d. Tin bare wire prior to termination unless the connector manufacturer recommend otherwise.

e. Individually insulate unused ends of line-level shields with shrinkable tubing and attached to the cable using an additional piece of shrinkable tubing.

4. Cable Service Loop: Install cable with a service loop at each connector.

a. Install cable with a 12 inches service loop at each connector.

b. Install cable with a 15 feet service loop at LEC location.

5. Cable Labels:

a. Clearly label both ends of each cable during the installation with cable labels.

b. Consecutively number the cable with respect to the devices, the leading service-level designation type.

c. Install cable labels 4 inches from the connector or termination at each end of the cable.

6. Cable Designation:

a. Format the Cable Designation as follows: "Leading Cable Designation Type" "-" "Cable Number".

b. Example:
1) M-45 = Microphone 45

2) L--122 = Line 122
3) L-1122 = Line parallel to line L-122
4) AES-1 = Digital Audio 1

c. Acceptable Cable Designation Type example:

1) M = Microphone-level Audio
2) L = Line-level Audio
3) SS = Speaker
4) S= 70-VoIt Speaker
5) DA = Digital Audio
6) CN = CobraNet Audio
7) AES = AES/EBU Digital Audio• Balanced
8) AESU =AE; S/EBU Digital Audio—Unbalanced
9) SDV = Serial Digital Standard Definition Video
10) SDH = Serial Digital High Definition Video
11) V = Composite Video
12) SV = S-Video
13) RGB = Component Video
14) RGBHV = RED, Green, Blue, Horizontal Sync, Vertical Sync Video
15) T = Triax Video
16) 8T = Sony Triax Video
17) RF = Radio Frequency 75 Ohm
18) WRF =Radio Frequency 50 Ohm
19) NET = Cat 5, CAT6 Network
20) C = Digital Control
21) DC = Direct Current Power

7. Cable Management

a. Bundle and route cables by type from source to termination uniformly to the equipment enclosures.

b. Install edge protection material “Cat track” or grommets on the edges of devices where cables cross a metal edge.

c. Secure the cable with cable ties, Kellems grips, or an approved device so that the connector does not support the weight of the cable. Size the cable management device as required. The weight of the cable shall not apply pressure in any direction to the connector.

C. AV Plates:

1. Mounting General:

a. The AV Plate details in the Contract Drawings do not distinguish between flush or surface mounted plates. It is the AV Contractor's responsibility to size each AV Plate-based on the field conditions.

b. Coordinate the All Plate size and mounting condition with Owner provided boxes.

2. AV Panel Screws:

a. Mount all AV panels to the back-box with pan-head screw hardware. Drill and tap the back box.

b. The mounting screws shall match the finish of the wall plate.

c. Use two screws on each side of the panel for AV Plates that have a side that is twelve Inches long or longer.

d. Ensure all manufactured screw holes are utilized.

3. Cable:

a. See Cable Installation requirements in this Section for the Cable Installation requirements.

4. AV Plates with surface-mounted back boxes:

a. Install the AV panels so that they are flush with the back-box edge. No part of the AV panel shall extend beyond the back-box creating a sharp edge.

b. See the Contract Drawings for details.

5. AV Plates with back boxes that are recessed in the wall:

a. Install the AV Panels so that they are flush with the wall surface and no part of the AV Back box or unfinished wall surface is visible. Extend the AV Panel beyond the opening in the wall creating a flush finished appearance.

b. See the Contract Drawings for details.

D. Seismic Restraints:

1. Secure all hanging and free-standing equipment to the building structure such that it resists seismic acceleration of 1g in any direction.

2. Comply with the local building codes and the most recent version of the NBC.

3. Submit calculations and detailed drawings stamped by a registered engineer.

4. The seismic restraints are not shown on the Contract Drawings. It is the AV Contractor's responsibility to develop shop drawings that reflect the field condition and the seismic requirements.

E. Free Standing Equipment Enclosure:

1. Install the equipment enclosure as shown on the drawings. Maintain clear space such that the equipment rack can turn in place free of obstruction for

service access.

2. Connected audio field lines entering the equipment enclosure directly to the switch or audio patch bay.
3. Connected video field lines entering the equipment enclosure directly to the switch or video patch bay.
4. Electrically isolate the equipment enclosure from the following:
    a. The building grounding system.
    b. The conduit system. Use nylon bushings.
    c. The building structural steel.
5. Electrically bond the equipment enclosures at one point to the isolated grounding system. See the AVS category drawings for grounding details.
6. Electrically isolated the equipment enclosure from:
    a. The building grounding system.
    b. The conduit system. Use PVC bushings to terminate the equipment enclosure to the conduit.
    c. The building structural steel.
7. Electrically bond the equipment enclosures at one point to the isolated grounding system. See the AVS category drawings for grounding details.

F. Interface with Other Work:
1. Lighting /Shades
2. Satellite Receiver
3. Furniture

G. Systems Integration:
1. Integrate the AV system as specified in the following:
    a. Paragraph 2.2, Vendor-supplied Products for functional programming.
    b. The AV system Drawing Package as specified in paragraph 1.5 Submittals.
    c. AV system equipment schedules.

H. Tolerances:
1. Completion of the AV system requires that the tolerances indicated in paragraphs 3.7B and 3.7C be met.

3.5 RESTORATION

A. General
1. All existing equipment shall be removed, cleaned and verified against original manufacturer's operation and specification prior to reuse in this installation.
2. Equipment found to be deficient shall not be used. Equipment found deficient

shall be listed by make, model and serial number and the Owner shall be notified as to the nature of the problem. The deficient component shall be repaired or replaced at the Owner's option.

3.6 RE-INSTALLATION

A. General:
   1. All Owner-furnished equipment that has been restored shall be reused only if it has met the minimum manufacturer standards and has been accepted by the Owner

3.7 SITE QUALITY CONTROL

A. General:

   1. The Verification and Performance Tests documented in this Section represent the minimum system testing required to fulfill the Contract Document Verification and Performance Testing requirements. Additional tests net documented in this Section shall be required to make the system Fully Operational.

   2. Record the results of each Test in this Section in the Project Operations and Service Manual described in Part 1 of this Section. Recorded the date each Test was completed and the results of each Test.

B. Verification Testing:

   1. System Energizing:

      a. Prior to energizing the system for Testing and Verification, ensure the following:

         1) All products are installed in a proper and safe manner in accordance to the manufacturer's instructions.

         2) That the insulation and shrinkable tubing is present where required.

         3) All dust, debris, solder-splatter, etc. is removed.

         4) Temporary facilities and utilities have been properly disconnected.

         5) Electronic devices are properly grounded

         6) Electrical mechanical connections are secure.

   2. Existing Loudspeaker Circuit Verification:

      a. Provide a low-level, band limited lest signal to each amplifier input.

      b. Turn on one channel of Amplifier #1 and verify that the correct loudspeaker or group of loudspeakers is operating. Correct any wiring or other problems found.

      c. In a similar manner, check each channel of all remaining amplifiers and their respective loudspeaker circuits.

3. Existing Constant -voltage Loudspeaker Verification:

    a. Play a pink noise signal through each group of constant -voltage loudspeakers. Only one amplifier channel should be on at a time.

    b. Walk the area covered by the loudspeakers to verify that each loudspeaker is operating and that there are no significant changes in volume level from one loudspeaker to the next. Verily that the extent of coverage is consistent through the area.

4. Existing Loudspeaker Polarity Verification:

    a. Use an electronic polarity checker, TEF-20, SYSID, SIM II, or other similar device to test each reinforcement loudspeaker. All loudspeakers should have the same relative polarity.

5. Existing Loudspeaker General Performance Verification

    a. Verified the general performance of each loudspeaker unit by sending it a pink noise signal at 10.0V level and verifying the specified output SPL at a distance of 30 cm.

    b. Verified normal undistorted sound quality by headphone listening at the output of the calibrated system.

    c. Feed each loudspeaker with an oscillator signal at 10.0V level within it intended frequency range, verifying absence or abnormal distortion of rattles due to Installation.

6. Headroom Verification:

    a. Once the preceding tests and adjustments have been completed, play a variety of musical programs through the system. Amplifiers should be ON for this test.

    b. Adjust the console gain to achieve peak output levels of +6 VU on the console meters.

    c. Observe if any of the components indicate clipping or less than 3 dB of headroom.

    d. Replace the musical program with a steady 1000 Hz sine wave. Connect an oscilloscope or similar device to selected amplifiers in each portion of the reinforcement system.

    e. Increase the output level of the console until the signal displayed on the oscilloscope begins to show distortion.

7. Remote Input Verification:

    a. Using a microphone or portable signal generator, connect to each microphone receptacle throughout the facility.

b. Verify that the receptacle under test appears at the correct position on the patch bay and is operating properly.

c. In a similar manner, check all remote tie lines and media related lines for correct wiring and labeling.

8. System Gain Adjustment:

a. Adjust each active device for proper gain from the console output to the input of the amplifier.

9. Video Camera Verification:

a. Prior to installing the lens on the camera, manually verify that the lens is dust free and that the zoom, front focus, iris, and rear focus rings move freely.

b. For conference rooms, classrooms, etc. verify that all lighting fixtures have the proper temperature bulbs for video and the light is even across the room.

c. Using system control, verify the range of ail lens components i.e. Zoom, focus and iris.

10. Video Display Set Up:

a. Adjust each display in accordance with the ISF-C testing procedures as follows:

1) Connect the VTG to the projector.

2) Place the colorimeter on its tripod adapter, mounted on a tripod, with the sensor facing the projector. Ensure the optical diffuser is attached to the colorimeter. (If necessary) Orient the colorimeter so that its shadow is in the center of the white window and aim it directly back at the projector lens, minimizing the shadow of the tripod adapter on the screen.

3) Examine the projector's service menu (if necessary) and locate the proper gain and bias controls.

a) Note: This is the biggest problem facing the calibrator – accessing the proper controls to perform the white balance adjustments. As stated in the coursework, not all projectors have these options, and most bury them in the service menus. Research and trial and error may be required.

b) BE EXTREMELY CAREFUL INSIDE THE SERVICE MENUS. IF IN DOUBT, DO NOT CHANGE SETTINGS. IT IS RELATIVELY EASY TO DESTROY THE PROJECTOR WITH IMPROPER SETTINGS.

4) Using the PLUGE test patterns from the VTG, preset the Brightness and Contrast controls.

5) Set the VTG window test pattern to 70 IRE and adjust the display color gain controls to achieve white balance to D65, as measured

by the colorimeter.

6) Set the window test pattern level to 20 IRE and adjust the color offset controls to achieve white balance to D65.

7) Repeat steps 3 and 4, as needed, to achieve accurate calibration at both high and low IRE.

8) Using the appropriate test patterns from the VTG, recalibrate the Brightness and Contrast (PLUGE pattern), Color (SMPTE Bar pattern), Hue (SMPTE Bar pattern), and Sharpness (Sharpness pattern) user controls.

11. Wiring and Cabling:

a. Verify that all of the wiring Is correctly and completely installed

b. Perform the following Verification:

1) Short Circuit Conductor: Verify that there are no short circuits between conductors within any cable.

2) Short Circuit Cable: Verify that there are no short circuits between cables.

3) Open Circuit: Verify that there are no open circuits.

4) Circuit Polarity: Verify that each AC circuit is 0 degrees in phase with respect to the system

C. Performance Testing:

1. General:

a. Perform all tests in accordance with manufacturer's written instructions.

b. Use particular caution when testing devices containing solid-state components and loudspeakers.

c. Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.

d. When testing the system involving equipment provided under other Sections, combine testing required by this Section with that required by the Sections specifying the other equipment.

2. AC Power Receptacle Test:

a. Test: Test each AC power receptacle with a circuit tester for proper hot, neutral and ground connections.

3. DC Resistance Test:

a. Test: Measure the DC resistance between the technical ground in each equipment rack, console and the main building ground.

b. Specification: Resistance should be 0.15 ohms or less.

4. Technical Ground Test:
    a. Test: Temporarily lift the technical ground from the main electrical ground, measure the DC resistance between them.
    b. Specification: Resistance should be 1000 ohms or greater.

5. Existing Loudspeaker Circuit Test:
    a. Test: Measure the impedance of each loudspeaker cable. For full range devices, use a frequency of 1000 Hz and 100 Hz, for band limited devices, use a frequency appropriate for the operating range of the transducer. When documenting the results of these tests, include the calculated impedances-based on number of units on a line and the size and distance of the run.
    b. Specification: Correct any field readings that differ more than 20% from the calculated impedances.

6. Signal-to-Noise Test:
    a. Test: Test the signal-to-noise ratio through each device.
    b. Specification: The signal-to-noise ratio of the system as installed shall be no greater than 1dB across any line.

7. Cross-talk:
    a. Test: Cross-talk between channels shall be measured with signal equivalent to 1.0 Volts output into 1 channel with its gain off and the gain of each other channel varied over their lull range.
    b. Specification: Maximum signal leakage at the system output must be not greater than -70 dB re 1.0V at the pre-amp output at 1 kHz, increasing to - 52 dB at 8 kHz.

8. Video Signal-level Test:
    a. Test: Feed the video system with a "known good signal" from a video signal generator.

9. Video Signal Chain Test:
    a. Test: Feed the video system with a "known good signal" from a video signal generator.
    b. Specification: All equipment and video signal chains shall operate according to the manufacturer's specifications.

10. Video Switching and Distribution Test:
    a. Test: Using a test signal generator, ensure that there is no signal degradation from each input to each output. Make adjustments as required.
    b. Specification:

1) Luminance level at1 00 IRE white, sync tip at-40 IRE.
2) Ensure the color burst ranges from -20 to +20 IRE.
3) Verify the maximum chrominance levels of the first two color bars (yellow and cyan). Both should be at exactly 100 IRE.
4) Verify there is no excessive frequency roll-off by verifying that the ends of the first two color bars drop less than 2 IRE from the above check.
5) Using a vector scope, ensure that each of the primary and secondary colors fall within the 2% box.
6) Check the Signal-to-noise ratio and verify that it has not increased more than 1% through the system from the manufactures published specification.

11. Video Camera Black-level Test:
    a. Test:
        1) Set the iris to approximately 75% open. Verify lighting is even and that there is no flaring, adjust iris as required to remove flaring.
        2) Connect a waveform I vectorscope the output of the camera.
        3) Cap the lens or block the front of the lens with an opaque substance such as a piece of cardboard
    b. Specification:
        1) On the vectorscope, verify that the camera output produces a "fuzzy" spot in the exact center of the display.
        2) On the waveform monitor verify the black level
        3) Adjust as necessary for proper results.

12. Video Camera White-level Test:
    a. Test:
        1) Set iris to approximately 75%. Verify lighting is even and that there is no flaring, adjust iris as required to remove flaring,
        2) Connect a waveform I vectorscope the output of the camera. Zoom the camera onto a pure white spot, paper, etc. Use the front locus adjustment and ensure the object is in focus.
        3) Specification:
            a) Verify with a vectorscope that the camera output produces a ''fuzzy'' spot in the exact center of the display.
            b) Verify the white level using a Waveform monitor. Adjust as necessary for proper results.

13. Video Source Equipment Test:

a. Test: At the furthest destination point from the source equipment output color bars, verify the following and adjust as required:

b. Specification:

1) Luminance level at 100 IRE white, sync tip at-40 IRE.

2) Ensure the color burst ranges from -20 to +20 IRE

3) Check the maximum chrominance levels of the first two color bars (yellow and cyan).Both should be at exactly 100 IRE.

4) Verify there is no excessive frequency roll-off by verifying that the ends of the first two color bars drop less than 2 IRE from the above check.

5) Using a vector scope, ensure that each of tr.-e primary and secondary colors fail within the 2% box.

6) Check the Signal-to-noise ratio and verify that it has not increased more than 1% through the system from the manufactures published specification.

14. RF Distribution Test:

a. Test:

1) Set the modulators channels as defined on the AVS category Drawings for the RF System.

2) Input a video signal from one of the source devices into each of the modulators.

3) Adjust modulator outputs to the signal strength shown on the AV category Drawing.

4) Specification:Measure the signal at each of the connector plates and record initial results.

5) The signal levels should be +10db plus or -7db. Add additional RF pads as required to meet this requirement

6) Using a TV with tuner, verify that the picture quality is clear with no noise visible.

15. UTP Test:

a. Test: Test UTP cable in accordance with the referenced "Standards."

b. Specification: Category 5e and Category 6.

16. Control Test:

a. Test programmable control related to light balancing, occupancy sensing, and other controls under conditions that simulate actual operational conditions

D. Demonstration and Acceptance Testing:

1. General: The demonstration and acceptance tests shall be done by a qualified engineer. The AV Contractor shall provide a copy of the following information

in electronic format in order to verify the AV switching equipment has been installed and configured correctly:

a. The number of HDCP keys supported by each source.

b. The video timing, HDCP use and audio format of each source when operating (not needed for walk-in equipment).

c. The video timings and supported audio formats for each connected sync.

d. The video timings and supported audio formats presented in the EDID to each source—the preferred video timing shall be indicated

e. The length of cable used on all shielded twisted pair cable used for AV distribution

f. The data rate supported by each shielded twisted pair cable used for AV distribution.

E. Test Equipment:

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

a. Sound-level Meter: ANSI S1.4-1971 Type SEA with digital or analog display. Meter to provide ranges of 40 to 120 dBA.

b. Impedance Meter: Capable of testing audio lines at three frequencies, minimum, between 250 Hz and4k Hz. Measurement Range: 10 ohms to 100k ohms

c. Multi-meter-Measurement range: DC to 20kHz, 100 mV to 300V, 10 mA to 10 A

d. Audio Oscillator: bandwidth 20 Hz to 20k Hz ±1 dB at 0 d8m output. Output to be balanced, Oscillator to include adjustable output level

e. Ladders and scaffolding necessary to inspect all loudspeakers

f. Temporary 100-foot microphone cable tor testing purposes

g. Tektronix 1721

h. Sencore SLM 1453 RF signal-level meter

i. Extron VTG 4000

j. Three portable UHF band radios during all inspections

k. Extech 407025 NIST

l. OTC 1000 M Optical Tri-Stimulus Colorimeter

m. MP-500 Digital Audio Video Generator and HDMI Analyzer

3.8 ADJUSTING

A. Signal Delay Adjustment:

1. Adjust the delay to each subsystem to ensure proper synchronization between the existing main loudspeakers and delayed loudspeakers.

2. Using a TEF 20, SYSID, SMAART, SIM II, or an approved time-based measurement system, measure the arrival time of the distant signal and then measure the arrival of the local signal-based on the arrival times measured, adjust the delay applied to the local loudspeakers to synchronize them with the distant loudspeakers. Repeat the test to verily the delay has been set to within 1 ms of the arrival of the distant signal.

    a. Continue to test and adjust each separate subsystem with a dedicated delay channel.

B. Level Adjustment— Existing Reinforcement System:

1. Adjust the gain of each amplifier to provide a consistent and appropriate volume level throughout the facility.

2. Begin by connecting a pink noise source to one input to the mixing console, Adjust the console output to -10 dB on the VU meter. Adjust the appropriate amplifiers to achieve 85 dBA in the area covered by one section loudspeakers, Use a calibrated sound-level meter to make the measurement

3. If the test group of existing loudspeakers employs an active crossover, use an FFT- based analyzer, TEF 20, SYSID or SMAART to balance the spectrum by adjusting the level for each band.

4. Once the existing loudspeakers have been properly adjusted, begin adding the other loudspeakers in each adjacent areas and repeating the same adjustments. When a given area or seating level has been completed, move to the next lower area and repeat the tests and adjustments for that area,

5. Existing Amplifier settings for loudspeakers covering similar seating areas should have the same gain settings, Investigate and correct any occurrences where an amplifier deviates more than 2 dB from the average.

6. Existing Amplifiers should be set to provide an average of 85 dBv ±1.5 dB throughout each seating section.

C. Existing Amplifier-level Adjustment—70V System:

1. Adjust the level to 70V system to achieve a volume level appropriate for their location and intended use.

2. After setting the amplifier level for each system, play a pink noise signal over the loudspeakers and walk through each area. Using a sound-level meter, identify any areas where the SPL changes by more than 3 dB. Identify the cause of the change and where it is due to mounting height or architectural differences, adjust the transformer taps of the affected loudspeakers to bring the sound level within range.

D. System Equalization:

1. Use SMAART to equalize the existing loudspeaker system. The equalized loudspeaker shall have an average frequency response, +/- 3dB within the audience seating area.

    a. Use your identical measurement microphones located randomly within the audience seating area to measure the loudspeaker response. The microphones shall have a capsule diameter of 1/2" or less. Microphones equivalent to Earthworks M30 are acceptable.

2. Equalization methods using Real Time Analyzers (RTAs) are specifically un-approved methods of equalization.

E. Video Camera Focal Adjustments:

1. Zoom the lens all the way out Adjust rear focus ring to bring objects at far end of view into locus.

2. Zoom the lens all the way in. Adjust the front locus to bring near objects into focus.

3. Verify that the picture stays in focus while traveling to the extents of the zoom function.

F. Camera Resolution:

1. Using a SMPTE camera resolution chart verify the camera's resolution performance is within the specifications 01 the camera.

2. Adjust as required to bring within specifications. Note: any adjustments performed shall require that the black and white-level adjustment be re-verified.

G. Video Projector:

1. Completely fill projected images with their respective screen formats to full size without “cropping."

2. Projection lenses shall provide distortion free images without color fringing or aberration,

3. Using a test signal generator, Insert SMPTE color bars and adjust brightness and contrast accordingly

4. Using test signal generator, Insert a cross-hatch pattern and adjust convergence as required.

H. Video Monitor:

1. Setup and adjusted video monitors following the manufacturer's guidelines using a blue gun including the following:

a. Black level, using the brightness control

b. White level, using the contrast control

c. Correct Hue

2. Three months after the date of Substantial Completion, provide eight hours, to adjust AV system, make program changes, and adjust the AV system to suit the actual operational conditions.

3.9 CLEANING

A. Waste Management:

1. Conforming to local waste and recycling requirements, remove and dispose of all contractor-generated refuse at the work site.

2. Leave no packaging material on the test site.

3. Any costs associated with clean-up or waste removal shall be charged to the AV Contractor.

B. Extent of Cleaning:

1. Clean all provided equipment and devices externally and internally using methods and materials recommended by manufacturers.

C. Cleaning Milestones:

1. All provided equipment shall be free from dust for the Substantial Completion Inspection and the Final Inspection.

3.10 CLOSEOUT ACTIVITIES

A. Inspections:

1. General: For both Substantial Completion Inspection and the Final Inspection and Acceptance, complete the following tasks:

a. Two weeks prior to each inspection, notify the Owner's Representative in writing that the system is ready for inspection. If the company is a closely held corporation, the notice must be signed by the majority shareholder. In a publicly traded company or sole proprietorship, it must be signed by the Owner.

b. Perform the following functions for the Owner’s Representative for the purpose of making adjustments during the inspections:

1) Project engineer

2) Project manager

3) Technical support person

c. Provide Operator-level (mode) training as specified in subparagraph 3.11B.

d. Provide Presenter-level (mode) training as specified in subparagraph 3.11B.3.

e. Ensure that the documentation specified in subparagraph 3.11C is completed and available.

2. Substantial Completion Inspection:

a. Assist the Owner's Representative in performing final system tests and adjustments

b. Provide all labor, materials, tools, and test equipment necessary forthese tests and adjustments.

c. Ensure portable equipment is available for inspection.

d. Failure: In the event that the system fails to meet the criteria for Substantial Completion, all of the costs for additional inspections shall be borne solely by the AV Contractor. Costs include:

1) Consulting fees

2) Travel and daily expenses

e. Deficiencies: After the Substantial Completion Inspection, the Owner's Representative shall issue a report documenting any system deficiencies.

3. Final Inspection and Acceptance Inspection:

a. Assist the Owner's Representative in performing final system tests and adjustments.

b. Provide all labor, materials, tools, and test equipment necessary for these tests and adjustments.

c. Accept the project deliverables if the following tasks have been completed:

1) All of the deficiencies documented in the Substantial Completion Inspection Report have been corrected.

2) All fixed equipment has been furnished, programmed, and installed according to the drawings and specifications.

3) All portable equipment has been turned over to the Owner.

4) All equipment has been tested individually and as a completed assembly, performing all functions as specified.

5) The Operations and Service Manual and As-Built Documentation have been completed, approved, and delivered to the Owner.

B. Training:

1. General: For both Technical-mode and Presenter-mode training, complete the following tasks:

a. Submit all training materials to the Owners Representative for review at least two weeks prior to scheduling training sessions.

b. Schedule training with the Owner's Representative at least seven days in advance of the training start date.

c. Videotape allof the training sessions and provide three copies to the Owner on digital video disk (DVD) format.

2. Operator-Mode Training:

a. During or immediately after the Substantial Completion Inspection, AV Contractor shall provide eight hours of Operator-mode training for technical support staff designated by the Owner. Such training shall include troubleshooting, servicing, equipment adjustment, preventative maintenance for the following topics:

1) Overall system operation

2) Control system operation

3) DSP software control operation

4) Optics system field performance

5) Electro-acoustic field performance

6) Audio system field performance

7) Video system field performance

8) RF system field performance

9) Performance testing verification (as described in Part 3 ofthis Section)

b. Enlist a factory-authorized service representative to conduct this training.

c. Attend the first scheduled event to demonstrate the practical operation, set-up, and operation of the system.

d. Provide four hours of follow-up Technical-mode training within three months of the initial training session to review the most critical parts of the original training—especially troubleshooting scenarios.

3. Presenter-Mode Training:

a. After any necessary changes are implemented as a result of the Substantial Completion Inspection, the AV Contractor shall, before the Final Inspection and Acceptance, provide 4 hours of Presenter-mode training for basic users on the following topics:

1) General sound, video and control system operation and theory.

2) Signal topology for each system provided.

3) Basic functionality.

4) Correct operating procedures.

5) DSP equipment software configuration and operation.

6) Control system operation.

7) Routine maintenance and upkeep.

b. Enlist the Owner's technical staff to conduct this training; AV Contractor shall provide them support as necessary.

C. Documentation:

1. Prior to the Substantial Completion Inspection, write an Operations and Service Manual for use by the technical staff.

2. For the Substantial Completion Inspection, ensure the following documentation is available for review during the inspection:

   a. Operations and Maintenance Manual

   b. Operations and Maintenance Binder

   c. Shop Drawings

   d. Shop Test Report

   e. Field Test Report

3. Prior to the Final Inspection and Acceptance Inspection, complete As-Built Documentation for approval by the Owner.

3.11 PROTECTION

A. Protect device condition:

1. Upon installation but prior to Owner acceptance, the provided AV system shall be protected by the General Contractor who shall take appropriate proactive and reactive measures as follows:

   a. Prevent dust, dirt, paint, moisture, and any other unintended foreign material from accumulating on or inside of the device.

   b. Ensure equipment is properly installed so it cannot be easily dislodged.

   c. Ensure equipment is appropriately secured within the framework of the facility's security protocol.

   d. Ensure equipment is not operated by anyone other than personnel authorized in writing by the Owner's Representative.

   e. Maintain appropriate temperature and humidity levels for the devices.

B. Damaged devices:

1. If damage occurs during this protection period, the components and entire units shall be replaced as necessary to ensure the provided system is in its original, undamaged condition.

3.12 MAINTENANCE

A. Maintenance Service:

1. The Designer shall provide the following subsequent to Owner acceptance:
    a. Conduct at least two semiannual visits to the site for checking and adjusting the equipment.
    b. Provide a Maintenance Service Agreement to the Owner after the Warranty Period has expired.

END OF SECTION

ATTACHMENT 1: AV EQUIPMENT LIST

Chamber Council Room & A/V Room (106/108)

DEVICE ID	MAKE/MODEL	DESCRIPTION	SUPPLIED BY:	QTY
ALE-1-1	TELEX RTS ST-300	ASSISTIVE LISTENING EMITTER	(OFE-REUSED)	1
AMP-1-1	BOGEN MODEL T.B.D.	AUDIO AMPLIFIER	(OFE-REUSED)	1
CAM-1-1	LUMENS VC-A61PNB	PTZ CAMERA	(NEW)	1
CAM-1-2	LUMENS VC-A61PNB	PTZ CAMERA	(NEW)	1
CAM-1-3	LUMENS VC-A61PNB	PTZ CAMERA	(NEW)	1
CAM-1-4	LUMENS VC-A61PNB	PTZ CAMERA	(NEW)	1
CCU-1-1	LUMENS VS-KB30	CAMERA CONTROL UNIT	(NEW)	1
CNI-1-1	GLOBAL CACHE IP2CC-P	CONTROL NETWORK INTERFACE	(NEW)	1
DAIS MICS	AUDIO TECHNICA ES915SC18	GOOSENECK MICROPHONE	(OFE-REUSED)	9
DEC-1-1	VISIONARY SOLUTIONS D4100	NETWORK DECODER	(NEW)	1
DEC-1-2	VISIONARY SOLUTIONS D4100	NETWORK DECODER	(NEW)	1
DEC-1-3	VISIONARY SOLUTIONS D4100	NETWORK DECODER	(NEW)	1
DEC-1-4	VISIONARY SOLUTIONS D4100	NETWORK DECODER	(NEW)	1
DEC-1-5	VISIONARY SOLUTIONS D4100	NETWORK DECODER	(NEW)	1
DEC-1-6	VISIONARY SOLUTIONS D4100	NETWORK DECODER	(NEW)	1
DEC-1-7	VISIONARY SOLUTIONS D4100	NETWORK DECODER	(NEW)	1
DSP-1-1	QSC CORE510i	AUDIO DSP – PROVIDE IN/OUT CARDS AS SHOWN IN DESIGN DRAWINGS	(NEW)	1
ENC-1-1	VISIONARY SOLUTIONS E4100	NETWORK ENCODER	(NEW)	1
ENC-1-2	VISIONARY SOLUTIONS E4100	NETWORK ENCODER	(NEW)	1
ENC-1-3	VISIONARY SOLUTIONS E4100	NETWORK ENCODER	(NEW)	1
ENC-1-4	VISIONARY SOLUTIONS E4100	NETWORK ENCODER	(NEW)	1
ENC-1-5	VISIONARY SOLUTIONS E4100	NETWORK ENCODER	(NEW)	1
ENC-1-6	VISIONARY SOLUTIONS E4200	NETWORK ENCODER	(NEW)	1

DEVICE ID	MAKE/MODEL	DESCRIPTION	SUPPLIED BY:	QTY
ENC-1-7	VISIONARY SOLUTIONS E4100	NETWORK ENCODER	(NEW)	1
S-1-1	ATLAS-SOUND GD87W	SPEAKER CIRCUIT 1	(OFE-REUSED)	4
S-1-2	ATLAS-SOUND GD87W	SPEAKER CIRCUIT 2	(OFE-REUSED)	2
FPD-1-1	SONY FW75BZ30J W/ CHIEF TS318TU MOUNT	75" FLAT PANEL DISPLAY	(NEW)	1
FPD-1-2	SONY FW75BZ30J W/ CHIEF TS318TU MOUNT	75" FLAT PANEL DISPLAY	(NEW)	1
FPD-1-3	SONY FW75BZ30J W/ CHIEF TS318TU MOUNT	75" FLAT PANEL DISPLAY	(NEW)	1
FPD-1-4	SONY FW75BZ30J W/ CHIEF TS318TU MOUNT	75" FLAT PANEL DISPLAY	(NEW)	1
FPD-1-5	SONY FW43BZ30J	43" FLAT PANEL DISPLAY	(NEW)	1
HDDA-1-1	EXTRON DA6 HD 4K	HDMI DISTRIBUTION AMP	(NEW)	1
HDDA-1-2	EXTRON DA6 HD 4K	HDMI DISTRIBUTION AMP	(NEW)	1
LECTERN MIC	AUDIO TECHNICA ES915SC18	GOOSENECK MICROPHONE	(OFE-REUSED)	1
LVC-1-1	DA-LITE 70137LS	LV SCREEN CONTROL	(OFE-REUSED)	1
MOD-1-1	GENERAL INSTRUMENT C6M-II	MODULATOR	(OFE-REUSED)	1
MON-1-1	ASUS 24” IPS	DAIS MONITOR	(OFE-REUSED)	1
MON-1-2	ASUS 24” IPS	DAIS MONITOR	(OFE-REUSED)	1
MON-1-3	ASUS 24” IPS	DAIS MONITOR	(OFE-REUSED)	1
MON-1-4	ASUS 24” IPS	DAIS MONITOR	(OFE-REUSED)	1
MON-1-5	ASUS 24” IPS	DAIS MONITOR	(OFE-REUSED)	1
MON-1-6	ASUS 24” IPS	DAIS MONITOR	(OFE-REUSED)	1
MON-1-7	ASUS 24” IPS	DAIS MONITOR	(OFE-REUSED)	1
MON-1-8	ASUS 24” IPS	DAIS MONITOR	(OFE-REUSED)	1
MON-1-9	ASUS 24” IPS	DAIS MONITOR	(OFE-REUSED)	1
DAIS MONITORS	PEERLESS LCT620A	MOUNTS FOR OFE DAIS MONITORS	(NEW)	9

DEVICE ID	MAKE/MODEL	DESCRIPTION	SUPPLIED BY:	QTY
MS-1-1	LEIGHTRONIX LGX-2TBR	MEDIA STORAGE	(OFE-REUSED)	1
NAI-1-1	AUDINATE ADP-USB-AU-2x2	NETWORK AUDIO INTERFACE	(NEW)	1
NSW-1-1	NETGEAR GSM4248P-100NAS	48 PORT NETWORK SWITCH	(NEW)	1
PAS-1-1	SHURE UA221	PASSIVE ANTENNA SPLITTER	(NEW)	1
PAS-1-2	SHURE UA221	PASSIVE ANTENNA SPLITTER	(NEW)	1
PRO-1-1	EPSON PRO CINEMA 1985	PROJECTOR	(OFE-REUSED)	1
REMOTE ALS ANTENNA	TELEX ANTENNA	INCLUDED WITH OFE TELEX RTS ST-300 SYSTEM	(OFE-REUSED)	1
REMOTE MIC ANTENNA	SHURE 1/2 WAVE RECEIVER ANTENNA	INCLUDED WITH NEW QLXD SYSTEMS	(NEW)	2
STAFF MICS	AUDIO TECHNICA ES915SC18	GOOSENECK MICROPHONE	(OFE-REUSED)	8
TCP-1-1	NEWTEK 2-STRIPE	TriCaster CONTROL PANEL	(NEW)	1
TP-1-1	QSC TSC-80TW-G2-BK	8" TOUCH PANEL	(NEW)	1
TP-1-2	QSC TSC-80TW-G2-BK	8" TOUCH PANEL	(NEW)	1
UHUB-1-1	LIBERTY DL-4USB-PHUB	USB HUB	(NEW)	1
VCD-1-1	EPIPHAN ESP1360	VIDEO CAPTURE DEVICE	(NEW)	1
VFC-1-1	BLACKMAGIC CONVCMIC/SHO3G/WPSU	VIDEO FORMAT CONVERTER	(NEW)	1
VFC-1-2	BLACKMAGIC CONVCMIC/SHO3G/WPSU	VIDEO FORMAT CONVERTER	(NEW)	1
VFC-1-3	BLACKMAGIC CONVCMIC/SHO3G/WPSU	VIDEO FORMAT CONVERTER	(NEW)	1
VFC-1-4	BLACKMAGIC CONVCMIC/SHO3G/WPSU	VIDEO FORMAT CONVERTER	(NEW)	1
VFC-1-5	BLACKMAGIC CONVCMIC/SHO3G/WPSU	VIDEO FORMAT CONVERTER	(NEW)	1
VFC-1-6	BLACKMAGIC CONVBDC/SDI/HDMI03G	VIDEO FORMAT CONVERTER	(NEW)	1
VFC-1-7	KILOVIEW KVW-D300	VIDEO FORMAT CONVERTER	(NEW)	1
VFC-1-8	KILOVIEW KVW-D300	VIDEO FORMAT CONVERTER	(NEW)	1

DEVICE ID	MAKE/MODEL	DESCRIPTION	SUPPLIED BY:	QTY
VPM-1-1	LEIGHTRONIX NEXUS	VIDEO PLAYBACK MODULE	(OFE-REUSED)	1
VPS-1-1	NEWTEK TriCaster TC2 ELITE W/ RR2RU3RU RACKING KIT	VIDEO PRODUCTION SWITCHER	(NEW)	1
WMR-1-1	SHURE QLXD24/B58-G50	WIRELESS MIC RECEIVER/SYSTEM	(NEW)	1
WMR-1-2	SHURE QLXD14/85-G50	WIRELESS MIC RECEIVER/SYSTEM	(NEW)	1
SOFTWARE	QSC SLQSE-510-P	Q-SYS CORE 510 SCRIPTING ENGINE LICENSE, PERPETUAL	(NEW)	1
SOFTWARE	QSC SLQUD-510-P	Q-SYS CORE 510 UCI DEPLOYMENT LICENSE, PERPETUAL	(NEW)	1
SUPPORT	NEWTEK PTUTC2E3RU	ProTek Ultra for TriCaster 2 Elite	(NEW)	2
SUPPORT	NEWTEK PTU2STRIPE	ProTek Ultra for 2 Stripe Control Panel	(NEW)	2
SUPPORT	NEWTEK	REMOTE SYSTEM COMMISSIONING – 1 DAY	(NEW)	1
TRAINING	NEWTEK	Intro to the Tricaster Live Online Training	(NEW)	1
SOFTWARE	AUDINATE DVS	DANTE VIRTUAL SOUNDCARD	(NEW)	1
RACK	MIDDLE ATLANTIC WRK-24SA-S7	24RU EQUIPMENT RACK	(NEW)	1
RACK	MIDDLE ATLANTIC CBS-WRK-27	EQUIPMENT RACK CASTER BASE	(NEW)	1
RACK	MIDDLE ATLANTIC VFD-24	EQUIPMENT RACK VENTED FRONT DOOR	(NEW)	1
RACK	MIDDLE ATLANTIC U2V	2RU UTILITY RACK SHELF	(NEW)	1
WIRE	WINDY CITY WIRE CAT6AP-BLK	24 GA 4 PR CATEGORY-6 CABLE	(NEW)	SEE PLANS
WIRE	WINDY CITY WIRE RG58P-BLK	RG58 ANTENNA CABLE	(NEW)	SEE PLANS
			Total	

ATTACHMENT 2: TOTAL SYSTEM COSTS

AV Cost Schedules

Chamber Council Room & A/V Room (106/108)

Item	Cost
Equipment Subtotal	
Non-equipment Subtotal	
Engineering	
Pre-Installation	
Installation	
General & Administrative	
Total	