

SECTION 27 40 00 – AUDIO-VIDEO COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. The objective of this document is to describe audio-visual systems.

1.02 RELATED DOCUMENTS

- A. Refer to “Audio-Visual Drawings” to be considered part of this specification

1.03 DEFINITION OF TERMS

- A. The following definitions shall apply herein.
1. The term **Owner**: Museum of Chinese in America.
 2. The term **Construction Manager**: New York Construction Associates.
 3. The term **Architect**: Bialosky & Partners
 4. The term **Consultant**: Integrated Media and Design Group
 5. The term **“Audio-Visual Contractor” (AVC)**: The successful bidder responsible for the complete installation of the audio-visual systems specified herein.
 6. The term **“shall”** is mandatory, the term **“will”** is informative, the term **“may”** describes an option and the term **“should”** is advisory.
 7. The term **“By Others”** shall refer to material and work that is related to this A/V Sub-Contract and for which the AVC is not responsible except as otherwise detailed herein. Some or all of these items may be included in the overall Electrical Contract.
 8. The term **“OFE”** shall refer to **“Owner Furnished Equipment,”** which shall be provided by the Owner to the Contractor. The Contractor shall be responsible for installing and integrating this equipment as detailed herein.
 9. The term **“NIC”** shall mean **“Not in Contract,”** which the Owner or other contractors may provide. The AVC shall be responsible for providing cabling, plates, and other infrastructure as indicated on the drawings and herein so as to provide **“plug and play”** ready installation of all NIC equipment.

- B. The basis for the terminology used in this document is standard construction and sound & communications industries practices and that of IEEE/ANSI-100-1988.

1.04 WORK BY OTHERS.

1. Conduits, wireways, connection boxes, pull boxes, junction boxes, A/V floor boxes and outlet boxes permanently installed in floors, walls and ceilings
2. All electrical breaker panels and power receptacles necessary to bring power to the audiovisual systems equipment racks and to devices in the Project as indicated in the drawings
3. Supply and Pulling of Crestron Cabling (Crestnet & CrestCat) from Server Room to Exhibit locations.
4. Room lighting fixtures, dimmers, power receptacle outlets, and interconnecting wiring for these circuits
5. Structural work, wall openings, platforms, railings, stairs, fire prevention and safety devices, rough and finished trim, painting and patching, drapes, carpets, floor coverings, computer floors, glazing, acoustical treatments, and heating, ventilating, and air conditioning systems unless noted otherwise
6. Moveable furniture, desks, and chairs
7. Installation of Manual and electric projection screens
8. See Construction Documents for reference to items marked "Not In Contract" and/or "by others"

1.05 SCOPE OF WORK

- A. Provide materials, labor, and equipment including but not limited to:
1. The delivery, unloading, setting in place, fastening to walls, floors, ceilings, counters, or other structures where required.
 2. Provide low voltage cable as per A/V drawings (other than Crestron Cable) or as required to deliver a fully functional system.
 3. Final terminations, dressing, and testing of all AV Cabling inclusive of cables pulled by others.
 4. Interconnecting wiring of the system components and equipment alignment and adjustment
 5. All other work whether or not expressly specified herein and on the drawings to provide complete operational turnkey systems.
- B. These specifications and the drawings do not necessarily indicate every single component part of each system. It is the responsibility of the AV Contractor to engineer each system and its interconnection in order to provide, furnish, and install completely operational turnkey systems. No error or omission herein or on any related Construction Documents shall relieve the Contractor from this responsibility to do so.

- C. Install all equipment to industry safety and ergonomic standards and provide full engineering and technical support throughout the installation process.
- D. The AV Contractor shall study the drawings and familiarize himself with the Work of the entire project scope. The Work of this section shall be carefully organized and programmed so that its progress shall be concurrent with the work of all other trades and so that the work shall proceed as expeditiously as possible.
- E. The AV Contractor shall be responsible for the correct placing of the Work of this section, equipment to fit into the structure as built, and attachment of equipment to the work of all other trades and Owner furnished equipment and facilities.
- F. It shall be the responsibility of the AV Contractor to coordinate with those performing related work and to interface other systems with the Work of this section. The AV Contractor shall ensure that the work by others shall integrate properly with the Work of this section and that all such work collectively complies with all requirements as specified herein.
 - 1. Coordination shall include providing timely submittal and field coordination of mounting requirements, dimensions, and any other information required by other trades.
 - 2. Maintain constant communications with all designated personnel of the CM and attend all construction meetings as requested by the CM.
- G. The AV Contractor shall generate all shop drawings and information for the complete installation and wiring of the system. The Contractor shall provide Pull Schedules and Riser Diagrams for the on-site installation and wiring and shall provide on-going supervision and coordination during the implementation phase. The AVC shall provide pre- printed wire labels numerically organized for signal type and cable count according to the engineering documentation & shop drawings.
- H. Where there is a discrepancy between drawings or between drawings and documents, the AV Contractor shall conform to the guidelines below. The AV Contractor shall consider all the information in combination and not consider one element alone to meet a minimum requirement. The guidelines are as follows:
 - 1. Room layouts indicate device locations
 - 2. Architectural and Electrical drawings indicate the location of all floor boxes, back box, and all conduit interconnect points as shall be installed as an infrastructure by the Electrical Contractor. These drawings are to inform

the Contractor as to all points within the facilities for cable and connector plate installation

3. Audio-Visual detailed block diagrams to indicate general signal flow and interconnection of devices, pin outs detailed at signal levels
4. The Audio-Visual specifications delineate minimum performance requirements, methodologies, and the design intent
5. Where there is a conflict in number or type of device specified, the drawings shall govern

I. System Interconnections

1. The functional interconnections of the audio, control, and video systems shall comply with the manufacturer's system installation guidelines industry standard practices, and as specified herein
2. The AV Contractor shall provide all interconnection cable, connectors, terminal strips, wireway, flexible conduit, raceways, etc., to facilitate the audio-visual systems as detailed within these specifications and drawings
3. The Contractor shall provide all custom connector panels required

J. The AV Contractor shall be fully responsible for the coordination of the control system custom programming. The AV Contractor shall receive the custom programming from the client's consultant. Further, the AV Contractor shall be responsible for coordinating the on-site programming, software de-bugging, and revising custom screens after initial use. Specific details are included in part 2 of this document

K. The AV Contractor shall be fully responsible for uploading content to the Digital Video Players. This requires copying files from the CD / DVD supplied by the Media Producer(s) to the Memory Cards provided for the players. This includes providing compression specifications to the Media Producers for recommended bit rate, etc. so the files are compatible with the specifications of the player.

L. The AV Contractor shall be responsible for the comprehensive adjustment of the systems as specified herein and shall provide all test equipment for the system checkout and acceptance tests. AV Contractor shall provide on-the-job training in systems operation and maintenance to Owner designated personnel.

1. Adjust and balance all circuits as specified herein. Set all controls and software parameters to render fully and optimally operating systems and subsystems. All computer controlled functions shall require complete audio/computer/software setup, balancing, label-entry and documentation

1.06 SUBMITTALS

The A/V Contractor shall submit to the consultant at least two full sets of pre-construction submittals as described in this section unless instructed otherwise by the construction manager or general contractor.

A. Conduit and Cabling Submittals

1. Submit for approval all cable pull schedules and/or run sheets prior to cable installation. Documentation of the entire conduit and cabling installation shall be fully performed to construction documentation standards and as specified herein

B. System Design Submittals

Prior to fabrication the Contractor shall submit for approval, all designs pertaining to the systems. These designs include, but are not limited to, the following:

1. Complete system construction and point to point wiring schematic drawings, including all component values and showing complete letter and number identification of all wire and cable as well as jacks, terminals, and connectors
2. All cut sheets related to equipment and components supplied by the AVC.
3. All panels, plates, and designation strips, including details relating to terminology, engraving, finish, and color
4. All custom designed consoles, tables, carts, support bases, and shelves
5. Schematic drawings of all custom components, assemblies, and circuitry
6. All equipment modifications
7. Patch-panel assignment layout drawings
8. Front mechanical drawings of each equipment rack
9. All items of equipment whether a stock manufactured item or custom built shall be supported by complete and detailed schematic drawings and replacement parts lists. No "black boxes" or unidentified components shall be acceptable

C. Equipment Substitution Submittals

When submitting a request for substitution or deviation, include:

- a) Descriptions of the total foreseeable effect of the substitution or deviation upon the design of the Project and agree to be directly responsible for any resultant extra costs

- b) Note: Materials and equipment proposed as being in compliance with or in deviation from specified standards or as a substitute for specified items shall be indicated as soon as possible. Upon receiving disapproval for any item, the contractor shall immediately resubmit a revised list for approval and, thereafter, continue to resubmit a revised list until complete written approval of all items has been obtained

D. System Installation Submittals

1. Provide week-by-week Work Progress schedules keyed to personnel, vendors, and tasks as specified herein and provide updates as requested by the Construction Manager (CM), consultant or owner

E. Close out Documents

1. At the completion of the installation, the AV Contractor shall provide the following items, and submit at least four sets of each. Two full sets shall be submitted to the owner, one to the General Contractor and one to the consultant. The following list shall define "Close out Documents". **NO OWNER OR END USER SHALL SIGN OFF ON ANY SYSTEM OR SUBMIT FINAL PAYMENT TO ANY CONTRACTOR WHO HAS NOT DELIVERED THESE ITEMS**
 - a) Equipment manufacturer's operation and maintenance manuals for each piece of equipment, bound in a three ring binder. Include any "as modified" drawings pertaining to any equipment that has been modified by the contractor
 - b) A full set of "As Built" or "As Installed" drawings showing all final connections and field wiring numbers
 - c) A simplified functional block drawing identical to the specification drawing with the addition of all input and output circuit cable and terminal block numbers as well as all jack field circuit I.D. designations. A copy of this drawing shall be framed in protective plastic and mounted on the inner surface of the equipment rack door

- d) System Operation and Maintenance Manual - The AV Contractor shall produce this manual specifically for the systems detailed herein. The "Operation" section shall describe in detail, all typical procedures necessary to activate each system to provide for the functional requirements as listed under the Specifications. The reader of this manual shall be assumed to be technically competent, but unfamiliar with this particular facility

The "Maintenance" section shall provide a recommended maintenance schedule with reference to the applicable pages in the manufacturer's maintenance manuals. Where the manufacturer provides inadequate information, the AV Contractor shall provide the information necessary for proper maintenance. In addition to the more detailed System Operation and Maintenance Manual, prepare a more simplified "Quick Start" or "Executive Summary" version that shall consist of no more than one 8 1/2 by 11 inch sheet describing the most basic functions. Laminated copies of this instruction sheet should be located for easy access by the user

- e) Electronic Submittals – The AVC shall supply all System Operation manuals, Operational and Maintenance Instructions, As-Built Drawings and Documentation, Crestron & DSP Processor Source Code (uncompiled) and Settings as Microsoft Word or PDF data files published on CD-Rom

1.07 QUALITY ASSURANCE

A. AV Contractor Qualifications

1. AV Contractor shall be a firm with at least ten (10) years experience in the fabrication, assembly, and installation of audio-visual systems of similar magnitude and quality as specified herein, and shall provide documentation with the bid submission. This documentation must identify, specifically, similar projects of the same or greater magnitude. Of those projects noted, the bidder must provide current contact names and telephone numbers, as well as a job description with a clear delineation between labor and equipment costs, as well as duration of project. The descriptions supplied must clearly indicate the firm submitting the bid response has actively been involved in these projects and that the firm has actively been involved for at least ten years in projects of this magnitude
2. The supervisor of the work of this section shall have at least five (5) years direct professional experience with devices, equipment, and system installation of the type and scope specified herein

3. At least one supervisory level staff person shall be have CTS Certification
4. All personnel engaged in the installation of this Section shall have at least three (3) years direct experience with devices, equipment, and system installations of the type and scope specified herein

B. Quality of Materials and Equipment

1. All materials and equipment supplied by the AV Contractor shall be new and shall meet or exceed the latest published specification of the manufacturer in all respects
2. The AV Contractor shall supply the latest model, available at the time of bidding, of each piece of equipment
3. The materials and completed Work of this Section shall conform to the applicable requirements of all current local and state codes, and of the following reference codes:
 - a) Occupational Safety and Health Act of 1970 and all amendments thereto
 - b) National Electrical Code, ANSI C1, as amended by all state and local codes
 - c) Uniform Building Code
 - d) All Authorities Having Jurisdiction (AHJ)

1.08 TIMELY DELIVERY AND STORAGE

- A. Timely delivery and installation of material required for the Work of this Section is the responsibility of the AV Contractor. The AV Contractor shall be held responsible for all delays associated with both specified and alternate materials, and for the timely submittal of proposals, submittal items, drawings, and other information in order to expedite the Work and to avoid delays
- B. Costs of all shipping to the site, and of all storage requirements, shall be borne by the Contractor. It shall be the responsibility of the Contractor to make appropriate arrangements, and to coordinate with authorized personnel at the site, for the proper acceptance
- C. During the installation, and up to the date of final acceptance, the Contractor shall be under obligation to protect his finished and unfinished work against damage and loss. In the event of such damage or loss, he shall replace or repair such work at no cost to the Owner

1.09 PROJECT SITE CONDITIONS

- A. The A/V Contractor shall be responsible to survey all areas to locate poke-thrus, furniture openings, sleeves, conduits, cable trays, conduit stub-ups, back boxes and pull boxes provided by others for Audiovisual Cabling. Due to ceiling height conditions on the Lower Level, it may be necessary for the AV Contractor to point to point test and verify cable quantities at time of installation as the finished ceiling will be partially installed as required for fire code compliance. There will be limited or no access to the cable bundles after the ceiling has been installed.

- B. The A/V Contractor shall be responsible for verifying on-site conditions of all systems, equipment and conditions that directly or indirectly affect the A/V Contractor's scope of work to include but not limited to:
 - 1. Walls painted
 - 2. Carpet or other floor covering installed
 - 3. All power and conduit installed as per consultant's drawings
 - 4. All A/V devices installed by the GC such as: projection screens, screen low voltage control interfaces, video projector and plasma lifts, A/V back boxes, A/V floor boxes, room lighting A/V interfaces and window shade low voltage control interfaces
 - 5. All A/V related CATV, data, ISDN, T-1, IP, voice and analog lines as specified by the consultant
 - 6. All A/V related furniture installed such as lecterns, credenzas, board/conference tables, closets and other millwork designed to house A/V equipment

- C. The A/V Contractor shall be responsible for meeting project schedule dates regardless of local disputes

- D. The A/V Contractor shall be responsible for the protection of all installed and configured systems as well as non-installed stored materials from acts of theft

- E. A/V Contractor shall be responsible for protection of his work from acts of vandalism and environmental conditions. Any delivery schedules affected by environmental conditions shall be noted to the Construction and Project managers not less than 72 hours prior to day of scheduled delivery with just cause documented in writing

1.10 SEQUENCING AND SCHEDULING

- A. The A/V contractor shall maintain a running progress report. The contractor shall submit this report upon request of the consultant at any time during the contract period. This report shall include, but is not limited to:
1. Time line for each installation activity
 2. Percentage of completion of each activity
 3. Continuous vertical lines to identify the first working day of each week
 4. Illustrate how start of a given activity depends on completion of preceding activities and how completion of a given activity may restrain start of subsequent activities
 5. Identify the critical path
 6. Status of the installation detailing all remaining critical tasks
 7. Requests for receiving major equipment and material shipments
 8. Request for subcontractors to enter the job site
 9. Requests for utility service disconnection and connections
 10. Delays and stoppages - any delays or stoppages shall not affect the scheduled completion date unless instructed otherwise by the Construction Manager
 11. Emergencies and accidents
 12. Losses of material and property

1.11 GUARANTEE AND MAINTENANCE

- A. The A/V Contractor shall guarantee all equipment and cabling, programming, and software furnished, in writing, against defects in workmanship and material for a period of **ONE YEAR** from the respective dates of final acceptance. All defects developing during that period shall be corrected in compliance with the "GUARANTEE" conditions under these specifications
- B. The Contractor shall service the complete installation during this one year guarantee period
- C. This Guarantee clause shall in no way preclude or nullify any manufacturer's warranties. All manufacturer warranty cards shall be sent to the respective manufacturers with photo-copies showing model number and serial numbers to be included with a certificate of warranty and to be delivered to the Owner by the Contractor with the Owner's Operating Manual

- D. All equipment and systems provided under this section shall be guaranteed to be free from defects in materials and workmanship for a period as indicated in the Contract Documents from the date of final acceptance, provided it does not show abuse
- E. The Contractor shall maintain regular service facilities and provide a qualified technician familiar with the work of this section, at the site, within four (4) hours of receipt of a notice of malfunction from the owner or his representative. As part of this guarantee, the Contractor shall provide, at no expense to the Owner, all material, devices, equipment, and personnel necessary and provide alternate facilities, services, and systems for the duration of the repairs
- F. All repairs and service under this guarantee shall be at the job site unless in violation of manufacturer's warranty, and/or practically not possible
- G. Transportation of warranty substitute equipment, devices, material, parts, and personnel to and from the job site shall be at no expense to the Owner, provided it does not show abuse
- H. Warranty Statement
 - 1. To maintain certain manufacturers' warranties, said equipment must be installed, aligned, and serviced by those installers authorized by said manufacturer to perform those duties. If said manufacturer does not authorize the Contractor, it is the Contractors responsibility to make the appropriate arrangements and bear all cost and consequences thereof
 - 2. All equipment provided by the contractor shall be new and shall meet or exceed the latest published specifications of the manufacturer in all respects
 - 3. Upon completion of all Work and compliance with all requirements of this Section, including submittals, tests, record drawings and data as required herein, the Owner may elect to verify the Contractor's test data as part of the acceptance procedure. The Contractor shall provide personnel and equipment, at the convenience of the Owner, to demonstrate any aspect or parameter of system performance and to assist the Owner with such tests. All costs associated with acceptance testing shall be the responsibility of the Contractor

1.12 SERVICE CONTRACT

- A. The Contractor shall offer a separate annual service contract covering all installed systems. This service contract shall cover a minimum of four (4) visits per year, at regular intervals, to perform operation checks of the equipment; check focus, alignment, and convergence; clean recording/playback heads and other critical surfaces and to lubricate moving parts as recommended by the respective manufacturers. The service contract shall commence immediately after expiration of the initial base-bid warranty period and continue for one year. This service contract may be renewed under separate agreements between the contractor and the owner
- B. The Contractor shall also submit separate costs for emergency situation “on-call” service visits and an “in-shop” hourly-rate for repair and maintenance work as part of the post-guarantee period herein. Spaces have been provided for on the bid forms for “on-call” and “in-shop” service contract pricing
- C. The costs for this service contract shall not be commingled with the costs for the systems base bid. Spaces have been provided for on the bid forms for “SECOND YEAR” and “THIRD YEAR” service contract pricing.
- D. This “Service Contract” shall not in any way conflict with the first year warranty covered as specified herein. The intent of this paragraph is for the Owner’s option in preparing budgets and comparing long-term costs between vendors. As such the Bidder shall provide costs for year two and three to include cost escalations

1. PART 2 – SYSTEMS AND EQUIPMENT

SYSTEM DESCRIPTIONS - This section of the specifications defines the details of the audio-visual systems to be furnished and installed at the Museum of the Chinese in America. For additional system information, refer to the A/V system diagrams and itemized equipment lists.

A. Crestron Multi-Functionality

1. The Crestron Control equipment specified for this project shall be employed to support the Audio Visual Systems for the Exhibit Activities on several levels including:
 - a. **Signal Distribution** – Crestron's Quick Media signal transport technology shall be used to route audio and video signals (AV over Cat5e) from the back of house Content Source Players in the Server Room to the individual exhibit areas in the public space. Depending on the type of exhibit, PC (RGBHV), Composite Video, and Line Level Audio. This shall be accomplished by connecting the AV Sources to Crestron Quick Media Transmitters installed in the racks in the server room wired to Crestron Quick Media receivers at each exhibit. Typical cable drops for each exhibit consists of (2) CrestCat and (1) Cat5e shall be run from the Server Room to each exhibit area. In the Sever Room, the Cat5e cables shall be terminated to 48 port Cat5e Patch panel(s) mounted on the wall behind the racks. The Crestnet component data cable shall be landed on Crestron SPN-300 Power Distribution Hubs also mounted to the wall behind the racks. The AVC shall provide a custom single gang plate on the exhibit side containing (3) RJ-45 Ethernet Jacks and (2) 4 Pin Crestnet Jacks. The AVC shall be responsible for terminating and testing these cables on site (to be provided and pulled by others) prior to delivery if the system racks.
 - i. In addition to point to point AV Signal Distribution, the Quick Media (QM-RMCRX-BA) receiver boxes shall provide DSP processing for the exhibit Audio, allowing the audio for each exhibit to be tuned and balanced to optimize the sound quality.
 - ii. The QM-RMCRX-BA also contains an I/O interface in which Motion Detectors will be connected to start programs.

- b. **Serial Control** – Local Quick Media Receivers located at the exhibits shall be connected to the local display monitor or projector to turn it on or off, and change inputs when required. For exhibits containing Touch Screens, the 2nd serial port on the Crestron QM receiver box will return signals from the touch screen back to the PC driving the display.
- c. **Transport Control** - A Crestron Controller located in the Server Room shall communicate to Audio & Video Media Servers to control their operation. For the Media Appliances (Alcorn McBride Digital Audio and Video Players) the Crestron Controller shall automate interactivity, i.e.: interrupt file 1 (attract loop) and play file 2 after motion detector is tripped. For PC's employed as Media Servers, Crestron's applications such as "eStart", eMediaPlayer" and "eScript" shall enable communication to these devices. http://www.crestron.com/features/e-control/power_applications.asp
- d. **Roomview and eControl** – All Quick Media Receivers at exhibit activities and Control Processors located in Server Room shall be on the same network, allowing for both eControl and Roomview to be used providing a Master Control System for the entire museum. The AVC shall be responsible programming a Master Control System that communicates to all of the exhibit components and turns them on / off per scheduled hours of the museum. This Master Control System shall have the ability to be overridden if events occur outside of schedule. In addition, the Master Control System shall provide global volume level presets that can be recalled depending on museum traffic. Through the use of Roomview, the system shall be programmed to send email alerts when equipment is in need of service or maintenance.
- e. **Exhibit Activity Reporting** – The AVC shall include in the Crestron programming the use of Crestron's "eDatalogger" application to monitor and log visitor usage and activity at each exhibit. <http://www.crestron.com/features/e-control/e-datalog.asp>
- f. **Crestron Control of other systems** – Two public spaces on the first floor contain permanently installed AV Systems consisting of ceiling mounted projectors with motorized retractable screens, ceiling speakers, wireless microphones, DVD/VHS Players and Laptop Input Connection Plates. These Systems are to be installed in a rack to be located in an equipment closet on the 1st floor. Each system shall contain a Crestron MPS-200 with an APAD Controller to control the room's equipment. Programming for these rooms shall include Room Combining for room overflow; is shall also be connected to the Museum Master Control System. The AVC is responsible for programming the functionality of these rooms.

B. Exhibits Audio Visual Specification

1. Lobby Kiosk

Two freestanding kiosks are located on the reception lobby where visitors can log-in and view current information related to the museum. Each kiosk features an industrial, flush mounted keyboard with integrated trackball, a 17" Touch Screen LCD monitor (panel mounted), and a set of headphones. The PC's that drive the displays are located in the server room on the lower level. A KVM extender is used to transport signals from the PC to the kiosk in the lobby. Content is to be created and installed by others.

2. Portrait Gallery

(5) 46" LCD Displays, installed vertically, are located in the window openings facing into the museum from the atrium. Each display is driven by its own dedicated PC located in the Server Room. Each of the (5) displays has a focused audio speaker installed on the ceiling and a motion detector which shall start the video program when a visitor is detected. (5) Additional 46" LCD Displays are also installed vertically and face into the atrium. A single PC shall drive all (5) displays in extended desktop mode, the content is a silent program that loops. The AV signals for the source PC's are delivered to the displays via Crestron Quick Media, AV over Cat5e solution. Crestron eMedia, installed on the PC's enable them to be controlled as media servers. Content by others, to be uploaded to PC by AVC.

3. Map Movies

(1) 40" LCD Display is wall mounted, (4) 30" LCD displays are installed on a rail system at an angle to the floor. A PC located in the Server Room (1 per display) acts as the media server for the content to be displayed on the screens. The program is silent and loops. The AV signals for the source PC's are delivered to the displays via Crestron Quick Media, AV over Cat5e solution. Crestron eMedia, installed on the PC's enable them to be controlled as media servers. Content by others, to be uploaded to PC by AVC.

4. Angel Island

A Holosonic speaker is mounted on the ceiling above a chair containing a motion detector. When a visitor is seated the audio program begins. The Audio Source is a Digital Message Player located in the Server Room. The DAP is controlled by a Crestron Controller located in the server room via serial or Ethernet. The AV signals from the DAP are delivered to the overhead speaker via Crestron Quick Media, AV over Cat5e solution. Content by others, to be uploaded to DAP by the AVC. Programming of the DAP playback is to be done by the AVC.

5. Old Store

The Old Store is a replica of a typical store in Chinatown in the early 1900's. One wall in the store is a Dual View Projection Screen (to be supplied as OFE) allowing the image to be viewed from inside the store, and at night, visible outside through the glass window. A ceiling mounted projector with a short throw lens provides the image; the video source (silent) is a Digital Video Player located in the server room. The AV signals from the DVP are delivered to the projector via Crestron Quick Media, AV over Cat5e solution. Content by others, is to be uploaded to DVP by the AVC. Programming of the DVP playback is to be done by the AVC.

6. Red Scare

A 1950's Style TV with its CRT replaced by an LCD is provided as OFE to the AVC for installation. The video source is a Digital Video Player located in the server room. The sound for this exhibit is played back over a Holosonic speaker installed on the ceiling. A Motion Detector starts the program when a visitor is detected. The AV signals from the DVP are delivered to the LCD via Crestron Quick Media, AV over Cat5e solution. Content by others, is to be uploaded to DVP by the AVC. Programming of the DVP playback is to be done by the AVC.

7. Nixon in China

A 14" "raw" CRT shall be modified (by others) by attaching an LCD Panel to the glass face to simulate a working CRT. The CRT/LCD Assembly shall be OFE and supplied to the AVC for installation. The video source is a Digital Video Player located in the server room. This exhibit activity is silent. The AV signals from the DVP are delivered to the LCD via Crestron Quick Media, AV over Cat5e solution. Content by others, is to be uploaded to DVP by the AVC. Programming of the DVP playback is to be done by the AVC.

8. Golden Venture

A 9" "raw" CRT shall be modified (by others) by attaching an LCD Panel to the glass face to simulate a working CRT. The CRT/LCD Assembly shall be OFE and supplied to the AVC for installation. The video source is a Digital Video Player located in the server room. The audio program is played back over headphones located at the exhibit. The AV signals from the DVP are delivered to the LCD via Crestron Quick Media, AV over Cat5e solution. Content by others, is to be uploaded to DVP by the AVC. Programming of the DVP playback is to be done by the AVC.

10. Story Table

This exhibit contains an interactive table which shall sense post cards with bar codes printed on them to launch the program. This exhibit has two areas, the table itself and the input station. The input station is similar to the reception kiosk and allows visitors to upload their personal stories. The PC for the input station is located in the server room. The table is self contained and is provided to the AVC as OFE. Prior to delivery to the site, the table will be installed at the content developer's studio, and then be shipped to the fabricator to be "finished" as far as its final appearance. Then it will be installed on site. The AVC shall be responsible for overseeing the final installation of the table on site, and then be responsible for its maintenance as part of the warranty. The table contains a video projector that will require lamp changes, and there will be periodic calibration of the table sensors from time to time. A technician from the factory that manufactures the table shall be on hand for the final installation for set-up and calibration, and training.

11. China Trade

Six 40" LCD Monitors are wall mounted at various height for this exhibit that behaves like a data ticker. The first screen is a touch screen version of the monitor and serves as the control panel; the visitor selects the market she wants to view and the results are displayed across the other (5) 40" displays. The touch screen is connected to its own dedicated PC in the server room, (3) additional PC's, each with a dual output card drive the (5) display PC's. The AV signals for the source PC's are delivered to the displays via Crestron Quick Media, AV over Cat5e solution. Crestron eMedia, installed on the PC's enable them to be controlled as media servers. The content will be both created and uploaded by the content producer.

12. Beijing or Bust

A 14" "raw" CRT shall be modified (by others) by attaching an LCD Panel to the glass face to simulate a working CRT. The CRT/LCD Assembly shall be OFE and supplied to the AVC for installation. The video source is a Digital Video Player located in the server room. The audio program is played back over headphones located at the exhibit. The AV signals from the DVP are delivered to the LCD via Crestron Quick Media, AV over Cat5e solution. Content by others, is to be uploaded to DVP by the AVC. Programming of the DVP playback is to be done by the AVC.

13. C100 Interviews

A 14" "raw" CRT shall be modified (by others) by attaching an LCD Panel to the glass face to simulate a working CRT. The CRT/LCD Assembly shall be OFE and supplied to the AVC for installation. The video source is a Digital Video Player located in the server room. The audio program is played back over headphones located at the exhibit. The AV signals from the DVP are delivered to the LCD via Crestron Quick Media, AV over Cat5e solution. Content by others, is to be uploaded to DVP by the AVC. Programming of the DVP playback is to be done by the AVC.

14. Add / Alt

This is a placeholder for (2) additional AV Points to be located at two TBD locations in the museum space. These AV Points are for future use.

15. Master Control System

The Master Control System shall run on the main control processor located in the server room and networked to the other Crestron devices at each exhibit via Ethernet or Crestnet. The Master Control System shall manage the power up and down of all of the monitors and other controllable devices in the system. The Museum Exhibits should power up / down according to a schedule based upon the museums operational hours. An override button should be provided to manually turn the system on or off when an event takes place outside the scheduled hours. In addition to power on and off, Crestron Control Devices that are processing audio shall be communicated with to allow for (4) preset volume setting to be recalled, soft, medium, loud, or mute, which can be manually selected depending on museum traffic. The master Control System shall monitor the operational hours of projectors and notify, via email, when the temperature reaches a preset level indicating the filters need to be cleaned, or a lamp is approaching expiration, alerting that the lamp will need to be replaced.

16. Control (Server) Room

(5) Equipment Racks have been specified for the Server Room. In addition to the equipment related to the Museum Exhibits, the Office Systems, Point of Sale, Ticketing, and Surveillance Servers shall also occupy space in the racks. A 32 Port KVM has been specified to allow the 17 Exhibit PC's and the other Servers to be monitored in the Server Room. A combination keyboard / flip-up monitor drawer has been specified to connect as the console for the KVM. The racks shall be bolted together and sit on a riser base, which should be installed early in the Server Rooms to reserve the floor space in the server room. Equipment shall be installed in both the front and rear of the racks. A plywood wall, behind the racks shall enable the mounting of CAT5e Patch Panels and Crestron Power Distribution blocks enabling the cables to be dressed and terminated prior to the racks delivery to the site.

17. Changing Exhibit Gallery

All wiring for the Changing Gallery report to a equipment Rack located in a closet on the 1st floor. (12) AV Points are pre-wired back to this rack to support future exhibits that may be installed in this Gallery. This room shall also serve as a screening room; it shall contain a motorized screen, a ceiling mounted projector, and ceiling mounted speakers permanently installed. The signals are routed by a Crestron MPS-200 located in the rack; control of the equipment is via an APAD which shall be programmed by the AVC to operate the room's equipment. AV Input Plates are installed for the connection of a Laptop; a DVD/VHS Combo is located in the rack for video playback.

18. Public Meeting Classroom

The Public Meeting Classroom is identical to the Changing Gallery, without the AV Points which are not required for this room.

19. Pantry Conference Room

This small conference room is to be used primarily by the staff and includes a wall mounted flat panel display with side mounted speakers, and a DVD/VCR Combo. CATV may be added. There is no control system for this room; the supplied handheld IR remotes are used to operate the equipment.

20. Divisible Meeting Room

With the exception of ceiling speakers, all of the equipment for this room is to be installed on an AV cart. Two identical systems are provided for the rooms when used individually; when the room is used for a large group, one of the systems shall be used and the ceiling speakers linked in a room combined mode. Room equipment includes a Fast Fold Screen, a mobile cart containing a projector; wireless microphone receivers, DVD/VCR Combo, and an audio mixer/ amplifier are installed on the cart. Two podiums are also specified for this space. Input Panels located in the front and rear of each room enable the connection of the mobile cart and a laptop PC.

1. GENERAL REQUIREMENTS

- A. All equipment shall be rack-mounted and permanently attached. All power supplies, rack-mounts, interconnects, brackets, etc., shall be included while they may not be specifically called out herein.
- B. All equipment shall be new and the latest model number and revision as of the proposal date.
- C. Material and equipment specified herein have been selected as the basis of acceptable quality and performance and have been coordinated to function as component parts of the included systems. Where a particular material, device, equipment or system is specified directly, the current manufacturer's specification for it shall append these specifications.
- D. Subject to the functional and minimum performance requirements for each item, the Consultant may require independent laboratory tests proving equivalence of certain alternative equipment not fully or adequately described by the technical specification of the manufacturers. Any and all costs arising from equivalency testing shall solely and completely be the responsibility of the Contractor.
- E. Verify with all manufacturers and/or suppliers' availability and cost of all material and equipment proposed, including all material and equipment specified herein. No cost increases shall be allowed for manufacturers' cost increases, or for substitutions required because of unavailability of proposed equipment.
- F. **The manufacturer specifications shall be considered as minimum performance levels of acceptance.** Where a particular model is specified its performance, operating, and physical characteristics are part of these specifications. Further, these characteristics are part of a design as a whole and particularly the Architect's and Engineer's designs are in full coordination with these characteristics.

2.03 CUSTOM WALL PLATES

- 1. All plates shall be equivalent in type, color and finish to other plates in the same room, unless otherwise specified by the Architect or Owner
- 2. Unless otherwise noted, all plates shall be 0.125-inch thick brushed and anodized aluminum with 45-degree chamfered edges.

3. Mounting screws shall be matching stainless or black Allen flathead screws.
4. Custom-fabricate to size indicated on drawings.
5. Black or white filled engraving, whichever provides the highest contrast to the plate color and finish.
6. Typeface shall be 14 pt Helvetica Bold.
7. Submit sample of engraved plate for owner approval before fabrication of job plates.
8. Approved manufacturers: Panel Authority or RCI

2.04 CUSTOM EQUIPMENT RACKS PANELS

- A. Standard EIA specifications, nominal 19-inches wide, number of spaces as indicated or required.
- B. Material shall be brushed and anodized Aluminum, minimum 0.125-inch thick.
 1. Finish black anodized.
 2. White filled engraving.
 3. Typeface shall be 14 pt Helvetica Bold.
 4. Provide panel stiffeners as required to prevent panel deformation during normal plugging and switching operations.
 5. Mounting screws shall be matching stainless or black Allen flat-head screws with lock washers.

PART 3 - EXECUTION

3.01 EQUIPMENT LAYOUT

- A. The equipment layout and locations shall be as detailed herein and in the audio-visual section of the drawing as well as all architectural drawings that pertain to this area.

3.02 PROJECT MEETINGS

- A. It shall be the responsibility of the Contractor to supply any necessary requested information and have its project supervisor in attendance at all project meetings in order to coordinate with all related trades.

3.03 COORDINATION

- A. All the Work of this section shall be coordinated with the current operation of the system(s).
- B. The Contractor shall coordinate the finish required for all fixtures, plates, panels, grilles, and enclosures supplied as part of this specification section with the Architect and Owner. The Contractor shall supply finish samples as requested by the Architect or Owner.
- C. The Contractor shall be responsible for coordination with the Millworker for any audio-visual items to be built or mounted into millwork.
- D. It shall be the responsibility of the Contractor to cooperate at all times with all contractors doing work in the building, to the end that lost time, work stoppages, interference, and inefficiencies do not occur.
- E. Maintain constant communications with all designated personnel of the CM and attend all construction meetings as requested by the CM
- F. Coordinate the switch over of all systems; subsystems; and software with OWNER operations and maintenance personnel as designated by the CM.
- G. Perform field surveys to determine existing cabling and mechanical conditions.
 - a. Verify existing as-builds including cable labeling and ensure new documentation and installation cabling is coordinated and appropriately labeled.

3.04 WORKMANSHIP

- A. Maintain a competent supervisor and supporting technical personnel, acceptable to the Architect, Construction Manager, Owner, and Consultant during the entire installation. The AV Contractor shall submit the name and telephone number of the supervisor. Change of supervision during the project is not acceptable without prior written approval from the Construction Manager.
- B. Adjust and balance all circuits as specified herein. Set all controls and software

parameters to render a fully and optimally operating systems and subsystems. All computer-controlled functions shall require complete audio/computer/software setup, balancing, label-entry and documentation.

- C. Install all equipment to industry safety and ergonomic standards and provide full engineering and technical support throughout the installation process.

3.05 FABRICATION & INSTALLATION

- A. All installation practices shall be in accordance with, but not limited to, these specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements, and recommendations of authorities having jurisdiction.
- B. If, in the opinion of the AV Contractor, an installation practice is desired or required, which is contrary to these specifications or drawings, a written request for modification shall be made to the Consultant. Modifications shall not commence without written approval from the Consultant.
- C. Provide intelligible, permanent identification on or adjacent to all patching jacks, connectors, receptacles, terminal blocks, meters, indicators, switches, equalizers, mixers, amplifiers, etc. The identification shall clearly indicate the function, or circuit.
- D. The Contractor must take such precautions as are necessary to guard against electromagnetic and electrostatic hum, to supply adequate ventilation, and to install the equipment so as to provide maximum safety to the operator.
- E. Care shall be exercised in wiring so as to avoid damage to the cables and to the equipment. All joints and connections shall be made with rosin-core solder or with mechanical connectors approved by the Consultant.
- F. All wire and cable shall be continuous and splice free for the entire length of run between designated connections or terminations.
- G. When connecting stranded wire to compression screw terminals do not tin the wire ends. When inserting wires into a compression terminal take proper care to insert only the stripped portion of the cable.

3.06 EQUIPMENT RACK FABRICATION

- A. Wire each equipment rack as a unit to self-contained terminal strips. All connections to adjacent equipment racks and/or control lines, input lines, and output lines shall be made via terminal strip connections.
- B. Wire all racks completely in the shop. No internal rack wiring shall be done on the job site.
- C. Install all rack-mounted equipment and devices in equipment racks in a logical, functional manner, demonstrative of signal flow within the respective system arranged for easy accessibility and convenient maintenance.
- D. Install equipment in racks with ventilating panels as required to provide adequate ventilation and according to equipment manufacturer's recommendations.
- E. Provide a.c. outlets within each rack, and appropriately circuited, to provide power to the installed equipment, with one (1) each extra outlet per blank space.
- F. Provide at least one (1) each dedicated A/C service outlet per rack.
- G. Ensure that all panel mounting holes are pre-tapped and free of debris.
- H. Run all microphone and line level wiring in the equipment racks on the equipment input side of the rack and all AC, control, and speaker wiring on the equipment output side of the rack.
- I. All non-line voltage wiring shall be run within the rack in plastic wiring duct with snap-in slot design, such as Panduit Type E, or equal; and provide snap on duct cover. All wiring between racks shall be fully protected in conduit, or enclosed cable trays.
- J. Do not buss the commons of the loudspeaker lines together, and do not ground.
- K. Provide unused panel space with blank or ventilating panels.

- L. Locate free standing racks as shown and provide access to rear without need for moving racks.
- M. Equipment racks of this system shall be firmly attached to each other, both mechanically and electrically, in order to provide a good ground connection between adjacent racks.
- N. Equipment racks of this system shall be totally isolated form equipment racks of other systems.
- O. Provide each rack with protective plastic covers for run sheets, rack elevation, and single-line drawings.
- P. All power supplies shall be located, oriented, and connected electrically so as to minimize hum and RFI interference. Further, all plug-in type power supplies shall be firmly attached using mechanical fasteners to its associated power receptacle to insure accidental removal and/or connection loss.

3.07 EQUIPMENT LABELING

- A. In addition to permanently labeling each cable and termination device, each piece of equipment, device, and panel shall have permanent label corresponding to its function as shown on system drawings.
- B. All user cables shall be labeled as to there function. User cables include audio, video, VGA, control or other connector cables that that the user is required to handle during normal system setup and use.

3.08 PATCH PANEL ASSIGNMENTS & DESIGNATIONS

- A. All patch panels shall be wired so that signal “sources” (outputs from) appear on the upper row of a row pair; and all “loads” (inputs to) appear on the lower row of a row pair.
- B. All audio and video patch panel designation strips shall utilize alphanumeric identifications and descriptive information. The jack position in each horizontal row shall be numbered sequentially from left to right. The horizontal jack rows shall be lettered sequentially from top to bottom. The alphanumeric identification

of each jack shall be included on the functional block drawings, as well as on reproductions of these drawings that shall be mounted in an appropriate location near the patch bays.

3.09 GROUNDING

- A. The Contractor shall follow all standard NEC and local codes for grounding practices on all of the audiovisual equipment and equipment racks.
- B. All RGB video lines to external devices exceeding 100 feet or being powered from different power panels shall have suitable line drivers and isolation as specified herein.
- C. It shall be the responsibility of the Contractor to follow good engineering practices. At no time shall there be a compromise in safety or any exception to the NEC and local codes.
- D. Ground equipment, racks, and audio line shields to independent audio system ground ONLY as shown on drawings.
- E. Ground all conduits ONLY to power system ground. Insulate all conduits and electrical boxes from this system including equipment racks, and audio system ground.
- F. Ground case of power strips/channels in equipment racks to the racks and insulate from power system ground.
- G. Provide a separate ground lead from each amplifier chassis and from each of the other items of equipment normally requiring grounding to the rack ground buss.
- H. Insulate all conductors in conduit, including shields, from the conduit, back boxes, and from each other for the entire conduit length.
- I. At each group of racks, provide a single labeled Isolated Ground bus bar terminal strip to land the individual labeled rack grounds.

- J. At each rack, provide a lug bonded to the rack frame with a minimum #12 TW stranded wire to the Isolated Ground bus central to the rack group.
- K. Equipment signal ground shall be to the Isolated Ground System via the green wire of the equipment power cord. Where equipment uses two (2) wire power cord, provide a green bond wire to rack IG bus bar, with gauge equal to the equipment main's power supply conductors.
- L. Cable shields shall only be grounded by a single path to Isolated Ground.
- M. Shields shall be tied to Isolated Ground at the driving or transmitting end of a run or circuit only, unless otherwise noted.
- N. The resistance of the ground system from common ground point at racks to building ground point shall not exceed 0.1 ohm.
- O. Provide isolated ground receptacles typical for all power receptacles for all equipment.
- P. The Contractor shall ensure that ONLY the audio-visual equipment is connected to the AUDIOVISUAL dedicated Ground system.

3.10 IDENTIFICATION

- A. All installation shall bear the following identification plate, supplied by this contractor, mounted on the front of the main rack at the top:
 - i. SYSTEMS ENGINEERED & DESIGNED BY: Integrated Media and Design Group, New York, NY 10001
 - ii. SYSTEM FABRICATED & INSTALLED BY: Contractor Name Full Address Telephone Number
- B. Engraving shall be white filled Helvetica lettering on a black background or as appropriate to the identification plate material.

3.11 OFFSITE SYSTEM CHECKOUT

- A. Before onsite installation, the Contractor shall be prepared to perform system checkout under the supervision of the Owner and Consultant at his shop. He shall furnish all required test equipment and shall perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification. This work shall include the following:
 - 1. Test all audio systems for compliance with the Performance Standards.
 - 2. Check all control functions, from all controlling devices to all controlled devices for proper operations.

3.12 DELIVERY OF EQUIPMENT

- A. Ensure that the spaces where any electronic equipment is to be stored and/or installed is completely free from any foreign substances, such as concrete dust, or any other material that may otherwise be harmful to electronic equipment and connections. No allowances shall be made to the Contractor for equipment damage, or delays due to environmental damage.

3.13 BENEFICIAL OCCUPANCY

- A. During the installation the Owner and his representatives shall be entering and partially using devices and systems. This shall in no way be considered as any form of acceptance, or first use of the system. Further this shall have no affect whatsoever on the Warranty. The Contractor shall at all times be responsible for the safety and security of the equipment and the Owner shall not take on responsibility through the action of using any audio-visual equipment in advance of final acceptance.

3.14 LOUDSPEAKER INSTALLATION

- A. The following general minimum standard requirements shall be applicable to the fabrication and installation of all loudspeaker(s), and loudspeaker assemblies in the Project:
- B. Provide positioning and support elements for loudspeaker assemblies wherever required.
- C. Coordinate installation of all loudspeaker assemblies and baffles to ensure proper projection of the respective loudspeaker elements, and access to them for maintenance and/or removal.

- D. Verify that no loudspeaker assembly is subjected to stress, abrasion, or loading effects which could contribute to extraordinary failure.
- E. Eliminate all conditions causing noise, rattle, or other extraneous sounds resulting from the operation of a loudspeaker assembly under any operating condition.
- F. Verify that baffle openings and loudspeaker components are clear of paint, and/or any other obstructions.
- G. Use tamper/vandal-proof screws for all loudspeaker baffles in all restroom areas.
- H. Connect all loudspeaker assemblies to the appropriate 70-volt line transformer tap to realize specified sound pressure levels and ensure uniform polarities of loudspeaker elements.

3.15 AC POWER

- A. The Contractor shall ensure the Electrical Contractor has provided adequate power circuits and the grounding scheme is in accordance with the GROUNDING paragraph herein.
- B. If a dedicated A/V power system is part of this design, the Contractor shall ensure that ONLY the audio-visual equipment is hooked up this dedicated ac power system.

3.16 PHYSICAL INSTALLATION

- A. All equipment shall be firmly secured in place with a safety factor of at least five (5). All hardware shall be SAE Grade 5 minimum and all installation practices shall comply with standard rigging practice, OSHA standards, and all building codes.
- B. All boxes, equipment, etc. shall be secured plumb and square.
- C. In the installation of equipment and cable, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.

- D. All power supplies shall be located, oriented, and connected electrically so as to minimize hum and RFI interference. Further, all plug-in type power supplies shall be firmly attached using mechanical fasteners to its associated power receptacle to insure accidental removal and/or connection loss.

3.17 CABLE LENGTH & SPLICES

- A. All cables (except video and pulse cables that must be cut to an electrical length) shall be cut to the length dictated by the run. No splices shall be permitted in any pull boxes without prior permission of the Consultant. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.

3.18 CABLE INSTALLATION

- A. All cables, regardless of length, shall be marked with wrap-around number or letter cable markers at both ends. There shall be no unmarked cables at any place in the system. Marking codes used on cables shall correspond to codes shown on drawings and run sheets. Clear heat shrink (or equal) shall protect numbers.
- B. All inter-rack cabling shall be neatly strapped, dressed, and adequately supported.
- C. For all cables interfacing with racks, cabinets, consoles, or equipment modules requiring terminal blocks, boards, strips, or connectors these shall be either of the "barrier strip" type, screw down terminal strip or insulation displacement punch down type as manufactured by ADC or Siemon. No audio cables shall run directly to the audio patch panel jacks. Each audio patch panel shall be furnished with an audio terminal block, and all audio cables to and from the audio patch panel shall terminate on this block
- D. All cables shall be grouped according to the signals being carried. In order to reduce signal contamination, separate groups shall be formed for the following cables:
 - 1. Power cables
 - 2. Control cables
 - 3. Video cables
 - 4. Audio cables carrying signals less than -20 dBm.

- 5. Audio cables carrying signals between -20 dBm and +20 dBm.
- 6. Audio cables carrying signals above +20 dBm.

- E. All power cables, control cables, and high level cables shall be run vertically on one side of an equipment rack as viewed from the rear. All other cables shall be run vertically on the other side of an equipment rack, as viewed from the rear.

- F. Cables and Connectors

CABLE TYPES	
Video	
RF Riser (Plenum)	Liberty RG11-P-CATV
RF Drop (Plenum)	Liberty RG6-P-CATV
Baseband (Plenum)	Liberty RGB5C-SD-PLN
RGBHV (Plenum)	Liberty RGB5C-PLN
RGBHV-Video-(4) Audio – Control (Plenum)	Liberty AVC-18-PLN
Audio	
Mic/Line Level (Plenum)	Liberty 22-1P-CMP-EZ
Digital Audio (Plenum)	Liberty 24-1P-DIGITAL
Speaker Level, 8 ohm (run>20 feet Non-Plenum)	Liberty 12-2C
Speaker Level, 8 ohm (run>100 feet Plenum)	Liberty 12-2C-P
Speaker Level, 70v (Plenum)	Liberty 14-2C-PP
Control	
4 Conductor (Plenum)	Liberty 22/18-1PSH/2C-P
Other Cable types are to be submitted to the Consultant for approval.	

Cables running in plenum areas without conduit shall be plenum rated cable and match the specified cable above. Cables running in areas exposed to environmental factors such as, but not limited to, UV, chemicals, direct burial, etc. shall be rated for such exposure and shall match the performance characteristics of its equivalent cable above.

All cables (except video and sync cables which must be cut to an electrical length) shall be cut to the length dictated by the run. No splices shall be permitted without prior permission of the Consultant. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.

No cable shall be installed with a bend radius less than that recommended by the cable manufacturer.

3.19 PERFORMANCE

iii. AUDIO

1. At the maximum distance as designated by the Consultant this system shall be capable of supplying 80 dB-SPL program level plus 10 dB peaking factor over a bandwidth of 250 Hz to 4 kHz without deformation of the waveform as observed on an oscilloscope connected to the output of a SLM in every zone unless noted otherwise.
2. Distribution of sound in the listening area from 250 Hz to 4 kHz shall vary not more than +/-2.0 dB at any location, as measured in octaves with an ANSI SLM.
3. The system shall provide adequate dynamic range at an acoustic distortion level sufficiently low to ensure minimum listening fatigue and intelligibility acceptable to the Owner. The intelligibility is based on listeners not familiar with the message, or talker; no visual cues; normal activity; and moving position both within and between zones.
4. Unless restricted by the published specifications of a particular piece of equipment or unless otherwise required under the Detailed Specifications, the following performance standards shall be met by each system:
 - a. S/N (including cross talk and hum) 60 dB minimum.
 - b. Total Harmonic Distortion 1% maximum from 30 Hz to 16,000 Hz.
 - c. Frequency Response Within plus or minus 1.0 dB, 30 Hz to 16,000 Hz.

iv. VIDEO

- a) S/N un-weighted DC to 5 MHz 55 dB minimum.
- b) Frequency Response Within plus or minus 0.5 dB, to 5 MHz.
- c) Line and Field-Tilt 2% maximum.
- d) Differential Gain 3% maximum.
- e) Differential Phase 2 degrees maximum.

v. PERFORMANCE TEST SIGNAL PATHS:

The signal paths for the above Performance Standards shall be as follows:

- a) Audio
From all source inputs (for microphones, audio tape units, video tape units, etc.) through all mixers, audio distribution amplifiers, switchers, etc., to all signal destinations.
- b) Video
From all source inputs (for cameras, video tape units, etc.) through all processors, switchers, etc., to all signal destinations.

vi. OPTICAL

All optical projection systems shall meet the following performance standards:

- a. The total varied light output from a projector, in lumens, shall be within plus-or-minus 15% of that specified by the projector manufacturer.
- b. The light meter used for the above measurements shall be a properly calibrated foot-candle (or Lux) meter and shall be cosine-corrected.
- c. Projectors, lenses, and mirrors shall be solidly mounted and braced so that there shall be no observable movement in the image induced by motor vibration or other mechanical operations.

During performance testing, all equipment shall be operated under standard conditions as recommended by the manufacturer.

3.20 TESTS AND ADJUSTMENTS

- A. Before Acceptance Tests are scheduled, the Contractor shall perform his own system checkout. He shall furnish all required test equipment and shall perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification. This work shall include the following:
 1. Maintain documentation of all performance tests for reference by the Consultant during the System Acceptance Tests.
 2. Test all audio and video systems for compliance with the Performance Standards.
 3. Adjust, balance, and align all equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for all level controls, and record these settings in the "System Operation and Maintenance Manual."
 4. Check all optical projection images for average light level, light fall-off, image alignment and size to comply with the Performance Standards, specifications, and drawings. Check to determine that all projectors, projector bases, carts, tables, and mirrors are rigid and vibration-less in operation.
- B. Provide all required test equipment specified herein (or equal) to successfully complete the tests and adjustments. Kits, home-built, and other non-professional test equipment shall be unacceptable.
 1. Video signal generator, Leader 410C
 2. RGBS signal generator, Extron VTG 150
 3. Combined waveform monitor/vectorscope, Leader 5872A
 4. Dual trace oscilloscope (15 megahertz bandwidth)
 5. Prerecorded VHS tape (NTSC)

6. Prerecorded VHS tape (PAL), if required
 7. Prerecorded VHS tape (SECAM), if required
 8. Prerecorded DVD test disk
 9. Prerecorded S-VHS tape (NTSC), if required
 10. Blank VHS tape
 11. RGBHV cable, Extron BNC-5-6'HR
 12. Audio and Video cable, terminations, adapters, etc
 13. Signal generator, Leader LAG-120B
 14. AC millivoltmeter, Leader LMV-181A
 15. Audio test set, Audio Precision P1PLUS
 16. Pink noise generator IVIE IE-20B
 17. Spectrum analyzer IVIE-IE30A
 18. Harmonic and intermodulation distortion analyzer Leader LDM-171
 19. Prerecorded cassette tape
 20. Audio Test CD
 21. 35mm Calibrated Test Slide
 22. Loudspeaker and Microphone polarity checker
- C. Perform the following inspections and adjustments, and submit to the Consultant the written results of each inspection for inclusion in the permanent records of the audio and video system.
1. AUDIO
 - a. Measure and record the impedance of each active device operating as a source to any passive device or series of passive devices. Record the dc resistance of any build-out resistors used.
 - b. Measure and record the input impedance of any active device used to terminate passive devices, and record the total impedance of all such devices. Record the dc resistance of any terminating resistor used.
 - c. Measure the absolute polarity of all devices, including all loudspeakers in the signal path, correct and record any reversals.
 - d. Adjust the gain of all devices in the signal path for optimum signal-to-noise ratio and maximum crest factor.
 - e. Without changing gain, terminate microphone and line-level inputs, with shielded resistors of 150 and 600 ohms respectively.
 - f. Measure and record the overall hum and noise level at each power amplifier output. Level shall be at least 75 dB below rated power output of amplifier over a bandwidth of 40-16,000 Hz.
 - g. Measure and record the impedance of each loudspeaker line at 250, 1000, and 4000 Hz before connecting it to the output of its respective amplifier.
 - h. Load power amplifiers with resistors matching nominal impedance of output terminals used in system in place of actual loudspeaker loads.
 - i. Adjust gain of system as for hum and noise level tests above.

- j. Apply 1,000 Hz. Sine-wave signal to each microphone and line-level input at level required to produce measured full amplifier output.
- k. THD shall measure less than 1.0%.
- l. Set up system for each specified mode of operation.
- m. Use wide-bandwidth oscilloscope and loudspeaker monitoring.
- n. Check to ensure that system is free of spurious oscillation and RF pickup in the absence of any input signal and also with the system momentarily driven to full output at 400 Hz.
- o. Feed full/wide-dynamic range music to the system. Adjust the system for frequent peaks at its specified maximum sound pressure level.
- p. Listen carefully for noise, rattle, or other extraneous sounds, and objectionable distortion.
- q. Correct all causes of such defects. If cause is outside system, promptly notify the Construction Manager, and the Consultant, indicating cause and suggested corrective procedures.
- r. Measure and record the acoustic distribution of the loudspeakers of this system at locations as designated by the Consultant, one (1) in every zone. Record the location of all position where any 1/3 octave band, deviates more than +/-3 dB from 500 Hz to 4 kHz, weighted by -5 at 800 Hz re: 2500 Hz.

2. VIDEO

- 1. Utilizing an NTSC color bar generator and waveform analyzer with the video signal set at 100% saturation and 75% amplitude check that the video performance specifications are met at the display devices from all source inputs to all system outputs. Connect the combined waveform monitor/ vectorscope to a final output point, e.g. an input to a picture monitor or video projector. Ensure that the test signal is routed to the selected output.
- 2. For all RGBHV inputs, connect the RGBHV output of the signal generator to a floor box/table/rack connector and select the SMPTE & PLUGE signal at the following computer scan rates:
 - 3. 640 x 480 31.5kHz H, 60Hz V
 - 4. 640 x 480 37.5kHz H, 75Hz V
 - 5. 800 x 600 38kHz H, 60Hz V
 - 6. 1024 x 768 48kHz H, 60Hz V
 - 7. 1280 x 1024 64kHz H, 60Hz V
- 8. Check that the image is correctly displayed at all system outputs including the monitor(s) and/or by the video projector.
- 9. Repeat using Crosshatch, Checkerboard, and H Pattern Signals.

3.21 CLEANUP AND REPAIR

- A. Upon completion of the work the Contractor shall remove all his refuse and

rubbish from and about the premises, and shall leave the relevant areas and equipment clean and in an operational state. The Contractor shall be responsible for repairing any damage caused to the premises by the Contractor's installation activities, at no cost to the Owner.

3.22 SYSTEM ACCEPTANCE TESTS

- A. System Acceptance Tests shall not be performed until the Contractor's System Checkout has been completed. The System Acceptance Tests shall be supervised by the Consultant, Owner Representative and Construction Manager and shall consist of the following:
1. A physical inventory shall be taken of all equipment on site and shall be compared to equipment lists in the specification section documents.
 2. The Contractor shall demonstrate the operation of all system equipment.
 3. Both subjective and objective tests shall be required by the Consultant, Owner's Representative to determine compliance with the specifications. The Contractor shall be responsible for providing test equipment for these tests.
 4. All final, "as-built" drawings, run sheets, manuals, and other required documents, otherwise known as "Close Out Documents" as detailed herein, shall be on hand. Two complete sets of these documents shall be delivered to the Owner at this time. (One complete set shall have been delivered to each the Consultant and General Contractor prior to the scheduling of Acceptance Tests). See also section 1.06, E, 1.
 5. In the event further adjustment is required, or defective equipment must be repaired or replaced, tests may be suspended or continued at the option of the Consultant and/or Owner.

3.23 OPERATION INSTRUCTION

- A. The Contractor shall provide on-the-job training by a suitably qualified instructor, to personnel designated by the Owner, to instruct them in the operation and maintenance of the systems. At no additional cost to the Owner, the Contractor shall provide a manufacturer's representative for such instruction in the event the Contractor does not have qualified instructors on staff for certain sophisticated equipment. All training shall take place after the systems are operational, but before the acceptance tests. There shall be a total of up to 40 hours of training on the systems included in this specification, at the discretion of the owner.
- B. The Contractor shall orally instruct and demonstrate, to personnel selected by the Owner, the Owner's Operating Manual and all final drawings as provided for in this Section.

- C. This training session shall be performed independent of any acceptance testing procedures, and factory training at any manufacturer's facility. This training session shall be performed independent of any other clause in the Section.
- D. A schedule shall be submitted clearly defining the training period two weeks prior to commencement of such training.

PART 4 – ITEMIZED PARTS LIST

- A. The itemized parts list attached to this specification represents, to the best of our knowledge, all major components required for the construction of a complete and working systems as described herein. It shall be the responsibility of the contractor to verify that no item has been omitted that may be required for complete and working systems. Any additional items may be listed on a separate sheet along with associated line item costs and submitted with the bid response.
- B. SEE ATTACHED SHEETS FOR EQUIPMENT LIST.

END OF SECTION 03 12 08