SECTION 27 41 16
AUDIO VIDEO SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Contract Documents

1. The General and Special Conditions are hereby made a part of this Section. Where requirements of this Section are at odds with requirements stated in any Special or Supplementary Conditions, the more stringent requirements shall apply.
2. The Contract Documents are complementary and are intended to include or imply all items required for the proper execution and completion of the work. Any item or work required by the Specification or other portion of the Contract Documents, but not shown on the drawings, or shown on the drawings but not described in the Specification, shall be provided and installed by the Contractor as if shown or mentioned in both.
3. The Consultant may furnish additional instruction or clarification necessary for properly executing the work. Instructions or clarifications shall be consistent with the Contract Documents or agreed-upon modifications thereof, and inferable therefrom. In giving instruction or clarification, only the Agency's Project Director shall have the authority to make minor changes in the work that will not entail an increase in the Contract price or time.
4. Copies of drawings and specifications regardless of how furnished are the property of the Agency and are not to be used on any other work or project. No contract documents may be released for publication or to any other party without the written consent of the Agency.

B. Scope of Work

1. Work under this Contract includes the following spaces/systems:
   a. Sanford Room (104)
   b. Foraker Room (105)
   c. Bridge Room (106)
   d. Denali Room (107)
2. Refer to "Appendix A: AV Systems Functional Description" for a complete and detailed description of the A/V Systems and associated functional requirements.
3. Work under this Contract includes all labor, materials, tools and equipment, transportation services, supervision, coordination, etc., necessary to complete the installation of high-quality A/V Systems and Control Systems, in excellent working order, as described in these specifications and the associated drawings and following good engineering practice, and to maintain the systems throughout the Warranty period.
4. The systems defined herein shall be called "A/V Systems" and shall include, but are not limited to, the following major items:

a. Audio mixers, equalizers, amplifiers, program sources, digital recording devices, microphones, and other signal processing equipment;
b. Loudspeakers and loudspeaker mounting, aiming, rigging, and support hardware;
c. Video switching, video over IP transmitters/receivers, video display equipment, video conferencing systems, cameras, and other video playback devices.
d. Audio Video and Control Network equipment;
e. Control equipment;
f. Equipment racks, cabinetry, and furniture;
g. System accessories;
h. Cable, connectors, adapters, plates, panels, transformers, and other interface devices.

5. The Contract also includes:

a. Verification of dimensions and conditions at the job site.
b. Preparation of submittal information.
c. Installation following the contract documents, manufacturer's recommendations, and all applicable code and legal requirements.
d. Initial tests and adjustments, written report, demonstration for approval, final adjustments, and documentation.
e. Instruction of operating personnel; provision of manuals.
f. Maintenance services; Warranty.

6. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the A/V System Contractor to supply systems in full working order to meet all code requirements for the installation of cable.

7. Notify the Agency’s Procurement Manager of any discrepancies in part numbers, sizes, or quantities before the deadline for written questions as described in the RFP. Failing to provide such notification, the Contractor will be required to supply items, sizes, and quantities according to the intent of the design as described in the Specifications and Drawings, without claim for additional payment.

8. Supply accessories and minor equipment items needed for a complete and properly functioning system, or where required to meet the specified performance, even if not specifically mentioned herein or on the drawings, without claim for additional payment.

9. Distribute AC power within all equipment racks and furniture supplied herein. As required, provide all AC power cables, wireways, junction boxes, and power distribution units located in equipment racks or furniture provided by the A/V System Contractor. This shall also include any power cabling from A/V equipment racks or furniture to adjacent receptacles or junction box(es) unless otherwise noted.

C. Products Supplied But Not Installed Under This Section

1. Certain equipment may be supplied but not installed or may be determined as “installed by others” or “installed by Agency.” This may include but not be limited to portable equipment and/or cables.

D. Products Installed But Not Supplied Under This Section

1. Certain equipment may be identified after the Contract is awarded as Agency

Furnished Equipment (AFE). Agency Furnished Equipment is presently part of the Agency's system or will be provided by the Agency and will be delivered to the Contractor's off-site construction facility, delivered to the Contractor's on-site secured storage area, or otherwise provided on-site, as appropriate, for incorporation into the system.

2. Inspect the AFE equipment and notify the Agency promptly in writing of damage or defect and the extent of repair and/or adjustment required to bring the AFE to original specification. Service AFE only as directed by the Agency, under the arrangements of a separate contract or agreement.
3. Incorporate AFE equipment into the system as if provided new, exempting any warranty coverage. The Contractor shall not be responsible for the warranty of AFE equipment unless specifically covered under a separate contract or agreement.
4. The Contractor shall be responsible for the physical safety and care of any AFE equipment while in their possession. Any damage or destruction of AFE equipment while in the Contractor's custody shall be the responsibility of the contractor to remedy without additional claim.

E. Governing Clause

1. For the sake of brevity these specifications omit phrases such as "Contractor shall furnish and install," "unless otherwise noted or specified," etc.; nevertheless, the requirements of the specifications are mandatory, and these phrases shall be inferred. The mention of materials and operations implies the Contractor shall furnish and install such materials and perform such operations to the overall standards set by the Contract Documents. Exceptions are noted herein or shown on the drawings.
2. If the Consultant is not a participant in this project after award of contract, all references to "Consultant" in this document shall be replaced with "Agency."

F. Questions

1. Before the Deadline for Written Questions as listed in the RFP, questions about the Drawings and Specifications must be submitted to the Agency's Procurement Manager in writing.

G. Related Requirements

1. Section 27 41 60 – Audio DSP Configuration

1.02 REFERENCES

A. Definitions

1. A/V System: A set of specified individual components (audio, video, control, and networking equipment as well as associated hardware and wiring) designed and configured to operate as one comprehensive system for the conveyance of audio/video content to an audience. A/V Systems may include, but are not limited to, the following major items:
   a. Audio mixers, equalizers, amplifiers, program sources, digital recording devices, microphones, and other signal processing equipment;
   b. Loudspeakers and loudspeaker mounting, aiming, rigging, and support

hardware;
c. Video switching, video over IP transmitters/receivers, video display equipment, video conferencing systems, cameras, and other video playback devices.
d. Network equipment;
e. Control equipment;
f. Equipment racks, cabinetry, and furniture;
g. System accessories;
h. Cable, connectors, adapters, plates, panels, transformers, and other interface devices.

2. Agency: The designated responsible party with authority to make final decisions on contract and technical issues as well as provide final acceptance of the A/V Systems. May also include designated representatives and/or subordinates as part of a larger “Agency Team” such as Project Director, End-users, Facility Managers, A/V Technology Managers, Building Committees, Purchasing Agents, and/or Contract Representatives.
   a. State of Alaska
3. Consultant: The “Consultant” referred to in this specification is the entity who has been hired to design and specify the AV System as well as work with other design team members and well as contractors/trades to ensure proper collaboration
   a. Salas O’Brien
4. Contractor: The “Contractor” referred to in this specification is the A/V Systems Contractor selected by the Agency, through a competitive solicitation process, to provide the A/V systems described by this specification, and to whom a contract has been awarded to do so.
5. Masculine Pronoun: In all cases where a masculine pronoun is used within these specifications, the pronoun is used in the interest of simplicity of syntax, and the reference shall be interpreted as genderless.

B. Reference Standards
1. The workmanship and installation of the audio video systems and equipment shall adhere to industry best practices, AVIXA standards, and all national and local codes.
2. The following documents, or the versions closest in time prior to the release of this specification, shall form a part of this specification to the extent specified herein. Where the requirements of these documents conflict with the instructions herein, the requirements of this specification shall govern.
   a. National Fire Protection Association (N.F.P.A.) National Electrical Code (NEC).
   b. Electronics Industry Association/Telecommunications Industry Association

(EIA)/TIA) Standards.
c. International Telecommunications Union (ITU) Standards.
d. Society of Motion Picture and Television Engineers (SMPTE) Standards.
e. Audio Engineering Society (AES) Standards.
f. American National Standards Institute (ANSI)
g. Building Seismic Safety Council (B.S.S.C.)
h. The Secretary of the Interior's Standards for the Treatment of Historic Properties.

C. Other Reference Standards

1. Shields and Grounds: Safety, Power Mains, Studio, Cable, and Equipment, (special excerpt) The June 1995 issue of the Journal of the Audio Engineering Society.
2. Grounding and Shielding Techniques in Instrumentation, by Ralph Morrison, published by John Wiley and Sons, Inc.; 3rd edition (March 1986) ISBN: 0471838055
3. Sound Reinforcement Handbook, by Gary Davis and Ralph Jones, published by Hal Leonard Publishing Corporation; 2nd edition (March 1, 1990) ISBN: 0881889008
4. DOJ 28 CFR Part 36, Appendix A to Part 36 - Standards for Accessible Design: Americans with Disabilities Act Accessibility Guidelines (ADAAG).
5. A Clean Audio Installation Guide, Allen H Burdick, Benchmark Media Systems, Inc., (800) 262-4675, (available on the World Wide Web at http://www.benchmarkmedia.com/);
6. Audio System Design and Installation, Phillip Giddings, Butterworth-Heinemann; Reissue edition (July 1990) ISBN: 0672226723
7. Sound System Engineering (2nd Edition), Don & Carolyn Davis, Focal Press; 2 edition (May 19, 1997) ISBN: 0240803051

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. Coordinate work with Agency personnel involved in this project, Consultant, representatives, and employees/subcontractors employed of/by the Agency.
2. Cooperate with all trades present on the project, so that lost time, work stoppages, interference, and work inefficiencies do not occur.
3. Assure labor "harmony" among personnel and subcontractors, and with other trades associated with construction, delivery, installation, and testing of the facility.
4. Failures in coordination shall not be a reason for additional payment to correct omissions or errors.
5. The Electrical Contractor for this project will be a subcontractor of the A/V Systems Contractor. The Electrical Contractor shall be licensed and bonded.
6. It is the A/V Contractor's responsibility to verify that all conduits, junction boxes, raceways, back boxes, and power receptacles meet the project requirements.

B. Pre-installation Meetings

1. Meet with the Agency on the site and reach a written understanding regarding project conditions outside the A/V Systems Contractor's scope of work which will impact the timely completion of this contract.
2. Items that must be coordinated include a schedule of access to equipment room and other areas where access will be required; security of the equipment room; secure storage for equipment and tools on-site; cleanliness of the equipment room including both trash and dust; HVAC for the equipment room; technical power in the equipment room and other required locations; conduit and junction box completion; any wire pulling needed for this contract but not provided by the A/V Systems Contractor; all job site conditions that may impact the timely completion of this contract or its conclusion in excellent condition; and all other work that must be provided by others that is required for the timely completion of this contract or its conclusion in excellent condition.
3. Develop an agreed timeline for all the above items, showing the last acceptable completion date for each item, and signed by the Agency and the representative of the A/V Systems Contractor.
4. Meet with any other contractor whose work will impact the performance of this contract and coordinate as outlined above.

C. Sequencing

1. As required, sequence work with the Agency and all trades present on the project.
2. Notify the Agency and/or Agency's Representative immediately of any issues of sequencing so that lost time, work stoppages, interference, and work inefficiencies do not occur.

D. Scheduling

1. Coordinate and schedule all on-site activities with the Agency.
2. A/V System Contractor shall work and complete all on-site tasks following the access to the site provided by the Agency.

1.04 SUBMITTALS

A. General

1. Submit A/V System product information, shop drawings, and samples to the Consultant for review. Begin submittals not later than ten (10) days after the date of Contract execution; failure to comply with this requirement shall be cause for cancellation of the contract, on the basis the selected Contractor does not have the ability or intention to comply with the specifications or schedule. Submit product data binders and submittal drawing information in not more than three submittals. If any submittal drawings are rejected, correct, and resubmit within five (5) working days.
2. Obtain approval before ordering material or fabrication. Ordering, receipt, or assembly of any equipment before approval is done entirely at the risk of the Contractor, and any rework required is not a valid cause for delay to the project or additional cost to the Agency.

B. Product Data

1. Product data submittals to be submitted for review according to general project requirements. The Contractor shall utilize the project information management system (PIM). If hard copies are required, see specific submittal requirements below. The Contractor shall verify the project requirements before providing product data submittals for review.

2. Provide product data submittal as a single submittal for review.

   a. Provide product data submittal for Consultant review organized with logical and consistent formatting such as font choice, font size, margins, page headers and footers showing project, spec section, date, page numbering, etc.
   b. Provide title sheet with Project Name, Agency, Specification Section, Date of Submittal, AV Contractor contact information, and any other pertinent project information.
   c. Provide a table of contents (TOC) outlining major sections as noted below. Include operable bookmarks and page numbers for major sections.
   d. Provide clear section labels and page breaks for each major section such that it is clear when one section ends and another starts.
   e. Organize product data submittal into the following six (6) major sections.
   f. Section I
      1. Provide a complete bill of materials (BOM) in spreadsheet format of all major and minor products, hardware, and materials to be provided. Logically group according to specification format—as provided in appendix/appendices. Include any additional or ancillary items not shown in the specification required for a complete and working system.
      2. See “Appendix Z: FORMATTING REQUIREMENTS FOR SUBMITTALS” for layout and formatting requirements.
   g. Section II
      1. Provide the manufacturer's product data sheet or specification sheet for all equipment and materials contained in this specification.
      2. Organize and present the manufacturers’ product data sheets as provided in Section One BOM order. Full-line catalogs, short-form catalogs, user manuals, web prints, product pictures with little or no technical data, and unreadable photocopies are not acceptable.
      3. Remove extraneous and/or blank pages with no useful information.
      4. Remove any repeated information in non-English languages.
      5. If no specification sheet is available, excerpts from larger manufacturer information documents are acceptable. Adhere to the guidelines outlined above. Keep information provided relevant to pertinent technical data only and as brief as possible.
   h. Section III
      1. Provide in spreadsheet format proposed project install cables and associated connectors. Provide the make, model, and the specific use conditions applicable to each cable type and associated connector. Provide ONLY the cables and connectors to be used for the project. “Typical” or “Standard” cable types and connectors shall be rejected and required for resubmission.
      2. See “Appendix Z: FORMATTING REQUIREMENTS FOR SUBMITTALS” for layout and formatting requirements.

3. Provide the manufacturer's product literature for all cables and connectors.
4. Organize and present the manufacturers' product data sheets as provided in Section Three project cable types and connectors spreadsheet order. Full-line catalogs, short form catalogs, user manuals, web prints, product pictures with little or no technical data, and unreadable photocopies are not acceptable.
5. Remove extraneous and/or blank pages with no useful information.
6. Remove any repeated information in non-English languages.
7. If no specification sheet is available, excerpts from larger manufacturer information documents are acceptable. Adhere to the guidelines outlined above. Keep information provided relevant to pertinent technical data only and as brief as possible.
8. Specifically note any proposed substitutions. *NOTE: Submittal of proposed substitution does not guarantee acceptance by Consultant. All substitutions are subject to approval. Ordering, receipt, or installation of any cabling before approval is done entirely at the risk of the Contractor. Any rework, removable, and or re-installation required is not a valid cause for delay to the project or additional cost to the Agency.*

i. Section IV
1. Provide the manufacturer's product literature for any products which are proposed substitutes to the equipment contained in this specification. Full line catalogs, short form catalogs, user manuals, product pictures with little or no technical data, and unreadable photocopies are not acceptable. *NOTE: Submittal of proposed substitution does not guarantee acceptance by Consultant. All substitutions are subject to approval and ordering, receipt, or installation of any equipment prior to approval is done entirely at the risk of the Contractor. Any rework, removable, and or re-installation required is not a valid cause for delay to the project or additional cost to the Agency.*
2. Remove extraneous and/or blank pages with no useful information.
3. Remove any repeated information in non-English languages.
4. If no specification sheet is available, excerpts from larger manufacturer documents are acceptable. Adhere to guidelines outlined above and keep information provided relevant to pertinent technical data only and as brief as possible.

j. Section V
1. Provide a list showing coordination of selected frequencies for all wireless microphone systems. When multiple frequency block is available from a manufacturer, note the manufacturer's recommended block selection based on RF frequency coordination with TV channels and/or other local interference.

k. Section VI
1. Provide a schedule of finishes indicating proposed materials and color selections for all custom or exposed items subject to Agency's selection and approval not explicitly noted in the BOM.

3. Electronic Submittal Requirements

a. Submit one (1) portable document format (.PDF) file organized as outlined

above.
b. Provide operable bookmarks for major sections outlined above.

4. Hard Copy Submittal Requirements **(only if required)**

a. Submit three (3) copies organized as outlined above.
b. Utilize three-ring binders not exceeding 3" spine size, with clear vinyl pockets on the cover and spine.
c. Provide title sheets for the cover and spine identifying the project and the system, room, or area covered by the submittal.
d. Print title sheets in ink (pen plotter, inkjet, or laser printer) on heavy paper sized to fill the entire pocket.
e. Provide tabbed dividers for major sections outlined above.

C. Shop Drawings

1. Shop drawings to be submitted for review according to general project requirements: project information management system (PIM) or hardcopy. AV Contractor to verify project requirements before providing shop drawings submittals for review.
2. Minimum drawing sheet size: 24" x 36" (Arch D).
3. Execute drawings at an appropriate scale, but not smaller than 1/8" = 1'-0", utilizing architectural scale factors exclusively.
4. Title, number, and note the scale on each drawing.
5. Submit one (1) electronic reproducible set (portable document format . PDF).
6. Submittal drawings shall contain sufficient information to describe specifically the work to be performed, and the item(s) to be fabricated/manufactured, and to guide installers, technicians, and manufacturers thoroughly and completely in the assembly of the systems. “Typical” or “Boiler Plate” information related to the Contractor’s standard documentation package and/or means and methods should not be included.
7. Drawings shall include but not necessarily be limited to the following:

a. Cover Sheet
1. Provide a cover sheet that includes general project information, drawing release, date, project engineer (and/or draftsperson), sheet index, and AV Contractor contact information.
b. Legend and General Notes
1. Provide a legend and general notes clearly showing symbols and other abbreviations used. Include details clearly showing and dimensioning cable preparation details for each cable and connector utilized in the system.
2. Provide a complete labeling approach, including the proposed lettering/numbering scheme and data format that cable log will be supplied in. Include representative equipment labeling sizes, styles, and numbering.
a) Follow AVIXA F501.01:2015 Cable Labeling for Audiovisual Systems standard.
3. Provide a schedule (table) clearly showing the installed cable types and connectors to be used for the project. Provide information related to the

make, model, plenum/non-plenum, and field conditions under each cable is to be specifically used.
   a) Show ONLY the cables and connectors to be actually supplied and utilized on the project. Tables that are the “Typical” or “Standard” cable and connector types by the AV Contractor shall be rejected and shall be required for resubmission.

c. Floor Plans and Reflected Ceiling Plans
   1. Provide architecturally scaled floor plans and reflected ceiling plans that show the location of all AV equipment, racks, consoles, millwork, etc. Include device names and pertinent installation details.

d. Sections and Elevations
   1. Provide architecturally scaled sections and elevations that show the location of all AV equipment, racks, consoles, millwork, etc. Include device names and pertinent installation details.
   2. Include detailed drawings of loudspeaker installation, showing the location, orientation, and support and aiming system for each case. Verify load ratings of all hanging components including attachment hardware.
   3. Include detailed drawings of video equipment installation (e.g., projection screens, video projector mounting, LCD television mounting, etc.), showing the location, orientation, and support system for each case. Verify load ratings of all hanging/installation components including attachment hardware.

e. Wiring diagrams
   1. Provide complete, detailed wiring diagrams for all systems, based on the contract drawings, but with the addition of:
      a) Cable types, identification, and color codes
      b) Cable numbers (as detailed above).
      c) Details of connections, both at equipment and between equipment racks and furniture and wiring in the building
      d) Application of connector models and types
      e) Comply with AES, ANSI, IEC, and ISO recommendations and standards.
      f) Schematic drawings of any custom circuitry or equipment modifications, including connector pinouts and component part lists.

f. Patch Panels and Custom Plates and Panels
   1. Provide shop drawings of actual machine shop drawings since plates and panels are to be fabricated exactly as shown on the submittal drawings. If discrepancies are discovered by the Contractor due to errors or modification of a manufactured product, these must be called to the attention of the Consultant and propose their resolution on the Submittal Drawings.
   2. Engraving details and requirements for patch panel and rack labels.
   3. Finishes/Colors

g. Rack Elevations
   1. Provide vertical elevation drawings for all equipment racks regardless of size showing all major equipment, shelves, drawers, vents, and other rack mount hardware.
   2. Provide dimensions, wire routing, cabling, and support details, AC power outlet and ground buss locations, location of transformers, relays, accessories, etc.

h. Consoles, Enclosures, Tables, and Supports
   1. Provide detailed construction drawings of cabinetwork and metalwork, including materials, finishes, adhesives, and fasteners.

8. References may be made in specification paragraphs to a requirement for submittal drawings for that particular item. Such references do not define the only items requiring submittal drawings.

9. Do not consider the Consultant's review of submittals to be exhaustive or complete in every detail. Approval of shop drawings and submittals indicates only the acceptance of the manufacturer, model, materials, general design or method of construction, and quality.

10. Requirements, arrangements, quantities, and installation must comply with the contract documents unless specifically approved to the contrary. Submittal approval does not relieve the Contractor of responsibility for errors in dimensions, details, sizes, fit, etc., or for coordinating items with actual building conditions and dimensions.

11. Submittals that, in the Consultant's opinion, are incomplete, deviate significantly from the requirements of the Contract Documents, or contain numerous errors, will be rejected and returned without review for rework and resubmittal.

D. Samples

1. Provide product samples as required herein or as requested by the Consultant, Architect, or Agency.

2. Submit electronic copies of any custom programming including source code. Include printed copies of all control screens, wiring pages, etc.

E. Delegated Design Submittals

1. Include delegated design submittals for any systems or sub-systems that are not specifically designed by the A/V contractor but are required for review and approval. For example, this might include:

   a. Manufacturer designs for induction loop hearing assist systems
   b. Loudspeaker System or Room EASE (or other acoustic) models
   c. Structural engineering designs for loudspeaker hanging hardware

F. Test and Evaluation Reports

1. Shop Testing

   a. A/V equipment racks shall be populated, wired, and tested to the fullest extent possible in the Contractor’s shop before shipping to the job site.
   b. When applicable, measure, and record the DC resistance between the rack ground bus bar and the chassis of all rack-mounted components. Also, measure and record the DC resistance between the rack ground bus bar and the signal common for all components.

2. Field Testing

   a. Before delivery of equipment to the job site, submit any test reports for all measurements specified under Shop Testing above.
   b. Before delivery to the job site, submit photographs depicting the quality of

wiring and grounding within equipment racks.

c. Immediately after installation, submit photographs showing cable entries and terminations within equipment racks, enclosures, and pedestals at the job site.
d. All loudspeakers and loudspeaker assemblies shall be tested by the Contractor in the Contractor's shop before delivery to the site.
e. Make all equipment including loudspeakers available for testing by the Consultant on the site before installation

G. Questions

1. Submit questions about the Drawings and Specification to the Consultant in writing.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Contracts

1. Provide in writing any maintenance contracts included in the project.

B. Operation and Maintenance Data

1. Prepare Operation and Maintenance manuals as outlined below. Directly submit one (1) PDF copy of each manual to the Consultant for review at least ten days before acceptance testing. After review, make corrections and additions required by the Consultant. After approval, deliver two (2) approved printed copies of the System Reference Manual to the Agency unless otherwise directed by the General Project Requirements or the Agency or the Agency's Representative.

a. Assume the intended reader of the manual to be technically inexperienced and unfamiliar with the facility.
b. Utilize three-ring binders not exceeding 3" spine size, with full-size clear vinyl pockets on the front cover and spine.
c. Provide title sheets for both cover and spine identifying the project and the system, room, or area covered by that manual; title sheets shall be printed in ink on heavy paper and fill the entire cover or spine pocket.
d. Divide the manual into two or more binders
    1. Part I shall consist of the Systems Reference Manual
    2. Part II shall consist of the Maintenance Manual(s)
    3. Part III shall consist of the Warranty Reference
    4. The first section of each binder shall be a Table of Contents
    5. Provide tabular dividers on heavy paper with permanent laser-printed legends for the sections identified below.
    6. Correct and update the System Reference and Maintenance Manuals, if necessary, according to the Consultant's instructions after acceptance testing.
    7. Provide DVD or CD-ROM (unless otherwise requested by the Agency) copies of any training sessions for later review by the operators and maintenance staff

2. System Reference Manual (Part I)

a. System Description
    1. Provide a typed description of each system including key features and operational concepts (e.g., remote control features, switching or routing

functions, patch points, mixing and linking capabilities).

b. System Operation and Instructions
   1. Provide "quick set-up" instructions (per space or system) oriented at inexperienced users under time pressure.
   2. Provide “typical procedures” instructions (per space or system) for the operation of the equipment.
   3. Provide “complete procedures” for the operation of the equipment as a system, organized by subsystem or activity.

c. Equipment Settings
   1. Provide a list of the settings of all semi-fixed controls, as finalized after Acceptance Testing. When these settings are in a software format, include software files with settings saved on them. Indicate the name of the product that the file is associated with and all file names on a label physically attached to all software provided.

d. As-Built Drawings
   1. Include corrected (as-built) wiring diagrams of each major subsystem, including plans showing locations and circuit numbers for all system outlets and receptacles, mounting, and other pertinent details of the system installation, based on the contract drawings, at a reduced scale easy to handle but fully legible. Normal maximum drawing size: 24" x 36". Provide one additional full-size bound set separately, as well as one electronic set in portable document format (.PDF) format for Agency and Consultant.
   2. Provide an additional set of reduced-size drawings placed in a pocket folder attached to the equipment rack for convenient future reference.

e. Manufacturers’ Operation Manuals
   1. Provide manufacturer's instruction manuals for all items of equipment, incorporating manufacturer's warranty statements. Provide printed original manuals, not photocopies, unless more copies of a manual are required than the number of units in the total system. For custom circuits or modifications, provide a thorough description of the purpose, function, specifications, and operation.

f. Other Data
   1. Provide any other pertinent data generated during the project or required for future service.

3. Maintenance Manual (Part II)

   a. Contractor’s Warranty
      1. Include a clear statement of the terms and period of the Contractor's warranty; Contractor's service department phone and facsimile number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes; and instructions for the proper use of maintenance products.

   b. Equipment List
      1. Provide a comprehensive list of all equipment by subsystem, tabulating the manufacturer, model, serial number, physical location, and wiring diagram drawing number and code.

   c. Manufacturers' service manuals
      1. Provide manufacturers’ service manuals for all major equipment items. For custom circuits or modifications, provide a thorough description of the purpose, function, specifications, and operation.

d. Performance Test Reports
    1. Include a copy system startup test report generated meeting the requirements outlined in Section 3 of this Specification, and test results generated during Commissioning of the system.
e. Maintenance Schedule
    1. Provide a recommended preventative 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.

4. Warranty Documentation (Part III)

a. Contractor's Warranty
    1. Include a clear statement of the terms and period of the Contractor's warranty; Contractor's service department phone and facsimile number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes; and instructions for the proper use of maintenance products.
b. Manufacturers' Warranty
    1. Provide a list of the various manufacturer's warranties for all the major equipment.

C. Record Documentation

1. Keep a complete set of documents - contract and approved submittal - on the job, and note any changes made during installation.
2. Provide a corrected set of as-built shop drawings in PDF format showing the work as installed, with input and output levels noted, for review and inclusion in the Closeout Submittals.

D. Software

1. Provide a properly licensed working copy of the latest version of any contractor-provided software required to operate or configure the systems specified herein shall be a part of the system supplied. This includes but is not limited to, all software, firmware, and hardware required for configuration, adjustment, diagnosis, and repair.
2. Software shall be fully documented, and that documentation shall be included.
3. The Agency shall retain ownership of all software. This includes both out-of-the-box software and custom scripting and control software as well as the associated source code.
4. Software shall be included in its "installable" state on industry-standard CD-ROM, USB flash drive, or another appropriate format. Back-up of the working software may be provided as an additional inclusion. Disk images are unacceptable.

E. Logins and Passwords

1. Provide any logins and passwords required for the operation, maintenance, or modification of the AV Systems. This includes but is not limited to, both hardware as well as software.

a. Audio Digital Signal Processor (DSP)
b. Control Systems
c. Network Switches and Wireless Access Points
d. Configuration and Maintenance Computers
e. Touch Panel PINs.
f. Any other password-protected equipment.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts

1. The specification may list extra quantities over and above those needed for the installation. Such extra quantities are intended as Agency's on-site spares and are to be turned over to the Agency during the training session. Spares may include fuses, lamps, power supplies, hard drives (pre-loaded with all software), rack screws, connectors, phoenix connectors, etc.

B. Keys

1. Submit in triplicate all keys required for access to, and operation of, the systems.

C. Tools

1. The specification may list tools that are to be provided and turned over to the Agency during the training session. Tools may include crimpers (both ratchets and dies), adjustment tools, extraction tools, etc.

a. Provide manufacturer’s storage case if applicable.

1.07 QUALITY ASSURANCE

A. Qualifications

1. The A/V system described in the Specification is a complex system requiring the services of a trained and experienced specialty contractor with the resources to carry out the project in a timely and professional manner.
2. The Agency prefers that the A/V Contrator’s project team members be recognized by the AVIXA certification process, and the team possess certifications by percentage of team members as shown below.

a. Engineers required CTS-D 30% or a minimum of one (1), CTS 70%
b. Supervisors required CTS-I 30% or a minimum of one (1), CTS 70%
c. Technicians and other installers CTS-I 10% or a minimum of one (1), CTS 40%, AVIXA Recognized AV Technologist 50%.
d. No technical staff may be without at least the AVIXA Recognized AV technologist certificate or equivalent independent qualification

3. The Agency prefers that the A/V Contractor has previous experience in the engineering and installation of A/V systems for similar projects and to provide the following information with their proposal.

a. AV project team resumes.
b. AV project team industry qualifications and certificates.
c. AV project team organizational chart
d. Corporate AV industry membership certificates.
e. Three (3) project references with telephone and e-mail contact information for past completed projects of a similar nature. This shall include both

examples of previous work through photographs and example submittals.
f. Sample shop drawings—schematic and layout
g. Sample photographs from past projects including front and rear rack assemblies.
h. Details of the A/V Contractor's workshop(s).
i. List of the A/V Contractor's workshop tools and test equipment.

B. Continuity of Supervision

1. The Contractor shall maintain the same individual in charge of work for the full duration of the project unless illness, loss of personnel, or other circumstances beyond the control of the Contractor intervene.

C. Certifications

1. As required, all certifications shall be current, and the organization or individual(s) shall be in good standing with the certifying entity.

D. Regulatory Requirements.

1. Obtain all permits necessary for the execution of any work about the installation or operation of any system equipment by the Agency. Comply with applicable federal, state, and local labor and union regulations.

2. Execute all work following the National Electrical Code, the National Electrical Safety Code, the Life Safety Code, and all applicable federal, state, and local codes, laws, ordinances, regulations, and requirements including, but not limited to, those of OSHA, EEOC, ATBCB, ADA, ANSI, UL, and the FCC. If a conflict exists between the contract documents and any code or regulation and is reported to the Consultant sufficiently before the bid opening, the Consultant will prepare the clarification required. Where a conflict is reported after the contract is awarded, propose a resolution of the conflict and, upon approval of the change, install the work

E. Construction Observation

1. The failure of the Consultant or another representative of The Architect or Agency to condemn any defective work or material shall not release the Contractor from the obligation to at once tear out, remove, and replace the same at any time before final acceptance upon discovery of said defective work or material.

F. Safety

1. Site Safety and Personal Protection Equipment

a. Contractor shall adhere to all site safety requirements as directed by the Agency, Agency's Representative, Building or Site Supervisor including, but not limited to general project safety training and/or site-specific training for possible contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards.
b. Contractor shall adhere to all PPE (personal protective equipment) requirements.
c. These requirements shall include, but not be limited to, any personnel assigned to the project that may perform work onsite including project engineers, project managers, installers, programmers, and/or other

technicians.

d. Contractor shall keep all safety certifications in full force until all work is completed and accepted by the Agency.

2. Seismic Safety

a. Observe mechanical and electrical support means of all installed equipment as required for the seismic hazard zone for this installation. Refer to Federal Emergency Management Agency (FEMA) Document 303: Recommended Provisions for Seismic Regulations for New Buildings and Other Structures. Also, refer to any applicable local building codes.
b. All equipment racks are to be anchored with suitable anchors to meet safety standards.
c. Appropriate safety attachments as required for overhead mounting of devices.
d. Shock and/or vibration isolation of equipment or fixtures as required.

3. Fiber Optic Cable Safety

a. The following warnings shall be posted on the job site: WARNING: PERMANENT EYE DAMAGE CAN RESULT FROM LOOKING DIRECTLY INTO A LIGHT BEAM GENERATED BY AN LED OR LASER SOURCE OR INTO THE END OF A CABLE FIBER CONNECTED TO ONE OR THESE SOURCES. CAUTION: LIGHT GENERATED BY THESE SOURCES MAY NOT BE VISIBLE YET REMAIN HAZARDOUS TO THE EYE. LOOK FOR WARNING LABELS ON SOURCE DEVICES.
b. Observe all warning signs on equipment and all written safety precautions in the instruction manual or equipment technical manual.
c. Always handle cable carefully to avoid personal injury. Care should be taken with individual fibers to prevent injury to the eyes or penetration of the fibers into the skin.

4. Asbestos Prohibition

a. No Asbestos containing materials shall be used under this section. The contractor shall ensure that all materials incorporated in the project are Asbestos free unless specifically authorized in writing by the Agency.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements

1. Coordinate with Agency's Representative for any equipment and materials to be delivered on site.

2. All equipment shall be assembled in the Contractor's shop into equipment racks, furniture, or other assemblies, and fully wired and tested before delivery to the site.

3. Do not ship, or cause to be shipped to the site, any material without first ensuring secure dust-free storage facilities are available, and HVAC system is operating.

B. Storage and Handling Requirements

1. Coordinate with Agency's Representative for any equipment and materials to be stored on site.

2. Store and protect products and materials following common sense and the manufacturer's recommendations, regardless of location.
3. As needed, provide a secure storage location for any products and materials stored on site.

C. Waste Management

1. Coordinate with the Agency, Agency's Representative, and/or Building Superintendent for the disposal of packaging as well as other debris and waste materials caused by the installation from the site to an approved common trash point or receptacle.
2. Participate in any project construction and demolition waste management plans (LEED).
3. Instead of any specific project construction and demolition waste management plans, the Contractor is encouraged to develop and maintain an AV waste management plan that diverts equipment packaging and construction waste away from landfills and towards recycling facilities (plastic, cardboard, paper, wood, steel, etc.). The intent shall be to reduce construction and demolition waste disposed of in landfills and incineration facilities by recovering, reusing, and recycling materials.
4. Keep work area neat and orderly and free from the accumulation of waste materials.

1.09 FIELD CONDITIONS

A. Ambient Conditions

1. All locations where any portion of the equipment specified in this Section is installed must be temperature and humidity-controlled, clean, and dust-free.
2. Conditions suitable for office work and equipment shall be acceptable.
3. Do not power up equipment unless you have a source of clean technical power, and the HVAC system is operating correctly.
4. Verify all conditions on the job site applicable to this work. Notify Agency and Consultant in writing of conflicts, discrepancies, or omissions promptly upon discovery.
5. Specific items will dissipate heat and must be provided with additional airflow and cooling. Make sure adequate HVAC is supplied to equipment spaces to remove the heat generated on a year-round basis.
6. The drawings diagrammatically show conduit, wiring, and arrangements of equipment fitting the space available without interference. If conditions exist at the job site that makes it impossible or disadvantageous to install the work as shown, recommend solutions and/or submit drawings for approval showing how the work may be installed.

B. Existing Conditions

1. The system is designed to operate correctly given the current/designed physical and acoustic environment of the project site.

1.10 INSURANCE

A. Insure materials against theft, vandalism, damage due to the elements, fire, etc., to their full value. Materials and the flawless condition of materials shall remain the responsibility of the A/V System Contractor until acceptance of the system by the Agency.

B. Refer to RFP documents for insurance requirements.

1.11 WARRANTY AND BOND

A. Contractor's Warranty

1. Labor and materials provided under this contract shall be warranted for one (1) year following the date of final acceptance to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Certain individual pieces of equipment may be covered for a longer period as provided in a specific manufacturer's warranty. Rectify defects occurring in labor or materials within the Warranty period by replacement or repair without charge. Projection lamps are excluded from this Warranty unless damage or failure is the result of defective material or workmanship covered by Warranty, or work performed under warranty.
2. Within the warranty period, respond to service calls within twenty-four hours, and correct the problem within forty-eight hours if at all possible.

B. Manufacturers' Warranty

1. Register warranty in the Agency's name for any product with a manufacturer's warranty stipulated in the Contract Documents.

C. Extended Correction Period

1. Six months after final acceptance, the Agency reserves the right to direct additional minor changes to the control system software. Such changes shall be made without additional cost to the Agency.

D. Bond Requirements

1. Refer to the RFP for Bond requirements.

PART 2 - PRODUCTS

2.01 AGENCY FURNISHED PRODUCTS

A. New Products

1. Custom Dais Station Box (wooden enclosure only) for Dais, Recording Table, Testimony Table, and Control Desk in Denali 107 and Bridge 106 (Qty. 18). AV Contractor shall procure and install custom brass plates for speakers and custom brass plates for XLR input port and switch (Qty. 18).
2. Shure MX418/C 18" gooseneck microphones for custom dais station boxes in Denali 107 and Bridge 106 (Qty. 18)
3. Shure A412MWS black locking metal windscreen for MX418/C gooseneck microphones (Qty. 18)

B. Existing Products

1. Desktop computer, monitor, keyboard and mouse at Testimony Table in Denali 107 (Qty. 1)
2. Desktop computer, monitor, keyboard and mouse at Recording Table in Denali 107 (Qty. 1)
3. Panasonic AW-HE50 PTZ cameras mounted in ceiling in Denali 107 (Qty. 2)
4. Ceiling loudspeakers in Denali 107 (Qty. 9)
5. Press panel in Denali 107 (Qty. 1)
6. Williams AV Digi-Loop cabling under carpet in Denali 107
7. Williams AV Digi-Loop amplifier in equipment rack in Bridge 106 (Qty. 1)
8. Microsoft Teams desktop computer, monitor, keyboard and mouse at Control Desk in Bridge 106 (Qty. 1)
9. Panasonic AW-HS50 compact live switcher at Streaming Table in Bridge 106 (Qty. 1)
10. Streaming desktop computer, monitor, keyboard and mouse at Streaming Table in Bridge 106 (Qty.1)
11. Middle Atlantic equipment rack in Bridge 106 (Qty. 1)
12. Sharp PN-E802 80” flat panel displays in Sanford 104 (Qty. 2)
13. Ceiling loudspeakers in Sanford 104 (Qty. 4)
14. Sharp PN-E802 80” flat panel displays in Foraker 105 (Qty. 2)
15. Ceiling loudspeakers in Foraker 105 (Qty. 4)

2.02 EQUIPMENT

A. Description

1. See “APPENDIX A: A/V SYSTEMS FUNCTIONAL DESCRIPTION”

B. Equipment

1. See “APPENDIX B: A/V SYSTEMS EQUIPMENT LIST”

C. Substitute Equipment

1. Materials and products specified herein establish the overall performance level as well as provide the physical appearance, component part quality, construction quality, and background of proven reliability desired by the Agency and therefore define the “minimum standards of quality” required for this project. Substitutions will generally not be considered unless the materials or products have been discontinued.
2. If equipment or material other than that specified is proposed, furnish the Consultant a written request including a detailed specification sheet and any samples or information required for evaluation. Samples of specified equipment may be required as well as the proposed substitute to facilitate comparison.
3. If required as a condition of accepting the proposed substitute, the Contractor

shall Warranty the quality of the substitute item. Contractor shall recognize function, performance, appearance, size, utility of service, and accessory requirements are based upon the model or product cited in the specifications, and that if a substitute product varies in any respect and is approved, any additional cost incurred by such approval shall be borne by the Contractor;

4. Approval of a substitute, if and when given, does not relieve the Contractor, material/product supplier, or manufacturer of any responsibility whatsoever; but rather, they jointly assume the responsibility the material/product installed will meet the functions, intent, and performance required by the contract drawings and specifications;
5. Delay in the delivery of any substitute product or material shall not be cause for change to the construction schedule or completion date.
6. The drawings and specifications are based on specific equipment, processes, and arrangements. At no additional cost to the Agency, furnish accessories, parts, and equipment, and perform all work necessary, for the proper functioning and fit of any approved substitute item to the purpose, arrangement, and intent originally indicated.

2.03 ACCESSORIES

A. Equipment lists may exclude minor components in the interest of conciseness and clarity. Where these components are integral to a functionally and aesthetically complete system, the Contractor shall without additional compensation provide them as outlined herein. This shall include manufacture’s rack mount kits, power supplies, rack blank/vent panels, power distribution, cable management, etc.

PART 3 - EXECUTION

3.01 INSTALLERS

A. General

1. Installation work shall be performed by experienced AV Contractors skilled and practiced in the proper techniques required for the activity involved.
2. Installers shall demonstrate the qualifications as outlined in Part 1, Article “1.7 Quality Assurance”, Paragraph “A. Qualifications.”

3.02 EXAMINATION

A. Verification of Conditions

1. Verify all conditions on the job site applicable to this work. Notify Agency and Consultant in writing of conflicts, discrepancies, or omissions promptly upon discovery.
2. All locations where any portion of the equipment specified in this Section is installed must be temperature and humidity controlled, clean, and dust free.
3. If conditions exist at the job site which make it impossible or disadvantageous to install the work as shown, recommend solutions and/or submit drawings for

approval showing how the work may be installed.

B. Pre-installation Testing

1. Install equipment into racks and furniture consoles and fully wire and test before delivery to the job site. If it is impractical to ship certain items installed in a console or rack, assemble, wire, and test in shop; then remove, ship separately, and reinstall at site.
2. Permanently mount all equipment; no equipment shall be installed loose or secured or suspended only by signal or power cables.
3. Panels or equipment mounted on rear rack rails shall not block clear access to the rear of any front mounted components or their wiring.
4. Mount racks on rubber isolation mat (Mason Industries Super W Pad or equal) when installing on steel or concrete floors, unless the rack is to be equipped with wheels (casters).

3.03 PREPARATION

A. Protection of In-Place Conditions

1. The contractor shall make reasonable accommodation to protect the surrounding areas and surfaces during the installation of the A/V Systems.
2. If the integrity of the surrounding areas and/or surfaces is in jeopardy, the A/V contractor shall notify the Agency or the Agency's Representative, Building or Site Supervisor immediately and coordinate an appropriate action plan to protect the surrounding areas from damage.

B. Demolition/Removal

1. Coordinate with the Agency or the Agency's Representative any requirements for the demolition/removable of existing A/V systems or equipment.
2. Coordinate the storage of any identified equipment to be removed and reused for the project.

3.04 INSTALLATION

A. General

1. Execute all work following the NEC, NESC, and with all local and state codes, ordinances, and regulations.
2. Coordinate work with all other trades to avoid causing delays in construction schedule. Expedite the delivery of equipment and materials and provide additional labor if required to meet the construction schedule.
3. Mount all equipment to be installed over public areas in a manner adequate to support the equipment loads with a minimum 10:1 safety factor or as specified by the Agency, using methods approved by the Agency. Awarded contractor to comply with all safety requirements. Requirements to be supplied to AV Contractor upon award.
4. Colors and finishes of all exposed and custom fabricated items and labels to blend in with the surroundings as approved by the Agency in the submittal

process.

5. Install equipment following manufacturers' recommendations. Ensure that levels and impedances are properly matched between components. Verify that projector distances and lenses are appropriate for the corresponding screen sizes.
6. All work shall meet the historical preservation requirements as directed by the Agency and The Secretary of the Interior’s Standards for the Treatment of Historic Properties.

B. Mechanical

1. All equipment and enclosures shall be aligned, matched, true, plumb, and square. All equipment, except portable equipment, shall be permanently attached and held firmly in place. Supports shall be designed to support loads with a safety factor of at least three, without sag or deflection.
2. Permanently mount all equipment; no equipment shall be installed loose or secured or suspended only by signal or power cables.
3. Panels or equipment mounted on rear rack rails shall not block clear access to the rear of any front mounted components or their wiring.
4. Mount racks on rubber isolation mat (Mason Industries Super W Pad or equal) when installing on steel or concrete floors, unless the rack is to be equipped with wheels (casters).
5. Provide ventilation adequate to keep the temperature within the rack(s) below 85 degrees F. Provide an approved low noise ventilation fan in each rack only if the temperature in the rack rises above 85 degrees when powered continuously for five hours.
6. Cover edges of cable pass-through holes in chassis, racks, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.

C. Electrical

1. A/V Systems Contractor shall coordinate with the Agency for the placement of all electrical receptacles, raceways, back boxes, and low voltage conduits required for the project, using the TE Drawing set as a guide.
2. All the electrical work, to include new power receptacles, low voltage conduits, junction boxes, raceways, and back boxes, will be completed by the Electrical Contractor under the direction of the A/V Systems Contractor.

D. Wiring

1. Coordinate the final connection of power and ground wiring to junction box(es). Power and ground wiring shall be hardwired directly to power contactors and ground busses to ensure uninterrupted operation.
2. Execute wiring in strict adherence to the highest standards of acknowledged industry and professional practice.
3. Take whatever precautions are necessary to prevent and guard against electromagnetic and electrostatic hum. For permanently installed line-level audio circuits, ground cable shields at the output of the source device and float at the input of the destination device. If RF interference is encountered, place an RC

network between the floated shield and the input ground.

4. All wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and terminated by approved soldered or mechanical means. No bare wire ends are acceptable. Cables with wire shields, braid, or wound, must use all the wire conductors for shield termination, and not just a drain wire or some of the shield strands. Connections not following this requirement will be rejected. Foil-shielded cables only provided with a drain wire must use the drain wire for shield termination. Fold shields or drain wires not connected back over the cable jacket and cover with heat shrinkable tubing; do not cut off unused shields or drain wires. Dress the shield or drain wires with Teflon tubing and install heat shrinkable tubing over the junction of the fanout and outer jacket.
5. Exercise care in wiring; damage to cables or equipment will not be accepted. Isolate cables of different signal types or levels, and separate, organize, and route cabling to prevent crosstalk or feedback oscillation in any amplifier section. In all cases, separate wiring for microphone signals, audio line level signals, loudspeakers, video, control, RF, and power into groups.
6. Rack Wiring. Contractor shall follow AVIXA F502.01:2018 “Rack Building for Audiovisual Systems” standard. Adhere to all cable management and signal separation recommendations/best practices. Run wiring vertically inside adequately sized plastic raceways, or employ an equivalent bundling and support system, to maintain a clear and organized appearance. Support all horizontal wiring using horizontal support bars as needed. Route AC cords directly to the side of the rack, under or over the equipment chassis, and then back to the power outlets, tying the excess cord only at the side of the rack. Organize cabling so that signal and AC cords are in the least possible proximity.
7. All wiring and connections shall be completely visible and labeled in the rack.
8. No splices shall exist in any length of cable run unless specifically shown on the contract drawings at a designated junction enclosure. All cables shall originate and terminate at active or passive devices. Where several devices are in close proximity, utilize approved housing-to-housing connectors and adapters; all such adapters shall be rotational.
9. Do not wire any cables with a polarity reversal between connectors, end for end, unless required by the manufacturer for operation. Connect all loudspeakers electrically in phase and of consistent polarity, using the same wire color code for loudspeaker wiring throughout the project. Note that different manufacturers employ differing color coding conventions for driver terminals. Wire all drivers - cone, compression, ribbon, or any other type - so that a positive voltage at the power amplifier "+" terminal causes a positive acoustic pressure out of the driver/enclosure system.
10. For cables terminating at an interface or connection plate mounted on or in an enclosure, dress cables so as to allow removal of the plate from the enclosure and sufficient cable length for service or re-termination. In these circumstances, the plate shall set on the floor or freely swing clear.
11. Install cables without sharp bends or distortion. Where limited clearance prevents the manufacturer's recommended minimum bend radius from being observed, such as in junction boxes, provide a right angle or similar connector.

12. All expansion loops must be neat, and roughly the same size to provide for ease of servicing in the future.
13. In pulling cable, do not bend to less than the manufacturer's recommended radius. Employ temporary guides, sheaves, rollers, or other tools to prevent excessive tension or abrasion to the cable(s). Pull cable with tension, tools, and lubricants recommended by the manufacturer.
14. Prepare television system semi-rigid cable following manufacturer's recommendations, with approved coring, cleaning, preparation, and assembly tools. Do not score center conductor; utilize tubing cutters to trim the outer conductor. Completely de-burr all conductors. Utilize approved center conductor cleaning tool; degrease the connector and cable before termination. Torque connectors to the manufacturer's recommended values.
15. All coaxial or triaxial video or RF connections to plates or panels in boxes, pedestals, racks, or any similar location with limited clearance that would prevent the associated cable manufacturer's minimum bend radius from being strictly observed shall be provided with the appropriate right angle or similar adapter as appropriate.
16. All cable installed under this specification which is to be terminated by others for "future" or Agency Furnished Equipment (AFE) in racks, shall be provided with ten (10) feet of slack when dressing to the location of future or AFE equipment. All cable installed under this specification which is to be terminated by others shall be provided with twenty (20) feet of slack when ending in a rack enclosure. All cable provided under these specifications, to be terminated by others, shall be provided with fifty (50) feet of slack when terminating in an equipment room without a clear point of demarcation, or in a group of racks where the destination is not known.
17. Fiber Optic Cables
    a. Consult NECA/FOA-301 Standard for Installing and Testing Fiber Optics.
    b. All fiber splicing shall utilize the fusion splice method. The maximum allowable loss per fusion splice shall be 0.2 dB average.
    c. The bend radius shall be no less than manufacturer’s specifications.
    d. The total degrees of turn shall be no more than the manufacturer’s specifications.
    e. The pull force shall be no more than the manufacturer’s specifications.
    f. When each cable reel arrives from the manufacturer, it shall have a Factory Lot test report attached to it. Factory Lot test reports, for example, Belden Wire & Cable Company Fiber Tracking System, shall be copied to the Agency and their representatives upon acceptance of the cable on the site.
    g. The use of the cable shall be tracked from the reel to each pull. Paperwork, in chart form, shall include the Reel Number, Code ID, and each conduit designator and description that includes cable from the specific reel.
    h. Splices, terminations, and any patching shall take place after the location has been declared “Dust Free” or “Clean.” Special care shall be taken to ensure the integrity of the fiber and connection(s) when these conditions cannot be met. Fiber found to be broken in the length of the run after the pull shall be deemed to be damaged during the installation process and replaced

at the expense of the installer.

18. Network Wiring:
    a. Unless specifically called out for a connection, all data cabling is to be Unshielded Twisted Pair (UTP). The minimum acceptable performance rating for UTP and all associated connectors is Category 6 (CAT 6). All completed Links including all components making up a complete interconnection link between two Ethernet components shall be tested after installation and certified to meet or exceed CAT 6 Gigabit Ethernet performance requirements.
        1. Full test results for every complete Link, Permanent Link, and Patch cord must be made available in printed form as part of the Record Documentation before Acceptance Testing.
    b. No UTP cable may exceed 90 meters in length. All permanently installed UTP must be 4-pair solid wire and terminated according to the connector manufacturer's instructions in outlets certified as meeting CAT 6 or better specifications.
    c. In no circumstances may solid wire UTP be terminated in RJ-45 plugs not certified by the manufacturer specifically for solid wire.
    d. All UTP patch cords must be factory made and certified by their manufacturer as meeting at least CAT 6 performance. These patch cords must be made with 4 pair stranded wire. Unless otherwise noted, all patch cords must be provided with strain relief boots.
    e. All UTP wiring shall follow the EIA/TIA 568B color code.
    f. Under no circumstances may more than 1/2" of the pairs in a UTP be untwisted as terminated in a connector, nor may more than 1/2" of a pair be exposed past the end of the jacket of the UTP.
    g. Interconnections between Ethernet switches may require that the patch cord at one end be a crossover cable. If the switches in question require a crossover cable for proper operation, supply the appropriately wired cable at one end. All crossover cables must be prominently marked indicating they are not normal straight-through cables.
    h. All UTP cabling must be installed following industry standard minimum spacing requirements for specific electromagnetic interference sources as outlined in the NEC/NFPA 70 Article 800-52.
    i. Ordinary plastic cable ties are not permitted on all UTP cabling. Plastic cable ties or anything else that can pinch the jacket of the UTP must be avoided. Use Velcro strap type ties as required.
    j. UTP cables must never be combed out so neatly that they run parallel to each other. Such a practice can cause “alien crosstalk’ between the cables that run next to each other. Instead let the UTP cables run with a loose and random lay.
    k. UTP cables must never be bundled snugly together.
    l. UTP cables installed in Conduit or other wire ways must never exceed 40% fill.
    m. UTP cables must never have more than 25 lbs. (or the manufacturer's maximum recommended pull force if lower) of force applied while pulling into conduit or at any other time during installation.
    n. UTP cables must never be bent sharper than a 1" radius (2" diameter) bend

even if straightened out afterward.

E. Connections

1. Microphone, Audio line, video, time code, MIDI, RF, and digital signal or control wiring shall be continuous and unbroken from connector plate/chassis to chassis/patch panel, unless a terminal, connector, or other splice is explicitly shown on the contract drawings.
   a. In junction boxes Wago LEVER-NUTS® Splicing Connectors or PUSH WIRE® shall be acceptable. The Contractor shall note the use of these connectors in the shop drawing submittals.
2. Make all joints and connections with rosin core solder or with mechanical connectors approved by the Consultant.
3. Make all solder connections with rosin core solder; employ temperature controlled soldering irons of wattage appropriate to the specific work involved. Soldering guns or unregulated irons are unacceptable.
4. Where spade lugs are used, crimp properly with ratchet type tool. Spade lugs shall be gold or nickel plated to match the receiving binding post or terminal.
5. Conventional non-ratcheting crimping tools are not acceptable.
6. Where terminal blocks are used, utilize Phoenix Contact MBK 2.5/E or MBK 5/E mounted on NS 35/7.5 DIN mounting rails or approved equal. All terminal blocks shall be fully exposed, labeled, and mounted on 1/2" birch veneer plywood board primed and painted two coats latex enamel or rack panels.
7. Make all connections with connectors specified herein. Employ XLR and BNC connectors wherever possible in preference to screw terminals, terminal strips, or phono connectors. All connectors employed shall be designed specifically for the cable in use.
8. Make connections to loudspeaker transformers with properly sized closed end connectors crimped with factory approved ratchet type tools, or terminal blocks.
9. All coaxial connectors shall be installed using the appropriate hexagonal die crimp tool or compression crimp tool that is correct for the combination of cable and connector. Non-ratcheting type crimping tools are not acceptable; the presence of such tools on the job site shall be interpreted as evidence of mechanical connections made incorrectly and shall provide sufficient grounds for rejection of all mechanical connections in the system.
10. "Electrical" adhesive backed tape is not acceptable for any purpose whatsoever. Adhesive cable tie anchors are only acceptable when employed for routing, not support; in any case, do not fasten anchors to any equipment chassis.
11. Do not employ connector adapters. Wire nut, "Scotchlok," or “Beanie” connectors are not acceptable for any purpose.

F. Labeling

1. Provide engraved plastic Lamicoid (or similar) identification labels at the front of all equipment mounted in racks. Install labels in a neat, plumb, square, and permanent manner. Mount labels on the equipment rack, not on the equipment, or on blank rack panels if so directed. Where the rack vertical frame has a slightly

recessed mid-section, match label width to the recessed section width. Similarly, provide engraved labels at the rear only of equipment mounted in furniture consoles or frames. Equipment labels should have two items of information; the first identifying the equipment type, i.e., "POWER AMPLIFIER"; and the second showing the wiring diagram code, i.e., "AMP1-01".

2. Unless otherwise noted, engraving on plates, panels, and labels shall be 1/8" high, and the typeface, sans serif. Use white letter fill on dark panels or push-buttons, and black fill on stainless steel or brushed natural aluminum plates or light-colored push-buttons. Fill safety or operational warning labels orange.
3. Embossed labels are not acceptable for any purpose.
4. Label all cables except patch cords at both ends with self-laminating labels. Handwritten labels are not acceptable. Contractor shall follow AVIXA F501.01:2015 Cable Labeling for Audiovisual Systems standard. Locate labels within 2" of the connectors, consistent with regard to orientation, dress, and distance from the connector. For connections to in-room panels or floor boxes, label on cable should match panel engraving. For connections to portable equipment, label on cable should match device engraving.
5. Label each terminal strip with a unique identification code in addition to the numerical labels for each terminal (Phoenix Contact BN series). Show terminal strip codes on the system wiring diagrams.

3.05 RE-INSTALLATION

1. The process of acceptance testing may necessitate the moving or adjustment of certain components; perform without claim for additional payment.

3.06 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. Verify the following before beginning actual tests and adjustments on the system:
   a. All electronic devices are properly grounded.
   b. All powered devices have AC power from the proper circuit. All dedicated AC power circuits are properly wired, phased, and grounded.
   c. Insulation and shrink tubing are present where required.
   d. Dust, debris, solder splatter, etc. is removed.
   e. All cable is dressed, routed, and labeled; all connections are properly made and consistent with regard to polarity.
2. Grounding System Tests.
   a. Measure the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.
   b. Verify that the Agency where applicable has connected the technical ground to building ground at only one location with 4 AWG or larger wire.
   c. Measure the DC resistance between the signal ground at any connector plate and the conduit system.
   d. Identify and correct any problems if within the A/V System scope of work;

notify the Agency if a problem is in a related area of work.

3. The system shall be completely free of hum, parasitic oscillation, ground loops, RF interference, and any audible noise and distortion problems.

B. Non-Conforming Work

1. All identified non-conforming work shall be documented and remedied at no additional cost to the Agency.
2. Any non-conforming work shall be subject to additional verification prior to acceptance.

3.07 SYSTEM START-UP

A. Audio System Tests

1. Perform the following tests and adjustments, supplying all test equipment required. Set for slow meter damping and A or Linear weighting as required. Document all tests and complete measurement results including wire number, date, test equipment used, operator, and test results. If any problems are detected in testing, correct the problem, and retest. Make corrections necessary to bring the system(s) into compliance with the specifications.
   a. Test all cables as installed for shorts between conductors or to building ground and opens.
   b. Measure the loop resistance of all loudspeaker cables.
   c. Measure and record the impedance of each loudspeaker line circuit terminating at the equipment rack, with loudspeakers connected, over the entire frequency range from 20 Hz to 20 kHz.
   d. Adjust the gain of each active device to provide an optimum signal-to-noise ratio and 18 to 20 dB headroom. Record input and output levels at each step in the signal chain.
   e. Measure and record overall system hum and noise level of each mic or line amplifier with controls set so that -50 dBu microphone input or +4 dBu line level input would drive the system to full amplifier output. Terminate inputs with appropriately sized shielded resistors (150 ohms typical) for this test.
   f. Measure and record system electrical frequency response for each input channel through power amplifier output with all filters and equalization bypassed in the DSP. Deviation shall not exceed ± .75dB within the range 20 Hz to 20 kHz.
   g. Check system to assure freedom from oscillation or stray RF pickup. Check all inputs without signal and with 500 Hz sine wave driving system to full average output. Detect unwanted signals on an oscilloscope at rack termination and over single loudspeakers connected at the farthest distance from the rack for each loudspeaker line.
   h. Apply a sinusoidal sweep signal to each loudspeaker system, sweeping from 50 to 5000 Hz at a level 10 dB below full amplifier output, and listen for rattles or objectionable noise. Correct any rattles or noise that is discovered.
   i. Check the polarity of all loudspeakers with an electronic polarity checker, and by applying music program or pink noise signal to the system while walking through the transition areas of coverage from one loudspeaker to the next. The transition should be smooth with no apparent shift in source from

one loudspeaker to the next.

j. Wireless Systems
   1. Ensure that all wireless systems operate on different frequencies from each other and any other transmitters in the area.
   2. Coordinate frequency selection for compatibility with local RF environment.

B. Video System Tests

1. Verify performance of all video connecting cables, as specified herein. Continuity tests are not acceptable. Document all tests and complete measurement results including wire number, date, test equipment used, operator, and test results. If any problems are detected in testing, correct the problem, and retest. Replace any defective cable without claim before continuing tests.

2. Perform video signal parameter tests on individual items of equipment, and the work as a whole following EIA, SMPTE, and AES Recommended Practices and other recognized standards as listed under REFERENCES.

   a. Projection Systems Performance
      1. Verify optical performance of projection devices to ANSI Standards using standard test signals connected directly to the device under adjustment.
      2. Set device level and true before adjustment, and mark positions for future reference.
      3. Complete device's optical adjustments for focus, centering, geometry, and registration before applying any electronic corrections.
      4. Do not under any circumstances apply corrections at signal sources to compensate for errors in device alignment or adjustment, or timing errors in source material.
      5. Set brightness and contrast using reference test signals connected directly to the device. Adjust grayscale and grayscale tracking using ramp or stair step test signals. Set overall brightness and contrast with pluge and white flag signal.
      6. Reconnect the projection devices to the system as a whole and verify performance of completed installations. Check that registration has not been affected by timing errors occurring elsewhere on all sources. Verify that source signal levels are consistent and match the reference levels set by the standard test signals. Correct any deficiencies noted.
      7. Record lamp operating hours at the conclusion of adjustments.
   b. Video System Tests
      1. Test and document all links for compliance with SMPTE standards.
      2. Verify performance of all video cables to SMPTE digital video standards using a test signal (Color Bars) connected directly to the device under adjustment.
         a) Use professional level 0.800 volt peak-to-peak digital video test source with digital test signals. Recommended Tektronix SPG700 with OPT SDI (provides 3G/HD/SD-SDI signal outputs).
         b) Use professional waveform monitor with physical layer test abilities. Recommended Tektronix WFM2300 with Option 3G (provides 3G HD-SDI signal inputs).
      3. Perform Eye-pattern Testing
         a) Verify cable length and cable loss. Compare measured cable loss

to distance and manufacturer's stated performance of the entire video link (cable and connector).
b) Verify signal amplitude, risetime, and overshoot.
c) Eye-pattern shall be open (or equalized open) and symmetrical.
d) Observe any overshoot and undershoots on the eye display indicating improper termination

4. SMPTE Digital Video Performance Standards
a) Analog NTSC Video: Test all links to SMPTE 259M standard.
b) SD-SDI (SMTPE 259M): 30 dB loss at 1/2 the data clock frequency (135 MHz)
c) HD-SDI/3G HD-SDI (SMPTE 292M/SMPTE 424M): 20 dB loss at 1/2 the data clock frequency (743 MHz/1.485 GHz).

c. CATV System Tests
1. Check all paths and outlets for appropriate compliance with the Performance Standards. Measure levels at all feeder termination points. Compare actual values to design calculations and investigate any difference of more than 2 dB, rectify or justify these discrepancies to the satisfaction of the Agency. Document all tests and complete measurement results including wire number, date, test equipment used, operator, and test results. If any problems are detected in testing, correct the problem, and retest.
2. Television Distribution System amplitude standards:
a) Minimum visual sync-tip level: +3 dBmV
b) Maximum visual sync-tip level: +10 dBmV
3. CATV Cable Testing: Each Trunk Cable line shall be inspected for proper termination:
a) Using a standard TV receiver connected to each outlet, observe picture quality. No visible components of cross modulation (windshield wiper effect), ghosting, noise, or beat interference shall appear on the screen of the receiver tuned to any normal signal.
b) Carrier-to-noise test shall employ an approved field strength meter. Measurements shall be made at the termination of each Trunk Cable and system extremity. With the normal levels in the system, the field strength meter shall be tuned to the picture carrier of each channel in turn, and the meter reading noted. Tune the field strength meter to an unused portion of the spectrum within the passband, read the level of remaining noise in the absence of the signal and algebraically add the meter bandwidth correction factor. Record the difference between the two readings. Provide calculations or the manufacturer's data concerning the bandwidth correction factor.
c) System flatness, both forward and reverse, test shall employ an approved high-level sweep transmitter receiver pair. Sweep measurements shall be taken at the termination of every branch line termination in the system. Where possible, record sweep results by photographic or computer data logging means.

C. Fiber Optic Tests
1. An OTDR shall be used to check each strand for:

a. Loss per Unit Length: in dB.
b. Splice and Connector Evaluation.
c. Possible Fault Location.

2. Test results from the OTDR shall be bound and copied to the Agency and their representatives. A strand-per-data file index shall be included.

3. Diligence shall be employed to produce efficient testing: i.e., connectors shall be checked with a microscope to determine whether a bad test run is a bad connector, bad termination, dirt, or a connector needing polishing.

4. Connectors shall remain capped or otherwise protected, when not in use.

D. Network Tests

1. Check all paths and outlets for appropriate compliance with the Performance Standards. Document all tests and complete measurement results including wire number, date, test equipment used, operator, and test results. If any problems are detected in testing, correct the problem, and retest.

2. Certify all data cables to Category 6 (Draft 9a) or better using a tester capable of 350 MHz measurements such as Fluke DSP-4300, Agilent WireScope 350 or equivalent.

E. Report

1. Upon completion of the initial tests and adjustments, submit a written report of tests to the Consultant along with all documents, diagrams, and record drawings required herein. The Report shall include the date of each test, pertinent conditions such as control settings, etc., test circuit, and test equipment employed. In addition, submit written notification that the installation has been completed in accordance with the requirements of the Contract Documents, and is ready for acceptance testing.

3.08 COMMISSIONING

A. Provide the following test equipment on site and available to the Consultant during commissioning. Assure scaffolding or other temporary access equipment is in place if needed for inspection.

1. Tools, including screwdrivers, pliers, cutters, wire strippers, nut drivers, ratchet crimpers, heat gun, controlled temperature soldering unit, ladders, flashlights, measuring tapes, electric drills, long and short precision levels, etc.

2. Sound Pressure Level Meter. The meter shall meet ANSI S1.4 1971 Type 1 standards, with an octave band filter set and A, C, and Linear weighting filters. Provide stand for Type 1 microphone, and cables and interfaces to allow it to be used with the sound level meter, time windowed acoustical measurement system, or STI measurement device.

3. Portable Audio Spectrum Analyzer. Handheld unit with graphical display and internal filter sets for standard third-octave band response measurements.

4. Sine Wave Generator. Output: +4 dBu, 5 Hz to 50,000 Hz with less than 0.03 % THD into any load.

5. Pink Noise Source. Equal energy per octave bandwidth over the band 20 - 20,000 Hz, ±1 dB (long-term average) at 0 dBu output. Stability: ±2 dB per day.

6. Multimeter. Measurement range, DC to 100,000 Hz, true RMS reading, 100 mV to 300 V, 10 ma to 10A, direct dB reading, frequency counter. Acceptable: Fluke 8060A or equal.
7. Headphones.
8. Programmable Video and Audio Test Generator with SDI/HD-SDI Output.
    a. SDI/HD-SDI, RGBHV, component video, S-video, and composite video output.
    b. Video test patterns including multiple crosshatch patterns, color bars, PLUGE, crop patterns, geometry, grayscale, and alternating pixel patterns, as well as flat field, window, checkerboard, hum bar, and Patented CTF Contrast Transfer Function patterns with adjustable levels.
    c. Selectable output rates, including high-resolution computer-video, HDTV, and NTSC/PAL video.
    d. Audio test signals including sine waves, square waves, pink noise, white noise, polarity, frequency sweeps, and sine wave bursts with selectable frequencies and output levels.
    e. Acceptable: Extron VTG 400D or equal.
9. Programmable Video and Audio Test Generator with DVI-D/HDMI Output
    a. DVI, RGBHV, component video, S-video, and composite video output.
    b. Displays native resolution of the DVI device when new EDID data is received.
    c. Video test patterns including multiple crosshatch patterns, color bars, PLUGE, crop patterns, geometry, grayscale, and alternating pixel patterns, as well as flat field, window, checkerboard, hum bar, and Patented CTF Contrast Transfer Function patterns with adjustable levels.
    d. Selectable output rates, including high-resolution computer-video, HDTV, and NTSC/PAL video.
    e. Audio test signals including sine waves, square waves, pink noise, white noise, polarity, frequency sweeps, and sine wave bursts with selectable frequencies and output levels.
    f. Acceptable: Extron VTG 400DVI or equal.
10. Portable Video and Audio Generator and HDMI Analyzer.
    a. HDMI Tx/Rx enabled testing of HDMI sink/source devices up to 300MHz.
    b. Test analog RGB video for PCs.
    c. HDMI 2.0 4:2:0 Testing. Generator patterns with 4:2:0 pixel encoding with 4K formats at 60Hz.
    d. HDCP Verification. Show HDCP test on the sink. Show each of the key steps in authentication.
    e. EDID Verification. Read sink EDID in human text, run partial EDID compliance test.
    f. Aux Channel Monitoring. View hot plug events, EDID exchange, HDCP transactions and CEC message exchange with sink.
    g. Status bar showing HDMI Out status.
    h. Cable & Link Test (loopback).
    i. 7” color touch screen.
    j. Acceptable: Quantum Data 780B with Aux Channel Emulation and Network

Analyzer optional feature package.

11. Adapter and test lead kit to allow any of the above to be connected to any circuit or connector in the system.

12. Wire number machine as used to produce all the wire numbers for the project.

B. Have on site during acceptance testing all parts and components that may be required to make system repairs and minor modifications to bring the system in the Consultant's opinion into compliance with the Specification. At a minimum these parts shall include:

1. All types of connectors used in the system. Plus, straight, and right angle XLR 3, 4, and 5 pin connectors of both sexes, straight and right angle ¼" phone 3 conductor connectors of both sexes, RCA connectors of both sexes, "F" connectors, and BNC connectors, even if not used in the system.

2. All types of wire used in the system.

3. All types of hardware used in the system, plus an assorted hardware kit.

4. All types of fuses used by equipment in the system.

C. Commissioning will include the operation of each major system and any other components deemed necessary. The contractor will assist in this testing and provide the test equipment specified herein. Contractor shall provide at least one technician available for the entire commissioning period, at any time of the day, to assist in tests, adjustments, and final modifications. Furnish all labor, tools, and material required to make any necessary repairs, corrections, or adjustments.

D. In the event the need for further adjustment or work becomes evident during acceptance testing, the Contractor will continue his work with a full labor complement until the system is acceptable, at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications, the Contractor will pay for additional time and expenses of the Consultant at the Consultant's standard rate in effect at that time, during an extension of the acceptance testing period.

3.09 CLEANING

A. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where Work has been completed unless designated for storage.

B. Clean all areas around system equipment and be sure that the inside of each equipment rack is free of wire stripping and other debris.

3.10 CLOSEOUT ACTIVITIES

A. Demonstration

1. Upon completion of the Work, the Agency may elect to verify test data as part of the acceptance procedure. Provide personnel and equipment, at the convenience of the Agency, to reasonably demonstrate system performance and to assist with such tests without additional cost to the Agency.

B. Training

1. Provide four (4) hours instruction to Agency designated personnel on the use and operation of the system. This training must be provided in accordance with a schedule acceptable to the Agency. The instructor should be fully knowledgeable and qualified in system operation. The System Reference Manuals should be complete, approved, and on-site at the time of this instruction.

C. First Use

1. The A/V Contractor shall provide a person familiar with the system to be present at the first formal use of the system.

3.11 PROTECTION

A. The contractor shall make reasonable accommodation to protect the A/V equipment and completed work after installation, but prior to acceptance by the Agency.

B. When the integrity of the installation is in jeopardy, the A/V contractor shall notify the Agency or the Agency's Representative, Building or Site Supervisor immediately.

C. Protection methods shall include, but not be limited to, the wrapping or "bagging" (in plastic) and/or the temporary removal of major equipment, wiring, and portable equipment.

3.12 ATTACHMENTS

A. None

END OF SECTION

APPENDIX A: AUDIO VIDEO SYSTEMS FUNCTIONAL DESCRIPTION

A. General Requirements
   1. Arrange a preconstruction meeting between Agency, Agency's Networking Vendor, Design Team, and AV contractor to ensure that roles and responsibilities are defined and understood.
   2. Where coordination with the Agency's Networking Vendor is necessary, document all communication and share with the entire project team.
   3. AV contractor is responsible for programming AV system.

B. Audio DSP and Programming Requirements
   1. Coordinate all DSP and Programming Requirements with Agency.
   2. AV contractor shall configure the networked audio DSP and control system with remote access for controlling the AV system using a computer or tablet, connection to fire alarm system for muting, and the ability to configure and play pre-recorded messages.
   3. Telecom network switches and configurations are Agency provided via the Agency's Networking Vendor. AV contractor shall coordinate all required protocols, ports, PoE, bandwidth, QoS, and link settings with the Agency's Networking Vendor.
   4. AV contractor shall coordinate with the Project contractor to ensure their systems are tested and signed off before beginning work.

C. AV control panels:
   1. AV contractor shall design user-friendly, self-explanatory, and intuitive control panel interfaces with PIN password protection.
   2. Shade and Lighting system control are not required and shall be independent of the AV control system.

D. Rack/Tablet Control Requirements
   1. AV contractor shall provide an administrative interface that will run on a rack PC or an Agency furnished tablet. This interface must be tightly coordinated with the new user control interface to ensure that the new DSP and control system operate as an integrated, intuitive, user-friendly system.
   2. Audio Routing:
      a. Allow simple routing of various sources and mixes/automixes to destinations.
   3. Audio Controls:
      a. AV contractor shall provide controls for microphone volume level adjustment, mute, and input metering.
      b. AV contractor shall provide controls for ceiling loudspeakers volume level adjustment, mute, and output metering.
      c. AV contractor shall provide controls for near-end and far-end volume level adjustment, mute, and input/output metering.
   4. Access:

a. AV contractor shall provide pin code protection for UCI security and coordinate Wi-Fi SSID with Agency's Networking Vendor for a unique SSID serving connections to the AV network.
b. AV contractor shall verify that the general public cannot access UCIs or be aware of their presence due to broadcast traffic, and the Agency's Networking Vendor shall isolate traffic on a VLAN that cannot reach the internet.
c. AV contractor shall notify the Agency's Networking Vendor and manager if any network conditions vary from expectations.

E. AV System Design

1. The AV systems shall be based on an Audio-Visual over Internet Protocol (AVoIP) design, utilizing a network switch as the hub for routing audio, video, and control data. This design allows for ease-of-use, scalability, compatibility, and simplification.
2. AV Input/output ports via wall plates and floor boxes plates shall be installed at the locations outlined below. Reference the floor plans for additional details.
    a. Denali 107
        1. TV
            a) One 1-gang cut-in ring or equivalent shall be installed behind each 80" flat panel display.
        2. ANT
            a) One 1-gang cut-in ring or equivalent shall be installed at each wireless microphone antenna location.
        3. PRESS
            a) Reuse existing back box and press panel.
        4. FB
            a) Utilize existing floor boxes at Dais, Testimony table, and Recording table. Floor box panels shall not be used due to the limited space in the floor box.
    b. Sanford 104
        1. TV
            a) Reuse existing back box.
        2. CAM
            a) One 1-gang cut-in ring or equivalent shall be installed below the 80" flat panel display for the connection of a conference camera.
        3. FB
            a) Utilize existing floor box under Conference Table. Floor box panels shall not be used due to the limited space in the floor box.
    c. Foraker 105
        1. TV
            a) Reuse existing back box.
        2. CAM
            a) One 1-gang cut-in ring or equivalent shall be installed below the 80" flat panel display for the connection of a conference camera.
        3. FB
            a) Utilize existing floor box under Conference Table. Floor box panels shall not be used due to the limited space in the floor box.
3. Room Systems

a. Denali 107
   1. Technology in Denali 107 shall allow for wired AV presentations, Microsoft Teams and Zoom video conferencing, VoIP audio conferencing, and a mix-minus sound reinforcement/voice lift functionality.
   2. This space shall have two wall-mounted 80” flat panel displays (repurposed from Sanford 104 and Foraker 105), one ceiling-mounted projector, and one 159” diagonal tensioned electric projection screen.
   3. Video content that is transmitted from the Agency provided PC at the testimony table shall be capable of being routed to the 80” flat panel displays on the walls, projector, 13” displays on the Dais, and a 55” confidence monitor mounted to the front side of the testimony table. The Agency provided PC at the testimony table shall also be connected to an Agency provided monitor, allowing duplicate desktop or extended desktop video display options.
   4. Microsoft Teams and Zoom video content that is transmitted from the Agency provided PC at the control desk in Bridge Room 106 shall be capable of being routed to the 80” flat panel displays on the walls, projector, 13” displays on the Dais, and 55” confidence monitor. The Agency provided PC at the control desk shall also be connected to an Agency provided monitor, allowing duplicate desktop or extended desktop video display options.
   5. Routing control of all video shall be accomplished via the touch panel at the control desk in Bridge Room 107. A preview of the video content shall be visible on the touch panel so the controller can view what is being presented on the computer before sending the video to the rooms 80” flat panel displays, projector, 13” displays at the Dais, and/or the 55” confidence monitor. The controller shall have the ability to send video content to all displays in the room, or just a selection. For example, the controller could choose to send the content to just the Dais 13” displays but not the 80” flat panel displays and/or projector.
   6. Dais Stations shall be provided that consist of a wooden box (to be constructed by a qualified woodshop as determined by AV contractor) with a gooseneck microphone, a 4” loudspeaker, and a mute button. Program audio from the video content presentation, and from the in-room microphones, shall be sent to the 4” loudspeaker in each Dais station as well as the ceiling loudspeakers. The DSP shall be programmed so that microphone audio from the person speaking does not feed into their Dais Station loudspeaker, and surrounding Dais Stations shall be configured with an appropriate level of a mix-minus signal. Individuals next to the person speaking do not need to hear the microphone audio transmitted from their Dais Station, thereby eliminating feedback from the microphone in nearby loudspeakers. A headphone jack shall also be available at the Dais Stations for people who would like to use them.
   7. The existing ceiling loudspeakers shall remain in place and be rewired so each loudspeaker has a dedicated amplifier channel to provide coherent audio from the mix-minus configuration in the DSP. These loudspeakers shall provide clear audio coverage from the Dais Station microphones, far end audio from the Microsoft Teams and/or Zoom meetings, and any associated audio from the video being presented at

the testimony table.

8. Two wireless microphones shall be provided as a supplement to the in-room audio. This audio shall be routed to the ceiling loudspeakers and Dais Stations.
9. Microsoft Teams and/or Zoom meetings shall be conducted at the control desk in Bridge Room 107 using the existing Agency provided PC. Video from one of the two Agency provided ceiling-mounted PTZ cameras shall be provided via an SDI to USB converter to the Agency provided PC. An audio feed from the in-room microphones shall also be provided via USB for the Agency provided PC. Video output from the Agency provided PC shall be encoded onto the in-room video network.
10. SIP phone lines shall be made available for the DSP to interact with the Agency provided VoIP system.
11. The Assisted Listening System (ALS) shall be comprised of both the existing Williams AV Digi-Loop system and a new Bluetooth wireless system. The Bluetooth system shall be configured with a PIN # on the audio stream to make it secure as well as control the sphere of audio coverage in the room by increasing or decreasing the coverage as defined in the product interface. The Bluetooth system shall support Auracast chip settings, allowing individuals to listen to the audio stream with a PIN #.
12. Video from the Agency provided ceiling-mounted PTZ cameras shall feed into an Agency provided SDI switcher. The SDI switcher shall connect to an SDI audio embedding component with the output feeding into an Agency streaming desktop PC. PTZ camera selection shall be programmed in the touch panel to allow for manual switching or automated switching, depending on the preference of Agency personnel.
13. AV overflow transmission into Sanford 104 and Foraker 105 shall be programmed into the control system for events requiring this feature.
14. One On Record/Off Record/In Session indicator light shall be ceiling mounted inside the room and one just outside the entrance to the room.

b. Sanford 104 & Foraker 105
   1. Technology in Sanford 104 and Foraker 105 shall allow for wired AV presentations, Microsoft Teams and Zoom video conferencing, and VoIP audio conferencing.
   2. Each room shall have one wall-mounted 80” flat panel display.
   3. Video content that is transmitted from the Agency laptop at the conference table shall route to the local 80” flat panel display on the wall.
   4. Routing control of video from the Agency laptop shall be accomplished via the touch panel at the conference table in each room.
   5. One beam-forming microphone shall be ceiling-mounted in each room. Program and far-end conferencing audio from the Agency laptop shall be sent to the existing ceiling loudspeakers.
   6. The existing ceiling loudspeakers shall remain in place and be rewired in a 70V setup. These loudspeakers shall provide clear audio coverage from participants of far-end conferencing calls and any associated audio from the video being presented at the conference table.
   7. Microsoft Teams and/or Zoom meetings shall be conducted at the Agency laptop at the conference table. Video from the fixed walled-

mounted camera in each room shall stream via USB to the Agency provided laptop. The audio mix from the ceiling-mounted microphone shall also be provided via USB to the Agency laptop. Video output from the Agency laptop shall be encoded onto the in-room video network.

8. SIP phone lines shall be made available for each dedicated room DSP to interact with the Agency provided VoIP system.
9. Each room shall allow for receiving an audio and video feed from Denali 107 for overflow events.

END OF APPENDIX A

APPENDIX B: AUDIO VIDEO SYSTEMS EQUIPMENT LIST

Qty.	Manufacturer	Model Number	Description
Denali 107			
AV01 - Audio			
11	QSC	QIO-FLEX4A	Mulit-channel mic/line/speaker network interface.
1	QSC	24F	Q-SYS Network + Analog I/O processor
2	QSC	SPA4-60	1/2 RU 4 Channel ENERGY STAR amplifier / Multichannel operation 60 watts into 8Ω & 4Ω, Bridged pair operation 200 watts into 8Ω & 4Ω, and 250 watts into 70v and 100v / 100-240 VAC Operation
1	QSC	SPA2-60	1/2 RU 2 Channel ENERGY STAR amplifier / Stereo operation 60 watts into 8Ω & 4Ω, Bridged operation 200 watts into 8Ω & 4Ω, and 250 watts into 70v and 100v / 100-240 VAC Operation.
1	AJA Video Systems	3G-AMA-R0	3G-SDI 4-Channel Analog Audio Embedder/Disembedder, bal. XLR
2	Audinate	ADP-USBC-AU-2X2	Dante AVIO USBC IO Adapter 2x2
1	Williams AV	BA SYS2-00	NEW! Infinium™ System | 4 Receivers Includes BA CT1 package plus 4 receivers, 1 6-bay charger, 4 headphones, 2 neckloops, 1 rack mount kit, and an Auracast® assistive listening wall plaque
18	Custom	Dais Station Box	Agency Provided, AV Contractor Installed Custom Wooden Enclosure for Dais Stations. AV Contractor to provide custom brass plate for speaker, custom brass plate for XLR and switch.
18	Dayton Audio	DA115-8	4" Aluminum Cone Woofer
18	Shure	MX418/C	Agency Provided, AV Contractor Installed Cardioid-18" Gooseneck Condenser Microphone,
18	Shure	A412MWS	Agency Provided, AV Contractor Installed Black Locking Metal Windscreen for Microflex® Gooseneck Microphones
18	NKK SWITCHES	LB15RKW01-5F12-JB	SPDT Illuminated Pushbutton Switch - Green, Rectangular
18	Neutrik	NC3FX-BAG	Cable end X series 3 pin female - black/silver
1	Shure	ULXD4DGV=-G50	Dual Digital Wireless Receiver with Always On AES256 Encryption, Internal Power Supply, 1/2 Wave Antenna and Rack Mounting Hardware, 470-534 MHz
1	Shure	ULXD1=-G50	Digital Wireless Bodypack Transmitter with Miniature 4-Pin Connector

1	Shure	WL184MB/S-TQG	Lavalier Microphone, Supercardioid , Black
2	Shure	ULXD2/SM58=-G50	Handheld Transmitter with SM58 Microphone
2	Shure	UA864US	Wall-Mounted Wideband Antenna
AV02 - Video			
10	QSC	NV-21-HU	4K60 4:4:4 Network Video Endpoint for Q-SYSEcosystem, software configurable as Encoder or Decoder. 1 HDMI 2.0 Input, 1 USB-C Input, 1 HDMI 2.0 output. Optional Software License to enable AV Bridging (SLQBR-P).
2	Extron Electronics	60-1482-01	Six Output HDMI Distribution Amplifier
11	Beetronics	13TS7M	13-inch Touchscreen; Full HD multi-touch panel; Input: HDMI, DisplayPort, USB-C, VGA; Metal
1	Sharp	4W-B55FT5U	55" Class AQUOS BOARD®
1	Epson	V11HA52920	EB-PU2010W Business Projector, 10,000 Lumens, WUXGA, White
1	Epson	ELPLW06	Wide Zoom #2 Lens
1	Chief	RPMAUW	UNIVERSAL RPMA
1	Da-Lite	39151	Da-Lite Tensioned Advantage Series, 78" x 139" (159" Diagonal) with HD Progressive 1.0 Surface.
1	AJA Video Systems	U-TAP-SDI-R0	HD/SD USB 3.0 Capture Device for Mac/Windows/Linux with 3G-SDI Input,
AV03 - Control			
1	Winford	WSD120-04-0	12V DC Power Supply
1	Winford	RLY202-12V-DIN	2-Channel 15A SPDT Relay Board
1	Netgear	MSM4352-100NES	M4350-44M4X4V - 44x2.5G, 4x10G/Multi-gig PoE++ (194W base, up to 3,314W) and 4xSFP28 25G (MSM4352) Managed Switch
1	Netgear	NET-APS2000W-100NES	2000W 100-240VAC MODULAR PSU
2	Bittree	DSKP124B-C6APS	Flush-Mount Modular Keystone Panel, CAT 6A, 110 Punchdown, Shielded, 1x24, 1 RU
1	QSC	TSC-101-G3	Q-SYS 10.1” PoE Touch Screen Controller for In-Wall Mounting. Color - Black only
2	Yellowtec	YT9580	Litt Riser S 120mm with lock screw black
2	Yellowtec	YT9590	Litt Mounting Flange black
2	Yellowtec	YT9901	Litt 50/35 Color Segment RED black
2	Yellowtec	YT9905	Litt 50/35 Color Segment BLUE black
L04 - Cable			
48	Bittree	DSP2406-CAT6S	CAT 6 data patchcord, 24" (60 cm), shielded, Blue

5	Extron Electronics	26-663-03	HDMI Ultra/3 - 4K Premium High Speed HDMI Ultra-Flexible Cable - 3' (90 cm)
10	Extron Electronics	26-663-06	HDMI Ultra/6 4K Premium High Speed HDMI Ultra-Flexible Cable - 6' (1.8 m)
11	Extron Electronics	26-663-15	HDMI Ultra/15 4K Premium High Speed HDMI Ultra-Flexible Cable - 15' (4.5 m)
2	Liberty AV Solutions	24-4P-P-L6ASH-BLK	CAT6A 10G F/UTP 23/4P CMP BLK
1	Liberty Wire & Cable	24-4P-L6-EN-BLU-CS	Blue Category 6 U/UTP EN Series 23 AWG 4 Pair Unshielded Cable
1	Liberty AV Solutions	22-2C-PSH-WHT-500	COMMERCIAL 22/2 OASH CMP WHT
1	Liberty AV Solutions	20-CMP-VID-COAX-BLK	SDI COAX RG59 HD CMP BLACK
1	Liberty AV Solutions	LWC-16-2C-P-BLK	Liberty 16-2C-P-BLK Commercial-Grade General Purpose 16 AWG 2 Conductor Plenum Cable - 1000 Feet (Black)
V13 - Racks / Furniture			
1	Middle Atlantic	UPX-2000R-2	2000VA 120V UPS LOCAL BANK CONTROL

Foraker 105			
AV01 - Audio			
1	Shure	MXA710W-2FT	Linear Array Microphone, White, 2ft
1	QSC	CORE 8 FLEX	Unified Core with 8 local audio I/O channels, 64x64 network I/O channels with 8x8 Software-based Dante license included, USB AV bridging, dual LAN ports, VoIP telephony, 8x8 GPIO, 8 AEC processors, Half-size 1RU.
1	QSC	SLQSE-8N-P	Q-SYS Core 8 Flex, Core Nano, NV-32-H (Core Capable). Scripting Engine Software License, Perpetual.
1	QSC	SLQUD-8N-P	Q-SYS Core 8 Flex, Core Nano, NV-32-H (Core Capable). UCI Deployment Software License, Perpetual.
AV02 - Video			
2	QSC	NV-21-HU	4K60 4:4:4 Network Video Endpoint for Q-SYSEcosystem, software configurable as Encoder or Decoder. 1 HDMI 2.0 Input, 1 USB-C Input, 1 HDMI 2.0 output. Optional Software License to enable AV Bridging (SLQBR-P).
1	QSC	NC-110	110° Horizontal Field of View, ePTZ network camera, PoE, includes mounting bracket for monitor and surface mounting
AV03 - Control			
1	QSC	TSC-70-G3	Q-SYS 7” PoE Touch Screen Controller for In-Wall Mounting. Color - Black only
L04 - Cable			
5	Extron Electronics	26-663-06	HDMI Ultra/6 4K Premium High Speed HDMI Ultra-Flexible Cable - 6' (1.8 m)

3	Extron Electronics	26-751-06	USB-A to USB-B 5 Gbps Cables - 6' (1.8 m)

Sanford 104			
AV01 - Audio			
1	Shure	MXA710W-2FT	Linear Array Microphone, White, 2ft
1	QSC	SPA4-100	1/2 RU 4 Channel ENERGY STAR amplifier / Multichannel Operation 100 watts into 8Ω & 4Ω, Bridged pair operation 200 watts into 8Ω & 4Ω, and 350 watts into 70v and 100v / 100-240 VAC Operation
1	QSC	CORE 8 FLEX	Unified Core with 8 local audio I/O channels, 64x64 network I/O channels with 8x8 Software-based Dante license included, USB AV bridging, dual LAN ports, VoIP telephony, 8x8 GPIO, 8 AEC processors, Half-size 1RU.
1	QSC	SLQSE-8N-P	Q-SYS Core 8 Flex, Core Nano, NV-32-H (Core Capable). Scripting Engine Software License, Perpetual.
1	QSC	SLQUD-8N-P	Q-SYS Core 8 Flex, Core Nano, NV-32-H (Core Capable). UCI Deployment Software License, Perpetual.
AV02 - Video			
2	QSC	NV-21-HU	4K60 4:4:4 Network Video Endpoint for Q-SYSEcosystem, software configurable as Encoder or Decoder. 1 HDMI 2.0 Input, 1 USB-C Input, 1 HDMI 2.0 output. Optional Software License to enable AV Bridging (SLQBR-P).
1	QSC	NC-110	110° Horizontal Field of View, ePTZ network camera, PoE, includes mounting bracket for monitor and surface mounting
AV03 - Control			
1	QSC	TSC-70-G3	Q-SYS 7” PoE Touch Screen Controller for In-Wall Mounting. Color - Black only
L04 - Cable			
5	Extron Electronics	26-663-06	HDMI Ultra/6 4K Premium High Speed HDMI Ultra-Flexible Cable - 6' (1.8 m)
3	Extron Electronics	26-751-06	USB-A to USB-B 5 Gbps Cables - 6' (1.8 m)

END OF APPENDIX B

APPENDIX Z: FORMATTING REQUIREMENTS FOR SUBMITTALS

Bill of Materials Formatting Example

SECTION ## ####: SECTION NAME

Client: Project Name

Section, System, or Room Name: Bill of Materials

MM/DD/YYYY

Section or Subsystem Heading

Description	Manufacturer	Model	Part Number	Finish/Color	Qty
<Equipment Description>	<Manufacturer>	<Model>	<Part Number>	<Finish>	#
<Equipment Description>	<Manufacturer>	<Model>	<Part Number>	<Finish>	#
<Equipment Description>	<Manufacturer>	<Model>	<Part Number>	<Finish>	#
<Equipment Description>	<Manufacturer>	<Model>	<Part Number>	<Finish>	#

Section or Subsystem Heading

Description	Manufacturer	Model	Part Number	Finish/Color	Qty
<Equipment Description>	<Manufacturer>	<Model>	<Part Number>	<Finish>	#
<Equipment Description>	<Manufacturer>	<Model>	<Part Number>	<Finish>	#
<Equipment Description>	<Manufacturer>	<Model>	<Part Number>	<Finish>	#
<Equipment Description>	<Manufacturer>	<Model>	<Part Number>	<Finish>	#

<Add Additional Sections or Subsystems as Needed or Provide Individual BOM per Space>

MM/DD/YYYY BILL OF MATERIALS PAGE # OF #

Project Cable Types and Connectors Formatting Example

SECTION ## ####: SECTION NAME

Client: Project Name

Section, System, or Room Name: Project Installation Cable Types and Connectors

MM/DD/YYYY

Project Installation Cables

ID	Cable Description	Use Case	Manufacturer	Part Number	Jacket	Color
A	22/2 Shielded Audio Cable	In-rack & In-conduit Line Level Analog Audio	West Penn	454BK	Non-plenum	Black
M	22/2 Shielded Audio Cable	In-rack & In-conduit Analog Mic Level Audio	West Penn	454WH	Non-plenum	White
V1	RG59/U Digital Video Cable	In-rack & In-conduit HD-SDI Video >50' and <200'	West Penn	819	Non-plenum	Black
L1	4 Pair 23AWG UTP Category 6	In-rack & In-conduit CAT6 Network and Video Over IP	West Penn	4246BL	Non-plenum	Blue
S2	12/2 Loudspeaker Cable	8Ω Loudspeaker Cable >25 and <150'	West Penn	25227B	Plenum	Gray
S3	18/2 Loudspeaker Cable	70V Loudspeaker Cable <500'	West Penn	25225B	Plenum	Gray

<Show For All Cables Types Used>

Project Installation Connectors

ID	Connector Description	Use Case	Manufacturer	Part Number	Color
X3F	Female 3-pin XLR Connector w/Gold Contacts	Cable Mount Microphone and Line Level Audio	Neutrik	NC3FX-B	Black
X3FC	Female 3-pin XLR Connector w/Gold Contacts	Chassis Mount Microphone and Line Level Audio	Neutrik	NC3FD-L-1-B	Black
NL4	4-Conductor Loudspeaker Connector	Chassis Mount Locking Loudspeaker Connector	Neutrik	NL4MP	Black
BNC	HD-SDI Video Connector	Chassis Mount 75Ω HD-SDI Video Connector	Canare	BCJ-JR	Silver

<Show For All Installation Connectors Used -- Including Those on Custom Plates and Panels>

MM/DD/YYYY **PROJECT INSTALLATION CABLES AND CONNECTORS** **PAGE # OF #**

END OF APPENDIX Z