SECTION 27 51 25
AUDIO VISUAL SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide complete and functional audio/visual systems as shown on the Drawings and described in the Specifications. Provide all equipment and installation in its entirety whether or not enumerated on the Drawings for an operational system, including miscellaneous relays, power supplies, isolation transformers and termination materials as necessary.

1.02 DESCRIPTION OF TYPICAL AUDIO/VISUAL SYSTEMS

A. Huddle Space:
1. Video Display Equipment: Single wall mounted video monitor and a wireless Crestron Airmedia connection for presentation of audio/visual content from a laptop computer or other portable device.
2. Control Equipment: Utilize the remote control included with the video display.
3. Room Scheduler located adjacent to door on outside of room.
4. Audio/visual head end equipment shall be located behind the monitor.

B. Small Meeting Room System
1. Video Display Equipment: Single wall mounted video monitor and a wireless Crestron Airmedia connection for presentation of audio/visual content from a laptop computer or other portable device.
2. Audio and Video Conferencing Equipment: Soundbar with integral video conferencing camera.
3. Control Equipment: Utilize the remote control included with the video display.
4. Room Scheduler located adjacent to door on outside of room.
5. Audio/visual head end equipment shall be located behind the monitor.

C. Medium Meeting Room System:
1. Video Display Equipment: Single wall mounted video monitor and a wireless Crestron Airmedia connection for presentation of audio/visual content from a laptop computer or other portable device.
2. Video Equipment: Wall mounted Huddly IQ Series camera.
3. Audio Equipment: Ceiling mounted microphone array with integrated speaker and amplifier.
4. Control Equipment: Crestron panel to operate video display and soundbar.
5. Room Scheduler located adjacent to door on outside of room.
6. Audio/visual head end equipment shall be located behind the monitor.

D. Large Meeting Room System:
1. Video Display Equipment: Dual wall mounted video monitors, wall mounted micro-PC, and a wireless Crestron Airmedia connection for presentation of audio/visual content from a laptop computer or other portable device. Video signal splitter shall be included to mirror video content to both monitors.
2. Video Camera: Wall mounted Huddly S1 or L1, depending on room layout.
3. Audio Equipment: Ceiling mounted microphone arrays and ceiling mounted speakers shall be utilized for video conferencing and audio playback.
4. Control Equipment: Crestron panel to operate video display and soundbar.
5. Room Scheduler located adjacent to door on outside of room.
6. Audio/video head end equipment shall be located behind the monitor.

E. Seminar Room System:
1. Video Display Equipment: Single wall mounted 75" Promethean interactive monitor and a wireless Crestron Airmedia connection for presentation of audio/visual content from a laptop computer or other portable device.

2. Video Equipment: Promethean 4K camera.
3. Audio Equipment: Utilize speakers integral to the Promethean Display.
4. Control Equipment: Promethean Display remote control.
5. Room Scheduler located adjacent to door on outside of room.
6. Any audio/visual head end equipment shall be located behind the monitor.

F. Small Classroom System: (32 students or less)
1. Video Display Equipment: Single wall mounted video monitor OR a single large projection screen shall be used on the teaching wall depending on room size and layout. The system shall utilize a wired HDBaseT video switcher located at the instructor's desk for connections to the instructor's PC and a wireless Crestron Airmedia connection for presentation of audio/visual content from a laptop computer or other portable device. A single monitor shall be mounted to the lectern on and articulating arm. The monitor will act as a confidence monitor for the instructor's content.
2. Video Conferencing/Streaming Equipment: A wall or ceiling mounted camera with auto tracking capability shall be located at the back of the room.
3. Audio Equipment: Ceiling mounted microphone arrays and ceiling mounted speakers shall be utilized for video conferencing and audio playback.
4. Control Equipment: A desktop Crestron control pad located at the lectern shall be utilized to operate the video monitors, cameras, and sound system equipment.
5. Room Scheduler located adjacent to door on outside of room.
6. All audio/video equipment amplifiers, processors, video switching equipment, and other miscellaneous head end equipment shall be mounted in the instructor's desk, and in a floor standing equipment rack adjacent to the desk.

G. Large Classroom System: (more than 32 students)
1. Video Display Equipment: Single or dual video projection screens shall be used on the front teaching wall determined by the viewing angles from the seats. The system shall utilize a wired HDBaseT video switcher located at the instructor's desk for connections to the instructor's PC, a wireless Crestron Airmedia connection for presentation of audio/visual content from a laptop computer or other portable device, document camera, and one spare connection. Two video monitors shall be mounted to the lectern on articulating arms. One monitor functions as a confidence monitor for the instructor's content, the second monitor functions as an annotation monitor via USB connection to the instructor's computer. A desktop document camera shall be located on the lectern and connected to the video switching equipment.
2. Video Conferencing/Streaming Equipment: A wall or ceiling mounted camera with auto tracking capability shall be located at the back of the room.
3. Audio Equipment: Ceiling mounted microphone arrays and ceiling mounted speakers shall be utilized for video conferencing and audio playback, audio amplifier shall be located in the instructor's desk.
4. Control Equipment: A desktop Crestron control pad located at the lectern shall be utilized to operate the video monitors, cameras, and sound system equipment.
5. Room Scheduler located adjacent to door on outside of room.
6. All audio/video equipment amplifiers, processors, video switching equipment, and other miscellaneous head end equipment shall be mounted in the instructor's desk, and in a floor standing equipment rack adjacent to the desk.

H. Auditorium Classroom System:
1. Video Equipment: A dual video projector/motorized screen system shall be located on the front teaching wall in these rooms. The system shall utilize a wired HDBaseT video switcher located at the instructor's desk for connections to the instructor's PC, a wireless Crestron Airmedia connection for presentation of audio/visual content from a laptop computer or other portable device, document camera, and one spare connection. A desktop document camera shall be located on the lectern and connected to the video switching equipment. Two video monitors shall be mounted to the lectern on articulating arms. One monitor will operate as a confidence monitor for the instructor's content, the second monitor will function as an annotation monitor via USB connection to the

instructor's computer. A desktop document camera shall be located on the lectern and connected to the video switching equipment.

2. Video Conferencing Equipment: Wall or ceiling mounted cameras with auto framing capability shall be utilized for video conferencing connections.
3. Audio Equipment: Wall mounted speaker column array speakers with a throw-box style wireless microphone system will be utilized.
4. Control Equipment: A desktop Crestron control pad located on the instructor's desk. shall be utilized to operate cameras, sound system equipment, route video signals and operate the projectors.
5. Room Scheduler located adjacent to door on outside of room.
6. All audio/video equipment amplifiers, processors, video switching equipment, and other miscellaneous head end equipment shall be mounted in the instructor's desk, and in a floor standing equipment rack adjacent to the desk.

I. Active Classroom System:
1. Video Display Equipment: Two video monitors OR a single projection screen shall be located on the front teaching wall in these rooms depending on room size, and a separate video monitor shall be located at each student table. The system shall utilize HDMI over IP encoders/decoders located at the instructor's desk for connections to the instructor's PC, a wireless Crestron Airmedia connection for presentation of audio/visual content from a laptop computer or other portable device, document camera, and one spare connection. The students will utilize Crestron Airmedia to connect to the local student monitor from each table. The instructor's desk. shall also be connected to each student table monitor via HDMI over IP, to allow instructor content to be displayed on any or all student monitors. The main displays on the front wall shall be connected to the instructor's desk. equipment via HDMI over IP. Two video monitors shall be mounted to the lectern on articulating arms. One monitor will operate as a confidence monitor for the instructor's content, the second monitor will function as an annotation monitor via USB connection to the instructor's computer.
2. Video Conferencing/Streaming Equipment: Wall or ceiling mounted cameras with auto-framing capability shall be located at the front and back of the room.
3. Audio Equipment: Ceiling mounted microphone arrays and ceiling mounted speakers shall be utilized for video conferencing and audio playback of local content.
4. Control Equipment: A desktop Crestron control pad located on the instructor's desk. shall be utilized to operate the cameras, audio/visual system equipment, and route video signals to the video displays.
5. Room Scheduler located adjacent to door on outside of room.
6. All audio/video equipment amplifiers, processors, video switching equipment, and other miscellaneous head end equipment shall be mounted in the instructor's desk, and in a floor standing equipment rack adjacent to the desk.

J. Owner Furnished/FF&E Equipment
1. The AV systems installer will be required to interface with equipment that is furnished outside of the AV systems bid. The following items are listed for contractor information and coordination purposes only:
   a. Interactive Video Boards: Promethean Activepanel 10 Premium Series, 65" or 75", OPS-Mi7 with OS preinstalled.
   b. Instructor's Computer and Monitor: Dell, exact model varies.

1.03 SHOP DRAWINGS

A. Provide drawings that clearly indicate dimensions, schematic diagrams, electrical characteristics, electrical connections, power requirements, system flow diagrams and rack layouts.

B. Provide riser diagram indicating conduit and junction box sizes and mounting heights for all audio-visual systems.

C. Submit a detailed manufacturer's data sheet on all equipment and components to be provided.

1.04 QUALITY ASSURANCE

A. All equipment and materials for contained herein shall be the products of recognized manufacturers and shall be new.

B. All equipment shall utilize U.L. listed components.

C. All components and the system will conform to the minimum applicable standards issued by EIA. All work in conjunction with this installation will meet the provisions of the National Electrical Code and other applicable codes.

1.05 TEST REPORTS

A. Provide a printed test report for each audio/visual system verifying operation of the following items and include with O&M and As-Built submittals.
   1. Display of wireless Airmedia sources on the video display(s) and the corresponding audio signal associated with that source.
   2. Control of all equipment from the Crestron system as applicable to the room. Indicate successful operation of device power, source input, volume levels, and any system presets.
   3. Coordinate network addresses of all equipment with UND IT representatives Verification that UND AV personnel have access to all network enabled equipment remotely over campus LAN/WAN.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store in dry area, protected from the weather. Maintain temperature above freezing.

B. Protect equipment from damage due to the presence of dust and construction debris before final system acceptance. Do not deliver equipment to the site until the spaces have been cleaned and are dust free.

C. The Contractor is responsible for all shipping and unloading at the project site.

D. The Contractor shall be responsible for tagging equipment with UND provided Asset Tags.

E. The Contractor shall be responsible for supplying a spreadsheet showing all items purchased with their associated manufacturer, model number, serial number, asset tag, location, cost/value, acquisition/purchase date, vendor, MAC address, warranty duration.

1.07 OPERATION AND MAINTENANCE DATA

A. Submit information for operating and maintaining the system including wiring diagrams, repair parts list, setting of controls (including initial setting), as-built drawings, troubleshooting guide, and name/contact information of nearest service organization. Provide 3 USB drives with printed label containing an electronic copy of system software configurations and system code for all applicable products listed in this specification. Provide 4 hours of Owner instructions, see Training described in this specification.

1.08 RECORD DRAWINGS

A. Produce all Record As-Built Drawings using the latest version of AutoCAD and in PDF format. Record drawings shall, at a minimum, include the following:
   1. Floor plan drawings indicating device locations, with device legends indicating manufacturers and model numbers for each device
   2. Floor plan drawings indicating wire routing. Wire routing shall be delineated in straight line runs and be tagged with cable identification and terminal strip numbers to coincide with the installation
   3. Mounting details for all equipment and hardware
   4. Functional block diagrams for each subsystem

1.09 INSTALLATION

A. All audio system components and cables must be electronically balanced in nature.

B. All cabling must be arranged in a neat and orderly fashion using trimmed tie wraps and must be fastened securely to prevent them from physical damage and to minimize visibility.

C. Speaker-mounting hardware used should be installed as per the manufacturer's recommendations.

D. The AV systems Subcontractor shall coordinate with the Electrical Contractor for required raceway/junction box locations for audio visual equipment, and routing of audio, video, control, and power cables/raceway from equipment, terminal and pull boxes to system equipment racks.

1.10 QUALITY ASSURANCE

A. Installer Qualifications: A company having at least 5 years experience in the installation and testing of the type of systems specified, and:
1. Supervisors and installers shall be factory certified by manufacturers of products to be installed.
2. Employing experienced technicians for all work; show at least 5 years experience in the installation of the type of system specified, with evidence from at least 5 projects that have been in use for at least 18 months; submit project name, address, and written certification by user.

B. All installers requesting approval to bid this project must submit the following information for evaluation.
1. General Company Information.
2. List of projects, with description of work performed in the last five years. Project list shall include cost of system, Owner's Representative, address and telephone number.
3. Final approval of acceptable installers will be at the discretion of the Architect/Engineer and the Owner.

PART 2 PRODUCTS

2.01 FURNITURE/EQUIPMENT CABINETS

A. Teaching Station – Stand Alone
1. Manufacturer: Computer Comforts, Inc.
2. Model: 72" Power Lift EB Lectern
3. Work Surface Area: 70"W x 30"D
4. Height (Adjustable): 25" min. – 49" max.
5. Electronics Bay Depth: 7"
6. Surface Color: Natural Gray Felt (4971-58)
7. Edge Color: Black
8. Paint Color: Black (Textured)
9. Provide Computer Comforts, Inc. electronics bay fan.
10. Provide Byrne Axil Z 4-Window Power Center

B. Teaching Station – Paired with Free Standing Equipment Rack
1. Manufacturer: Computer Comforts, Inc.
2. Model: 48" Power Lift EB Lectern
3. Work Surface Area: 48"W x 30"D
4. Height (Adjustable): 25" min. – 49" max.
5. Electronics Bay Depth: 7"
6. Surface Color: Natural Gray Felt (4971-58)
7. Edge Color: Black
8. Paint Color: Black (Textured)
9. Provide Computer Comforts, Inc. electronics bay fan.
10. Provide Byrne Axil Z 4-Window Power Center

C. Floor Standing Equipment Cabinet:
1. Manufacturer: Computer Comforts, Inc.
2. Model: Freestanding Rack Box
3. Number of Rack Units: 18
4. Work Surface Area: 24"W x 30"D
5. Height: 36.75"

6. Surface Color: Natural Gray Felt (4971-58)
7. Edge Color: Black
8. Paint Color: Black (Textured)
9. Order with special hole cut for easier cable routing through the bottom of cabinet. See cut-out drawing at the end of this section.

D. Wall Mounted AV Equipment Rack
1. Description: 19-inch rack, EIA/TIA 310D compliant, 16-gauge steel construction, swing out door for rear access, black in color.
2. Manufacturer: Middle Atlantic DWR Series, Lowell LWR Series, or approved equal.
3. Provide wire management for lacing and managing cables.
4. Provide with vented locking front door.
5. Useable depth: 22 inches.
6. Rack Unit Spaces: 35 RUnits
7. Provide with rack mounted shelf units for any components that are not rack mountable.
8. Provide with 1 3-RU drawer.
9. Provide blank panels for all unused rack spaces.

2.02 POWER PROTECTION/DISTRIBUTION

A. Teaching Station/Floor Standing Equipment Cabinet Surge Protection
1. Manufacturer: Tripplite/Eaton
2. Model: Protect IT TLP1010USB Series or Approved Equal.
3. 20 Amp rated, 120 VAC.
4. (10) 5-15R outlets, (2) USB A charging outlets, 10-foot power cord.
5. Integral dual lamp swivel lightbar, 1,000 lumens.
6. AC suppression: 4,500 Joules, <1 ns response time.
7. Maximum surge Amps: 6,500 Amps
8. EMI/RFI Filtering: 150 Khz - 100 Mhz.
9. Surface mounted device.
10. Provide (1) power protection device for each equipment rack, and (1) power protection device for each system installed in a teacher lectern.

B. Teaching Station In-Surface Power Center
1. Manufacturer: Byrne
2. Model: Axil In-Surface – 4 Window
3. Modules: 2-Power Simplex, 1-Powered USB-C, 1-Belay
4. Faceplate Color: Matte Black
5. Anodized Aluminum Housing: Black
6. Plastic End Caps & Window Frames: Black

2.03 DIGITAL SIGNAL PROCESSOR

A. Auditoriums/Active Learning/Large Classrooms
1. Symmetrix Radius NX Series or Approved Equal.
   a. 48 kHz digital sampling rate.
   b. Frequency Response: 20 Hz - 20 kHz, +/- .5 dB.
   c. THD + N: <95 dB, 1 kHz @ + 15 dBu with 0 dB gain.
   d. Latency (A/D/A): 1.04 ms, inputs routed to outputs
   e. Quantity of balanced microphone/line inputs and outputs as required by the drawings.
   f. Dante 64 x 64 Digital audio port.
   g. USB Audio Connector: One (1) high-retention Type B, 48 kHz sample rate, 1×1 (echo cancelling speakerphone and non-echo cancelling speakerphone modes) – driverless, 2×2 line I/O mode – driverless, and 8×8 line I/O mode.
   h. Connect to LAN network jack in telecommunications patch panel for remote management.

          i.   Provide programming of device with system software to configure system as directed by the Owner. Configure integral equalizers, filters, routers and gain controls for optimal system performance.
          j.   Rack mount device.

  B. Small Classrooms:
      1. Shure Intellix P300 Series or Approved Equal.
          a.   (2) balanced analog audio input, (2) balanced analog audio output.
          b.   (1) USB 2.0, Type B.
          c.   (1) RJ-45 Dante audio network port, 10 input channels x 8 output channels, 48 kHz sampling rate, 24-bit depth.
          d.   POE+ power supply.
          e.   Integral acoustic echo cancellation, noise reduction, automatic mixing, parametric EQ, mute, limiter, and gain controls for each channel.

  C. Meeting Rooms
      1. Shure ANSI USB Series or Approved Equal.
          a.   (1) balanced analog audio input, (1) balanced analog audio output.
          b.   (1) USB 2.0, Type B.
          c.   (1) RJ-45 Dante audio network port, 4 input channels x 2 output channels, 48 kHz sampling rate, 24-bit depth.
          d.   POE power supply.
          e.   Integral parametric EQ, mute, limiter, and gain controls for each channel.

2.04 AMPLIFIER

  A. Large Classrooms:
      1. Crestron Amp X300 Series or Approved Equal.
          a.   Four channel amplifier, up to 75 Watts per channel.
          b.   Configurable either Low Impedance (4 or 8 Ohm), or 70 Volt operation.
          c.   High pass filter: - 3 dB @ 80 Hz, -12 dB/octave.
          d.   THD+N: < 0.1 % at 1 kHz @ - 3 dB full rated output.
          e.   S/N Ratio: > 103 dbA, 20 Hz to 20 kHz, balanced.
          f.   1 RU, half rack form factor.
          g.   Configurable Stereo, Bridged, and Mono Sum modes.
          h.   Dante port: optional per room requirements. See system drawings for rooms that require Dante connectivity.
          i.   1 RU, half rack form factor.

  B. Four Speaker Installations:
      1. Crestron Amp X75 Series or Approved Equal.
          a.   Two channel amplifier, up to 35 Watts per channel, or 75 Watts in bridged mode.
          b.   Configurable either Low Impedance (4 or 8 Ohm), or 70 Volt operation.
          c.   High pass filter: - 3 dB @ 80 Hz, -12 dB/octave.
          d.   THD+N: < 0.1 % at 1 kHz @ - 3 dB full rated output.
          e.   S/N Ratio: > 103 dbA, 20 Hz to 20 kHz, balanced.
          f.   1 RU, half rack form factor.
          g.   Configurable Stereo, Bridged, and Mono Sum modes.
          h.   1 RU, quarter rack width form factor.

  C. Auditorium Amplifier:
      1. Yamaha XMV4280 Series or Approved Equal (For use with Yamaha VXL24 Series column speaker)
          a.   Class D four channel amplifier, up to 280 Watts per channel at four channels driven into 8 Ohms.
          b.   Configurable either Low Impedance (4 or 8 Ohm), 70 Volt operation, or bridged mode.
          c.   THD+N: < 0.2 %, 1 kHz @ - 3 dB half rated output.

   d. Frequency Response: 20 Hz to 20 kHz, +1 dB at 1W into 8 ohm or 70V load.
   e. S/N Ratio: > 100 dbA, 20 Hz to 20 kHz, balanced.
   f. Crosstalk: <-60 dB.
   g. I/O connectors: Euroblock balanced connectors, Primary/Secondary RJ-45 Dante port.
   h. Rack mounted device.
  2. Yamaha XMV4140 Series or Approved Equal. (For use with Yamaha VXL16 Series column speaker)
   a. Class D four channel amplifier, up to 140 Watts per channel at four channels driven into 8 Ohms.
   b. Configurable either Low Impedance (4 or 8 Ohm), 70 Volt operation, or bridged mode.
   c. THD+N: < 0.2 %, 1 kHz @ - 3 dB half rated output.
   d. Frequency Response: 20 Hz to 20 kHz, +1 dB at 1W into 8 ohm or 70V load.
   e. S/N Ratio: > 100 dbA, 20 Hz to 20 kHz, balanced.
   f. Crosstalk: <-60 dB.
   g. I/O connectors: Euroblock balanced connectors, Primary/Secondary RJ-45 Dante port.
   h. Rack mounted device.

2.05 CEILING MOUNTED SPEAKER

 A. 2'x 2' Ceiling Speaker Manufacturer: Crestron Saros ICT5T Series or Approved Equal.
  1. 5-inch speaker, 2' x 2' mounting format.
  2. Frequency Response: 70Hz - 18 kHz, - 10 dB.
  3. 70V adjustable tap @ 2 W, 4 W, 8 W, 16W at 70 Volt, or Low Z operation.
  4. Sensitivity: 90 dB @ 1W/1M.
  5. Coverage: 120 degree nominal.
  6. Steel white baffle.

 B. Recessed Speaker Manufacturer: Crestron Saros IC6T Series or Approved Equal.
  1. 6.5-inch coaxial LF driver, 1 inch dome tweeter.
  2. Frequency Response: 50 Hz - 2 kHz, - 3dB.
  3. 70V adjustable tap @ 3.75 W, 7.5 W, 15 W, 30 W, or bypass.
  4. Sensitivity: 88.5 dB @ 1W/1M.
  5. Coverage: 100 degree nominal.
  6. Zero bezel frameless grill design, white in color.

2.06 WALL MOUNTED LINE SOURCE SPEAKER

 A. Manufacturer: Yamaha VXL16 Series or Approved Equal.
  1. (16) 1.5-inch, full range drivers.
  2. Frequency Response: 81Hz - 20 kHz, - 10 dB.
  3. Horizontal Coverage: 170 degrees.
  4. Vertical Coverage: 25 degrees (+/-12.5 degrees).
  5. Power Rating: 160W PGM, 320W Peak.
  6. Peak SPL: 116 dB @ 1 meter.
  7. Sensitivity: 91 dB @ 1W/1M.
  8. Color: black or white, coordinate with room finishes.

 B. Manufacturer: Yamaha VXL24 Series or Approved Equal.
  1. (24) 1.5-inch, full range drivers.
  2. Frequency Response: 77Hz - 20 kHz, - 10 dB.
  3. Horizontal Coverage: 170 degrees.
  4. Vertical Coverage: 15 degrees (+/-12.5 degrees).
  5. Power Rating: 220W PGM, 440W Peak.
  6. Peak SPL: 117 dB @ 1 meter.
  7. Sensitivity: 91 dB @ 1W/1M.

8. Color: black or white, coordinate with room finishes.

2.07 PTZ CLASSROOM CAMERA

A. Manufacturer: PTZ Optics PT20X - 4K Series or Approved Equal.
1. Maximum Resolution: 3840 x 2160 at 60 FPS.
2. 20X zoom lens, 67-degree field of view.
3. Auto tracking and Auto framing modes.
4. Microsoft Teams and Zoom Certified.
5. Power Supply: 12V DC, POE 802.3AF.
6. I/O ports: (1) 3G-SDI, (1) HDMI outputs, RS232 input/output ports, (1) USB-A, (1) RJ-45 NDI/Ethernet port.
7. Infrared handheld remote control, Web UI, PTZ control App.
8. Provide with wall mount and associated hardware.

B. For TAA compliant rooms: Manufacturer: Canon - 4K Series or Approved Equal.
1. Maximum Resolution: 3840 x 2160 at 60 FPS.
2. 20X zoom lens,65-degree horizontal x 39.8-degree vertical field of view.
3. Auto tracking and Auto framing modes.
4. Microsoft Teams and Zoom Certified.
5. Power Supply: 24VDC, POE+802.3tAT.
6. I/O ports: (1) 3G-SDI, (1) HDMI outputs, RS232 input/output ports, (1) USB-A, (1) USB-C (1) RJ-45 NDI/Ethernet port.
7. Infrared handheld remote control, Web UI, PTZ control App.
8. Provide with wall mount and associated hardware.

2.08 VIDEO CONFERENCING CAMERAS

A. Selection of Video Conferencing Cameras is dependent on conference room size and configuration, coordinate with UND AV personnel.

B. Manufacturer: Jabra Panacast 50 Series or Approved Equal (small conference room or huddle room).
1. Resolution:3840 x 1080 at 30 FPS, 1920 x 1080 at 30 FPS, panoramic 180-degree adjustable field of view.
2. Standards based H.323 and SIP video.
3. Microphone: integral dual microphone system.
4. Microsoft Teams and Zoom Certified.
5. Power Supply: Powered by USB 3.0 cable.
6. I/O ports: (1) USB-C.
7. Provide with wall mount and associated hardware.

C. Manufacturer: Wyrestorm Apollo VX20-UC.
1. Resolution: 3840 x 2160 at 30 FPS, 1920 x 1080 at 60 FPS, 120-degree horizontal field of view.
2. Standards based H.323 and SIP video.
3. Microphone: integral 4X mic array, 16-26 ft pickup range.
4. Microsoft Teams and Zoom Certified.
5. Power Supply: 24V DC, 5 Amp.
6. I/O ports: (1) HDMI input, (1) HDMI outputs, (1) USB-C, (1) USB-B, (1) USB-A, (1) RJ-45 LAN port.
7. Bluetooth handheld remote control.
8. Provide with wall mount and associated hardware.

D. Manufacturer: Huddly IQ Series or Approved Equal.
1. Resolution: 12-megapixel, 1920 x 1080 at 30 FPS.
2. 120-degree horizontal field of view x 90-degree vertical field of view.
3. Digital PTZ operation.
4. Microsoft Teams and Zoom Certified.
5. Power Supply: 5 V

6. I/O ports: (1) USB-C.
7. Windows 10, Mac OS compatible.
8. Provide with wall mount and associated hardware.

E. Manufacturer: Huddly S1 Series or Approved Equal.
1. Resolution: 12-megapixel, 1920 x 1080 at 30 FPS.
2. 120-degree horizontal field of view x 90-degree vertical field of view.
3. Digital PTZ operation, 4X digital zoom.
4. Microsoft Teams and Zoom Certified.
5. Power Supply: POE.
6. I/O ports: (1) USB-C, (1) RJ-45 network port.
7. Windows 10, Mac OS compatible.
8. Provide with wall mount and associated hardware.

F. Manufacturer: Huddly L1 Series or Approved Equal.
1. Resolution: 6-megapixel, 1920 x 1080 at 30 FPS.
2. 92-degree horizontal field of view x 65-degree vertical field of view.
3. Digital PTZ operation, 5X digital zoom.
4. Microsoft Teams and Zoom Certified.
5. Power Supply: POE.
6. I/O ports: (1) USB-C, (1) RJ-45 network port.
7. Windows 10, Mac OS compatible.
8. Provide with wall mount and associated hardware.

G. Manufacturer: Logitech MX Brios Series or Approved Equal. (Huddle Spaces only).
1. Resolution: 3840 x 2160 at 30 FPS.
2. 4x Digital Zoom.
3. Dual beamforming microphone with noise reduction, 4-foot range.
4. Microsoft Teams and Zoom Certified.
5. Power Supply: POE.
6. I/O ports: (1) USB-C, (1) RJ-45 network port.
7. Windows 10, Mac OS compatible.
8. Provide universal mounting clips and associated mounting hardware.

2.09 ASSISTED LISTENING SYSTEM

A. Manufacturer: Williams AV WaveCAST Series or Approved Equal.
1. Real time audio over WI-FI devices.
2. Transmitter integration with personal device via Apple or Android App, or via handheld wireless receivers.
3. Third party control using Telnet commands via Ethernet. Commands including power, audio gain, DSP presets.
4. (1) RJ-45 Dante audio jack.
5. (1) Balanced XLR line level input jack.
6. Integral DSP with high pass and low pass frequency control, audio presets.
7. *Provide XXXX receiver kits, to include headphone, transmitter base and case.*

2.10 AV OVER IP EQUIPMENT

A. Manufacturer: Crestron DM NVX Series IP encoders or Approved Equal.
1. 4K60, 4:4:4 video over standard gigabit Ethernet.
2. Support for HDR and HDCP 2.3.
3. The System shall support native integration with a single enterprise grade software management platform to provide complete system monitoring, management, and control over the Owner's IT network.
4. Control of third-party equipment via Encoder and Decoder built-in control ports
5. Network Audio: Encoders and decoders shall support two channel AES67 network audio.
6. Encoder shall support embedding of stereo audio into HDMI input.
7. Freestanding unit compatible with surface, shelf, or rack rail mounting.

2.11 VIDEO SWITCHING EQUIPMENT

A. Manufacturer: Crestron HD-PS Series or Approved Equal.
  1. Part Numbers:
     a. Crestron HD- PS401 (4 in x 1 out switcher).
     b. Crestron HD -PS402 (4 in x 2 out switcher).
     c. Crestron HD-PS622 (8 in x 2 out switcher).
  2. HDMI inputs and outputs shall support the following: HDMI with Deep Color and 4K60 4:4:4, HDCP 2.3 compliant, EDID, HDR10, HDR10+, Dolby Vision video formats.
  3. Output: HDMI Type A connector, and Crestron DM HDBaseT twisted pair output.
  4. Resolution: up to 4096 x 2160.
  5. HDMI audio de-embedding: Switcher shall include two analog audio outputs which may be configured to output 2-channel audio from any connected HDMI source with stereo audio.
  6. Audio Input Connectors: 3.5 mm terminal block, balanced mono microphone level or line level analog inputs.
  7. Audio Output Connectors: (2) 5-pin 3.5 mm detachable terminal blocks; Balanced stereo line-level audio outputs
  8. 100BASE-TX/1000BASET Ethernet connectivity with built in web interface.
  9. Quantity of inputs and outputs as shown on the drawings.
  10. Rack mounted device.
  11. Input and output quantity: As indicated on the drawings.

B. Manufacturer: Crestron HD-MD Series or Approved Equal.
  1. Part Numbers:
     a. Crestron MD- 4X1-4KZ (4 in x 1 out switcher).
     b. Crestron MD- 4X1-2KZ (4 in x 2 out switcher).
     c. Crestron HD-MD8X8-4KZ (8 in x 8 out switcher).
  2. HDMI inputs and outputs shall support the following: HDMI with Deep Color and 4K60 4:4:4, HDCP 2.3 compliant, EDID, HDR10, HDR10+, Dolby Vision
  3. HDMI audio de-embedding: Switcher shall include two analog audio outputs which may be configured to output 2-channel audio from any connected HDMI source with stereo audio.
  4. Quantity of inputs and outputs as shown on the drawings.
  5. Rack mounted device.

2.12 CONTROL PANEL/ROOM SCHEDULER

A. Manufacturer: Crestron TSS-770 or Approved Equal.

B. Touch panel shall be used at the exterior of all classrooms and conference rooms as a room scheduling device. A separate touch panel shall be used inside classrooms or other rooms as noted to operate the audio visual equipment located in the room.

C. All touchscreens shall be programmed to use a UND approved user interface. Coordinate with UND AV representative and provide sample touchscreen layouts for approval prior to implementing the touch screen controls.

D. At minimum, the control panel shall provide the following controls:
  1. System power, including the video monitor or projector.
  2. Motorized screen control (if applicable).
  3. Source selection.
  4. Camera pan/tilt/zoom controls
  5. Volume control

E. Touchscreen equipment requirements:
  1. 7-inch TFT active-matrix color LCD touch screen 1280 by 800 WSVGA resolution display.
  2. IEEE 802.3at Type 2 compliant PoE+ Powered Device
  3. Ethernet 100 Mbps, auto switching, auto negotiating, auto discovery, full/half duplex, TCP/IP, UDP/IP, CIP, DHCP, SSL, TLS, SSH, SFTP (SSH File Transfer Protocol), IEEE 802.1X, SNMP, IPv4 or IPv6, Active Directory® service authentication.
  4. Wi-Fi: IEEE 802.11a/b/g/n/ac.

5. Room Scheduling Applications: Where used as a room scheduler, the panel will require the following features:
   a. The touch screen shall integrate directly with Ad Astra (classroom scheduling) and Office365 (conference room scheduling).
   b. Touchscreen shall allow on-site room reservations.

F. Provide tabletop or wall mounting hardware as required, see drawings for locations.

2.13 VIDEO PROJECTOR

A. Manufacturer: Epson PowerLite Series, Panasonic PT VM Series, or Approved Equal.

B. Panasonic PT-MZ Series or Approved Equal (Large Venue Use)

C. Lumens: Projector lumens shall be selected to provide a minimum 15:1 contrast ratio on the projection screen.

D. Native Aspect Ratio: 16:9

E. Resolution: Native WUXGA 1920 x 1200

F. Minimum Quantity of Ports: HDMI 2.1 port, RJ-45 Network Port, RS-232 bidirectional communications port.

G. Mounting: Provide mounting pole, hardware, and accessories for installation of projector. Attach to building structure above the projector. Projector mount shall be Chief RPMA universal series or equal by Peerless.

2.14 MICROPHONE ARRAY

A. Combination Speaker/Microphone array:(Medium Conference Rooms).
   1. Manufacturer: Shure MXA902 Series or Approved Equal.
      a. Ceiling mounted, combination microphone and loudspeaker in single enclosure.
      b. Onboard DSP with Acoustic Echo Cancellation, noise reduction, automatic gain control, and EQ.
      c. Paintable white finish, square form factor.
      d. Compatible with ceiling mounting, pole mounting or suspended cable mounting methods.

B. Ceiling Mounted Microphone Array:
   1. Manufacturer: Shure MXA920 Series or Approved Equal.
      a. Ceiling mounted device.
      b. Onboard DSP with Acoustic Echo Cancellation, noise reduction, automatic gain control, and EQ.
      c. Paintable white finish, square or round form factor.
      d. Compatible with ceiling mounting, pole mounting or suspended cable mounting methods.

2.15 WIRELESS MICROPHONE SYSTEMS

A. Manufacturer: Shure SLX-D Series or Approved Equal.
   1. Lavalier microphone: Shure WL183 Series, omnidirectional microphone with TA4F connector.
   2. Handheld microphone: Shure SM58 with wireless transmitter.
   3. Beltpack: Shure SLXD1 bodypack transmitter.
   4. Receiver: Shure SLXD4 Series single channel receiver
   5. Charger: Shure SBC203 Series, dual docking/charging station.

2.16 AUDIENCE MICROPHONE SYSTEMS

A. Manufacturer: Catchbox or Approved Equal, with Division of Marketing approved UND logo and colors.
   1. Throwable microphone: Catchbox Pro Series
      a. 50 Hz to 20 kHz frequency response.
      b. Electret condenser microphone, omni directional.
      c. Battery operated device.

2. Handheld microphone: Catchbox Stick Series.
   a. 50 Hz to 20 kHz frequency response.
   b. Electret condenser microphone, omni directional.
3. Wearable presenter microphone: Catchbox Clip Series.
   a. 50 Hz to 20 kHz frequency response.
   b. Electret condenser microphone, omni directional.
4. Receiver: Catchbox HUB Series DSP receiver
   a. Wireless 4 input microphone receiver, 4 balanced microphone inputs.
   b. Digital USB-C output, unbalanced and balanced analog audio outputs.
5. Charger: Catchbox charging base with lockable mounting kit.

2.17 DOCUMENT CAMERA

A. Manufacturer: Epson DC-21 Series. No Substitutions.
   1. Full HD 1920 x 1080 resolution, 30 frames per second maximum frame rate.
   2. 10X digital zoom, 12x
   3. Interfaces: HDMI, VGA in and out, USB-B, SD card slot.
   4. User functions: Zoom, Freeze, Auto Focus, Brightness, Negative, Black and White, Split Screen, Video Capture and Playback, Digital pan/tilt, Image Rotation.
   5. Windows 10 and Mac OSX 10.11 or later compatible.

2.18 INTERACTIVE PEN DISPLAY

A. For use in Auditoriums and Multi Display Classrooms.

B. Manufacturer: Wacom DTK 2451 Series, No Substitutions.
   1. 24-inch diagonal antiglare screen, full HD 1920 x 1080 LCD panel.
   2. Integrated USB 2.0 port, and DVI-I video port.
   3. Standard VESA mounting for 3rd party mounts and stands.
   4. Windows 10 and Mac OSX 10.11 or later compatible.

2.19 ACCESSORIES

A. Monitor Wallbox
   1. Manufacturer: Wiremold Evolution EFSB4 Series or Approved Equal.
   2. Four gang, recessed enclosure with angled device openings, accepts standard gang devices, no proprietary device plates.
   3. Low profile decorative trim flange and cover, white in color.
   4. Service conduit knockouts from 3/4" to 2" trade size.

B. USB Video Capture Devices
   1. Manufacturer: Epiphan AV.IO SDI +Series, AJA U-TAP SDI or Approved Equal.
      a. Interface Connections: SDI (BNC Style), USB 3.0 Type B.
      b. Supported input formats: 3G-SDI, HD-SDI, SD-SDI (including embedded audio for 3G-SDI and HD-SDI.
      c. Input Resolution: up to 1920 x 1080.
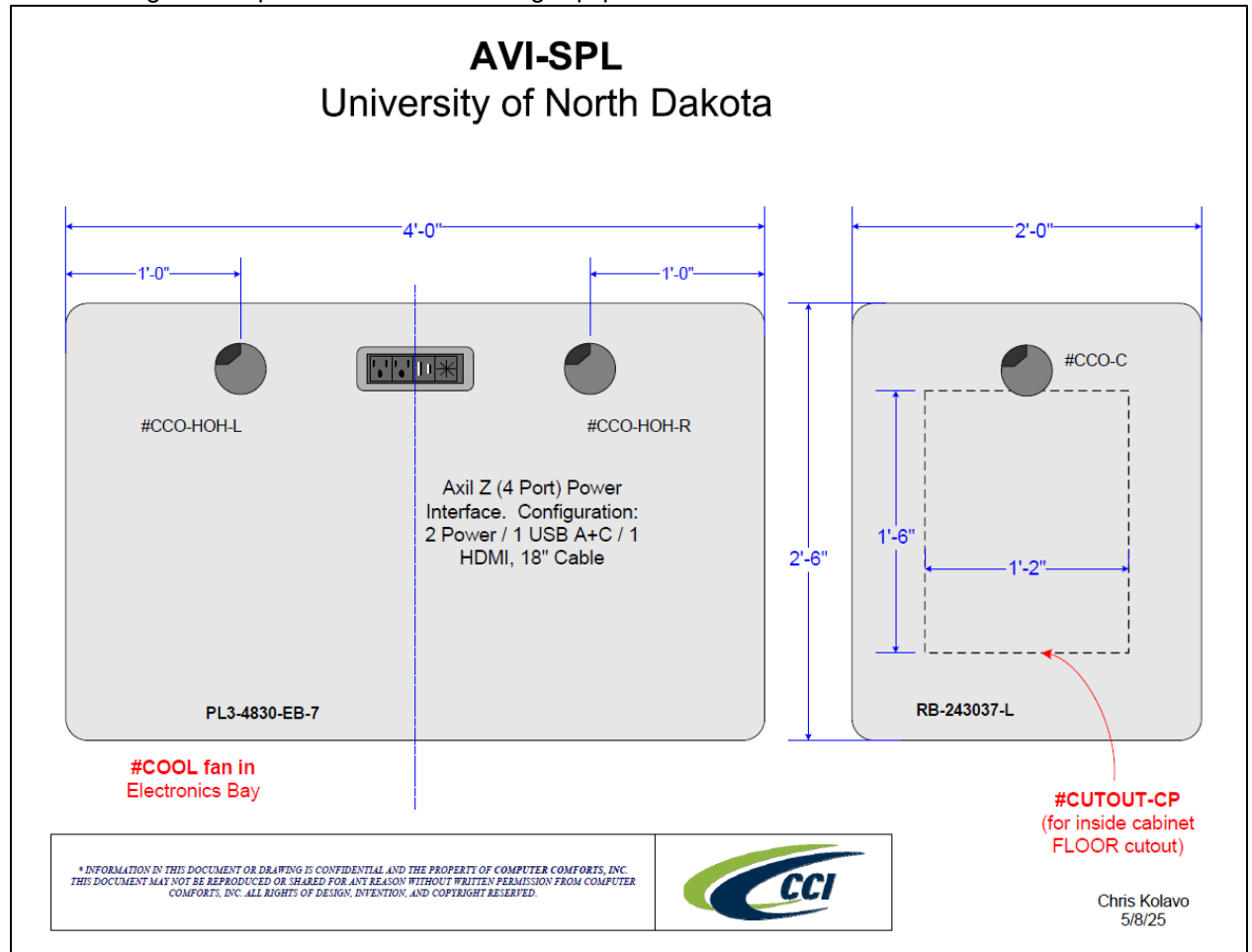   d. Windows and macOS, compatible.

2.20 CABLE

A. Mic/Line Level Audio Cable: Balanced and unbalanced audio cable shall contain a 22 AWG twisted pair cable with 100% overall aluminum foil shield and drain wire, with plenum rated jacket.
   1. Manufacturer: Equal to West Penn 25291.

B. Speaker Level Audio Cable - low impedance: Low impedance speaker cable shall be a 12 AWG twisted pair with 100% overall shield and drain wire, with plenum rated jacket.
   1. Manufacturer: Equal to West Penn 25296.

C. Speaker Cable - 70 Volt Systems: Plenum rated, a minimum of 18 AWG or as indicated on the drawings, two conductor speaker cable with 100% overall aluminum shield and drain wire.
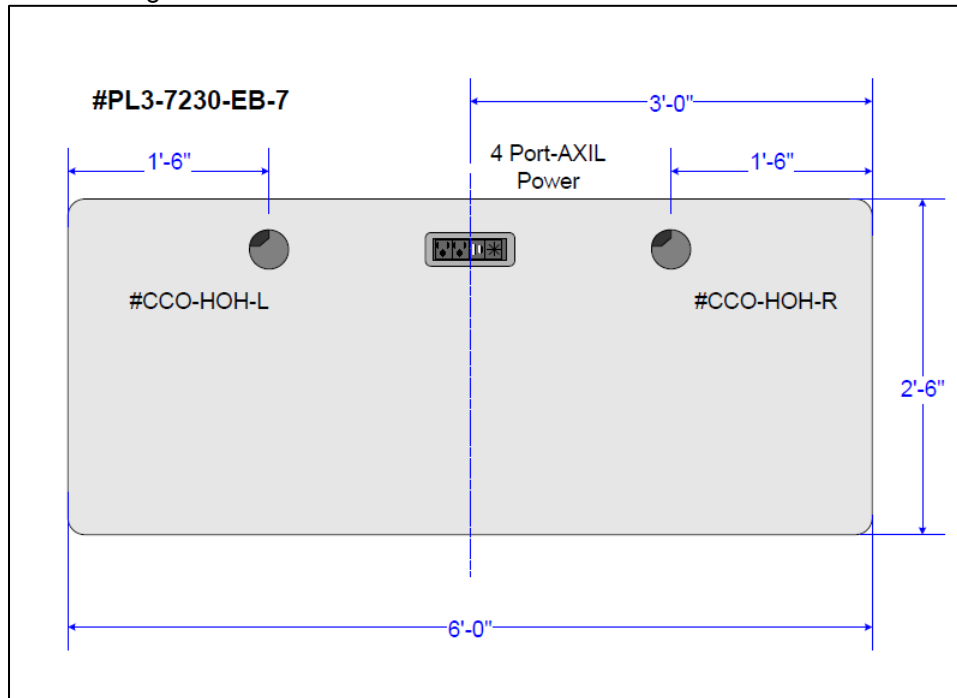   1. Manufacturer: Equal to West Penn 25293.

D. SDI Video Cable: Plenum rated, SMPTE ST 2082-1 compliant, 12 Ghz, 4K UHD RG-6 coaxial cable. 18 AWG solid silver copper center conductor, 100% tape + 95% braid.
    1. Manufacturer: Equal to West Penn 256450.

E. HDMI over IP network cable and HDBaseT (Crestron DM) cable: Plenum rated, Category 6A UTP to meet University of North Dakota telecom standards as described in Section 27 1005. See color coding requirements in this section.

F. HDMI Patch Cable: HDMI 2.1 compliant, Category 3 rated, 4K resolution at 60 FPS.
    1. Provide (1) for each connection between the instructional equipment and the video encoder and/or video switcher.
    2. Provide (1) for each connection between the video decoder and the video display device.

G. Microphone audio patch cable: Female XLR connector, #22/2 shielded cable.
    1. Provide audio patch cables as required for each connection between audio source equipment and the AV switcher or Digital Signal Processor.
    2. Manufacturer: Whirlwind MK Series.

H. Ethernet/Network Patch Cords:
    1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.
    2. Manufacturer: Ortronics RDC Series reduced diameter patch cables or Approved Equal.

I. Audio Visual System patch cables: Contractor to provide all necessary patch cables to interconnect the audio-visual equipment for a fully functional system. Exact patch cable lengths shall be coordinated with the installed equipment layouts in each rack or teacher station. Provide cables with sufficient length such that cables are not under tension, with service loops to allow equipment to be adequately serviced.

2.21 TEACHING STATION/EQUIPMENT CABINET CUT OUTS

A. 48" Teaching Station paired with free standing equipment cabinet:

AVI-SPL
University of North Dakota

4'-0"

1'-0"   1'-0"

#CCO-HOH-L   #CCO-HOH-R

Axil Z (4 Port) Power
Interface. Configuration:
2 Power / 1 USB A+C / 1
HDMI, 18" Cable

2'-6"

PL3-4830-EB-7

#COOL fan in
Electronics Bay

2'-0"

#CCO-C

1'-6"

1'-2"

RB-243037-L

#CUTOUT-CP
(for inside cabinet
FLOOR cutout)

CCI

Chris Kolavo
5/8/25

B. 72" Teaching Station

PART 3 EXECUTION

3.01 GENERAL

A. All conductors will be installed in conduit, 3/4 inch minimum in locations with no suspended acoustical ceiling. The audio-visual system installer shall verify that conduits for low voltage AV system conduits are sized appropriately, completed, and ready for AV Wire pulling prior to beginning work. Coordinate closely with the electrical contractor for all rough in requirements. \.

B. Plenum cable may be installed about acoustical ceiling areas without conduit. Provide bridle rings and tie wraps for all cables routed in free air above acoustical ceilings. Support cables at 4 feet maximum between supports. All cables shall be free from strain, and appropriate strain relief will be used so that connectors and terminations are not being pulled due to the weight or tension of the cables.

C. All audio-visual cables shall be continuous cable without splices. All termination of such lines must be made in accordance with manufacturer's specifications for the given electronic device. All audio terminations made at wall plates or cable connectors must be solder type. All equipment power and signal wiring shall conform to NEC and all state and local codes.

D. Provide service loops at each termination. Plates, panels, and equipment shall be able to be removed for inspection and service, and drawers or slides shall be able to move freely.

E. Terminations will be made using screw type terminals, push-on terminal boards, multi-pin connectors or solder lugs with good, clean solder joints. Under no circumstances are any terminations to be taped.

F. All AV cabling shall be neatly dressed, labeled, and secured, and measures to provide adequate strain relief shall be taken. Observe manufacturer bend radius requirements on all cables. Velcro cable straps, and NOT cable ties, shall be used on all Category cables. All incoming cables will be clearly marked as to origin with printed heat shrink tubing labels.

G. All inputs and outputs of switchers shall be labeled, so that users can easily make adjustments to signal flow without having to refer to the system drawings.

H. All cabling runs for POE connected devices, Video over IP and HDBaseT signals shall not exceed 100 meters.

I. Adjust location of ceiling microphones to provide microphone coverage of entire room, locations shown on the drawings are diagrammatic in nature.

J. Coordinate exact location of projector mounting poles with other trades prior to installation. Install support cables from building structure, cut tile and install mounting pipe.

K. Connect Owner Furnished computers to be used with the system, verify operation with video switcher or wireless receiver, and that the device properly displays on the video monitor or projector.

L. Coordinate all network addresses and any required connections to the campus network with UND IT representatives.

M. Digital crossovers should be used to eliminate portions of the frequency spectrum that are not supported by the loudspeakers per manufacturer's specifications.

N. Systems gain structure shall be configured so that all processing and amplification equipment reach their respective clipping points simultaneously. Care should be taken during this process so that no one element of the system is overloaded to the point of damage. Any damage to the system resulting from improper techniques will be the responsibility of the contractor.

O. All equipment power and signal wiring shall conform to NEC and all state and local codes.

P. All permanently installed speakers shall include safety cable rated for five (5) times the weight of the speaker. Cable should be attached to the permanent structure to prevent speaker from falling into seating areas.

3.02 WARRANTY

A. Provide manufacturer's warranty that system components other free from defects and will remain so for 1 year after date of Substantial Completion.

B. In cases where the manufacturer's warranty period is greater than twelve months, the contractor shall provide that warranty for the full extent of the manufacturer's warranty period. This shall not include any labor costs incurred by the contractor removing and re-installing the defective items.

C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

3.03 TRAINING

A. Contractor shall provide a minimum of one (1) 4-hour period of training for operation of the audio-visual system and system components for the Owner and designated representatives.

B. Training shall be provided by the Contractor at the Owner's Facilities.

C. The presenter of the training sessions shall have been directly involved with the project and have expert knowledge of the installed systems and their operation.

D. The instructions shall include the following topics:
1. Review the locations of inputs, equipment cabinets, control locations and other ancillary equipment in the room, and briefly discuss the purpose of each piece of equipment.
2. Demonstrate the process of connecting audio and video signals to the system.
3. Demonstrate the process of routing signals to video displays, speaker zones and selecting room presets. Demonstrate how to control ancillary equipment such as motorized screens, cameras, and video display devices as applicable to each specific room type.
4. Review general maintenance of components and basic troubleshooting techniques.

END OF SECTION